राष्ट्रीय इस्पात निगम लिमिटेड
विशाखपट्टणम इस्पात संयंत्र
(भारत सरकार का उपक्रम)
दिल्ली इकाई कार्यालय
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CIN No : U27109AP1982GOI003404

Ref No: 19 / ED(Projects Services) / 10 Date: 28.01.2019

To,
The Member, EAC (Violation)
Ministry of Environment, Forest & Climate Change
Indira Paryavaran Bhavan,
Jor Bagh Road, Aliganj, New Delhi-110 003

Subject: **Submission of Replies to Additional Details Sought (ADS) by EAC for grant of Environmental Clearance for expansion of Integrated Steel Plant from 6.3 MTPA to 7.3 MTPA Liquid steel within the premises of Visakhapatnam Steel Plant**

Reference: *Proposal No.:* *IA/AP/IND/73713/2018*
MoEFCC File No: *23-132/2018-IA.III (V)*

Dear Sir,

With reference to the above mentioned subject, we would like to bring to your kind notice that the Terms of Reference for the aforementioned project was granted vide MoEFCC's letter no IA-J-11011-196/2005-IA II(I) dated 02/08/2018.

As per recent guidelines of MoEFCC for grant of Environmental clearance, we had submitted our application for grant of Environmental Clearance for "Capacity Expansion of Visakhapatnam Steel Plant from 6.3 MTPA to 7.3 MTPA by revamping and augmentation of existing facilities by Rashtriya Ispat Nigam Limited" and our proposal was considered in the 13th Meeting of the Expert Appraisal Committee on 18th September, 2018. In the meeting, the EAC has asked us to submit some additional details regarding the project.

We are hereby enclosing all the required information as asked by EAC for your kind perusal.

You are requested to kindly consider our application for grant of Environmental Clearance.

Thanking you,

Regards,

P L Sahu
ED (Projects Services)
Rashtriya Ispat Nigam Limited,
Visakhapatnam Steel Plant.

पंजीकृत कार्यालय : मख्य प्रशासनिक भवन, विशाखपट्टणम - 530031

ADDITIONAL DETAILS SOUGHT
For

Expansion of Integrated Steel Plant from 6.3 MTPA to 7.3 MTPA Liquid Steel within the premises of Visakhapatnam Steel Plant

January, 2019

RASHTRIYA ISPAT NIGAM LIMITED
Visakhapatnam Steel Plant
(A Govt. of India Enterprise)
Gajuwaka, Visakhapatnam,
Andhra Pradesh- 530031
Project Proponent

MECON LIMITED
(A Govt. of India Enterprise)
Vivekananda Path
PO. Doranda
Dist – Ranchi, Jharkhand - 834002
Certificate no: NABET/EIA/1619/RA 0068
Environmental Consultant

ADDITIONAL DETAILS SOUGHT BY EAC

The proposal for Environmental Clearance for expansion of Integrated Steel Plant from 6.3 MTPA to 7.3 MTPA Liquid steel within the premises of Visakhapatnam Steel Plant by M/s. Rashtriya Ispat Nigam Ltd was considered at the 13th meeting of the Expert Appraisal Committee (EAC) proposals involving violation of EIA notification 2006 held on 18th September, 2018 at the Offices of the Ministry of Environment, Forest & Climate Change in New Delhi. After detailed deliberations, the EAC deferred the project for want of some additional information. The details of the points and coverage of the points in the report is shown in following Table.

Sl. No.	ADS Point	Page
1.	The quantity of excavated material handled for creating a reservoir was not considered while calculating the emission of particles during excavation and transportation. Resultant potential impact on health, vegetation, ecology and related remediation measures that could have been taken for preventing this impact, should have been considered as the major parameter for damage assessment in the EIA/EMP report.	3
2.	Air quality in the core zone was not monitored and correlation of emission from the plant area therefore could not be correlated properly for possible impact on the receptor in the buffer zone in the downwind direction. Project proponent had been asked to collect one month fresh data as the base line data used was mostly secondary collected in the year 2016 and was not updated for validity the current environment parameters.	21
3.	Waste water discharge points in the sea was studied by NIO that report has also to be presented along with terrestrial impact in the revised documents. Revalidation of the point of discharge for any potential impact should be carried out, if there is an increase in the quantity of discharge and change in composition of waste water.	47
4.	In the land use area, the green belt that was prescribed in the EC of 6.3 MTPA has to be properly demonstrated giving composition of the planted width of the green belt and height of the green belt. Since purpose of the green belt is attenuation of point and non-points source pollution, monitoring on both the side of green belt is tom be done to understand the utility of impact of green belt.	49
5.	Remediation plan was poorly drawn and needs to be revised by incorporating damage due to excavation of reservoir, transportation, impact on nearby habitat as mentioned in the report. Air quality changes due to emission from coke oven, two sintered plant (SP 1 & SP2), and Blast furnace (BF1 & BF2).	59
6.	No objection certification from CGWA/concerned state authority for ground water handling to be submitted.	70
7.	Proof of action taken by the State Government/SPCB against the project proponent under the provisions of section 19 of the Environment (Protection) Act.	71
8.	Submission of revised CER as per Ministry's OM dated 01st may, 2018 and also including works taken up under CER for the year 2018-2019.	72
9.	ESP proper functioning has to be properly brought out to study its effectiveness.	75
10.	Waste water from coke oven to be studied for phenols/VOCs.	79

VISAKHAPATNAM STEEL PLANT
EIA/ EMP Studies for expansion of Integrated Steel Plant from 6.3 MTPA to 7.3 MTPA Liquid steel within the premises of Visakhapatnam Steel Plant

Sl. No.	ADS Point	Page
11.	In air quality, particles be analyzed for associated phenols/VOCs and heavy metals to study the health status.	81
12.	Closure of Noncompliance reported by the regional office of the Ministry.	84
13.	Statement from PP that commissioning had been done within validity of EC.	85
14.	NOC from concerned department for cutting of trees during the construction phase to be submitted.	86
15.	Base line health study within 5km radius of the project.	87
16.	Revised EIA report along with compliance of ToR conditions with proper cross reference and page numbers to be submitted.	88
17.	A table mentioning the plants constructed or revamped shall be included in a tabular form involving an investment of about 6435 crores without prior EC.	89
18.	The damage assessment shall be calculated for each construction and revamping activity as deliberated in the meeting and then cumulative effect to be mentioned.	91
19.	The benefit accrued due to violation should be brought out properly on financial considerations.	92

Point wise reply to above details are given in the following paragraphs-

1.0 The quantity of excavated material handled for creating a reservoir was not considered while calculating the emission of particles during excavation and transportation. Resultant potential impact on health, vegetation, ecology and related remediation measures that could have been taken for preventing this impact, should have been considered as the major parameter for damage assessment in the EIA/EMP report.

RINL had received Environmental Clearance (EC) for increase in of Liquid Steel production from 3.5 to 6.3 MTPA in 2005. However, after installation of all units for achieving rated capacity of 6.3 MTPA, RINL started revamping / capital repairs of the existing critical equipment of the plant installed at the plant's inception. This modernization and revamping drive led to enhancement of capacity by 1 MTPA. The revamping was done in BFs 1 &2, Sinter Plant 1 and SMS2 (by installation of new converter 3 and caster 4). Construction of a new Coke Oven Battery (COB5) also commenced. In addition to these, construction of associated facilities like reservoir (KBR2) & guard pond also commenced.

Damage assessment during the construction of the all the units including new and revamped units for individual units and as well as cumulatively have been carried out. The EIA report has been revised accordingly.

Damage assessment during Construction of new Kanithi Balancing Reservoir 2

Present water requirement RINL of around 38 MGD for the existing plant is met from Yeleswaram Reservoir and Godavari River through 153 km long open canal. Water consumption is expected to increase to 45MGD when plant produces 7.3 MTPA steel.

With the measures like implementation of Zero Liquid Discharge Schemes & Rain Water Harvesting, another 5 MGD of incremental demand can be met. Still there will be a significant gap in demand and supply of water at 7.3 MTPA stage.

To meet the canal shutdown requirements, Kanithi Balancing Reservoir (KBR) of 15 Mm^3 capacity was constructed near plant premises over300 hectares in 1989.

In order to facilitate inlet water canal maintenance with increased per day water consumption and to take care of the surges in water flow through canal, it has been planned to increase in house water storage capacity by constructing an additional water storage reservoir of 12.32 Mm^3capacity, opposite to the existing reservoir. Location of the proposed reservoir relative to the existing reservoir is shown in **Figure 1.1**.

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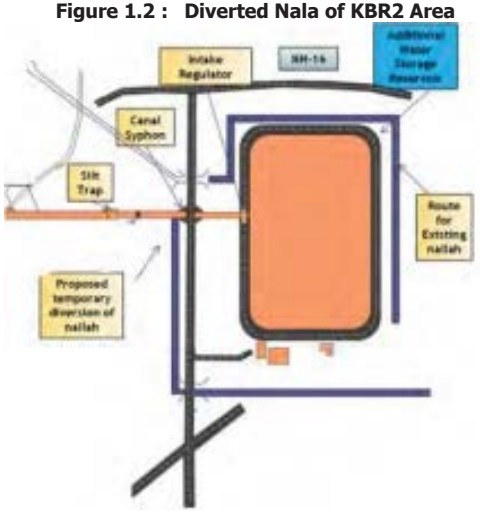
Figure 1.1 : Location of the proposed reservoir relative to the existing reservoir

The new water reservoir is being constructed about 4 km north of the plant near NH-5 and close to the existing water reservoir. The new water reservoir is spread over ~200 acres and will be ~20 m deep.

The habitation closest to the proposed reservoir is about 200m (Railway Colony; ~200 dwellings) from the excavated site in the East and about 300 m in the North side.

The soil at reservoir site comprises of silty clay and silty gravel up to a maximum depth of 10 m. Thickness of the soil layer (overburden) varies from 2.4 m 10 m. No soil exists below 10 m depth. Water table is at shallow depth (1.2 m - 5.0 m). At proposed KBR site there were three nalas viz Northern, Central and Southern flowing in the area. KBR2 is located in between Central Nala and Southern Nala. However, during construction entry of Central Nala near KBR2 diverted and temporarily made arrangement in the west side of the KBR2 and confluence with Southern Nala in the southern direction. The diverted nala is shown in **Figure 1.2**.

Figure 1.2 : Diverted Nala of KBR2 Area



Salient features of the construction of new KBR2are given in **Table 1.1.** Photographs of the site are given in **Figure 1.3-1.5.**

Table 1.1 : Salient features of the construction of reservoir

1.	Area, depth and dimension of bund wall, Quantity of material excavated	i) Area: 225acres ii) Depth : 13.53 m below G.L iii) Bund wall:3.208 km iv) Excavation Quantity:~45,00,000 m^3
2.	Ground water Depth in the reservoir area and Details of de-watering	i) Water table 4m below Ground level ii)20 dewatering pumps used
3.	Duration of excavation	21 months
4.	Method of Excavation	Excavators, Rippers, Rock breakers, Controlled Blasting
5.	Method and Location of material dumping	i) Transporting by Trucks ii) In the allotted land within VSP land boundary
6.	Details of modified drainage network of the area.	Re-routing drain passing through reservoir area.
7.	Details of Drilling and Blasting.	i) 7 nos. of drilling machines deployed ii) Controlled blasting. Approx. qty 4 lakh m^3.

Figure 1.3 : View New Water Reservoir Site on 23-07-18 from approx. 17°40'41.8"N, 83°10'05.0"E

Figure 1.4 : View New Water Reservoir Site on 23-07-18 from approx. 17°40'41.8"N, 83°10'05.0"E

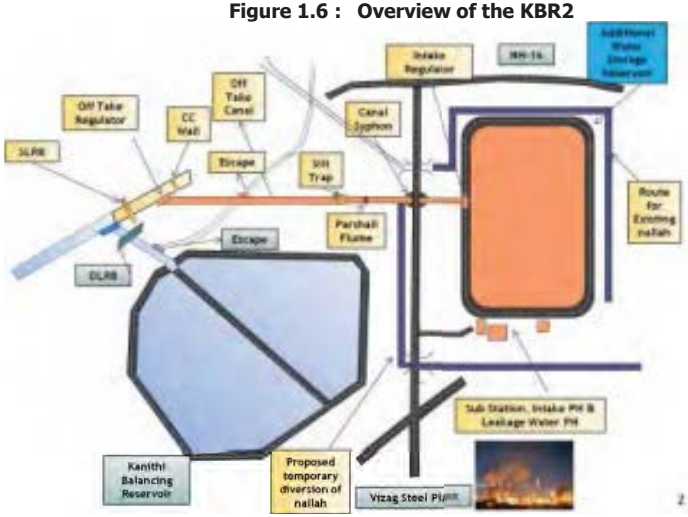
Figure 1.5 : View of New Reservoir Site on 29-10-18 Looking North from approx. 17°40'20"N, 83°10'16"E

Construction of the reservoir has involved the following activities:

1. Clearance of vegetation.
2. Diversion of natural stream passing through the site.
3. Excavation of soil & rocks.
4. Transport and dumping of excavated material
5. Discharge of seepage water
6. Construction of embankment by utilizing part of the excavated soil & rocks
7. Concrete lining of inner side of embankment
8. Construction of intake structure.

The water intake structure is being constructed on the southern side of the reservoir. This shall comprise of concrete structures to house electrically driven pumps with all necessary accessories. Construction of this intake structure shall involve fabrication and erection of steel reinforcements, construction of concrete structures, installation of electrical power supply system, installation of water pipelines and other accessories. The overview of the KBR2 is shown in **Figure 1.6**.

Figure 1.6 : Overview of the KBR2



1.1 Damage assessment:

The probable damages due to activities associated with the construction of the reservoir have been studied in relation to the following areas:

- Land environment
- Ambient Air Environment
- Noise environment
- Water environment
- Ecological environment

1.1.1 Damage to Land environment:

The site of the reservoir was an expanse of scrub land. The vegetation comprised of dense thickets of *Prosopis juliflora* with few *Acacia nilotica, Azadirachta indica* and *Borassus flabellifer*) and expanses of grassland as can be seen from the Google Earth Image of 26-01-2011 in **Figure 1.7-1.8**.

Figure 1.7 : Google Earth Image dated 26-01-2011 of New Reservoir Site. Existing Reservoir seen on left.

Figure 1.8 : Google Earth Image dated 13-04-2018 of New Reservoir Site. Existing Reservoir seen on left.

Approximately 4450000 m^3 of soil and rocks were excavated for creation of the reservoir. Excavation was carried out using mechanical shovels / excavators, which loaded the excavated muck on to tipper trucks. The tipper trucks then transported the material to designated dump sites. A few large boulders, too large to be excavated and broken up by the deployed shovels / excavators, were encountered. These were broken up into manageable sizes by blasting. Prior clearance had been obtained from the concerned authorities for using explosives for blasting rock.

The soil and rocks excavated from the reservoir site have been dumped externally at five locations:

1. Just beyond the north-eastern corner of the new reservoir (between latitudes 17°40'53.1" N & 17°41'04.5" N and longitudes 83°10'20.8" E & 83°10'33.3" E)
2. Just beyond the eastern side of the new reservoir site (between latitudes 17°40'26.5" N & 17°40'52.25" N and longitudes 83°10'30.5" E & 83°10'35.6" E).
3. Just beyond the south-eastern corner of the new reservoir (between latitudes 17°40'14.5" N & 17°40'26.1" N and longitudes 83°10'25.1" E & 83°10'36.2" E)

4. Just beyond the north-western corner of the existing reservoir, ~2.6 km due west of the new reservoir site (between latitudes 17°40'18.7" N & 17°40'39.8" N and longitudes 83°08'20.2" E & 83°08'53.3" E)
5. About 4.5 km due west of the new reservoir site (between latitudes 17°40'12.7" N & 17°40'32.1" N and longitudes 83°07'17.5" E & 83°07'43.9" E).

Top soil has been dumped separately as small dumps not more than 1 m high. ~90 ha area has been utilised for the reservoir and associated structures / facilities and 61.41 ha area has been utilised dumping material excavated from the reservoir. Dumped material spread over 25.91 ha area is being rehandled and being utilised for embankment construction i.e. 35.5 ha of dumps shall remain. The entire dump area shall be biologically reclaimed. Photograph of dump site is given imn **Figure 1.9** below.

Figure 1.9 : Excavated Material from New Reservoir Dumped Externally at approx. 17°40'25"N, 83°07'33"E

Measures considered for minimizing the damage:

- In order to preserve top soil, Top soil has been dumped separately as small dumps not more than 1 m high.
- Dumped material being rehandled and being utilised for embankment construction

1.1.2 Damage to Ambient air quality

As indicated above the new KBR 2 is being dug out near the existing KBR1 on the opposite site of the road. Since this is a fresh project, all the activities like, vegetation removal, ground levelling, drilling & blasting, civil construction work etc. shall be involved.

Approx. 4450000 m^3 of soil and rocks were excavated for creation of the reservoir. Excavation was carried out using mechanical shovels / excavators, which loaded the excavated muck on to tipper trucks. The excavated material stored at different locations
The estimated quantity of material transported during construction phase is as follows--

- Total quantity of excavated material and transported – 6675000 T
- Total Concrete transported – 200 T

The project basically involves digging out soil, rocks and other debris from site and storing it in some other areas. Along with this, an embankment is also provided which is constructed of the same material being dug out and some other material.

The main source pollutant generate from the above activities is dust. The emissions are fugitive in nature. The fugitive emissions arising out of these activities have been estimated based on AP-42 considering the quantity of material excavated and handled.

The emissions of NOx during transport of excavated material are estimated based on CPCB guidelines. The estimated emissions for each activity are given in **Table 1.2** below.

Table 1.2 : Pollutant emissions during construction phase of KBR2

Sl. No.	Activity	Emission Factor	Emission Rate (g/sec)
Excavation /Construction activities			
1	Bulldozing	2.292 Kg/hr	0.064
2	Motor Grading	0.6 g/Km/Vehicle	0.014
3	Truck Loading with debris	0.0002 Kg/T	0.057
4	Truck Unloading	0.0002 Kg/T	0.057
5	Drilling and blasting of rocks	0.59 Kg/Hole	0.074
6	Wind erosion of exposed material	9.03E-07 g/s/m^2	0.027
Material Transport			
1	Truck transport of cement to site on paved roads		
	PM	17.8 g/Km/Vehicle	0.000000000871 g/s/m^2
	NOx	9.3 g/Km/Vehicle	0.000000000456 g/s/m^2
2	Truck transport of excavated material on unpaved roads		
	PM	5.8 g/Km/Vehicle	0.000003528695 g/s/m^2
	NOx	9.3 g/Km/Vehicle	0.000005702298 g/s/m^2

Based on the above estimated emission values, damage of ambient air quality which would have happened during construction activities of reservoir are assessed. The assessment has been made by studying increase of ground level concentrations due to the construction activities in buffer areas. The incremental concentrations due to the construction activities are given in **Table 1.3** below. The isopleths of PM_{10} and NO_X concentrations are also given in **Figure 1.10**and **Figure 1.11** respectively.

Table 1.3 : GLCs due to construction activities of KBR2

Station ID	PM	NOx
A1	0.026	0.232
A2	1.592	1.880
A3	0.380	0.078
A4	0.115	0.925
A5	0.000	0.000
A6	0.568	0.313
A7	0.109	0.163
A8	0.132	0.005

**** All values in µg/m³.***

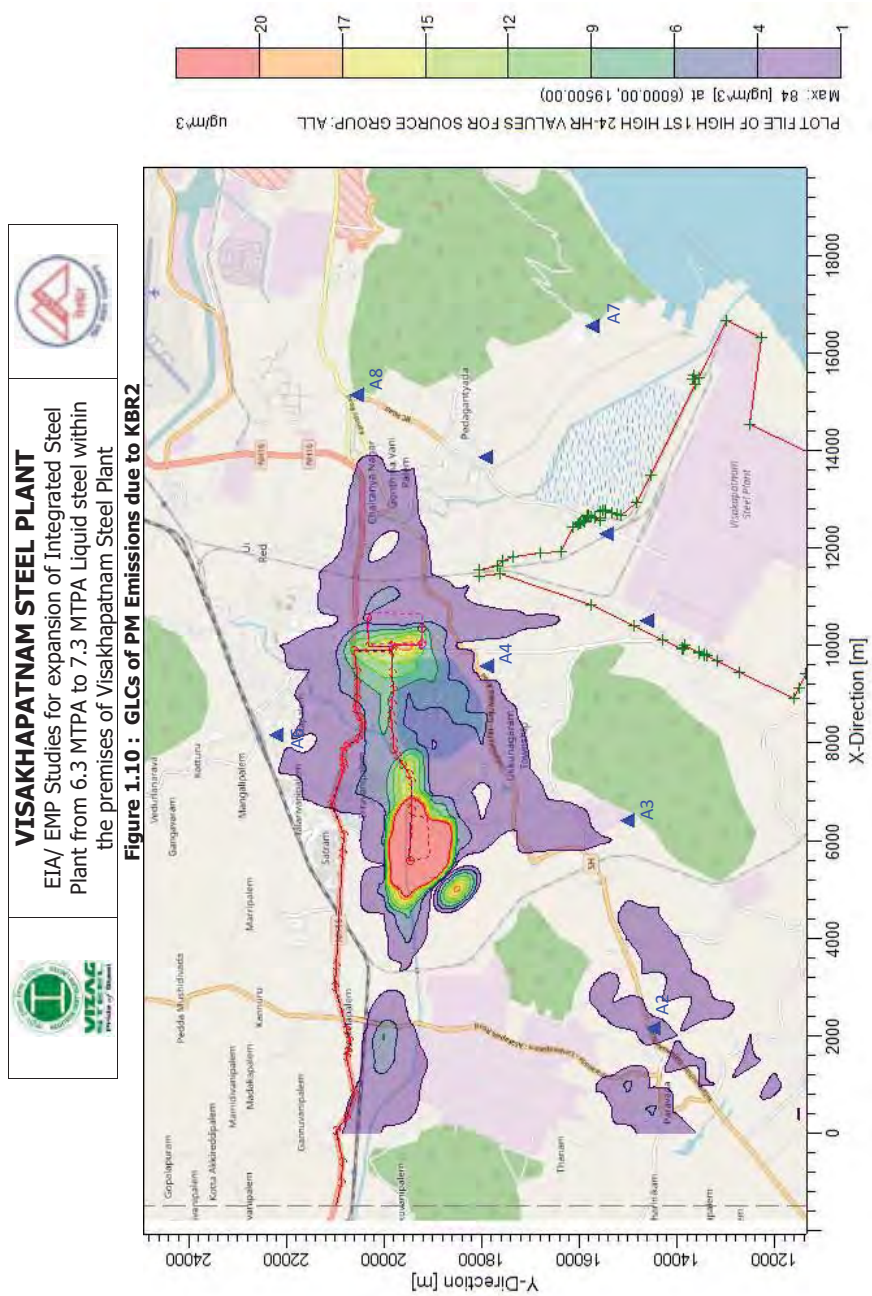


Figure 1.10 : GLCs of PM Emissions due to KBR2

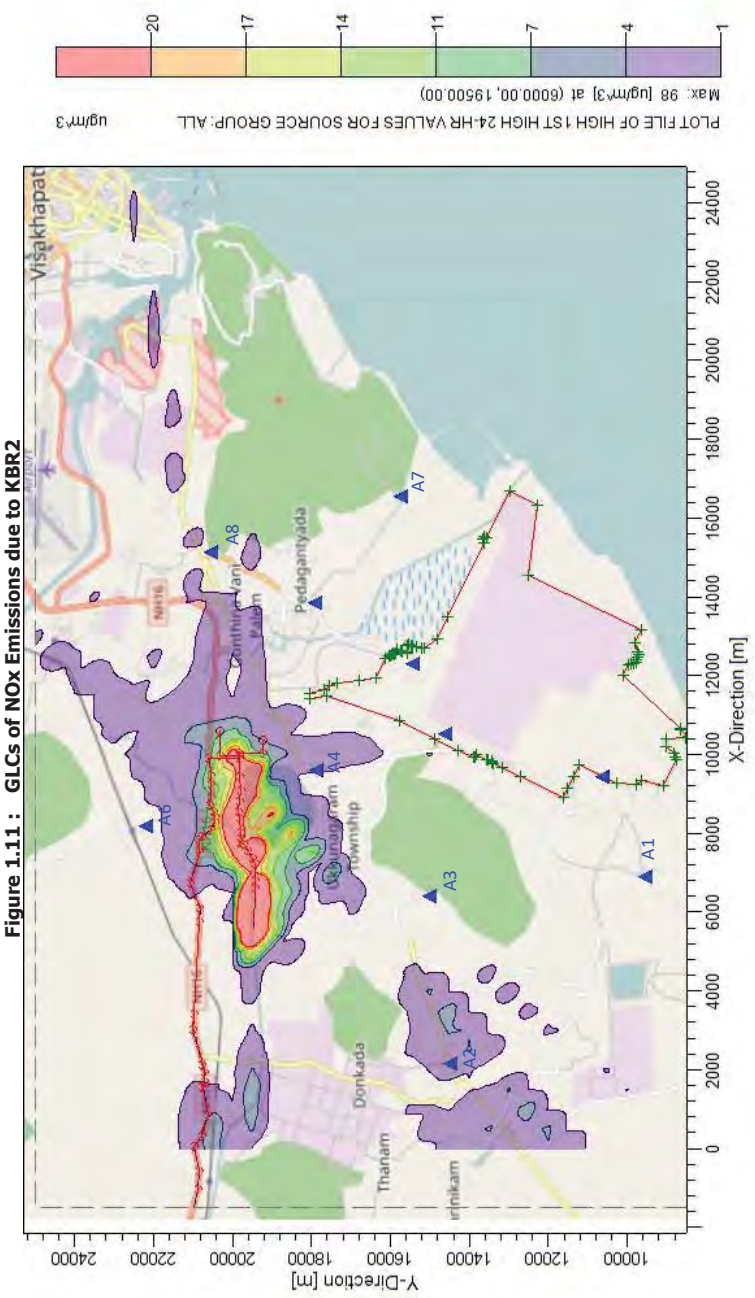


Figure 1.11 : GLCs of NOx Emissions due to KBR2

Based on the above, following conclusions can be drawn:

- During excavation of reservoir, the fugitive dust was generated due to various excavation activities, the maximum was near to the source. Concentrations of airborne dust at nearest habitation i.e. Railway colony which is 200m away from the site would have increased by about 4 µg/m^3 above the ambient concentrations. Similarly in the northern side beyond NH road the dust levels increased by 4 to 7 µg/m^3.
- Existing dust levels at this locations are in the range of 72 to 75 µg/m^3. The resultant concentrations at nearest inhabited areas during construction period would have been in the range of 76 to 82 µg/m^3 which are within the norms. Though there was minor increase in ambient air concentrations during excavation period of KBR2 which would have led to a minor damage to the environment.

Measures considered for minimizing the damage:

- Provided temporary enclosures to restrict the dust during excavation
- Regular water sprinkling on un paved approaching roads
- Muffling was done by sand bags, wire mesh and blast mats to reduce fly rocks and spread of dust. The fragments have been arrested within 15m of distance

1.1.3 Damage to Water environment:

Three natural perennial streams flowed through the reservoir site area. One (the Central Nala) entered the site somewhat in the middle of the western boundary of the reservoir site and flowed towards the south-east across the reservoir site. The second (Northern Nala) flows from the north slightly east of the eastern boundary of the reservoir site and flowed south-ward to join the Central Nala east of the south-eastern corner of the reservoir site. The third stream (Southern Nala) flows close to but outside the reservoir site. This stream flows from south-west to north-east in the southern part of the reservoir. After confluence with Central Nala coming from the north-west across the reservoir site east of the south-east corner of the reservoir site, it turns towards the south-east.

During construction of the reservoir the drains were diverted. Prior to commencement of reservoir construction a diversion channel was constructed to divert Central Nala along the proposed western and southern rim of the proposed reservoir area to the existing Southern Nala, thus maintaining the overall drainage pattern.

The new reservoir bottom is ~14 m below the original ground level. In the reservoir site, the ground water level is ~4 m below the original ground level. So water has to be discharged from the excavations. Due to this it would drained out the ground water in the surrounding areas.

RINL has constructed an artificial ground water recharging pond on the southern side of the reservoir site. Water seeping into the excavated reservoir water was pumped out into the ground-water recharging pit. The pits were grouted to avoid any further infiltration. The cross section of the reservoir is shown in **Figure 1.12.**

Figure 1.12 : Cross-section of the reservoir

Measures considered for minimizing the damage:

- In order to prevent infiltration of ground water during excavation and to avoid depletion of ground water levels in the surrounding areas, grouting was done.
- A diversion channel was constructed to divert Central Nala along the proposed western and southern rim of the proposed reservoir area to the existing Southern Nala, thus maintaining the overall drainage pattern.

1.1.4 Effects on Ambient Noise Levels:

The maximum noise generated by the diesel powered machinery deployed for excavations was 85 dB(A) at ~1 m distance from the machinery. The distance between the nearest residential areas (Railway Colony near the north-eastern corner of the reservoir site) and machine deployment site was 150 m.

Thus without any attenuation by physical barriers, the 85 dB(A) will reduce to 41.5 dB(A) at a distance from the source. The Railway Colony is close to the nearby National Highway on which there is very heavy traffic round the clock. Consequently the day time noise levels in the Railway Colony is ~59 dB(A).

The noise levels at the Railway Colony would have had increased by only 0.08 dB(A) on account of machinery deployed for reservoir construction. In reality, the actual increase was less because of attenuation by the thick vegetation in the intervening area i.e. background noise levels at nearby residential areas were unaffected by deployment of diesel powered machinery at the reservoir site.

Measures considered for minimizing the damage:

- Excavation activities have limited only during day time.
- Temporary enclosures have arranged to further decrease of noise levels.

- Thick vegetation in the intervening area and boundary wall between the reservoir and railway colony further decreases the noise levels

1.1.5 Ground Vibrations & Fly Rock:

Prior to blasting, trial blasting studies were carried out by M/s Mineral on Ground, Hyderabad to determine the maximum amount of explosives which can be used per blast without damaging any nearby buildings. Before carrying out trial blasting, the distance to nearby structures was determined and the quantity of explosives was adjusted accordingly so that the structures were not affected (i.e. only "Controlled Blasting" was carried out).

The minimum distance between buildings and blasting sites is about 380 m. Directorate General of Mines Safety (DGMS), has stipulated that a Safety Zone of 300 m must be maintained between blasting sites and residential areas to avoid risks to human life & property due to fly rock from blasting. Thus the distance between blasting sites and residential areas was adequate.

1.1.6 Damage to Ecology:

As mentioned earlier, the project area comprises of dense scrub and grass lands and bulk of the vegetation comprises of *Prosopis juliflora*.

Sample survey of vegetation of the areas adjacent to the areas cleared for the new reservoir indicates that *Prosopis juliflora* constituted ~92 % of the trees, *Acacia nilotica* ~5% and the balance was mostly *Borassus flabellifer, Azadirachta indica, Ficus* spp. along with a few isolated miscellaneous species.

Due to the spreading nature of the canopy of *Prosopis juliflora*, the green cover of the area (except the grass lands) was almost total although the trees were about 5 – 6 m apart on an average as can be seen from the flowing photograph (**Figure 1.13- 1.15**) inside the dense vegetation adjacent to the area cleared for the reservoir.

Figure 1.13 : Dense Vegetation Adjacent to New Reservoir Site at approx. 17°40'39"N, 83°10'34.7"E

Figure 1.14 : Dense Vegetation Adjacent to New Reservoir Site at approx. 17°40'12"N, 83°10'07"E

Figure 1.15 : Inside Dense Vegetation Adjacent to New Reservoir Site at approx. 17°40'12"N, 83°10'23"E

The damages on ecology due to reservoir construction are as follows:

1. Loss of green cover due to removal of vegetation
2. Loss of animals' habitat due to clearance of vegetation
3. Damage to vegetation due to deposition of fugitive dust on vegetation.

During clearance of the area for reservoir construction, a total of 23564 trees were felled of which 20982 were *Prosopis juliflora* of girth > 30 cm. 2053 nos. of trees had

girth between 30 cm & 60 cm, 521 trees had girth between 60 cm and 120 cm and 8 trees had girth >120 cm.

The area where the new reservoir is being constructed is surrounded by urban areas. The National Highway from Kolkata to Chennai via Cuttack, Bhubaneshwar, Visakhapatnam, Rajmundry and Vijaywada runs close to the site's northern boundary. There is very heavy traffic round the clock on this road. The size of the area, which is an isolated one, is too small to support any large animal. The only animals found in the reservoir area were common small birds, reptiles (snakes & lizards) and small mammals (squirrels, mongooses &rats & mice etc.).

The excavation and dumping has involved operation of diesel powered heavy earth moving machinery (HEMMs) over unpaved surfaces. Excavation and dumping of soil & rocks have led to generation of fugitive dust and NOx (from diesel engines). The excavated soil and hard rock dumped adjacent to the new reservoir, have been / are being re-handled and used for construction of the reservoir's embankments. The embankment will extend for up to 12 m above the original ground level. The slope of the embankment on the inner side (i.e. inside the reservoir) will be lined with concrete panels up to a depth of 4 m below the embankment. The work involves handling of excavated soil & rocks and movement of diesel powered HEMMs over unpaved surfaces. This is leading to generation of fugitive dust and NOx.

Water sprinkling was / is being carried out on the unpaved roads to suppress fugitive dust (**Figure 1.16**). However, the excavations and the dumps remain a major source of fugitive dust.

Figure 1.16 : Water Sprinkling on Road Between New Reservoir Site and Dump Site

The likely increase in airborne dust levels and NOx due to increased truck traffic has been estimated by mathematical modeling. The inputs for the mathematical modeling were (besides the increased vehicular movement) hourly meteorological data as monitored during Winter Season, 2016, emission factors suggested by Automotive Research Association of India, Pune after detailed field studies for Heavy Commercial Vehicles, Diesel Trucks manufactured after the year 2000. Emission factors for dust and NOx were considered to be 1.24 g/km and 9.3 g/km respectively.

The NOx was emitted over a wide area. Preliminary calculations have indicated that the quantity of NOx emitted over ~150 ha area was too less to have any measurable impact on the ambient air quality.

The maximum estimated ground level concentration of fugitive dust due to activities of the project was 84 µg/m^3 and occurred at the debris dumping location. It is to be noted that fugitive dust is generated at the ground level or few metres above the ground (in case of dumps). Fugitive dust does not travel very far unless there are very strong winds and most of the dust usually settles down within a few hundred metres of the source. The dust settling on the leaves of plants reduces the plants' photosynthetic activity and in extreme cases can also lead to the death of the leaves and apical buds. This is often seen adjacent to unpaved haul roads in mine areas. However, in the present project some dust deposition was observed on vegetation facing the dumps and the under-construction embankment, but fatal damage to vegetation by dust deposition was not observed, possibly due to effective dust suppression on unpaved roads.

1.1.7 Summary of Damages during Construction of KBR2

- A small portion of unutilized land which was already available with RINL was diverted for the project. The main vegetable of the land was some shrubs.
- Dust generation due to excavation and truck movement was major source of pollution. The same will cease to exist on completion on construction phase of the project.
- Some natural streams passing through the site were diverted.
- Major source of noise pollution was truck movement and blasting activities. The same will cease to exist on completion on construction phase of the project.
- The main vegetable of the land was some shrubs which was removed during construction phase.

1.2 Mitigation Measures

Measures considered during excavation and construction:

- Water is being sprinkled on unpaved roads to suppress fugitive dust.
- Garland drain and retaining wall will be constructed at the toe of the dumps to prevent wash off from the dump. The retaining walls shall be 1 m high and 0.5 m thick. The retaining walls will have weep holes leading to garland drain (0.5m X 0.5m). The garland drains will be routed through desilting ponds, before discharging to natural drainage channels.

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- After utilization of the material, the dump sites and the other two dumps (whose material will not be utilised), shall be biologically reclaimed. This will be carried out as follows:

  - On completion of external dumping / reclamation of dump sites, top soil (which was excavated during the initial stage of reservoir construction and has been stored in separate small dumps) will be scattered over the area. Water will be sprinkled over the topsoil.
  - Grasses and the shrub *Ipomea carnea* will be planted on the soil to stabilize it.
  - 0.5 m x 0.5 m x 0.65 m pits will be excavated at ~3 m intervals.
  - These pits will be filled with a mixture of topsoil, compost / organic manure.
  - About 0.6 m tall saplings of *Acacia nilotica*, *Azadirachta indica, Ficus bengalensis*, *Ficus religiosa*, and *Pongamia pinnata* will be planted in soil filled pits just after the commencement of monsoons. Seeds of *Phoenix sylvestris* will also be planted.

2.0 **Air quality in the core zone was not monitored and correlation of emission from the plant area therefore could not be correlated properly for possible impact on the receptor in the buffer zone in the downwind direction. Project proponent had been asked to collect one month fresh data as the base line data used was mostly secondary collected in the year 2016 and was not updated for validity the current environment parameters.**

Fresh baseline data was generated at site for one month duration. 4 AAQ stations were installed within the plant boundary (Core zone) spread in all 4 directions. In addition to this, one month baseline data generation was also conducted at 8 locations in 10 Km buffer zone of plant boundary to validate the previous data.

The establishment of baseline for different environmental components in the study area and at the project site has been done by conducting field monitoring for baseline data generation. The data generation was carried out covering micro-meteorology, Ambient Air Quality, Noise Levels, Water Quality and Soil.

2.1 MICRO-METEOROLOGY

The micro-meteorological data at site was freshly monitored for one month during the post-monsoon season of 2018. Various micro-meteorological parameters were recorded at one hour intervals continuously throughout the three month long monitoring period.

The parameters monitored were:

- *Wind speed*
- *Wind Direction*
- *Atmospheric Temperature*
- *Relative Humidity*
- *Solar Radiation*
- *Rainfall (on daily basis)*

Table 2.1 gives the summary of micro-meteorological data collected during the monitoring period. **Tables 2.2- 2.4** give the monitored wind frequency distribution for overall, day and night hours. Overall day, Day time (0600hrs.– 1800 hrs.) and night time (1800 hrs. – 0600 hrs.) Wind-rose diagrams have been prepared and presented as **Fig. 2.1, 2.2 & 2.3** respectively.

Table 2.1 : SUMMARIZED MONITORED MICRO-METEOROLOGICAL DATA AT VISAKHAPATNAM (OCT - NOV, 2018)

Period	Wind Speed (m/sec)			Temperature (°C)			Relative Humidity (%)		Solar Radiation (Watt/m²)			Rainfall		
(Oct-Nov'18)	Max.	Min.	Avg.	Max.	Min.	Avg	Max.	Min.	Max.	Min.	Avg.	24hrs Highest (mm)	Total (mm)	No. of rainy days
	7.4	<0.4	2.3	34.6	17.6	26.3	100	29	857	0	215	1.9	12.1	5

Figure 2.1 : WIND ROSE (OVERALL)

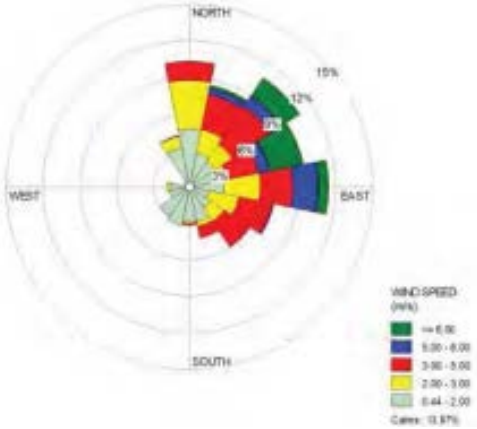

Table 2.2 : WIND FREQUENCY DISTRIBUTION (OVERALL)

Wind Direction (towards)	Wind Speed Ranges (m/s)					Total (%)
	0.4 - 2.0	2.0 - 3.0	3.0 - 5.0	5.0 - 6.0	>= 6.0	
N	4.74	4.00	1.55	0.00	0.00	10.29
NNE	2.86	1.96	2.94	0.49	0.25	8.50
NE	2.53	1.72	3.76	0.98	1.80	10.78
ENE	1.96	1.23	2.61	0.90	2.78	9.48
E	2.86	2.94	2.70	2.04	0.82	11.36
ESE	1.72	2.45	2.78	0.08	0.00	7.03
SE	2.12	1.31	2.53	0.00	0.00	5.96
SSE	2.94	0.41	0.98	0.00	0.00	4.33
S	2.86	0.16	0.16	0.00	0.00	3.19
SSW	3.27	0.00	0.00	0.00	0.00	3.27
SW	2.94	0.00	0.00	0.00	0.00	2.94
WSW	1.72	0.00	0.00	0.00	0.00	1.72
W	1.63	0.25	0.00	0.00	0.00	1.88
WNW	0.33	0.00	0.00	0.00	0.00	0.33
NW	0.57	0.00	0.00	0.00	0.00	0.57
NNW	3.27	0.98	0.08	0.00	0.00	4.33
Sub-Total	38.32	17.40	20.10	4.49	5.64	85.95
Calms (Wind speed <0.4 m/s or <1.6 km/hr)						***13.97***

Figure 2.2 : WIND ROSE (DAY)

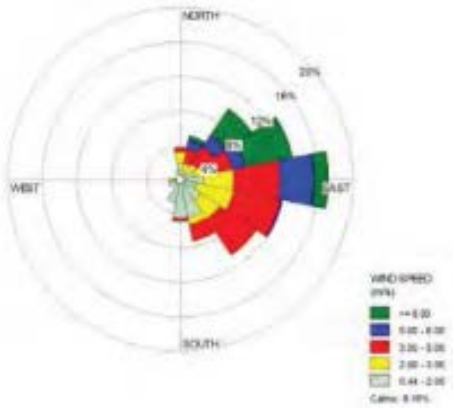

Table 2.3 : WIND FREQUENCY DISTRIBUTION (DAY)

Wind Direction (towards)	Wind Speed Ranges (m/s)					Total (%)
	0.44 - 2.0	2.0 - 3.0	3.0 - 5.0	5.0 - 6.0	>= 6.0	
N	1.79	1.47	0.49	0.00	0.00	3.75
NNE	0.65	1.31	1.79	0.98	0.49	5.22
NE	0.82	1.47	2.45	1.63	3.59	9.95
ENE	1.79	0.98	3.43	1.47	5.55	13.21
E	2.77	3.43	5.38	3.92	1.63	17.13
ESE	1.96	4.40	5.55	0.16	0.00	12.07
SE	2.94	2.61	5.06	0.00	0.00	10.60
SSE	4.57	0.82	1.96	0.00	0.00	7.34
S	4.57	0.00	0.33	0.00	0.00	4.89
SSW	2.77	0.00	0.00	0.00	0.00	2.77
SW	0.82	0.00	0.00	0.00	0.00	0.82
WSW	1.47	0.00	0.00	0.00	0.00	1.47
W	0.82	0.49	0.00	0.00	0.00	1.31
WNW	0.00	0.00	0.00	0.00	0.00	0.00
NW	0.00	0.00	0.00	0.00	0.00	0.00
NNW	1.14	0.00	0.00	0.00	0.00	1.14
Sub-Total	**28.87**	**16.97**	**26.43**	**8.16**	**11.26**	**91.68**
Calms (Wind speed <0.44 m/s or <1.6 km/hr)						***8.16***

Figure 2.3 : WIND ROSE (NIGHT)

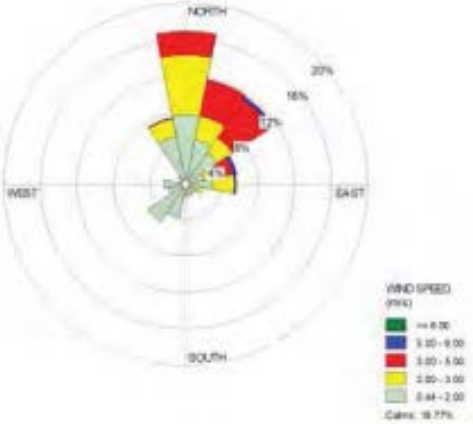

Table 2.4 : WIND FREQUENCY DISTRIBUTION (NIGHT)

Wind Direction (towards)	Wind Speed Ranges (m/s)					Total (%)
	0.4 - 2.0	2.0 - 3.0	3.0 - 5.0	5.0 - 6.0	>= 6.0	
N	7.68	6.54	2.61	0.00	0.00	16.83
NNE	5.07	2.61	4.08	0.00	0.00	11.76
NE	4.25	1.96	5.07	0.33	0.00	11.60
ENE	2.12	1.47	1.80	0.33	0.00	5.72
E	2.94	2.45	0.00	0.16	0.00	5.56
ESE	1.47	0.49	0.00	0.00	0.00	1.96
SE	1.31	0.00	0.00	0.00	0.00	1.31
SSE	1.31	0.00	0.00	0.00	0.00	1.31
S	1.14	0.33	0.00	0.00	0.00	1.47
SSW	3.76	0.00	0.00	0.00	0.00	3.76
SW	5.07	0.00	0.00	0.00	0.00	5.07
WSW	1.96	0.00	0.00	0.00	0.00	1.96
W	2.45	0.00	0.00	0.00	0.00	2.45
WNW	0.65	0.00	0.00	0.00	0.00	0.65
NW	1.14	0.00	0.00	0.00	0.00	1.14
NNW	5.39	1.96	0.16	0.00	0.00	7.52
Sub-Total	**47.71**	**17.81**	**13.73**	**0.82**	**0.00**	**80.07**
Calms (Wind speed <0.4 m/s or <1.6 km/hr)						***19.77***

The frequency table as indicated in **Tables 2.2, 2.3 &2.4** indicate that the study area winds are predominantly coming from East, North and North East directions. During daytime, East (E) is the predominant wind direction (prevailing for 17.13% of the time) followed by ENE (13.21%) and ESE (12.07%). Calm conditions prevailed for 8.16% of the daytime. During night, the predominant wind direction is N (16.83%), followed by

NNE (11.76%) and NE (11.6%). Calm condition prevailed for 19.77% of the time. Overall (24 hours), the predominant wind direction is also E (11.36%), followed by ENE (13.21%) and N (10.29%). Calm conditions prevailed for 13.97% of the time. During the entire monitoring period the predominant wind speeds were in the range of 0.4 – 7.4 m/s.

2.2 AMBIENT AIR QUALITY

Ambient air quality monitoring study has been done to correlate the emissions from the plant area and evaluate the existing air quality in and around the plant.

The existing ambient air quality, in terms of Respirable Particulate Matter (PM_{10} and $PM_{2.5}$), Sulphur-dioxide (SO_2), Oxides of Nitrogen (NOx), Carbon Monoxide (CO), Ozone (O_3), Ammonia (NH_3), Lead (Pb), Arsenic (As), Nickel (Ni), Benzene (C_6H_6) and Benzo(a)Pyrene (BaP), Phenols and Volatile Organic Compounds (VOC's) has been measured through a planned field monitoring. These parameters were monitored at selected Ambient Air Quality (AAQ) monitoring stations at four locations inside the plant (core zone) and eight locations outside the plant (buffer zone). The AAQ presented in this report is the AAQ monitored during post Monsoon season 2018 for one month as per MoM.

2.2.1 Location of Ambient Air Quality (AAQ) Monitoring Stations

To assess the ambient air quality, four locations inside the plant and eight locations outside the plant ambient air quality monitoring stations have been set up. **Table 2.5**gives the list AAQ monitoring stations. The location of stations has been shown in **Fig 2.4.**

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Figure 2.4 : Air Quality Monitoring Locations

For selection of the monitoring stations, Wind rose of IMD observatory at Visakhapatnam has been utilized to identify the probable locations. Station locations were decided by running screening model using wind direction & speed, atmospheric stability, stack details such as temperature, volume, velocity etc. of the existing stacks. As indicated earlier, the annual predominant wind directions in the study area in general are from E - ENE – N sectors. All predominant downwind sectors are considered for fixing up the monitoring stations.

The locations inside the plant i.e. core zone have been selected based on the above criteria looking into maximum emissions and the possible impact on receptors in the buffer zone in the downwind direction.

Table 2.5 : Ambient Air Quality (AAQ) Monitoring Stations

Sn	Station Code	Location	Latitude	Longitude	Direction& Distance from Plant (km)
Core Zone					
1.	WZAAQ1	Near Coke Oven Plant	17°36'6.41"N	83°12'12.37"E	Within plant boundary
2.	WZAAQ2	CPP 2 near Appikonda gate	17°37'9.24"N	83° 9'57.07"E	Within plant boundary
3.	WZAAQ3	Near Ash pond	17°35'24.99"N	83°11'6.60"E	Within plant boundary
4.	WZAAQ4	Central Laboratory	17°37'47.13"N	83°11'16.14"E	Within plant boundary
Buffer Zone					
5.	A1	Devada	17°35'7.98"N	83° 8'17.76"E	2.3 km, SW
6.	A2	Gorlavanipalem	17°37'50.83"N	83° 5'38.41"E	7.5 km, W
7.	A3	Bhavani Nagar	17°38'6.29"N	83° 8'2.47"E	3.7 km, W
8.	A4	Sector 3, VSP	17°39'38.34"N	83° 9'51.60"E	2.0 km, W
9.	A5	Chepurapalli	17°33'48.08"N	83° 5'23.00"E	8.5 km, SW
10.	A6	Duvvada	17°42'6.29"N	83° 9'42.67"E	5.3 km, NW
11.	A7	Gangavaram	17°38'25.66"N	83°13'47.46"E	2.4 km, NE
12.	A8	Gajuwaka	17°41'2.93"N	83°13'0.87"E	5.3 km, NE

2.2.2 Description of monitoring locations

Fresh baseline data is being generated at site for one month duration. 4 AAQ stations (WZAAQ1-WZAAQ4) were installed within the plant boundary and at 8 locations in 10 Km buffer zone of plant boundary to validate the previous data. The monitoring locations are described below-

a. WZAAQ1 – The monitoring station was setup near the Coke oven complex in the East direction near the under-construction COB5.
b. WZAAQ2 – The monitoring station was installed at the western boundary of the plant near the existing new CPP2 as the predominant wind direction in the study area is dominated by Easterlies.
c. WZAAQ3 – The monitoring location was installed in the south which is second predominant downwind direction near to the ash pond.

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d. WZAA4 – The monitoring location was in the upwind direction in the northern boundary of the plant.
e. AAQ1 –Located in south/south-west direction with reference to the plant, the monitoring station lies in the predominant downwind direction. The station is located in between three major industries in the area viz. RINL's steel plant, Hinduja Power Plant and NTPC's Simhadri power plant.
f. AAQ2 – Located west of the steel plant at a distance of ~7.5 km from plant boundary, the station is located in residential areas of Gorlavanipalem. The station is close to Gajuwaka-Almanchalli Road.
g. AAQ3 – Located within 5 km of plant boundary, the station is located in a residential area which is downwind of the steel plant. The station is at a distance of 4.8 km from the ash pond of Simhadri power plant which are to the south.
h. AAQ4 – The station is located in VSP Township which is a residential area with good green cover.
i. AAQ5 –The station is located further south of AAQ1 in the downwind direction beyond the Hinduja Power Plant. RINL's boundary is at a distance of 8.5 km.
j. AAQ6 – The station is located in residential areas north of the plant at a distance of about 5 km. The area is dominated by several building construction sites.
k. AAQ7 – Located North-East direction of the plant, the station is close to Gangavaram Port.
l. AAQ8 – Located north of the plant, the station is surrounded by dense population and several urban activities.

2.2.3 Predominant Wind Directions vis-à-vis Ambient air quality (AAQ) stations

As mentioned earlier, the predominant wind directions are E, followed by ENE and N. The monitoring locations covering upwind and downwind directions (as shown **Fig 2.5**) are as follows-

1. East to west - WZAAQ1 – WZAAQ2 – AAQ3 – AAQ2
2. North east to South west – AAQ7 – WZAAQ4 – WZAAQ2
3. East North east to South-South west –WZAAQ1 – WZAAQ3 – AAQ1 – AAQ5

Figure 2.5 : Air Quality Monitoring Locations vs Wind directions

2.2.4 Ambient air quality (AAQ) monitoring schedule

As mentioned earlier, the Revised EIA report has been prepared on the basis of Ambient Air Quality data generated in the study area for one month during the post monsoon season, 2018. Samples of 24 hourly duration were taken on each monitoring day twice a week for four weeks (i.e. 8 samples were collected at each location) for PM_{10}, $PM_{2.5}$, SO_2 and NOx. The other parameters has been measured through a planned field monitoring. The methods of sample collection, equipment used and analysis procedures as is as provided in Chapter 3 of the EIA report.

2.2.5 Methods of Sampling and Analysis

The methods of sample collection, equipment used and analysis procedures as followed are given in **Table 2.6.**

Table 2.6 : Methodology of Sampling & Analysis and Equipment used

Sl. No	Parameters	Method followed
1.	PM_{10}	Gravimetric. IS:5182 (Part 23)
2.	$PM_{2.5}$	Gravimetry
3.	NOx	Jacobs and Hochheiser modified (Na-arsenite) Method. IS:5182 (Part VI)
4.	SO_2	Improved West & Gaecke method: IS:5182 (Part II)
5.	CO	NDIR Method
6.	O_3	UV photometric
7.	NH_3	Indophenol blue method
8.	Pb	AAS method after sampling on EPM 2000 filter paper
9.	As	AAS method after sampling on EPM 2000 filter paper

10.	Ni	AAS method after sampling on EPM 2000 filter paper
11.	C_6H_6	Adsorption and Desorption followed by GC analysis
12.	Benzo(a)Pyrene	Solvent extraction followed by HPLC analysis
13.	Phenols	EPA Method TO-8,HPLC analysis
14.	Volatile Organic Compounds (VOC's)	NISOH-1501, Issue 3, 15th March 2003
15.	Heavy metals (Fe, Mn, Cd, Cu, Cr, Zn)	AAS method after sampling on EPM 2000 filter paper
16.	Hg	CVAAS method after sampling on EPM 2000 filter paper

2.2.6 Ambient Air Quality Monitoring Results

The summarized results of ambient air quality monitoring (covering PM_{10}, $PM_{2.5}$, NOx, SO_2, CO, NH_3, O_3, Pb, As, Ni, Benzene and BaP are given in **Table 2.7.** Station wise detailed monitoring data are furnished in **Tables 2.8** to **2.19**.

Table 2.7 : Summarized Results of one month AAQ Monitoring Inside the Plant during Post Monsoon Season

Parameter	Detection Limit of Instrument used	Statistical data	WZAAQ1	WZAAQ 2	WZAAQ 3	WZAAQ 4	A1	A2	A3	A4	A5	A6	A7	A8	NAAQS
PM_{10} ($\mu g/m^3$)	*5 $\mu g/m^3$*	**Mean**	128	85	185	82	90	85	84	68	84	81	98	72	*100*
		Min	96	69	119	73	79	73	69	57	74	72	87	59	
		Max	161	99	262	89	96	90	94	75	90	89	119	82	
$PM_{2.5}$ ($\mu g/m^3$)	*5 $\mu g/m^3$*	**Mean**	75	41	83	41	46	46	43	32	43	39	46	39	*60*
		Min	57	26	53	31	35	40	33	25	36	29	38	32	
		Max	95	58	118	50	52	52	52	42	49	47	57	49	
SO_2 ($\mu g/m^3$)	*4 $\mu g/m^3$*	**Mean**	47.7	11.8	26.5	15.8	13.7	20.8	11.5	11.8	14.2	12.4	17.5	12.6	*80*
		Min	38.1	8.9	21.2	11.2	12.7	19.3	10.3	8.4	12.7	8.6	11.8	9.4	
		Max	56.0	16.6	30.5	18.6	16.0	22.7	13.4	13.8	16.1	17.1	23.8	18.1	
NOx ($\mu g/m^3$)	*10 $\mu g/m^3$*	**Mean**	36.6	22.8	33.4	24.5	23.7	25.2	17.2	15.4	25.6	19.5	29.7	21.2	*80*
		Min	26.5	20.3	26.6	15.1	18.6	22.3	13.1	10.3	22.5	15.6	20.6	19.1	
		Max	48.2	26.7	39.9	31.7	29.3	28.9	20.7	20.1	28.8	23.4	41.3	26.1	
CO (mg/m^3)	*0.057 mg/m^3*	**Mean**	2.175	1.263	2.209	1.579	1.224	0.88	1.472	0.887	0.83	1.719	1.546	0.64	*2.0*
		Min	1.875	1.125	1.906	1.283	1.010	0.10	1.364	0.729	0.15	1.511	1.279	0.15	
		Max	2.581	1.384	2.541	1.871	1.543	2.69	1.575	1.105	2.57	1.928	1.975	1.32	
Ozone ($\mu g/m^3$)	*2.0 $\mu g/m^3$*	**Mean**	82	35	73	37	66	52	45	29	56	41	63	39	*100*
		Min	75	33	65	34	61	43	43	25	46	38	58	30	
		Max	89	39	80	41	71	60	47	34	65	44	67	49	
NH_3 ($\mu g/m^3$)	*4.2 $\mu g/m^3$*	**Mean**	177	48	73	64	62	41	57	26	63	59	71	68	*400*
		Min	149	37	67	56	55	37	52	20	58	51	68	65	
		Max	224	58	80	70	68	46	63	33	69	72	77	73	
Pb ($\mu g/m^3$)	*0.0006 $\mu g/m^3$*	**Mean**	0.1331	0.0117	0.1325	0.0292	0.0290	0.028	0.0414	0.0035	0.004	0.0460	0.0904	<0.0006	*1.0*
		Min	0.0860	0.0066	0.0846	0.0108	0.0234	0.013	0.0206	<0.0006	0.002	0.0160	0.0167	<0.0006	
		Max	0.1907	0.0185	0.1607	0.0569	0.0357	0.047	0.0608	0.0035	0.006	0.1059	0.1492	<0.0006	

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Parameter	Detection Limit of Instrument used	Statistical data	WZAAQ1	WZAAQ 2	WZAAQ 3	WZAAQ 4	A1	A2	A3	A4	A5	A6	A7	A8	NAAQS
As (ng/m^3)	*1.8 ng/m^3*	**Mean**	3.1	<1.8	3.5	<1.8	<1.8	2.3	<1.8	<1.8	2.8	<1.8	<1.8	2.0	*6.0*
		Min	2.0	<1.8	2. 6	<1.8	<1.8	<1.8	<1.8	<1.8	2.7	<1.8	<1.8	<1.8	
		Max	4.2	<1.8	4.7	<1.8	<1.8	2.6	<1.8	<1.8	3.0	<1.8	<1.8	2.0	
Ni (ng/m^3)	*0.6 ng/m^3*	**Mean**	12.3	4.2	16.0	3.5	14.5	3.8	13.6	<0.61	8.4	10.3	16.7	0.8	*20*
		Min	3.7	2.7	<0.61	0.9	12.1	1.7	8.6	<0.61	4.4	7.6	12.3	<0.61	
		Max	21.3	7.3	55.5	7.1	16.2	5.4	18.8	<0.61	10.8	12.5	22.7	1.0	
Benzene ($\mu g/m^3$)	*2.08 $\mu g/m^3$*	**Avg**	7.36	<2.08	4.48	2.82	2.56	3.82	<2.08	<2.08	2.77	2.51	4.86	2.72	5
BaP (ng/m^3)	*0.21 ng/m^3*	**Avg**	1.16	<0.21	0.52	0.36	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	1

Table 2.8 : Detailed Ambient Air Quality Results For Near Coke Oven Plant (WZAAQ1), POST MONSOON 2018

S.No.	Date of Sampling	PM_{10} ($\mu g/m^3$)	$PM_{2.5}$ ($\mu g/m^3$)	NO_X ($\mu g/m^3$)	SO_2 ($\mu g/m^3$)
1	15/10/2018	140	82	48.2	51.9
2	18/10/2018	138	82	35.2	52.1
3	21/10/2018	144	85	41.7	40.5
4	26/10/2018	161	95	42.2	56.0
5	31/10/2018	122	72	26.5	42.8
6	3/11/2018	110	65	29.6	38.1
7	6/11/2018	109	64	31.6	52.8
8	9/11/2018	96	57	38.0	47.3

Table 2.9 : Detailed Ambient Air Quality Results For CPP 2 Near Appikonda Gate (WZAAQ2), POST MONSOON 2018

S.No.	Date of Sampling	PM_{10} ($\mu g/m^3$)	$PM_{2.5}$ ($\mu g/m^3$)	NO_X ($\mu g/m^3$)	SO_2 ($\mu g/m^3$)
1	15/10/2018	85	39	20.3	10.5
2	18/10/2018	78	30	25.2	9.6
3	21/10/2018	69	26	21.2	8.9
4	26/10/2018	99	54	23.7	16.6
5	31/10/2018	91	45	21.8	12.6
6	3/11/2018	96	58	21.5	13.5
7	6/11/2018	87	43	26.7	10.4
8	9/11/2018	75	31	22.3	12.3

Table 2.10 : Detailed Ambient Air Quality Results For Near Ash Pond (WZAAQ3), POST MONSOON 2018

S.No.	Date of Sampling	PM_{10} ($\mu g/m^3$)	$PM_{2.5}$ ($\mu g/m^3$)	NO_X ($\mu g/m^3$)	SO_2 ($\mu g/m^3$)
1	15/10/2018	190	85	37.2	25.7
2	18/10/2018	231	104	39.9	30.5
3	21/10/2018	164	74	34.3	29.5
4	26/10/2018	132	60	30.4	26.0
5	31/10/2018	119	53	29.6	22.0
6	3/11/2018	216	97	36.4	30.0
7	6/11/2018	262	118	32.5	27.1
8	9/11/2018	164	74	26.6	21.2

Table 2.11 : Detailed Ambient Air Quality Results For Central Laboratory (WZAAQ4), POST MONSOON 2018

S.No.	Date of Sampling	PM_{10} ($\mu g/m^3$)	$PM_{2.5}$ ($\mu g/m^3$)	NO_X ($\mu g/m^3$)	SO_2 ($\mu g/m^3$)
1	15/10/2018	79	34	28.2	18.6
2	18/10/2018	80	38	20.9	17.4
3	21/10/2018	83	42	27.2	16.2
4	26/10/2018	89	50	31.7	15.7
5	31/10/2018	73	31	25.4	11.2
6	3/11/2018	88	47	26.9	15.7

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S.No.	Date of Sampling	PM_{10} ($\mu g/m^3$)	$PM_{2.5}$ ($\mu g/m^3$)	NO_X ($\mu g/m^3$)	SO_2 ($\mu g/m^3$)
7	6/11/2018	85	46	21.0	17.6
8	9/11/2018	81	40	15.1	13.8

Table 2.12 : Detailed Ambient Air Quality Results For Devada (A1), POST MONSOON 2018

S.No.	Date of Sampling	PM_{10} ($\mu g/m^3$)	$PM_{2.5}$ ($\mu g/m^3$)	NO_X ($\mu g/m^3$)	SO_2 ($\mu g/m^3$)
1	15/10/2018	92	52	22.7	13.2
2	18/10/2018	91	48	18.6	16.0
3	21/10/2018	90	47	25.8	12.7
4	26/10/2018	96	47	20.3	12.8
5	31/10/2018	95	51	27.3	13.1
6	3/11/2018	91	43	21.6	14.4
7	6/11/2018	87	41	29.3	13.3
8	9/11/2018	79	35	23.8	14.2

Table 2.13 : Detailed Ambient Air Quality Results For Gorlavaripalem (A2), POST MONSOON 2018

S.No.	Date of Sampling	PM_{10} ($\mu g/m^3$)	$PM_{2.5}$ ($\mu g/m^3$)	NO_X ($\mu g/m^3$)	SO_2 ($\mu g/m^3$)
1	13/10/2018	81	41	27.3	19.3
2	19/10/2018	90	48	28.9	19.3
3	25/10/2018	82	40	26.8	21.7
4	28/10/2018	89	50	24.0	21.1
5	1/11/2018	73	40	25.0	22.7
6	4/11/2018	88	52	22.3	19.7
7	7/11/2018	89	50	23.7	22.3
8	9/11/2018	86	45	23.7	20.1

Table 2.14 : Detailed Ambient Air Quality Results For Bhavaninagar (A3), POST MONSOON 2018

S.No.	Date of Sampling	PM_{10} ($\mu g/m^3$)	$PM_{2.5}$ ($\mu g/m^3$)	NO_X ($\mu g/m^3$)	SO_2 ($\mu g/m^3$)
1	15/10/2018	69	33	17.8	11.8
2	18/10/2018	79	45	13.1	13.2
3	21/10/2018	94	52	18.7	10.7
4	26/10/2018	90	51	16.2	13.4
5	31/10/2018	89	43	15.5	10.3
6	3/11/2018	81	36	18.2	11.0
7	6/11/2018	87	45	20.7	10.5
8	9/11/2018	82	38	17.1	10.8

Table 2.15 : Detailed Ambient Air Quality Results For Sector 3, VSP Quarters (A4), POST MONSOON 2018

S.No.	Date of Sampling	PM_{10} ($\mu g/m^3$)	$PM_{2.5}$ ($\mu g/m^3$)	NO_X ($\mu g/m^3$)	SO_2 ($\mu g/m^3$)
1	15/10/2018	68	26	15.6	11.5
2	18/10/2018	70	31	14.7	10.9
3	21/10/2018	74	35	13.2	13.2
4	26/10/2018	71	42	10.3	13.8
5	31/10/2018	63	30	15.9	10.7
6	3/11/2018	75	39	19.2	12.6
7	6/11/2018	63	29	20.1	13.2
8	9/11/2018	57	25	14.2	8.4

Table 2.16 : Detailed Ambient Air Quality Results For Cheepurapalli (A5), POST MONSOON 2018

S.No.	Date of Sampling	PM_{10} ($\mu g/m^3$)	$PM_{2.5}$ ($\mu g/m^3$)	NO_X ($\mu g/m^3$)	SO_2 ($\mu g/m^3$)
1	13/10/2018	89	40	28.8	14.4
2	19/10/2018	90	47	25.8	16.1
3	25/10/2018	82	36	25.7	15.1
4	28/10/2018	90	49	25.4	13.2
5	1/11/2018	86	45	22.5	13.2
6	4/11/2018	78	38	26.4	16.0
7	7/11/2018	74	41	26.8	12.7
8	9/11/2018	81	44	23.5	12.8

Table 2.17 : Detailed Ambient Air Quality Results For Duvvada (A6), POST MONSOON 2018

S.No.	Date of Sampling	PM_{10} ($\mu g/m^3$)	$PM_{2.5}$ ($\mu g/m^3$)	NO_X ($\mu g/m^3$)	SO_2 ($\mu g/m^3$)
1	15/10/2018	85	41	22.6	13.8
2	18/10/2018	84	44	20.2	11.7
3	21/10/2018	82	38	19.7	12.8
4	26/10/2018	79	36	17.3	13.2
5	31/10/2018	82	39	23.4	17.1
6	3/11/2018	72	29	18.7	10.5
7	6/11/2018	75	34	15.6	8.6
8	9/11/2018	89	47	18.3	11.5

Table 2.18 : Detailed Ambient Air Quality Results For Gangavaram (A7), POST MONSOON 2018

S.No.	Date of Sampling	PM_{10} ($\mu g/m^3$)	$PM_{2.5}$ ($\mu g/m^3$)	NO_X ($\mu g/m^3$)	SO_2 ($\mu g/m^3$)
1	15/10/2018	87	38	27.1	18.6
2	18/10/2018	89	41	30.8	15.3
3	21/10/2018	95	44	36.1	14.2
4	26/10/2018	119	54	41.3	23.1
5	31/10/2018	89	38	33.6	23.8
6	3/11/2018	87	45	22.3	15.6

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S.No.	Date of Sampling	PM_{10} ($\mu g/m^3$)	$PM_{2.5}$ ($\mu g/m^3$)	NO_X ($\mu g/m^3$)	SO_2 ($\mu g/m^3$)
7	6/11/2018	110	57	20.6	11.8
8	9/11/2018	98	43	25.4	17.7

Table 2.19 : Detailed Ambient Air Quality Results For Gajuwaka (A8), POST MONSOON 2018

S.No.	Date of Sampling	PM_{10} ($\mu g/m^3$)	$PM_{2.5}$ ($\mu g/m^3$)	NO_X ($\mu g/m^3$)	SO_2 ($\mu g/m^3$)
1	13/10/2018	80	49	26.1	18.1
2	19/10/2018	59	32	19.4	9.4
3	25/10/2018	61	34	20.2	10.6
4	28/10/2018	70	40	19.5	11.7
5	1/11/2018	72	41	21.3	15.0
6	4/11/2018	69	32	19.1	9.8
7	7/11/2018	82	39	24.6	16.4
8	9/11/2018	82	43	19.6	9.8

2.2.7 Summary of Results of Air Quality Status Inside and Outside the Plant

Inside the Plant (Core Zone)

AAQ was monitored at 4 stations in the four directions continuously for one month during the monitoring season. In absence of core zone ambient air quality standards, the values have been compared with NAAQS, 2009. The values of PM_{10} and $PM_{2.5}$ at WZAAQ2 and WZAAQ4 station is found within the limits when compared with National Ambient Air Quality Standards (NAAQS), 2009 of Central Pollution Control Board (CPCB).

The PM_{10} and $PM_{2.5}$ values are high in WZAAQ1 (near Coke Oven plants) in the East direction and WZAAQ3 (near Ash pond) in the South direction. High concentrations of pollutants are recorded at these locations. The high concentrations PM_{10} and $PM_{2.5}$ at WZAAQ1 can be attribute to the construction activities of new coke oven and activities nearby waste dumps. However, these are below norm when compared to work zone standards for dust specified in Indian Factories Act.

The WZAAQ1 (near Coke Oven plants) is also showing relatively high concentrations of ammonia , benzene and Benzo(a) pyrene concentrations compared to the other locations as the monitoring station is located in the downwind direction to ammonium sulphate and by product recovery plant. Whereas, the values in WAAQ3 (Near ash pond) is showing a downward trend for the above parameters. The values are further decreased in ambient air location A3 which is further south and beyond the plant premises.

Further, high Ni concentrations have observed in WZAAQ 1&3. However, WZAAQ2 & 4 the values are much below the norms. The presence of Ni in coal ash particles has been reported and naturally also available in soil (Journal of Industrial pollution Control (2008)).

The high concentrations PM_{10} and $PM_{2.5}$ at WZAAQ3 can be attributed to the ash handling activities at the ash pond area and plying of trucks nearby. It is to be noted that the sea is less than a km away. Sand and salt spray blowing in from the sea coast cannot be ruled out the high PM levels. PM_{10} and $PM_{2.5}$ values are within the norms in remaining locations.

The values of SO_2, NOx and other parameters are within the limits at all locations within the core zone.

Outside the Plant (Buffer Zone)

AAQ was monitored at eight AAQ stations continuously for one month during the monitoring season. The results indicate that air quality is within norms for all the monitoring locations for all parameters as prescribed by NAAQS, 2009. However, values of PM_{10} and $PM_{2.5}$ are relatively high at A1 and A7. It can be attributed to material handling areas of port including coal at Gangavaram Port as well as higher vehicular movement. The high results of PM_{10} at A1 may be attributed due to higher vehicular movement in residential area, industrial activities and activities near ash pond.

Ni values are found high in A7. Ni values are also relatively high at A1, A3 and A6 though the values are within norms. Higher values of Ni in ambient air have also been reported in studies in Vishakhapatnam area in literature (Ref. Atmospheric Pollution Research 7 (2016) 725-733). The possible reason is mainly due to anthropogenic activities.

Further, A5 station has reported values of As though within norms. The concentration of As might be due to proximity of thermal power plant in the vicinity of this monitoring station.

2.3 Water Environment

Water quality monitoring was carried out with the following objectives:

- To understand the ground water quality.
- To assess the waste water quality i.e. inlet and outlet of Coke Oven & By-product Plant.
- To assess the quality of the outfalls from the plant.

The locations of various Ground Water Sampling locations are given in **Table 2.20.**

Table 2.20 : Location of Ground Water Monitoring Station

Sn	Stn. No.	Location Name	Latitude	Longitude
1	**GW1**	Bhavaninagar	*17°38'25.3"N*	83°07'46.0"E
2	**GW2**	Devada	*17°35'12.1"N*	83°08'25.4"E
3	**GW3**	Gangavaram	*17°38'34.9"N*	83°13'33.8"E
4	**GW4**	Near Railway Colony	*17°40'50.8"N*	83°11'01.4"E
5	**GW5**	Appikonda	17°34'30.6"N	83°10'16.1"E
6	**GW6**	Pittavanipalem	*17°35'51.4"N*	83°07'36.6"E
7	**GW7**	Peddagantayada	*17°39'53.8"N*	83°11'56.8"E

Table 2.21 : Central Pollution Control Board (CPCB) Surface Water Quality Criteria

SN	Parameters	Class A	Class B	Class C	Class D	Class E
1.	pH	6.5–8.5	6.5–8.5	6.0-9.0	6.5–8.5	6.5–8.5
2.	Dissolved oxygen (as O_2), mg/l, min	6	5	4	4	-
3.	BOD, 5 days at 20° C, max	2	3	3	-	-
4.	otal coliform organism, MPN/100 ml, max	50	500	5000	-	-
5.	Free ammonia (as N), mg/l, max	-	-	-	1.2	-
6.	Electrical conductivity, μmhos/cm, max	-	-	-	-	2250
7.	Sodium absorption ratio, max.	-	-	-	-	26
8.	Boron (as B), mg/l, max.	-	-	-	-	2

Class A : Drinking water source without conventional treatment but after dis-infection
Class B : Outdoor bathing (organised)
Class C : Drinking water source after conventional treatment and after dis-infection
Class D : Propagation of Wild life and Fisheries
Class E : Irrigation, Industrial Cooling, and Controlled Waste Disposal
Below E : Not meeting A, B, C, D & E Criteria

The results of seven ground water samples collected and analysed during post-monsoon season as given in **Table 2.22.**

Table 2.22 : Ground Water Quality During Summer Season

SN.	Parameters	* Norms 1	* Norms 2	GW1 (Bhavaninagar)	GW2 (Devada)	GW3 (Gangavaram)	GW4 (Railway Colony)	GW5 (Appikonda)	GW6 (Pittavanipalem)	GW7 (Peddagantayada)
1	Colour, Hazen units, Max.	5	15	<5	<5	<5	<5	<5	<5	<5
2	Odour	Agreeable	Agreeable	Agr.	Agr.	Agr.	Agr.	Agr.	Agr.	Agr.
3	Taste	Agreeable	Agreeable	Salty	Agr.	Agr.	Agr.	Agr.	Salty	Salty
4	Turbidity, NTU, Max.	1	5	0.17	0.27	0.26	2.81	3.57	2.43	0.87
5	pH Value	6.5 to 8.5	NR	7.48	7.17	7.25	6.99	7.32	7.06	7.54
6	Total Hardness (as $CaCO_3$), mg/l, Max	300	600	208	652	520	336	504	984	272
7	Iron (as Fe), mg/l, Max.	1.0	NR	0.121	0.145	0.114	<0.05	0.436	0.486	0.493
8	Chloride (as Cl), mg/l, Max.	250	1000	129	252	391	94	307	601	102
9	Fluoride (as F) mg/L, Max.	1.0	1.5	0.750	0.813	0.788	0.721	0.551	0.638	0.896
10	Total Dissolved Solids mg/l, Max.	500	2000	724	1092	1234	526	1132	1902	626
11	Calcium (as Ca), mg/l, Max.	75	200	24	139	77	78	83	235	29
12	Magnesium (as Mg), mg/L, Max.	30	100	34	70	75	32	68	91	46
13	Copper (Cu), mg/l, Max.	0.05	1.5	<0.01	<0.01	<0.01	<0.01	<0.01	0.014	0.012
14	Manganese (as Mn), mg/l, Max.	0.1	0.3	<0.01	<0.01	0.099	<0.01	0.051	0.036	0.015
15	Sulphate (as SO_4), mg/l, Max.	200	400	89	137	97	106	218	209	149
16	Nitrate (as NO_3), mg/l, Max.	45	NR	35	29	40	42	33	68	37
17	Phenols (as C_6H_5OH), mg/l, Max	0.001	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
18	Mercury (as Hg), mg/l, Max.	0.001	NR	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
19	Cadmium (as Cd), mg/l, Max.	0.003	NR	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
20	Arsenic (as As), mg/l, Max.	0.01	NR	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
21	Cyanide (as CN), mg/l, Max.	0.05	NR	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
22	Lead (as Pb), mg/l, Max.	0.01	NR	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
23	Zinc (as Zn), mg/l, Max.	5.0	15	<0.1	<0.1	<0.1	0.720	1.762	<0.1	<0.1
24	Total Chromium (as Cr^{3+}), mg/l, Max.	0.05	NR	<0.01	0.011	<0.01	<0.01	<0.01	<0.01	0.018
25	Nickel (as Ni), mg/l, Max.	0.02	NR	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

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SN.	Parameters	* Norms 1	* Norms 2	GW1 (Bhavaninagar)	GW2 (Devada)	GW3 (Gangavaram)	GW4 (Railway Colony)	GW5 (Appikonda)	GW6 (Pittavanipalem)	GW7 (Peddagantayada)
26	Total Alkalinity (as $CaCO_3$) mg/l, Max.	200	600	200	316	304	224	232	400	176
27	Aluminium (as Al) mg/l, Max.	0.03	0.2	0.074	<0.01	<0.01	<0.01	0.091	<0.01	0.028
28	Boron, mg/l, Max.	0.5	1.0	0.320	0.166	0.296	0.056	0.222	0.196	0.393
29	Total Coliform, MPN/100ml	Shall not be detectable in any 100ml sample	-	ND	ND	ND	ND	ND	ND	ND
30	Faecal Coliform, MPN/100ml	-do-	-	ND	ND	ND	ND	ND	ND	ND
* Norms as per Drinking Water – Specification - IS: 10500 (2012) Revision 2015. Norm[1] : Requirement (Acceptable limits); Norm[2] : Permissible limits in the absence of alternate source										
NR: No relaxation, ND: Not Detected (Detection limit 1.1 MPN/100mL)										

2.3.1 Results of Ground Water Quality Analysis

In absence of any specific norms for Ground Water Quality, the results have been compared with drinking water norms (IS: 10500).

- The turbidity of the ground water samples were in the range of 0.17 to 3.57 NTU.
- The turbidity values in all the samples were within the Acceptable Limit except for GW4 (Railway Colony), GW5 (Appikonda) & GW6 (Pittavanipalem) where the value exceeded Acceptable Limit, but did not exceed the Permissible Limit.
- The pH of the ground water samples are in the range of 6.99 to 7.54.
- Total hardness (as $CaCO_3$) levels were within the Acceptable Limit except for GW2 (Devada) & GW6 (Pittavanipalem) wherein the values exceeded the Permissible Limits also which might be due to impact of sea water intrusion.
- The sulphate concentrations in ground water samples were within Acceptable Limits at all the locations except GW5 (Appikonda) & GW6 (Pittavanipalem) where the values though on higher side were within Permissible Limits.
- Iron concentration was found below detectable limits in all samples.
- Nitrate is found high in GW6 (Pittavanipalem) and for the other samples the values are well within the acceptable limit. Reports of higher concentrations of nitrate has also been reported in this area in literature.
- The alkalinity concentrations are above the acceptable limit but below the permissible limits in all the samples.
- Aluminium has been detected in GW1 (Bhavaninagar) and GW5 (Appikonda) however the values are well within permissible limit.

Apart from the above parameters, rest of the parameters at all the ground water locations were well within the limits when compared with the drinking water quality standards specified in IS: 10500 (2012) and Amendment IS: 10500: 2015.

2.4 Soil Characteristics

The soil sampling locations were selected with the following objectives:

- To assess the quality of soil Dumped of Kanithi Balancing Reservoir - 2 (KBR-2).
- To assess the impact (if any) of project air emissions, effluent outfall and solid waste on soil in the study area.

The soil samples were marked, brought to laboratory, air-dried and analysed for different physico-chemical characteristics[1]. The physical and chemical properties of soil were studied.

2.4.1 Soil analysis of KBR2

A total of two sampling locations were selected for studying the soil properties of KBR2 area. The selected locations are given below-

- KS1 - Top soil KBR-2
- KS2 - Rocky soil KBR-2

[1]Source : Jackson, M.L. (1967): "Soil Chemical Analysis" (Prentice Hall of India Pvt. Limited, New Delhi) and "Soil Test Methodology" (1992), Edited B.S. Mathur. SSAC (BAU) Tech. Bull. 3/92. Pp. 312. Department of Soil Sciences and Agriculture, Chemistry, BAU, Ranchi.

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The results of the available major nutrients in soil samples will be compared with soil rating criteria as given **Table 2.23.**

Table 2.23 : Available Major Nutrients in KBR2 Soil[2]

Nutrients and Ratings	Soil Rating Criteria
Organic Carbon (%)	<0.50 – Low; 0.50 to 0.75 – Medium; >0.75 – High
Available Nitrogen (kg/ha)	<280 – Low; 280 to 560 – Medium; >560 – High
Available Phosphorus (kg/ha)	<10 – Low; 10 to 25 – Medium; >25 – High
Available Potassium (kg/ha)	<120 – Low; 120 to 280 – Medium; >280 – High

Soil pH plays a very important role in the availability of nutrients. The composition of the soil microbial community is also dependent on the soil pH. The results of the soil pH in soil samples will be compared with soil under different reaction classes as given **Table 2.24**.

Table 2.24 : Soil Under Different Reaction Classes[3]

pH Range	Soil Reaction
< 4.5	Extremely acidic
4.6 to 5.2	Strongly acidic
5.3 to 6.0	Moderately acidic
6.1 to 6.5	Slightly acidic
6.6 to 7.0	Neutral
7.1 to 7.5	Slightly alkaline
7.6 to 8.3	Moderately Alkaline
8.4 to 9.0	Strongly alkaline
>9.0	Extremely alkaline

The EC values gives information on the total amount of soluble salts present in the soil vis-a-vis the degree of salinity. It is a measure of the concentration of soluble salts and ionic activity and indicates the severity of salt content in soil. **Table 2.25** shows electrical conductivity indicating the severity of salt content in soils and the consequent soil reaction to plant performance. Salt concentration is directly proportional to the osmotic pressure, which governs the process of osmosis in the soil – plant system.

Table 2.25 : Electrical Conductivity (EC), Severity of Salt Content and Effect on Plants

Soil EC (dS/m or mS/cm)	Salinity Level	Effect on Crop Plants	
0–1	Non Saline	Salinity effects negligible	Good Soil
1-2			Poor Seed Emergence
2–4	Slightly Saline	Yields of sensitive crops may be restricted	Harmful to some crops, e.g. Pulses
4–8 or >4	Moderately Saline	Yields of many crops are restricted	Harmful to most of crops
8–16	Strongly Saline	Only tolerant crops yield satisfactorily	

[2]Source: "Soil Test Methodology" (1992), Edited B.S. Mathur. SSAC (BAU) Tech. Bull. 3/92. Pp. 312. Department of Soil Sciences and Agriculture Chemistry, Birsa Agriculture University, Ranchi).

[3]Laboratory Testing Procedure for Soil & Water Sample Analysis (2009). Water Resources Department, Directorate of Irrigation Research & Development, Pune.

>16	Very Strongly Saline	Only a few very tolerant crops yield satisfactorily	
Source: Abrol, I.P., J.P.S. Yadav and F.I. Massoud (1988). Salt-Affected Soils and their Management (1988). **FAO Soils Bulletin 39**. Food and Agriculture Organization of the United Nations, Rome.			*Source:* Laboratory Testing Procedure for Soil & Water Sample Analysis (2009). Water Resources Department, Directorate of Irrigation Research & Development, Pune.
1S = 1 Siemens = 1 ohm^{-1} = 1 mho; Convert EC µS/cm to dS/m or mS/cm divide by 1000			

2.4.2 Results of Soil Analysis of KBR2

The results of analysis are given in **Tables 2.26-29**.

Table 2.26 : Physico-Chemical Properties of Soils

Characteristics	Results	
	KS1	KS2
Type of Soil	Agricultural land	Barren land
Colour	Brown	Light Brown
Texture	Loamy	Sandy loam
Bulk Density (gm/cc)	1.31	1.46
Water Holding Capacity (%)	**26.45**	16.40
pH (1: 5 ratio)	9.09	8.08
Electrical Conductivity (µS/cm)	340	301

In the study area the soil sample KS1 (Top soil of the KBR-2),is considered as "Extremely Alkaline" with pH of 9.06 and even KS2, is "Moderately Alkaline" in nature as compared from the **Table 2.26**.

The measurement of soil conductivity was carried out by measuring the the specific conductivity (at 25°C) of water extract of soil and water mixture by conductivity meter. The conductivity in the soil samples is in the range of 301 to 1254 µS/cm. Comparison of the study area soil EC with **Table 2.27**, indicates that all the soil samples are normal and fall under the non-saline level and good crop.

Table 2.27 : Available Major Nutrients in Soil (Chemical Properties of soil)

Nutrients	Results	
	KS1	KS2
Organic Carbon (%)	0.50(M)	0.29(L)
Organic Matter (%)	1.16	0.86
Available Nitrogen (kg/ha)	100(L)	50 (L)
Available Phosphorus (kg/ha)	3.93(L)	3.40 (L)
Available Potassium (kg/ha)	276 (M)	193(M)

Nutrient Ratings			
Nutrients	**Low (L)**	**Medium (M)**	**High (H)**
Organic Carbon (%)	<0.50	0.50 to 0.75	>0.75
Available Nitrogen (kg/ha)	<280	280 to 560	>560
Available Phosphorus (kg/ha)	<10	10 to 25	>25
Available Potassium (kg/ha)	<120	120 to 280	>280

Phosphorus and Nitrogen are limiting nutrients in soil. In the tested soil samples as given in **Table 2.28**, availability of Nitrogen is low in both the samples and the lowest is seen in KS2 (rocky soil of KBR-2). Phosphorus is low in both the collected soil samples. However, available Potassium is high in soil sample KS1 and KS2 fall in the medium category. Organic carbon content is medium in KS1 (top soil of KBR-2) to low in KS2 soil sample.

Table 2.28 : Exchangeable Cations in Soil (chemical properties of soil)

Cations	Results	
	KS1	KS2
Calcium (meq/100 gm)	3.75 (36.41)	5.25 (60.48)
Magnesium (meq/100 gm)	6.17 (59.90)	3.30 (38.02)
Sodium (meq/100 gm)	0.37 (3.59)	0.12 (1.38)
Potassium (meq/100 gm)	0.01 (0.10)	0.01 (0.12)
Total Bases (meq/100 gm)	10.3 (100)	8.68 (100)
Values in ( ) give the % of respective cation of the total cations		

The results of exchangeable cations in soil are given in **Table 2.29**. Calcium and Magnesium constitutes the bulk of exchangeable cations in the tested soil samples. The total bases are high in KS1 an KS2.

Table 2.29 : Available Micronutrients in Soil

Micro Nutrient	Results (in mg/kg)		Critical Limits* (mg/kg)
	KS1	KS2	
Iron (as Fe)	2.00	1.66	4.5 – 6.0
Copper (as Cu)	1.01	0.12	0.20 – 0.66
Zinc (Zn)	0.29	0.10	0.50 – 0.65
Manganese (Mn)	4.04	0.71	10-25
(* Source: "Soil Test Methodology" (1992), Edited B.S. Mathur. SSAC (BAU) Tech. Bull. 3/92. Pp. 312. Department of Soil Sciences and Agriculture Chemistry, Birsa Agriculture University, Ranchi).			

Copper is high in KS1 (Top Soil of KBR-2) whereas in KS2 (Rocky Soil of KBR-2) are below the critical limit. Zn in soil samples KS1 (Top Soil of KBR-2) and KS2 (Rocky Soil of KBR-2) are below critical limits.

Iron in KS1 (Top Soil of KBR-2) and KS2 (Rocky Soil of KBR-2) is below the critical limits. Manganese is below the critical limit in all the soil samples.

2.4.3 Soil analysis of Buffer Zone

The location of soil sampling in buffer zone are given in **Table 2.30** below.

Table 2.30 : Locations of Soil sampling stations

Sample No.	Location	Latitude	Longitude	Type of Land
S1	Islampeta	17°36'24.0"N	83°09'07.3"E	Agricultural Land
S2	Appikonda	17°34'39.7"N	83°10'05.8"E	Barren Land
S3	Desapatrunipalem	17°38'18.0"N	83°07'02.3"E	Agricultural land
S4	Rajeevnagar	17°42'01.2"N	83°09'38.7"E	Barren Land
S5	Gangavaram	17°39'20.7"N	83°12'44.3"E	Barren land

The results of analysis are given in **Tables 2.31-2.34**

Table 2.31 : Physical Properties Of Soil

Sample No.	Colour	Texture	Water Holding Capacity (%)	Bulk Density (g/cc)
S1	Yellowish brown	Silty clay	45.40	1.58
S2	Brownish	Sandy loam	44.78	1.35
S3	Blackish brown	Loamy sand	49.92	1.27
S4	Brown	Loamy sand	47.87	1.25
S5	Reddish brown	Sandy loam	48.94	1.32

Table 2.32 : Chemical Properties Of Soil

Parameters	S1	S2	S3	S4	S5
pH	6.55	7.61	6.54	8.59	7.49
Electrical Conductivity (µs/cm)	109	421	61	450	433

Soil pH plays an important role in the availability of nutrients. Soil microbial activity is also dependent on pH. In the study area the soil pH is slightly acidic in S1.

Electrical conductivity (EC) is a measure of the soluble salts and ionic activity in the soil. In the collected soil samples, the conductivity ranged from 61 to 450 µs/cm.

Table 2.33 : Available Major Nutrients In Soil

Parameters	S1	S2	S3	S4	S5
Available Nitrogen (kg/ha) & Rating	50.2 Low	125.4 Low	150.5 Low	100.4 Low	138.0 Low
Available Phosphorus (Kg/ha) and Rating	3.02 Low	0.69 Low	1.94 Low	1.02 Low	0.70 Low
Available Potassium (Kg/ha) and Rating	176 Medium	554 High	192 Medium	269 Medium	319 High
Organic carbon (%) and Ratings	0.43 Low	0.34 Low	0.74 Medium	0.60 Medium	0.63 Medium

Phosphorus and Nitrogen are limiting nutrients. In the tested soil samples, availability of phosphorus and nitrogen is low in all samples. Available potassium is medium to high whereas Organic carbon matter is low to medium.

Table 2.34 : Soil Chemical Constituents

(I) Exchangeable Cations

Parameters	S1	S2	S3	S4	S5
Calcium (meq/100gm)	0.4 (37.58)	4.4 (38.44)	5.6 (61.25)	7.4 (33.28)	13.0 (60.52)
Magnesium (meq/100gm)	0.4 (37.57)	6.2 (54.16)	2.4 (26.24)	6.4 (28.78)	7.6 (35.37)
Sodium (meq/100gm)	0.07 (6.87)	0.73 (6.39)	0.51 (5.60)	8.06 (36.17)	0.55 (2.55)
Potassium (meq/100gm)	0.19 (17.98)	0.12 (1.01)	0.63 (6.91)	0.39 (1.77)	0.34 (1.56)

- Figures in ( ) gives the % contribution of the respective ions to Base Saturation.

(II) Soil Micronutrients (mg/kg)

Parameters	S1	S2	S3	S4	S5
Copper	0.40	0.98	2.18	1.62	1.3
Zinc	2.27	2.92	5.85	2.83	1.29
Iron	10.36	12.49	9.06	4.99	1.24
Manganese	0.99	3.25	1.59	2.52	3.26

The above results show that in all five tested soil samples, calcium constitutes bulk of the exchangeable cations followed by magnesium whereas proportion of exchangeable sodium and potassium were low.

Soil micro-nutrients also play an important role in plant growth and can act as limiting nutrients. Soil micro-nutrient analysis can be employed as a diagnostic tool for predicting the possibility of deficiency of a nutrient and the profitability of its application. For this, it is essential to fix the critical limits. The critical limit of micro-nutrient in a soil is that content of extractable nutrient at or below which plantation practiced on it will produce a positive response to its application. The critical limits of copper, zinc and iron are 0.20-0.66 mg/kg, 0.50-0.65 mg/kg and 4.5-6.0 mg/kg respectively. The Cu values have exceeded the critical limit in S2, S3, S4 and S5. Iron levels are high in S1, S2 and S3 among all the micronutrients. The Zinc concentrations are exceeding at all locations. Excess of one or more micro-nutrients can slow down the uptake of other micro-nutrients due to the antagonistic effect. Excess of copper affects uptake of Molybdenum, another micro-nutrient. Excess of Zinc, Manganese and Copper affect Iron uptake. Excess Iron, Copper and Zinc affect Manganese uptake. This can improve soil fertility by neutralizing the effect of some excess micro-nutrients or can reduce soil fertility by blocking uptake of critically needed micro-nutrients.

3.0 Waste water discharge points in the sea was studied by NIO that report has also to be presented along with terrestrial impact in the revised documents. Revalidation of the point of discharge for any potential impact should be carried out, if there is an increase in the quantity of discharge and change in composition of waste water.

As per NIO report, NIO has conducted study considering 600 m^3/hr waste water discharge into deep sea and point of discharge without disturbing ecology. From the present plant operations about 200 m^3/hr effluent is being discharged after treatment.

The effluent quality before discharging into the sea is shown in **Table 3.1** below**.** The outfall samples results have been compared with standards for discharge of environmental pollutants into sea dated 01.01.2016 by MoEF&CC and marine and coastal area discharge norms.

Table 3.1: Outfall Water Quality

SN.	Parameters	MoEFCC Norms		OF1
		#CETP (Max. Permissible Values into Sea)	*Standards for Discharge of Environmental Pollutants (Marine Coastal Areas)	
1	pH Value	6 - 9	5.5 to 9.0	6.68
2	BOD, 3 days at 27° C, mg/l, max.	100	100	22
3	COD, mg/l , max.	250	250	232
4	Total Suspended Solids, mg/l, max.	100	100 (For Process Waste Water)	78
5	Electrical conductivity, µs/cm, max	NS	NS	8114
6	Temperature °C	Shall not exceed more than 5°C above ambient water temperature	Shall not exceed more than 5 °C above the receiving water temperature	27
7	Oil & Grease, mg/l, Max.	10	20	8
8	Ammoniacal Nitrogen, , mg/l, Max	50	50	42
9	Total Kjeldhal Nitrogen (TKN), mg/l, Max	50	100	70
10	Nitrate Nitrogen, mg/l, Max	50	20	60
11	Dissolved Phosphates (as P), mg/l, max.	NS	NS	20.2
12	Chlorides (as Cl), mg/l, Max.	NS	NS	1400
13	Sulphates (as SO_4), mg/l, Max.	NS	NS	787
14	Fluoride (as F) mg/L, Max.	15	15	7.4
15	Sulphides (as S), mg/l, Max.	5	5.0	3
16	Phenolic Compounds (as C_6H_5OH), mg/l, Max.	5	5.0	0.117
17	Zinc (as Zn), mg/l, Max.	15	15	<0.05
18	Iron (as Fe), mg/l, Max.	3	3.0	2.138
19	Copper (Cu), mg/l, Max.	3	3.0	0.011
20	Trivalent Chromium (as Cr^{3+}), mg/l, Max.	2	2.0	<0.01
21	Manganese (as Mn), mg/l, Max.	2	2.0	0.047
22	Nickel (as Ni), mg/l, Max.	3	5.0	<0.01

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SN.	Parameters	MoEFCC Norms		OF1
		#CETP (Max. Permissible Values into Sea)	*Standards for Discharge of Environmental Pollutants (Marine Coastal Areas)	
23	Arsenic (as As), mg/l, Max.	0.2	0.2	<0.01
24	Cyanide (as CN), mg/l, Max.	0.2	0.2	0.18
25	Lead (as Pb), mg/l, Max.	0.1	2.0	0.064
26	Hexavalent Chromium	0.1	1.0	<0.05
27	Cadmium (as Cd), mg/l, Max.	0.05	2.0	<0.01
28	Mercury (as Hg), mg/l, Max.	0.01	0.01	0.0005
29	Boron (as B), mg/l, Max.	-	-	0.236
30	Free Ammonia (as NH_3) , mg/l, Max	**	5.0	0.62
31	VOC,mg/l	-	-	<1.0

* The Environment (Protection) Rules, 1986 [Schedule – VI] General Standards For Discharge of Environmental Pollutants Part-A: Effluents; vide G.S.R. 422(E) **dated** 19.05.1993, published **in** the Gazette No. 174.

MoEFCC Norms for Treated Effluent Discharge from Common Effluent Treatment Plant (CETP) into Sea S.O. No. 4(E) dated 01.01.2016.

NS : Not Specified; ** Parameter not considered in Referred Standards.;

From the table it can be seen that the outfall water meets the specified criteria for discharge of environmental pollutants into coastal areas and the levels of different pollutants are well within the permissible values for discharge in to sea except for Total Kjeldhal Nitrogen and Nitrate Nitrogen in Outfall 1 (Gangavaram).

Due to installation of new COB5 and increase in steel production by 1 MTPA no additional waste water will be discharge into the sea. The treated effluents from the upcoming COB5 shall be utilized within the plant for dust suppression.

The study carried out by NIO for Marine discharge of treated effluents is attached as **Annexure A.**

4.0 In the land use area, the green belt that was prescribed in the EC of 6.3 MTPA has to be properly demonstrated giving composition of the planted width of the green belt and height of the green belt. Since purpose of the green belt is attenuation of point and non-points source pollution, monitoring on both the side of green belt is to be done to understand the utility of impact of green belt.

The map showing greenbelt plantation in and around the plant boundary is given in **Annexure B**. The composition, width and Height of greenbelt is provided in **Table 4.1** below.

Table 4.1 – Composition, height and width of Greenbelt

Zone	Species	Height	Width
(1A,1B,5)	*Acacia auriculiformis*	Maximum ~6 m	~3500 m
	Acacia nilotica	Maximum ~5 m	
	Alstonia scholaris	Maximum ~15 m	
	Azadirachta indica	Maximum ~15 m	
	Bauhinia variegata	Maximum ~10 m	
	Butea monosperma	Maximum ~5 m	
	Cassia fistula	Maximum ~6 m	
	Cassia siamea	Maximum ~8 m	
	Cocos nucifera	~15 – 20 m	
	Delonix regia	Maximum ~15 m	
	Eucalyptus spp.	Maximum ~20 m	
	Ficus bengalensis	Maximum ~20 m	
	Ficus racemosa	Maximum ~15 m	
	Ficus religiosa	Maximum ~20 m	
	Hadroanthus impetiginosus	Maximum ~12 m	
	Holoptelia integrifolia	Maximum ~15 m	
	Manilkara zapota	Maximum 6m	
	Lagerstroemia speciosa	~6 – 12 m	
	Leucaena leucophloea	Maximum ~10 m	
	Mimusops elengi	~3 –8 m	
	Morinda tinctoria	Maximum ~10 m	
	Neolamarckia cadamba	Maximum ~10 m	
	Peltophorum pterocarpum	Maximum ~15 m	
	Polyalthia longifolia	Maximum ~15 m	
	Pongamia pinnata	~3 – 15 m	
	Samania saman	~15 – 25 m	
	Sterculia foetida	~15 m	
	Syzigium cuminii	~10 – 20 m	
	Tabebuia rosea	Maximum ~15 m	
	Tecoma argentia	Maximum ~6 m	
	Tecoma castanifolia	Maximum ~6 m	
	Tectona grandis	~3 – 20 m	
	Terminalia arjuna	~10 – 15 m	
	Terminalia catappa	~10 -12 m	
	Thespesia populnea	Maximum ~15 m	
	Santalum album	3 – 6m	
	Dalbergia sissoo	5- 8m	
	Caryota urens	Maximum ~15 m	

Zone	Species	Height	Width
	Conocarpus erectus	8-10m	
	Kigelia africana	10-12m	
	Dendrocalamus strictus	10-15m	
	Couroupita guianensis	15-18m	
	Mitragyna parvifolia	12-15m	
	Adenanthera pavonina	*10- 12m*	
2	*Anacardium occidentale*	4- 6 m	350m – 1450m
	Prosopis julflora	3-5 m	
	Casuarina equisetifolia	4 – 8 m	
	Cocos nucifera	10 – 15 m	
	Borassus flabellifer	10-18	
3	*Acacia nilotica*	~5 – 7 m	~500 m
	Prosopis julflora	~ 3 – 6 m	
4	*Azadirachta indica*	7 – 10 m	~120 m
	Ficus religiosa	10 – 15 m	
	Leucaenal eucophloea	~10 m	
	Mimusops elengi	~6 m	
	Peltophorum pterocarpum	~14 m	
	Pongamia pinnata	~6 m	
6	*Bauhinia variegata*	Maximum ~8 m	~600 m
	Butea monosperma	Maximum ~5 m	
	Cassia fistula	Maximum ~5 m	
	Cassia siamea	Maximum ~10 m	
	Delonix regia	Maximum ~15 m	
	Leucaena leucophloea	Maximum ~10 m	
	Neolamarckia cadamba	Maximum ~10 m	
	Peltophorum pterocarpum	Maximum ~15 m	
	Pongamia pinnata	~5 – 8 m	
	Samania saman	~15 – 20 m	
	Syzigium cuminii	~7 – 15 m	
	Tectona grandis	~3 – ~20 m	
	Terminalia arjuna	~5 – 15 m	
	Dalbergia sissoo	5- 8m	
	Mangifera indica	4-8m	
	Terminalia catappa	~12 m	
	Borassus flabellifer	15-20m	
	Acacia auriculiformis	~10 m	
	Azadirachta indica	7 – 10 m	
	Pterocarpus santalinus	10-15m	
	Dalbergia sissoo	5- 8m	
E	*Anacardium occidentale*	3- 5 m	~500m
	Prosopis julflora	3-5 m	
H	*Anacardium occidentale*	4- 6 m	~900 m
	Prosopis julflora	3-6 m	
I,K,L	*Anacardium occidentale*	3- 5 m	~500 m
	Prosopis julflora	2- 6 m	
	Acacia auriculiformis	~10 m	
	Azadirachta indica	7 – 10 m	
M	*Alstonia scholaris*	~ 5 – 12 m	~400 m
	Azadirachta indica	~1.5 m - ~15 m	

Zone	Species	Height	Width
	Mangifera indica	4-8m	
	Bauhinia variegata	~ 5 – 6 m	
	Cassia fistula	~ 4 – 5 m	
	Cassia siamea	~ 6 – 10 m	
	Delonix regia	~10 – 15 m	
	Eucalyptus spp.	~10 – 15 m	
	Lagerstroemia speciosa	~6 – 10 m	
	Leucaena leucophloea	~5 – 10 m	
	Neolamarckia cadamba	~5 – 10 m	
	Peltophorum pterocarpum	~13 m	
	Samania saman	>20 m	
	Sterculia foetida	~ 15 m	

In order to study the efficacy of existing green belt in attenuation of noise pollution due to plant operations, ambient noise monitoring has been carried out at several locations inside and outside the plant boundary. Monitoring locations and results are given in **Table 4.2.**

Table 4.2: Results of Noise Monitoring at inside and outside RINL, Vizag

Sl. No.	Location	Coordinates		Sound Level dB(A)		
		Latitude	Longitude	Max.	Min.	Mean*
	Locations Inside the Plant					
1.	Sinter Plant – TPP Junction	17.60819	83.19497	82.8	72.6	76.5
2.	Conveyor belt	17.61889	83.20058	68.2	61.8	66.5
3.	WRM 1	17.62581	83.17697	65.8	57.4	60.3
4.	WRM Opposite	17.62672	83.17486	61.3	54.5	57.7
5.	Dolomite brick plant	17.62356	83.19758	60.8	52.0	56.6
6.	SMS 2 Area	17.61372	83.18589	82.8	66.5	77.4
7.	SMS 2 Inside Shop	17.6155	83.18706	88.1	72.2	82.6
8.	Sinter Plant Area	17.60833	83.19819	79.0	61.9	72.8
9.	Near Blower ESP Sinter Area	17.60997	83.20019	94.8	72.5	88.3
10.	Blast Furnace Area 2	17.61056	83.19528	84.2	78.6	81.3
11.	Coal Yard	17.61586	83.20761	63.8	46.3	56.3
12.	Opposite Benzol Plant	17.60867	83.20636	90.7	79.6	86.6
13.	Near NAFC plant	17.60197	83.20436	80.3	66.3	72.9
14.	Near ETP Boundary Plant	17.61528	83.22214	57.1	45.0	51.7
15.	Ash pond	17.59019	83.18486	57.8	47.2	53.5
16.	Near CPP – 2	17.61914	83.16583	72.8	63.7	67.3
17.	Boundary wall WT 29	17.61983	83.16532	61.1	48.0	53.6
18.	Outside CPP 2 Parking	17.61802	83.16534	76.2	64.7	72.0
19.	Oxygen plant shop outside	17.61122	83.18075	76.3	67.2	74.1
20.	Oxygen plant near compressor	17.61106	83.18078	86.7	78.9	83.9
21.	CAQQMS near main gate	17.63111	83.17278	58.4	47.5	54.8
22.	WRM 2	17.6216	83.18562	81.2	62.1	76.0
23.	MMSM	17.61908	83.18424	78.2	61.8	72.0
24.	LBSS 4 on road	17.62586	83.18586	69.7	53.0	67.3
25.	Main Gate near water tank	17.63062	83.16912	63.4	49.4	55.8
26.	Balacheruvu (BC) Gate	17.64139	83.19142	71.1	53.1	62.7
27.	Towards BC gate near Bridge	17.63594	83.18914	76.6	52.2	68.6
28.	Raw Material unloading Yard	17.62064	83.21114	67.8	54.3	62.9

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Sl. No.	Location	Coordinates		Sound Level dB(A)		
		Latitude	Longitude	Max.	Min.	Mean*
	Locations Outside the Plant					
29.	Railway track out side	17.66208	83.18192	65.0	52.5	57.9
30.	Outside WT 1 CISF Tower	17.65231	83.17978	52.7	42.4	46.0
31.	Outside BC gate	17.64283	83.19358	68.5	49.6	60.8
32.	BC Gate Boundary Wall	17.64064	83.19406	58.2	46.4	51.7
33.	K V Steel plant School - Sector 1	17.64678	83.15556	52.7	48.0	50.9
34.	Near Pragati Maidan opp RINL Appikonda gate	17.62438	83.16573	62.9	49.6	58.7
35.	Appikonda Gate outside near CPP2	17.62095	83.16584	58.9	47.3	56.4
36.	Towards Islampeta road	17.60417	83.15708	61.0	49.2	55.0
37.	WT 31, Laxminagar, Appikonda Road	17.592	83.16056	65.2	48.0	57.9
38.	Back side ash pond – Appikonda road	17.58131	83.15969	54.1	41.2	47.1
39.	Murubai - Appikonda Road (WT32,33)	17.58014	83.16228	48.3	41.7	45.0
40.	Appikonda Road	17.58039	83.17092	53.5	44.2	48.8
41.	Appikonda Village	17.57635	83.17242	56.2	46.1	52.7
42.	Near NAFC plant on Gangavaram Road	17.60151	83.20534	56.6	51.6	53.5
43.	On Gangavaram road	17.60685	83.20834	58.9	43.7	55.2

Based on the above data, isophones were plotted over the plant area upto nearby habitations. On those contours, several cross section profiles are plotted to study the noise attenuation due to present of green belt. The map showing noise profiles along with highlighted nearby habitats is given in **Fig 4.1**. The sound contour map of study area along with cross section profiles showing noise attenuation with distance and due to greenbelt is shown in **Fig 4.2 and 4.3** below. The length of greenbelt near plant boundary in the profile is highlighted in green.

Fig 4.1 – Map showing noise monitoring locations

Fig 4.2 – Isophone map of study area

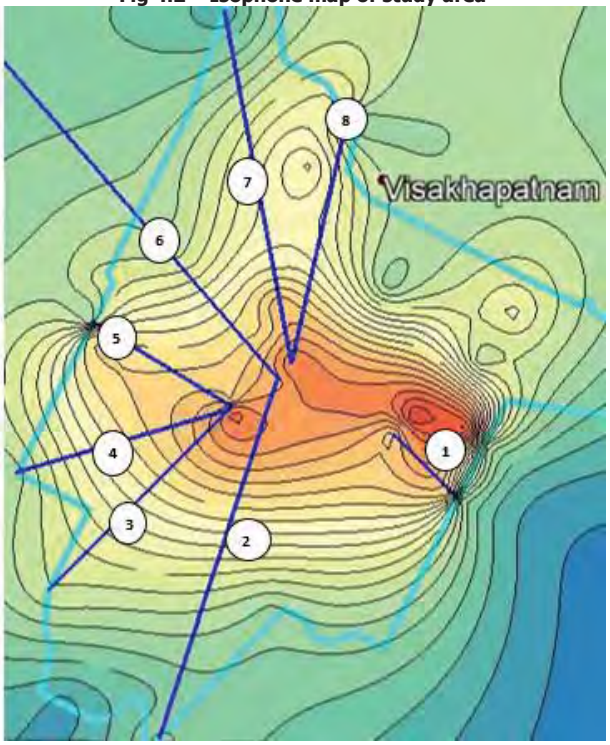

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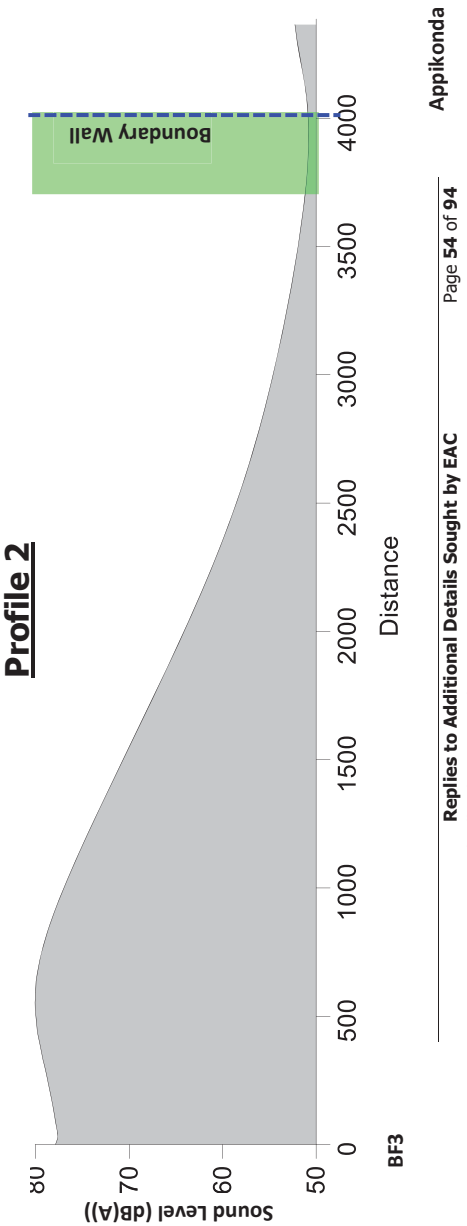
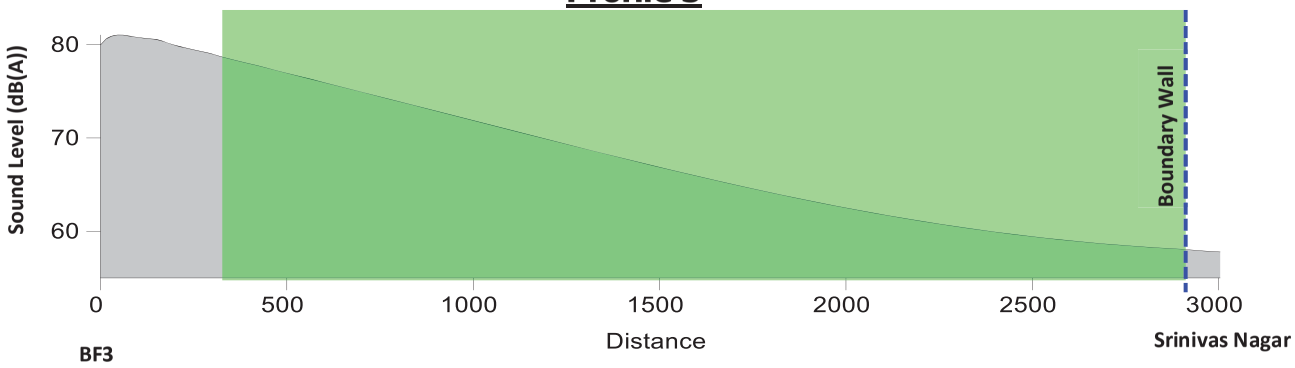
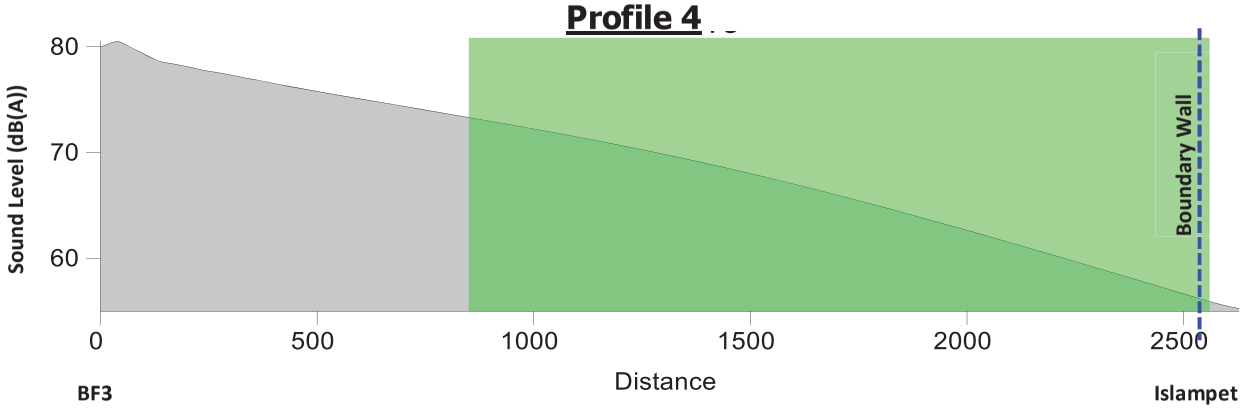
Fig 4.3 – Cross section Profiles showing Noise attenuation with distance



Profile 3



Profile 4



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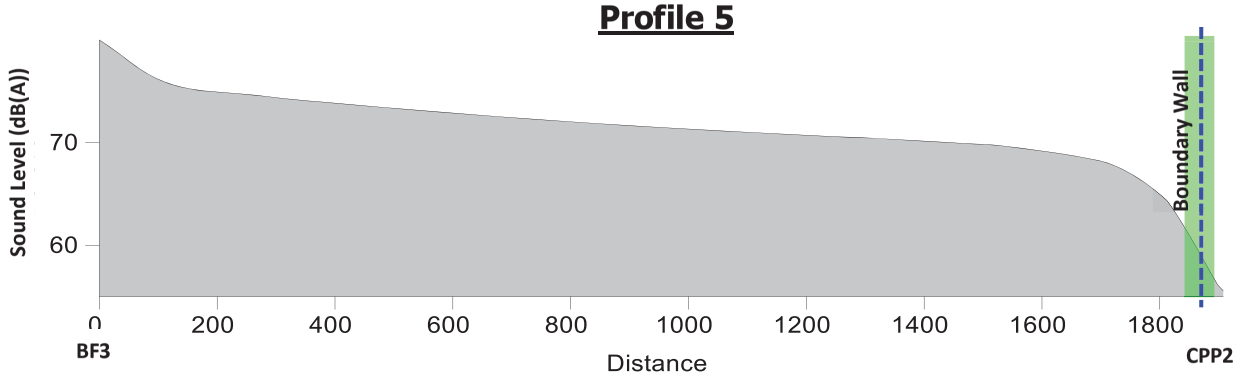
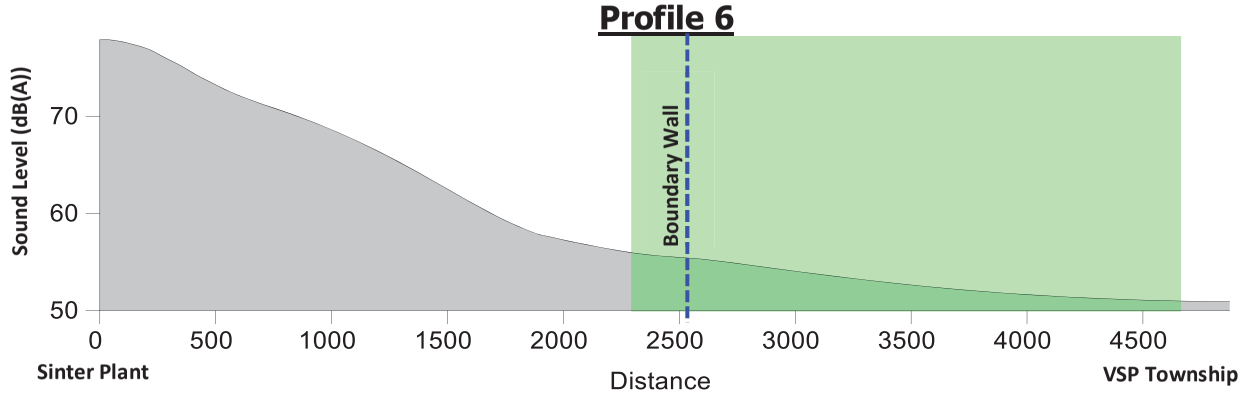
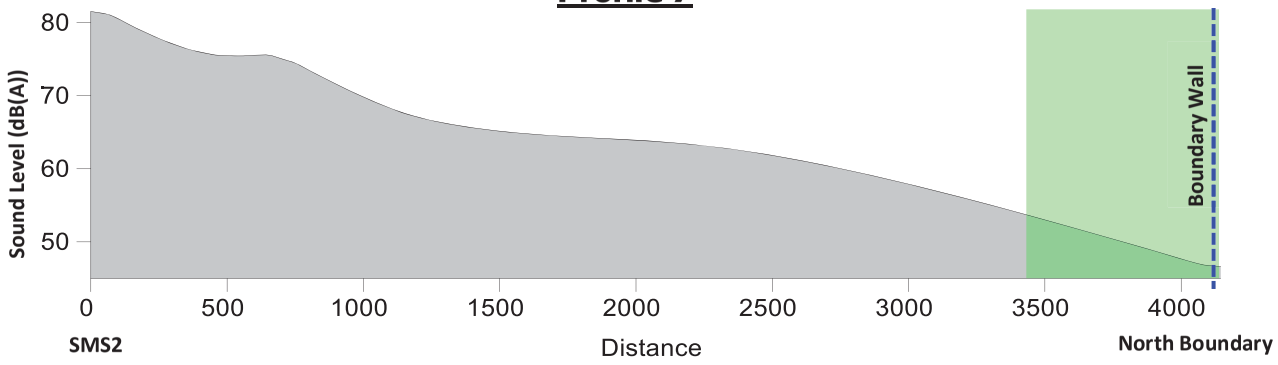
Profile 5



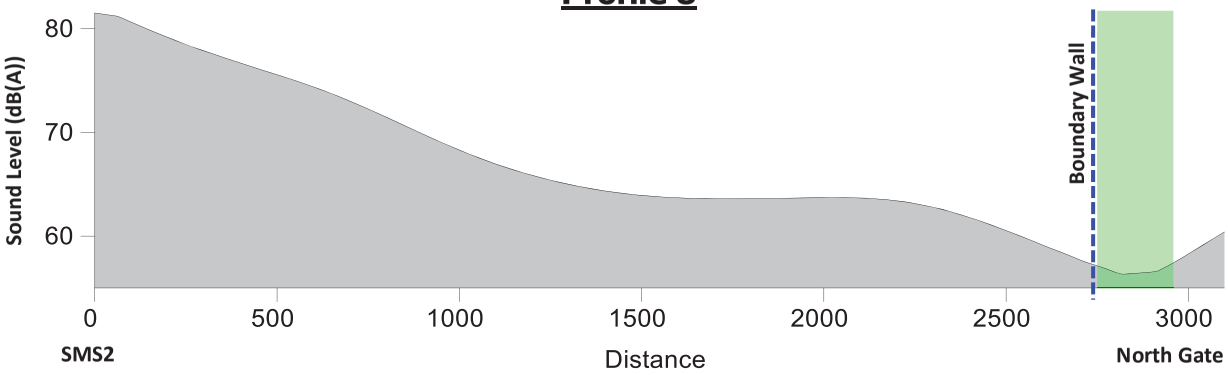
Profile 6



Profile 7



Profile 8



From the above curves, it can be observed that there is a decrease of sound pressure level of about 10 to 20 dB(A) outside the plant boundary as compared with the noise levels recorded within the plant area. The attenuation varied with the width of the green belt.

5.0 Remediation plan was poorly drawn and needs to be revised by incorporating damage due to excavation of reservoir, transportation, impact on nearby habitat as mentioned in the report. Air quality changes due to emission from coke oven, two sintered plant (SP 1 & SP2), and Blast furnace (BF1 & BF2).

Remediation plan has been revised based on the revised damage assessment incorporating damage due to excavation of reservoir, construction of new coke oven battery, emissions from revamping of sinter plant, and Blast furnace (BF1 & BF2) including transportation and impact on nearby habitat. The same is attached herewith and also presented in **Chapter 11 of the EIA report**.

Table 5.1 - Ecological Damage Assessment and Remediation Plan

Sl. No.	Environmental Attribute	Activity	Issues	Related Damages	Measures already been taken	Remediation plan	Estimated cost
1	Air environment	**I. Construction of new units/facilities:** KBR2 1. Site clearance 2. Excavation activities 3. Transport of excavated material 4. Controlled Blasting 5. Dumping of un used soil CO5 1. Site clearance 2. Transport of construction material 3. Construction activity Guard pond 1. Site clearance 2. Dumping of un used soil **II. Revamping of existing units and operation (BF1&2, SP2&2, SMS1&2)** Revamping stage: 1. Construction activity 2. transportation of construction material and debris	1. Fugitive dust emissions due to ground clearing and leveling activities at all new sites 2. Fugitive dust emissions during excavation activities at KBR2. 3. Emissions due to fuel combustion by vehicles used for transportation of excavated soil and construction material 4. Fugitive emission from paved/unpaved roads due to vehicular movement. 5. Fugitive emission from dumped areas of excavated soil. 1. Emissions due to fuel combustion by vehicles 2. Fugitive dust emission from paved/unpaved roads due to vehicular movement 3. Emissions during Process and during combustion through stacks	1. Degradation of air quality due to increase in dust concentration leading to respiratory problems. 2. Deposition of particulates on buildings, roads etc. leading to damage to property as well as disturbance to the aesthetics of the area. 3. Air pollutant deposition as well as gaseous emissions from vehicles and heavy machinery can cause damage to leaves of local flora. 4. Increase in air pollutant concentrations in the ambient air due to emissions releasing in the atmosphere through stacks	1. To prevent dispersion of fugitive emissions during excavation activity near reservoir, around the reservoir site especially residential area side covered with GI sheets 2. To prevent Depletion of ground water during excavation Grout curtains were made. 3. Ground water was pumped to nearby rain water harvesting ponds. 4. Regular water sprinkling done to avoid dust emission during vehicular movement. 5. Regular water sprinkling done to avoid dust emission during vehicular movement. 6. Covered vehicles to transport raw material, debris etc, 7. Allowed PUC certified vehicles 8. Up gradation pollution control equipment in BF, SP and SMS to meet the standards 9. Dust suppression and dust extraction system at all material transferring points,	1. Plantation near reservoir area 2. Plantation beyond plant boundary 3. Water sprinkling on the roads 4. Health Check-ups through Medical camps 5. Infrastructure support to public health centers /Govt. Hospitals	1200 plants @ Rs 250/plant with 2 years Maint. = Rs **3.0 lakhs** 1200 plants @ Rs 250/plant with 2 years maint. = Rs **3.0 lakhs** 5000L – 5 trips/day x Rs 800 @ 4 times in a month for one year= **Rs 2.0 lakhs** One camp/ qtr. Rs 2.5 L X 4 **= Rs 10 lakhs** Wheel chairs - 25nos @ Rs 15000 Stretchers-25nos @ Rs5000 Beds -100nos @ Rs5000 **Total Rs10 lakhs** for 5 PHCs 400 Sqm(ie., 80 RM of 5 M height)

Sl. No.	Environmental Attribute	Activity	Issues	Related Damages	Measures already been taken	Remediation plan	Estimated cost
		3. Transportation of equipment/machinery Operation stage: 1. Combustion of fossil fuels 2. Conveying raw material 3. Movement of tucks for material movement	4. Fugitive emissions from the shops 5. Emissions due to fuel combustion by vehicles 6. Fugitive dust emission from roads due to vehicular movement			6. Erection of enclosures around the project site during construction	@ 500 per Sqm by using in-house material **Rs.2 Lakhs** **Total = 30 lakhs**
2	Noise levels	**I. Construction of new units/facilities:** (KBR2, CO5, & Guard pond) 1. Vehicular movement 2. Excavation activity 3. Construction activity **II. Revamping of existing units and operation (BF1&2, SP2&2, SMS1&2)** Revamping stage: 1. Revamping activities of existing facilities 2. Vehicle movement Operation stage: 1. Operation of equipment such as compressors, blowers ID fans etc	1. Generation of noise due to tucks for transportation of excavated material & machinery 2. Generation of noise due to blasting, using machinery for excavation of soil 3. High noise generation during 1. Noise generation during Site preparation activities including debris removal etc., using heavy machinery 2. Noise generation due to Vehicular movement for transportation of construction material & labour during construction 3. High noise generation during operation of plant machinery	Increase in ambient noise levels in habitation areas may lead to disruption of sleep cycles in people, hearing losses as well as annoyance to patients and children.	1. Avoided excavation during night time 2. Control blasting was done at KBR2. The maximum allowable peak particle velocity is fixed at 10mm/s which is the safest limit of the structural damage as per DGMS guidelines. 3. Acoustic enclosures for High noise equipment the noise levels will be limited to 85 dB(A) in the working area. 4. Where ever it is not to cover the equipment, personal protective systems are provided to the working personnel. 5. Reducing vibration of high speed rotating machines by regular monitoring of vibration and taking necessary steps	1. Plantation near habitations (covered in sl 1) 2. Cochlear Implantation for poor children with hearing impairment	Five surgeries for implantation of cochlear for 5 children @ Rs 8.0 L = **Rs 40.0 lakhs**. **Total = 40 lakhs**

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Sl. No.	Environmental Attribute	Activity	Issues	Related Damages	Measures already been taken	Remediation plan	Estimated cost
		2. Vehicle movement					
3	Water environment	**I. Construction of new units/facilities: (KBR2, CO5, & Guard pond)** 1. Storm water run offs during construction 2. Interference of Ground water table **II. Revamping of existing units and operation (BF1&2, SP2&2, SMS1&2)** 1. Storm water run offs during construction 2. Use of fresh water for plant operations	1. Increase in Suspended Solids in storm water run offs during monsoon season 2. Obstruction of groundwater percolation due to ground water cementing 3. Percolation of contaminated groundwater 1. Generation of effluent from different unit of the plan 2. Use of water from community resources for plant purposes	1. Increase in suspended solids in the nearby surface water bodies 2. Depletion in water levels due to paving, 3. increasing run off factor 4. Contamination of ground water quality 5. Obstruction of natural drains 1. Increase in pollutant load, leading to contamination of community water resources in the area 2. Decrease in water availability due to exhaustion of community water resources	1. Catch pits are provided to arrest suspended solids 2. To prevent Depletion of ground water during excavation Grout curtains were made. 3. Ground water was pumped to nearby rain water harvesting ponds 4. Natural drains were diverted 5. complete recirculating cooling system for the equipment cooling after proper treatment 6. Effluent discharged from the plant will be utilised after treatment for dust suppression system 7. RINL has developed two nos of rain water harvesting ponds from which about 5.48 Mil cum water can be recovered per year. 8. Garland drain and retaining wall will be constructed at the toe of the dumps to prevent wash off from the dump	1. Rain water harvesting in communities. 2. Recharge pits 3. Construction of Check dams 4. Supply of Drinking Water(15 lakhs)	3mt X4mt rain water conservations pits @Rs 50,000 X 12 **=6 Lakhs** @Rs 50,000 X 6= **Rs 3.0 Lakhs** Each dam @2.0 Lakhs X3 = **6 Lakhs** 15 trips /day @825 X4 months =**Rs 15 Lakhs** **Total = 30 lakhs**
4	Land environment	**I. Construction of new units/facilities: (KBR2, CO5, & Guard pond)**	1. Change of land use 2. Green cover 3. Stress on common property resources	1. Land used for industrial purpose 2. Degradation of green cover	1. Facilities are proposed in already acquired land for industrial use.	1. Providing greenbelt resistant native species within the	60,000 plants x @Rs 100= **Rs 6 Lakhs**

Sl. No.	Environmental Attribute	Activity	Issues	Related Damages	Measures already been taken	Remediation plan	Estimated cost
		1. Location of facilities 2. Inflow of people		3. Loss of top soil 4. Increase in demand of land near project site for housing of construction labour. 5. Change in land use of the area due to increase in habitation of construction workers, converting vacant areas to settlements and loss of access to existing land uses such as roads etc. 6. Creation of new land uses such as roads etc. for catering to infrastructural needs of labour	2. Locations are not having any important plant species 3. Necessary infrastructure facilities for labour already in place. 4. Top soil is preserved for biological reclamation of the over burden dumps 5. Maximum utilization of solid wastes 6. Standard SOPs in place for Handling of hazardous chemicals 7. Major raw material transported through covered conveyers.	proposed plant units in place of shrubs 2. Biological reclamation of un used excavated soil	Out of 35.50 Ha, 12 Ha land reclaimed for three years @ 11110 per year by broad casting seeds **Rs.4 Lakhs** **Total = 10 lakhs**
		II. Revamping of existing units and operation (BF1&2, SP2&2, SMS1&2) 1. solid wastes generation 2. Handling of chemicals/raw materials	1. Storage of solid wastes 2. Spillages of chemicals/raw materials	1. Increase in land requirement for disposal of solid wastes generated 2. Change in land use of the area 3. destruction of existing land use such as existing access routes etc.			
5	Ecological Environment	**I. Construction of new units/facilities: (KBR2, CO5, & Guard pond)**	1. Loss of Green cover 2. Air Pollution from construction activity 3. Surface and ground water contamination	1. Loss of green cover leads to increase the pollution 2. potential of the area	1. Facilities are coming up in the already acquired land of RINL and kept for future industrial activity.	1. Distribution of free saplings to peripheral villagers preferably native plants	8000 plants x@ Rs 100=**8 lakhs**

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Sl. No.	Environmental Attribute	Activity	Issues	Related Damages	Measures already been taken	Remediation plan	Estimated cost
		1. Site clearance 2. Excavation activities 3. Transport of excavated material 4. Blasting 5. Dumping of un used soil		2. Clearance of vegetation due to site clearance / preparation leads to 3. generation of fugitive dust, noise, ground vibrations (due to blasting of rocks) 4. dewatering due to excavations 5. Generation of fugitive dust and noise due to movement of heavy vehicles as well as construction activities 6. Emission of particulate matter & gases (NOx, CO) from engines 7. Loss of animals' habitat 8. Damage to vegetation due to dust deposition. 9. Scaring away of fauna 10. Damage to nearby buildings / structures. 11. Increased siltation in receiving water body. 12. Damage to vegetation and human health due to air emissions from engines as well as dust.	2. Proposed areas comprises of dense scrub and grass lands and bulk of the vegetation comprises of *Prosopis juliflora* and comes under low risk category as per environment, forest, science &technology Department, Govt of AP. 3. Catch pits are provided to arrest suspended solids. 4. To prevent Depletion of ground water during excavation Grout curtains were made. 5. Ground water was pumped to nearby rain water harvesting ponds Natural drains were strategically diverted 6. Barricades were provided to restrict the spread of fugitive emissions to nearby residential areas. 7. Top soil was preserved for bio-reclamation of unused soil dumps.	2. Participating in Green Visakha project 3. Release of algae eating and larvae eating fish into water bodies	15,000 block plantation @Rs 200 =**Rs 30 Lakhs** Rs.1 lakh per year for 2 years **=Rs.2 Lakhs** **Total = 40 Lakhs**
		II. Revamping of existing units and	1. Generation of fugitive dust due to vehicular				

Sl. No.	Environmental Attribute	Activity	Issues	Related Damages	Measures already been taken	Remediation plan	Estimated cost
		operation (BF1&2, SP2&2, SMS1&2) 1. Revamping of existing units 2. Process emissions during operation	movement for transport of machinery and construction material. 2. Emission of particulate matter, gases (NOx, SO_2, CO, H_2, CH_4, NH_3, C_2H_6, C_6H_6, Phenols, H_2S etc.) 3. Generation & release of waste water	1. Damage to vegetation due to exposure to process emissions: Project site located inside integrated steel plant far from any major ecosystem. 2. Damage to human health due to exposure to process emissions and heat 3. Disturbance to fauna Contamination of receiving water body & surrounding habitats due to discharge of treated effluents: Increased incidence of diseases spread by insects which breed in water	1. Part of treated effluents utilized for industrial purposes in plant. Balance discharged after quality checks. 2. Increased biodiversity due to large surface water body: This is a beneficial impact 3. About 5297688 number of trees planted in around by RINL 4. RINL has developed two nos of rain water harvesting ponds from which about 5.48 Mil cum water can be recovered per year.		
6	Socio-economic Condition	**I. Construction of new units/facilities: (KBR2, CO5, & Guard pond)** 1. Construction activities	1. Emissions (both fugitive and other emissions) due to site activities including domestic activities such as firewood burning for cooking and heating purposes during cold weather conditions, construction activities as well as vehicular movement during construction phase .	1. Increase of migration of population(short term) leading to 2. increased stress on local infrastructure due to the influx of construction labour 3. Health issues to inhabitants as well as construction workers because of decrease in air quality due to emissions.	1. Secure facilities including labour camps with basic facilities like changing rooms, toilets established by the contractors during the construction phase. 2. Adequate provision for potable water supply facilities and sanitation facilities. 3. Arrangement of first aid kits at construction sites. Medical assistance from Primary Health Centre in case of	1. Providing community toilets in nearby villages/communities 2. Providing financial assistance for maintenance of toilets in schools	Two Nos of Porta cabin toilets (4 male & 4 female) @ 10.0 Lakhs each =**Rs 20 Lakhs** Skill dev. programmes for 300 beneficiaries@ Rs 5000 =**Rs 15.0 lakhs**

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Sl. No.	Environmental Attribute	Activity	Issues	Related Damages	Measures already been taken	Remediation plan	Estimated cost
			2. Influx of construction labour (short-term migration) 3. Creation of new infrastructure for construction workers (short term)	4. Sanitation and hygiene issues in area because of large number of people working/residing during construction activities.	medical exigencies also ensured. 4. Provision for Safety equipment (PPE) at site for construction workers and strict monitoring of adherence of safety protocols for construction activities ensured. 5. Supervision of labour activity within the plant works.	3. Providing facilities / support for education and skill development of local youth.	Digital class rooms @ 1.50 lakhs each X10=**Rs 15.0 lakhs** **Total = 50 Lakhs**
		II. Revamping of existing units and operation (BF1&2, SP2&2, SMS1&2) 1. Revamping activities 2. Project operations •Process emissions and fugitive emissions in the air environment •Creation of employment opportunities •Development of indirect employment opportunities	1. Fugitive emissions during revamping of existing units due to vehicular movement and construction activities 2. Increased labour movement and vehicular movement for construction material inside plant area	1. Increased labour movement inside plant area leading to safety issues. 2. Increase in employment generation both direct as well as indirect			
Grand Total (A)							**200 Lakhs**

Total budget allocated for Natural & Community Resource Augmentation Plan for the next three years i.e. 2018-19, 2019-20 & 2020-21 is **Rs 720 lakhs.**

Natural & Community Resources Augmentation Plan

The remediation plan concentrated on site activity and presented measures related to mitigation / control of pollution during construction. The impact of the construction activity related to transport of materials, employment, and resource consumption have a bearing on the surrounding areas. Hence it is proposed to prepare 'Natural & Community Resources Augmentation Plan' to compensate the impacts. Breakup of cost of activities to be carried out for Natural & Community Resource Augmentation is given in **Table 5.2** below.

Table 5.2 (a) - Natural Resources Augmentation Plan

Sl. No.	Activity	Year wise implementation Plan & Budgetary Provision during Operation Phase (Rs in lakhs)			Total Budgetary Provision (Rs.in lakhs)
		2018-19	2019-20	2020-21	
1	Raising and maintenance of block/Avenue plantation at various places in GVMC area @Rs 250 X 30,000 nos in three years.	15.00	30.00	30.00	**75.00**
2	Providing drinking water through gravity in tribal villages by conservation of water @Rs 5.0 lakhs /villages. Total 10 villages will be provided drinking water in 3 years.	10.00	20.00	20.00	**50.00**
3	Installation of rainwater harvesting systems in common/public buildings /school buildings @Rs 100000/- building avg. total 45 buildings	5.00	20.00	20.00	**45.00**
4	Development of greenery/ plantation / park in the surrounding areas of KB Reservoir	4.00	24.00	24.00	**52.00**
5	Improving of solid waste management systems like provision of Bins, waste management vehicles, machinery, compost machines etc. (@one compost m/c-10 lakhs+20lakhs-one vehicle for garbage collection + 25 bins @10,000 each)	5.00	25.00	25.00	**55.00**
6	Installation of solar street lights/solar power systems etc, in communities	1.00	5.00	5.00	**11.00**
	Total	**40.00**	**124.00**	**124.00**	**288.00**

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Table 5.2 (b) Community Resources Augmentation Plan

Sl. No.	Activity	Year-wise implementation Plan & Budgetary Provision during Operation Phase (Rs in lakhs)			Total Budgetary Provision (Rs. In lakhs))
		2018-19	2019-20	2020-21	
1	Providing free education to BPL children (around 500 Nos) from surrounding the Plant & Mines Rs @ 20,000/year/child	25.00	100.00	100.00	**225.00**
2	Creation of educational infrastructure in schools like additional class rooms, dual desk benches, lab equipment, sports equipment in surrounding areas the plant & mines for promoting education.	5.00	25.00	25.00	**55.00**
3	Support to Persons with disabilities by providing assistive devices like ,wheel chairs, artificial limbs, hearing aids ,vision aids etc	5.00	10.00	10.00	**25.00**
4	Providing sanitation facilities ,like installation of RO plants, construction toilets, construction of hand wash stations in schools /public places	5.00	16.00	16.00	**37.00**
5	Providing Medical infrastructure like Ambulances, X ray m/cs , equipment to Govt hospitals /PHCs/cancer hospital etc.	10.00	20.00	20.00	**50.00**
6	Empowering unemployed through skill development programmes like LMV tailoring, welding, solar mechanic, mobile repair, plumbing, home Nurse, beautician courses etc @ Rs 7500/head benefiting 460 persons in three years.	10.0	15.00	15.00	**40.00**
	Total	**60.00**	**186.00**	**186.00**	**432.00**

Table 5.2 (c) - Total Budgetary Provision made towards the implementation of Natural & Community Augmentation Plan (Rs in lakhs)

Year	2018-19	2019-20	2020-21	Total
Natural Resources Augmentation Plan	40.00	124.00	124.00	288.00
Community Resources Augmentation Plan	60.00	186.00	186.00	432.00
Total Budgetary Provision	**100.0**	**310.0**	**310.0**	**720.0**

Summary of budgetary allocation with respect to Remediation and Natural & Community Resource Augmentation Plan for the present study is provided in Table below.

Table 5.2 (d) - Budgetary allocation with respect to Remediation and Natural & Community Resource Augmentation Plan for the present study

Sl. No	Description	Estimated cost (Lakhs)
1	Estimated cost of damage/remediation with respect to ecological aspects	**200**
2	Natural & Community Resource Augmentation Plan for three years	**720**
3	Total Budget allotted	**920**

RINL will submit a bank guarantee equivalent to the above mentioned amount of **Rs 920 lakhs** towards remediation plan and natural & community resource augmentation plan.

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6.0 <u>No objection certification from CGWA/concerned state authority for ground water handling to be submitted.</u>

During excavation, encountered ground water was pumped in to the nearby rain water harvesting pond and existing KBR.

The size of the reservoir is 1070 m X 650 m. Maximum Water level as +21.25 m. Average ground level is about +12.5m. Cut off trench filled with impervious soil is provided from average embankment bottom level of +12.5m to -4m level and anchored about 1m in to the hard strata. Further curtain grouting with specified cement slurry was carried out all along the periphery of the reservoir up to -14 m to create water barrier by ensuring the permeability values to 3 lugeon. Due to the above measures the ground water level in surrounding areas will remain unaffected.

As drawal of water from ground was not envisaged, no specific approval was obtained from CGWA.

7.0 Proof of action taken by the State Government/SPCB against the project proponent under the provisions of section 19 of the Environment (Protection) Act.

Case filed on RINL by APPCB on 09.01.2019. Details are given below:

Case No.: CNR.APVSOB 40272019, SR No.: CC/24/2019.
Case is posted for hearing and appearance of complainant i.e., APPCB

Court Name: VIII ADDITIONAL CHIEF METROPOLITAN MAGISTRATE GAJUWAKA, VISAKHAPATNAM

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8.0 Submission of revised CER as per Ministry's OM dated 1st May, 2018 and also including works taken up under CER for the year 2018-2019.

As per Ministry's O.M. dated 1st May, 2018, fund allocation towards CER was about Rs 27.5 Crores. RINL has already allotted 8.5 crores towards community development during 2018-19 (**Table 8.2**).Remaining 19 crores will be spent against CER. Breakup of the same is given in following **Table 8.1**.

Table 8.1 – Breakup of Future CER Expenditure

Sl. No	Sector	Amount to be spent (Rs. Lakhs)			
		2019 -20	2020 -21	2021 -22	2022 -23
1	**Promoting Education**				
i	Construction of Additional class rooms in Govt. schools/ institutions	60	60	60	60
ii	Providing duel desk benches to Govt. schools/ institutions	30	30	30	30
iii	Providing infrastructure like digital class rooms, Lab equipments, RO Plants etc.to Govt. schools/ institutions	40	40	40	40
iv	Providing support/facilities to Special Education & Therapy	40	40	40	40
v	Support to education for children belonging to BPL families/ slum areas etc.	80	80	80	80
	Sub-total	**250**	**250**	**250**	**250**
2	**Health Care**				
i	Providing Medical equipments to Govt. Hospitals	20	20	20	20
ii	Providing wheel chairs & adaptive devices to 'Divyangjan'	10	10	10	10
iii	Organising medical/eye camps and providing free cataract surgeries to BPL patients	5	5	5	5
iv	Providing ambulances, stretchers, beds etc to Govt. Hospitals & Primary health centres	15	15	15	15
	Sub-total	**50**	**50**	**50**	**50**
3	**Skill Development and Livelihood**				
i	Providing infrastructure to Skill development centres	10	10	10	10
ii	Organising skill development/vocational training programmes for unemployed youth /women	20	20	20	20
iii	Organising skill development programme for persons with disabilities	20	20	20	20
	Sub-total	**50**	**50**	**50**	**50**
4	**Sanitation & Drinking Water supply**				
i	Installation RO Plants in villages	10	10	10	10
ii	Supply of drinking water in surrounding villages	10	10	10	10
iii	Providing infrastructure for supply potable drinking water in tribal villages	10	10	10	10

Sl. No	Sector	Amount to be spent (Rs. Lakhs)			
		2019 -20	2020 -21	2021 -22	2022 -23
iv	Construction of community toilets and toilet blocks in Schools/ educational institutions	10	10	10	10
v	Infrastructure support for solid waste management in the communities etc	10	10	10	10
	Sub-total	**50**	**50**	**50**	**50**
5	**Environment care**				
i	Taking up avenue plantation and Plantation in communities	20	20	20	20
ii	Installation of solar power/lights	20	20	20	20
iii	Providing infrastructure for rain water harvesting, construction of check dams /recharge pits etc	10	10	10	10
	Sub-total	**50**	**50**	**50**	**50**
6	**Rural Development**				
i	Laying roads construction of drains, other infrastructure for development of surrounding villages	25	25	25	25
	Sub-total	**25**	**25**	**25**	**25**
Total		**475**	**475**	**475**	**475**
Grand Total		**1900**			

The major points raised by the public are given below:

- Increase green belt in the surrounding areas to control pollution
- CSR funds to spent in Local Area
- Skill Development programmes to be organized for the youth in surrounding areas
- Safe drinking water to be provided in the surrounding villages
- Local youth to be involved in CSR activities

The above activities indicated in the CER plan are in line with the points that came up at the Public hearing.

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Table 8.2- Works taken up under CER for the year 2018-2019

Activities for Community Development 2018-19			
S.No	Activity	Allocated Budget (Rs. in lakhs)	Expenditure (Rs.in Lakhs)
1	Providing free Education to children belonging to BPL families of surrounding villages of Plant & Mines	450.00	317.07
2	Support to Arunodaya Special School for providing therapy and education to the Differently abled children in and around the plant.	30.00	12.61
3	Support to Ekalavya foundation for providing primary education to slum area children through 'Akshaya Vidya' Program	35.00	16.00
4	Installation of RO Plants in the surrounding villages of the Plant	15.00	0.00
5	Swachh Bharat initiatives (Maintenance of toilets constructed under 'Swachh Vidyalaya', Installation/construction of toilets, other sanitation works, etc.)	100.00	61.42
6	Supply of drinking water to RH Colonies &Surrounding villages during summer months	12.00	0.00
7	Rehabilitating Children with hearing impairment by Cochlear implantation.	25.00	8.53
8	Support for persons for spinal injuries, children with special needs, orthopaedic condition & older people	10.00	8.92
9	Free cataract surgeries to patients belonging to Below Poverty Line (BPL) families of the surrounding villages of the plant	5.00	0.00
10	Vocational training programs/skill development programmes (Vocational training programmes in surrounding villages of Plant & Mines and Skill development training for differently abled persons etc.)	42.00	11.68
11	Total adult literacy program in peripheral villages of Plant & Tribal areas of Visakhapatnam District.	13.00	0.00
12	Providing educational infrastructure like three seater dual desks and other furniture to various Govt. Schools/institutions	30.00	22.15
13	Activities for promotion of Sports including sports for Special children	8.00	0.00
14	Restoration works after Natural calamities	37.15	34.33
15	Educational infrastructure to Govt. Schools in surrounding villages of Forged Wheel Plant	4.85	4.85
16	Support to destitute elderly persons	15.00	0.00
17	Support to early cancer detection	18.00	5.95
	TOTAL	**850.00**	**503.51**

9.0 ESP proper functioning has to be properly brought out to study its effectiveness.

ESP system has been revamped to limit dust concentration at outlet to less than 50 mg/Nm^3 (originally design: 150 mg/Nm^3) New ESPs have been installed at Dog-house of SMS1 and with the new Convertor in SMS2. The ESP systems' performances were checked at site with respect to normal running, ESP Efficiency of operation, stack emission dust concentration, ESP Auxiliary system operation such as charging mechanism through TR controller, Rapping operation , Earthing , safety interlock system etc .

Take over point (TOP) of ESP revamping system

Suction hoods of dust generation points, fume generation points, ducting network up to ID fan inlet, dust disposal from hopper bottom to inlet hopper of pneumatic handling system, power distribution network, services facilities.

Scope of Work of Revamping:

ESP revamping scope included replacement of internals such as collecting and discharge electrodes, gas distribution screens, rapping system, TR sets with electrics control & instruments , replacement of drag chain conveyor, Ducting network partially as required ,Changing dust disposal system from wet type to dry type for better resource utilization & water conservation.

- Independent rapping system is provided for proper dislodging of dust from collecting electrode, discharge electrode, gas distribution screen.
- Dust hoppers installed with level switches (High & Low), hopper heater. At bottom of the hopper SS liner provided for ease of dust flow.
- GCP hot ESP casing and hopper insulated to avoid condensation inside ESP.
- High voltage transformer feed line taken from 6.6 kV LBDS station
- TR sets, TR controller, Rapper control panels, associated control automation system.
- Individual TR shall be provided with independent control automation.
- For ESP performance improvement Pulse energisation mechanism for TR controller is installed to arrest high resistive dust.

Check Points:

Following drives normal operation with respect to noise and casing temperature checked for proper performance of ESP:

- Rapper Motors of Gas Distribution Screen, Collecting Electrodes, Discharge Electrodes,
- Double Cone Valves / Rotary Air Lock gear motor at ESP Hopper Outlet
- Chain Conveyor motors
- Seal Air fan motor

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Following instruments were checked for proper safe performance of ESP:

- Limit Switch of double cone valve
- Gas Temperature Monitoring
- ESP hopper level switches
- Auto operation of hopper heater interlock with thermostat.
- Insulator heating system.

Earthing for existing and new equipment are checked with copper cables, connected to earthing grid at two points along mechanical safety interlock system provided for all high voltage ESP internals check.

As per PG condition ESP outlet dust measured and was found less than 50mg /Nm^3 as part of performance check point along with total gas flow.

Brief ESP functioning and salient design parameter are as follows.

Table 9.1 – RINL-VSP Status of ESP Revamping and study for checking their effective functioning

Description	BF-1		BF-2		SP1 & SP2			SMS
	BF Cast House DE	BF-1 Stock House DE	BF-2 Cast House	BF-2 Stock House DE	DE Sys-ACP1	DE Sys-ACP2	GCP1 & GCP2	Secondary DE System
Capacity N^3/h/ Am^3/h	12,60,000 / 16,97,000	13,00,000 / 15,81,000	12,60,000 / 16,95,000	22,25,000 Nm^3/hr	3,31,920 Nm^3/hr	9,45,360 Nm^3/hr	2* 9,27,000 Nm^3/hr	1500000 Nm^3/hr
Static pressure mm WG / Temp^0 C	400/50 ~ 80^0 C	400 / 10.5 ~45.5 ^{0} C	400/50 ~ 80^0 C	50^0 C	600/40^0 C	500/135	1920/90, 160^0 C	- / 111^0 C
Inlet Dust Load gm/Nm^3	2 gm/Nm^3	8 gm/Nm^3	2 gm/Nm^3	8gm/Nm^3	8gm/Nm^3	10 gm/Nm^3	3 gm/Nm^3	3gm/Nm^3
Outlet Emission mg/Nm^3	< 50 mg/Nm^3	< 50 mg/Nm^3	< 50 mg/Nm^3	<50 mg/NM^3	< 50 mg/Nm^3	< 50 mg/Nm^3	< 50 mg/Nm^3	< 50 mg/Nm^3
Actual Inlet Dust Load gm/Nm^3	1.68	2.9	1.2	5.2	8	10	1.6	1.4
Actual Outlet Emission mg /Nm3	20-22.7	17-18	37-47.5	24-36.7	67-86	67-86	19-22	34-38
Design Efficiency	97.50%	99.37%	97.50%	99.37%	99.37%	99.50%	98.33%	98.33%
Actual Efficiency	98.65%	99.38%	96.04 %	99.29%	98.93 %	99.14%	98.63%	97.29%
Press Drop mm WG	20	30	25	25	25	25	25	25
Dust Density t/m^3	1.2 ~ 1.8	1.3 ~ 1.5	2	1.3 ~ 1.5	2.2	2.2	2.2	1.6
No of ESP	2 Nos.	2 Nos.	2 Nos.	2 Nos.	1 No	1 No	1 No	2 Nos.
No of Field	3 Nos.	3 Nos.	3 Nos	3 Nos.	4 Nos.	4 Nos.	4 Nos.	3 Nos.
Sp Collecting Area Temp m^2 / m^3/sec.	64.1	60.98	60.26	64.67	83.3	76.03	83.51	59.87
Treatment time in Sec	12.83	12.2	12.05	12.93	16.66	15.21	16.7	11.97
Gas Velocity m/sec	1.169	1.18	1.198	0.792	0.96	1.05	0.96	1.37
Volumetric flow Nm3/hr(Actual as measured)	825951-826483	1090988-1100000	813987-814687	1718928-1730265	3,80,000-3,95,000	14,12,000-14,60,000	2698425-2712464	9,48000-10,50460
Casing / Hopper Thickness	6mm/6mm	6mm/ 6mm	Existing Liner SS-14 G	Existing Liner 5G-14G	Existing	Existing	Existing	5mm/5mm

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Description	BF-1		BF-2		SP1 & SP2			SMS
	BF Cast House DE	BF-1 Stock House DE	BF-2 Cast House	BF-2 Stock House DE	DE Sys-ACP1	DE Sys-ACP2	GCP1 & GCP2	Secondary DE System
Electrode Spacing in mm	400	400	400	400	400	400	400	400
TR Sets No. / precipitator	3 Nos.	3 Nos.	6 Nos	6	4 Nos.	8Nos.	8 Nos.	6 Nos
Collecting Electrode type and thickness	CRCA / 1.2 mm	CRCA /1.25 mm	CRCA/1.5 mm	CRCA/1.5 mm	CRCA/ 1.2 thick	CRCA/ 1.2 thick	CRCA 1.2 mm	Elex sigma type 1.25mm
TR Set Rating KV/MA unit / thickness	110kV / 1500MA	95Kv/ 2000 MA	110 Kv / 700MA	110/550MA	111 KV/ 1000MA	111 KV/ 1000MA	111Kv / 1000 MA	110Kv/1500 MA
Discharge Electrode	Rigid type with broken leaf	Rigid pipe & pin type	Rigid Pipe & Spike	Rigid Pipe & Spike	ERW Tubes with spikes on both ends	ERW Tubes with spikes on both ends	ERW Tubes with spikes on both ends	Rigid Pipe & spike
Hopper valley Angle Deg	60 deg	60 deg	60 deg	60 deg	60 deg	60 deg	60 deg	60 deg
ESP overall Size W X L X H m	26.9*33*27.61	29.6*28*36	17.6*24.6*33 (Each ESP)	11.8 X 24.68X 32.2(each ESP)	9.2 * 24.4 * 26.1	22.5 * 24.4 * 26.1	2 nos * 24.4 * 22.5 * 26.1	16.1*22.6*26.6
Effective migration Velocity cm/sec	4.1	8.32	6	8	6.09	6.97	4.9 cm/sec	6.8 m/sec
Rapper Type	Tumbling type	Tumbling type	MIGI Type	MIGI Type	Tumbling Nozzle EMIG1	Tumbling Nozzle EMIGE	Tumbling Nozzle - EMIGP	Tumbling type
Discharge /Collecting / Inlet Funnel Elect. Rapper drives no	6/3/2	6/3/2	72/36/4	168/72/8	EMIG1	6/3/2	6/3/2	6/6

10.0 Waste water from coke oven to be studied for phenols/VOCs.

Waste water sample from existing coke oven ETP have been collected from 2 locations-

1. At ETP inlet
2. At ETP outlet

The effluent qualities at inlet and outlet have been compared with the standards specified in Norms for coke oven effluents, 2012. The monitored results of inlet and outlet water of CO&BPP ETP is shown in **Table 10.1**.

Table 10.1: Inlet and Outlet of Coke Oven &By Product Plant water Quality

SN.	Parameters	Norms MoEFCC ISP 2012 Coke ovens outlet	EW1 (CO BPP Inlet)	EW2 (CO BPP Outlet)
1.	pH Value	6.0-8.5	8.25	6.86
2.	BOD, 3 days at 27° C, mg/l, max.	30	480	26
3.	COD, mg/l, max.	250	3280	218
4.	Total Suspended Solids, mg/l, max.	100	419	79
5.	Electrical conductivity, µs/cm, max	-	7966	8184
6.	Temperature °C	-	95	31
7.	Oil & Grease, mg/l, Max.	10	279	8
8.	Ammoniacal Nitrogen, , mg/l, Max	50	168	48
9.	Total Kjeldhal Nitrogen (TKN), mg/l, Max	-	333	76
10.	Nitrate Nitrogen, mg/l, Max	-	146	94
11.	Dissolved Phosphates (as P), mg/l, max.	-	48.6	15.6
12.	Chlorides (as Cl), mg/l, Max.	-	1819	1280
13.	Sulphates (as SO_4), mg/l, Max.	-	653	1638
14.	Fluoride (as F) mg/L, Max.	-	9.0	9.0
15.	Sulphide (as S), mg/l, Max.	-	233	18
16.	Zinc (as Zn), mg/l, Max.	-	<0.05	<0.05
17.	Iron (as Fe), mg/l, Max.	-	2.760	2.779
18.	Copper (Cu), mg/l, Max.	-	0.027	0.015
19.	Trivalent Chromium (as Cr^{3+}), mg/l, Max.	-	0.011	<0.01
20.	Manganese (as Mn), mg/l, Max.	-	0.012	0.050
21.	Nickel (as Ni), mg/l, Max.	-	<0.01	<0.01
22.	Arsenic (as As), mg/l, Max.	-	0.1	<0.01
23.	Cyanide (as CN), mg/l, Max.	0.2	6.25	0.36
24.	Lead (as Pb), mg/l, Max.	-	0.083	0.067
25.	Hexavalent Chromium	-	<0.05	<0.05
26.	Cadmium (as Cd), mg/l, Max.	-	<0.01	<0.01
27.	Mercury (as Hg), mg/l, Max.	-	0.0009	0.0007
28.	Boron (as B), mg/l, Max.	-	1.855	0.279
29.	Phenolic Compounds (as C_6H_5OH), mg/l, Max.	1.0	876	0.7
30.	VOC, mg/l	-	<1.0	<1.0

Phenolic compounds in outlet are found within permissible limits. However, for cyanide the values are slightly on the higher side. The existing ETP is being augmented and modified

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for better treatment of the coke oven effluent. Tender floated for the same. Volatile organics have not been detected in effluent.

In the meantime the treated effluent is diluted with other treated effluents to reduce the cyanide concentration to below the maximum permissible limits before being discharged into the sea. The effluent quality finally discharged into sea is given in ADS point no 3. **Table 3.1** shows that all the parameters are with the limit.

For modification and augmentation of existing MBC treatment plant (effluent treatment plant) tender has been invited from experienced bidders vide enquiry dt 14.12.2018 for the existing coal chemicals plant which will further improve the efficiency of the existing treatment plant. Volatile organics have not been detected in effluent.

11.0 In air quality, particles be analyzed for associated phenols/VOCs and heavy metals to study the health status.

Fresh baseline data was generated at site for one month. 4 AAQ stations were installed within the plant boundary and at 8 locations in the 10 km radius buffer zone to validate the previous data. The samples have also been analysed for phenols/VOCs and heavy metals.

Heavy metals (Pb, As, Ni, Fe, Mn, Cd, Cu, Zn, Cr and Hg), Phenols and VOC's have been analysed in the core zone and buffer zone. Air quality status for heavy metals, Phenols and VOCs are given in **Table 11.1 & 11.2** for core zone and buffer zone respectively**.**

The Ni concentrations are found to be relatively high in WZAAQ3 (near Ash pond). The levels of the other heavy metals have been compared with WHO guidelines and found to be within the norms except for Mn concentration in WZAAQ3.

Fe was relatively high in WZAAQ3 (near Ash pond) when compared with other monitoring locations within the plant area which might be due to dust generated by vehicular movement and the wind flow which easily pickups dry particles of soil, sand and dust. Coal ash has been reported to contain Ni and it has been reported in literature on Nickel and its availability in soil (Journal of Industrial pollution Control (2008).

In buffer zone, Ni values have been compared with the NAAQS, 2009 have been found within the norms .Values obtained might be due to burning of fossil fuels, scrapped vehicle tyres and biomass. Ni values are relatively high in A1, A3, A6 & A7 compared to other locations because of proximity to power plants / urban areas. Values of Fe and Mn obtained might be due the soil being rich in Iron and Manganese.

Phenol values have not been detected in any of the monitoring stations probably due to reason degradation of phenol. The gas-phase reaction of phenol with photo-chemically produced hydroxyl radicals is probably a major removal mechanism in the atmosphere of phenol (ref. Phenols & Phenolic Compounds, CPCB, August 2016 Page no 36).

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Table 11.1 - Air Quality Status inside the Plant (Core Zone) for Heavy Metals, Phenols and VOC'S

Parameter	Name of monitoring equipment used	Detection Limit	NAAQS	World Health Organisation (WHO) air quality guidelines	Ontario Ambient Air Quality Criteria April 2012 (24 Hour)	WZAAQ1	WZAAQ 2	WZAAQ 3	WZAAQ 4
Pb (µg/m³)	*AAS method after sampling on filter paper*	*0.0006 µg/m³*	**1**	0.5	0.5	0.1331	0.0117	0.1325	0.0292
As (ng/m³)		*1.8 ng/m³*	**6**	-	100	3.1	<1.8	3.5	<1.8
Ni (ng/m³)		*0.6 ng/m³*	**20**	-	300	12.3	4.2	16.0	3.5
Fe (µg/m³)		*0.0006 µg/m³*	-	-	4.0	0.4869	0.7090	3.2394	0.4206
Mn (µg/m³)		*0.0006 µg/m³*	-	0.15	0.2	0.1333	0.0632	0.1813	0.0340
Cd (µg/m³)		*0.0006 µg/m³*	-	0.005	0.025	0.0008	0.0009	0.0013	0.0007
Cu (µg/m³)		*0.0006 µg/m³*	-	-	50	0.0198	0.0016	0.0338	0.0028
Cr (µg/m³)		*0.0006 µg/m³*	-	-	0.5	0.0063	<0.0006	0.0214	<0.0006
Zn (µg/m³)		*0.0061 µg/m³*	-	-	120	0.0498	0.2736	0.0391	0.0317
Hg (ng/m³)	*CV AAS*	*0.031 ng/m³*	-	1.0	2000	0.072	<0.031	0.048	<0.031
Phenols (µg/m³)	*HPLC*	*0.4 mg/m³*	-	-	-	<0.4	<0.4	<0.4	<0.4
Volatile Organic Compounds (VOC's) (µg/m³)	*GC MS*	*0.008 mg/m³*	-	-	-	0.092	<0.008	<0.008	<0.008

Table 11.2 - Air Quality Status outside the Plant (Buffer Zone) for Heavy Metals, Phenols and VOC'S

Parameter	Name of monitoring equipment used	Detection Limit	NAAQS	WHO Air quality guidelines (WHO 2000) for Europe, (µg/m³)	Ontario Ambient Air Quality Criteria April 2012 (24 Hour)	A1	A2	A3	A4	A5	A6	A7	A8
Pb (µg/m³)	*AAS method after sampling on filter paper*	*0.0006 µg/m³*	**1 (µg /m³)**	0.5	0.5	0.0290	0.028	0.0414	0.0035	0.004	0.0460	0.0904	<0.0006
As (ng/m³)		*1.8 ng/m³*	**6 (ng /m³)**	-	100	<1.8	2.3	<1.8	<1.8	2.8	<1.8	<1.8	2.0
Ni (ng/m³)		*0.6 ng/m³*	**20 (ng /m³)**	-	300	14.5	3.8	13.6	<0.61	8.4	10.3	16.7	0.8
Fe (µg/m³)		*0.0006 µg/m³*	-	-	4.0	0.6947	0.420	1.9719	0.2668	0.12	1.3786	2.8469	0.092
Mn (µg/m³)		*0.0006 µg/m³*	-	0.15	0.2	0.0423	0.064	0.1066	0.0065	0.028	0.2834	0.1929	0.007
Cd (µg/m³)		*0.0006 µg/m³*	-	0.005	0.025	0.0012	<0.0006	<0.0006	0.0006	<0.0006	0.0015	0.0018	<0.0006
Cu (µg/m³)		*0.0006 µg/m³*	-	-	50	0.0166	0.004	0.0155	0.0096	0.003	0.0503	0.1269	0.002
Cr (µg/m³)		*0.0006 µg/m³*	-	-	0.5	<0.0006	0.003	0.0102	0.0017	0.001	0.0077	0.0094	0.003
Zn (µg/m³)		*0.0061 µg/m³*	-	-	120	1.2315	0.037	0.2379	2.4792	0.007	1.6128	0.5589	0.007
Hg (ng/m³)	*CV AAS*	*0.031 ng/m³*	-	1.0	2000	0.035	<0.035	<0.031	<0.031	0.05	0.035	0.037	<0.035
Phenols (µg/m³)	*HPLC*	*0.4 mg/m³*	-	-	-	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
VOC's (µg/m³)	*GC MS*	*0.008 mg/m³*	-	-	-	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008

12.0 Closure of Non-compliance reported by the regional office of the Ministry.

Report submitted to RO, MoEFCC, Chennai on 12/10/18. Since, RINL-VSP have not received any response in this regard from MoEF&CC Chennai office within one month of submission. As per the provisions of MoEF&CC circular dtd. 07-09-2017, in case the inspection is not carried out within one month, the certified compliance report from the concerned RO of SPCB shall also be accepted for deliberations by the EAC.

In this context, M/s RINL-VSP vide letter dtd. 27-11-2018, submitted a representation to the APPCB stating that they applied for the Environmental Clearance for the proposed capacity expansion project and requested the Board to submit the certified compliance report of the earlier Environmental Clearances as per the MoEF&CC circular dtd. 07-09-2017.

The officials of APPCB inspected the industry on 06-12-2018, verified and reported the compliance report of the earlier Environmental Clearances.

The certified compliance report issued is enclosed herewith as **Annexure C**.

13.0 Statement from PP that commissioning had been done within validity of EC.

RINL obtained CFE for 6.3 MTPA in May, 2005 with a validity of 5 years followed by EC by MoEFCC in August, 2005. The entire expansion of 6.3 MTPA was executed in two stages. Major construction activity for Stage-I facilities were completed by August 2010 and commissioning activities commenced progressively thereafter.

Meanwhile, MoEFCC vide S.O.1141 (E) dt.29-04-2015 amended the validity period for environmental clearance from five years to seven years.

Also, the Stage-2 i.e., Structural Mill & Special Bar Mill was also under execution and due to be commissioned by 2012.

Considering the above facts, RINL VSP requested APPCB vide their letter dtd.26.04.2010 to kindly grant extension of validity of above CFE upto June, 2012 to enable RINL to complete the implementation of 6.3 MTPA expansion.

RINL obtained consent for operation from APPCB in June 2012 and subsequently in 2013, 2014 and recently in 2015 (valid till April, 2019). All the 6.3 MTPA expansion units have been commissioned progressively and completed by April- 2015.

14.0 NOC from concerned department for cutting of trees during the construction phase to be submitted.

The reservoir construction area was covered with *Prosopis juliflora* (thorny bushes) and permission is not required for clearing *Prosopis juliflora*. The same was confirmed by AP Forest Department vide their letter dt. 07.12.2018, shown below:

GOVERNMENT OF ANDHRA PRADESH
FOREST DEPARTMENT.

Rc.No.7628/2018/S4,
Dated 07.12.2018.

Office of the Divisional Forest Officer,
Visakhapatnam.

From
Sri C.Selvam. I.F.S.,
Divisional Forest Officer,
VISAKHAPATNAM.

To
The General Manager
Design and Engineering,
R.I.N.L. VISAKHAPATNAM.

Sir,

Sub:- **APFD--Visakhapatnam District--Tree Valuation** -Construction of Additional Water Storage Reservoir at Visakhapatnam-Removal of Prosopis Juliflora-Permission report sent -Regarding.

Ref:-
R/O from Sri B.Nallarkiniyan General Manager, Vizag Steel Plant, Visakhapatnam Ref.no.DECS/KBR2/01/18/D&E-C&S/ dated 03.12.2018

The General Manager, Steel Plant, Visakhapatnam reported that, Additional Reservoir has to be constructed in Visakhapatnam Steel Plant. In the proposed construction area Prosopis Juliflora (Buses & Trees) were existing. They are clearing the area and the works are under progress. During the process of environmental clearance, Ministry of Environment & Forest sought to know whether Forest Department's clearance was obtained before clearing areas. Hence, he requested the under signed to clarify whether permission is required clearing Prosopis Juliflora.

Hence, the General Manager, Steel Plant, Visakhapatnam is informed that, A.P.Forest Produce Transit Rules, 1970 Rule 16 says that these rules shall not apply to substituted as Red Sanders and Sandal wood of timber firewood and other Forest Produce and in such areas as are specified in Schedule II and III. A copy of the same is enclosed herewith for information.

Encl:- As above.

Yours faithfully,
Sd/- C.Selvam,
Divisional Forest Officer,
Visakhapatnam.

// T.C.B.O. //

SUPERINTENDENT.

15.0 Base line health study within 5km radius of the project.

Baseline health survey has been conducted in several villages in 5 Km buffer zone of the plant boundary. Health questionnaires have been collected from about 450households.

In addition to this, health statistics have also been collected from nearby hospitals, Cancer institutes and Primary Health Centers (PHCs).Occupational health status has been collected from RINL's OHS Center.

Based on the above data, a baseline health study report has been prepared. The same is attached as **Annexure D.**

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16.0 Revised EIA report along with compliance of ToR conditions with proper cross reference and page numbers to be submitted.

Based on the observations made by EAC and incorporating the present Additional Details Sought (ADS) for the proposal, the EIA/EMP report has been revised. The same is enclosed herewith.

17.0 A table mentioning the plants constructed or revamped shall be included in a tabular form involving an investment of about 6435 crores without prior EC.

Cost breakup of units constructed or revamped prior to getting EC are given in following Table.

S. No	Facility	Cost (Rs. Crores)
Revamping Units		
1	Revamping of Sinter Plant 1	244
2	Revamping of Blast Furnace 1	656
3	Revamping of Blast Furnace 2	943
New Units		
1	Installation of Conv.3 & Caster4 (SMS -2)	975
2	Installation of Coke Oven Battery -5	2857.66
3	Turbo Blower -5	280
4	Kanithi Balancing Reservoir 2	465.85
5	Installation of LPG storage facility	15.07
6	Installation of Nitrogen Plant	3.5
7	Installation of Twin Laddle Heating furnace in SMS 2	106
Total		**6546.08**

The breakup of total Cost of project i.e. **Rs9439.53 Crores** involving revamping of existing pollution control facilities as well as installation of new units for Expansion is as follows-

S. No	Facility	Cost (Rs. Crores)
Revamping Units		
1	Revamping of Sinter Plant 1 & 2	489
2	Revamping of SMS-1	354
3	Revamping of Blast Furnace 1	656
4	Revamping of Blast Furnace 2	943
5	Revamping and Modernization of Continuous Casting Department	633.1
6	Revamping and upgradation of Walking beam type reheating Furnaces of the light and medium merchant mill (LMMM) 203	203
7	Rebuilding of coke oven battery no. 1	944.42
Sub - Total		**4222.52**
New Units		
1	Installation of Conv.3 & Caster4 (SMS -2)	975
2	Installation of LPG storage facility	15.07
3	Installation of Nitrogen Plant	3.5
4	Installation of Twin Laddle Heating furnace in SMS 2	106
5	Installation of Re bar mill	431
6	Installation of Coke Oven Battery -5	2857.66
7	Guard Pond	12.55

VISAKHAPATNAM STEEL PLANT
EIA/ EMP Studies for ongoing expansion of Integrated Steel Plant from 6.3 MTPA to 7.3 MTPA liquid steel within the premises of Visakhapatnam Steel Plant

S. No	Facility	Cost (Rs. Crores)
8	Turbo Blower -5	280
9	Kanthi Balancing Reservoir	465.85
10	Revamping & Upgradation of Electrostatic Precipitators of Two Boilers in Thermal Power Plant (TPP)	70.38
Sub - Total		**5217.01**
Total		**9439.53**

18.0 The damage assessment shall be calculated for each construction and revamping activity as deliberated in the meeting and then cumulative effect to be mentioned.

Revised Damage Assessment has now been carried out individually for the following units-

1. Construction of new KBR 2
2. Construction of new COB5
3. Construction of new Guard Ponds
4. Revamping of BF1 and BF2
5. Revamping of SP1
6. Expansion of SMS2 by installation of new converter 3 and caster 4.

Additionally, a cumulative damage assessment has also been carried out for overall impacts due to the construction and revamping activities.

The revised damage assessment for individual unit as well as cumulative damage is provided in Chapter 11 of the revised EIA/EMP report. The same is also enclosed as **Annexure E.**

19.0 The benefit accrued due to violation should be brought out properly on financial considerations.

The expansion of Integrated Steel Plant from 6.3 MTPA to 7.3 MTPA started with revamping and capital repair of existing BF1 followed by BF2. Subsequently, in order to match the increased Hot Metal Production capacity, expansion/ revamping/ modernization of existing facilities also got started. The schedule of these plant developmental activities is given in **Table 19.1**.

Table 19.1 - Time Table of Plant Development

Sl. No.	Facility	Commencement	Completion
1	**BF1 Revamping**	October 2013	July 2014
2	**SMS2 Converter 3**	March 2013	Nov. 2016
3	**SMS2 Caster 4**	June 2014	Dec. 2017
4	**COB 5**	July 2015	Yet to finish
5	**BF2 Revamping**	May 2016	August 2017
6	**SP1 Revamping**	October 2016	31.07.2017
7	**SP2 Revamping**	Yet to start	
8	**New Rebar Mill**	Yet to start	
9	**KBR-2**	July 2016	By Oct. 2018
10	**Turbo Blower 5**	June 2014	Nov. 2017
11	**Guard Pond**	March 2018	February 2020

From the above table, it can be seen that the various expansion/modernization programs for different units started at different times and some have been completed while some are still under progress. However, as per the actual production figures, the production of hot metal and crude steel have continually increased and reached a max of about 5.13 MTPA hot metal and 4.97 MTPA Liquid steel in 2017-18 though the approved capacities are at 6.5 MTPA of Hot Metal and 6.3 MTPA of Liquid steel.

a. Estimation based on production exceeding approved capacity

The two Blast furnaces were operating at near maximum capacity prior to expansion phase. For the capital repairs/expansion of capacity, the existing two blast furnaces were put for repair one after the other. However, even though the blast furnaces were placed under capital repair during the expansion period, an overall increasing trend in production of hot metal since 2012-13 is noted. This increase is mainly attributable to the simultaneous commissioning of new BF3.

Therefore, after 2012-13, when the production from BF1 started declining due to ongoing revamping activities, the production from BF2 was almost constant but the production from new BF3 started building up gradually. Similarly, when BF1 revamping was completed and BF2 revamping started in 2016, the production from BF1 was normalized around 1.8 MTPA. The contribution from revamped BF1 and new BF3 has reached to 1.8 MTPA each.

A significant increase in production was observed after 2016 when the BF1 was normalized after revamping with an output of around 2 MTPA and BF3 was also producing at near max capacity of 2.5 MTPA. And even though there was no output from BF2, the total hot metal production in 2016-17 was 4.4 MTPA. This was the first time when RINL has exceeded 4 MTPA hot metal production and this was mainly due to the newly installed BF3 of 2.5 MTPA capacity.

In August 2017, when the revamping of BF2 was completed, the production from the unit gradually started increasing. The final output figures of all the blast furnaces were 2.0 MTPA, 0.6 MTPA and 2.5 MTPA for BF1, BF2 & BF3 respectively. Total output was 5.13 MTPA.

Therefore, from the above paragraphs, it can be inferred that the gradual increase in hot metal production from 2012-13 to 2017-18 is mainly attributable to newly installed BF3. Secondly, even after the revamping and capacity expansion of BF1 & BF2 from 2.0 MTPA to 2.5 MTPA, none of the units have given an output exceeding the approved limit of 2.0 MTPA.

In such an integrated steel plant where input is basically iron ore, the income from the operation is directly proportional to the hot metal production. And since, the hot metal production from the two revamped units has never exceeded the approved capacity, the economic benefits derived due to the project can be assumed to be nil.

b. Estimation based on proportionate increase in production capacity

To arrive the notional economic benefits derived due to the violation, the same can be calculated based on the increase in actual production in proportion to the increased production capacities. Again, since the income from an integrated steel plant is directly proportional to the quantity of hot metal produced, therefore it is assumed that prior to commissioning of BF1 after revamping, no economic benefit was obtained.

The estimation of economic benefits derived shall be done in two phases-
Phase 1: when only BF1 was commissioned after revamping from July 2014 till May 2016.
Phase 2: when both BF1 & BF2 were being operated after revamping from May 2016 till date.

In Phase 1, the total capacity of Hot metal production has increased from 6.5 MTPA to 7.0 MTPA. Therefore, 0.5 MTPA of the total 7.0 MTPA hot metal production capacity shall be considered for calculation. This means that 7.1 % of the total income from production and expenses thereof during the period shall be considered for cost estimation.

Similarly in Phase 2, the total capacity of Hot metal production has increased from 6.5 MTPA to 7.5 MTPA. Therefore, 1.0 MTPA of the total 7.5 MTPA hot metal production capacity shall be considered for calculation. This means that 11.4 % of the total income from production and expenses thereof during the period shall be considered for economic benefit estimation. The estimation of costs for different financial years is shown in **Table 19.2**.

Table 19.2 - Year-wise estimated benefits due to violation

Sl. No.	Particulars	2014-15	2015-16	2016-17	2017-18
1	Production Capacity (TPA)	6833333	7000000	7000000	7333333
2	Incremental Capacity (TPA)	333333	500000	500000	833333
3	Incremental Capacity as Percentage of Total Production Capacity	4.9 %	7.1 %	7.1 %	11.4 %
Income & Expenses for actual production and those attributable to Violation (Rs in Crores)					
1	Total Income	10,688.5	10,480.6	12,679.0	14,872.4
2	Total Expenses	10,590.5	12,268.6	14,369.5	16,242.8
3	**Net Profit/Loss**	**62.38**	**-1420.64**	**-1263.2**	**-1369.0**

4	Income corresponding to Violation	508.9	723.8	887.1	1659.9
5	Expenses corresponding to Violation • *Cost of materials consumed* • *Excise duty* • *Finance costs* • *Depreciation and amortization expense* • *Consumption of stores and spare parts* • *Power and fuel* • *Repairs and maintenance* • *Rent* • *Rates and taxes* • *Insurance* • *Handling and scrap recovery* • *Freight outward* • *Miscellaneous expenses*	463	656.7	893.7	1591.8
6	**Net Economic Benefit (4-5)**	**45.9**	**67.1**	**-6.7**	**68.1**

**Other incomes and expenses which are not relevant to the above calculations are not shown.*

From the above table it can be observed that out of the 3 years as per the Balance Sheet, RINL has incurred operational losses. However, notional economic benefits derived due to the violation, by considering the cost for proportionate income and expenses from the revamped units, show a cumulative profit of **Rs 174.5** Crores in 4 years period of plant operation.

ANNEXURES

ANNEXURE A

RAPID MARINE EIA STUDY FOR LAYING OF MARINE PIPELINE FOR EFFLUENT DISCHARGE

ANNEXURE-A

DISTRIBUTION RESTRICTED

ISO-9001 accredited

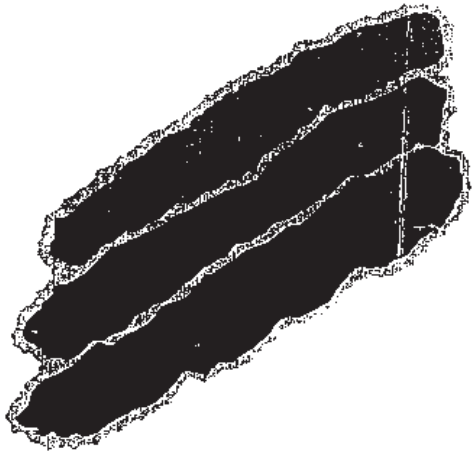
NIO / SP - 29 / 2006

Rapid Marine Environmental Impact Assessment (RMEIA) and investigations to lay a marine pipeline for discharging the effluents from Visakhapatnam Steel Plant

Sponsored by

Visakhapatnam Steel Plant

Visakhapatnam



August, 2006

ENV/LIB/STUDIES/ 62

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NATIONAL INSTITUTE OF OCEANOGRAPHY

Dona Paula, Goa - 403 004

CONTENTS

Rapid Marine Environmental Impact Assessment (RMEIA) and investigatioos to lay a marine pipeline for discharging the effluents from Visakhapatnam Steel Plant

Sponsored by

Visakhapatnam Steel Plant

Visakhapatnam

National Institute of Oceanography
(Council of Scientific & Industrial Research)
Regional Centre, Visakhapatnam

August, 2006

PREFACE

M/s. Visakhaptnam Steel Plant, Visakhapatnam approached the National Institute of Oceanography, Regional Centre at Visakhapatnam to carry out Rapid Marine Environmental Impact Assessment and investigations to lay a marine pipeline for discharging the treated effluents. Multidisciplinary Oceanographic studies will assist in locating the suitable discharge point, pipeline corridor for the marine out fall. In this connection, the following studies were carried out:

- CRZ Studies to demarcate High Tide Line (HTL) and Low Tide Line (LTL) of the study region.
- Seabed studies to locate a suitable corridor for an effluent discharge pipeline.
- Physical oceanographic studies to estimate the dispersion pattern and suggest a suitable discharge point.
- Chemical and biological studies to assess the present status of water quality and marine ecology
- Toxicological studies to know the survival rate of the species (prawn and fish) with the treated effluent from their existing firm.

This report describes the results of the above studies and includes the recommendations on the pipeline route and the point of discharge to the Sponsorer.

Station: Dona Paula, Goa

Date: 17.08.2006

S.P. Fondekar
Head
Sponsored Project Management Group

EXECUTIVE SUMMARY

M/s. Visakhapatnam Steel Plant, Visakhapatnam proposed to expand their unit with a production enhancement from 4.0 MT to 6.5 MT with an estimated cost of Rs. 8692 crores at Gangavaram - Appikonda in Visakhapatnam District, Andhra Pradesh. The Sponsor requested National Institute of Oceanography (NIO), Regional Centre, Visakhapatnam to carry out Rapid Marine Environmental Impact Assessment (RMEIA) studies for a suitable discharge point for the treated effluents in the marine environment. Accordingly NIO has studied the following oceanographic aspects during February - April 2006.

a. CRZ studies to demarcate HTL (High Tide Line) and LTL (Low Tide Line)
b. Seabed studies to suggest a suitable corridor for pipeline
c. Physical oceanographic studies to know the dispersion characteristics and to suggest a suitable discharge point for the treated effluents.
d. Chemical and biological studies to assess the status of water quality and ecology of the marine environment.
e. Toxicological studies to assess the survival rate of the species for the treated effluent.

Based on the above studies, the following suggestions and recommendations are provided:

CRZ Studies:

HTL and CRZ mapping was done for the area between Gangavaram hill and Kutukonda for laying the buried pipe line to discharge the treated effluents from the Steel plant (existing and after expansion of the steel plant).

The position of HTL, LTL and CRZ categories are demarcated in the nearest cadastral map of a scale 1:5000.

The HTL along the open coast of the study area was demarcated by taking into consideration the geomorphic signatures that are discernible in the field.

The LTL was demarcated with reference to chart datum by taking into consideration the bathymetry in the surf zone along the study area.

The setback lines of 200 m and 500 m measured landward side of High Tide Line along the open coast. The landfall point and part of proposed pipeline falls with in the set back lines of 200 m line.

Most of the area between Gangavaram hill and Kutukonda was covered by the man made forest, rocky outcrops and sand dunes.

Pipe line route does not have in its vicinity any sensitive and important ecosystems eligible to be categorized as CRZ I except the inter-tidal zone which is in CRZ I (ii).

Geophysical Studies:

Bathymetry studies in the region indicate that the topography in general is smooth and devoid of any significant features except minor irregularities in the nearshore region.

The bathymetry map drawn at 0.5 m contour level (Fig. 3.2) shows a steep gradient of 1:65 in the northern part and relatively gentle (1:105) in the southern part.

Sidescan sonar and shallow seismic studies indicate that the suggested corridor between profiles L_7 & L_{11} is found to be plain and smooth without any hazardous features, such as rock outcrops etc.

Physical Oceanographic Studies:

From the current measurements in the study area, it is observed that the speed of current mostly vary between 0.1 and 0.7 m/sec during the observational period. The direction was confined to 50° to 80°.

The average density of the water column in the study area is 1022 kg/m^3 during the observational period.

From the buoyant jet model, a 6 port diffuser with a diameter of 0.126 m with a jet velocity of 2.0 m/sec is recommended at 20 m water depth. The dilution can be enhanced to 198 times by increasing the jet velocity to 2.5 m/sec with 6 port diffuser system having 0.111 m diameter.

Chemical Studies:

The water quality at the proposed discharge site is having low concentrations of chemical constituents and within the stipulated levels of coastal environment. Since treated effluents will generally undergo dilution and dispersion after release, it will bring the quality and concentration to allowable ambient level in the surrounding marine environment. The sediments collected in the study area were mainly sands and silty sands.

Biological Studies:

Baseline data on biological characteristics indicate phytoplankton comprising of 15 different genera of diatoms. The zooplankton fauna was represented by 48 different taxa belonging to 14 groups with copepoda on the major group (83.2%).

A total of 85 taxa were identified which were belonging to 18 major groups. *Polychaete* was the most dominant and diverse group in terms of number of species and contributed to 70% of the total macrobenthic density.

Surface water samples have more bacterial population when compared to sediment samples. Overall results show low counts of coliforms and *salmonella* like organisms showing less impact of microbial pollution in the marine environment.

The demersal resources of the area (upto 30 m) had many variety of fishes and the catch was highest at 10 m depth zone. The catch composition revealed the occurrence of 16 major groups of fish and crustacean in the area.

The toxicological studies conducted on test organism revealed that the treated effluent is non toxic. Since the treated effluents will generally undergo dilution and dispersion after release, under the present scenario no impact will be noticed in the marine environment.

Considering the prevailing physico-chemical and bathymetry data of the study area, discharge point should be at 20 m water depth i.e. at 17° 35' 39" N; 83° 13' 50" E which is 1.21 km from the LFP. The pipeline route, LFP and marine discharge point are shown in Fig. 4.15.

Impact Assessment and Mitigation Measures

The proposed marine activities will have temporary localized impact on the environment during construction phase and are reversible within a short recovery period because the laying of submarine pipeline is a one-time activity.

Proper mitigation measures should be taken during construction and operational phases to protect the marine ecology from anthropogenic shocks.

Proper environmental management plan should be envisaged within the industry. The non toxic nature of the treated effluents and bioassay tests should be performed periodically by the industry's pollution control cell.

Periodical monitoring of the marine environment after the expansion activities are essential to assess the health of the coastal environment.

CONTRIBUTORS TO THE PROJECT

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1 BACKGROUND INFORMATION

1.1 INTRODUCTION

The Visakhapatnam Steel Plant (VSP) is located at about 10 kilometers south of Visakhapatnam (Latitude 17° 36' N and Longitude 83° 12' E) (Fig. 1.1) (Plates 1.1; 1.2a & b). At the northern and the southern boundaries of the plant lie two important fishing villages of the area called Gangavaram and Appikonda. The Steel Plant area is comprised of small hillocks and plains. The alignment of the coast between Gangavaram and Appikonda lies in a northeast and southwest direction. There is a shallow bay off Gangavaram having a narrow tidal inlet feeding salt water to the old salt-pans.

Visakhapatnam Steel Plant (VSP), the first coast-based integrated iron and steel plant in the country was set up in the year 1990 at Visakhapatnam in Andhra Pradesh by Rashtriya Ispat Nigam Limited (RINL) - a public sector undertaking. The process route of iron and steel making is conventional one, that is, Blast furnace-LD converter (BF-LD) route. The plant was designed for annual hot metal production of 3.0 million tons (MT) from two (2) BF Units and 2.7 MT liquid steel from three (3) LD Converters followed by downstream finishing mills of long products. Provision for future expansion of the plant was envisaged for a production capacity of hot metal up to 10 MT per annum.

It is now decided to increase the annual hot metal production from 4.0 MT to 6.5 MT (Fig. 1.2) and corresponding increase in liquid steel upto 6.3 MT. Under the proposed expansion, it is also planned to produce more quantities of value added steel for which liquid steel would be refined. The product-mix under expansion scheme adds a new product, that is, 300,000 tons/yr of seamless

tubes suitable to use by oil and gas industry and for other pipeline transport. Details of new production facilities at the plant are shown in Table 1.1.

Expansion of the VSP to 6.3 MT liquid steel is planned with an investment of Rs, 8,692 crores with a total effluent discharge of 14,400 m^3/day into the marine environment. While according consent for establishment by AP State Pollution Control Board and MoEF it was stipulated that the surplus treated water shall be stored in the holding pond for use in the lean period. The outflow shall be discharged through a marine outfall into the sea. In view of the above, it was decided by VSP to approach National Institute of Oceanography (NIO), Regional Centre, Visakhapatnam to get the Rapid Marine Environmental Impact Assessment (RMEIA) and investigations to lay a marine pipeline for discharging the effluents from Visakhapatnam Steel Plant. After examining the proposal, NIO agreed to carry out the field study to generate baseline and site specific data for RMEIA studies.

1.2 OBJECTIVES OF OCEANOGRAPHIC STUDIES

i. CRZ Studies to demarcate HTL & LTL.

ii. Seabed studies to suggest suitable corridor for laying of pipeline.

iii. Baseline data on physical, chemical and biological parameters to know the present status of marine environment.

iv. CTD and Current measurements to understand the flow characteristics and to suggest the discharge point for the treated effluents.

v. Toxicological studies on the test species with the treated effluents from their firm to know the survival rate of the species.

1.3 DETAILS OF THE STUDIES

As per the guidelines of MoEF, Coastal Regulatory Zone (CRZ) studies are undertaken for demarcation of HTL & LTL. Seabed studies comprising bathymetry, side scan sonar and shallow seismic surveys are undertaken to locate suitable corridor for laying of the pipeline. Generation of site specific environmental data base is a pre-requisite for the assessment of probable impact of any marine based activity. Hence baseline data on physical (at 9 stations), chemical and biological characteristics (at 12 stations) in the study area in one season are collected to assess the prevailing ecological conditions. The flow characteristics in these coastal waters are assessed through current measurements to suggest the suitable marine outfall point for disposal of treated effluents. The field measurements are carried out during Feb – April 2006 and the results are incorporated in this Rapid Marine Environmental Impact Assessment (RMEIA) report.

1.4 MANUFACTURING PROCESSES

The iron and steel making process comprises five (5) steps of operation, namely, (i) coke making in by-product recovery type coke ovens, (ii) sintering of iron ore fines, limestone/dolo fines, coke fines etc to produce sinter as one of the burden materials of Blast Furnaces, (iii) Iron making in Blast Furnaces by charging iron ore, sinter, coke and fluxes, (iv) Conversion of molten iron to liquid steel followed by casting of liquid steel to blooms, billets and rounds as semis in continuous casting machines and finally (v) reheating of semis for rolling in different types of rolling mills to produce finished steel products.

The supporting production facilities are calcination of limestone and dolomite, production of Oxygen, Nitrogen and Argon in air separation plant and captive power generation.

Following description gives a brief outline of the principal process steps stated above.

Coke making: Metallurgical coke is required for reduction of iron ore to produce hot metal. Metallurgical coke is produced by carbonising the coking coal at a temperature of around 1000º C under reduced atmosphere in closed door multiple ovens. The coke ovens produce metallurgical coke and by-product coke oven gas which after separation of ammonia, tar, naphthalene etc is used for plant fuel purpose. The run-of-oven coke after dry quenching with nitrogen is screened to separate out the sized coke and coke breeze. This coke dry quenching (CDQ) facility provides additional power.

Sintering: Sintering is a high temperature (1200-1300ºC) process for sintering of iron ore fines, with coke breeze and other recycled minerals like limestone, lime fines, metallurgical process wastes, LD slag, BF flue dusts etc. Sinter plant in fact is a waste utilisation plant for the solid wastes like fines and sludges produced in the steel plant.

Iron making: Sized iron ore, coke, sinter along with other fluxing agents are charged to the tall vertical blast furnace for production of hot metal in presence of hot blast air. The operational temperature is around 1600ºC. The gangue minerals present in the iron ore are converted to slag known as BF Slag. Fe content of the ore gets converted to hot metal due to reduction of oxide ore by carbon of the coke. The hot metal after desulphurisation is ready for conversion to steel in LD converters. The BF gas after cleaning in the Wet Gas Cleaning Plant is used for fuel purpose in the plant.

Steelmaking: In LD converters, the desulphurised hot metal along with burnt lime, limestone and other fluxing minerals is reacted with Oxygen to oxidise the excess carbon present in the hot metal. The operational temperature of LD converter is around 1750° C. The crude liquid steel so produced gets further refined by vacuum degassing and chemistry is adjusted with the addition of ferro alloys in ladle furnaces. The desired quality of steel in molten state is continuously cast in a special machine to produce semis in the form of blooms and billets respectively.

Rolling of semis: The billets are reheated to a temperature of around 1200°C in the furnace for rolling in different types of long product mills to produce long merchant products like bars, rods, sections, tubes etc. Rolling Mills are of proprietary designs, which give the finished shape of reheated semis to the desired forms like bars, rods, angles, channels etc of commercial quality.

Lime calcination: Burnt lime and dolomite are required for steel making. Limestone and Dolomite are burnt in the kilns at a temperature of around 1050° C to produce burnt lime and dolo, which after screening are fed to the LD Shops.

Air separation: Steel making in the LD Converters requires Oxygen of high purity. Air separation plant produces liquid Oxygen, Nitrogen and Argon from atmospheric air. Oxygen lancing is required in LD Converters for converting hot metal to liquid steel of desired carbon level. Argon is required for rinsing the molten bath and Nitrogen is used by the process at various steps of operation.

Table 1.1 List of New Production Facilities

	Production Facilities	Nos	Rated Capacity	Annual Production
A.	**New**			
1.	Sinter Machine No. 3 (SP-3)	1	400 sq m Grate Area	3.25 MT Charge Sinter
2.	Blast Furnace No. 3 (BF-3)	1	3800 cu m useful volume	2.5 MT Hot Metal
3.	Steel Melt Shop No. 2 (SMS-2)	1	2 x 150 T LD Converter with Steel Refining facilities and continuous casting	2.6 MT liquid steel
4.	Rolling Mills		1 x Wire Rod Mill	600,000 T
			1 x Special Bar Mill	750,000 T
			1 x Structural Mill	700,000 T
			1 x Seamless Tube Mill	300,000 T
5.	Lime/Dolo Calcining Plant		2 x 500 TPD Vertical Shaft Kilns	250,000 T
6.	RMHS		Additional storage beds for coal, Iron ore, flux etc	
B.	**Augmentation**			
1.	TPP & BH		330 TPH by-product fuel gas Steam Boiler for Turbo Blower TB-4 and 67.5MW TG	
2.	Water System		Additional facility for about 13 MGD water for the proposed new units under Expansion	

1.5 WATER & ENVIRONMENTAL MANAGEMENT

It is proposed to construct a pond as a balancing pond of surplus treated wastewater quantity after plant recycling. The pond water shall be used for dust suppression, floor washings and other miscellaneous non-production uses.

The present specific water consumption for the steel plant alone is 3.31 cu m per ton of liquid steel. If water consumption of TPP & BH is taken into consideration the specific consumption of water becomes 9.62 cu m/ton of liquid steel. The design of the water system of the proposed Expansion is 4 cu m/ton of liquid steel for the steel plant by adopting best practicable schemes for wastewater recycling.

1.5.1 Wastewater treatment, recycling and disposal

The following schemes are proposed for wastewater management comprising treatment, recycling and disposal system:

Coke oven effluent stream: The existing treatment scheme for 4 Nos. coke oven batteries would remain unchanged. Coke oven effluent water after initial separation of floating tars and oils are taken into equalising tanks. From the equalising tanks, the effluent passes through a series of 2-stage aeration in presence of specific bacterial species and nutrients added. The treated wastewater after clarification will be stored in the pond, along with any leakages flow from the process. The over flow from the pond shall be pumped to sea by marine pipeline.

Treatment of direct contaminated water: The direct contaminated water (DCW) from the gas cleaning plants (GCP) of BF and LD Converters of SMS is clarified and recycled to DCW cooling water for recycling the cold water to the wet gas cleaning plants. The clarified sludge will be passed through vacuum disc filter

press for recovering the GCP sludge, which would be used in new Sinter Machine. The filtered water shall be recycled to the Gas cleaning water circuit.

Treatment of Mill wastewater: The mills wastewater contain fine mill scales and mill oils. The mills would be provided with large scale pits where floating oils are first skimmed off. The settled mill scales would be recovered mechanically from the scale pit. The scale pit water would be pumped to the settling tank for separation of finer solids and removal of oil. The clarified water after filtration would be recycled to the DCW cooling circuit of Mills. The fine sludges after thickening in the thickener would be dewatered for recycling to the Sinter Machines.

Treatment of Cooling Tower Blow Down: Blow downs from Cooling Towers (CT) shall be used in slag granulation, dust suppression, ash handling and part at its will be used as make up to direct contaminated cooling water (DCW) circuit. Thus 100 per cent reuse of CT blow downs to the extent possible is made within the plant to conserve make up water consumption. The proposed expansion scheme envisages same utilisation of CT blow down within the plant to the extent possible.

Treatment of TPP & BH effluent: The effluent from TPP & BH originates from the back washings of resin beds of water de-mineralisation plant. The DM plant effluent is almost self-neutralising due to presence of HCl and NaOH. The effluent therefore after pH adjustment is pumped to ash pond and reused for transportation of ash.

1.5.2 Disposal of wastewater

In view of the above sewage wastewater management schemes being practised in the plant, the net amount of treated effluent after Expansion to be

discharged into the sea would be of the order of 14,400 KLD. The distribution of treated wastewater to be discharged after expansion is presented in the Table 1.2.

Table 1.2 Disposal of Treated Effluent into the sea

Treated effluent streams	Present discharge	Estimated discharge after Expansion
	KLD	~ KLD
Coke oven effluent	2880 (from 3 batteries)	abt. 3800 (from 4 batteries)
Plant sewage	3820	4300
DM water plant of TPP & BH	2000	2800
Misc, wastewater from canteens, excess blowdowns, leakages etc.	2900	11000
Total	11600	21900

1.5.3 Overall Water Balance

The overall water balance after expansion is presented in Fig. 1.3. In the diagram, there is also a scheme for recycling of Township effluent of the order of 8000 KLD to the Plant. It is proposed to construct a pond of adequate size to hold the treated wastewater of the plant for improved conservation purpose. After treatment the same shall be used as make up at SMS – II. Rolling Mills TPP, etc. Part quantity shall be used for dust suppression, urinal / toilet flushing, yard fire sighting and other miscellaneous uses. Sewerage water from the plant shall be treated by RO process and used as make up at coke oven & byproducts recirculting water system. However, the water from coke ovens plant sewage after treatment and other leakage for the plant to some extent shall be pumped to sea by marine pipe line.

1.6 EFFLUENT TREATMENT PROCESSES

The wastewater from C & CCD is treated by physical, chemical methods followed by biological treatment. The MBC Plant at Visakhapatnam Steel Plant is designed by M/s Giprokoks of erstwhile USSR. MBC Plant (Fig. 1.4) is designed to treat 120 cum/hr of effluents. The physical & chemical treatment units at MBC are tar settling tanks, oil flotators and equalization tanks. The biological treatment is by multistage activated sludge process. Steps involved in the treatment of C & CCD effluents are as follows:

1.6.1 Collection of waste water

Excess flushing liquor after Ammonia stripping (Input W-1) is pumped to the pre-aerators (distribution tanks) through the double pipe heat exchangers where it is cooled from 90° C to 50-55° C with the help of recirculating cooling water. The cooling tower blow-down water from FGC Circuit (Input W-2) and Benzol Distillation Section (BDS) effluent is also be taken into the pre-aerators. Mixed effluent at a temperature of about 50 - 55° C is distributed in equal positions in tar settling tanks by gravity.

1.6.2 Tar removal

In pre-aerators effluents are mixed thoroughly with the help of air. The combined waste water carries traces of tar particles and emulsified oils, which need to be separated prior to biological treatment to avoid any adverse effect on the active biomass.

Five numbers of mild steel fabricated circular tar settling tanks each of size 230 cu.m. are installed. These are provided with steam heating coil and scrapper mechanism at the conical hopper bottom.

Tar settling tank is provided for removing tar and oil from the effluent. Oil floats on the surface of water and tar settles down in conical bottom. Tar collected at the bottom of each tank is pumped into tar collecting tank once in 3-5 days.

1.6.3 Oil removal

Two nos. of MS air flotation tanks (flotators) of size 270 cum each are installed. The over flow from the tar settling tanks is collected in vertical steel tanks named phenolic water collecting tanks from where it is pumped to the oil floatation tank No.1 through pressurised head tank No.1. Air (5% by volume of water) is injected into the delivery line of the pumps before it is pumped to the pressure tank. In the flotation tank, air bubbles through the water as the water is de-pressurised and the oil is entrained by air bubbles and floats at the water surface. The entrained oil is skimmed with oil skimmer mechanism of floatation tank and is collected through the oil discharge through to a tank. Tar and oil from the collecting tanks are finally pumped to tar acid utilization plant.

1.6.4 Equalization tank

After removal of tar and oil, the effluent is collected in equalization tank. Equalization tank is an RCC tank with two chambers each of 1650 cu.m capacity. Each chamber has one over flow tank. In equalization tank phenolic effluent is thoroughly equalized with the help of air. Ortho-phosphoric acid is added to the overflow of equalization tank as nutrient for the bacteria. 73% strong ortho-phosphoric acid is added at the rate of 20 g/cum of effluent.

1.6.5 Biological treatment (1st stage)

From Equalization tank the effluent is pumped to aeration tank of 1st stage purification through shell and tube heat exchangers to maintain effluent temperature between 35-38^0 C.

In the 1st stage of purification, purification is done with the help of phenol destructive bacteria. Five numbers of RCC aeration tanks are provided. Each aeration tank is a comprehensive treatment unit with in built sludge settling and sludge regeneration chambers. To maintain the vital activity of bacteria compressed air from the air blower is supplied to the aeration tanks.

The over flow from each tank first goes to the settling chamber where sludge gets settled down and the supernatant water over flows to the 1st stage purified water collecting tank (P-1) of 90 cum capacity. The settled sludge then flows to the attached regeneration tank from where it is recycled back to the aeration tank with the help of air lifting pump. Phenol degradation takes place with the help of phenol destructing bacteria of activated sludge process.

1.6.6 Biological treatment (2nd stage)

After degradation of phenol at 1st stage purification water from P-1 tank is pumped into aeration tanks of 2nd stage purification. In the 2nd stage purification, Rhodanides and cyanides are destroyed with the help of Rhodanide destructive bacteria. In second stage also five numbers RCC aeration tanks (650 cum capacity each) are provided. The construction and activity in 2nd stage is similar to 1st stage aeration tanks.

Treated effluent from 2nd stage aeration tanks is collected by gravity into two RCC tanks (P-2) of size 90 cum each. The design characteristics of the effluent at various status of MBC plant are shown in Table 1.3. The treated

effluent is then pumped to effluent treatment plant for further treatment along with plant.

1.6.7 Sludge drying beds

RCC sludge drying bed with three compartments is provided with a facility to take back excess water. The sludge from any aeration tank and equalizing tank can be pumped to these beds. The dried sludge is taken out and recycled in coke oven batteries by adding it to the coal charged into coke ovens.

Table 1.3 The design characteristics of the effluent at various stages of MBC plant

PARAMETER	INLET WATER	AFTER TAR SETTLING TANKS	AFTER OIL FLOTATORS	AFTER 1ST STAGE PURIFICATION	AFTER 2nd STAGE PURIFICATION
PHENOL	400 MAX	400	400	3-5	1 MAX
RHODANIDES	400 MAX	400	400	350	10 MAX
AMMONIA AS NH4	100	100	100	90-100	80-100
TAR & OILS	500	60	35-40	30-35	25 MAX
	100	30	30	200-300	150-200
CYANIDES AS CN	20	16-20	16	12	1.5-3.5
BOD5	-	-	2000	1000	100 AVG 150 MAX
COD	2500 MAX	2500	2500	1200	300 MAX

1.7 SEWERAGE TREATMENT PLANT (ETP)

1.7.1 Design basis

Effluent treatment plant (ETP) (Fig. 1.5) (Plate 1.3) is designed to receive wastewater from plant sewerage system and phenolic water from C & CCD. Plant sewerage network carries a) Faecal sewage generated from different office buildings, shops, canteens etc. b) Neutralised effluents from laboratories and c) Condensate from the seal pots of BF and CO gas mains. The phenolic water received at ETP is the treated effluent of Mechanical Chemical and Biological treatment plant of C & CCD. Total quantity of effluent to ETP (Fig. 1.2) is 280 cum/hr. The monthly average results on the treated effluent characteristics carried out by the firm are given in Table 1.4.

Process: The phenolic effluent from MBC is discharged into the oil trap to remove oil and then to the open launder located above the ground. The faecal sewage is also discharged on the other side of launder. The combined wastewater flows by gravity from the launder to the screens.

Screens are provided for arresting particles of size greater than 20mm. After screening the combined effluent goes to detritors for removal of grit. The screened, de-gritted combined wastewater flow to equalization tank.

The equalizing tank has three nos. floating aerators for mixing of different waste waters with acid or alkali required for pH adjustment and minimizing the sludge deposition in the tank. Wastewater from the equalizing tank is then pumped to the aeration tank.

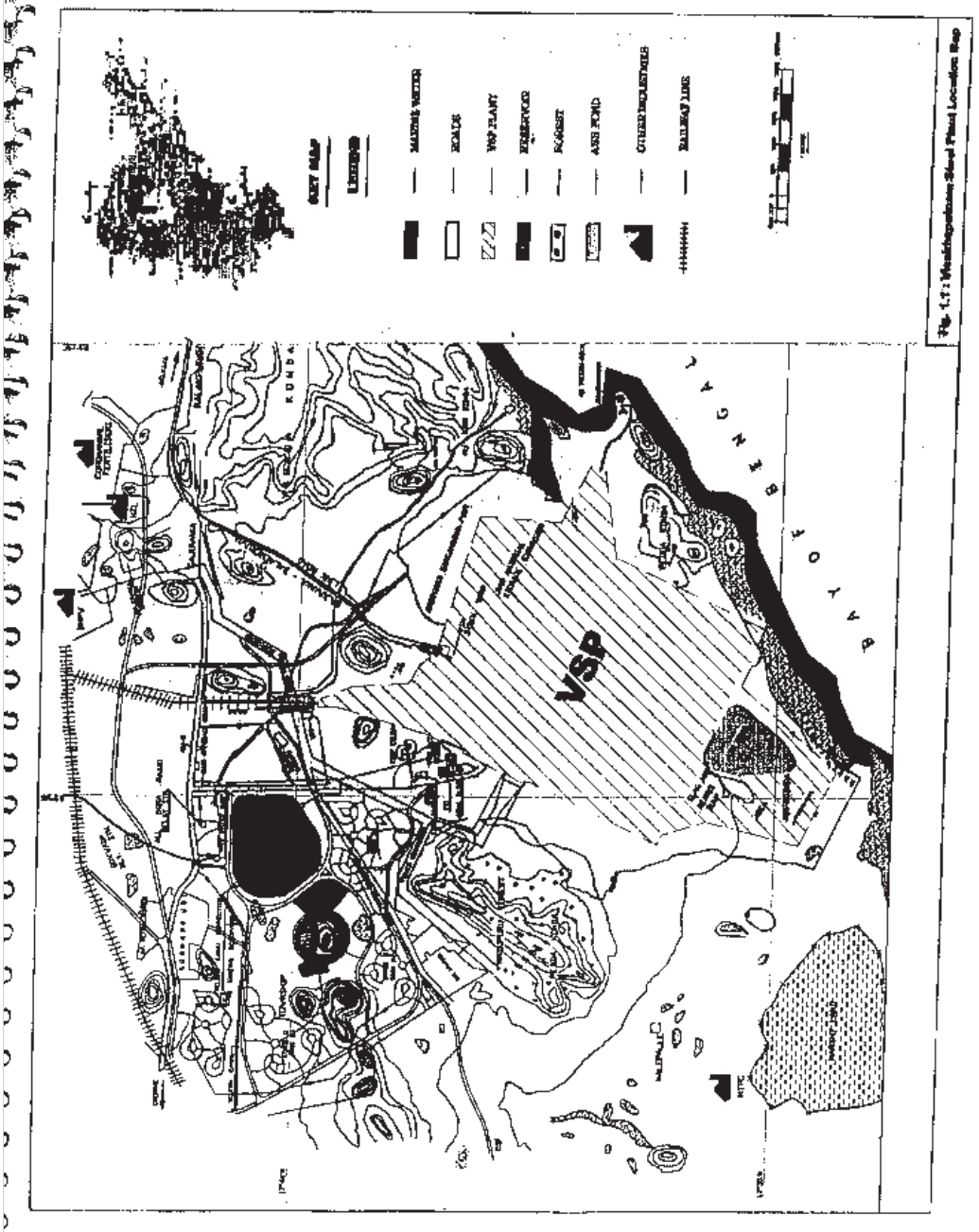
In aeration tank, the biological treatment takes place by extended aeration system using four fixed type mechanical aerators. Overflow from aeration tank is

led to two nos. circular clarifiers. After clarification the treated water overflows from clarifiers and joins the final effluent channel.

Sludge from clarifiers flows by gravity to sludge sump. Sludge from sludge sump is pumped back to aeration tank to maintain MLSS. Excess sludge is pumped to sludge dewatering beds.

Table 1.4 ETP Treated Water Analysis Result (Monthly average) Unit: mg/l

PARAMETER	NORM	Oct'05	Nov'05	Dec'05	Jan'06	Feb'06	Mar'06
PH	6.0-8.5	7.60	7.30	7.30	7.50	7.50	7.50
TSS	100	60.60	65.50	65.50	69.80	57.40	60.20
OIL & GREASE	10	6.50	6.70	6.40	6.30	6.20	6.30
PHENOL	01	0.30	0.30	0.30	0.30	0.30	0.30
COD	250	244.3	236.3	236.5	217.0	220.0	216.0
BOD	30	28.2	26.6	27.6	26.2	27.6	26.6
Cyanide	0.2	BDL	BDL	BDL	BDL	BDL	BDL
AMMONICAL N2	50	86.4	85.6	86.0	84.6	81.6	82.0



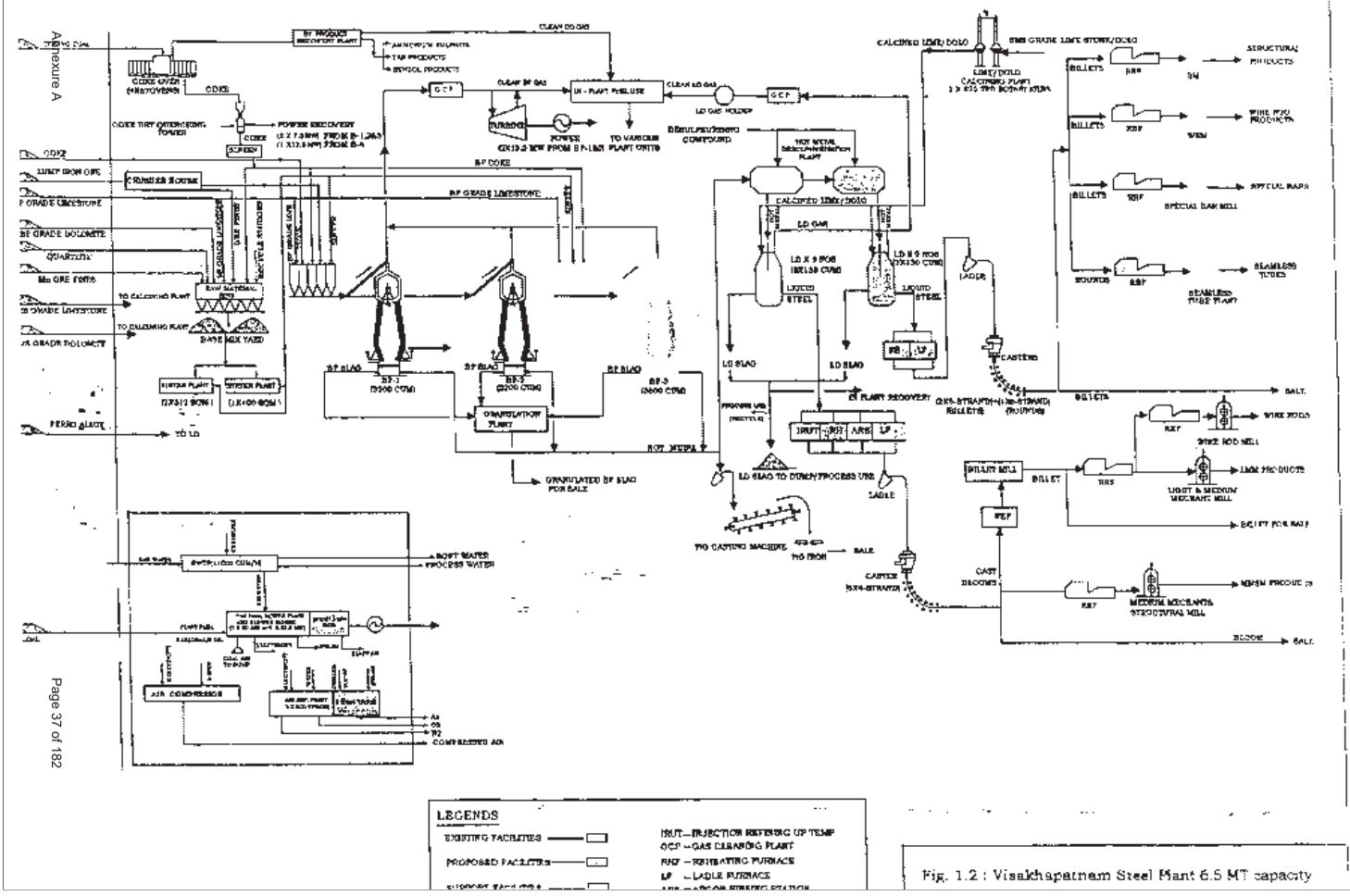
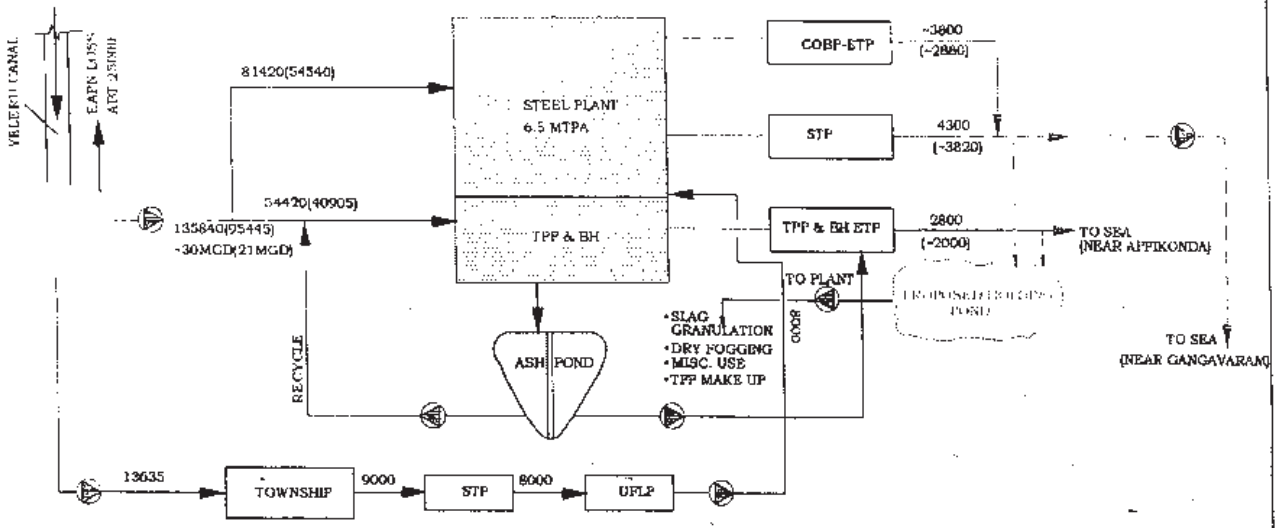


Fig. 1.2 : Visakhapatnam Steel Plant 6.5 MT capacity



LEGNDS

1. ALL FIGURES ARE EXPRESSED IN CuM / DAY UNLESS OTHERWISE STATED
2. FIGURES IN BRACKETS INDICATE PRESENT STATE OF AFFAIRS AT 4.0MT PRODUCTION LEVEL
3. STP - SEWAGE TREATMENT PLANT
4. UFLP - ULTRA FILTRATION PLANT
5. COBP-ETP- COKEOVENS BY-PRODUCT EFFLUENT TREATMENT PLANT
6. TPP & BH - THERMAL POWER PLANT & BLOWER HOUSE
7. ——— TREATED EFFLUENT STREAMS ---- PROPOSED

Fig. 1.3 TREATED EFFLUENT DISPOSAL DIAGRAM OF VSP AFTER 6.5MT EXPANSION

FIG. 1.4 MECHANICAL BIOLOGICAL & CHEMICAL TREATMENT PLANT - FLOW DIAGRAM

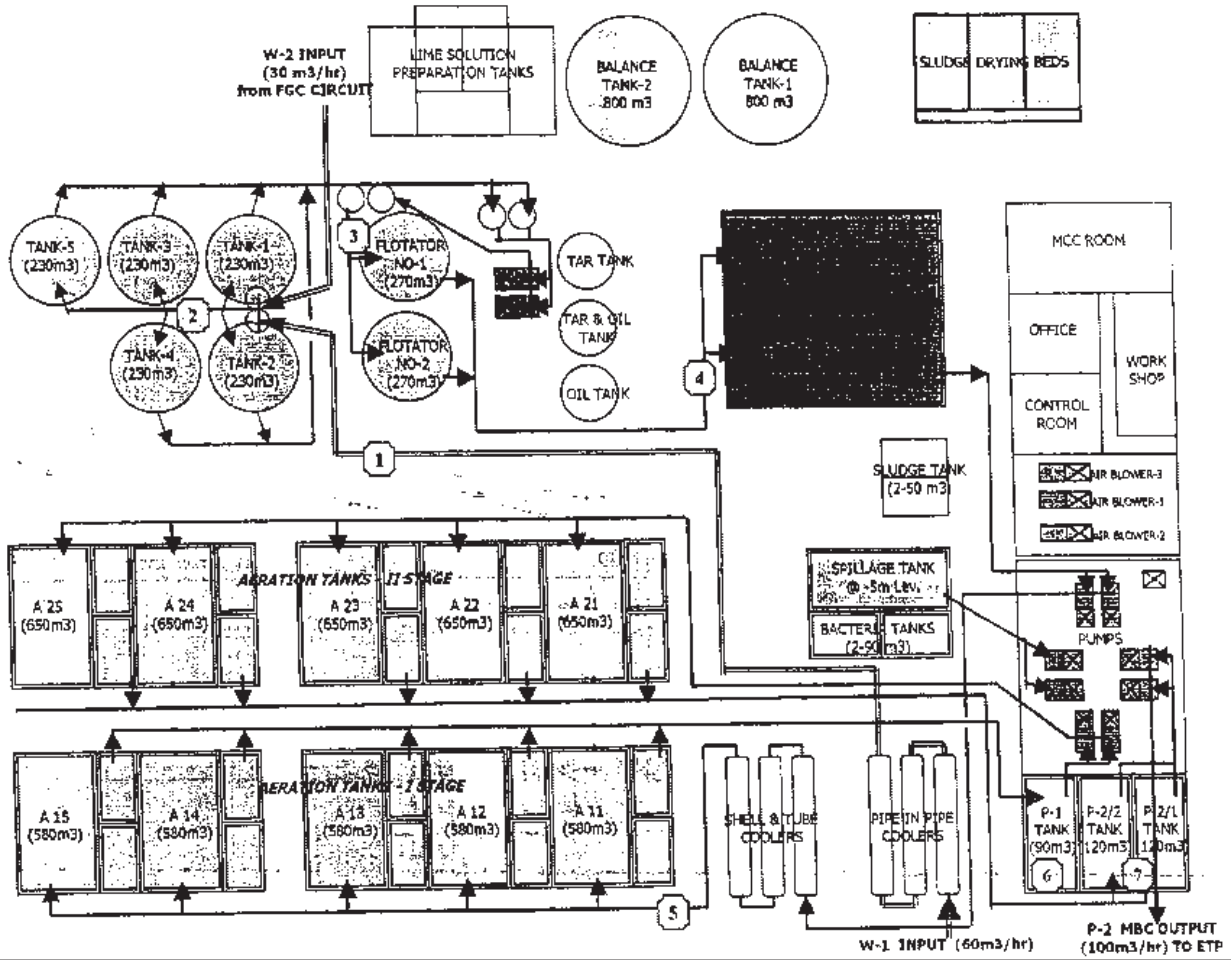
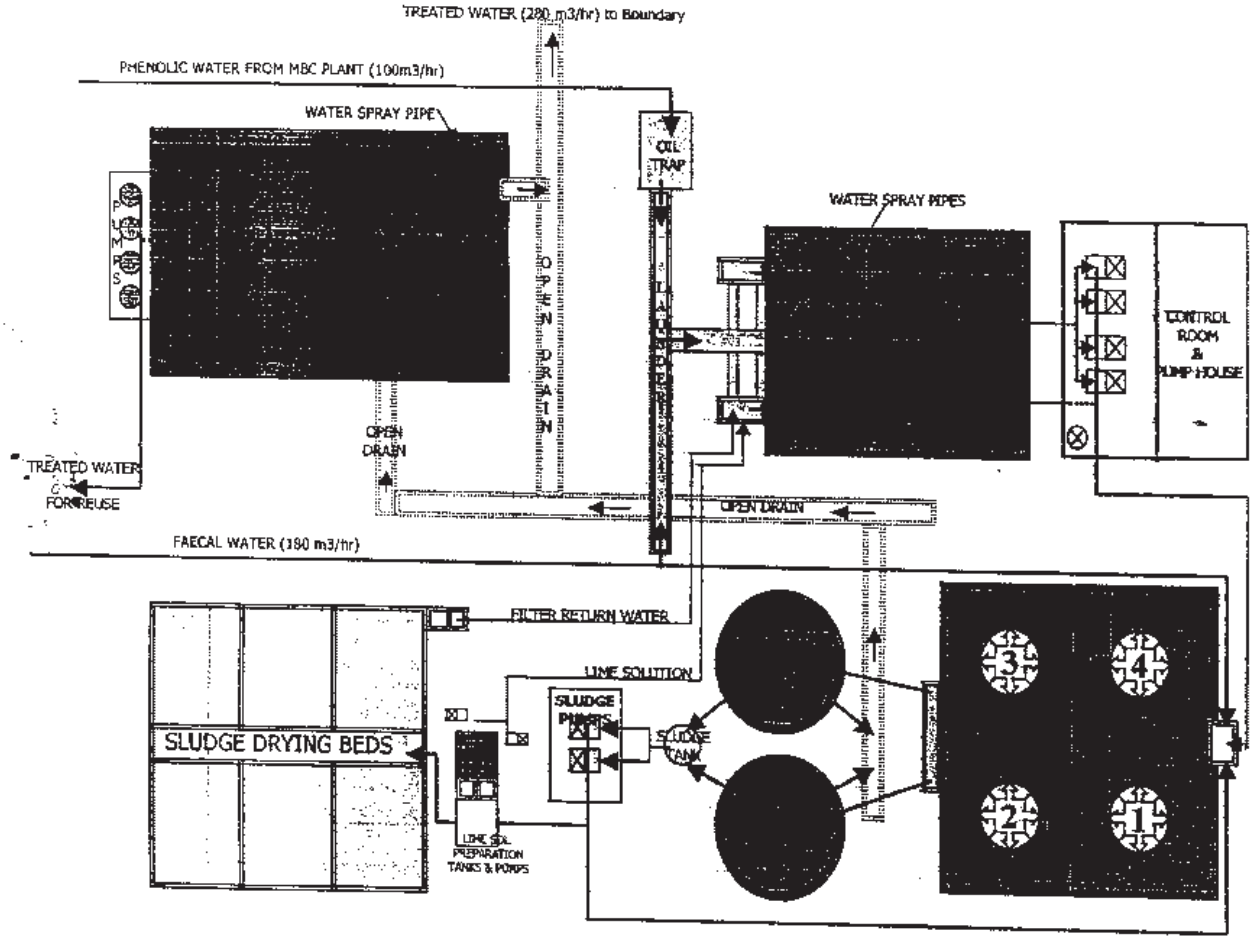


FIG. 1.5 EFFLUENT TREATMENT PLANT - FLOW DIAGRAM



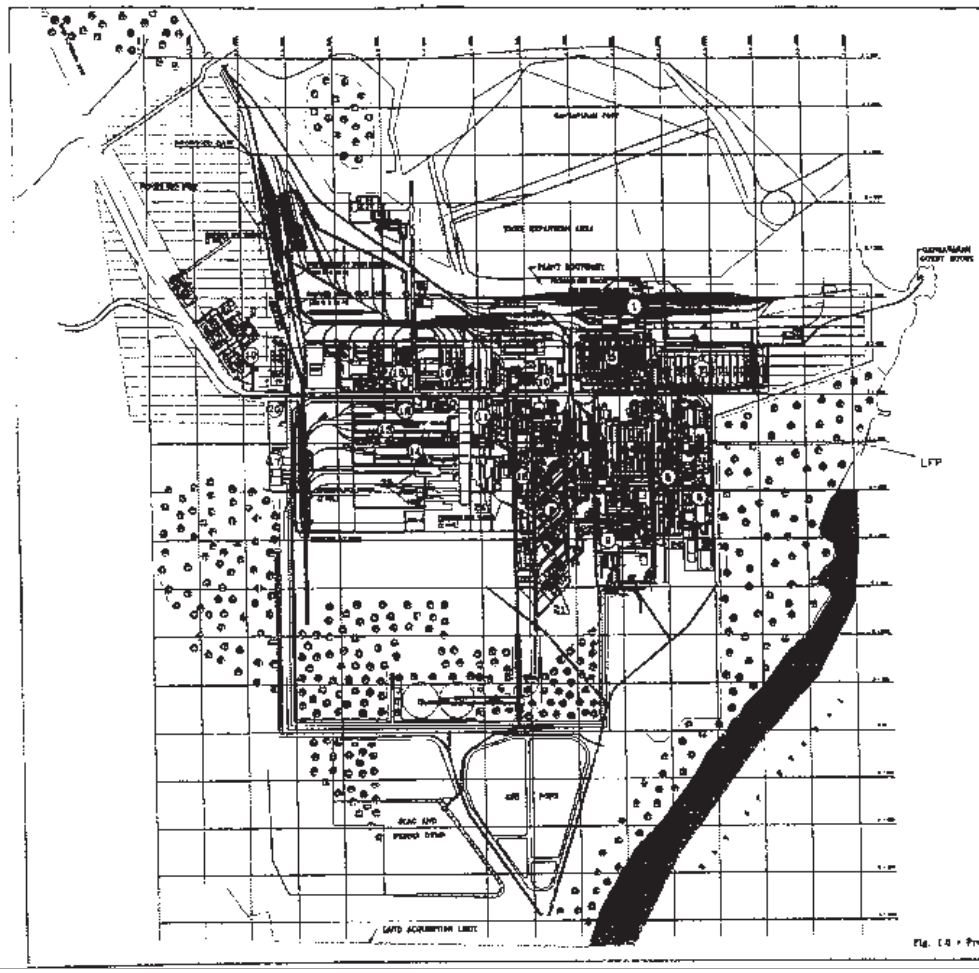
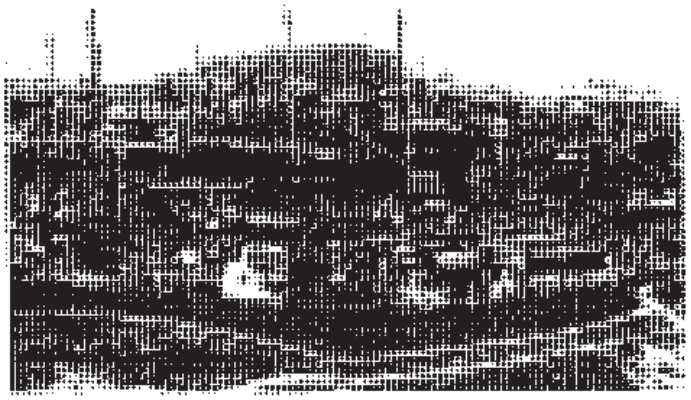


Fig. 1.1 : Proposed route of marine pipeline to discharge effluents from VSP

Plate 1.2a View of Visakhapatnam Steel Plant with green belt

Plate 1.2b View of Visakhapatnam Steel Plant



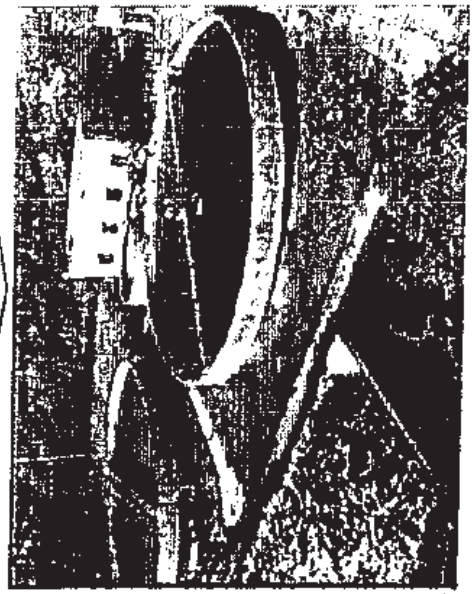


Plate 1.3 Effluent Treatment Plant Tanks

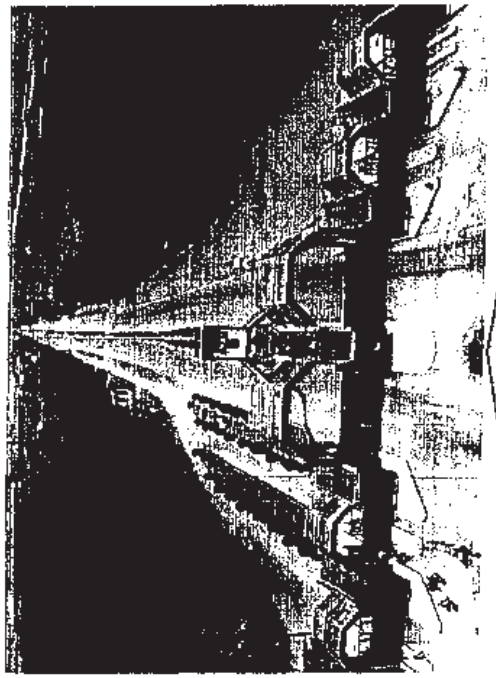


Plate 1.1 View from Steel Plant Main Gate

2. CRZ STUDIES

2.1 INTRODUCTION

In general, the coastal zone is unique in geological, physical and biological aspects with immense economic and environmental values. Inadequately planned coastal and marine developments, poorly regulated economic activities and increasing population growth have risen to rapid destruction of coastal and marine ecosystems. The recent enactment of legislation like Coastal Zone Regulation Act is indicative of both National and State policies, concern for the effect of regulating the development in environmentally sensitive coastal zones. This legislative promulgation has been mainly intended for regulating various uses of terrestrial and aquatic resources in the coastal areas restricting to a distance of 500 m from HTL in the open coast and 100 m in cases of estuaries and creeks. For strict compliance of the Coastal Regulation Zone (CRZ) act, these areas are expected to remain qualitatively unchanged in respect of their fauna and flora.

Regional Centre of National Institute of Oceanography, Visakhapatnam has carried out the required surveys and field measurements for the demarcation of HTL and LTL on 29.3.06 and 16.4.06. The observations and inferences are reported here.

2.1.1 Geology of the area

The study area consists of predominantly of granulite facies rocks from Eastern Ghat Granulite Belt (EGGB). The area mainly comprises two major rock

suites. One charnockitic and the other khondalitic. The khondalitic group includes garnet – sillimanite gneisses, quartzites and calc – silicates while the charnockitic group consist of hypersthenes bearing granulites and basic to acid charnockitic gneisses. All these rocks have been subjected to granulite facies metamorphism and were subsequently sheared and variably migmatised in association with the intrusive phase of alkaline and anorthositic rocks.

Climate : The climate is influenced predominantly by northeast and southwest monsoons. The northeast monsoon season prevails from November to February. The hot summer season extends from April to May and June to September is the southwest monsoon season in which most of the annual rainfall received at this location.

Tide : Tidal range here is about 1.5m. The tidal values as obtained from Indian Tide Tables of 2006 published by Surveyor General of India, are given below.

Tide Level at Visakhapatnam Height (m) above Chart Datum	
Mean Lowest Low Water Spring (MLLWS)	0.02
Mean Low Water Spring (MLWS)	0.09
Mean Low Water Neap (MLWN)	0.54
Mean Sea Level (MSL)	0.84
Mean High Water Neap (MHWN)	1.10
Mean High Water Spring (MHWS)	1.50

2.1.2 Objective of the study

Keeping in view the requirement of coastal regulation zone legislation, the work has been undertaken with the following objective :

- To demarcate the HTL, LTL and Coastal Regulation Zone boundaries of 200, 500 m in 1:5000 scale as notified by the Ministry of Environment and Forest, Government of India between Gangavaram Hill and Appikonda and along pipeline route.

2.1.3 Approach and data source

Based on the above objective, studies have been made about land use pattern, morphological features and environmentally sensitive areas to predict the response of the proposed development with in CRZ. The key elements of general approach are as follows:

To delineate the HTL, LTL and CRZ boundaries based on the Coastal Regulation Zone notification as prescribed by the Ministry of Environment & Forest notification dated 19th February 1991 and modified from time to time.

- To conduct the primary field inventory on large scale base map.
- To assess the influence of tidal action on the water bodies in the area.
- To gather information on status of eco-system (such as mangroves, tidal, sand dunes, flats, saltpans etc) prevalent.
- To prepare the CRZ map delineating the HTL, LTL and the CRZ boundaries.
- To interpret and demarcate CRZ with optimum level of CAD support.

Data Source

- A variety of data sources were used for compilation of the final map and preparation of the CRZ report.
- Hydrographic chart of Survey of India and land use map of A.P.State Application Centre.
- Route maps and charts of the project area provided by the Steel plant of India, Visakhapatnam.
- Tide data as obtained from the Indian Tide Tables (2006) and field observations.
- Field mapping.

2.2 MATERIALS AND METHODS

For the purpose of meeting the requirement of the CRZ notification, the High Tide Line means the line on the land up to which the highest water line reaches during the spring tide. Here the word *"highest water line reaches during the spring tide" refers to the mean high water spring (19 years average of spring water) that is the regular water level fluctuations caused by changes in relative position of Sun, Moon and the Earth.*

Coastal stretches of seas, bays, estuaries, creeks, rivers and back waters which are influenced by tidal action (on land ward side) are included in Coastal Regulation Zone (CRZ). Highest range of spring tide and its horizontal run up on the land was identified by way of morphological features, permanent vegetation line and flotsam along the open sea and along the creek as per the existing guideline of MOEF. Demarcation of HTL was carried out by using (CEEDUCER, Australia) the Differential Global Positioning System techniques by walking over along high tide line and the data were collected by following the established principles in survey of this nature. Low Tide Line (LTL) was demarcated by

making a bathymetric chart of the coastal area with the datum of chart being the lowest low tide. The line along which zero meter depth occurs on this bathymetric chart is demarcated as low tide line.

The Everest 1830 Datum and Transverse Mercator Projection have been used for presenting the HTL, LTL on the map and also for preparing the CRZ classification map. Finally the positions of HTL, LTL and CRZ boundary lines of 200, 500 m were marked on the local CZM maps in 1: 25000 scale (Fig. 2.1) and 1:5000 (Fig. 2.2a &b).

2.2.1 Differential Global Positioning System (DGPS)

The Differential Global Positioning System (DGPS), which is a satellite based navigation and surveying system, was deployed for the determination of precise positions. DGPS is primarily a navigation system for real-time positioning. However, with transformation from the ground-to-ground survey measurements to ground-to-ground measurements made possible by DGPS (and other space geodetic surveying techniques). This technique overcomes the numerous limitations of terrestrial surveying methods, like the requirement of inter-visibility of survey stations, dependability on weather, difficulty in night observations, etc. These advantages over the conventional methods and the economy of operations made DGPS the most promising surveying equipment of the future. With the well established high accuracy achievable with DGPS in positioning of points separated by few hundreds of meters to few hundreds of kilometers, this unique surveying techniques have found important applications in diverse fields.

For the present studies, the CEEDUCER DGPS system with the help of radio beacon signal from the Visakhapatnam Beacon transmitter was used for

acquiring the geographical position. This works on the basis of differential calculation through Satellite Communications gives accuracy close to ± 1m.

2.3 RESULTS

Ministry of Environment and Forests (MoEF), Government of India has declared the stretches of seas, bays, estuaries, creeks, rivers and backwaters which are influenced by tidal action (in the landward side) up to 500 m, in case of the open sea and minimum 100 m in the estuaries, rivers, creeks and back waters from High Tide Line (HTL) and the land between the Low Tide Line (LTL) and the High Tide Line as Coastal Regulation Zone, and imposes with effect from the date of the notification, the restrictions on setting up and expansion of industries, operations or processes etc; in the said Coastal Regulation Zone (CRZ). A key component of the coastal regulation zone are setback lines measured from the high tide line through which coastal development is regulated in a protected zone contiguous to HTL. These setback lines are referenced to HTL and act as buffer zones between the ocean and land upland property. Thus the precision is required in delineating the high tide line which forms the base to define the setback.

The HTL and LTL was demarcated as per the procedure of MoEF and instructions of US Coast and Geodetic Survey guidelines to their topographic field parties. Accordingly, the HTL was demarcated by physical survey. The horizontal position of HTL, associated with wave run up at preceding high tides and forming geomorphic features and the features such as boundary of perennial natural terrestrial vegetation, flotsam, and drift wood have been considered. The identification of these markings enabled a reasonably accurate assessment of High Tide Line. LTL was demarcated with reference to the chart datum (0 m)

from the bathymetric data collected in the surf zone. Survey data were acquired with range and azimuth system.

The following salient features were outlined through the perception and judgment of the team of NIO carrying out the CRZ mapping.

Physical demarcation of CRZ boundaries relevant to the project site was carried out on 29.3.06 and 16.04.06. The Steel plant is bounded by a compound wall with a road constructed along this boundary wall (Plate 2.1). As per the CZMP of Andhra Pradesh, the area between the road and HTL, is shown as agricultural lands. However, Steel plant has developed this area with plantation as part of the Green Development Programme (Plate 2.2 & 2.3). There is grass vegetation between Gangavaram hill and adjacent hill, near the steel plant guest house (Plate 2.4). One fishing village, Chepalapalem is existing along the High Tide Line at the southern boundary of the steel plant. A buried pipeline may be laid along the existing 5mt wide road towards HTL (LPP) (Plate 2.5), to carry the treated effluent from the steel plant. Sand dunes are noticed along the HTL line in most of the study area. The proposed buried pipe line is to be laid along the existing road without disturbing the plantation and sand dunes. The development work will not alter the topography of the land surface and thus will not interfere with the drainage from the upland or the sea sources. The proposed pipe line route area does not fall or contain environmentally sensitive areas of National park sanctuaries, Sand dunes, Mangroves, Coral or coral reefs, area's rich in genetic diversity etc.

2.4 SUMMARY AND CONCLUSIONS

Based on the precised policy, practice and procedure of MOEF, the following conclusions have been drawn. Whenever, there was an ambiguity, the

perception and judgment of the team of NIO carrying out the CRZ mapping prevailed.

- HTL and CRZ mapping was done for the area between Gangavaram hill and Kutukonda for laying the buried pipe line to discharge the treated effluents from the Steel plant.
- The position of HTL, LTL and CRZ boundaries are demarcated in the nearest cadastral map of a scale 1:5000 (Fig. 2.1).
- The HTL along the open coast of the study area was demarcated taking into consideration the geomorphic signatures that were discernible in the field.
- The LTL was demarcated with reference to chart datum by taking into consideration the bathymetry in the surf zone along the study area.
- The setback lines of 200 m and 500 m were measured landward side of High Tide Line along the open coast. The Land Fall Point (LFP) and part of proposed pipeline falls with in the set back lines of 200 m.
- Most of the area between Gangavaram Hill and Kutukonda was covered by the plantation, rock outcrops and sand dunes.
- Pipe line route does not have in its vicinity, any sensitive and important ecosystems eligible to be categorized as CRZ I except the inter-tidal zone which is in CRZ I(ii) and plantation developed by Steel plant as greenery and sand dunes which is in CRZ I(i).
- A road exists in the developed area between Salt konda and Sukka Metta, wherein the proposed pipeline route is recommended.

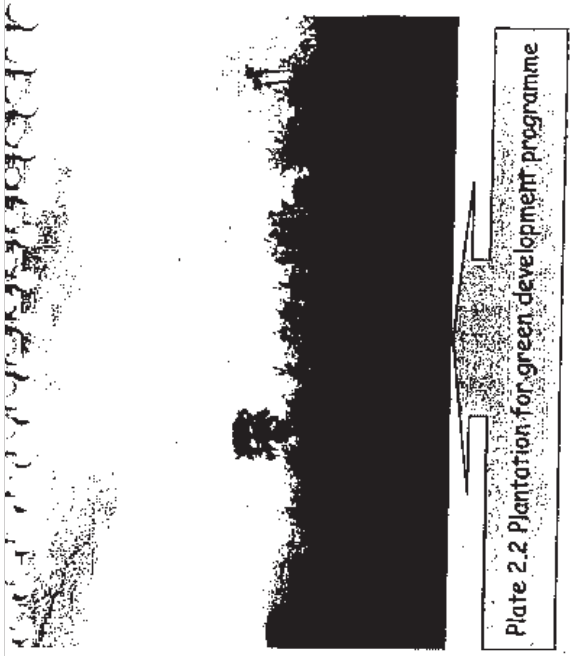


Plate 2.2 Plantation for green development programme

Plate 2.1 Road constructed along the boundary wall

Plate 2.3 Plantation for green development programme

Plate 2.4 Guest House

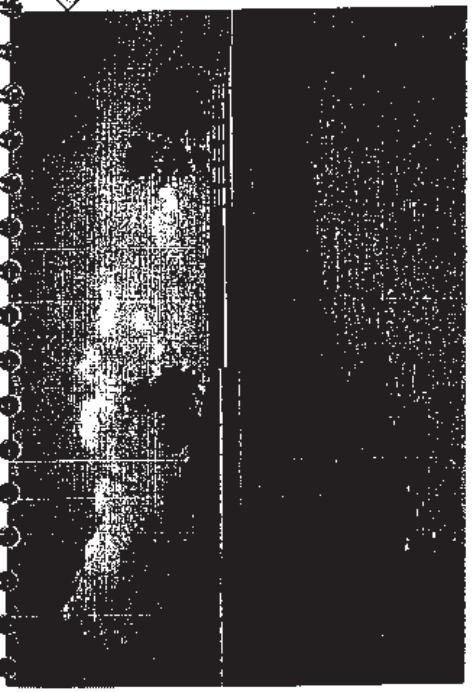


Plate 2.5 Existing Kachacha road

3. GEOPHYSICAL STUDIES

3.1 INTRODUCTION

Bathymetry, Side scan sonar and high-resolution seismic surveys were planned in the inner-shelf region between Gangavaram and Kutukonda up to a water depth of about 25 m to study the nature of the seabed and thereby to recommend a suitable corridor for laying the effluent discharge pipeline. Based on the feasibility studies and also by considering the local geology and geomorphology from the Landsat imagery (Fig 3.1) and the available topo sheet (Fig 3.2) in the survey area, the Land Fall Point (LFP) is on the coast between Gangavaram and Jonnala Konda.

The entire area was surveyed (Fig 3.3) with long interval profiles to understand the general nature of the seabed. Based on that, detailed investigations were carried out in the northern part of the survey area (Fig 3.4) with a line spacing of 100 m, i.e. between Gangavaram and Jonnala Konda, which is in close proximity to the LFP.

3.2 SURVEY VESSEL

The surveys were carried out onboard *Sona* type mechanised boat. The particulars of the vessel are as follows.

Name :	F/V. SRINIVASA
Length :	14.4 m
Breadth :	4.7 m
Draught :	2.0 m

3.3 DETAILS OF EQUIPMENT

3.3.1 Differendal Global Positioning System (DGPS)

CEEDUCER make Differential Global Positioning System was used for position fixing during the surveys.

The "CEEDUCER" system

The system provides an echo sounder, a GPS receiver, a Differential signal receiver, a data logging device and a course guidance indicator.

There are four basic components interconnected by cable.

- An echo sounder, which comprises a transducer with all the electronics contained within the underwater housing.
- The "Ceeducer" unit houses the 12-channel GPS receiver, the Differential signal receiver that uses the Marine Radio Beacon receivers, a solid state data logging device and an internal battery.
- The GPS & Differential receiver antennas are housed in a single unit which can be mounted on a mast.
- A Laptop computer that uses the CEEMAN navigational software provides as course guidance indicator.

The "Ceeducer" unit records all the measurements, taking six soundings per second and a position fix for every two seconds, and stores data of about 8 hours continuous operation.

Course guidance information for running predetermined survey lines over an area is fed to the Laptop computer.

3.3.2 Echo-sounder

The CEEDUCER system, that also comprises the echo-sounder, was used to measure the water depths in the survey area. The depth range of the echo-sounder is 30 cm in the shallow waters to 100 m in the deep waters.

An additional dual-frequency echo-sounder (*make*: Odom-Echotrac - DF 3200 MK II) was also used to have a cross-check of bathymetry values with hard copy recording. The lower frequency (38 KHz) of the echo-sounder provides relatively more penetration, while the higher frequency (200 KHz) provides better resolution. The transducer (model TXDCR Dual CMS 3116j14-P) was mounted on the starboard side of the survey vessel in such a way that it is fully submerged even during the roll and pitch of the vessel. The bathymetry data have been corrected for tidal variations.

3.3.3 Side Scan Sonar

An EG&G make (model 260) Side Scan Sonar along with tow fish (model 272) was used to obtain the seabed image to locate the surficial features. The 'Fish' was towed behind the vessel by using a lightweight tow cable. Even though the system has the maximum scanning range of 600 m, only 100 m range was selected to have a better resolution to identify the hazardous/anomalous zones on the seabed in the study area. The system automatically corrects for speeds and slant ranges.

3.3.4 Sub-bottom Profiler

High-resolution shallow seismic system (make: EG&G) was deployed to acquire the sub-bottom information of the region. The system includes Power Supply (Model 232-A), Trigger capacitor bank (Model 265), 3-element Sparker Array (Model 267), Hydrophone (Model 263D) and EPC graphic recorder (Model

4603). The Sparker array, towed aft the vessel, was used to transmit the energy in the range of 200 to 300 joules. The reflected signals from the seabed and the subsurface layers are received by an 8-element hydrophone, which is also towed aft the vessel. The signals are filtered by a band pass filter and recorded on a graphic recorder in analogue form.

The basic principle of the system is to initiate a sound pulse at the source and to receive the reflected signals at the receiver close to the source. The time taken by the signal from its initiation till its receiving (after reflections from subsurface layers such as water, sediments and rock formations etc.) is measured and recorded on the chart. The thickness of the subsurface layers will be computed based on these two-way travel times.

3.4 SURVEY DETAILS

Total no. of lines surveyed - 36
Average length of each line - 1.5 km
Area covered - ~ 11 sq.km
Line spacing - ~ 100 m *(between Gangavaram and Jonnala Konda)*
Bathymetry *(line km)* - ~ 58 lkm
Side scan sonar *(line km)* - ~ 48 lkm
Shallow Seismics *(line km)* - ~ 10 lkm

3.5 GEOLOGY OF THE AREA

The coastal terrain of the survey area is underlain by khondalite suite of rocks of Archaen age. Gondwana sandstones of Triassic age dot the coast

intermittently and sub-recent to recent formations occupy the area extensively. The khondalite suite of rocks is intruded by charnockites, granites, pegmatites and quartz veins. The following Table gives the geological succession in the region.

Age	Geological formations
Recent	River alluvium, small alluvial fills and residual soils
Sub-recent	Laterite and lateritic gravel
Triassic	Gondwana sandstones/clays
Archaens	Khondalites, quartzites, calc-granulites and gneisses intruded by charnockites, granites, pegmatites and quartz veins

The coast adjacent to the study region, between Gangavaram and Kutukonda, is extending in NE-SW direction and occupied by plain beach and sand dunes at backshore and protruded by promontories like khondalite bearing hillocks at several places on the coast. In the northern part of the survey area, i.e. off Gangavaram, there exist some sea stacks which are locally called as pigeon hills in the very shallow waters. The beach sands on the coast are composed of pale brown quartz sands, heavy minerals, feldspars and black sands containing Magnetite, Ilmenite, Zircon, Rutile etc.

3.6 RESULTS

3.6.1 Bathymetry

Bathymetry data along 36 profiles were collected in the study area (Fig 3.3). The survey was carried out along NW-SE trending coast perpendicular profiles, with 100 m line spacing between Gangavaram and Jonnala Konda (Fig 3.4) and with a variable line spacing of about 500 m to 1.0 km towards southwest of Jonnala Konda (Fig 3.3), in the water depths ranging from 6.5 to 25 m. However, the study is mainly confined to the inner-shelf between

Gangavaram and Jonnala Konda in order to have a detailed record of the nature of the seabed in the area because of its close proximity to the LFP on the coast.

Generalised bathymetry contour map of the study area between Gangavaram and Kutukonda drawn at 0.5 m contour interval (Fig 3.5) shows a very steep gradient (1:65) in the northern part and relatively gentle in the southern part (1:105). The topography of the area, in general, is smooth with seaward dipping and devoid of any significant relief features except minor irregularities in the near-shore region.

The bathymetry map (Fig 3.6), based on the detailed study over the northern part that have a close proximity to the LFP, between Gangavaram and Jonnala Konda indicate smooth and gentle seaward dipping seafloor. Representative sections of the continuous echograms collected along different profiles, L3, L6, L11, L15 and L23, covering the study area are presented for clear understanding of the seabed (Plates 3.1 to 3.5). The seabed is having more or less similar gradient all along these profiles. However, some minor irregularities of insignificant nature were noticed in some of the profiles, particularly in the near-shore region, between 6.5 and 10 m water depth. Beyond 10 m water depth, the seabed is found to be plain and smooth over the entire region.

3.6.2 Side Scan Sonar

Side Scan Sonar data were collected along 26 coast perpendicular profiles and two coast parallel profiles (P1 and P2) between 6.5 and 25 m water depths (Fig 3.3 & 3.4). The scanning range in the recorder was fixed at 100 m either side of the tow fish to obtain a better resolution. The tow fish was reasonably lowered according to the standard limitations as per the selected scanning range.

Thick tonal variations with clusters of dark patches of various dimensions and shapes in the near-shore region have been observed in the sonar images of

the northern most profiles from L21 to L25, central profiles from L12 to L19 and southern most profiles from L1 to L6 and shoreward cross lines of these profiles (Plates 3.6, 3.9 to 3.11). The dark patches and light tonal variations reflect the density of the rock outcrops that are lying on the seabed. These dark patches are observed either on port side or starboard side and some times on both the sides, but they are very significant features in terms of magnitude and distribution. Thick tonal variations observed in the north-eastern part of the study area indicate remnant rock outcrops/sub-crops on the seabed and are probably related to the relicts of the protruding rocky features that are observed presently on the shore (Plates 3.10 & 3.11). In the central part, the sonograms show relatively medium and light tonal variations indicating soft rocky bottom with low-density material (Plates 3.7 to 3.9). The sonar images along the profiles L7 to L11 show that the area is covered by mostly smooth seabed with sandy bottom (Plates 3.7 & 3.8).

The near-shore region of the study area, between 5 and 10 m water depth, can be divided mainly into three zones, namely 1) the region with significant rocky features, 2) the region with moderate occurrence of rocks, and 3) the region covered with plain sediment. The profiles L21 to L25 and L1 to L6 fall in Zone-1, whereas the region between the profiles L12 and L19 fall under Zone-2. However, the region between the profiles L7 to L11 fall in Zone-3, which is totally covered with plain sediment and devoid of any significant rock outcrops on the seabed.

Detailed analyses of the sonar images in the study area indicate that the near-shore region is covered either with fully exposed rocks or partial exposure with thin sediment cover. The sonar images clearly show the rocks, which are well spread over the near-shore region. However, the sonograms in the deeper region, between 10 and 25 m water depth, show mostly plain and smooth seabed without any significant rocky features.

3.6.3 Sub-bottom Profiling

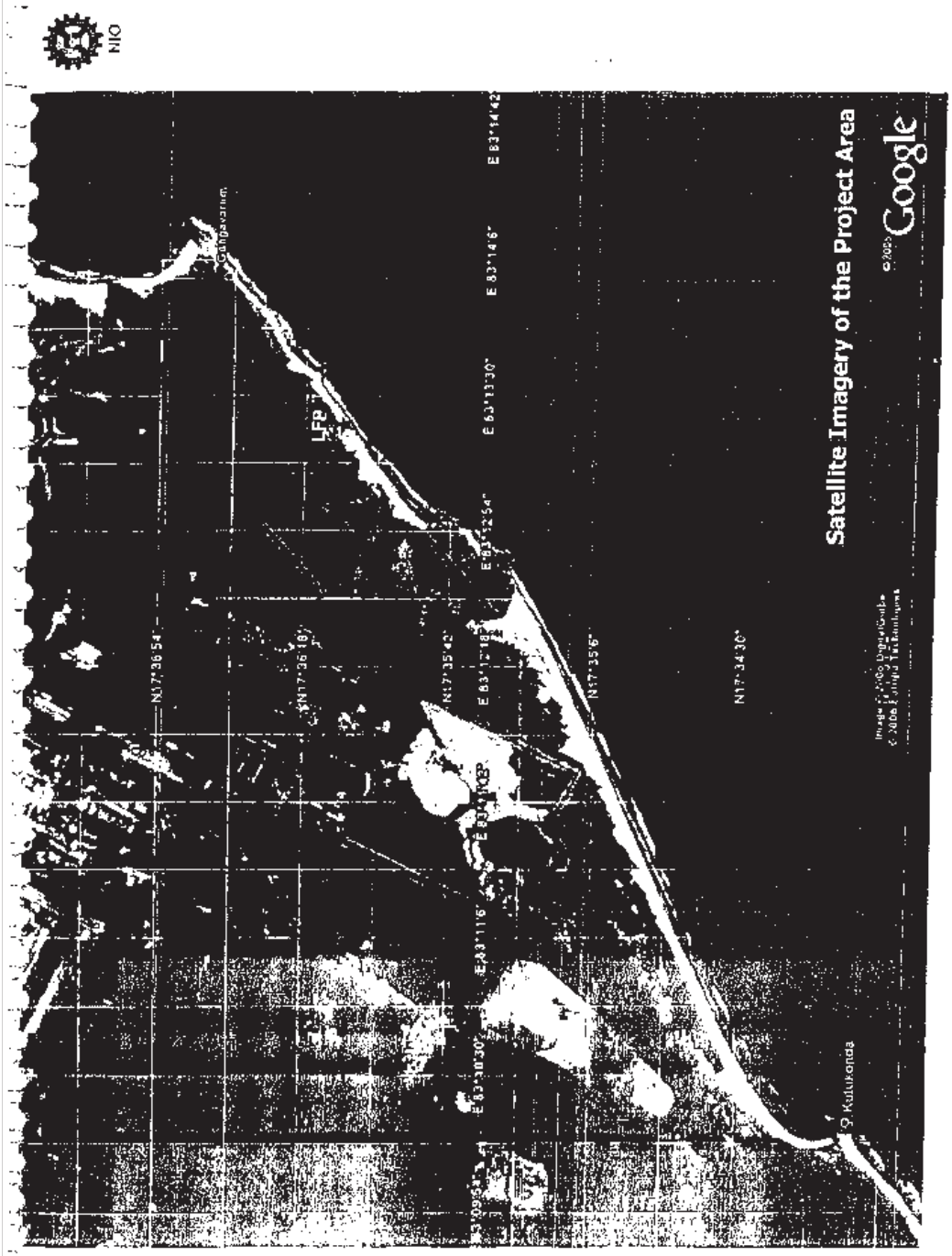
High-resolution shallow seismic data were collected along 4 coast perpendicular profiles (L1, L14, L18 & L24), between Gangavaram and Jonnala Konda (Fig 3.4), by using 200-300 joules of energy to understand the subsurface geology. The sediment thickness is measured on the basis of maximum penetration obtained from the records. Due to the shallow depths in the study area, multiple reflections obscured signals from sub-bottom reflectors.

Shallow seismic records of the area indicate soft sub-bottom with sediment thickness varying from 7 to 15 m between 6 and 25 m water depth. Representative seismic sections presented along the profiles L18 (off LFP) and L24 (north of LFP) show smooth and uniform seaward dipping reflectors below the seabed (Plates 3.12 & 3.13). However, some chaotic reflections noticed in the seismic record both in the offshore as well as near-shore areas, probably related to system generated noise. Analyses of seismic data indicate that the subsurface area of the study region is found to be filled with sedimentary strata dipping parallel to the seabed and does not have any rocky formations.

3.7 CONCLUSIONS

Based on the analysis of bathymetry, side scan sonar and high-resolution seismic data in the study area, it can be inferred that the rocky features that are observed north off LFP in the near-shore region have a very low relief and limited areal distribution. The corridor immediate south off LFP, between profiles L7 and L11, consists of plain seabed and relatively safer region when compared to the other two sides. This proposed corridor (Fig 3.7) is recommended for laying the effluent discharge pipeline from the LFP.

FIGURE 3.1



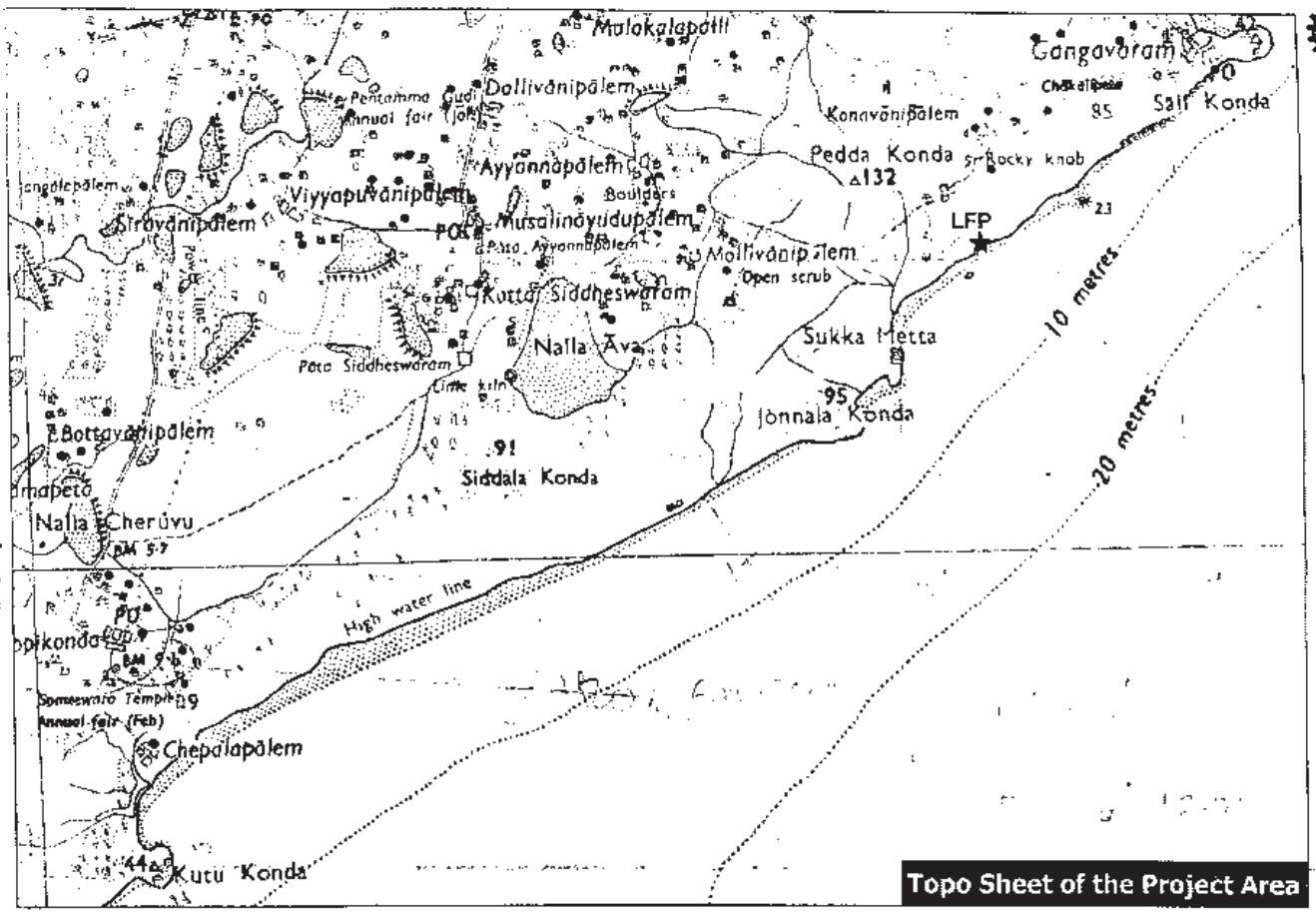


FIGURE 3.2

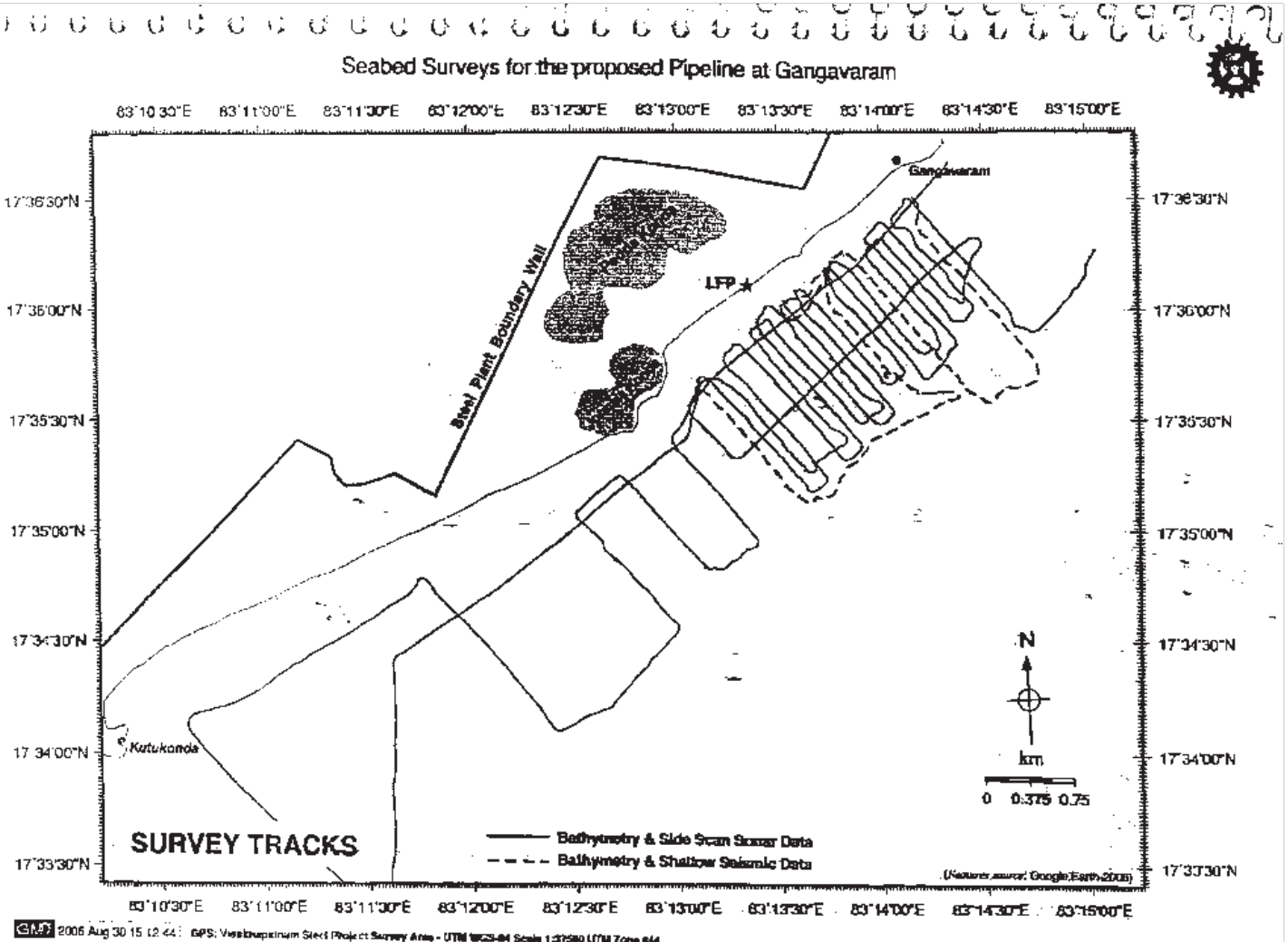


FIGURE 3.3

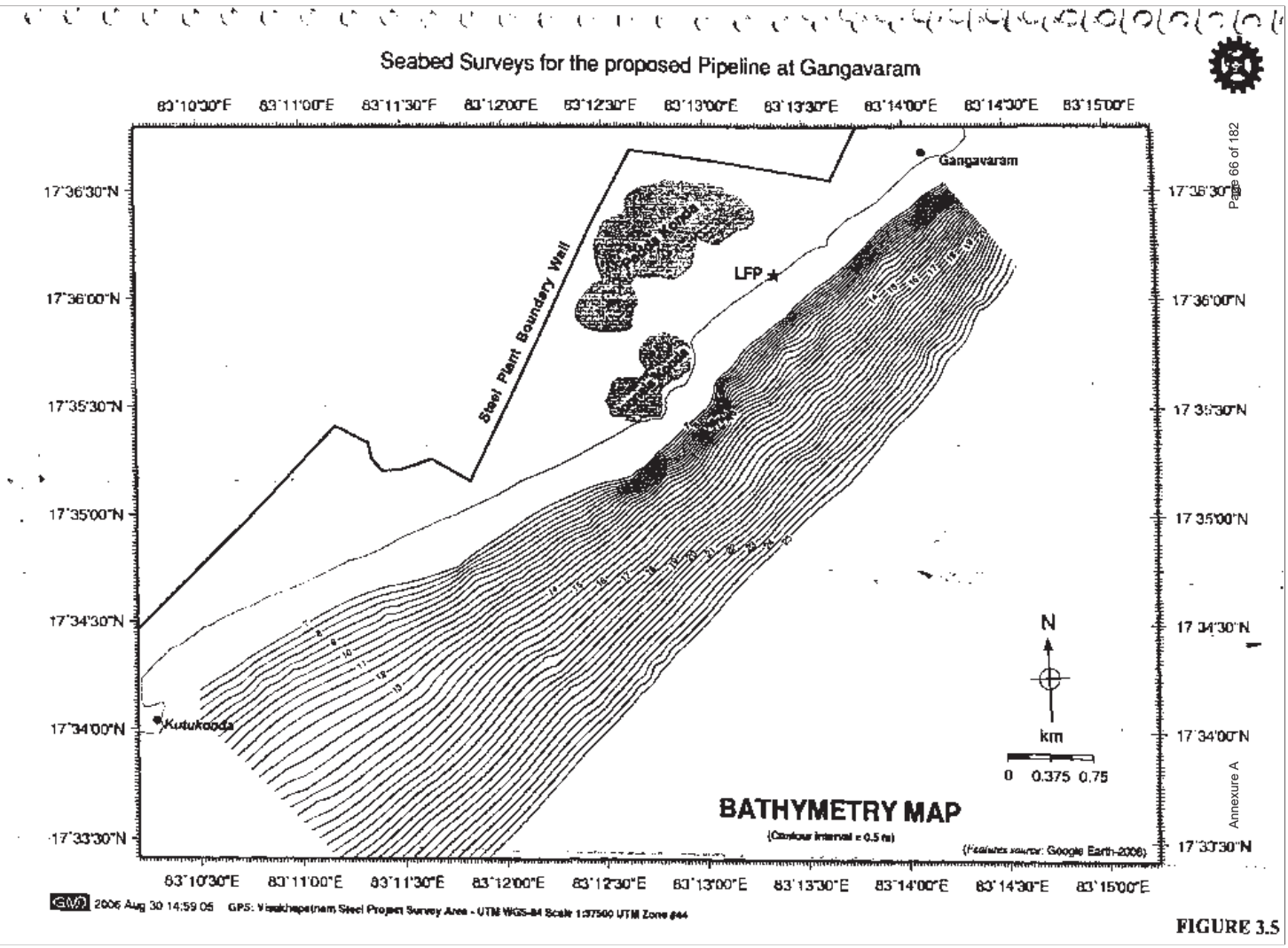
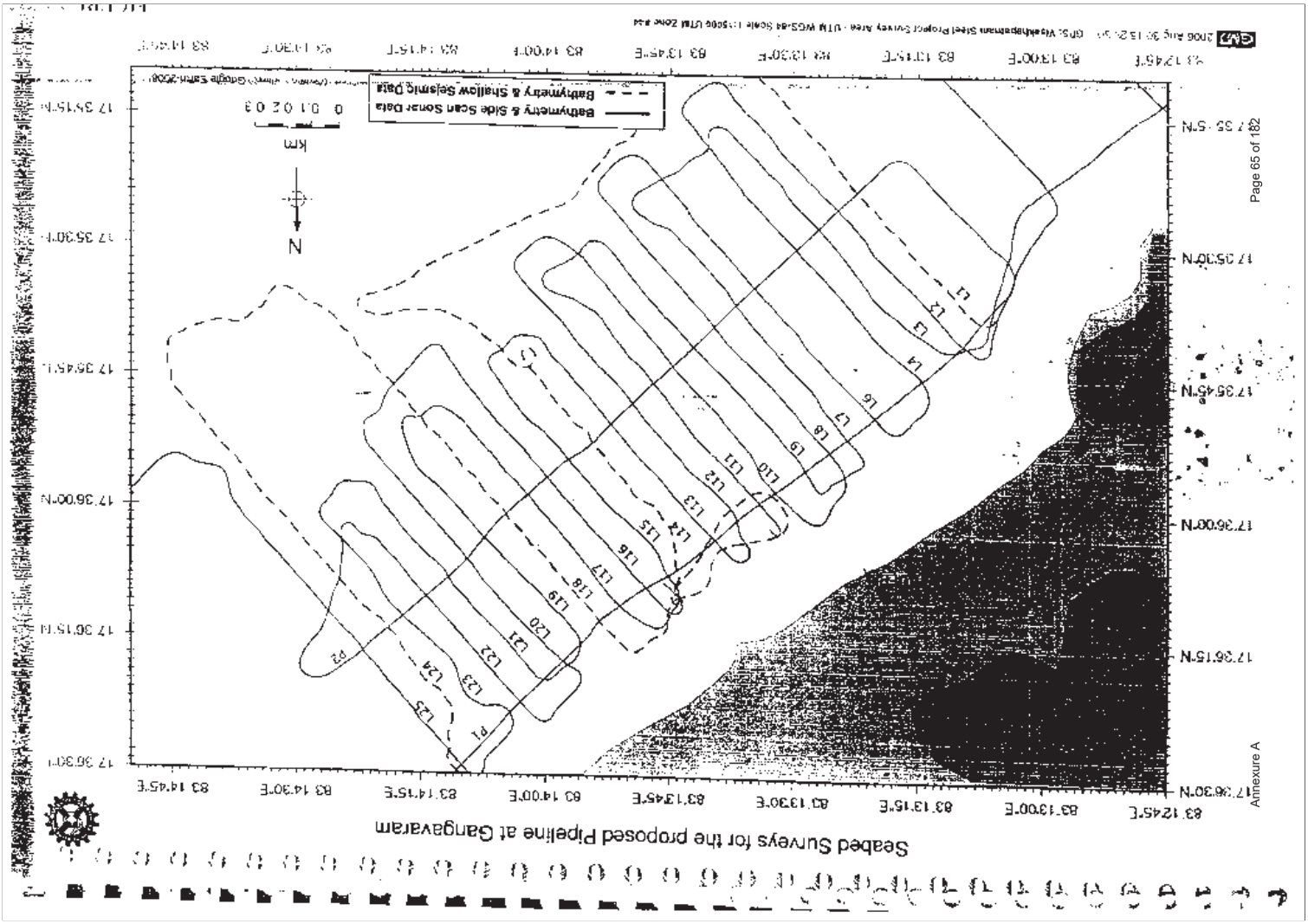

Seabed Surveys for the proposed Pipeline at Gangavaram
83°10'30"E
83°11'00"E
83°11'30"E
83°12'00"E
83°12'30"E
83°13'00"E
83°13'30"E
83°14'00"E
83°14'30"E
83°15'00"E
17°36'30"N
17°36'00"N
17°35'30"N
17°35'00"N
17°34'30"N
17°34'00"N
17°33'30"N
Gangavaram
LFP
Steel Plant Boundary Wall
Kutukooda
N
km
0 0.375 0.75
BATHYMETRY MAP
(Contour interval = 0.5 m)
(Features source: Google Earth-2006)
2006 Aug 30 14:59:05 GPS: Visakhapatnam Steel Project Survey Area - UTM WGS-84 Scale 1:37500 UTM Zone #44

FIGURE 3.5


Seabed Surveys for the proposed Pipeline at Gangavaram
Bathymetry & Side Scan Sonar Data
Bathymetry & Shallow Seismic Data
N
km
0 0.1 0.2 0.3
L1
L2
L3
L4
L5
L6
L7
L8
L9
L10
L11
L12
L13
L14
L15
L16
L17
L18
L19
L20
L21
L22
L23
L24
L25
P1
P2
83°12'45"E
83°13'00"E
83°13'15"E
83°13'30"E
83°13'45"E
83°14'00"E
83°14'15"E
83°14'30"E
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17°35'30"N
17°35'15"N

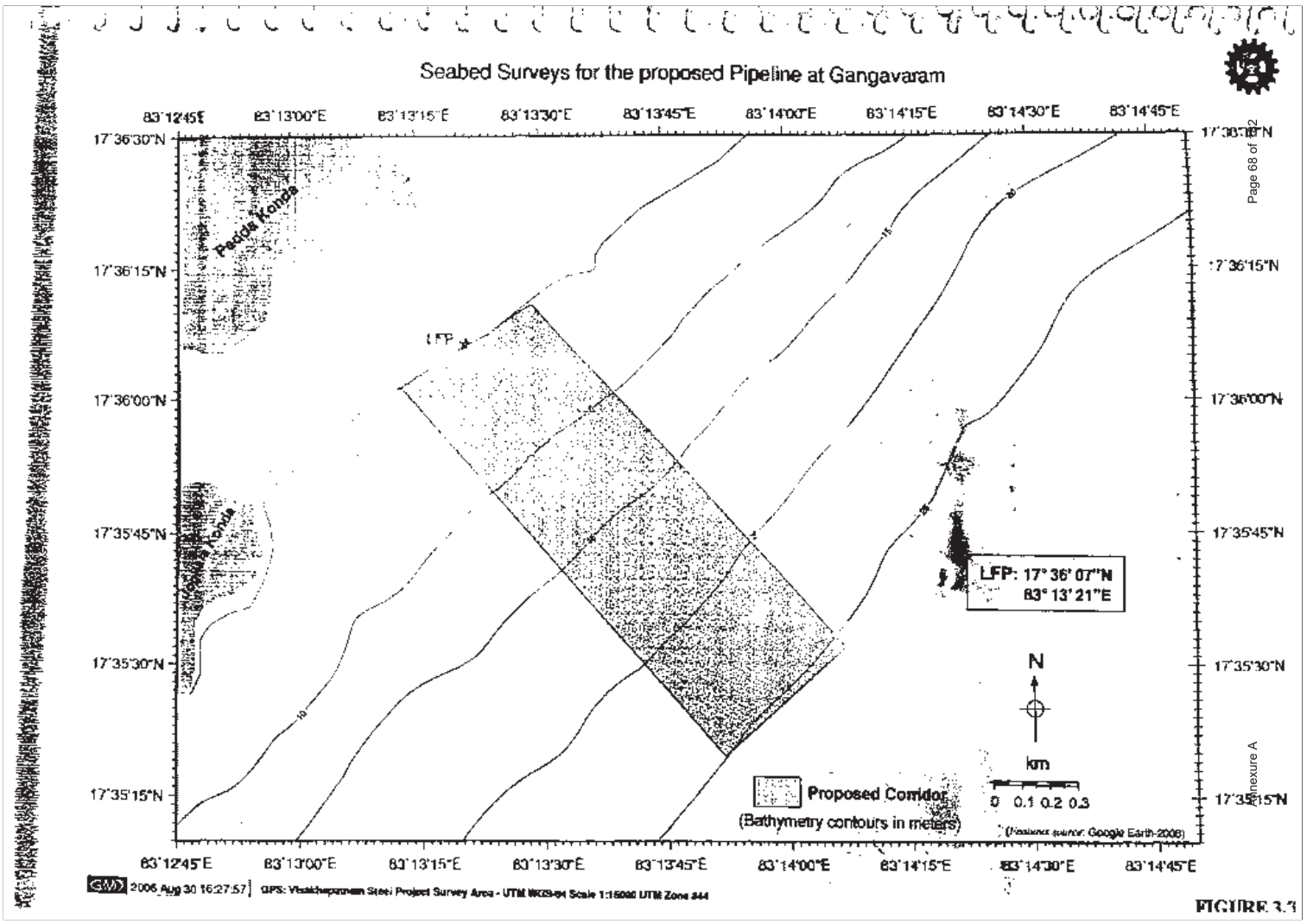


FIGURE 3.5

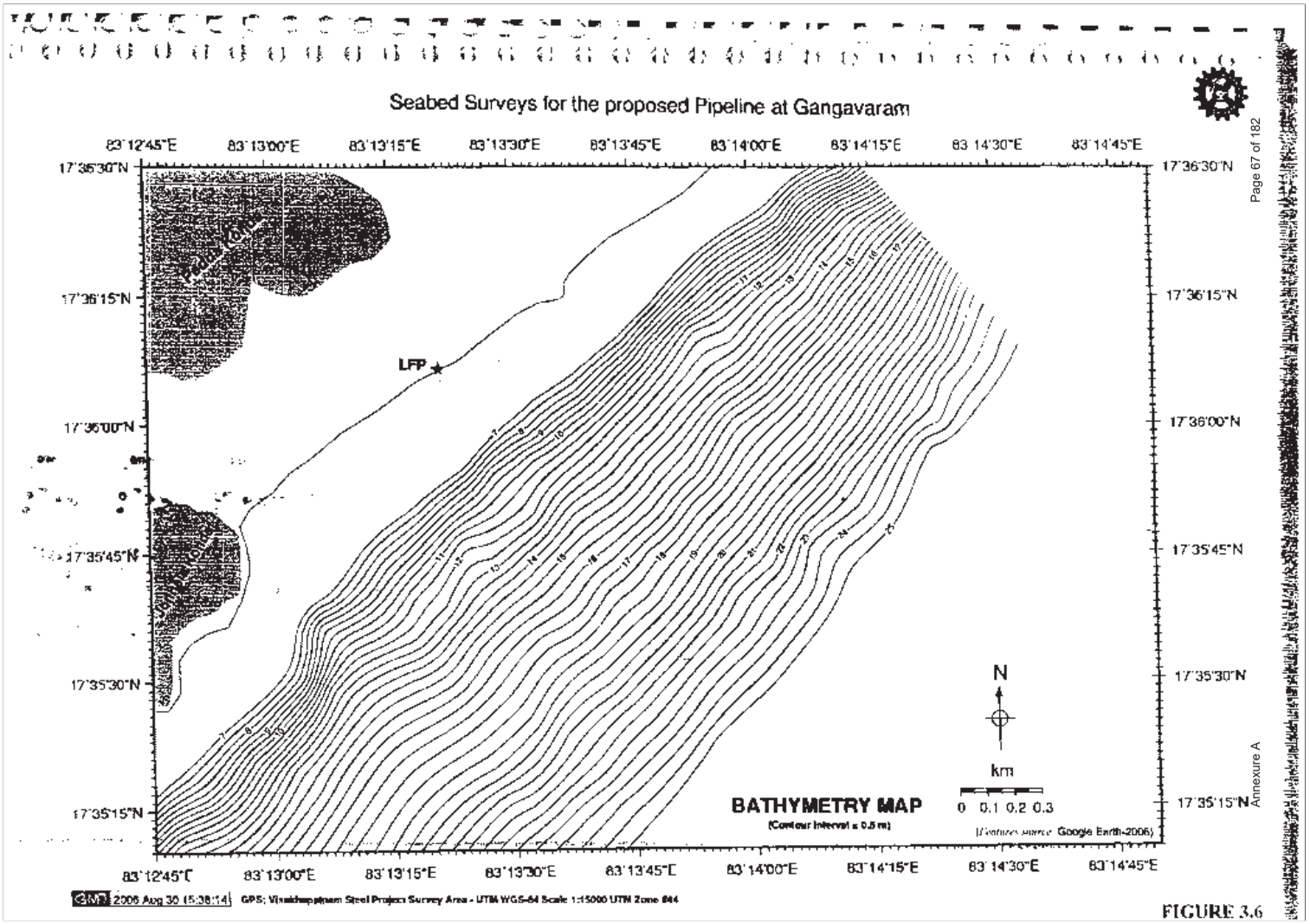
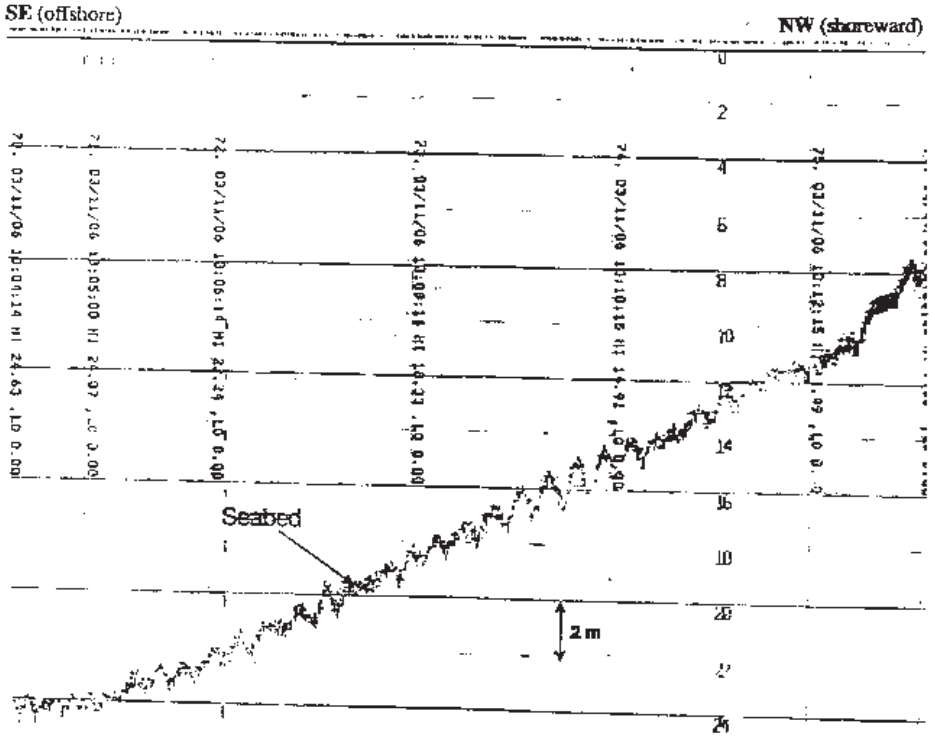


FIGURE 3.6



Profile – L6

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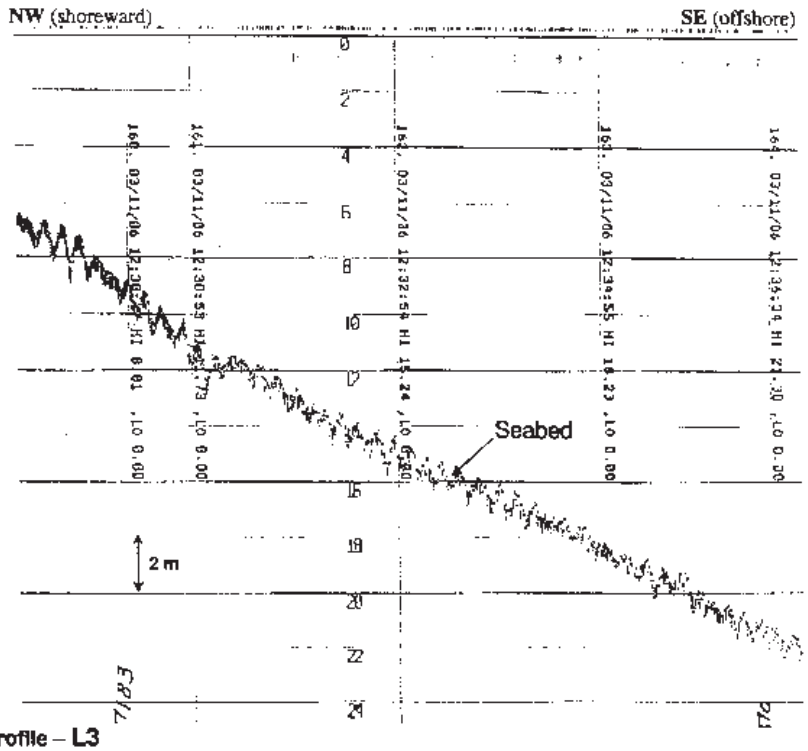
Regional Centre, Visakhapatnam

Surveys for: Visakhapatnam Steel Plant

PLATE – 3.2



Profile – L3

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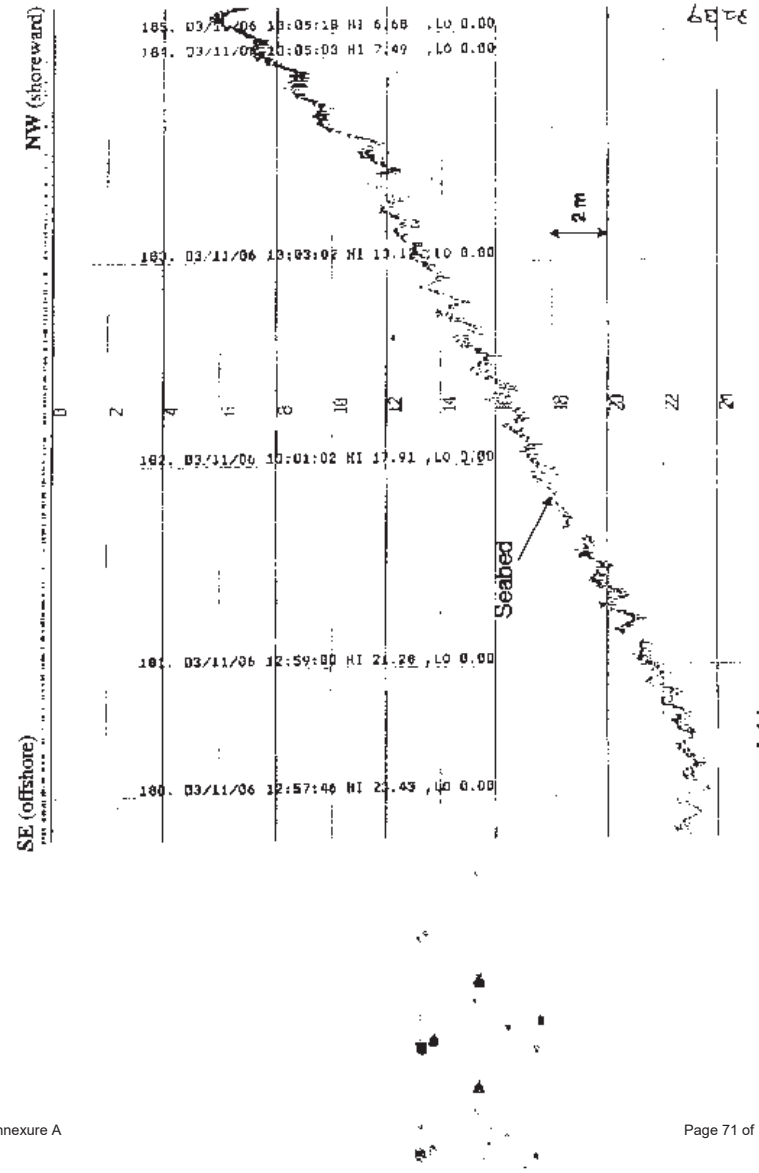
Regional Centre, Visakhapatnam

Surveys for: Visakhapatnam Steel Plant

PLATE – 3.1



Profile – L11

Surveys for: Visakhapatnam Steel Plant

PLATE – 3.3

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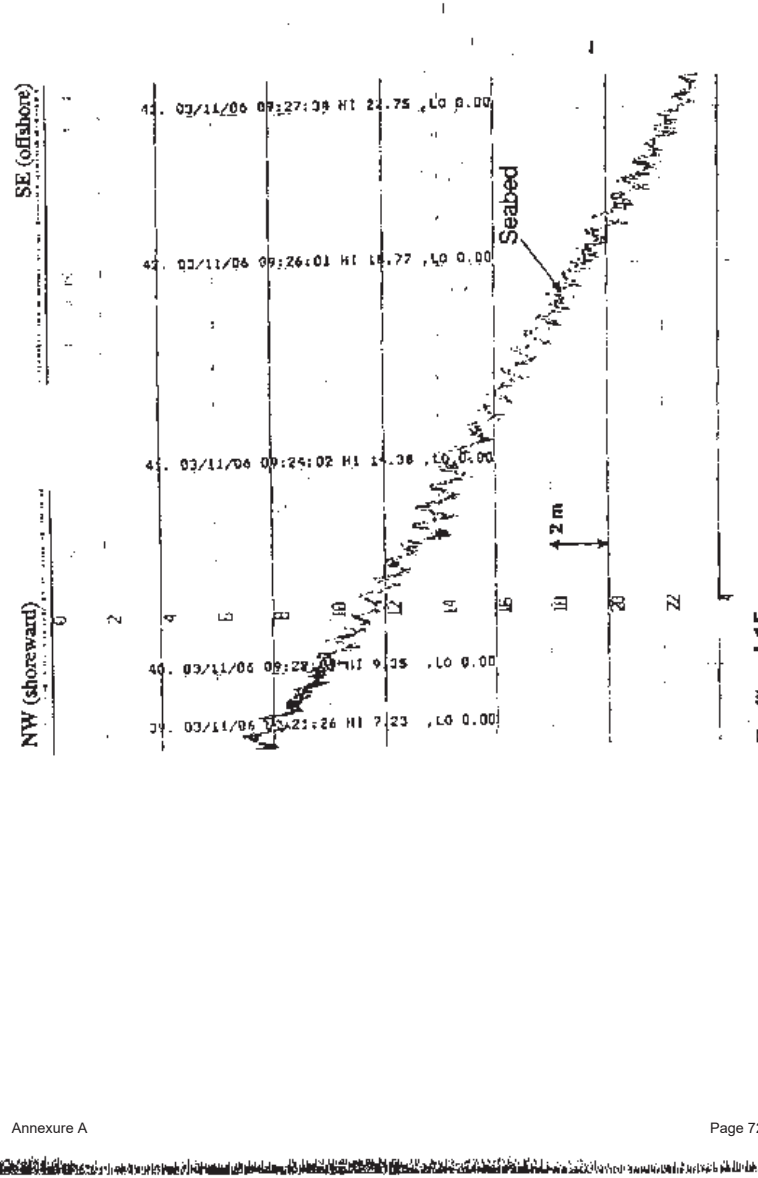
Regional Centre, Visakhapatnam



Profile – L15

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PLATE – 3.4

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National Institute of Oceanography
Regional Centre, Visakhapatnam
Surveys for: Visakhapatnam Steel Plant
PLATE – 3.4

National Institute of Oceanography
Regional Centre, Visakhapatnam
Surveys for: Visakhapatnam Steel Plant
PLATE – 3.5
NW (shoreward)
SE (offshore)
Seabed
2 m
Profile – L23

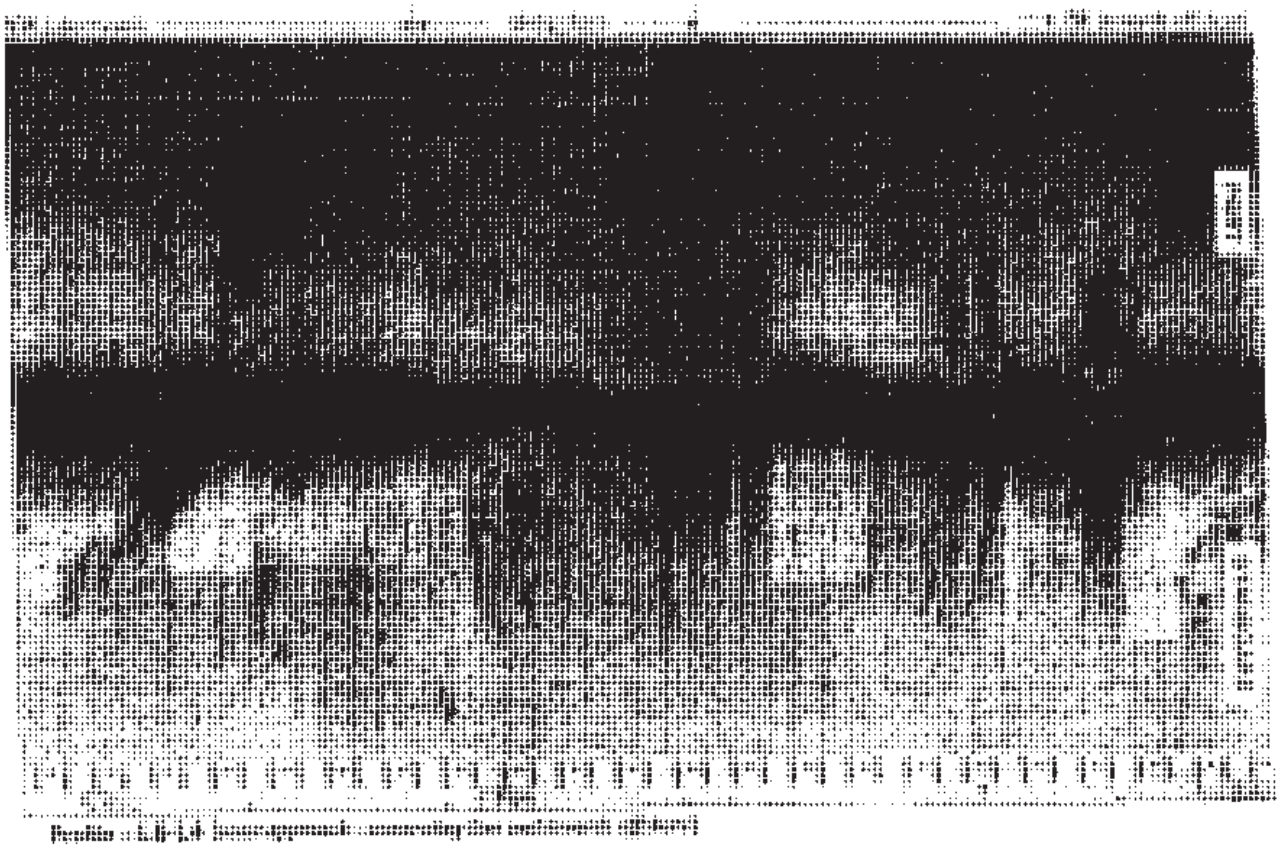

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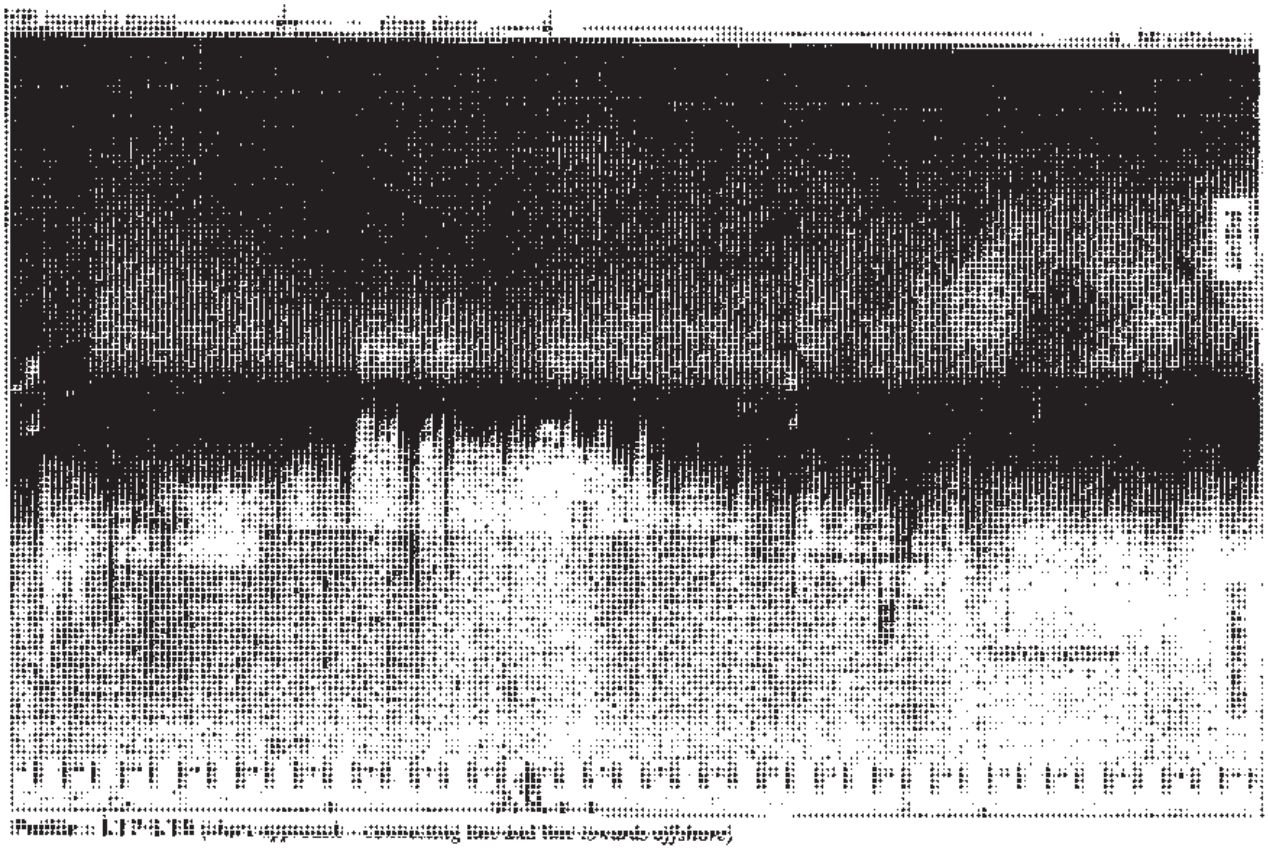
PLATE – 3.6



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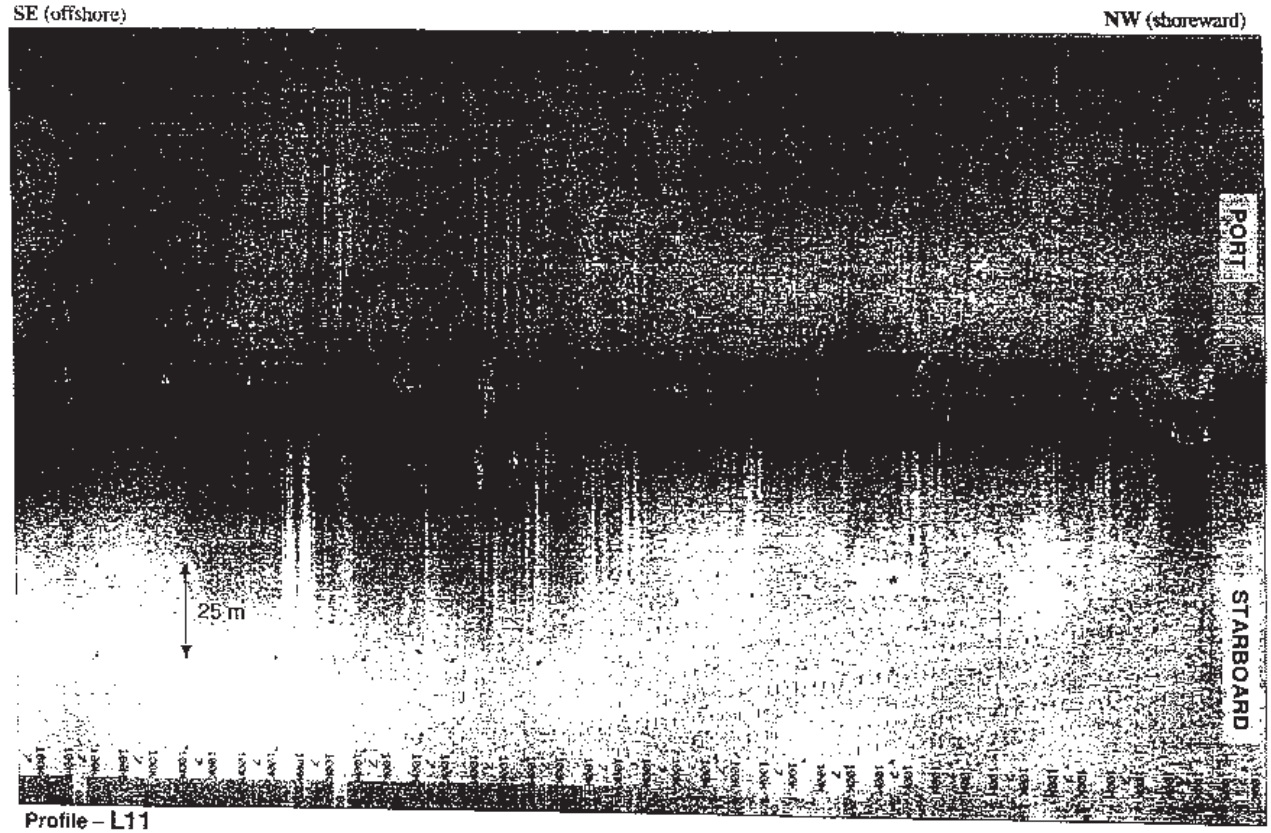
Regional Centre, Visakhapatnam

Surveys for: Visakhapatnam Steel Plant

PLATE – 3.9



Profile – L11

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Regional Centre, Visakhapatnam

Surveys for: Visakhapatnam Steel Plant

PLATE – 3.8

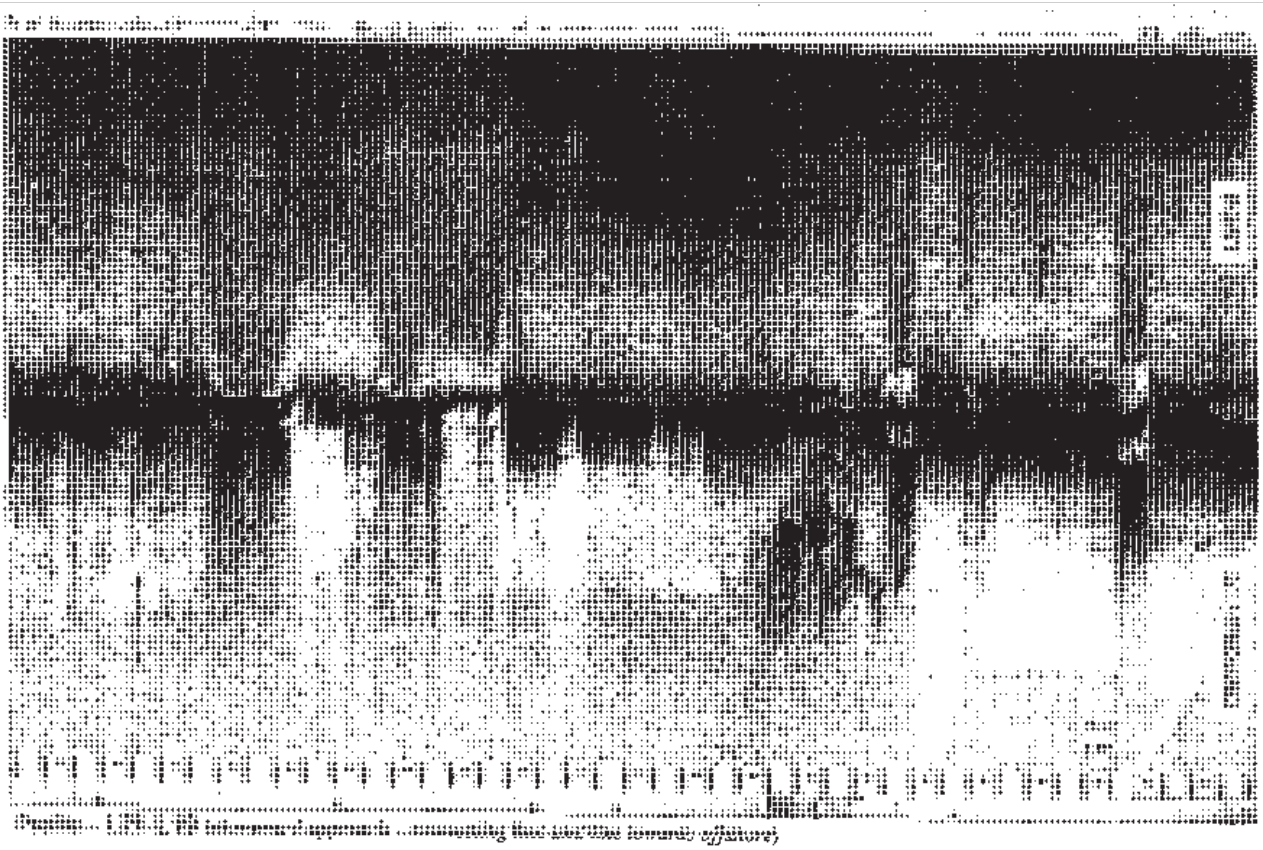

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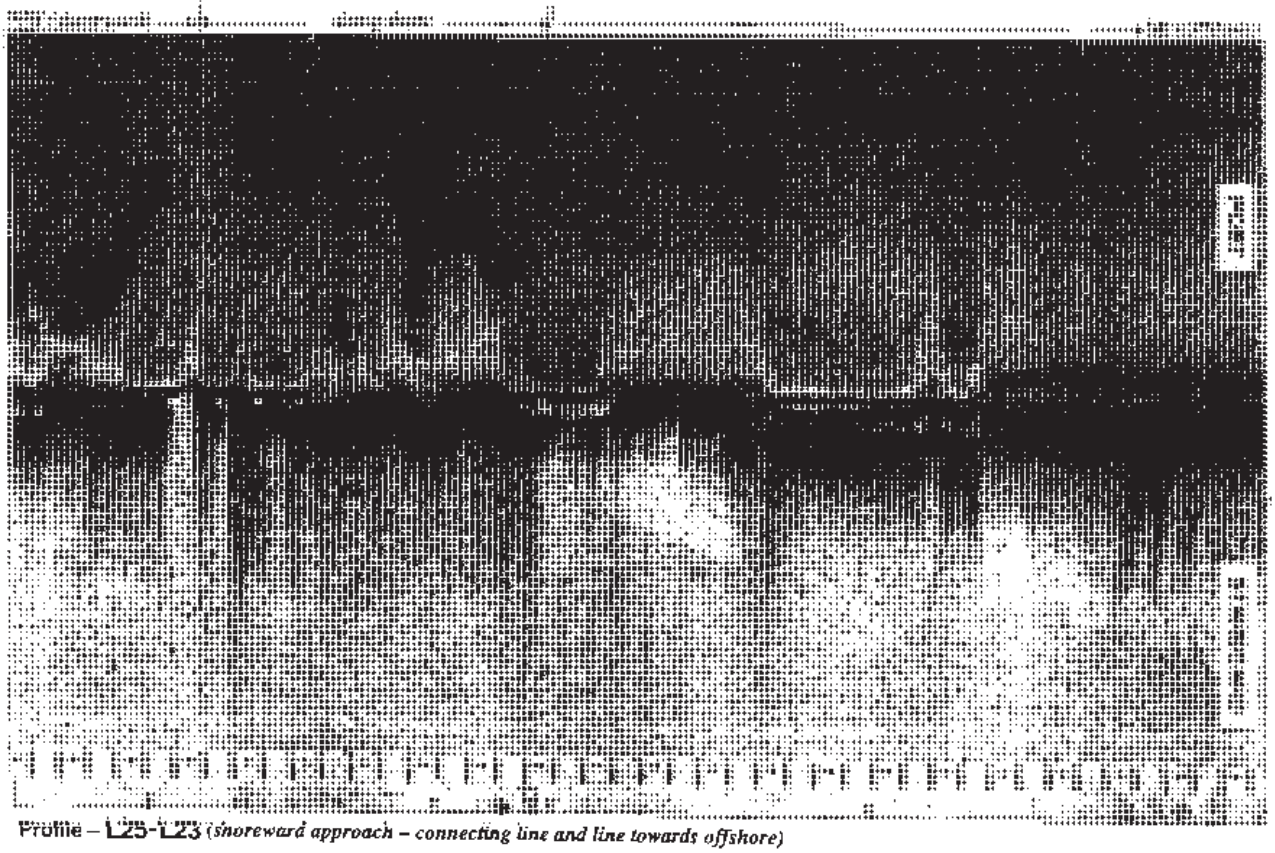
PLATE – 3.10



Profile – L25-L23 *(shoreward approach – connecting line and line towards offshore)*

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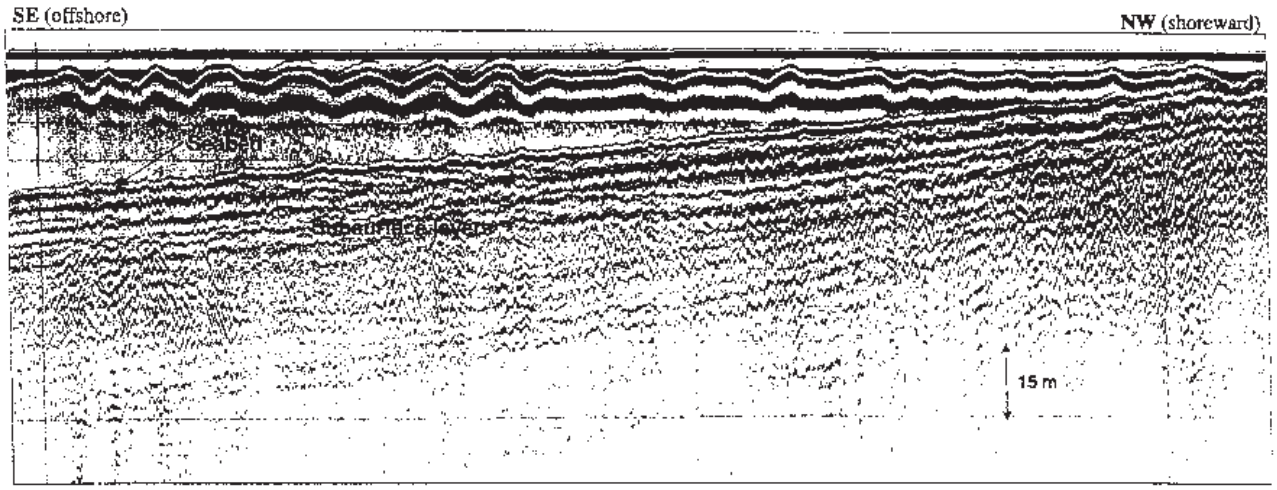
Surveys for: Visakhapatnam Steel Plant

PLATE – 3.11



Profile – L18

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Surveys for: Visakhapatnam Steel Plant

PLATE – 3.12

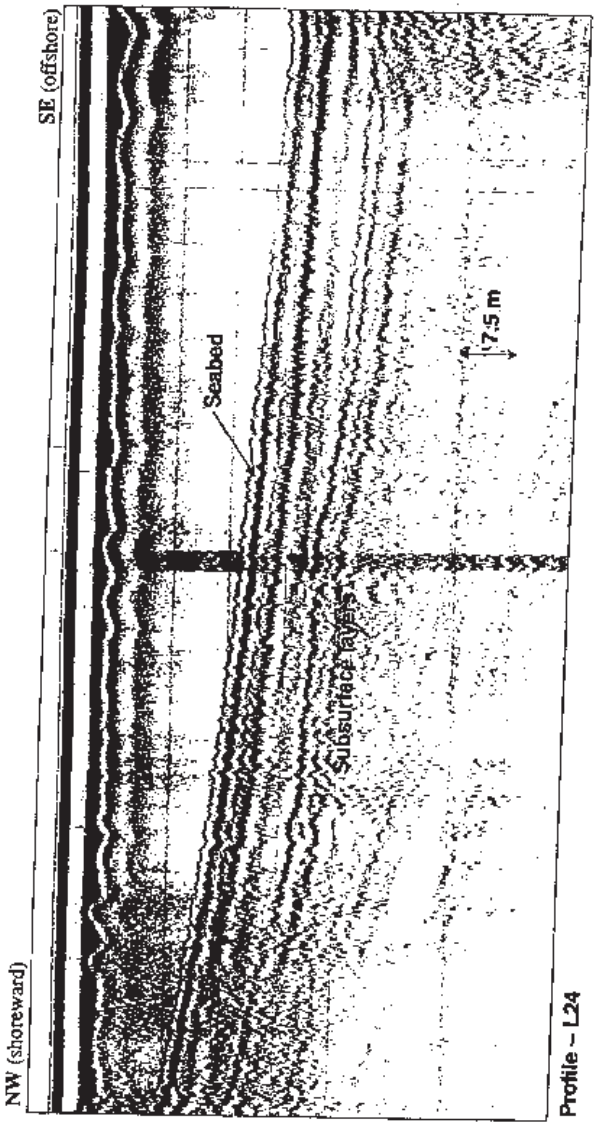

PLATE – 3.13

Surveys for: Visakhapatnam Steel Plant

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Regional Centre, Visakhapatnam

4. PHYSICAL STUDIES

To understand the flow and mixing conditions in the coastal waters, data on physical oceanography parameters (temperature, salinity, density and currents) are essential. Based on the above information, mainly during calm weather conditions, it is possible to assess the near field dilution which depends on the pipeline design and ambient sea water conditions. In this section, details on the pipeline design and outfall point are given using the time series data collected in the study area (Gangavaram – Appikonda) and from the buoyant Jet Model.

4.1 DATA COLLECTION

Temperature and salinity profiles at nine stations (N1, N2, N3 - northern transect; C1, C2, C3 - central transect; S1, S2, S3- southern transect) (Fig.4.1) in the study area are collected on 20.2. 2006. Density (kg/m^3) was estimated from temperature and salinity data.

Time series data on speed and direction of the currents are collected at three (Stns. 1, 2 and 3) (Fig.4.2.) locations in the study area from 20th February to 7th March, 2006.

4.2 EQUIPMENT

4.2.1 SBE19 plus Seacat Profiler

The data on temperature and salinity had been collected using SBE19 plus Seacat Profiler (make: Seabird Electronics, USA) which was purchased recently.

The SBE19 plus can be operated without a computer even from a small boat, with data recorded in non volatile FLASH memory and processed later on the PC. The 19 plus faster sampling and pump controlled TC ducted flow configuration significantly reduces salinity spiking caused by ship heave, and allows slower descent rates for improved resolution of water column features. The 19 plus uses the same temperature and conductivity sensors proven in 5000 SEACAT and MicroCAT instruments and a superior new micro machined silicon strain gauge pressure sensor developed by Druck,Inc. Improvements in design , materials, and signal acquisition techniques yield a low cost instrument with a superior performance that is easy to use.

Range and accuracy:

Conductivity (S/m)

Range : 0 to 9
Accuracy: 0.0005
Temperature : (° C)
Range : -5 to 35
Accuracy: 0.005

4.2.2 RCM 7 Current Meters

RCM-7 Current Meters (Make: Aanderaa Instruments, Norway) are used to obtain the time series data on the speed and direction of the currents. RCM-7 is a self recording current meter intended to be moored to obtain average speed and direction of the current . The instrument records data internally in a removable and reusable solid state Data Storage Unit (DSU2990) . As the current meter aligns itself in the current, the orientation of the instrument is measured by a compass located at the bottom of the instrument. Speed is measured by the rotor

at the top of the recording unit. The resolutions of the rotor are magnetically transferred to an electronic counter inside the unit. Every half resolution is counted.

After retrieving the current meter, DSU2990 is removed from the unit. The raw data can be downloaded to PC with the help of DSU Reader 2995 and the program 4059 supplied by Anderaa Instruments, Norway. After processing the raw data, speed and direction with time are obtained.

Accuracy :

Current speed
Range : 2 to 295 cm
Accuracy: ± 1 cm or +2 cm of actual speed which ever is greater

Current direction
Accuracy: ± 5 for speeds 5-100 cm/sec
± 7.5 for speeds 2.5 to 5 cm/sec and 100-200 cm/sec

4.3 TEMPERATURE, SALINITY AND DENSITY PROFILES IN THE STUDY AREA

Temperature (T, ^{0}C), salinity (psu) and density(kg/m^3) profiles at nine stations (N1, N2, N3 - northern transect; C1, C2, C3 – central transect; S1, S2, S3- southern transect) (Fig. 4.1) were collected off Gangavaram – Appikonda on 20th February 2006. Temperature at surface was 26.41 °C – 26.73 °C while it was 24.52 °C- 25.8 °C at bottom, in the northern transect (Fig.4.3) . A slight inversion of 0.1 °C was noticed at Stn. N2 . Along the central transect ,temperature at surface was 26.94 °C – 27.09 °C while it was 25.22 °C- 25.91 °C at bottom. A slight inversion of 0.1 °C was noticed at Stn. C1(Fig.4.4) . Along the southern transect,

temperature at surface was 26.92 °C - 27.13 °C while it was 25.32 °C- 26.15 °C at bottom. (Fig.4.5) Salinity varied from 32.64 to 33.73 psu at surface while it varied from 34.02 to 34.58 psu. The gradient was about 2 psu from top to bottom at 20 m depth (Figs.4.6-4.8). Density was fluctuating around 1022 kg/m^3 in the study area (Figs. 4.9 to 4.11). From the data collected in the study area the average density of the water column is about 1022 kg/m^3 (Table.4.1). Since the temperature and salinity vary with the season, the density also changes during an year. From the earlier observations a minimum density of 1015 kg/m ^{3} is possible in the study area.

4.4 CURRENTS

Time series data on Speed (m/sec) and direction of the currents at 3 locations (Fig.4.2) are collected at 20 min interval. The data at st.1 was collected from 20-21 Feb 2006. The speed of the current varied between 0.4 to 0.7 m/sec while the direction was 50-80^0. (Fig.4.12). More or less similar trend was observed at stn.2 during 21-27 Feb 2006. (Fig.4.13) . At Stn.3 (10 m depth) which is close to the coast, the speed of current varied from 0.1 to 0.5 m/sec , with the direction 50-70 ^{0} during 27th February to 7th March, 2006 (Fig.4.14) .

From the earlier measurements for one year in the study area, the maximum temperature (29-31° C) was observed during May-June and October months while the minimum (26-27° C) was observed during winter months (Dec-Jan). Salinity varied between 25 and 35.55 psu with a maximum during April-July and minimum during October-December. During the other months the surface and bottom salinity varied from 32 to 34 psu.

From the vertical distribution of density, the water column was stratified during October-November, near neutral during May-July and weakly stratified

during the rest of the year. The density of the water column was mostly varied between 1015 to 1022 kg/m^3 during an year.

The current measurements in the study area showed that 80% of the time the speed of current was between 0.1 and 0.3 m/sec, on annual scale. (NIO, 1981).

It may be mentioned here that though the observations were taken long back with the available equipment in those days, the data is well comparable with the recent measurements from sophisticated equipments.

Based on the above information and the data collected in the study area , buoyant Jet model is run to suggest the pipeline design and outfall point for the discharge of the treated effluents from the industry.

4.5 DISCHARGE POINT AND PIPELINE DESIGN THROUGH A MODEL

When the effluents are discharged through a submerged pipe line in the coastal waters the initial dilution mainly depends on the design characteristics of the pipeline, density and volume of the effluents, density structure and the currents in the ocean.

Effluent released through a submarine diffuser is diluted in two stages – near-field and far-field. In the near field, plume dilution is controlled by momentum and buoyancy forces of the effluent whereas in the far-field, the dilution is affected by the prevailing ambient currents.

Mixing conditions in the near field are quite sensitive and controllable . In contrast mixing conditions in the far field often show little sensitivity unless the ambient conditions change substantially or drastic process variation are introduced. Outfall designers can usually affect the initial mixing characteristics through appropriate manipulation of design variables.

In the coastal waters, simple reversal of currents and moderate pollutant loadings, the use of near field mixing zone models are sufficient to evaluate a design of a point source discharge that meets the regulations. Submerged multi port diffuser result in much higher initial dilution and reduces the immediate effect of the discharged flow on the ocean.

a) Near-field dilution

Near-field dilution was assessed based on the Buoyant Jet Model for which the governing equations are as follows:

$$\frac{du}{ds} = \frac{2g\lambda^2}{u}\frac{\Delta\rho}{\rho_o}\sin\theta - \frac{2u\alpha}{b}$$

$$\frac{db}{ds} = \frac{2\,\alpha\, bg\lambda^2}{u^2}\frac{\Delta\rho}{\rho_o}\sin\theta$$

$$\frac{d\theta}{ds} = \frac{2g\lambda^2}{u^2} - \frac{\Delta\rho}{\rho_o}\cos\theta$$

$$d\frac{\Delta\rho}{ds} = \frac{1+\lambda^2}{\lambda^2}\sin\theta\frac{d\rho}{dy} - \frac{2\alpha\Delta\rho}{\rho}$$

$$\frac{dx}{ds} = \cos\theta; \qquad \frac{dy}{ds} = \sin\theta$$

where g = acceleration due to gravity
ρ = density of effluent
ρ_o = density of seawater

α = constant
λ = entrainment coefficient
x = horizontal distance from Jet orifice
y = vertical jet coordinate
u = jet velocity
θ = angle of jet orifice with horizontal plane
ds = step increment
also $c_o\ u_o\ b_o$ = c u b
where c = concentration at given time
b = width of jet/plume at given time

$c_o\ u_o\ b_o$ represent concentration/mass density, jet velocity and jet width at time t = 0.

The model also takes the ambient velocity into account while calculating initial dilution. The above equations were solved explicitly by Range-Kutta integration scheme.

Computations were performed for a diffuser with different number of ports and jet velocities. Generally port velocities are selected in the range of 2.0 to 3.0 m/s as the lower velocities can cause settlement of suspended load in the effluent pipeline and clogging of ports while higher velocities produce head losses.

VARYING DISCHARGE DEPTH AND WITH CURRENT VELOCITY AS 0.10 M/s, SEA WATER DENSITY AS 1022 Kg/m³

CASE – 1

Input

Effluent quantity (m^3/day)	14400
Effluent density (kg/m^3)	1005
Seawater density (kg/m^3)	1022
Minimum water depth (m)	10.0
Current velocity (av) (m/s)	0.10
Angle	45 °
Jet velocity (m/sec)	2.0
Step increment (m)	0.001

Output

No of ports	Port Diameter (m)	Dilution (times)
1	0.326	17
2	0.226	27
3	0.186	35
4	0.156	48
5	0.136	59
6	0.126	65

CASE – 2

Input

Effluent quantity (m^3/day)	14400
Effluent density(kg/m^3)	1005
Seawater density (kg/m^3)	1022
Minimum water depth (m)	15.0
Current velocity (av) (m/s)	0.10
Angle	45 °
Jet velocity (m/sec)	2.0
Step increment (m)	0.001

Output

No of ports	Port Diameter (m)	Dilution (times)
1	0.326	30
2	0.226	49
3	0.186	69
4	0.156	89
5	0.136	110
6	0.126	122

CASE - 3

Input

Effluent quantity (m^3/day)	14400
Effluent density(kg/m^3)	1005
Seawater density (kg/m^3)	1022
Minimum water depth (m)	20.0
Current velocity (av) (m/s)	0.10
Angle	45 °
Jet velocity (m/sec)	2.0
Step increment (m)	0.001

Output

No of ports	Port Diameter (m)	Dilution (times)
1	0.326	46
2	0.226	78
3	0.186	109
4	0.156	142
5	0.136	174
6	0.126	196

CASE – 4

Input

Effluent quantity (m^3/day)	14400
Effluent density(kg/m^3)	1005
Seawater density (kg/m^3)	1022
Minimum water depth (m)	10.0
Current velocity (av) (m/s)	0.30
Angle	45 °
Jet velocity (m/sec)	2.0
Step increment (m)	0.001

Output

No of ports	Port Diameter (m)	Dilution (times)
1	0.326	26
2	0.226	42
3	0.186	54
4	0.156	75
5	0.136	91
6	0.126	101

CASE – 5

Input

Effluent quantity (m^3/day)	14400
Effluent density(kg/m^3)	1005
Seawater density (kg/m^3)	1022
Minimum water depth (m)	15.0
Current velocity (av) (m/s)	0.30
Angle	45 °
Jet velocity (m/sec)	2.0
Step increment (m)	0.001

Output

No of ports	Port Diameter (m)	Dilution (times)
1	0.326	46
2	0.226	77
3	0.186	108
4	0.156	139
5	0.136	171
6	0.126	191

CASE - 6

Input

Effluent quantity (m^3/day)	14400
Effluent density(kg/m^3)	1005
Seawater density (kg/m^3)	1022
Minimum water depth (m)	20.0
Current velocity (av) (m/s)	0.30
Angle	45 °
Jet velocity (m/sec)	2.0
Step increment (m)	0.001

Output

No of ports	Port Diameter (m)	Dilution (times)
1	0.326	72
2	0.226	122
3	0.186	170
4	0.156	222
5	0.136	273
6	0.126	307

VARYING DISCHARGE DEPTH AND WITH CURRENT VELOCITY AS 0.10 M/s, SEA WATER DENSITY AS 1015 Kg/m^3

CASE - 7

Input

Effluent quantity (m^3/day)	14400
Effluent density(kg/m^3)	1005
Seawater density (kg/m^3)	1015
Minimum water depth (m)	10.0
Current velocity (av) (m/s)	0.10
Angle	45 °
Jet velocity (m/sec)	2.0
Step increment (m)	0.001

Output

No of ports	Port Diameter (m)	Dilution (times)
1	0.326	17
2	0.226	28
3	0.186	37
4	0.156	46
5	0.136	56
6	0.126	62

CASE - 8

Input

Effluent quantity (m^3/day)	14400
Effluent density(kg/m^3)	1005
Seawater density (kg/m^3)	1015
Minimum water depth (m)	15.0
Current velocity (av) (m/s)	0.10
Angle	45 °
Jet velocity (m/sec)	2.0
Step increment (m)	0.001

Output

No of ports	Port Diameter (m)	Dilution (times)
1	0.326	29
2	0.226	50
3	0.186	66
4	0.156	84
5	0.136	103
6	0.126	115

CASE - 9

Input

Effluent quantity (m^3/day)	14400
Effluent density(kg/m^3)	1005
Seawater density (kg/m^3)	1015
Minimum water depth (m)	20.0
Current velocity (av) (m/s)	0.10
Angle	45 °
Jet velocity (m/sec)	2.0
Step increment (m)	0.001

Output

No of ports	Port Diameter (m)	Dilution (times)
1	0.326	44
2	0.226	77
3	0.186	102
4	0.156	133
5	0.136	163
6	0.126	183

CASE - 10

Input

Effluent quantity (m^3/day)	14400
Effluent density(kg/m^3)	1005
Seawater density (kg/m^3)	1015
Minimum water depth (m)	10.0
Current velocity (av) (m/s)	0.30
Angle	45 °
Jet velocity (m/sec)	2.0
Step increment (m)	0.001

Output

No of ports	Port Diameter (m)	Dilution (times)
1	0.326	26
2	0.226	44
3	0.186	57
4	0.156	73
5	0.136	88
6	0.126	98

Case-11

Input

Effluent quantity (m^3/day)	14400
Effluent density(kg/m^3)	1005
Seawater density (kg/m^3)	1015
Minimum water depth (m)	15.0
Current velocity (av) (m/s)	0.30
Angle	45 °
Jet velocity (m/sec)	2.0
Step increment (m)	0.001

output

No of ports	Port Diameter (m)	Dilution (times)
1	0.326	45
2	0.226	78
3	0.186	102
4	0.156	132
5	0.136	161
6	0.126	180

CASE - 12

Input

Effluent quantity (m^3/day)	14400
Effluent density(kg/m^3)	1005
Seawater density (kg/m^3)	1015
Minimum water depth (m)	20.0
Current velocity (av) (m/s)	0.3
Angle	45 °
Jet velocity (m/sec)	2.0
Step increment (m)	0.001

Output

No of ports	Port Diameter (m)	Dilution (times)
1	0.326	69
2	0.226	120
3	0.186	160
4	0.156	208
5	0.136	255
6	0.126	286

CASE - 13

Input

Effluent quantity (m^3/day)	14400
Effluent density(kg/m^3)	1005
Seawater density (kg/m^3)	1015
Minimum water depth (m)	20.0
Current velocity (av) (m/s)	0.10
Angle	45 °
Jet velocity (m/sec)	2.5
Step increment (m)	0.001

Output

No of ports	Port Diameter (m)	Dilution (times)
1	0.291	47
2	0.201	83
3	0.161	114
4	0.141	139
5	0.121	174
6	0.111	198

From the above results, it is evident that 6 port diffuser system with 0.126 m diameter, 183 times dilution is possible at a depth of 20 m. The jet velocity should be 2 m/sec .

To achieve a dilution greater than 180 times with a 6 port diffuser system of 0.126 m diameter and jet velocity of 2.0 m/sec, the discharge point should be at 20 m water depth. The dilution can be enhanced to 198 times with a jet velocity of 2.5 m/sec with 6 port diffuser system of having 0.11 diameter (Case.No.13)

It should be mentioned here that the Simhadri Power plant is located south of the Steel plant and a jetty was constructed to draw seawater and release the waste water from the plant. The Ramky Pharma city at Parawada, will be discharging treated effluents from the proposed industry and the discharge point is suggested at 18 m water depth off Tikkavanipalem (NIO, 2005). On the north side, construction of the Gangavaram port has already been started. This depth is suggested to get sufficient dilution of the treated effluents even under very low current speed (0.1 m/sec) and low sea water density conditions (1015 kg/m^3).

Keeping in view of the above and the sea bed characteristics the discharge point is suggested at 20 m water depth, i.e., 17°35'39" N; 83°13'50" E, which is 1.21 km from LFP (shown in Fig. 4.15).

References:

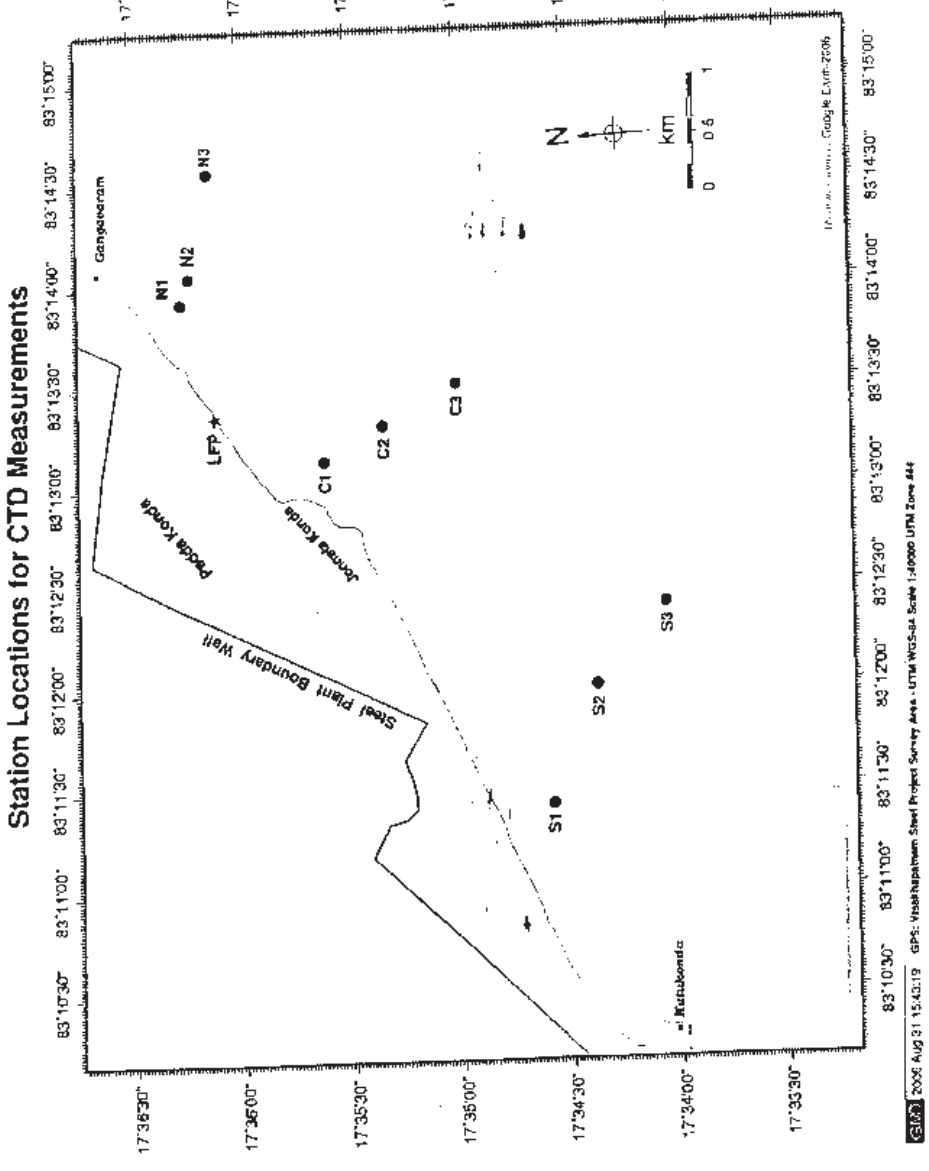
1. NIO, 1981: Oceanographic studies for the discharge of treated effluents into the sea, for Steel Authority of India, Visakhapatnam.
2. NIO, 2005: Rapid environmental impact assessment studies for the treated effluents in the marine environment off Tikkavanipalem-Mutyalammapalem , Visakhapatnam Dist, A.P.

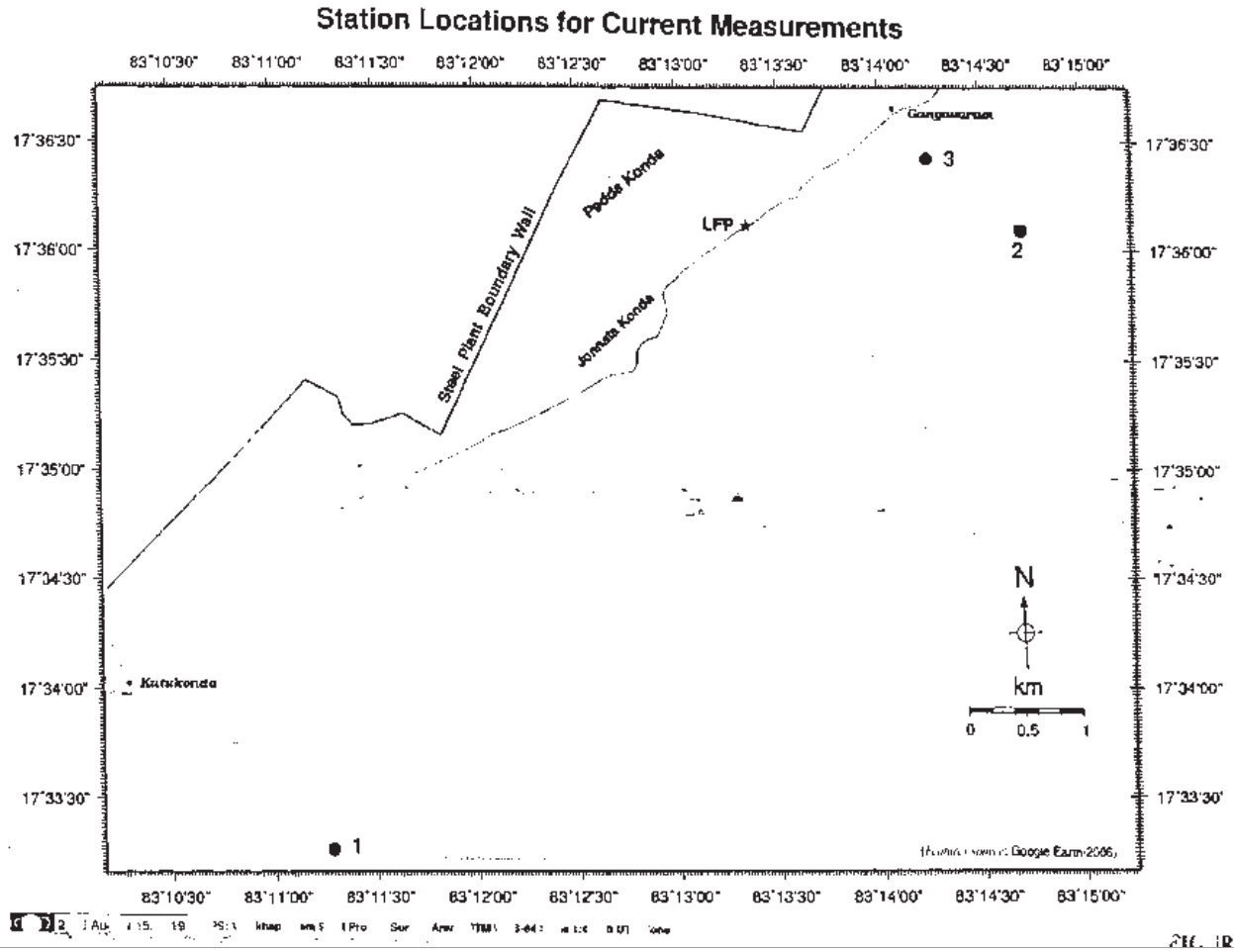
Table.4.1 Temperature (°C), Salinity (psu) and Density (kg/m³) values at surface (S) and bottom (B) at 9 stations off Gangavaram-Appikonda (20.2.2006)

Station	Temperature		Salinity		Density	
	S	B	S	B	S	B
N1	26.41	25.80	33.72	34.05	1021.94	1022.4
N2	26.58	25.31	33.73	34.24	1021.9	1022.72
N3	26.73	24.52	32.78	34.58	1020.4	1023.3
C1	26.94	25.91	33.00	34.02	1021.2	1022.3
C2	27.05	25.56	33.23	34.15	1021.4	1022.6
C3	27.09	25.22	32.64	34.3	1020.9	1022.8
S1	26.92	26.15	33.45	33.94	1021.6	1022.2
S2	27.13	25.76	33.25	34.08	1021.4	1022.5
S3	27.05	25.32	33.27	34.26	1021.4	1022.8

45

Fig.4.1





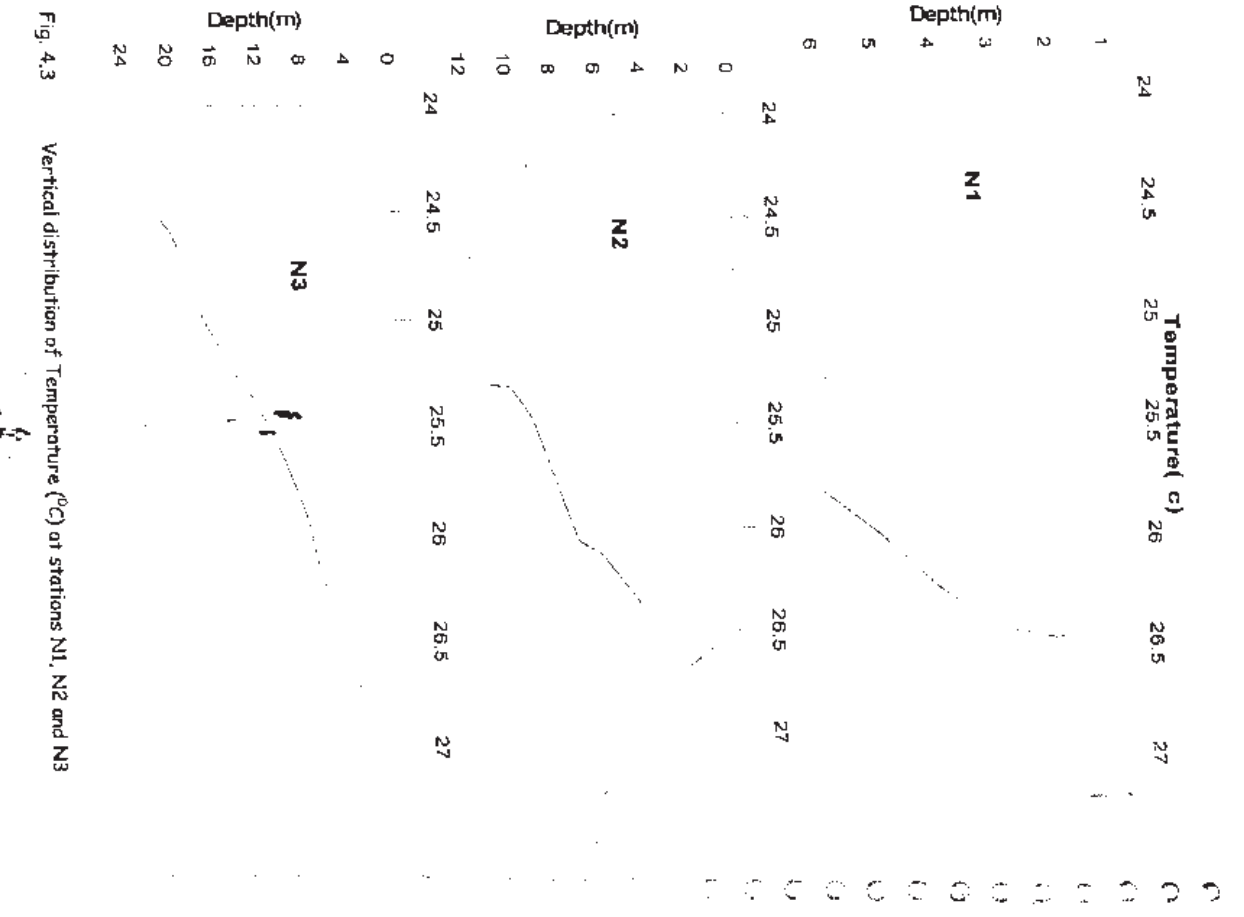


Fig. 4.3 Vertical distribution of Temperature (°C) at stations N1, N2 and N3

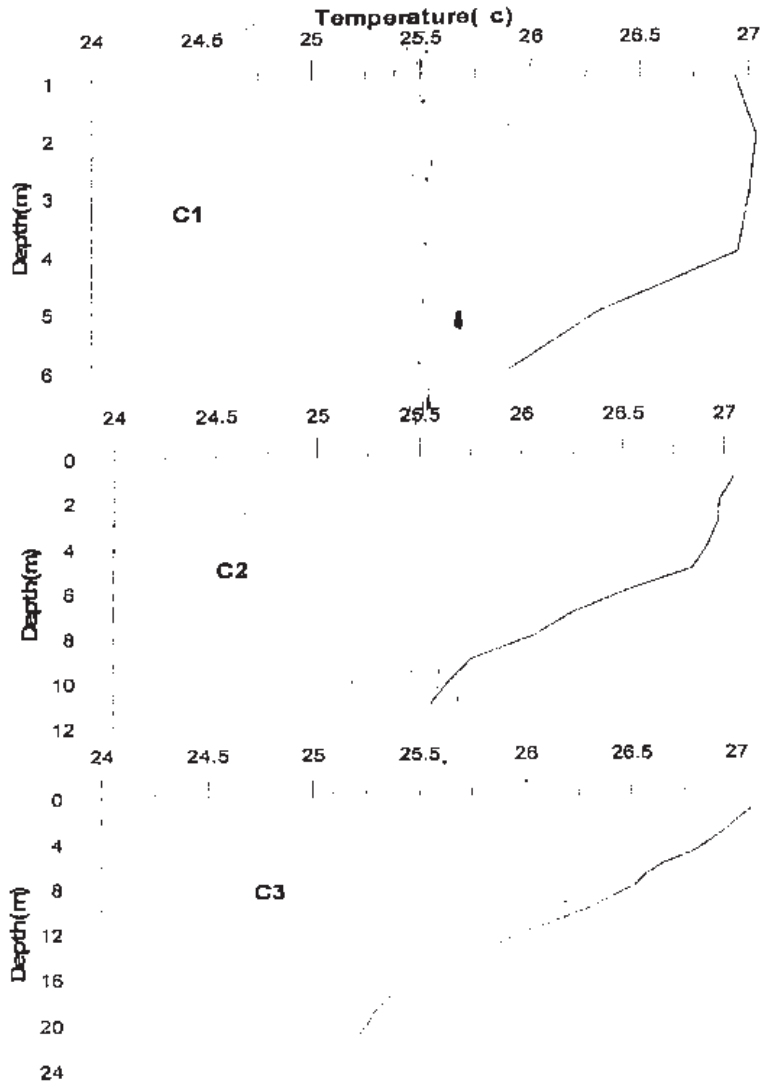


Fig. 4.4 Vertical distribution of Temperature (^0C) at stations C1, C2 and C3

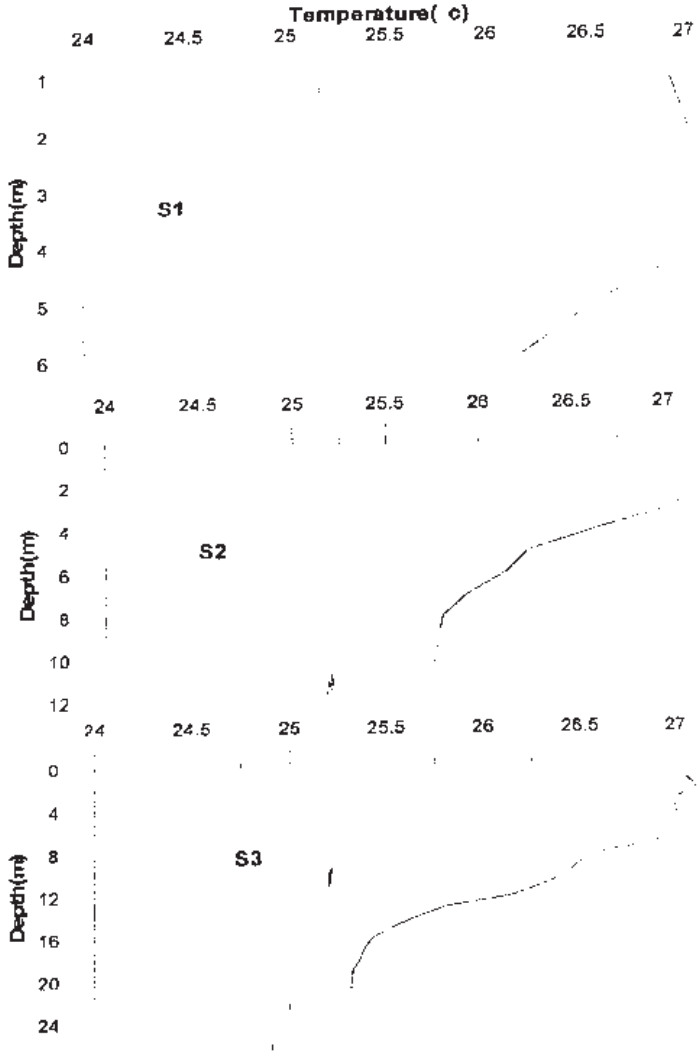


Fig. 4.5 Vertical distribution of Temperature (^0C) at stations S1, S2 and S3

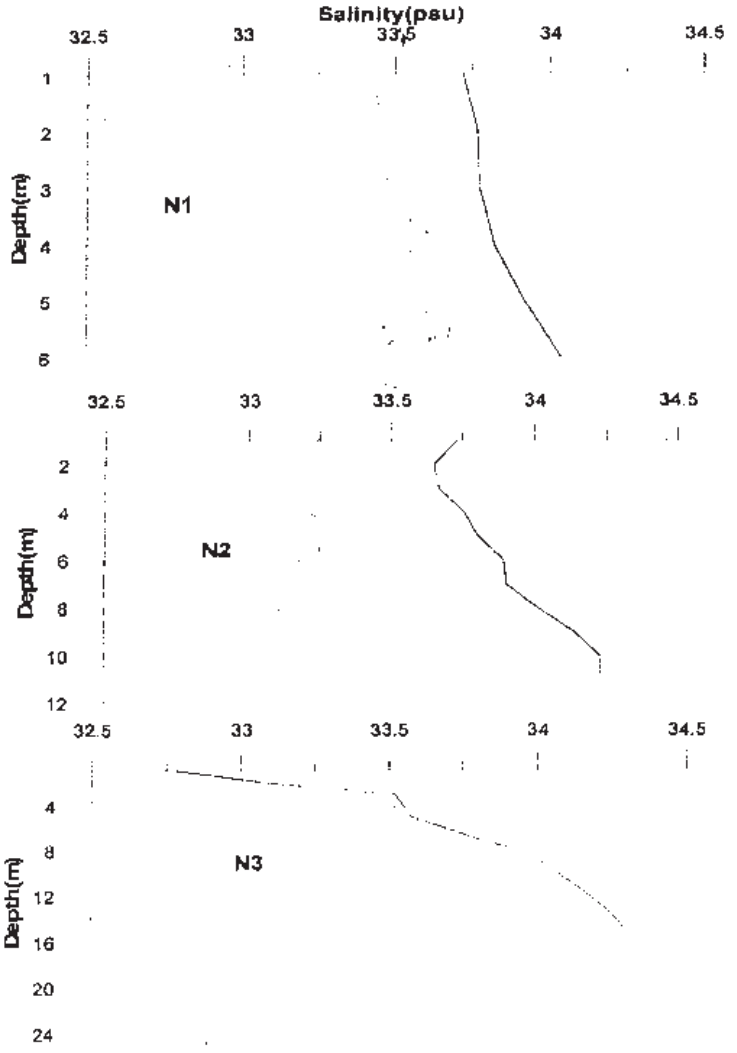


Fig. 4.6 Vertical distribution of Salinity (psu) at stations N1, N2 and N3

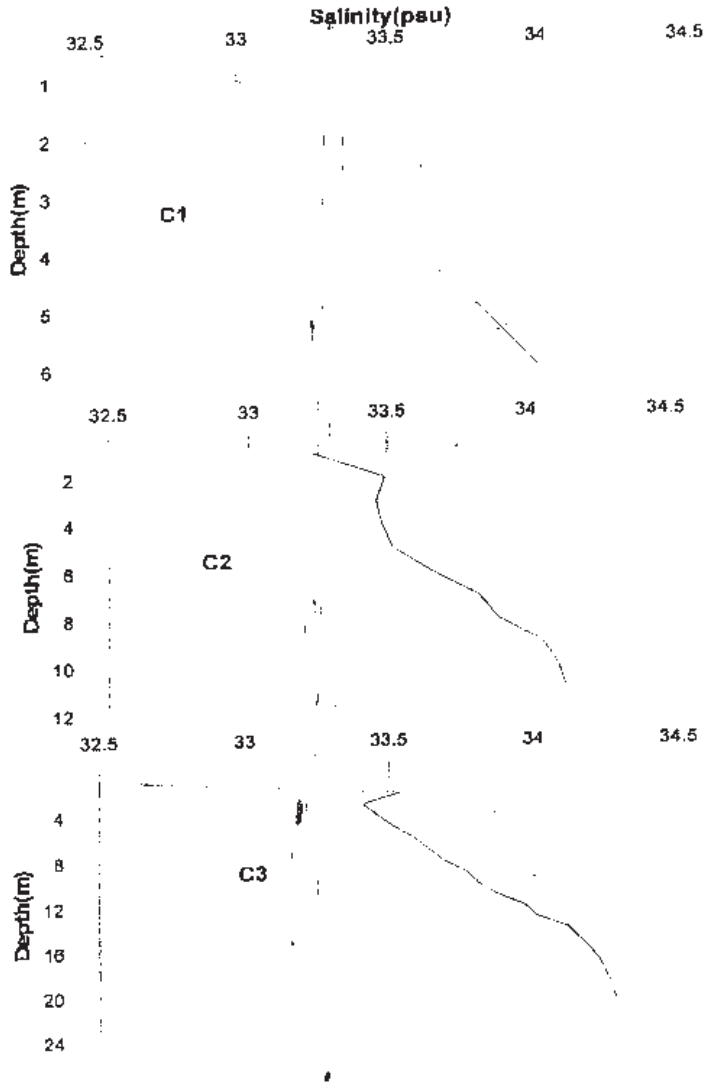


Fig. 4.7 Vertical distribution of Salinity (psu) at stations C1, C2 and C3

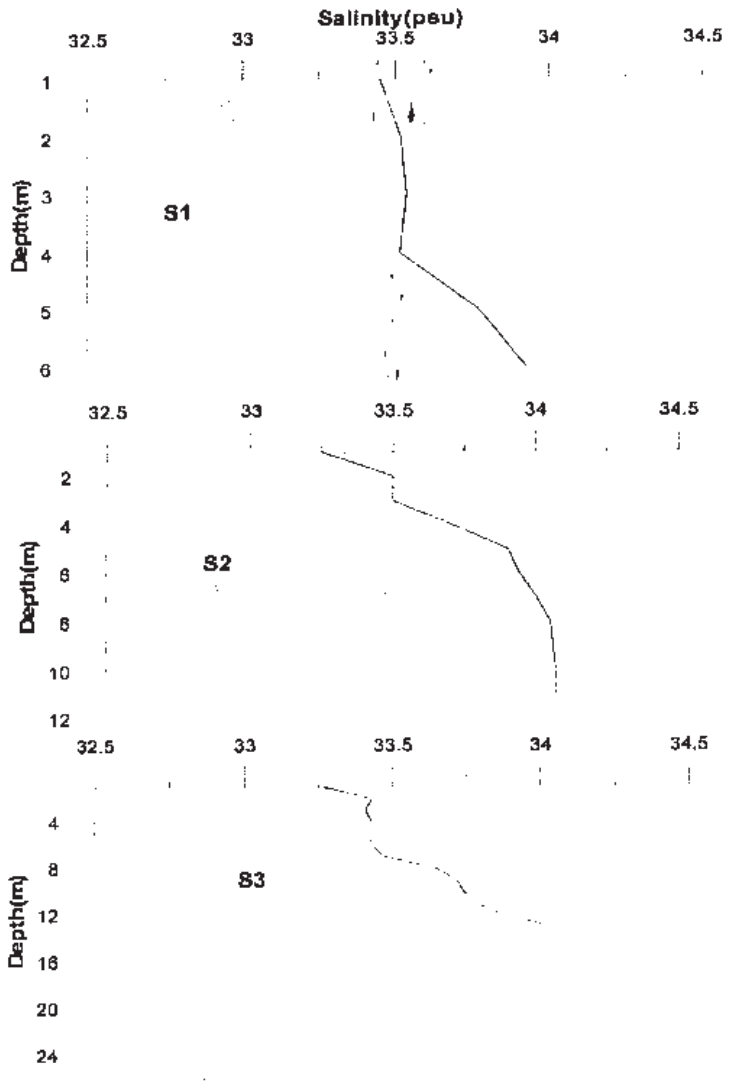


Fig. 4.8 Vertical distribution of Salinity (psu) at stations S1, S2 and S3

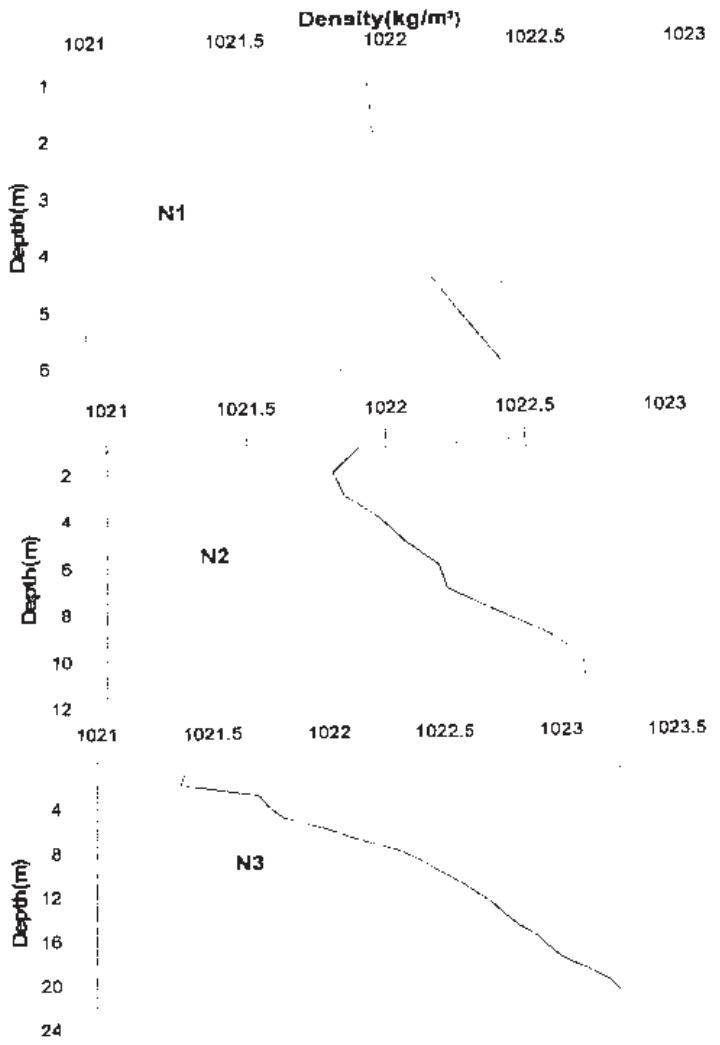


Fig. 4.9 Vertical distribution of Density (kg/m^3) at stations N1, N2 and N3

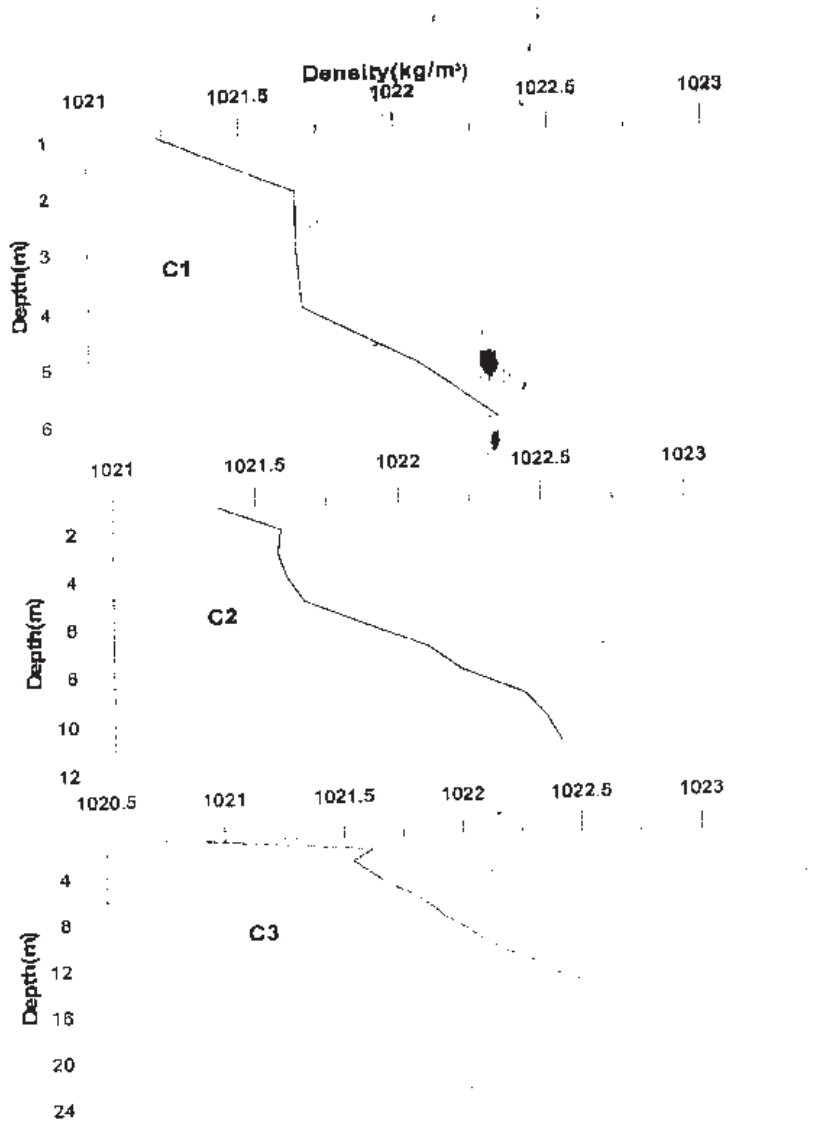


Fig. 4.10 Vertical distribution of Density (kg/m^3) at stations C1, C2 and C3

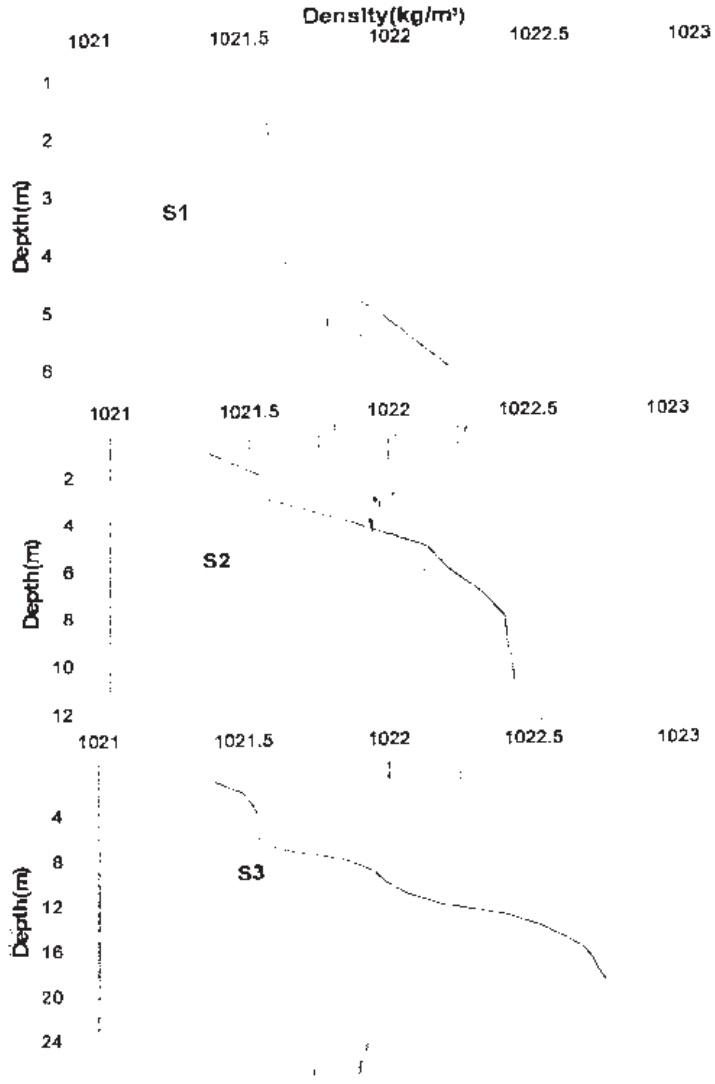


Fig. 4.11 Vertical distribution of Density (kg/m^3) at stations S1, S2 and S3

Fig. 4.12 Speed and Direction of currents at station 1.

Fig. 4.13 Speed and Direction of currents at station 2.

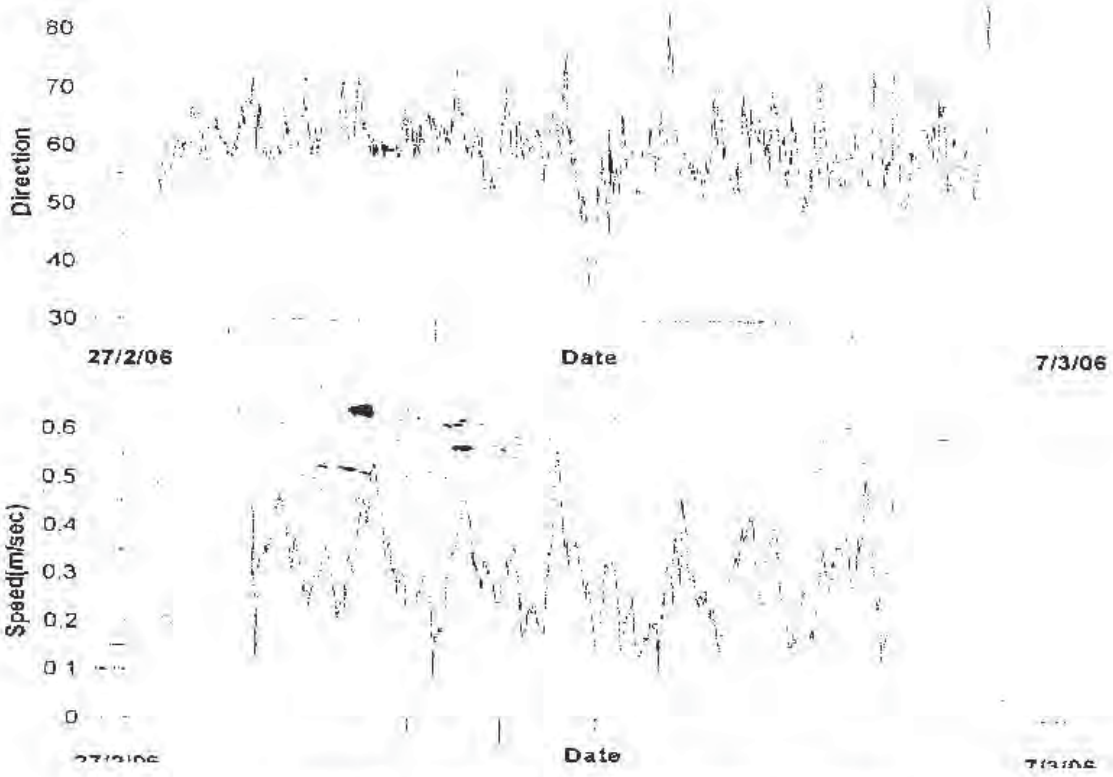


Fig. 4.14 Speed and Direction of currents at station 3.

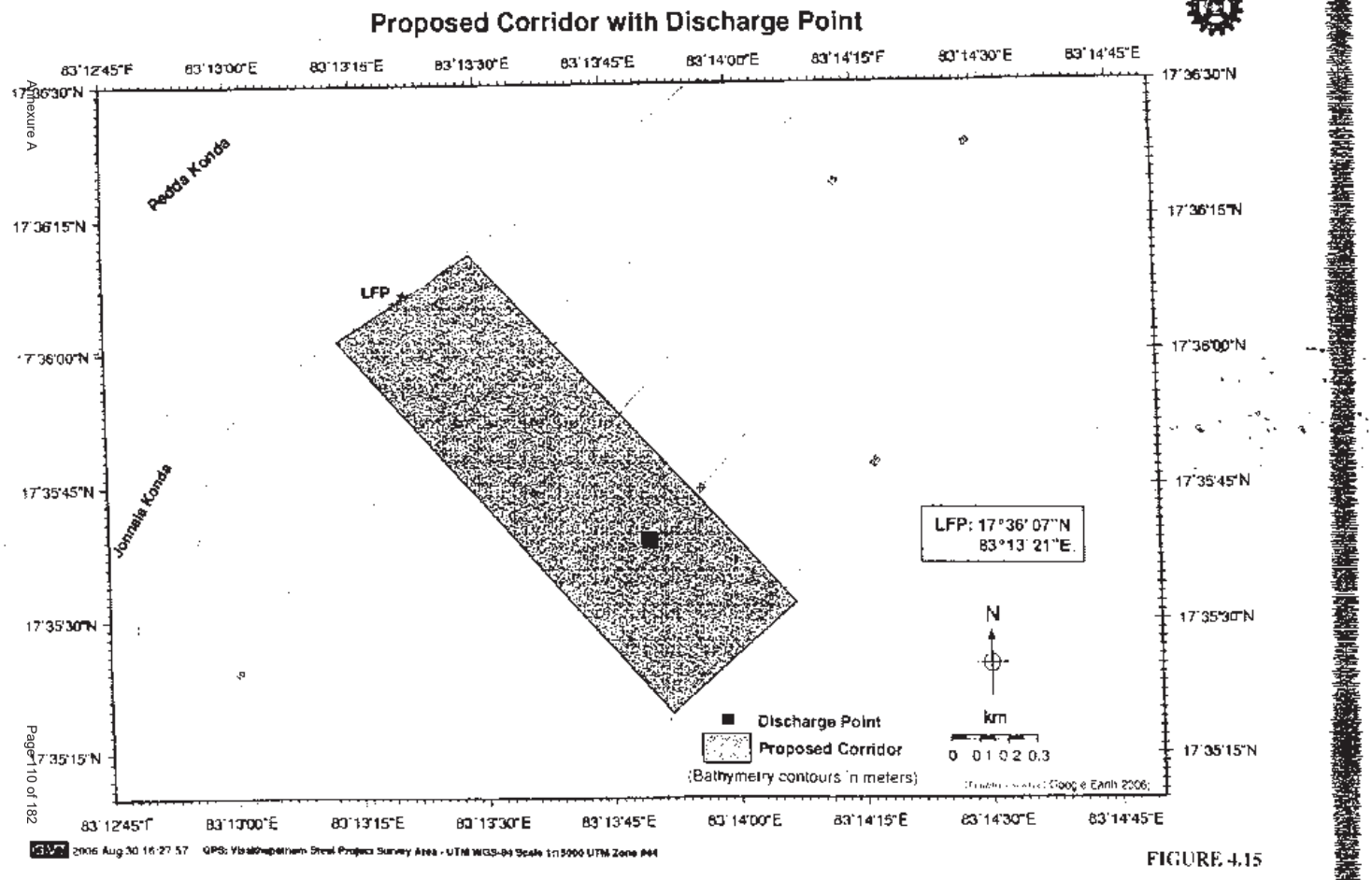


FIGURE 4.15

5. CHEMICAL STUDIES

5.1 PLAN OF WORK

Four perpendicular transects between Gangavaram and Kutukonda were selected for sample collection. Each transect has three stations within the depth range of 7-24 m as shown in Fig 5.1, wherein water and sediment samples were collected for chemical analyses. The main objective of the work is to know the status of the marine environment and acquire base line data on chemical parameters.

5.2 SAMPLING AND ANALYSIS

A Niskin Water sampler has been used for collection of water samples from surface and near bottom depths. Water samples were collected in pre-cleaned glass/plastic bottles as soon as the water sampler brought to the deck. The samples were fixed immediately for Dissolved Oxygen (DO) and for Biochemical Oxygen Demand (BOD) after collecting simultaneously. Samples for nutrient analysis were collected in plastic bottles and kept frozen until the samples reached shore laboratory. Analysis was carried out within the stipulated period of time in the shore laboratory. A brief account of methodology for estimation of chemical constituents are given below.

5.2.1. pH

Water pH was measured immediately using Lab-India pH Analyser (PHAN) after standardizing it with standard pH buffers.

5.2.2. Dissolved Oxygen (DO)

Winkler's method was adopted for the determination of DO by fixing a measured volume of water sample immediately after collection with the reagents A (manganous chloride) and B (alkaline potassium iodide). Standard iodiometric titration with sodium thiosulphate is adopted for the analysis purpose. DO is expressed in *mg/l*.

5.2.3 Biochemical Oxygen Demand (BOD)

Samples for the determination of biochemical oxygen demand were collected in triplicate. The dissolved oxygen concentration was immediately determined using one of the triplicate samples according to Winkler Method. The remaining bottles were then left for five days at 20°C in the BOD incubator. Dissolved oxygen in these samples was determined after fixing the samples on completion of five days incubation. BODs was computed from the initial DO concentrations and expressed in *mg/l*.

5.2.4 Ammonia - Nitrogen (NH_4 - N)

Ammonia - Nitrogen in seawater samples was determined with the indophenol blue method using trione. Care should be taken for the analysis of ammonia and the distilled water should be ammonia free and afresh to avoid any contamination as ammonia is highly soluble in water. The absorbance measurements were made at 630 *nm*. NH_4 - N is expressed in *µg/l*.

5.2.5 Nitrite - Nitrogen (NO_2 - N)

Nitrite was determined by the method of Bendschneider and Robinson whereby the nitrite in water sample was diazotised with sulphanilamide and

coupling with N-1-Naphthyl ethylene diamine dihydrochloride. The absorbance of the resultant azo-dye was measured at 543 nm. NO_2 - N is expressed in $\mu g/l$.

5.2.6 Nitrate - Nitrogen (NO_3 - N)

Nitrate in seawater sample was first reduced to nitrite by heterogeneous reduction by passing the buffered samples through an amalgamated cadmium column and the resultant nitrite was determined as above. The measured absorbance was due to initial nitrite in the sample and nitrite obtained after reduction of nitrate. Necessary correction was therefore made for any nitrite initially present in the sample. NO_3 - N is expressed in $\mu g/l$.

5.2.7 Phosphate - Phosphorus (PO_4 -P)

Inorganic phosphate was measured by the method of Murphy and Riley in which the samples were made to react with acidified molybdate reagent and then reduced using ascorbic acid. The absorbance of the resultant phosphorous molybdenum blue complex was measured at 880 *nm*. PO_4 - P is expressed in $\mu g/l$.

5.2.8 Silicate - Silicon (SiO_4 - Si)

Silicate - silicon was also estimated by reaction with acid - molybdate and ascorbic acid in the presence of oxalic acid. The interference of phosphate is prevented by addition of oxalic acid. The absorbance of the resultant silico - molybdenum blue complex was measured at 810 nm. SiO_4 - Si is expressed in $\mu g/l$.

5.2.9 Total Phosphorus (TP)

The seawater sample is autoclaved with alkaline potassium persulphate in a closed bottle. The solution is neutralised and then estimated for phosphate as described in 5.2.7. The total phosphorus is expressed in $\mu g/l$.

5.2.10 Total Nitrogen (TN)

Seawater sample is autoclaved with alkaline persulphate in order to oxidise all organic forms of nitrogen compounds to inorganic nitrate. The solution is neutralised and nitrate is estimated as per the procedure described in 5.2.6.

5.2.11 Cyanide

Cyanide is converted to cyanogen chloride (CNCl) by reaction with chloramine – T at a pH less than 8. After the reaction is complete, the CNCl forms a red blue dye on addition of Pyridine-barbutyric acid reagent. The absorbance is measured at 578 nm and the concentration is estimated in $\mu g/l$.

5.2.12 Thiocyanate

At an acidic pH, ferric ion forms an intense red colour with thiocyanate. A series of standards prepared (50-500 µg) and colour is developed by adding ferric nitrate and adjusting the pH to 1-2 with 1:1 HNO_3. The absorbance is measured at 480 nm and the concentration is expressed in $\mu g/l$.

5.2.13 Phenolic compounds

Phenolic compounds in water were estimated by colorometric reaction with 4 – amino antipyrine at a pH of 10.0 ± 0.2 in the presence of potassium

ferricyanide to form a colored antipyrine dye, which was extracted into chloroform. The absorbance measurements were made at 460 nm and Phenol concentrations are expressed in *µg/l*.

5.2.14 Petroleum Hydrocarbons

Dissolved or dispersed petroleum hydrocarbons were extracted from seawater with n-hexane. The extracted materials were accumulated products of oil degradation with possible contribution from non-polar aromatic compounds derived from other sources. Reference materials used for quantifying petroleum hydrocarbons were Chrysene or standard Saudi-Arabian Crude Oil. PHC was estimated by Ultraviolet spectrophotometric method and concentrations are expressed in *µg/l*.

5.3 RESULTS

5.3.1 Water Quality

Baseline data on environmental parameters are prerequisite for understanding any developmental activity to assess the environmental quality before, during and after such an activity. In order to assess the quality of the waters, it is essential to study the spatial and temporal variations of these parameters in the potential impact zone in the coastal waters of the proposed discharge point. The concentrations of hydrochemical characteristics in the marine environment off Gangavaram - Kutukonda are shown in Tables 5.1 and 5.2.

pH Values ranged between 7.91 to 8.08 in the surface and bottom waters of the study area. The variations of pH between surface and bottom waters are

marginal and these values can be compared with that of clean tropical coastal waters.

Dissolved Oxygen (DO) varied between 3.91 mg/l to 6.03 mg/l in the entire study region. High concentrations of DO values and less variations in surface and bottom waters indicate well-oxygenated and well mixed conditions in these coastal waters.

Biochemical Oxygen Demand (BODs) is an empirical biological test in which the water conditions such as temperature, dissolved oxygen and microbial flora play a decisive role. BODs values ranged between 0.16 mg/l to 3.09 mg/l. in the study region indicate that these values are within the primary water quality criteria and do not pose any threat to the environment under present condition. Marginally higher values in surface values in the near shore stations showed the impact of the land discharge.

The total suspended matter (TSM) ranged between 22.8 mg/l to 54.0 mg/l in the study region. Normally bottom waters experience high suspended sediments because of bottom turbulence and churning of the sediments.

The organic chemical constituents viz., phenols and petroleum hydrocarbons are categorized as highly persistent and toxic pollutants in the marine environment. The majority of oil entering the marine environment originates from land based sources including coastal refineries, municipal and industrial waste water discharges, urban run off and river flow. Phenols enter coastal waters through decomposition of attached algae and phytoplankton and waste water discharges from a variety of chemical industries. Thus there is an essential need to check these constituents in the coastal environment under study. The concentrations of Phenols and Petroleum hydrocarbons of the study area are shown in Table 5.1. Petroleum hydrocarbons range between 1.80 to 4.54 *µg/l* and phenols range between 0.8 to 2.8 *µg/l* in the entire study

region. No variation was found in their concentrations between surface and bottom waters and are well within the normal limits of coastal waters.

Nutrients play a vital role in the biogeochemical cycles in the marine environment. The concentrations of nitrite (NO_2 -N) in surface and bottom waters varied between 2.16 µg/l to 7.70 µg/l, while nitrate (NO_3 - N) varied between 6.65 µg/l to 31.8 µg/l, which are within the acceptable limits of coastal environment. Not much variations are noticed between surface to bottom concentrations. Ammonia (NH_4 - N) varied between 4.70 µg/l to 37.6 µg/l in the study region with high concentrations noticed in the near shore stations. High range concentrations of total nitrogen (335 µg/l – 957 µg/l) in the marine environment indicate the impact of organic load from land runoff and other discharges.

Inorganic phosphate (PO_4 -P) is in the range of 1.46 µg/l to 18.8 µg/l in both surface and bottom concentrations while total phosphorus varied between 53.0 µg/l to 125 µg/l in the entire study region. High total nitrogen concentrations to total phosphorus concentrations in the study region indicate the organic load mainly contains nitrogenous compounds rather than phosphorus compounds.

Silicate - Silicon (SiO_4 - Si), one of the major nutrients for phytoplankton growth ranged between 60.5 µg/l to 409 µg/l in surface and bottom waters and during the present study the levels of silicate are within the ambient limits of coastal environment.

Cynides and Thiocynates in the study area are in non detectable concentration levels.

5.3.2 Sediment Quality

Most of the sediments collected in the study region are silty sands. The surficial sediment samples from 12 stations (Fig. 5.1) between 7 and 24 m water depth were collected using a Van Veen grab along 4 transects perpendicular to the coast.

The textural characteristics of these sediments were evaluated. Grain size parameters of the sediments are shown in Table 5.3. The sediments comprise of very fine sands with presence of silt in stations, A3 , B3, & C3. Sand content vary from 61.70 to 97.43% while silt vary from 1.65 to 36.63 %. Token presence of clay is noticed in the samples with silt and the range varies from 0.66 to 1.67%.
The sediments are brown to dark grey in color.

The characteristics of the treated effluents obtained from Visakhapatnam Steel Plant are given in Annexure – I. The ranges of these concentrations are well within the acceptable limits. The tolerance limits for industrial effluents discharged into marine coastal area as per Indian Standards IS2940, part I ISI 1974 are given in Annexure – II.

Table 5.1 Hydro chemical Characteristics in the marine environment off Gangavaram - Kutukonda

Date of Collection : 14.03.2006

Stations	Depth	DO (mg/l)	BOD (mg/l)	pH	TSM (mg/l)	PHC (µg/l)	Phenols
A1	S	5.38	1.14	8.05	23.8	3.63	1.2
	B	5.21	1.30	8.02	27.8	3.21	1.4
A2	S	4.56	1.30	8.07	54.0	4.54	2.2
	B	4.89	0.65	8.00	39.4	4.53	2.4
A3	S	4.89	1.14	8.03	31.4	4.25	2.8
	B	5.86	0.81	8.02	32.2	3.67	2.2
B1	S	5.86	2.44	7.99	27.8	3.07	2.1
	B	6.03	2.28	8.01	30.8	3.09	1.4
B2	S	5.38	1.95	8.08	34.0	3.90	2.0
	B	5.86	1.30	8.05	45.4	3.78	2.2
B3	S	5.21	1.14	8.08	31.0	3.20	2.0
	B	5.38	0.97	8.03	35.4	3.27	0.8
C1	S	5.70	2.93	8.01	30.8	1.82	1.1
	B	4.89	0.16	7.91	44.4	1.80	1.1
C2	S	6.03	2.28	8.05	31.8	2.55	1.4
	B	5.05	0.65	7.99	22.8	2.60	1.5
C3	S	5.86	2.44	8.07	23.2	3.54	2.4
	B	5.54	1.63	8.04	30.2	3.36	2.2
D1	S	6.03	3.09	8.05	33.4	2.85	2.4
	B	5.21	0.98	7.98	26.4	2.45	2.2
D2	S	5.70	2.12	8.06	23.8	3.32	2.6
	B	4.72	0.16	8.02	39.2	2.98	2.5
D3	S	4.07	0.33	7.97	23.8	3.15	2.0
	B	3.91	0.33	7.95	27.2	3.05	1.9

S : Surface B : Bottom

DO : Dissolved Oxygen BOD : Biochemical Oxygen Demand

TSM : Total Suspended Matter PHC : Petroleum Hydro Carbons

Table 5.2 Hydrochemical Characteristics in the marine environment off Gangavaram – Kutukonda

Date of Collection : 14.03.2006

Stations	Depth	NO_2-N (µg/l)	NO_3-N (µg/l)	NH_4-N (µg/l)	TN (µg/l)	PO_4-P (µg/l)	TP (µg/l)	SiO_4-Si (µg/l)	CN (µg/l)	SCN (µg/l)
A1	S	2.77	31.8	11.1	335	2.86	61.3	156	ND	ND
	B	5.24	21.3	21.5	469	4.36	62.6	117	ND	ND
A2	S	2.16	12.2	7.06	507	1.46	66.9	82.8	ND	ND
	B	3.39	21.7	17.8	693	7.16	65.4	118	ND	ND
A3	S	2.16	10.8	10.1	637	2.86	53.0	60.5	ND	ND
	B	2.16	8.40	13.5	683	1.46	73.7	77.8	ND	ND
B1	S	3.08	10.8	31.3	687	7.16	57.0	117	ND	ND
	B	4.31	13.3	22.6	734	10.1	94.8	113	ND	ND
B2	S	2.46	15.0	19.8	637	1.46	55.8	109	ND	ND
	B	2.16	10.8	15.8	627	7.16	53.0	92.8	ND	ND
B3	S	3.08	9.10	8.40	673	5.76	54.2	71.2	ND	ND
	B	3.08	11.5	11.4	776	10.1	75.3	77.8	ND	ND
C1	S	4.31	10.5	4.70	721	7.16	59.8	131	ND	ND
	B	6.47	15.7	32.9	846	7.16	78.1	155	ND	ND
C2	S	3.39	17.5	13.8	413	10.1	65.5	86.8	ND	ND
	B	4.00	13.3	37.6	595	5.76	97.6	99.8	ND	ND
C3	S	2.77	6.65	33.6	465	8.64	75.3	174	ND	ND
	B	2.77	6.65	19.2	493	4.36	62.6	105	ND	ND
D1	S	3.70	14.7	27.2	957	5.76	106	409	ND	ND
	B	6.16	18.9	26.2	627	14.4	125	137	ND	ND
D2	S	3.39	28.0	27.6	627	8.66	118	163	ND	ND
	B	2.70	26.9	29.2	487	11.6	110	221	ND	ND
D3	S	4.31	22.7	29.6	455	15.9	108	215	ND	ND
	B	6.47	25.9	15.5	445	18.8	114	132	ND	ND

S : Surface B : Bottom

NO_2-N : Nitrite-Nitrogen; NH_4-N: Ammonia – N; NO_3-N : Nitrate-Nitrogen

TN : Total Nitrogen; PO_4-P : Phosphate – Phosphorous;

TP : Total Phosporous Sio_4 – Si : Silicate – Silica

CN: cyanide SCN :thiocyanate

Table-5.3 : Grain size parameters of sediments

Station No.	Sand %	Silt %	Clay %	Texture
A1	91.11	7.90	0.99	Sand
A2	94.34	4.79	0.87	Sand
A3	61.70	36.63	1.67	Silty sand
B1	93.65	5.30	1.05	Sand
B2	94.36	4.37	1.27	Sand
B3	65.65	32.81	1.54	Silty sand
C1	87.60	11.44	0.96	Sand
C2	92.88	6.17	0.95	Sand
C3	78.55	20.58	0.87	Silty sand
D1	88.26	11.08	0.66	Sand
D2	97.43	1.65	0.92	Sand
D3	86.84	12.01	1.15	Sand

ANNEXURE - I

Characteristics of the treated effluents

Characteristics	Effluent Analytical value
BOD for 5 days at 20^0 mg/l	50
pH	7.9
Total suspended matter mg/l for process waste water	57
Oil and Grease mg/l	NIL
Phenolic compounds mg/l	NIL
Cyanides (as CN) mg/l	NIL
Sulphides (as S) mg/l	NIL
Fluorides (as F) mg/l	0.5
Residual chlorides mg/l	0.8
Cadmium (as Cd) mg/l	NIL
Nickel (as Ni) mg/l	0.01
Mercury (as Hg) mg/l	NIL
Ammonical Nitrogen, mg/l	1.15
Nitrite – Nitrogen (NO_2 – N) mg/l	0.37
Nitrate – Nitrogen (NO_3 – N) mg/l	0.34
Phosphate – Phosphorus (PO_4 – P) mg/l	0.24
Silicate – Silicon (SiO_4 - Si) mg/l	1.33
Chemical Oxygen Demand, mg/l	185

Annexure - II

TOLERANCE LIMITS OF INDUSTRIAL EFFLUENTS

(Extract from I S : 1968 - 76 - Tolerance limits of Industrial Effluents Discharge in to Marine Coastal area)

Characteristics	Marine Coastal Area IS : 1988
BOD for 5 days at 20° C mg/l, Max.	100
pH	5.5 to 9.0
Total suspended matter mg/l, Max.	—
- for process waste water	100
- for cooling water effluent	Total suspended matter content of influent cooling water plus 10 %
Particle size of :	
- Floatable solids, Max.	3 mm
- Settleable Solids, Max.	850 microns
Temperature	45° C (Max) at the point of discharge
Oil and grease, mg/l, Max.	20
Phenolic compounds, mg/l, Max.	5.0
Cyanides (as CN), mg/l, Max.	0.2
Sulphides (as S), mg/l, Max.	5.0
Fluorides (as F), mg/l, Max.	15
Residual chloride, mg/l	1.0
Insecticides	--
Arsenic (as As), mg/l, Max.	0.2
Cadmium (as Cd), mg/l, Max.	2.0
Chromium, mg/l, Max.	1.0
Copper (as Cu), mg/l, Max.	3.0
Lead (as Pb), mg/l, Max.	1.0
Mercury (as Hg), mg/l, Max.	0.01
Nickel (as Ni), mg/l, Max.	5.0
Selenium (as Se), mg/l, Max.	0.05
Zinc (as Zn), mg/l, Max.	5.0
Ammonical nitrogen, mg/l, Max.	50
Chemical oxygen demand, mg/l, Max.	250
Radioactive materials :	
- Alpha emitters, c/ml, Max.	10^{-8}
- Beta emitters, c/ml, Max.	10^{-7}
Pesticides:	
- Organo-phosphorus compound (as P), mg/l, Max.	1.0
-Chlorinated hydrocarbon (as Cl), mg/l, Max.	0.02

58

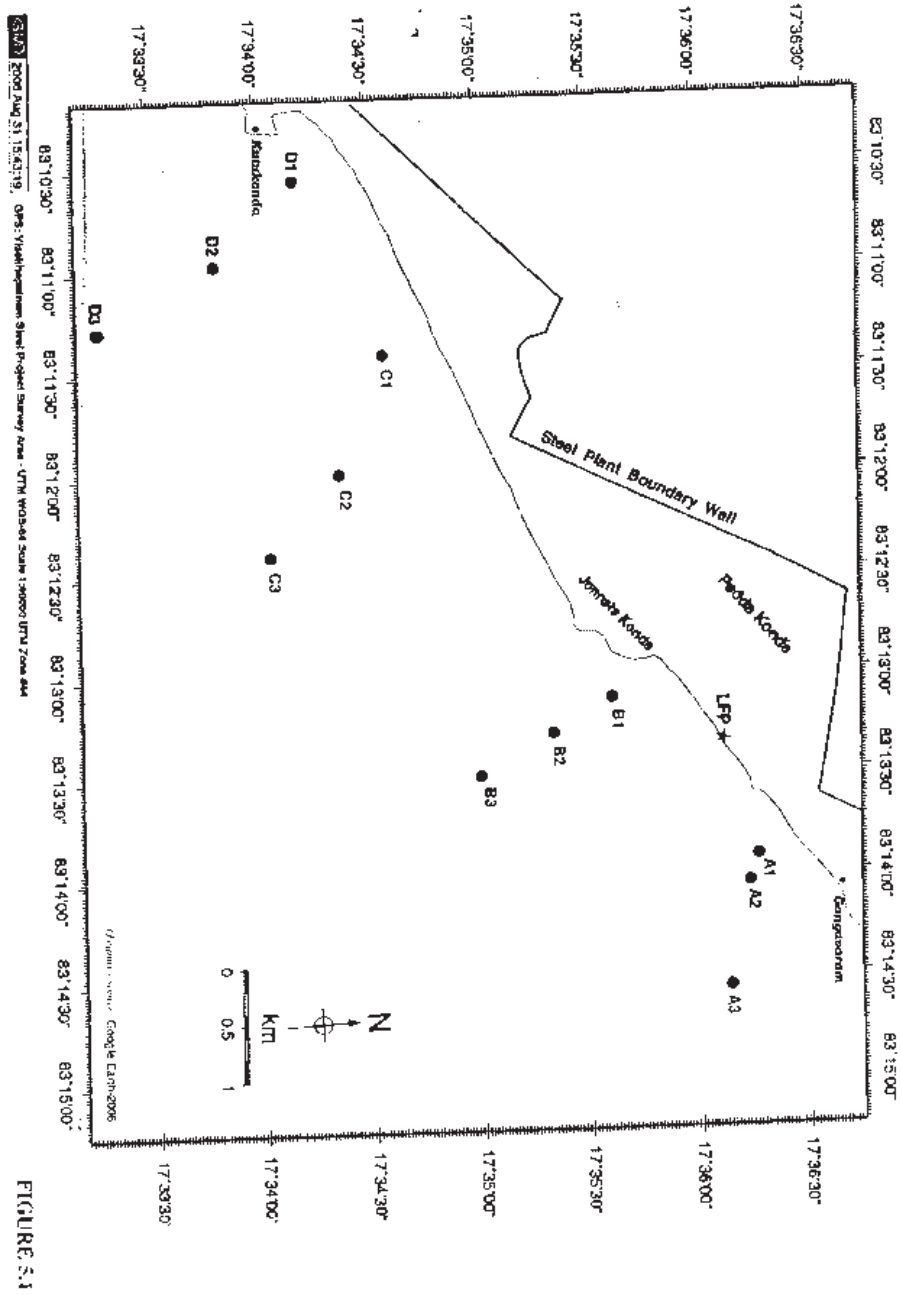


FIGURE 5.1

6. BIOLOGICAL STUDIES

6.1 INTRODUCTION

The inshore coastal waters bear the brunt of all anthropogenic activities and hence, the coastal zone is the ecologically sensitive area and need proper care for development. Any imbalance will lead to major ecological changes, which may affect the local fisheries. In this context, the baseline information acts as a reference and is very useful in the monitoring process. Further, regular monitoring of the aquatic ecosystem is an essential module of environmental monitoring, as it directly records the impact of the environmental disturbance on the biota. Certain planktonic as well as bottom leaving organisms such as copepods, polychaetes, gastropods and bivalves are known as efficient bioaccumulators and to a certain extent, bio-magnify the effects of a single or a combination of metal and other pollutants in space and time. Thus, regular monitoring in space and time or season, generates comparable set of data for seasonal and /or annual cycle and a comparison between the baseline and succeeding set of data, enables to identify and to delineate the qualitative and quantitative changes in biota on seasonal and interannual decadal scale.

With this view, a detailed biological sampling was conducted in the coastal waters off Gangavaram – Kutukonda to generate the baseline information on the planktonic and benthic environment as well as demersal fishery of the area.

6.2 MATERIAL AND METHODS

6.2.1 Phytoplankton

Water samples from surface and bottom were collected for Phytoplankton taxonomy studies using standard water sampling devices. A measured amount of water samples are fixed by adding "Lugol's Iodine". Stored in dark and cool place. Samples were allowed to settle for 02 weeks and concentrated to approximate volume in shore labouratory. 1 ml of each of these concentrates is examined using Sedgwick - Rafter with a Olympus Inverted microscope, using standard reference material.

6.2.2 Chlorophyl *a*

For the estimation of chlorophyll *a* (Chl *a*), one-litre water sample was filtered through GF/C filter paper. Chlorophyll-a and phacophytin were extracted with 90% acetone and concentrations were estimated by using spectrophotometric method.

6.2.3 Zooplankton Studies

The zooplankton samples were collected as horizontal surface tow with a modified Heron-Tranter (HT) net (having 0.25m^2 mouth area and 330µm mesh size) (Plate. 6.1). A calibrated TSK flow meter was fitted at the net mouth to measure the volume of water filtered. All the samples were preserved in 5% neutralized formaldehyde solution. The zooplankton biomass was later estimated by displacement volume method and readings were converted for 100m^3. Different zooplankton taxa were sorted, identified and enumerated under stereoscopic zoom binocular microscope. The numbers were calculated for the whole samples and given for 100m^3 of water

6.2.4 Bottom communities

Sediment samples for benthic study were collected from the intertidal as well near shore subtidal area. Intertidal macro- and meiofaunal samples were collected with a metallic quadrant (25x25x10cm) and hand held acrylic core respectively. Subtidal sediment was collected with a stainless steel van Veen grab covering an area of 0.024m².

6.2.4.1 Meiobenthos

For studying the distribution of meiobenthos, sediment samples were collected from 9 subtidal and 4 intertidal stations. Sub-samples were taken from the grab samples using a hand held acrylic core tube (4.5 cm dia) and preserved in 5% formalin rose-Bengal solution. Triplicate samples were taken at each station. Only the top 0-5 cm sediment was considered for meiobenthos. In the laboratory, meiobenthic samples were passed through a 500 µm and a 62 µm-mesh sieve. The materials retained on the finer mesh were used for analysis of meiobenthos. All organisms were sorted, identified and counted under stereoscopic binocular microscope.

6.2.4.2 Macrobenthos

Duplicate grab samples were taken from each sampling station for macrobenthos and washed through a 500 µm mesh size stainless steel sieve. The material retained on 500 µm was preserved in 10% seawater formalin containing Rose- Bengal stain. In the laboratory, all the samples were again washed through a 500-µm-mesh sieve in running water to clear adhering sediment. Later all the organisms were sorted counted and identified upto species level. Biomass (wet weight) was taken after removing the hard parts and expressed as gm^{-2}.

Matrix of species diversity: Zooplanktonic, microbenthic, meiobenthic and macrobenthic data are analysed following the standard method using the PRIMER (Plymouth Routine in Multivariate Ecological Research) software package, after square root transformation. The univariate measures such as Shanon - Wiener diversity index (H'), species richness (Margalef d) and evenness (J') are calculated.

6.2.5 Microbiological observations

In terms of water quality i.e., total viable counts (TVC), total coliforms (TC) and *Salmonella* like organisms (SLO) were analyzed from water and sediment samples. Mainly on occurrence, species/composition, and their abundance both in water and sediment samples were given priorities. Water samples collected with the pre sterilized glass bottles and the sediments were stored in the fresh UV sterilized polythene bags with the sterile spatula. Samples were brought to the laboratory, and analyzed with minimum delay.

Samples were analyzed for Total Viable Counts (TVC), Total coliforms and *Salmonella* like organisms. Selective medias used to enumerate various total and fecal groups are mentioned below. Standard microbiological methods were followed for serial dilution, plating and incubations. All the analyses were carried out within few hours of collection. Spread plating techniques were used to quantify the bacterial populations. For spread plating techniques 0.1 ml inoculums were directly used for water samples. Sediment samples were serially diluted in 50% seawater to get a countable number and then plated.

6.3 RESULTS

6.3.1 Phytoplankton

During the study period all together 172 different species of phytoplanktons were identified from the coastal waters sampled off the Gangavaram during March 2006 (Tables 6.1a-d). Out of 92 different species of diatoms, 77 different species of Dinoflagellates and 3 different species of other Algae were recorded from the 16 stations taken. The following 15 species were recorded as the major ones : *Pinnularia* sp., *Biddulphia* sp., *Coscinodiscus* sp., *Cylindrotheca* sp., *Gyrosigma* sp., *Navicula* sp., *Paralia* sp., *Alaxandrium* sp., *Prorocentrum* sp., *Protoperidinium* sp., *Gymnodinium* sp., *Gonyaulax* sp., *Pyrophacus* sp., *Scripsciella* sp. and *Trichodesmium* sp. Diatoms dominated the phytoplankton counts at all the stations. The total counts of phytoplankton varied from 0.0800 X10⁴/lit to 0.9270X10⁴/lit. The maximum counts were 0.9270 X10⁴/lit at station D1 surface and the minimum counts was in the bottom water (Table 6.2). In surface waters, counts varied from 0.0900 X 10⁴/lit to 0.9270 X10⁴/lit, and in case of bottom, counts varied from 0.0800 X 10⁴/lit to 0.8050 X 10⁴ / lit. Out of the 15 species, only *Prorocentrum micans, Scripsciella trachoidea, Protoperidinium depressum, Pyrophacus horologium,* and *Trichodesmium erythraeum* were recorded almost from all the stations. Also the statistical analysis of the data showed that the deviation was higher at bottom i.e. 0.064X10⁴/lit to that of surface where it was 0.023X10⁴/lit (Fig. 6.1).

6.3.2 Chlorophyll *a* and phaeo pigments

The values of Chl *a* and phaeo pigment are shown in Table 6.3. Surface Chl *a* range from 0.000 to 3.564 mg/m³ while the bottom values ranges from

0.331 to 6.112 mg/m³. The phaeo pigments varied between ND and 0.841 mg/m³ in the entire study region.

6.3.3 Abundance and distribution of Zooplankton

The population density of zooplankton ranged from 9547 to 51710, nos. 100m⁻³ with a mean value of 26179±14034; n=11 (Table 6.4 & 6.5). The minimum and maximum values were recorded at #C1 and #D2, respectively. Calanoid copepods showed highest mean abundance (12445 nos. 100 m⁻³), followed by harpacticoid copepods (9356 nos. 100 m⁻³) and invertebrate eggs (1809 nos. 100 m⁻³, Table 6.5).

The biomass of zooplankton (expressed as displacement volume) ranged from 1.2 –7.1 ml. 100m⁻³ with an average mean value of 3.0 ± 2.0 ml. 100m⁻³ (Table 6.5). The lowest and highest values were recorded at #C1 and #B3, respectively. High biomass observed at #B3 was mainly due to the higher abundance of *Oithona* sp. (2256 nos. 100 m⁻³). Although high biomass was recorded at #B3, the total density was highest at #D2.

The zooplankton fauna was represented by 48 different taxa belonging to 14 major groups (Table 6.6). Copepoda was the most dominant group (83.2%) as typical of any coastal zooplankton sample and formed the bulk of the population. Among the copepods, calanoids were the most dominant forming 47.5%, followed by cyclopoids with 35.7% and the harpacticoids contributed to a very small percentage of just 0.9%. Among the calanoids, *Centropages* sp. was the most dominant with 10.8% followed by *Centropages furcatus* (6.8%), *Nannocalanus minor* (4.1%), *Eucalanus* sp. (3.9%), *Paracalanus parvus* (3.6%) and immature copepods formed 3.5%. Among the harpacticoids, *Corycaeus* sp. showed the highest density forming 26.7%.

Zooplankton faunal diversity (no.of groups) was highest at #D2 (37.5%) with 18 different taxa and lowest diversity was observed in the vicinity of #C3 and #D3 (18.9%) with only 9 taxa (Table 6.6). Maximum numbers of copepod species were recorded with at #D2 and *Corycaeus* sp. was the most dominant copepod with a density of 15649 nos. 100 m^{-3}. *Nannocalanus minor and Centropages* sp. (3856 nos. 100 m^{-3}) was the next dominant group at #D2. Some of the taxa such as *Centropages* sp. (10.8 %) and *Corycaeus* sp. (26.7%) were recorded at 11 sampling stations (Table 6.5). The zooplankton diversity in terms of number of taxon and percent occurrence is shown in Table 6.6.

Fish eggs were observed at few stations with highest density (680 nos. 100 m^{-3}) at #D2. The sergestid *Lucifer hanseni* was not recorded at any of the station on the #D transect, whereas, Thaliacian, *Salpa* sp. was observed only at #D3 (454 nos. 100 m^{-3}). Invertebrate eggs were recorded at most of the stations with the exception of #A2, #A3 and #D3 (Table 6.7).

Other groups such as Appendicularia (2.7%), Decapoda (2.3%), Chaetognatha (1.6%), (Sergestidae (0.5%), Cladocera (0.4%), Siphonophora (0.3%), Thaliaceae (0.2%), Bivalvia, Polychaeta and Ostracoda (0.1%), were recorded with very low density as compared to the major groups. All these groups together accounted for less than 10% of the total count with copepods forming the bulk of the zooplankton fauna. In the present study, only group Copepoda showed 100% prevalence (Table 6.7).

The maximum species diversity (H') of zooplankton with a value of 2.73 was recorded at #D2 and the minimum (1.79) was at #A3. Both highest and lowest values for species richness were observed at #D2 (2.488) and #D3 (1.069). At #A3, maximum species evenness was recorded with a value of 0.723 and minimum value for this index was observed at #C1 (0.897) (Table 6.8).

6.3.4 Macrofaunal Community

The subtidal macrobenthic community of Steel plant was represented by 85 taxa belonging to 18 major groups. Density value ranged from 70-838no.m^{-2} (mean=282±280). Highest macrobenthic density was recorded at Stn. C2. Lowest density was recorded at Stn. A1 and B1 (Table 6.9). Polychaeta dominated the macrobenthic density with 70% of the total density. The density ranged from 32-643 no.m^{-2} (229±385). Among the Polychaeta, *Prionospio pinnata* dominated with 21 % of the total density (Table 6.10). Highest density of *Prionospio pinnata* was recorded at stn. C2 (333) no.m^{-2}) and lowest at stn. B3 (6 no.m^{-2}). *Prionospio* sp.1 (5 %), *Nephtys* sp. (4%), *Aricidea* sp. (3.25%), *Magelona* sp. (3.25%), *Scolelepsis* sp. (3.1%) were the other dominant Polychaeta species.

Crustacean was the second dominant group with 21 % of the total density. Amphipoda with 14% dominated the crustacean. Unidentified Phoxocephalidae (5.7%) and Ampeliscidae (3.3 %) was the dominant species. Polychaeta dominated in terms of species diversity and contributed to 60% of the total species identified. Nemertinea (3.3%), Cumacea (2%), Isopoda (2%), Mollusca (2 %) were the other dominant macrobenthic groups. Biomass values ranged from 0.01-12.98 no.m^{-2} (2.0±3.6) recorded at #D1 and #C1 respectively (Table 6.10).

Species number ranged from 8- 44 with highest species recorded at stn. C3 and lowest at Stn. B1. Species richness in the area ranged from 1.6-6.5 recorded at Stn. B1 and Stn. C3 respectively (Fig. 6.2). Evenness was highest at Stn. A1 (1) and lowest of 0.69 at Stn. C1. Species diversity was 1.9 at Stn. B1 and highest of 3.16 was at Stn. A3 (Fig. 6.2)

Bray- Curtis similarity showed to major groups at 30%. Group I constituted of Stns. A1, C1 and D1 (Fig. 6.3). Second group constituted of Stns. A2, A3, B2, B3, C2, C3, D2, D3. Stn. B1 did not form any group, however at >20% it merged with Group I. Similarly, the Mean Dimensional Scaling of the community data also showed 2 groups of similar stations (Fig. 6.4). Thus the benthic community data presented in figure 3 and 4 suggest that subtidal benthic fauna off Gagavaram (in the vicinity of Steel Plant), although display a depth-wise zonation (all the shallower stns i.e A1, B1, C1 and D1 were grouped in a major group), separating shallow and deeper sampling locations, however the Bray- Curtis similarity values for the three groups lies well below the demarcated 50% similarity mark. Thus, although the central transect "C" recorded highest density and biomass the difference in the shallow and deeper stations was not significant.

6.3.5 Intertidal macrobenthic fauna

In addition to the subtidal sediment sampling, sampling was also conducted on the intertidal beach near Gangavaram village, near the proposed landfall effluent disposal point to study the composition and abundance of intertidal macrobenthos. Standard quadrant method was employed to sample the macrobenthos. Triplicate quadrant samples were collected respectively from the high-, mid- and low-tide area. Sediment was sieved on the 500 um mesh sieve and material retained on the 500 um mesh was fixed in 10% formalin rose Bengal solution.

Macrobenthic community in the intertidal region was represented by seven taxa (Table 6.11). Polychaeta was the most dominant group, constituting with 54% of the total macrofaunal density followed by crustaceans (35%), ostracods (5%), Nematodes (3%) and bivalves (2%) (Fig. 6.5).

6.3.6 Microbiology

Among all the 12 stations sampled, the total viable count (TVC) in water was ranging from 0 cfu/mlx10^3 to 3.62 cfu/mlx10^3 with C3 station showing highest count. Total colliform count in water was ranging from 0 to 0.57cfu/mlx10^3 to 0.32 cfu/mlx10^3 (Table 6.12) in the study area. Four station samples were positive for salmonella like organisms (SLO).

For sediment samples TVC was ranging from 0 to 4.87 cfu/gmx10^3 with B_2 station showed the highest count.Total colliform (TC) count was ranging from 0 to 0.62 cfu/gmx10^3 (Table 6.13), where in eight samples showed positivity. Four samples were positive for SLO. Overall results show that there is low colliform & SLO count and hence indicates the less fecal inputs.

6.3.7 Fish and Fishery

Fisheries is an important industry of the coastal state of Andhra Pradesh. The information on fish stock and their potential is a vital input in the formulation of strategies for the judicious exploitation and monitoring of this resource. Visakhapatnam is the second largest district of Andhra Pradesh, having 132 km long coastline with the following marine statistics. It has the second

1. Continental shelf area	-	4288 sq. km
2. Fishermen villages	-	61
3. Major Fishing harbour	-	01
4. Marine fishermen population	-	108,000
5. Active fishermen	-	24464

largest fishermen population. There are 117 Primary Fishermen Cooperative societies in the district. There is one fisheries Elementary school for the welfare of fishermen.

The number of boats operating in the district are as follows

1. Trawlers	-	64
2. mini trawlers	-	31
3. Mechanised boats	-	615
4. Sona boats	-	52
5. BLCs	-	546
6. Country crafts	-	2078

6.3.7.1 Exploratory trawling

The experimental fishing was conducted with a fishing trawler of 48 feet length. The trawl net used has a mouth opening of 8.5 m and cod end mesh size of 20 mm. The net was towed at a constant speed of 1.5 knots for one hour. Three trawl of one hour duration each were taken in 10, 20 and 30 m depth zone. The trawl catch was segregated in groups counted for numerical abundance and total weight taken. All samples were identified as far as possible. In addition data on fish landing, total catch, catch rate and fishery potential of the Visakhapatnam was collected from the offices of Joint Director Fisheries, Visakhapatnam and Fishery Survey of India, Visakhapatnam.

Data of the exploratory trawling on Demersal resources collected are given in Table 6.14. The demersal resources of the area (up to 30 m depth) had many variety of fishes and the catch was highest in 10m depth zone. The catch composition revealed occurrence of 16 major groups of fish and crustacean in the area. Prawns, clupeids and Silver bellies were the most dominant group in the catches Prawns were dominated by *Metapenaeus monoceros, M. dobsoni* and non

penaeid prawns. Silver bellies were represented *Leiognathus splendens* and *Secutor* sp. The other species of intreset were Sciaenids, catch fish, ribbon fish and nemipterids. These species contributed more towards biomass.The *Nemipterus mesoprion* was more common in the shallow area and *N. japonicus* was more towards deeper water. The cephalopods were present in all the depth. Interestingly a fair amount of the catch was represented of juveniles which is in conformity of the earlier reports that the coastal waters are used as nursery ground by many fish and crustacea. During the period of the study no endangered species was recorded in the trawl catch from the area.

6.3.7.2 Fisheries exploitation and potential resources of the area

The total marine fish catch of Visakhapatnam district for the years 2000 to 2005 is given in Table 6.15. The catches have shown increasing trend till 2004 and thereafter a decline was noticed. The composition of catches is given in Table 6.16a-b. Among shrimps the penaeid prawns specially the Metapenaeus species dominated the catches. Among fishes clupeids , upenoids, ribbon fish, Sciaenids, pomfrets and cephalopods were main group. The major fishing activities are confined to the limited coastal areas between 0-100 meters. The catches suggest a zonal distribution along different depth contour. According to FSI report the highest catches are recorded in the depth zone 30-50 m. This area may face high fishing pressure. However, more data will be required to draw any inferences on the fisheries trend of the area particularly seasonal and annual variation.

The biomass production of the important species of both pelagic and demersal fisheries resources of Andhra Pradesh is given in Table 6.17. These figures are based on mid water trawl and bottom trawl. The mid water trawl catches were dominated by ribbon fishes, mackerels, silver bellies and clupeiods in the depth zone 30-100 m. Beyond this depth zone the catches were poor. The fishery potential of the present study area for 2003-2005 years is given in

Table 6.16b. In terms of biomass both pelagic and demersal resources are important. The average catch rate of pelagic resources was 29.2 kg/haul in the depth zone 30-100 meter. Similarly the Demersal catch rate was 112.6 kg/haul. The pelagic resources are dominated by silver bellies, seer fish, carangids, ribbon fish and clupeids. The Demersal resources are dominated by upenoids, ribbon fish, perches, shrimps and cephalopods. As reported by FSI there was a clear zonation in the depth distribution of the resources. The depth zone of 50-100 m appeared more productive since the maximum catch recorded from this depth zone. It is also possible that the traditional fishing grounds in the depths of 20-50 m was getting overfished and hence the catches declined in this depth zone. The depth zone 100-200 m showed poor resources. A substantial portion of contribution of marine fish landing in visakhapatnam District comes from the non-mechanized sector.

6.3.7.3 Effect of Project activities on the fisheries of the region:

The treated effluents discharging into the sea may affect the fisheries of the area. The physico-chemical properties of the effluent is governed by the stipulated rules of the State Pollution Control Board and hence is expected to have no toxic effect. The results of toxicity test also shows the non-toxic nature of the effluent. Under such condition the discharge of the effluent is not likely to have any adverse effect on the fisheries.

6.3.8 Fisheries and Socio Economic Impact

The coastal areas of Visakhapatnam District are occupied by scattered villages and is dominated by fishermen community. The total fishermen population of Visakhapatnam district is 1,08,000 of which only 24464 are actively engaged in fishing. Other members of the fishermen community are engaged in

marketing of fish, repairing of nets, processing of fish etc. Under different schemes, the Government of Andhra Pradesh gives subsidy and support the poor and needy fishermen.

The coastal marine fisheries sustain the economy of coastal people since it provides food, employment and income to the local population. Considering that most current landing of fish is harvested from the inner shelf area within 50 m depth, precautionary measures are required to be taken in discharging the industrial effluent. Since the socio-economic condition of the fishermen community is directly dependent on the fisheries of the region, it becomes extremely important to take due care of the living resources while venturing into the industrialization and urbanization of the area. Any change due to the anthropogenic activities including pollution may affect the delicate ecological balance of the area and ultimately lead to socio-economic problem among the poor fishermen community. It is recommended that the concentration of chemicals constituents in the treated effluent must be kept at the minimum level to have no effect on the fisheries. Regular monitoring of the treated effluent before discharging into sea must also carried out.

Table 6.1a Phytoplankton diversity along Transect A of the study area

S.No.	Genera/ species	A1		A2		A3	
		Surface	Bottom	Surface	Bottom	Surface	Bottom
	Diatoms						
1.	*Acanthochiasma serulata*	+	-	-	-	-	-
2.	*Actinoptychus senarius*	-	-	-	+	-	-
3.	*Amphiprora surirelloides*	-	+	-	-	-	-
4.	*Biddulphia aurita*	+	+	+	+	-	-
5.	*Biddulphia mobiliensis*	+	+	-	-	-	-
6.	*Biddulphia regia*	-	+	-	-	-	-
7.	*Cerataulina turgidus*	+	-	-	-	-	-
8.	*Chaetoceros gracile*	+	-	-	-	-	+
9.	*Chaetoceros subtile*	+	-	-	-	-	
10.	*Coscinodiscus welsii*	-	+	-	-	-	-
11.	*Cylinderotheca closterium*	+	-	+	-	-	-
12.	*Diplonies bombus*	-	-	-	+	-	-
13.	*Diplonies crabro*	-	+	-	-	-	-
14.	*Diplonies chersonensis*	-	+	-	-	-	-
15.	*Diplonies fusca*	+	-	-	-	-	-
16.	*Ditylum brightwelli*	+	+	-	-	-	-
17.	*Gyrosigma balticum*	+	-	+	-	-	-
18.	*Gyrosigma fasciolum*	+	-	-	-	-	-
19.	*Gyrosigma littorale*	+	+	-	-	-	-
20.	*Leptocylindrus mininus*	+	-	-	-	-	-
21.	*Melosira moniliformis*	+	+	+	+	-	-
22.	*Navicula clementis*	-	-	-	+	+	+
23.	*Navicula directa*	-	+	-	-	-	+
24.	*Navicula maculosa*	+	+	+	+	-	-
25.	*Navicula membranaceae*	+	-	-	-	-	-
26.	*Nitzschia accuminata*	+	+	-	-	-	-
27.	*Nitzschia frigida*	+	-	-	-	-	-
28.	*Nitzschia sigma*	+	-	-	-	+	+
29.	*Paralia sulcata*	+	+	-	+	-	-
30.	*Pinnularia rectangulata*	+	-	-	-	-	-
31.	*Plagiogrammopsis vanheurckii*	-	+	-	-	-	-
32.	*Pluerosigma elongatum*	+	-	-	-	-	-
33.	*Rhizosolenia imbricata*	-	-	-	-	-	+
34.	*Rhizosolenia setigera*	+	-	-	+	+	-
35.	*Stephanopyxis nipponis*	-	+	-	-	-	
36.	*Surirella smithii*	+	-	-	-	-	-
37.	*Thalassiothrix frauenfeldi*	+	-	-	+	-	-
	Dinoflagellates						
38.	*Alaxandrium ostenfeldii*	+	-	+	+	+	+
39.	*Amphidoma sp.*	-	-	+	+	-	+
40.	*Amphidoma nanum*	+	-	-	-	-	-
41.	*Ceratium boelunii*	+	-	-	-	-	-
42.	*Ceratium furca*	+	-	-	+	+	+
43.	*Gonyaulax brevisulcatum*	-	-	+	-	-	-
44.	*Gonyaulax brunni*	-	-	-	-	+	-

45.	*Gonyaulax digitalne*	+	-	-	-	-	-
46.	*Gonyaulax kofoidii*	-	-	-	-	-	+
47.	*Gonyaulax pavillardii*	-	-	-	+	-	-
48.	*Gymnodinium sp.*	+	-	-	+	-	-
49.	*Gymnodinium breve*	-	-	-	+	-	-
50.	*Gymnodinium gracile*	-	-	-	-	+	+
51.	*Gymnodinium spirale*	+	+	-	-	-	+
52.	**GYRODINIUM SPIRALE**	-	-	+	+	+	-
53.	*Heterocapsa triquetra*	-	-	-	-	+	-
54.	*Ornithocercus quadratus*	-	-	-	-	+	-
55.	*Oxyloxum nanum*	-	-	-	+	+	-
56.	*Oxytoxum parvum*	+	-	-	-	-	-
57.	*Peridinium recticulatum*	+	-	-	+	-	-
58.	*Prorocentrum gracile*	-	+	+	+	+	+
59.	*Prorocentrum micans*	+	+	+	+	+	-
60.	*Prorocentrum minimus*	+	-	+	-	-	-
61.	*Protoperidinium conicum*	-	-	+	-	-	-
62.	*Protoperidinium sournaii*	+	-	-	+	+	-
63.	*Protoperidinium sternii*	+	-	-	-	-	+
64.	**PYROPHACUS HOROLOGIUM**	+	-	+	+	-	-
65.	*Pyrophacus steinii*	+	-	-	-	-	-
66.	*Scripsiella trochoidea*	+	+	+	+	+	+
	Other algae						
67.	*Trichodesmium erythraeum*	+	+	+	-	-	-
68.	*Trichodesmium thibautti*	-	-	-	-	+	-

Table 6.1b Phytoplankton diversity along Transect B of the study area

S.No.	Genera/ species	B1		B2		B3	
		Surface	Bottom	Surface	Bottom	Surface	Bottom
	Diatoms						
1.	*Acanthochiasma fusiformis*	-	-	-	-	+	-
2.	*Bacillaria paxillifer*	-	+	-	-	-	-
3.	*Bacteriastrum delicatula*	-	-	-	-	-	+
4.	*Biddulphia aurita*	-	+	-	-	-	-
5.	*Biddulphia mobiliensis*	-	+	-	-	-	-
6.	*Biddulphia regia*	+	+	-	+	-	-
7.	*Chaetoceros affine*	-	-	-	-	-	-
8.	*Coscinodiscus eccentricus*	-	+	-	-	-	-
9.	**COSCINODISCUS GRANII**	-	-	-	+	-	-
10.	*Coscinodiscus nitidus*	-	+	-	-	-	+
11.	*Cylinderotheca closterium*	-	-	-	-	-	-
12.	*Ditylum brightwelli*	+	+	-	-	-	-
13.	*Gyrosigma balticum*	-	+	-	-	-	-
14.	*Leptocylindrus danicus*	-	-	+	-	-	-

15.	*Leptocylindrus minimus*	-	-	-	-	+	-
16.	*Melosira moniliformis*	+	+	+	-	-	-
17.	*Navicula clementis*	+	+	+	+	-	-
18.	*Navicula hennedyii*	-	+	+	+	-	-
19.	*Navicula maculosa*	-	+	-	-	-	+
20.	*Navicula sp.1.*	-	-	-	+	-	-
21.	*Nitzschia accuminata*	-	+	-	-	-	-
22.	*Nitzschia sigma*	-	-	+	-	-	-
23.	*Paralia sulcata*	+	+	+	+	-	+
24.	*Pinnularia ambigua*	+	+	-	-	-	-
25.	*Pinnularia rectangulata*	-	+	-	+	-	-
26.	*Pleurosigma elongatum*	-	+	-	-	-	-
27.	*Pseudo-nitzschia seriata*	-	-	-	-	+	-
28.	*Rhizosolenia delicatula*	-	-	+	-	-	-
29.	*Rhizosolenia setigera*	-	-	+	-	+	-
30.	*Skeletonema costatum*	-	-	-	-	+	-
31.	*Thalassiothrix frauenfeldi*	-	-	-	-	+	+
32.	*Thalassiothrix longissima*	-	-	+	-	+	-
	Dinoflagellates						
33.	*Alexandrium ostenfeldii*	+	+	+	+	+	-
34.	*Amphidoma sp.*	-	-	-	-	+	-
35.	*Amphidinium sp.*	+	-	-	-	-	-
36.	*Amylax tricantha*	-	+	-	-	-	-
37.	*Centrodinium sp.*	-	-	-	+	-	-
38.	*Ceratium boehmii*	-	-	-	-	+	-
39.	*Ceratium furca*	+	-	-	+	-	-
40.	*Ceratium lineatum*	-	-	+	-	-	-
41.	*Dinophysis caudata*	+	-	-	-	-	-
42.	*Gonyaulax brevisulcatum*	+	+	-	-	+	-
43.	*Gonyaulax nolneri*	-	-	-	+	-	-
44.	*Gonyaulax pacifica*	+	-	+	-	-	+
45.	*Gymnodinium sp.*	+	-	-	-	-	-
46.	*Gymnodinium breve*	-	+	-	-	-	-
47.	*Gymnodinium gracile*	+	-	-	-	-	-
48.	*Gymnodinium spirale*	+	-	-	+	-	-
49.	**GYRODINIUM SPIRALE**	-	-	+	-	-	+
50.	*Heterodinium tripetra*	-	-	-	+	-	-
51.	*Oxytoxum nanum*	-	-	+	+	-	-
52.	*Oxytoxum parvum*	+	-	-	-	-	-
53.	*Peridinium sp.*	+	-	-	-	-	-
54.	*Prorocentrum cordatum*	-	-	-	-	-	+
55.	*Prorocentrum gracile*	-	+	+	+	-	-
56.	*Prorocentrum micans*	+	+	+	+	+	-
57.	*Prorocentrum minimus*	+	+	+	+	+	-
58.	*Protoperidinium sournaii*	+	-	+	+	-	-
59.	*Protoperidinium sternii*	+	-	-	-	-	-
60.	*Protoperidinium subinerme*	-	-	-	-	-	+
61.	**PYROPHACUS HOROLOGIUM**	+	+	+	+	-	-

62.	*Pyrophacus steinii*	+	-	-	-	-	-
63.	*Scripsiella trochoidea*	+	-	+	+	+	-
	Other algae						
64.	*Trichodesmium erythraeum*	-	-	+	-	+	+
65.	*Trichodesmium thiebautii*	+	-	+	-	+	+

Table 6.1c Phytoplankton diversity along Transect C of the study area

S.No.	Genera/ species	C1		C2		C3	
	Diatoms	Surface	Bottom	Surface	Bottom	Surface	Bottom
1.	*Acanthochiasma fusiformis*	-	-	-	+	-	-
2.	*Actinoptychus senarius*	-	+	-	-	-	-
3.	*Amphiprora surirelloides*	+	-	-	-	-	-
4.	*Bacteriastrum furcata*	-	-	-	+	-	-
5.	*Biddulphia aurita*	-	+	-	-	-	-
6.	*Biddulphia mobiliensis*	+	+	-	-	-	-
7.	*Biddulphia regia*	+	+	+	+	-	-
8.	*Chaetoceros compressum*	-	-	+	-	-	-
9.	*Chaetoceros curvisetum*	-	-	-	-	-	+
10.	*Chaetoceros gracile*	-	+	-	-	-	-
11.	*Chaetoceros perpusillum*	-	+	-	-	-	-
12.	*Chaetoceros sociale*	+	-	-	-	-	-
13.	*Cocconies sublitoralis*	-	+	-	-	-	-
14.	*Coscinodiscus eccentricus*	+	+	-	+	-	-
15.	*Coscinodiscus nitidus*	+	+	-	-	-	-
16.	*Coscinodiscus oculus*	-	-	-	-	-	+
17.	*Coscinodiscus welsii*	-	+	-	-	-	-
18.	*Cylinderotheca closterium*	+	+	+	+	-	-
19	*Ebria tripartita*	+	-	-	-	-	
20.	*Gyrosigma balticum*	+	-	-	-	-	-
21.	*Gyrosigma fasciculum*	+	-	-	-	-	-
22.	*Gyrosigma littorale*	-	+	-	+	-	+
23.	*Leptocylindrus minimus*	-	+	-	+	+	-
24.	*Melosira moniliformis*	-	+	-	-	-	-
25.	*Navicula clavata*	-	-	-	+	-	
26.	*Navicula crucigera*	-	-	+	-	-	-
27.	*Navicula levidensis*	+	+	-	-	-	-
28.	*Navicula peregrina*	-	+	+	-	-	-
29.	*Navicula sp.1.*	-	-	-	+	-	-
30.	*Nitzschia frigida*	-	+	+	+	-	-
31.	*Nitzschia sigma*	-	-	-	+	-	-
32.	*Nematodinium armatum*	-	-	-	+	-	-
33.	*Paralia sulcata*	+	+	+	+	-	-
34.	*Pinnularia ambigua*	-	-	-	-	+	-

35.	*Pinnularia rectangulata*	+	+	+	+	-	+
36.	*Planktoniella sol*	-	-	-	-	-	-
37.	*Pleurosigma elongatum*	-	+	-	-	-	-
38.	*Rhizosolenia setigera*	-	-	-	-	+	-
39.	*Stephanopyxis palmeriana*	-	-	-	-	-	+
40.	*Suriella gmithii*	-	+	-	-	-	-
41.	*Suriella ovata*	-	+	-	-	-	-
42.	*Synendra hennedyana*	-	-	-	+	-	-
43.	*Thalassiosira subtilis*	-	+	-	-	-	-
44.	*Thalassiothrix frauenfeldi*	+	+	-	-	-	+
	Dinoflagellates						
45.	*Alaxandrium ostenfeldii*	-	-	+	+	+	-
46.	*Amphidoma navum*	-	+	+	+	-	-
47.	**BALACHINA COERULEA**	-	-	+	-	-	-
48.	*Ceratium armata*	-	-	-	-	+	-
49.	*Ceratium furca*	-	-	-	+	-	+
50.	*Gonyaulax brevisulcatum*	+	-	+	-	-	-
51.	*Gonyaulax kofoidii*	-	-	+	-	+	-
52.	*Gymnodinium sp.*	-	+	-	-	-	-
53.	*Gymnodinium breve*	-	-	+	-	-	+
54.	*Gymnodinium splendens*	-	-	-	+	-	+
55.	**GYMNODINIUM SPIRALE**	-	-	-	+	-	-
56.	*Heterocapsa triquetra*	-	+	-	-	-	-
57.	*Heteroaulacus polyedricus*	-	+	-	-	-	-
58.	*Heteroaulacus sphaericus*	-	-	+	-	-	+
59.	*Kofoidinium laboure*	-	-	-	-	-	+
60.	*Ornithoceros quadratus*	-	-	+	-	-	+
61.	*Oxytoxum parvum*	-	-	-	+	-	-
62.	*Oxytoxum scolopax*	-	-	-	-	+	-
63.	*Peridinium orientale*	-	+	-	-	-	-
64.	*Peridinium recticulatum*	-	-	-	-	+	-
65.	*Podolampus palmipes*	-	+	-	-	-	-
66.	*Prorocentrum cordatum*	+	+	+	+	-	+
67.	*Prorocentrum gracile*	+	+	+	+	+	+
68.	*Prorocentrum micans*	+	+	-	-	-	-
69.	*Prorocentrum mininus*	-	-	-	+	-	-
70.	*Protoperidinium biconicum*	-	-	+	-	-	-
71.	*Protoperidinium depressum*	-	-	-	-	-	-
72.	*Protoperidinium paradoxum*	+	-	+	-	-	-
73	*Protoperidinium sournaii*	-	-	-	+	-	-
74.	*Protoperidinium sternii*	-	+	-	-	-	-
75.	**PYROCYSTIS NOCTILUCA**	+	+	+	+	+	-
76	*Pyrophacus horologium*	-	+	+	+	-	+
77.	*Scripsiella trochoidea*						
	Other algae						
78.	*Trichodesmium erythraeum*	+	-	+	+	+	+

Table 6.1d Phytoplankton diversity along Transect D of the study area

S.No.	Genera/ species	D1		D2		D3	
	Diatoms	**Surface**	**Bottom**	**Surface**	**Bottom**	**Surface**	**Bottom**
1.	*Acnanthus longipes*	+	-	-	-	-	-
2.	*Acnathochlasma serulata*	+	-	-	-	-	-
3.	*Actinoptychus senarius*	-	+	-	-	-	-
4.	*Amphiprora surirelloides*	-	-	-	+	-	-
5.	*Bacillaria paxillifer*	-	-	-	+	-	-
6.	*Bacteriastrum delicatuin*	-	-	-	+	-	-
7.	*Biddulphia aurita*	+	+	-	+	-	-
8.	*Biddulphia mobiliensis*	-	+	-	-	-	-
9.	*Biddulphia regia*	-	+	-	-	-	-
10.	*Biddulphia sinensis*	-	-	-	+	-	-
11.	*Chaetoceros coarctatum*	-	+	-	-	-	-
12.	*Chaetoceros filiforme*	-	-	-	-	-	+
13.	*Coscinodiscus centralis*	+	+	-	-	-	-
14.	*Coscinodiscus eccentricus*	-	-	-	-	-	+
15.	*Coscinodiscus welsii*	-	-	-	+	-	-
16.	*Cylinderotheca closterium*	-	+	+	+	+	+
17.	*Diplonies crabro*	+	+	+	-	-	-
18.	*Ditylum brightwelli*	-	+	-	-	-	-
19.	*Gyrosigma bolticum*	+	-	-	-	-	-
20.	*Gyrosigma fascicolum*	-	-	-	-	-	+
21.	*Gyrosigma littorale*	-	+	-	+	-	-
22.	*Melosira moniliformis*	+	+	+	+	-	+
23.	*Navicula clementis*	+	+	+	-	-	-
24.	*Navicula maculosa*	+	+	-	+	+	+
25.	*Navicula membranaceae*	-	-	+	-	-	-
26.	*Nitzschia accuminata*	-	+	-	-	-	-
27.	*Nitzschia frigida*	-	+	-	-	-	-
28.	*Nitzschia sigma*	-	-	-	+	+	+
29.	*Paralia sulcata*	-	+	-	+	+	-
30.	*Pinnularia ambigua*	+	+	-	-	-	-
31.	*Pinnularia rectangulata*	-	+	+	-	-	-
32.	*Plagiogrammopsis vanheurckii*	-	-	+	-	-	-
33.	*Pluerosigma angulatum*	-	+	-		-	-
34.	*Pluerosigma aestuarii*	-	+	-	-	-	-
35.	*Rhizosolenia setigera*	-	+	+	+	-	+
36.	*Rhizosolenia robusta*	-	-	-	-	+	-
37.	*Skeletonema costatum*	-	-	-	+	-	-
38.	*Suriella smithii*	-	+	-	-	-	-
39.	*Suriella ovata*	-	+	-	-	-	-
40.	*Thalassiosira subtilis*	-	+	-	-	-	-
41.	*Thalassiothrix frauenfeldi*	+	+	-	+	-	+
	Dinoflagellates						
42.	*Alaxandrium ostenfeldii*	-	+	+	-	+	-
43.	*Amylax tricantha*	-	+	-	-	-	-
44.	*Ceratium furca*	-	+	+	-	-	-

45.	*Dinophysis caudata*	-	+	-	-	-	-
46.	*Gonyaulax brevisulcatum*	+	-	-	-	+	-
47.	*Gonyaulax brunni*	-	+	+	-	-	-
48.	*Gonyaulax glyptorhynchus*	-	+	-	-	-	-
49.	*Gonyaulax milneri*	+	-	-	-	-	-
50.	*Gonyaulax pacifica*	-	-	+	-	-	-
51.	*Gymnodinium gracile*	-	+	-	-	-	-
52.	*Gymnodinium splendens*	-	+	-	-	-	-
53.	*Gymnodinium spirale*	-	+	+	-	-	-
54.	*Helerocapsa triquetra*	-	-	-	-	+	-
55.	*Prorocentrum gracile*	+	+	+	-	-	-
56.	*Prorocentrum micans*	+	+	+	+	-	-
57.	*Prorocentrum minimus*	+	+	+	-	-	+
58.	*Prorocentrum veloi*	-	-	-	-	-	+
59.	*Protoceratium spinulosum*	+	+	-	-	-	-
60.	*Protoperidinium depressum*	+	+	+	-	-	-
61.	*Protoperidinium sourrati*	+	+	-	-	-	-
62.	*Pyrocystis noctiluca*	-	-	-	+	-	-
63.	PYROPHACUS HOROLOGIUM	+	+	+	+	+	+
64.	*Scripsiella trochoidea*	+	+	+	+	+	+
	Other algae						
65.	*Trichodesmium erythraeum*	-	-	+	-	+	+
66.	*Trichodesmium thiebautii*	-	-	-	-	+	+

Table 6.2 Total phytoplankton cell counts of the study area

St No.	Surface (Cells x 10^4 / lt)	Bottom (Cells x 10^4 / lt)
A1	0.7080	0.3960
A2	0.3870	0.6000
A3	0.1400	0.1320
B1	0.5530	0.3300
B2	0.3540	0.2160
B3	0.4440	0.1680
C1	0.3520	0.7650
C2	0.3440	0.7600
C3	0.1920	0.1800
D1	0.9270	0.8050
D2	0.2520	0.1920
D3	0.3200	0.1960

Table 6.3 Chlorophyll-a and Phaeo Pigments in the marine environment of the study area

Station	Depth	Chl-a ($mg.m^{-3}$)	PP ($mg.m^{-3}$)
A1	S	0.864	ND
	B	1.908	ND
A2	S	0.178	ND
	B	1.220	ND
A3	S	0.000	0.000
	B	0.331	ND
B1	S	0.711	ND
	B	1.730	ND
B2	S	0.711	ND
	B	0.711	ND
B3	S	0.000	ND
	B	0.840	0.000
C1	S	3.564	0.841
	B	4.761	ND
C2	S	1.706	ND
	B	1.042	0.104
C3	S	1.018	0.040
	B	0.533	ND
D1	S	1.171	0.200
	B	6.112	0.681
D2	S	1.244	ND
	B	0.711	ND
D3	S	1.399	ND
	B	0.711	0.160

Table 6.4 Density (nos.100 m^{-3}), Biomass (ml/100m^3) and Dominant groups of zooplankton of the study area

Area	No.of Obs.	DENSITY			BIOMASS		
		Min	Max	Average	Min	Max	Average
Off Gangavaram	11	9547	51710	26179	1.2	7.1	3.0

Table 6.5 Composition and abundance (nos.100 m^{-3}) of zooplankton of the study area

Taxon	A1	A2	A3	B1	B2	B3	C1	C2	C3	D2	D3	Mean	SD	%
Appendicularia														
Oikopleura thin	609	0	0	365	326	0	0	186	3432	907	683	592	993	2.3
Oikopleura flat	0	0	0	547	163	564	0	0	0	0	0	116	223	0.4
Bivalvia	0	0	0	0	0	0	0	0	172	0	0	16	52	0.1
Cladocera														
Evadne tergestina	0	0	0	0	0	0	0	186	172	680	0	94	207	0.4
Copepods														
CALANOIDA														
Acartia spinicauda	1015	0	0	0	489	0	0	0	0	0	0	137	326	0.5
Acartia sp.	1421	0	0	1460	0	1410	749	1118	686	1134	0	725	626	2.8
Nannocalanus minor	609	698	136	0	0	1410	749	932	3432	3856	0	1075	1350	4.1
Nannocalanus sp.	203	0	0	1095	1141	0	0	0	686	0	455	326	453	1.2
Clausocalanus sp.	609	0	0	1642	1304	1410	187	0	0	227	0	489	649	1.9
Calocalanus sp.	0	0	0	182	0	0	0	0	0	0	0	17	55	0.1
Arrocalanus sp.	1218	0	949	0	0	0	0	0	0	0	228	218	437	0.8
Paracalanus parvus	0	2326	1220	1277	0	0	1310	932	0	2948	228	931	1016	3.6
Paracalanus sp.	0	0	0	730	0	1692	0	0	0	0	0	220	535	0.8
Eucalanus sp.	203	1860	0	912	2446	564	0	373	0	4990	0	1032	1548	3.9
Subeucalanus sp.	0	0	0	0	0	0	0	0	0	1134	0	103	342	0.4
Centropages furcatus	0	698	678	5474	0	3102	187	1305	2059	3856	2276	1785	1775	6.8
Centropages sp.	203	2093	1356	1825	7011	7050	374	1118	7379	2268	455	2830	2855	10.8
Pseudodiaptomous sp.	0	465	542	0	7174	0	0	0	0	0	0	744	2142	2.8
Pleuromamma robusta	0	0	0	0	0	0	0	0	172	0	0	16	52	0.1
Labidocera acuta	0	0	136	0	0	0	0	0	0	227	0	33	76	0.1
Labidocera sp.	203	0	0	0	163	0	0	186	0	0	0	50	86	0.2
Scolecitrix sp.	0	233	0	547	0	0	187	0	0	227	0	109	176	0.4
Temora stylifera	0	0	0	0	163	0	0	1305	0	0	0	133	392	0.5
Temora turbinata	0	0	0	0	0	0	0	746	0	454	3186	399	957	1.5
Tortanus gracilis	203	0	0	0	0	0	0	0	0	0	0	18	61	0.1
Unidentified Tortanus	1623	0	0	0	0	0	0	0	0	0	0	148	489	0.6
Immature calatnoid copepods	1015	1395	0	1277	2935	3384	0	0	0	0	0	910	1248	3.5
CYCLOPOIDA														
Corycaeus robustus	0	0	0	0	0	0	0	186	0	227	0	38	84	0.1
Corycaeus sp.	1826	9302	6100	3832	10109	12126	1498	4660	7894	15649	3869	6988	4472	26.7
Farranula gibbula	0	465	407	0	0	1128	187	0	0	0	0	199	354	0.8
Farranula sp.	0	465	136	0	326	0	0	186	686	0	0	164	235	0.6
Oithona brevicornis	0	0	0	0	163	0	0	0	0	0	0	15	49	0.1
Oithona similis	812	0	0	0	0	0	0	373	0	2041	0	293	634	1.1
Unidentified Oithona	0	698	0	0	0	2256	1123	0	0	227	0	391	722	1.5
Oncaea venusta	0	0	0	0	0	0	0	0	0	0	228	21	69	0.1

Oncaea sp.	3856	1163	949	2190	1304	564	936	559	172	2041	0	1248	1103	4.8
HARPACTICOIDA														
Microsetella rosea	0	0	0	0	326	0	374	0	0	227	0	84	148	0.3
Euterpina acutifrons	203	0	0	182	0	0	187	0	0	680	0	174	207	0.4
Miracia efferata	406	0	0	0	0	0	0	0	0	0	0	37	122	0.1
Chaetognatha														
Sagitta sp.	1421	0	136	547	0	0	187	0	686	1361	228	415	534	1.6
Decapoda														
Macruran larvae	1015	0	0	365	978	1692	0	373	0	1814	455	608	674	2.3
Fish eggs	0	0	0	912	0	0	187	0	172	680	0	177	318	0.7
Fish larvae	0	0	0	0	0	0	0	0	0	227	0	21	68	0.1
Invertebrate eggs	1826	0	0	547	2283	4230	936	373	7207	2495	0	1809	2235	6.9
Sergestidae														
Lucifer hanseni	0	465	0	730	0	0	0	186	0	0	0	126	247	0.5
Ostracoda														
Cypridina sp.	0	0	0	0	0	0	0	186	172	0	0	33	72	0.1
Polychaeta larvae	0	0	0	0	0	0	0	186	0	0	0	17	56	0.1
Siphonophora														
Diphyes sp.	0	0	0	0	0	0	0	0	0	227	0	21	68	0.1
Lensia sp.	0	0	0	0	0	0	187	0	0	454	0	58	143	0.2
Thaliaceae														
Salpa sp.	0	0	0	0	0	0	0	0	0	454	0	41	137	0.2
Total density nos./100m3	20496	22326	12742	26639	38804	42583	9547	15656	35179	51710	12290	26179	14034	100.0
Biomass ml/100m3	2.0	1.9	5.9	3.4	2.7	7.1	1.2	1.6	2.9	6.6	2.7	3	2	0.0

Table 6.6 Zooplankton diversity in the study area

Station	Diversity (No. of groups)	% Diversity
#A1	17	35.4
#A2	13	27.1
#A3	10	20.8
#B1	15	31.3
#B2	14	29.2
#B3	12	25.0
#C1	13	27.1
#C2	14	29.2
#C3	9	18.8
#D2	18	37.5
#D3	9	18.8

Table 6.7 Composition and mean abundance (nos.100 m^{-3}) of major zooplankton groups in the study area

Taxon	A1	A2	A3	B1	B2	B3	C1	C2	C3	D2	D3	Mean	% Prevalence
Appendicularia	609	0	0	912	489	564	0	186	3432	907	683	708	73
Bivalvia	0	0	0	0	0	0	0	0	172	0	0	16	9
Cladocera	0	0	0	0	0	0	0	186	172	680	0	94	27
Copepoda	19626	21860	12607	22625	35054	36097	8049	13979	23167	42411	10924	22036	100
Chaetognatha	1421	0	136	547	0	0	187	0	686	1361	228	415	64
Decapoda	1015	0	0	365	978	1692	0	373	0	1814	455	608	64
Pisces	0	0	0	912	0	0	187	0	172	907	0	198	36
Invertebrate eggs	1826	0	0	547	2283	4230	936	373	7207	2495	0	1809	73
Sergestidae	0	465	0	730	0	0	0	186	0	0	0	126	27
Ostracoda	0	0	0	0	0	0	0	186	172	0	0	33	18
Polychaeta larvae	0	0	0	0	0	0	0	186	0	0	0	17	9
Siphonophora	0	0	0	0	0	0	187	0	0	680	0	79	18
Thaliaceae	0	0	0	0	0	0	0	0	0	454	0	41	9
Total density nos/100m^3	19888	22326	12742	25727	38315	42019	9547	15470	31747	50803	11607	25472	
Biomass ml/100m3	2	2	6	3	3	7	1	2	3	7	3	3	

Table 6.8 Diversity indices for zooplankton of the study area

Sample	d	J'	H'
#A1	2.015	0.8945	2.614
#A2	1.298	0.7774	2.052
#A3	1.164	0.7228	1.796
#B1	1.963	0.8802	2.68
#B2	1.609	0.7611	2.2
#B3	1.313	0.8476	2.295
#C1	1.746	0.8966	2.54
#C2	2.071	0.8309	2.53
#C3	1.338	0.7571	2.05
#D2	2.488	0.7845	2.723
#D3	1.062	0.7708	1.848

Table 6.9 Macrofaunal group density and biomass in the study area.

TAXA	A1	A2	A3	B1	B2	B3	C1	C2	C3	D1	D2	D3	Mean	SD	%
Foramnifera	0	0	0	0	0	0	0	0	0	0	0	19	1.6	5.5	0.5
Hydroid	0	0	0	0	0	0	13	0	0	0	0	0	1.07	3.7	0.3
Nemertinea	6	32	16	0	0	0	0	45	6	6	6	13	10.9	14.1	3.3
Sipuncula	0	0	13	0	3	0	0	6	13	0	0	6	3.47	5.0	1.1
Phoronida	0	0	0	0	3	0	0	6	0	0	0	0	0.8	2.0	0.2
Polychaeta	38	51	256	51	160	218	256	544	643	32	339	154	229	384.8	69.7
Oligochaeta	0	0	0	0	0	0	0	58	0	0	0	0	4.8	16.6	1.5
Bivalvia	6	0	3	0	3	0	13	0	0	6	6	0	3.2	7.9	1.0
Gastropoda	0	19	0	0	3	0	13	6	3	0	0	0	3.73	11.1	1.1
Amphipoda	19	147	10	6	16	19	38	147	42	26	13	77	46.7	84.5	14.2
Isopoda	0	19	13	6	0	0	0	13	6	0	13	0	5.87	6.9	1.8
Cumacea	0	32	0	0	10	3	0	6	3	6	6	13	6.67	9.0	2.0
Decapoda	0	13	0	0	10	22	0	0	10	0	6	0	5.07	10.0	1.5
Mysidaceae	0	6	0	0	0	0	0	0	0	0	0	0	0.53	1.8	0.2
Tanaidacea	0	0	3	0	3	0	0	6	6	0	13	0	2.67	4.1	0.8
Stomatopoda	0	0	6	0	0	0	0	0	0	0	0	0	0.53	1.8	0.2
Ostracoda	0	0	0	6	0	3	0	0	3	0	0	6	1.6	2.6	0.5
Ophiuroidea	0	0	0	0	0	3	0	0	0	0	0	0	0.27	0.9	0.1
Total (no.m^{-2})	70	320	320	70	211	269	333	838	736	77	403	288	328	572.4	100.0
Biomass (g.m^{-2})	0.052	2.93	0.78	0.29	0.63	0.9	12.98	1.69	3.41	0.01	0.58	0.07	2.03	3.6	0.6

Table 6.10 Macrofaunal species density (no.m^{-2}) and biomass (g.m^{-2}) in the study area

Taxa	A1	A2	A3	B1	B2	B3	C1	C2	C3	D1	D2	D3	%
Foramniefra	0	0	0	0	0	0	0	0	0	0	0	19	0.5
Hydroid	0	0	0	0	0	0	13	0	0	0	0	0	0.3
Nemertinea	6	32	16	0	0	0	0	45	6	6	6	13	3.3
Sipuncula	0	0	13	0	3	0	0	6	13	0	0	6	1.1
Phoronida	0	0	0	0	3	0	0	6	0	0	0	0	0.2
Polychaeta													
Hypsicomus sp.	0	0	0	0	3	6	0	6	0	0	0	0	0.4
Harmothoe sp.	0	0	3	0	0	0	0	0	0	0	0	0	0.1
Sthenelais sp.	0	0	10	0	0	0	0	0	0	0	0	0	0.2
Phyllodoce sp.	0	0	0	0	6	0	0	32	13	0	0	6	1.5
Eteone sp.	0	0	3	0	0	3	6	0	0	0	0	0	0.3
Pseudoeurthyoe sp.	6	0	16	0	10	10	0	6	19	0	32	13	2.8
Syllidae	6	0	0	0	0	0	0	6	6	0	0	0	0.5

Ancistrasyllis sp.	0	0	0	0	0	3	0	0	0	0	0	0	0	0.1
Cabira sp.	0	0	3	0	0	0	0	0	0	0	0	0	0	0.1
Nereis sp.	0	0	10	0	0	0	0	0	3	0	0	0	0	0.3
Nephthys sp.	6	0	19	13	10	6	0	38	26	6	19	13	4.0	
Glycinde sp.	0	0	0	0	0	3	0	0	0	0	6	0	0.2	
Glycera sp.	0	6	0	0	6	0	0	6	3	0	0	0	0.6	
Goniada sp.	0	0	0	0	0	0	0	0	6	0	19	0	0.7	
Bumbriconereis sp.	6	0	3	0	0	0	19	0	6	0	13	0	1.2	
Ninoe sp.	0	0	0	0	0	6	0	0	0	0	0	0	0.2	
Dioptra sp.	0	0	0	0	0	10	0	0	10	0	0	0	0.5	
Onuphis sp.	0	0	3	0	3	3	6	13	35	0	13	6	2.3	
Eunice sp.	6	0	3	0	0	10	0	0	16	0	0	6	0.8	
Aricia sp.	0	0	0	0	0	6	13	0	16	6	6	0	1.4	
Scoloplos sp.	0	6	0	0	0	6	0	0	0	0	0	0	0.2	
Aricidea sp.	0	0	0	0	0	6	0	0	0	0	0	0	0.2	
Levinsenia sp.	0	0	38	0	0	35	0	13	35	6	0	0	3.3	
Scolelepis sp.	0	0	10	0	0	0	0	0	0	0	0	0	0.2	
Nerine sp.	0	0	0	0	96	0	0	19	3	0	6	0	3.2	
Laonice sp.	0	6	0	0	3	0	0	19	0	0	13	6	1.2	
Prionospio sp.1	0	0	19	0	0	0	0	0	10	0	0	0	0.7	
Prionospio sp.2	0	6	3	0	0	10	0	19	22	0	83	32	4.5	
Prionospio pinnata	0	0	10	0	0	0	0	0	6	0	6	0	0.6	
Pseudopolydora sp.	0	0	10	19	0	6	179	333	205	0	102	0	21.7	
Polydora sp.	0	0	10	0	0	0	0	0	38	0	0	19	1.7	
Minuspio cirrifera	0	0	3	0	0	13	0	0	0	0	0	0	0.4	
Disoma orissae	0	0	0	0	0	0	6	0	0	0	0	0	0.2	
Cossura sp.	0	0	0	0	0	3	0	0	0	0	0	0	0.1	
Cirratulidae	0	0	0	0	0	0	0	0	3	0	0	0	0.1	
Capitellidae	0	6	3	0	0	10	6	19	22	0	0	6	1.9	
Mediomastus sp.	0	0	0	0	0	6	0	6	3	0	0	0	0.4	
Magelona sp.	0	13	19	0	19	16	0	0	10	0	19	6	2.6	
Axiothella sp.	6	0	35	0	3	13	13	6	51	0	0	0	3.3	
Phyllochaetopterus sp.	0	6	3	6	0	6	0	0	0	0	0	0	0.6	
Armandia lanceolata	0	0	0	0	0	0	0	0	0	13	0	0	0.3	
Sternapsis scutata	0	0	0	6	0	3	6	0	0	0	0	6	0.6	
Poecilochetus sp.	0	0	3	0	0	0	0	0	3	0	0	0	0.2	
Scalibregma sp.	0	0	3	0	0	6	0	0	6	0	0	0	0.4	
Brada sp.	0	0	0	6	0	0	0	0	10	0	0	0	0.4	
Amphinomidae	0	0	0	0	0	3	0	0	13	0	0	0	0.4	
Terebellidae	0	0	13	0	0	0	0	0	0	0	0	0	0.3	
Loimia sp.	0	0	3	0	0	0	0	0	3	0	0	26	0.8	
	0	0	0	0	0	0	0	0	3	0	0	0	0.1	

Terebellidae stromiae	0	0	0	0	0	0	0	0	3	0	0	0	0.1
Amphicteis sp.	0	0	0	0	0	13	0	0	29	0	0	6	1.2
Amage sp.	0	0	0	0	0	0	0	0	3	0	0	0	0.1
Oligochaeta	0	0	0	0	0	0	0	58	0	0	0	0	1.5
Bivalvia													
Aloides sp.	0	0	0	0	3	0	0	0	0	0	0	0	0.1
Solenidae	6	0	0	0	0	0	13	0	0	6	0	0	0.7
Chione sp.	0	0	3	0	0	0	0	0	0	0	0	0	0.1
Mactra sp.	0	0	0	0	0	0	0	0	0	0	6	0	0.2
Gastropoda													
Cyclincha sp.	0	13	0	0	3	0	0	0	0	0	0	0	0.4
Columbellidae	0	6	0	0	0	0	0	0	0	0	0	0	0.2
Terebra sp.	0	0	0	0	0	0	0	6	0	0	0	0	0.2
Olivia sp.	0	0	0	0	0	0	13	0	3	0	0	0	0.4
Amphipoda													
Ampeliscidae	0	0	6	0	6	6	13	58	29	6	0	6	3.3
Melphidippidae	0	0	0	0	0	0	0	6	0	0	0	0	0.2
Phoxocephalidae	6	96	0	0	3	0	26	51	0	19	13	13	5.8
Gammaropsis sp.	0	0	0	0	0	6	0	0	0	0	0	0	0.2
Haustoriidae	6	19	3	0	0	0	0	6	6	0	0	0	1.1
Synchelidium sp.	6	32	0	6	6	0	0	26	0	0	0	26	2.5
Atylidae	0	0	0	0	0	0	0	0	0	0	0	6	0.2
Ischyroceridae	0	0	0	0	0	0	0	0	0	0	0	13	0.3
Isaeidae	0	0	0	0	0	6	0	0	0	0	0	0	0.2
Unidentified amphipoda	0	0	0	0	0	0	0	0	6	0	0	13	0.5
Isopoda													
Cyathura sp	0	19	13	6	0	0	0	13	6	0	13	0	1.8
Cumacea	0	32	0	0	10	3	0	6	3	6	6	13	2.0
Decapoda													
Prawns	0	0	0	0	6	19	0	0	10	0	6	0	1.1
Brachyura	0	6	0	0	3	3	0	0	0	0	0	0	0.3
Emerita sp.	0	6	0	0	0	0	0	0	0	0	0	0	0.2
Mysidaceae													
Gastrosaccus sp.	0	6	0	0	0	0	0	0	0	0	0	0	0.2
Tanaid	0	0	3	0	3	0	0	6	6	0	13	0	0.8
Ostracoda	0	0	0	6	0	3	0	0	3	0	0	6	0.5
Stomatopoda													
Squilla sp.	0	0	6	0	0	0	0	0	0	0	0	0	0.2
Ophiuroidea	0	0	0	0	0	3	0	0	0	0	0	0	0.1
Total (no.m^{-2})	70	320	320	70	211	269	333	838	736	77	403	288	
Biomass (g.m^{-2})	0.0525	2.93	0.779	0.291	0.632	0.9	12.98	1.699	3.412	0.01	0.58	0.074	

Table 6.11 Macrobenthic abundance (no.m-2) in the intertidal waters near the steel plant studied during march 2006

Groups	Intertidal area				
	High tide	Mid tide	Low tide	Mean	% Composition
Polychaeta	32	89	36	52.33	53.77
Bivalvia	0	6	0	2.00	2.05
Amphipoda	19	0	24	14.33	14.73
Nematoda	10	0	0	3.33	3.42
Copepoda	15	23	0	12.67	13.01
Mysis	21	0	0	7.00	7.19
Ostracoda	0	0	17	5.67	5.82
Total	97	118	77	97.33	100.00

Table 6.12 Bacterial count for water samples in the study area

S.No.	Stations	TVC cfu/ml $\times 10^3$	Total colliforms cfu/ml $\times 0^3$	*Salmonella* like organisms cfu/ml$\times 10^3$
1	A1	3.15	0.32	0.06
2	A3	2.98	0.12	0
3	B1	0	0.31	0.03
4	B2	3.10	0	0
5	C1	0	0.11	0.01
6	C2	3.40	0.09	0
7	C3	3.62	0.14	0
8	D1	0	0.32	0
9	D3	2.43	0.57	0.05

Table 6.13 Bacterial count for sediment samples in the study area

S.No.	Stations	TVC cfu/ml$\times 10^3$	Total colliforms cfu/ml$\times 10^3$	*Salmonella* like organisms cfu/ml$\times 10^3$
1	A1	4.02	0.43	0
2	A3	0	0.17	0
3	B1	4.73	0.41	0
4	B2	4.87	0	0.02
5	C1	1.93	0.31	0
6	C2	0	0.24	0.01
7	C3	2.48	0	0
8	D1	0	0.51	0.01
9	D2	4.35	0.21	0
10	D3	3.94	0.62	0.04

TVC → Total viable count

Cfu → Colony forming unit

Table 6.14 Fish catch data (No./haul) from exploratory trawling in the study area

Taxa	10 m	20 m	30 m
Prawn	116	203	287
Cephalopods	32	12	6
Crabs	7	18	12
Elasmobranch	-	2	7
Pomfret	3	2	8
Cuttlefish/squids	12	22	17
Clupeids	312	109	210
Sciaenids	12	16	27
Lactarius lactarius	-	8	11
Catfish	13	7	18
Ribbon fish	24	14	6
Nemipterid	36	42	83

Perches	6	13	2
Lizard fish	-	-	8
Silver bellies	254	192	107
Carangids	7	2	7
Polynemids	-	3	5
Upenoids	-	-	3
Miscellaneous	154	93	44
Total	988	758	868
Biomass (kg)	19.8	13.2	15.5

Table 6.15 Average total marine Fish production from Visakhapatnam District

Values are in metric tones

Year	Fishes	Shrimp	Total
2000-01	26591	3944	30535
20001-02	31257	3520	34777
2002-03	40798	3217	44015
2003-04	46348	5256	51604
2004-05	34455	5372	39827

Source: Office of Joint Director, Fisheries, Visakhapatnam

Table 6.16 Percentage catch composition of the dominant species of shrimp (A) and fishes (B) from coastal waters of Andhara Pradesh

(A)

Penaeus monodon	5.5
Penaeus indicus	0.2
Metapenaeus monoceros	48.5
Metapenaeus dobsoni	2.9
Others	42.7

(B)

Elasmobranchs	2.8
Squids	12.3
Lobsters	0.02
Eels	0.08
Tuna	3.6
Pomfret	2.7
Clupeids	29.3
Sciaenids	2.0
Lactarius lactarius	2.8
Upenoids	15.5
Ribbon fish	2.9
Cat fish	2.6
Nemipterus	4.0
Saurida	2.4
Polynemus	10.5
Carangids	1.6
Perches	2.4
Silverbellies	5.5

Source: directorate Fisheries, Visakhapatnam

Table 6.17 Monthly Catch rate (kg/h) and fisheries potential o[illegible]akhapatnam coast , Andhra Pradesh. Values are average of 2003 - 2005

	Mid water trawl	Demersal trawl
Jan	23.2	128.3
Feb	15.5	131.8
Mar	28.6	59.2
Apr	19.9	96.4
May	38.2	147.9
June	40.9	127.5
July	45.1	123.5
Aug	45.7	83.2
Sep	15.4	155.6
Oct	27.8	121.6
Nov	17.4	65.0
Dec	32.8	112.2

Source : Fishery Survey of India. (FSI)

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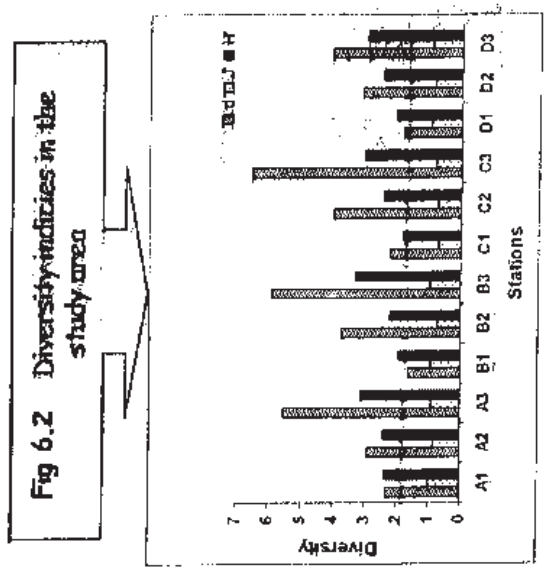


Fig 6.2 Diversity indices in the study area

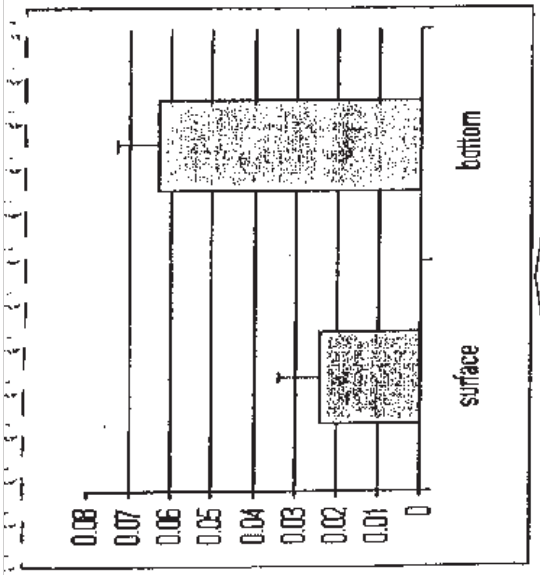


Fig.6.1 Phytoplankton diversity at surface and bottom waters of the study area

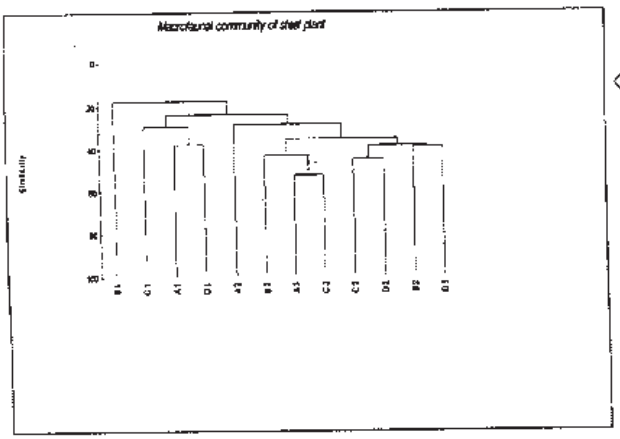
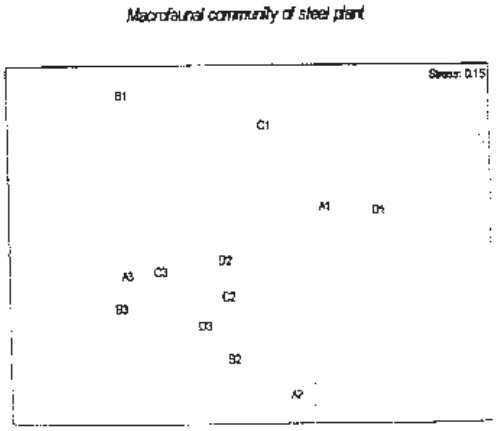


Fig 6.3 Dendrogram of the study area

Fig 6.4 MDS of the study area



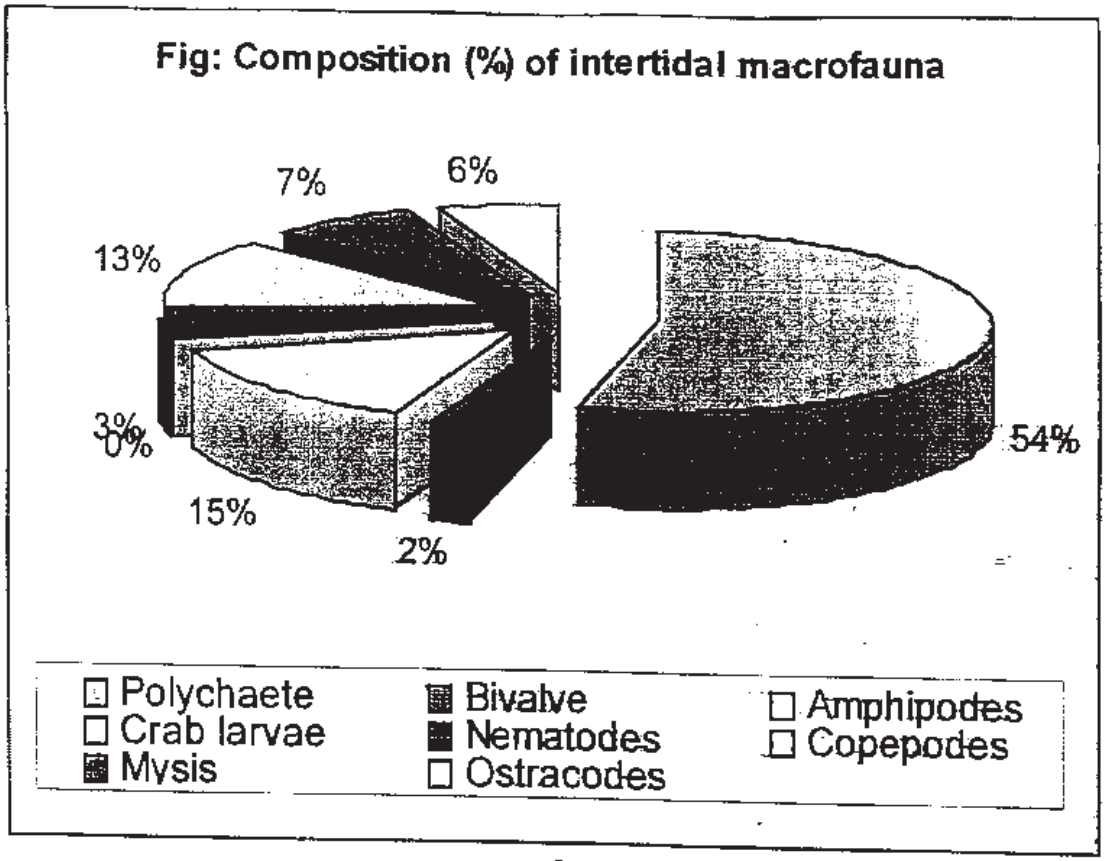


Fig. 6.5 Composition (%) of intertidal macrofauna

7. TOXICOLOGICAL STUDIES

7.1 INTRODUCTION

Toxicity of the effluent can be studied by several ways and bioassay is one of the important methods to determine the sensitivity of the organisms on exposure to a toxicant. Bioassay is defined as the test in which a living tissue, organism or group of organisms are used as a reagent for determination of the potency of any physiologically active substance of unknown activity. During this test, the test species or experimental organisms are exposed to different concentrations of the toxicant in a given time in order to know the nature and degree of response. The acute toxicity test is the one in which the tolerance response of the organism to any toxicant is evaluated by exposing it for a short period of time. In general, the level of tolerance of organism to the toxicant is observed for a period of 96hrs. The static bioassay method, which is widely used as a short-term response experiment, is very quick and the response of a toxicant to the organism is measured in terms of mortality or lethality. In recent years, these experiments are carried out in a static renewable media and the medium is changed for every 24hrs with the respective concentrations of the toxicant. Because of this renewable method, the excretory wastes and other mucous secretions of the organisms in response to the toxicant, if any, can be eliminated.

As this is a reliable method and yields good result, it has become widely used. In the present project, the treated effluent (100 lts) collected from the pond overflow near STP of Visakhapatnam Steel Plant ,was tested for its toxicity by exposing *Penaeus monodon* postlarvae and an estuarine fish, *Liza macrolepis*.

7.2 METHODOLOGY

The test species used for the study include *Penaeus monodon* postlarvae and a fish *Liza macrolepis*. These test species were chosen depending on their availability in large numbers for conducting the experiments and also sensitive to any of the toxicants. Since it is difficult to culture and maintain marine organisms in the laboratory, the above test species are chosen.

7.2.1 Postlarvae of *Penaeus monodon*

They were obtained from a shrimp hatchery and transported to the laboratory in plastic bags filled with ambient seawater (10ppt) and oxygen. The postlarvae were transferred immediately into plastic containers and were maintained the same way as in the hatchery. Care was taken while handling the postlarvae to avoid any damage. Crowding was avoided during maintenance of the larvae in the laboratory. Almost uniform sized postlarvae (9 to 9.5mm) were chosen for the experiment. Only active and intermoult postlarvae were considered for the experiments. They were acclimatized to the laboratory conditions for a period of 48 hrs before use. Aeration was provided throughout the period of maintenance and experimental regimen. The postlarvae were fed with commercial diet (Higashi 3000 started B, Higashimaru Co. Ltd., Japan) two times daily based on 10% of body weight. In addition, a supplementary diet of *Artemia* flakes was given daily. Excess food was removed every day by siphoning.

7.2.2 *Liza macrolepis*

They were collected from the backwaters of Bhimilipatnam during high tide and brought to the laboratory in ambient seawater (20ppt). They were acclimatized to the laboratory conditions in fibreglass tanks with ambient seawater for a period of 48hrs. They were provided with a commercial feed and the water in the tanks was fully aerated during maintenance and experimentation. Uniform sized (5 to 7cm) fish were used for the experiment.

Experimentation: Static renewal bioassays were conducted by using the above test species individually. Seven concentrations of the effluent were used and they consisted of 10, 25, 50, 75 and 100% for both post larvae of *Penaeus monodon* and fish. Preliminary experiments were carried out for finalizing the concentrations. These concentrations were prepared by mixing ambient seawater and care was taken to maintain the salinity. Twenty five post larvae and ten fish were exposed to each of the above concentrations in each experiment for a period of 96hrs. Ten fish were exposed to each concentration in each experiment. The mortality, if any, was monitored for every 24hrs and recorded. The concentrations were also renewed daily. Parallel controls were maintained for both the experiments. Commercial diet and aeration was provided throughout the experimental period as described above. These experiments were repeated three times and the results were processed. Parallel controls were maintained along with each experiment with out the effluent.

7.3 RESULTS

7.3.1 *Penaeus monodon* postlarvae

Table 7.1 represents the data on mortality rates of *P. monodon* postlarvae obtained from three independent experiments at five different concentrations of the effluent namely 10, 25, 50, 75 and 100%. There was no mortality in any of the exposed concentrations except at 100%. At 100% also, no mortality was recorded till 48hrs. However, a 4% mortality occurred at 72hrs and 8% at 96hrs of exposure to 100% concentration. The average mortality rates are presented in Table 7.2. shows the percent survival in all the exposed concentrations and this indicates that there is 100% survival in all most all the exposed concentrations except at 100% and 75% where 96% and 92% survival were recorded at 72 and 96hrs respectively.

7.3.2 *Liza macrolepis*

The mortality rates at different concentrations (10, 25, 50, 75 and 100% of effluent) for three independent experiments are shown in Tables 7.3. The average rate of mortality is presented in Table 7.4 for these experiments. Figure 7.2 represents the survival of the fish at the above concentrations of the effluent. In correlation with the above experiments on post larvae, no mortality was recorded up to 75% concentration of the effluent. But at 100% concentration of the effluent, a mortality rate of 10% was observed in fish. any exposed concentrations within 96hrs in all the experiments indicating no toxicity.

The data suggest that the effluent from Steel Plant is not at all toxic in nature to the test species as there was marginal mortality even at 100% concentration of the effluent.

Table 7.1 Effect of the effluent from the study area on the mortality rate of *Penaeus mondon* postlarvae

Experiment-1

Concentration of the effluent	Mortality rate (%)			
	24hrs	48hrs	72hrs	96hrs
10%	0	0	0	0
25%	0	0	0	0
50%	0	0	0	0
75%	0	0	0	0
100%	0	0	4	8

Experiment 2

Concentration of the effluent	Mortality rate (%)			
	24hrs	48hrs	72hrs	96hrs
10%	0	0	0	0
25%	0	0	0	0
50%	0	0	0	0
75%	0	0	0	0
100%	0	0	4	8

Experiment 3

Concentration of the effluent	Mortality rate (%)			
	24hrs	48hrs	72hrs	96hrs
10%	0	0	0	0
25%	0	0	0	0
50%	0	0	0	0
75%	0	0	0	0
100%	0	0	4	8

Table 7.2 Average mortality rates of *Penaeus mondon* postlarvae exposed to different concentrations of the effluent for 96hrs.

Concentration of the effluent	Mortality rate (%)			
	24hrs	48hrs	72hrs	96hrs
10%	0	0	0	0
25%	0	0	0	0
50%	0	0	0	0
75%	0	0	0	0
100%	0	0	4	8

Table 7.3 Effect of the effluent from the study area on the mortality rate of fish exposed to different concentrations of the effluent for 96hrs.

Experiment-1

Concentration of the effluent	Mortality rate (%)			
	24hrs	48hrs	72hrs	96hrs
10%	0	0	0	0
25%	0	0	0	0
50%	0	0	0	0
75%	0	0	0	0
100%	0	0	10	10

Experiment 2

Concentration of the effluent	Mortality rate (%)			
	24hrs	48hrs	72hrs	96hrs
10%	0	0	0	0
25%	0	0	0	0
50%	0	0	0	0
75%	0	0	0	0
100%	0	0	10	10

Experiment 3

Concentration of the effluent	Mortality rate (%)			
	24hrs	48hrs	72hrs	96hrs
10%	0	0	0	0
25%	0	0	0	0
50%	0	0	0	0
75%	0	0	0	0
100%	0	0	10	10

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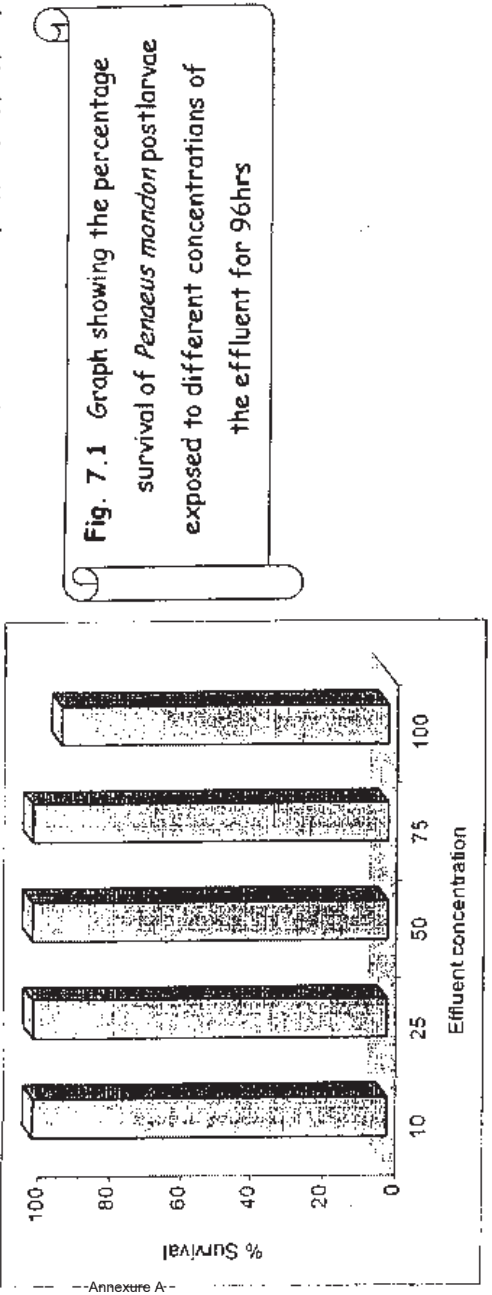


Fig. 7.1 Graph showing the percentage survival of *Penaeus mondon* postlarvae exposed to different concentrations of the effluent for 96hrs

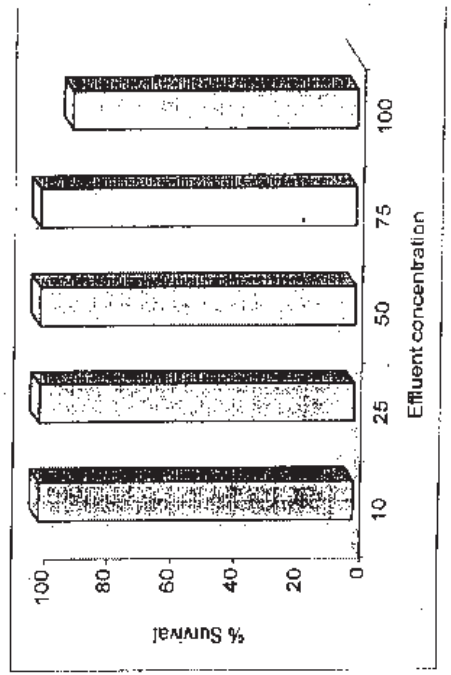


Fig. 7.2 Graph showing the percentage survival of fish (*Liza macrolepis*) exposed to different concentrations of the effluent for 96hrs

Table 7.4 Average mortality rates of fish exposed to different concentrations of the effluent for 96hrs

Concentration of the effluent	Mortality rate (%)			
	24hrs	48hrs	72hrs	96hrs
10%	0	0	0	0
25%	0	0	0	0
50%	0	0	0	0
75%	0	0	0	0
100%	0	0	10	10

8. MARINE ENVIRONMENTAL IMPACT ASSESSMENT & MITIGATION MEASURES

8.1. MARINE ENVIRONMENTAL IMPACTS

Any activity, which interferes with natural set up of marine environment such as beaches, marine components and the biota that live in, is bound to effect changes in the set up. For this purpose all activities related to the construction, operational and post operational phase were considered for the identification of impact. Evidently, potential negative impacts on marine ecology can arise during the construction as well as operational phases of the proposed expansion of the project and laying submerged pipeline.

8.1.1 Construction Phase

Marine environmental impacts during the construction phase may potentially manifest in the form of (i) changes in physical processes (bathymetry, circulation pattern, littoral transport); (ii) degradation in water quality and sediment texture; (iii) destruction of biotic communities ,of localized subtidal and intertidal areas. Environmental considerations have become major significance while laying the submarine pipeline and associated works. Even though the effect may not be detrimental, but will appear to be objectionable to the public. The main areas of influence include (i) physical disturbance (ii) release of contaminants (iii) depleted oxygen supplies and (iv) increase in water turbidity.

Physical processes: Though marine construction i.e., laying of submarine pipeline is unlikely to result in gross changes in tide levels, current speeds and

circulation, but small physical disturbances such as littoral transport and an increase in water turbidity may be envisaged. However being a divergence zone and one time excavation and the entire pipeline operations are within a narrow corridor, any long term adverse impact will not be possible.

8.1.2 Water Quality

Primary water quality criteria are scientific derived quantitative measures of highest permissible level of most commonly encountered constituents in water and these criteria form the basis of judgement about the compatibility of a given water composition with a particular water use without any known detrimental effect. The primary water quality criteria for marine coastal waters developed by Central Pollution Control Board and used under classification scheme based on designated best uses. Since the developmental activities envisaged here are mainly in nearshore waters, primary water quality criteria for SW IV water are taken into account. The churning of bottom water due to the laying of submarine pipeline may alter the levels of DO and BOD and other chemical constituents, thus exposing the biota to high level of pollutants. BOD_5 values (0.81 mg/l to 2.93 mg/) in the study area indicate that it is within primary water quality criteria and do not pose any threat to the marine environment at present. Localised and temporary deterioration in the nearshore water result due to short term disturbances in the subtidal bottom hydrography of the narrow corridor during construction phase. But in the present case there are no chances of formation of anoxic pockets in the coastal environment as the marine environment is highly saturated with DO and the water column is well mixed zone. Increased turbidity in the water column and suspension of sediments may cause concern during construction phase.

Hence the water quality in terms of an increase in turbidity, resuspension of sediment particles, BOD, nutrients etc., would be influenced marginally and these perturbations would level out within short period of the construction phase.

8.1.3 Sediment Quality

The impact of construction activity on the subtidal as well as intertidal sediment quality would be largely confined to the changes in sediment texture. The textural change however would be minor since most of the seabed sediments collected in the study area were sandy sediments. Considering the depth of burial the offshore seabed will have minimum morphology disturbances and these disturbances will soon resettle.

8.1.4 Flora and Fauna

The project activities will have effect on marine ecology during different phases of operation. The maximum impact of laying pipeline would be on the intertidal and subtidal biota. Negative impacts on intertidal and subtidal biota of degraded areas would be severe in this ecologically diverse habitat. The danger of biota getting exposed to pollutants released from the sediment during construction is minimal since the sediments are free from gross contamination.

The increase in suspended load may reduce the penetration of sunlight and affect photosynthetic activity of phytoplankton in localized areas causing temporary los of some species during the construction phase. The low primary production will have effect on second trophic level of zooplankton and benthos. Such changes are temporary and normal to the overall zooplankton productivity of the coastal system of the study area. Benthic animals particularly the

meiobenthos known for their sediment nature, have been found to repopulate in the disturbed sediment quickly. Since the marine activities of the project are limited for a short period, there will not be any long term serious impact on fishery potential of the coast area under study.

8.2 OPERATIONAL PHASE

During the operational phase, the main concern is the discharge of treated effluents into the open sea. The firm discharges a total of 14,400 KLD treated wastewater at the point recommended in this report. The quality of the treated effluent will meet the norms stipulated by Central Pollution Control Board (CPCB) and the concentration levels of each parameter will be kept below the prescribed values of MINAS. Further the Total Dissolved Solids (TDS) discharged will be further diluted because of mixing conditions prevailing in the marine environment and will be within the threshold limits. It is envisaged that the prevailing currents at the discharge point during different seasons will further help in dilution and dispersion of the effluents causing no concern for the existing conditions of the marine environment.

8.3 MITIGATION MEASURES

It is essential that certain decisions are taken and strictly implemented beginning with the planning process itself so that the risk factors are reduced to a minimum in order to protect the rich and sensitive ecology of the area from anthropogenic shocks during the construction as well as operational phases of the project. The field data collected during the study indicated that the water quality in the waters of the study area, in general, was good with high concentration of DO (5 to 8 mg/l) and well oxygenated and well mixed

condition. The laying submarine pipeline will give rise to short term changes in physico – chemical and biological parameters. Measures have been suggested to minimise these effects. However, a proper layout of a management plan will prove highly beneficial for adopting control measures to prevent deterioration of marine environment.

The pipeline in the inter tidal area should be buried to a safe depth and the depth of the burial should be ascertained. The pipeline should be protected from damages caused by sediment moment and also trans operations, area being a potential fishing zone.

The trenching operations should be restructured to minimum required area to cause least damages to the marine environment. The impact due to construction on marine environment would be temporary and reversible in nature. Nevertheless, certain precautions are warranted to minimize the impacts on the near shore ecology. Apart from the disturbances caused by the constructions process itself, the coastal ecology suffers additional stresses if the construction time is prolonged which invariably the case when executing marine infra structural projects, if not carefully planned. Hence the key factor in minimizing adverse impacts would be the reduction in construction period. This would need advance planning and coordination between different agencies executing the contracts.

Ocean disposal accomplished by submarine outfalls consists of long section of pipe to transport wastewater some distance from shore with a diffuser at the end to dilute the wastewater with seawater and bring the minimal effect. A thorough study to eliminate the possibility of leakages and breakdown of the pipeline is therefore essential. Modern process technologies with suitable designs should be employed to meet with the standards maintained for pollution control.

8.4 ENVIRONMENTAL MANAGEMENT PLAN

Disasters impede socio-economic development and disasters affect population where there is physical, infrastructural, environmental or socio-economic vulnerability. The higher the individual and other vulnerabilities, the higher are the risks. A comprehensive understanding of the pattern of various hazards is crucial in order to have a focus and prioritise the scarce resources for ensuring sustainable development in areas and populations at risk. As a first important step towards the maintenance of health of the marine ecology of the study area, critical locations are to be carefully selected and designated as monitoring sites for periodic health checks with respect to water quality, sediment quality and flora and fauna. To understand these variations it is necessary to conduct periodic studies at least seasonally to evolve seasonal baseline. The parameters to be monitored are listed below.

8.4.1 Water quality

Water samples near surface and bottom for temperature, pH, TSM, salinity, DO, BOD, dissolved phosphate, nituate, nitrite, ammonia and Petroleum Hydro Carbon, phenols, cyanides.

8.4.2 Sediment quality

Sediment from subtidal, intertidal regions are to be analysed for texture and toxic metals.

8.4.3 Flora and Fauna

Biological characteristics are to be assessed based on primary productivity, phytopigments, phytoplankton populations and their generic diversity; biomass, population and group diversity of zooplankton: biomass,

population and group diversity of benthos; fish quality, and density as well as species diversity.

8.5 POST PROJECT MONITORING

A comprehensive marine quality-monitoring programme with periodic investigations at predetermined locations in and around discharge point by a competitive agency is a practical solution to ensure quality data acquisition. This can be a continuation of the study designed for baseline quality.

The post project monitoring can be as follows:

(a) Parameters to be measured for Post Project Monitoring

1. Surface & Bottom Waters - pH, temperature, suspended solids, salinity, dissolved oxygen, BOD, dissolved phosphate, nitrate, nitrite, ammonia and Petroleum Hydrocarbons
2. Sediments - Texture and toxic metals (Pb and Cd)
3. Flora & Fauna - Phytoplankton, Zooplankton and Benthic fauna
4. Bioassay Test - For treated effluents

(b) Frequency

Frequency of Monitoring should be atleast three times in a year covering the three seasons.

(c) **Infrastructure**

The industry is having environmental monitoring cell to measure the effluent characteristics and also should monitor marine environmental characteristics. Infrastructure includes basic analytical equipment as well as lab facilities with advanced analytical techniques.

The results of each monitoring should be carefully evaluated and cross checked by authorized organics to identify changes, beyond the natural variability from baseline studies.

8.5.1 Monitoring and Reporting Procedure

Regular monitoring of important and crucial environment parameters is of immense importance to assess the status of environment during the plant operation. With the knowledge of the baseline conditions, the monitoring programme can serve as an indicator for any deterioration in environmental conditions due to operation of the plant and suitable mitigatory steps could be taken in time to safe guard the environment. Monitoring is an important as that of control of pollution since the efficiency of control measures can only be determined by monitoring.

In conclusion, the proposed expansion would unlikely to cause any insurmountable environment impacts and will improve the infrastructure and socio-economic conditions in the Visakhapatnam Steel Plant township.

9. SUMMARY AND CONCLUSIONS

1. CRZ studies reveal that the Land Fall Point (LFP) and part of the proposed pipe line route falls within setback lines of 200 m and CRZ – I (HTL to LTL).

2. The recommended pipeline route does not have in its vicinity, any sensitive and important ecosystems to be categorized as CRZ – I and does not disturb the sand dunes.

3. Bathymetry studies in the region indicate that the topography in general is smooth and devoid of any significant features except minor irregularities in the nearshore region.

4. The bathymetry map drawn at 0.5 m contour level (Fig. 3.2) shows a steep gradient of 1:65 in the northern part and relatively gentle (1:105) in the southern part.

5. Sidescan sonar and shallow seismic studies indicate that the suggested corridor between profiles L_7 & L_{11} is found to be plain and smooth without any hazardous features, such as rock outcrops etc.

6. From the current measurements in the study area, it is observed that the speed of current mostly vary between 0.1 and 0.7 m/sec during the observational period. The direction was confined to 50^0 to 80^0.

7. The average density of the water column in the study area is 1022 kg/m^3 during the observational period.

8. The water quality at the proposed discharge site is having low concentrations of chemical constituents and within the stipulated levels of coastal environment.

9. The sediments collected in the study area were mainly sands and silty sands

10. From the buoyant jet model, a 6 port diffuser with a diameter of 0.126 m with a jet velocity of 2.0 m/sec is recommended at 20 m water depth. The dilution can be enhanced to 198 times by increasing the jet velocity to 2.5 m/sec with 6 port diffuser system of having 0.11 diameter (Case.No.13).

11. Baseline data on biological characteristics indicate phytoplankton comprising of 15 different genera of diatoms.

12. The zooplankton fauna was represented by 48 different taxa belonging to 14 groups with copepoda on the major group (83.2%).

13. A total of 85 taxa were identified which were belonging to 18 major groups. *Polychaete* was the most dominant and diverse group in terms of number of species and contributed to 70% of the total macrobenthic density.

14. Surface water samples have more bacterial population when compared to sediment samples. Overall results show low counts of coliforms and *salmonella* like organisms showing less impact of microbial pollution in the marine environment.

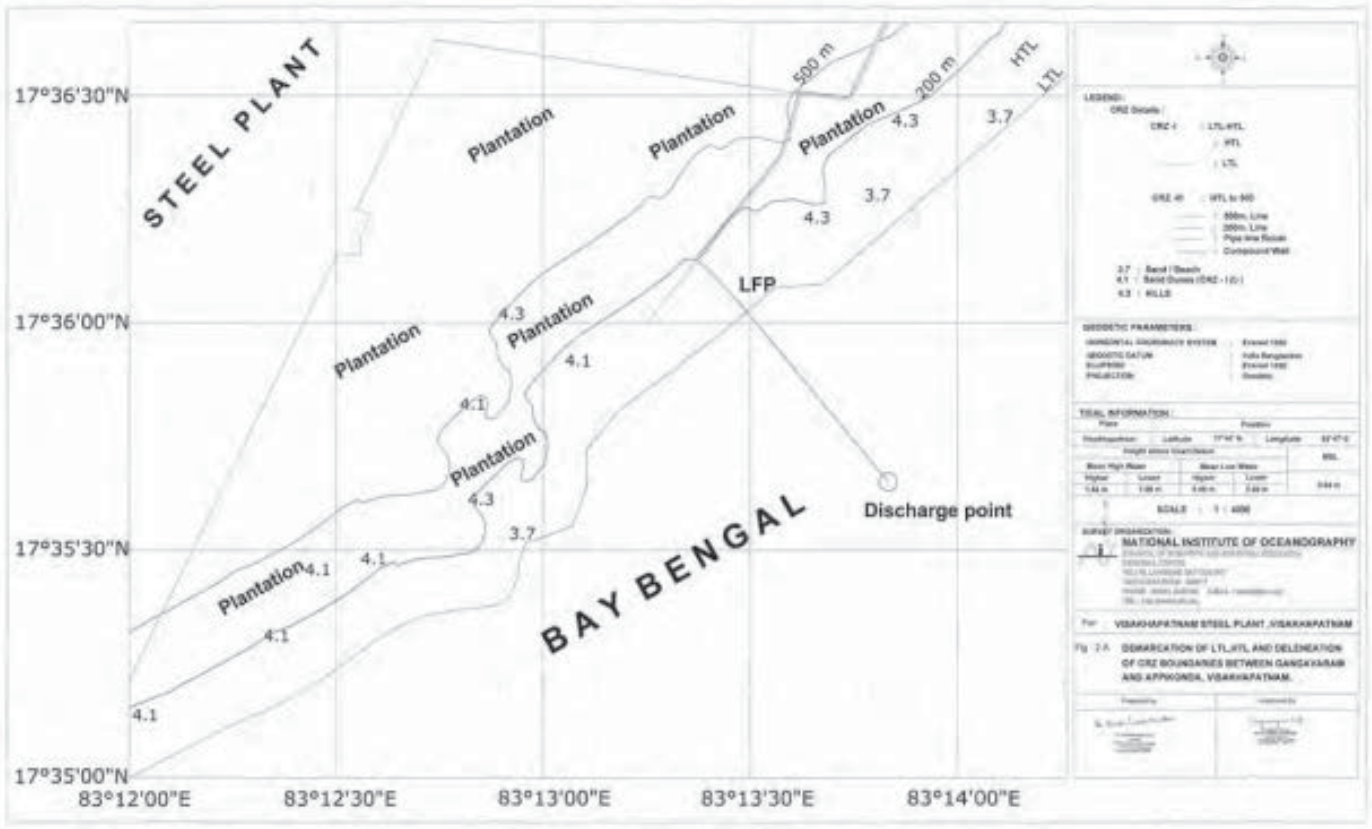
15. The demersal resources of the area (upto 30 m) had many variety of fishes and the catch was highest at 10 m depth zone. The catch composition revealed the occurrence of 16 major groups of fish and crustacean in the area.

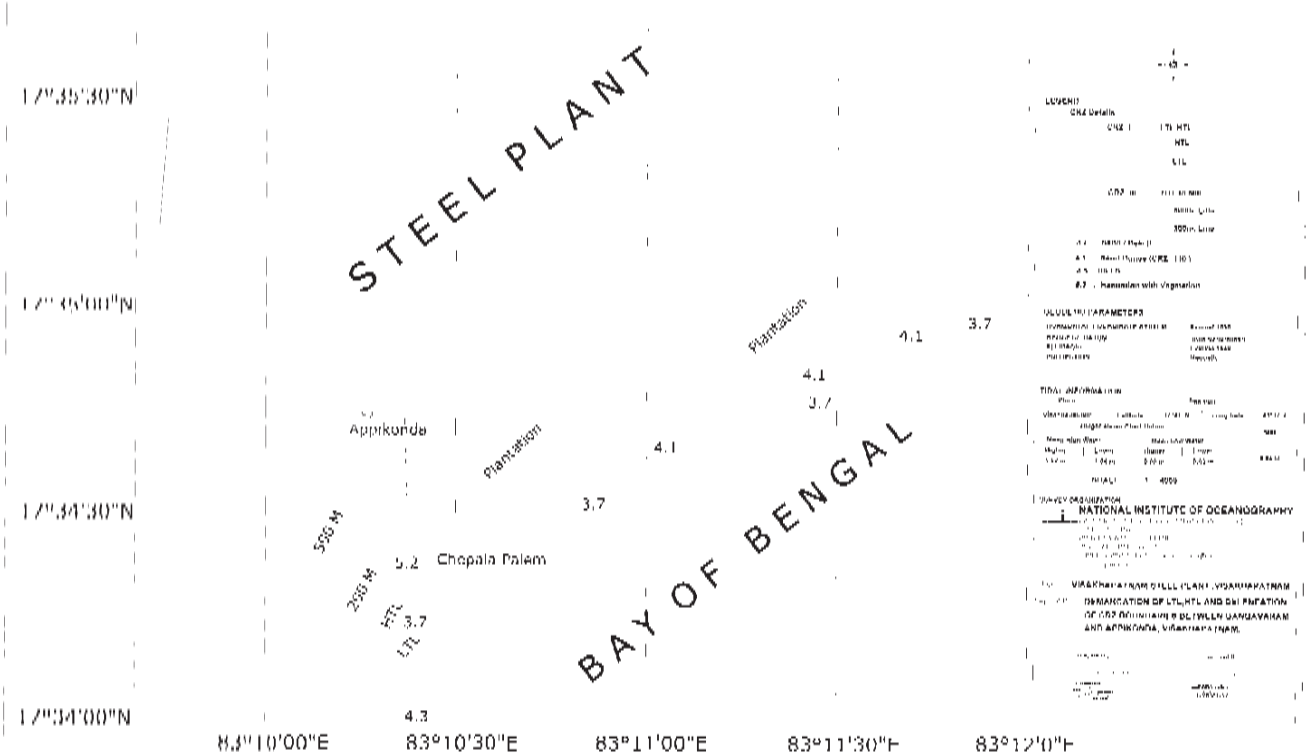
16. The toxicological studies conducted on test organism revealed that the treated effluent is non toxic. Since the treated effluents will generally undergo dilution and dispersion after release, under the present scenario, no impact will be noticed in the marine environment.

17. **Considering the prevailing physico-chemical and bathymetry data of the study area, discharge point should be at 20 m water depth i.e. at 17° 35' 39" N; 83° 13' 50" E which is 1.21 km from the LFP. The pipeline route, LFP and marine discharge point are shown in Fig. 4.15.**

18. A comprehensive marine monitoring programme with seasonal (three times in a year) observations at predetermined locations in and around the marine outfall point is recommended as a part of post project monitoring. In addition, bioassay tests for the treated effluent should be conducted with regular intervals after the expansion of the steel plant.

19. The results of this report are site specific and based on one-time observations only.

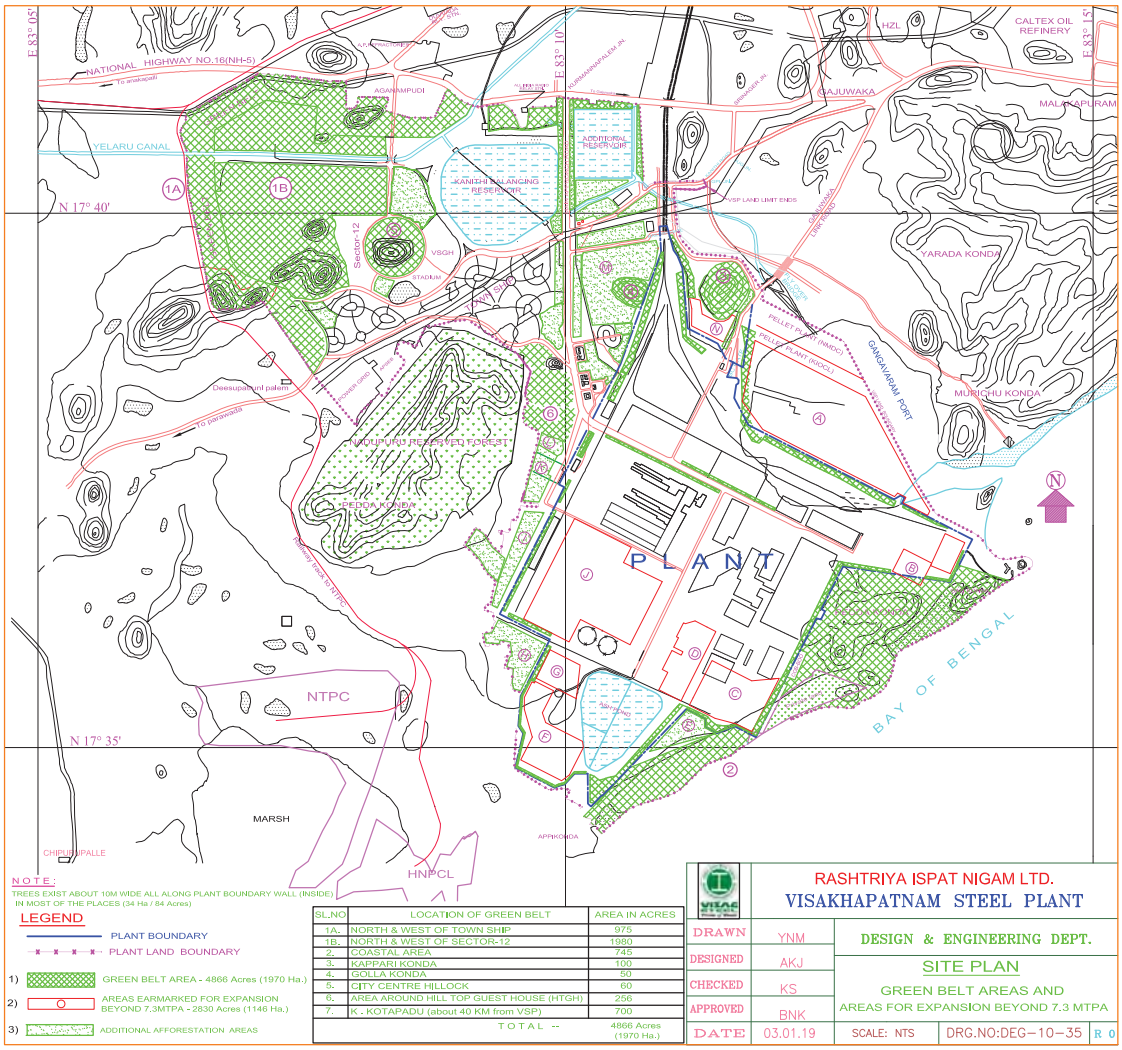

STEEL PLANT
BAY BENGAL
LFP
Discharge point
Plantation
500 m
200 m
HTL
LTL
4.3
3.7
4.1
17°36'30"N
17°36'00"N
17°35'30"N
17°35'00"N
83°12'00"E
83°12'30"E
83°13'00"E
83°13'30"E
83°14'00"E
LEGEND:
NATIONAL INSTITUTE OF OCEANOGRAPHY
VISAKHAPATNAM STEEL PLANT, VISAKHAPATNAM
DEMARCATION OF LTL,HTL AND DELINEATION OF CRZ BOUNDARIES BETWEEN GANGAVARAM AND APPIKONDA, VISAKHAPATNAM.


STEEL PLANT
BAY OF BENGAL
Appikonda
Chapala Palem
Plantation
595 M
255 M
HTL
LTL
3.7
4.1
4.3
5.2
17°34'30"N
17°34'00"N
83°10'00"E
83°10'30"E
83°11'00"E
83°11'30"E
NATIONAL INSTITUTE OF OCEANOGRAPHY

ANNEXURE B

SITE PLAN SHOWING GREEN BELT AREAS

Annexure B



NOTE:
TREES EXIST ABOUT 10M WIDE ALL ALONG PLANT BOUNDARY WALL (INSIDE) IN MOST OF THE PLACES (34 Ha / 84 Acres)

LEGEND

- PLANT BOUNDARY
- PLANT LAND BOUNDARY
- 1) GREEN BELT AREA - 4866 Acres (1970 Ha.)
- 2) AREAS EARMARKED FOR EXPANSION BEYOND 7.3MTPA - 2830 Acres (1146 Ha.)
- 3) ADDITIONAL AFFORESTATION AREAS

SL.NO	LOCATION OF GREEN BELT	AREA IN ACRES
1A.	NORTH & WEST OF TOWN SHIP	975
1B.	NORTH & WEST OF SECTOR-12	1980
2.	COASTAL AREA	745
3.	KAPPARI KONDA	100
4.	GOLLA KONDA	50
5.	CITY CENTRE HILLOCK	60
6.	AREA AROUND HILL TOP GUEST HOUSE (HTGH)	256
7.	K. KOTAPADU (about 40 KM from VSP)	700
	TOTAL --	4866 Acres (1970 Ha.)

RASHTRIYA ISPAT NIGAM LTD.
VISAKHAPATNAM STEEL PLANT

DRAWN	YNM	DESIGN & ENGINEERING DEPT.
DESIGNED	AKJ	SITE PLAN
CHECKED	KS	GREEN BELT AREAS AND AREAS FOR EXPANSION BEYOND 7.3 MTPA
APPROVED	BNK	
DATE	03.01.19	SCALE: NTS — DRG.NO:DEG-10-35 — R 0

ANNEXURE C

CERTIFIED EC COMPLIANCE REPORT

Annexure C

ANDHRA PRADESH POLLUTION CONTROL BOARD
D.No.33-26-14D/2, Near Sunrise Hospital, Pushpa Hotel Centre,
Chalamalavari Street, Kasturibaipet, Vijayawada - 520 010
Phone. No.0866-2463200, Website : www.appcb.ap.nic.in

Lr No : APPCB/VSP/VSP/108/CFO/HO/2015- Date: .01.2019

To
The Scientiest - F/ Director,
The Ministry of Environment, Forest and Climate Change,
Indira Paryavaran Bhavan,
Jor bagh Road, Aliganj,
New Delhi- 110003.

Sir,

Sub: APPCB - UH-IV- Capacity expansion of M/s. Rashtriya Ispat Nigam Ltd., (Visakhapatnam Steel Plant) from 6.3 MMTPA to 7.3 MMTPA - Certified Compliance Report - Submitted -Reg.

Ref :
1. Show Cause Notice issued by MoEF&CC vide F. NO.J-11011/196/2005-IA.II (I) Pt., dated 08.3.2018.
2. Letter addressed by MoEF&CC to the GoAP vide F. No. IA-J-11011/196/2005 - IA- II (I), dated 02.08.2018.
3. Letter addressed by EFST, Go. AP to the Member Secretary, APPCB vide letter No. 3833/Env. Sec.I/2018, dated 28.08.2018.
4. Case No. CNR.APVSOB 40272019, SR No.CC/24/2019.
5. M/s. RINL Lr. No. VSP/18/GM(S&E) I/C/123 Dt: 27.11.2018
6. EC issued vided Letter No.J-11011/1/87-IA Dated 04.01.1988 for 3.0MTPA.
7. EC issued vided Letter No.J-11011/196/2005-IAII(I), Dtd: 11.08.2005 for 6.3 MTPA.

The MoEF&CC, GOI vide reference 1st cited issued a Showcause notice to M/s. Rashtriya Ispat Nigam Ltd., (Visakhapatnam Steel Plant), Visakhapatnam under Sec. 5 of the Environment (Protection) Act, 1986 for capacity expansion from 6.3 MMTPA to 7.3 MMTPA by revamping and augmentation of existing facilities without obtaining prior Environmental Clearance as required under the provisions of the EIA Notification, 2006.

The MoEF&CC vide reference 2nd cited addressed a letter to the Principal Secretary, EFS&T, Govt. of A.P to take credible action against the project proponent under the provisions of Sec. 19 of the Environment (Protection) Act, 1986 for violation of EIA Notification, 2006.

The Principal Secretary to the Government, EFS&T Dept, Govt. of AP vide reference 3rd cited addressed a letter to the APPCB to take necessary action under section 19 of the E(P) Act, 1986.

Accordingly, the APPCB vide reference 4th cited, filed a case against M/s. Rashtriya Ispat Nigam Ltd., (Visakhapatnam Steel Plant), Visakhapatnam before the Hon'ble District Sessions Court, Visakhapatnam under the provisions of Sec. 19 of the Environment (Protection) Act, 1986 for violation of EIA Notification, 2006.

M/s. Rashtriya Ispat Nigam Ltd., (Visakhapatnam Steel Plant) vide reference 5th cited submitted a representation to the APPCB stating that they applied for the environmental Clearance for the proposed capacity expansion project and requested the Board to submit the certified compliance report of the earlier environmental clearances as per the MoEF&CC circular dt: 07.09.2017. The officials of APPCB inspected the industry on 06.12.2018, verified and reported the compliance status of the Environmental Clearances issued vide reference 6th & 7th cited.

In this regarded, I am here with submitting the certified compliance report of Environmental Clearance(EC) issued vide 7th and 8th reference cited for the 3.0MTPA and 6.3 MTPA respectively.

Yours Sincerely,

Encl: Certified Compliance Report

Member Secretary,
A.P. Pollution Control Board

Copy to:
1. The JCEE, ZO, APPCB, Visakhapatnam for information.
2. The EE, RO, APPCB, Visakhapatnam for information and necessary action.
3. M/s. Rashtriya Ispat Nigam Ltd., (Visakhapatnam Steel Plant), Visakhapatnam for information and necessary action.

Certified copy of the Compliance Report to 3.0 MTpa

Subject : Visakhapatnam Steel Project – Environmental Clearance- Regarding.

Reference: Letter No.J-11011/1/87-IA Dated 04.01.1988.

Present Status of the project : As informed by the Project Authority (PA) this Environmental Clearance (EC) is for 3 million tonnes of liquid steel / 4 million tonnes of hot metal. The PA has achieved the quantity in the year 2000. The PA is manufacturing steel and the unit is running.

Date of Monitoring : 06/12/2018

Sl.No.		Conditions	Compliance Status
i.	a)	Environmental Management Plan (EMP) must be prepared which among others, should contain results of air and water quality monitoring to be done in the project area.	Complied. Environment management plan was prepared along with the results of air and water quality monitoring along and submitted. Further air & water quality are being monitored regularly and results of the same are being submitted along with six monthly compliance reports.
	b)	Continuous monitoring of air and water quality must be initiated immediately. Water to be monitored must include both marine and inland waters.	Complied. • Continuous monitoring of Ambient Air quality is being done using 4 CAAQM stations at 4 locations • Continuous monitoring of effluents from 2 discharge outlets is being done using 2CEM stations • Data from both(Ambient air & Effluent) continuous monitoring systems is being posted to CPCB and APPCB portals • In addition to the above Inland water quality being monitored on daily basis and marine water on a monthly basis
	c)	Minimum three ambient air monitoring stations must be installed	Complied. Three numbers of continuous ambient air quality monitoring stations(CAAQMS) are set up at three locations near the plant boundary and they are monitoring air quality continuously.

Sl.No.		Conditions	Compliance Status
	d)	An air monitoring station in the Zoological park in the north east must be set up.	Complied. An ambient air monitoring station (Respirable dust sampler) is installed in the zoo park area and monitoring is being done regularly.
	e)	Two monitoring stations one for air and other for water must be set up at Kondakarla lake towards the south of Visakhapatnam	Complied. Two monitoring stations one for air and other for water has been set up at Kondakarla Lake towards South of Visakhapatnam.
ii.		The project authorities (RINL) must consider using low sulphur gas / oil. If such use is not possible appropriate flue gas de-sulphurisation devices must be installed at relevant units	Complied. RINL is using low sulphur coal i.e coal having Sulphur less than 1%.
Iii .		RINL authorities must recycle effluents to the extent possible. In any case, the treated effluent must be used for irrigation of afforested area	Complied. • Township sewage water is treated and being used as make up water in Rolling mills&SMS after treatment in Ultra-filtration plant since Dec'2005onwards • Treated effluent from Coke ovens is used for dust suppression at raw material handling .plant after meeting the standards. • Treated effluent from plant ETP is now being pumped to RO plant and then after treatment the water is used as make up water in Coke Ovens • The remaining treated water is being disposed through Appikonda and Balacheruvu.
iv.		RINL authorities must divert the storm water towards the south side away from the creek (which is on the northern side)	Complied This condition was dropped by MoEF vide letter no. J-11014/75/90-1A .II(i) Dated 20.07.2000

Sl.No.		Conditions	Compliance Status
v.		RINL authorities must relocate sludge / debris dump, the ash pond, the lab our and staff colony shown in the south west corner away from the sea shore. Revised plan in this regard must be submitted to this Ministry for approval	Complied. RINL authorities relocated sludge / debris dump, the ash pond, the labourer and staff colony shown in the south west corner away from the sea shore. Revised plan in this regard was submitted to this Ministry for approval on 30.07.88.
vi.		Present and future linkages for coal must be established and reported to the ministry.	Complied. The coal linkage for RINL is as follows: 1. Steam coal is from collieries of Talcher&Ib Valley of M/s Mahanadi Coal Fields. 2. Coking coal is imported from Australia, New Zealand and USA etc., through Gangavaram Port limited. 3. Medium coking coal is from washeries - Rajarappa, Swang and Kathara of M/s Central Coal fields. And the same were report to the Ministry.
vii.	(a)	RINL authorities must provide a green belt of 3600 ha.	Please see para 'c' below.
	(b)	The above green belt will include 500 metres wide green belt on the boundary of the acquired land.	Complied The above green belt includes 500 metres wide green belt on the boundary of acquired land also.
	(c)	Out of total green belt, 1970 hectares must be declared as reserve forest under the control of RINL and covered by the Forest conservation act, 1980. The balance 1630 hectares must not be used for any other purpose excepting for further expansion of the plant.	**a)** 1970 hectares has been developed with green belt. However, same has not been declared as reserve forest as State Forest Dept. indicated that land should be handed over to them. The same is not possible as land was acquired in the name of Ministry of Steel. **b)** About 566.80 Ha (1400 Acres) of land was handed over to GoAP for construction of Gangavaram Port against which GoAP earmarked 283.40 hectares (700 Acres) of land at K.Kotapadu for developing green belt.

Sl.No.		Conditions	Compliance Status
			c) Out of 1630 hectares (3952 Acres) earmarked for afforestation, which can be used for expansion, 880 hectares (2174 Acres) was used for expansion to 6.5 tons of hot metal per annum. Greenery exists in the balance area. • *Afforestation status as submitted by RINL is enclosed at Annexure-1*
	(d)	2809 hectares of salt lands must be afforested with appropriate floral species. This area will be regarded as permanent reserve forest under the control of RINL and will be governed by the Forest (Conservation) Act, 1980 .	As there appeared to be error in indicating 2809 hectares (6966 Acres) of salt lands, as the total extent of salt land was about 2400 Acres only, it was taken up with MoEF for change.

Certified copy of Compliance Reportto 6.3 MTPA

Subject: Expansion of hot metal (Steel plant) from 4.0 to 6.5 million tons per annum (MTPA) at Visakhapatnam, Andhra Pradesh by M/s. Rashtriya Ispat Nigam Limited.

Reference : No.J-11011/196/2005-IAII(I), Dtd: 11.08.2005.

Present status of the project: The Project Authority manufacturing 4.5 million tons per annum of hot metal and generating 248.1 MW power.

The IA informed that they have approached MOEF for the expansion of the plant from 6.5 to 7.5 MTPA (hot metal) and applid for the TRO. MOEF& CC issued TOR in the on 19.09.2016.

By that time, the RINL started their construction activities for their modernization/ expansion from 2013 onwards with out obtaining EC. Blast furnace-I was started in october 2013, Blast furnace-II was started in may, 2016, sinter plant-I was started in october 2016, converter –III was started in march, 2013, converter –IV was started in june, 2014, Turbo Blower-V was started in June 2014 and Reservoir was started in July 2016. All these expansion activities were started with out obtaining prior Environmental clearance. The status of the expansion details is given in ***Annexure-IX.***

Date of monitoring: 06/12/2018

A. Specific Conditions.

Sl.No.	Conditions	Compliance Status as per inspection on 06/12/2018
i	The Gaseous emissions from various process units shall confirm to the load/mass based standards notified by this Ministry on 19th May. 1993 ad standards prescribed from time to time the state board may specify more stringent standards for the relevant parameters keeping in view the nature of the industry and its size and location. At no time the emission level shall go beyond the prescribed standards. In the event of failure of any pollution control system adopted by the unit, the respective unit shall not be re started until the control measures are rectified to achieve the desired efficiency.	Complied. Load based norms was stipulated only for Coke oven plant by APPCB. As per their norms for CO in coke oven batteries is 3 Kg/tonne of coke produced.The PA informed that the load based norm is between 2.2 and 2.5 kg/tonne of coke produced. As informed that at no time the emission level has gone beyond the prescribed standards and assured that in the event of failure of any pollution control system adopted by the unit, the respective unit would not be restarted until the control measures are rectified to achieve the desired efficiency. *Analysis reports carried by APPCB is here with submitted as* ***Annexure-II*** *Latest report provided by RINL is provided at* ***Annexure-III***

Sl.No.		Conditions	Compliance Status as per inspection on 06/12/2018
ii	a)	As reflected in the EIA/Environmental management plan report ,the company shall undertake water conservation measures by adopting closed loop water recirculation system ,recycling of direct contaminating cooling water through cooling tower, use of cooling tower blow down and slag granulation and dust suppression.	Complied RINL is undertaking water conservation measures by a)Adopting closed loop water recirculation system, recycling of direct contaminating cooling water through cooling tower, use of cooling water blow downs and slag granulation and dust suppression. B). Installed RO & UF for the STP –BF area and is being reusing the treated effluents for cooling and other purposes. c) Proposed to reuse the effluents from gas cleaning, cooling tower blow down which are letting out at Balacheruvu for various purposes after treatment in the effluent treatment plants.
	b)	The waste water from Gas Clearing Plant , Rolling mill, power plant, cooling tower, blow down shall be treated in waste water treatment plants.	Complied. The waste water from the Gas Cleaning Plant, cooling tower, blow downs are treated in waste water treatment plants.
	c)	The coke oven effluent shall not increase 2880 m3/. Existing effluent treatment plan shall be upgraded to treat the coke oven effluent and treated effluent shall comply with the prescribed standards.	Complied. • The Coke Oven effluent generation is about 2000m^3/day. • The effluent treatment plant was upgraded to treat the Coke Oven effluent and treated effluent is complying with the prescribed standards. APPCB is doing monthly monitoring. In addition online effluent monitoring system and connected the data to CPCB web site.
	d)	The company shall make efforts to maximize the reuse of the treated effluent. The surplus treated waste water shall be stored in the holding pond for use in the lean period.	Complied. • Township sewage water is treated and being used as make up water in Rolling mills & SMS after treatment in Ultra-filtration plant since

Sl.No.		Conditions	Compliance Status as per inspection on 06/12/2018
			Dec'2005onwards • Treated effluent from Coke ovens ETP is used for dust suppression at raw material handling plant after meeting the standards. • Treated effluent from plant ETP is now being pumped to RO plant and then after treatment the water is used as make up water in Coke Ovens. • The excess treated effluents are being let out in to Appikonda drain and Balacheruvu drains. ***Annexure-IV*** *provides the quantities of water savings*
	e)	The overflow shall be discharged through a marine outfall in to the sea. The discharge point shall be decided in consultation with the National institute of Oceanography, Goa.	Complied. • The marine outfall discharge point was finalized in consultation with NIO, Goa. • the marine pipeline has been laid, but not being put n operation. • Guard pond is under construction as per APSPCB directions. • Discharges through marine outfall shall be commenced after completion of the guard pond.
	f)	Further a marine ecological study shall be carried out to study the impact of discharge of excess treated waste water on the marine water quality	Complied. • RINL informed that the National Institute of Oceanography, Goa has carried out the study on " Monitoring of chemical & biological parameters in the marine environment off Appikonda and toxicological studies of the treated effluent of Visakhapatnam Steel Plant " in the year 2010, where in it was mentioned that there is no impact of discharge of treated water on marine ecology. • APPCB has also entrusted study of marine water to NIO and the report is awaited

Sl.No.		Conditions	Compliance Status as per inspection on 06/12/2018
	g)	The domestic waste water after treatment in STP shall be used for rolling mill and steel melt shop for cooling purpose.	Complied. RINL is reusing the treated effluents at Steel Melting Shop & Rolling Mills after ultra filtration.
iii	a)	In plant control measures for checking fugitive emissions from spillage/ raw materials handling shall be provided.	Complied
	b)	Further specific measure provisions of dust extraction and dust suppression system from raw material handling, water sprinkling system at the stock yards shall be provided.	Partially Complied. • RINL has informed that dust extraction and dry Fog type suppression systems are provided in raw material handling systems. • It was informed that a water sprinkling system has been provided in the coal stock yards. • Though the systems are in place, the AAQ values at Raw Material handling area seem high and the surroundings areas are dusty.
	c)	The company shall provide dry fogging system for crushing and screening plant , material and transfer points.	Partially Complied. Dry fog type systems are provided for crushing and screening plant, material and transfer points. Though the systems are in place, the AAQ values at Raw Material handling area seem high and the surroundings are dusty.
	d)	Data on fugitive emissions shall be regularly monitored and records maintained.	Complied. RINL has provided 4 Nos CAAQM stations at various locations & Fugitive emissions are being monitored regularly .
iv)		The company shall strictly comply with the standards notified under the Environment (Protection) Act, 1986 vide GSR 631 € dated 31st October 1997 to control the fugitive emissions , VOC from the doors, lids and off take of the coke oven batteries	Complied. RINL has informed that Fugitive emissions and VOC emissions from the doors, lids, and offtakes of the coke oven batteries are monitored regularly as per the notified standards and are below the norms.

Sl.No.		Conditions	Compliance Status as per inspection on 06/12/2018
v.	a)	The company shall provide dust suppression systems by bag filters and ESP to control the particulate emissions within 50 mg / m^3.	Partially Complied. RINL has installed dust suppression systems such as bag filters and ESP are provided to control the particulate emissions to within 50 mg / m3, but the emission are not meeting the stipulated standard for most of the chimneys. Status of APC's existing and its up-gradation (as provided by RINL) is given below • ESPs of Blast Furnace 1 &2 and of Sinter Machine-1 are upgraded to control emissions to below 50 mg/Nm3. • ESP is Sinter Machine 2 shall be upgraded in $2^{nd}/3^{rd}$ quarter of 2019 • ESP of TPP- Blr-1 – Upgradation work is under progress and expected to be completed by Mar'2019 • Balance 4 ESPs of TPP shall be upgraded in 19-20 after finalisation of contract
	b)	Cast house extraction system shall be based on ESP/ bag filters	Complied. RINL has provided ESP for the Cast house extraction system
	c)	The company shall use low NOx burners to control the NO_x emissions.	Complied. RINL informed that low NOx burners are provided at all process units wherever required.
vi.	a)	As per the solid waste management plan submitted to the Ministry, the company shall enhance efforts for reuse of solid wastes. The BF slag shall be sold to cement industries.	Complied. RINL started disposing the BF slag reuse of solid wastes (slag, coal dust) and that BF slag is being sold regularly to cement industries for manufacturing slag cement. Coal dust is recycled in sinter plant.
	b)	The slag from the steel melting shop shall be partly reused , partly dumped within the plant premises	Complied. RINL informed that

Sl.No.		Conditions	Compliance Status as per inspection on 06/12/2018
			• Slag of Steel Melting shop is partly being recycled at Sinter Plant • It is also being used for making roads as railway ballast and filling of low lying areas. • Balance is being stored within the plant premises for future use.
	c)	The sludge, dust extraction dust and mill scales and used refractory bricks shall be 100% recycled.	Complied. RINL informed that • Sludge dust extraction dust, mill scales are being recycled at Sinter Plant • Used refractory bricks are being recycled for as tundish lining and partly being sold to external agencies • 100% of the solid waste is reused.
	d)	The dry fly ash shall be utilized for brick making and ash from the pond will be used for reclamation	Not complied. RINL has informed that • Tendering has been done for setting up of brick making unit in RINL land. Two parties have qualified and further process is under way to implement the project. • Pond ash is being used for land reclamation works. • Dry fly ash is also being supplied for cement making etc. • Fly ash utilisation is not being complied.
	e)	The hazardous wastes generated in the tar sludge ,benzol muck, MBC sludge shall be charged along with coal into the coke oven batteris.	Complied. Hazardous wastes such as tar sludge, Benzol muck, Mechanical, Biological and Chemical treatment plants sludge are being charged along with coal into the coke oven batteries.
	f)	The spent oil shall be sold to the authorized re-processors.	Complied. RINL has informed that • Spent oil is being collected, reclaimed and reused in their plant. • Further only non-reclaimable waste oil is collected, stored and disposed

Sl.No.		Conditions	Compliance Status as per inspection on 06/12/2018
			to authorized re-processors.
vii.	The company shall develop Green Belt in 34 ha. of the plant area in addition to the 3425 ha. of plant area already afforested. Selection of plant species is as per the Central Pollution Control Board Guidelines.		Partially complied. • RINL has informed that the balance area of 34 ha. Green Belt will be taken up after the land dispute is resolved by the State Government. • Plantation is done as per the CPCB guidelines and details of species are provided at ***Annexure-V***
viii.	The company shall undertake rain water harvesting measures to recharge the ground water		Complied. RINL has informed that • 12 masonry check dams, 3 earthen check dams, 112 Percolation pits and recharging wells have been constructed for Rain Water harvesting. • 1 rain water harvesting pond of size Pond of app size 400 m x 100 m x 5 m depth near 18 MLD WTP and • 1 rain water harvesting pond of size Pond of app size 400 m x 100 m x 5 m depth near Kanithi Police station are also constructed
ix.	Occupational Health Surveillance (OHS) of the workers should be done on a regular basis and records maintained as per the Factories Act.		Complied. RINL has a full-fledged OHS is functioning since 1992 onwards. Periodical medical examinations are carried out regularly and records maintained.
x.	Recommendations made in the Charter on Corporate Responsibility on Environment Protection (CREP) shall be implemented.		Refer below. The details of implementation of CREP recommendation provided by RINL are given at Annexure-VI.
B. General Conditions			
S.No	Conditions		Compliance
i.	The project authorities must strictly adhere to the stipulations made by the APPCB and State Government		Complied.

Sl.No.	Conditions	Compliance Status as per inspection on 06/12/2018
ii.	No further expansion or modifications in the plant shall be carried out without prior approval of the MoEF .	Not complied. RINL started their construction activities for their modernization/ expansion from 2013 onwards with out obtaining EC. Blast furnace-I was started in october 2013, Blast furnace-II was started in may, 2016, sinter plant-I was started in october 2016, converter –III was started in march, 2013, converter –IV was started in june, 2014, Turbo Blower-V was started in June 2014 and Reservoir was started in July 2016. All these expansion activities were started with out obtaining prior Environmental clearance The details are given below: • Already the case was referred to Violation Committee and the violation has been dealt by MoEF& CC as per the S.O. 804 (E) dt. 14/03/2017. • In accordance with the prescribed Terms of Reference by Violation Committee, the EIA/ EMP Report has been prepared in compliance with the TOR issued by MoEF& CC and submitted for consideration of MOEF&CC. • MoEF&CC has conducted a meeting on 18/09/2018 and directed RINL and their Consultant MECON to comply with additional Observations and Recommendations. • The status of expansion works from 6.3 to 7.3 MTPA is here with submitted vide ***Annexure-IX***
iii.	At least four ambient air quality monitoring stations shall be established in downward direction as well as where maximum ground level concentration of SPM , SO2 and NOX are	Complied. • 3 continuous Ambient Air Quality monitoring stations (CAAQMS) have been established within plant

Sl.No.		Conditions	Compliance Status as per inspection on 06/12/2018
		anticipated in consultation with the State Pollution Control Board. Data on ambient air quality and stack emission should be regularly submitted to this Ministry including its Regional Office at Bangalore and the State Pollution Control Board / Central Pollution Control Board once in six months.	premises and fourth station is installed at Peda Gantyada village in the downwind direction of factory. The locations of the monitoring stations were decided in consultation with APPCB. The real time data are transmitted to APPCB and CPCB.
iv.		Industrial wastewater shall be properly collected, treated so as to confirm tot the standards prescribed under GSR422 (E) dated 19th May 1993 and 31st December 1993 or as amended from time to time. The treated waste water should be utilized for make up plantation etc.	Partially Complied . • 3 Industrial waste water recycling projects are implemented. Water is collected at 3 locations, treated and reused back in the steel plant as make-up water. • Total industrial waste water recycled this year (as provided by RINL)is given at ***Annexure- IV.***
v	a)	The overall noise levels in and around the plant area shal be kept well within the standards (85dbA) by prevailin noise control measure including acoustic hoods,silencers, enclosures etc on all sources of noise generation.	Complied. RINL has informed that adequate noise control measures such as acoustic hoods, silencers, enclosures etc are provided at all sources of noise generation. The noise levels were monitored and as informed the levels within the limit.
	b)	The ambient noise levels should conform to the standards prescribed under Environment (Protection) Act 1986 rules, 1989 viz., 75 dBA (day time) and 70 dbA(night time)	Complied. RINL has informed that monitoring of noise levels during day and night times are being carried out regularly and the results are within the limits.
vi.	a)	The project proponent shall comply with all the environmental protection measures and safe guards recommended in the Environmental Impact Assessment Notification 1994 /Environmental Management Plan report.	Not Complied To control fugitive dust emissions: 10 Nos of Dry fog Systems were commissioned in 83 areas covering 510 locations to avoid fugitive emissions during material handling & processing. Another 5 nos of Dry fog systems (101 to 105) are commissioned recently at coal handling area for use and controlling fugitive emissions further.

Sl.No.		Conditions	Compliance Status as per inspection on 06/12/2018
			Though the above measures are implemented , the fugitive dust level control measures are highly inadequate.
	b)	Further, the company must undertake socio-economic development activities in the surrounding villages like Community Development programmes, Educational Programmes, Drinking water supply and health care etc.	Refer below. • RINL has informed that under CSR, many activities were carried out in and around the villages. • Copy of the report(as provided by RINL) is enclosed herewith as ***Annexure-VII.***
vii.		The project authorities will provide requisite funds both recurring and non-recurring to implement the conditions stipulate by the Ministry of Environment & Forests as well as the State Government along with the implementation schedule for all the conditions stipulated herein. The funds so provided shall not be diverted for any other purposes.	Complied. RINL has informed that: • An amount of Rs 1283 Crores has been spent towards environment protection at 6.3 MTPA stage • An amount of Rs 558.59 Crores has been spent towards environment protection at 7.3 MTPA stage. • Also Rs 337 crores expenditure was incurred annually towards environmental management activities.
viii.		The Regional Offices of this Ministry at Bangalore/ Central Pollution Control Board / State Pollution Control Board will monitor the stipulated conditions. A six monthly compliance report and the monitored data along with statistical interpretation should be submitted to them regularly.	Being Complied. RINL is submitting six monthly compliance reports and the monitored data to MoEF& CC, RO, APPCB and CPCB regularly.
ix.		The project proponent shall inform the public that the project has been accorded the Environmental Clearance by the Ministry and copies of the clearance letter are available with the State Pollution Control Board / Committee and may also be seen at Website of the MoEF at http// envfor.nic.in . This should	No details made available. Complied Complied with details are enclosed at ***Annexure- VIII***

Sl.No.		Conditions	Compliance Status as per inspection on 06/12/2018
	be advertised within seven days from the date of issue of the clearance letter, at least in two local newspapers that are widely circulated in the region of which one shall be in the vernacular language of the locality concerned and a copy of the same should be forwarded to the Regional Office.		
x.	a.	The project authorities shall inform the Regional Office as well as the Ministry the date of the financial closure	Refer below. RINL informed that the point is noted and shall hence forth be complied.
	b	Final approval of the project by the concerned authorities and the date of commencing the land development work.	Refer below. RINL informed that the point is noted and shall hence forth be complied
3.		The Ministry may revoke or suspend the clearance, if implementation of any of the above conditions is not satisfactory.	RINL informed that the point is noted
4.		The Ministry reserves the right to stipulate additional conditions if found necessary. The company in time bound manner will implement these conditions.	RINL informed that the point is noted
5.		The above conditions will be enforced, inter-alia under the provisions of the Water (Prevention & Control of Pollution) Act, 1974, the Air (Prevention & Control of Pollution) Act, 1981, the Environment (Protectin) Act, 1986 and the Public (Insurance) Liability Act, 1991 along with their amendments and rules.	Refer below. CFO validity is up to April 2019 and the Public (Insurance) Liability Act, validity is upto March 2019.

Raavi Lakshmi Narayana

Digitally signed by Raavi Lakshmi Narayana
Date: 2019.01.19 17:43:49 +05'30'

Annexure-I

Annexure - II

ANDHRA PRADESH POLLUTION CONTROL BOARD
ZONAL LABORATORY, VISAKHAPATNAM

D.No. 39-33-20/1/4, Behind RTA Office,
Madhavadhara VUDA Colony, Visakhapatnam-530 018.
P. SOM SUNDAR, M.Sc.
SENIOR ENVIRONMENTAL SCIENTIST
Ph: 2719480/2800481 Fax: 2719480
e-mail:zonelab-ses1.apcb.gov.in

STACK MONITORING REPORT

Sample No.	2017 – 12 – ST – 01 to 32
Name of the industry	M/s. Rashtriya Ispat Nigam Limited, (Visakhapatnam Steel Plant) Kurmannapalem, Visakhapatnam
Sample collected by	JSO's Analyst Gr-I & Analyst (C) (O/o The CEE,RO-VSP,ZL-VSP)

S. No	Date of monitoring	Stack Identity	Conc. of SPM (mg/Nm³)	Conc. of CO (Kg/Tonne)
1	04.12.2017	Stack attached to BF – II Burden Handling System	119.9	–
2		Stack attached to BF – II Cast House Exhaust Station	38.1	
3		Stack attached to Blast Furnace – 3 (Cast house de-dusting)	139.8	
4		Stack attached to Coke Oven Battery No.I	45.4	4.5
5		Stack attached to Coke Oven Battery No.II	47.0	
6		Stack attached to Coke Oven Battery No.III	24.6	
7		Stack attached to Coke Oven Battery No.IV	33.8	
8		Stack attached to Blast Furnace – 3 (Stock house de-dusting)	25.3	
9	05.12.2017	Stack attached to BF – I Burden Handling System	28.8	–
10		Stack attached to BF – I Cast House Exhaust Station	27.5	
11		Stack attached to Thermal Power Plant Boiler – I	308.4	
12		Stack attached to Thermal Power Plant Boiler – II	338.1	
13		Stack attached to Thermal Power Plant Boiler – III	534.5	
14		Stack attached to Thermal Power Plant Boiler – IV	204.5	
15		Stack attached to SMS Centralized Ventilation System	73.8	
16		Stack attached to SMS – 2 (Secondary emission control system)	21.0	
17	06.12.2017	Stack attached to Sinter Plant Air Cleaning Plant	27.5	
18		Stack attached to Sinter Plant Gas Cleaning Plant	288.0	
19		Stack attached to Rolling Mills (LMMM) W.B Furnace	32.1	
20		Stack attached to SMS – 2 (material handling de-dusting system)	22.2	
21		Stack attached to SMS – 2 LFRH – 1	16.7	
22		Stack attached to SMS – 2 LFRH – 2	22.4	
23		Stack attached to Thermal Power Plant Boiler – VI	286.5	
24		Stack attached to Sinter Plant – 3 (De-dusting)	25.2	
25	07.12.2017	Stack attached to Rolling Mills (LMMM) RH Holding Furnace	19.4	
26		Stack attached to WRM Walking Beam Furnace – I	20.2	
27		Stack attached to MMSM Walking Beam Furnace – II	17.5	
28		Stack attached to CRMP Flux Kiln – III & IV	56.6	
29		Stack attached to CRMP Flux Kiln – V	151.5	
30		Stack attached to Sinter Plant – 3 (Waste gas)	82.8	
31		Stack attached to Wire Rod Mill – 2 Walking beam furnace (fuel – by Product gases)	15.9	
32		Stack attached to CRMP Flux Kiln – I & II	128.7	
		STANDARD	50.0 mg/Nm³	3 Kg / Tonne Coke Produced

- CO monitoring of Coke Oven Battery I to IV was conducted on 06.12.2017 to 07.12.2017 using Flue Gas Analyzer of M/s TESTO India Pvt. Ltd : Make & Model: TESTO-350

SENIOR ENVIRONMENTAL SCIENTIST

Annexure-III

CO Specific Emissions

Norm: 3 kg/Tonne of Coke produced

CO Specific Emission Kg/t of Coke : 2.473

CO Specific load in Coke oven Batteries								Annexure - II
Date of sampling: 17.09.2018								
	Concentration of CO (PPM) at different operating conditions					Avg. Conc.of CO (mg/Nm3)	Flue gas flow rate (Nm3/hr)	CO emission (kg)
	Sample 1	Sample2	Sample3	Sample4	Avg.			
Bat 1	304.3				304.3	304.30	192654	1406.99
Bat 2	552.0	98.4			325.2	211.80	195215	992.32
Bat 3	2130.9	2701.2	2411.2	1393.5	2159.2	2166.28	193673	10069.18
Bat 4	1332.2		1206.3	1852.4	1463.6	1507.44	191483	6927.60
							Total	19396.08
Gross Coke production on 17/9/2018 in Tonnes								7843
CO Specific Emission Kg/t of Coke								2.473

Annexure- IV

Industrial waste water recycling projects

Water Savings in Million Gallons

Treatment Plant	Month							
WWTP	April'18	May'18	Jun'18	Jul'18	Aug'18	Sep'18	Oct'18	Nov'18
Balcheru	30	31	30	30.35	31	30	31	30
Appikonda	13.56	15.65	11	19.7	17.55	12.13	14.69	18.82
UF Plant	16.85	16.11	13.89	14.78	17.47	18.5	21.27	8.74
Total	60.41	62.76	54.89	64.83	66.02	60.63	66.96	57.56

Annexure- V

Type of species planted and number of plants planted

Sl. No.	Species	Number of Plants Planted	Remarks
1	*Casurina equisetifolia*	2453257	To effectively combat TUSNAMI attacks and to act as Wind barriers during Cylones, as the Plant is located in close proximity to Sea.
2	*Acacia auriculiformis*	534088	To contain Air Pollution and for Carbon Sequestration.
3	*Eucalyptus spp.*	947475	
4	Miscellaneous	743722	
5	Mango	29441	
6	Coconut	8318	
7	Cashew	46888	
8	Guava	5561	
9	*Salvadora*	12000	
10	Neem	44314	
11	Babul	31362	
12	Teak	1814	
13	*Borassus flabellifer*	50000	Naturally grown
14	*Pongamia pinnata*	140000	To produce Bio-Diesel
15	*Jatropha spp.*	255000	
	TOTAL	**5303240**	

Annexure –VI

Status of Charter on Corporate Responsibility for Environmental Protection (CREP) of detail below:

STATUTORY BODY	COMPLIANCE TO	STATUTE UNDER
Central Pollution Control Board.	Charter on Corporate Responsibility for Environmental Protection.	Commitment by Steel Industry to CPCB.

Status Report on Corporate Responsibility for Environment Protection (CREP)

Sl. No	Action point	Status/action taken	Remarks
1	To meet the parameters PLL, PLD & PLO as notified under EPA by Dec'06	PLD, PLL & PLO in existing 3 batteries are well below the norms.	
2	To re-build at least 40% of Coke Oven Batteries by 2012	Battery-1 re-building for 30 months from AUG'2016 after Bat-5 commissioning in June'2016 Batt-2: Cold repairs done in 2000. Battery-1 17 nos of Hot full wall repairs completed by Aug'2013 Battery-3 Hot full wall repairs completed in total 68 No's of Heating walls by Apr'2015	
3	Steel Melt Shop – Fugitive emissions to reduce 30% by Mar'04	Fugitive emissions reduced by 30% by installing Torpedo ladle fume extraction system in Dec'02. Since then it is maintained for controlling fugitive emissions.	Complied
4	Steel Melt Shop – Fugitive emissions to be reduced by 100% by Mar'08 including installation of secondary de-dusting facilities	Installation of secondary de-dusting facilities is under progress SMS-2: Installed & Commissioned SMS-1: 1,2 &3 Converters -Commissioned	
5	Direct injection of reducing agents by June, 2013	Pulverized Coal Injection in BF-1 commissioned on 18/03/15 & BF-2 is commissioned Sep'2018 Pulverized coal injection in BF-3 is commissioned on 02/11/2015	
6	Solid waste / Hazardous waste management - SMS & BF slag utilization 70% by '04, 80% by '06 and 100% by '08 – CREP	QUANTITY (t)	

Item	2015-16	2016-17	2017-18	Nov'18	2018-19
BF slag generation	1424169	1434882	1655381	154421	1189139
BF slag utilisation	1264809	1220617	2352523.97*	248145*	1830839*
SMS slag	507959	527819.786	694842	68468	580787.646

Sl. No	Action point	Status/action taken	Remarks
		generation / SMS slag utilisation / % of (BF& SMS) total slag utilisation	

	2015-16	2016-17	2017-18	Nov'18	2018-19
generation					
SMS slag utilisation	132894	97048	129062	15018	92013
% of (BF& SMS) total slag utilisation	72.34	67.14	105.59*	118.07*	108.64*

*- Excess qty. sold/recycled was from previous stock.

100% disposal of Hazardous wastes being done as per authorization of APPCB

7	Charge of tar sludge / ETP sludge in coke oven by June'03	' Complied ' Charging being done regularly	
8	Inventorization of hazardous wastes	' Complied ' Annual returns are being submitted in form-4 regularly-	
9	Water conservation & water pollution : reduce specific water consumption to 5 m3/tls	Complied. Sp. water consumption of RINL is as given below.	

Parameter	15-16	16-17	17-18	Nov'18	2018-19
Specific water consumption. (m3/tcs)	2.63	2.50	2.40	2.28	2.35

10	To operate COBP effluent treatment plant efficiently to achieve the standards by July'04	Being maintained efficiently	Status to be maintained in future also
11	Installation of continuous stack monitoring equipment by Jun'05	On-line monitors for all stacks are already installed and in operation	Status to be maintained in future also
12	Setting up of 3 nos. on-line ambient air quality monitoring stations by Jun '05	Four stations (3 in the plant premises & 1 outside) are commissioned and working	Status to be maintained in future also
13	To operate existing pollution control eqpt.& keep proper records	Procedures and records for status / availability of DE systems and pollution control facilities are established as per QMS and EMS. Emissions of DE systems are also monitored and records maintained as per EMS.	Status to be maintained in future also
14	To implement the recommendations of LCA Study • Battery 1, 2, 3 repaired. In good health • Coke dry quenching, BF top gas recovery, LD gas recovery and 100% continuous casting. • Dog house- SMS:	• Complied • Complied • Planned along with replacement of existing converters	Status to be maintained in future also

Sl. No	Action point	Status/action taken	Remarks
	• PCI in BF 1&2: • Sp. Water Consumption • Specific Energy consumption	• Commissioned. • Complied. • Complied.	
15	Energy recovery from BF top gas pressure	Gas Expansion Turbines - 2x12 MW in BF 1 &2 are in operation. For new BF-3 - 1 x 14 MW TRT installed and commissioned on 11.06.2014.	
16	Use of tar free runners / BF	• Complied	
17	De-dusting in cast house	• Complied - Cast House Exhaust Station in all Blast Furnaces is in operation	
18	Suppression of fugitive emission using N_2	Cast house exhaust stations with ESPs are already provided to take care of cast house emissions hence, suppression with N_2 is not required / applicable.	
19	Processing of waste containing flux & ferrous wastes through waste recycling plant	Lime briquette plant, skull breaker, magnetic separator, screens and facilities for LD slag recovery exist.	
20	To implement rain water harvesting measures	12 masonry check dams, 1 Earthen check dam, Percolation pits and recharge wells 112 have been constructed so far.	1. 125 Rain water facilities are provided 2. Two Rain harvesting projects being implemented at an expenditure of Rs. 1303 lakhs for saving of 3.3 MGD of water
21	Reduction of green house gasses by: a. Reduction in power consumption	Following initiatives taken for reduction of power consumption: • Reducing field currents in DC motors in rolling mills (during no rolling periods) • Use of vector drives in Raw Material Handling Plants • Use of VVF drives in DE Systems of Coke Ovens • Regular audit and fine tuning of equipment to reduce power consumption • Energy saving devices and energy efficient lighting systems implemented extensively in the plant • Transparent roof sheets provided in suitable areas to reduce load during day time	
	b. Use of by-products gases for power generation	Being used extensively in TPP, CCCD, CRMP, SP, SMS, BF & Mills.	
	c. Promotion of Energy Optimization Technology incl.energy audit	In-house energy audits are done.	
22	To set targets for Resource Conservation such as raw material, energy and water	Internal targets are set towards resource conservation & monitored regularly to ensure the targets are met	

Sl. No	Action point	Status/action taken	Remarks
	consumption		
23	Up-gradation of the monitoring and analysis facilities for air and water pollutants. Also impart elaborate training to the manpower	1. Monitoring facilities: 4 Continuous Ambient Air Stations and 20 Continuous Stack Emission Monitoring Systems are installed. 2. Environment laboratory is now equipped to analyse all parameters related to physical characteristics, inorganic and organic elements, trace metals, microbiological and Bio-Assay characteristics. 3. Training being imparted regularly.	
24	Power Plants should provide dry fly ash free of cost to the users		Dry Fly ash is being provided free of cost to external agencies
25	Good housekeeping	Good housekeeping is being maintained all over the plant thro' EMS, QMS, OHSMS. As a proactive measure, RINL has also adopted the concept of "5-S" to improve housekeeping. In each department a team has been formed for the implementation of "5S". All **74** departments have implemented 5S and have been certified for the same.	

III. Compliance to Other Regulations:

Sl.No	Regulations	Requirement	Status
1	The Manufacture, Storage and Import of Hazardous Chemical (Amendment) Rules, 2000.	Incase of Major accident involving Haz.chemicals, full analysis of the major accident be submitted to MOEFCC	No such Accident
2	The ozone Depleting substances (Regulation and control) Rules,2000	Phase out of ODS	Phased out
3	Bio Medical Waste	1. Authorization for handling of Bio-Medical Waste exists 2. Submission of Form-2 to APPCB being done annually	

IV. Compliance to Other requirements:

Sl. No	Other Requirements	Status/Action taken	Remarks
1	Plantation of trees as per Green Visakha Program	Being complied	Status as provided by RINL is given below

Sl No	Year	Target	Planted as on date		
			Outside	Inside	Total
1	2012-13	25000	25,000	-	25,000
2	2013-14	75000	75,000	-	75,000
3	2014-15	100000	1,00,000	-	1,00,000
4	2015-16	125000 (Inside)	-	148,400	148,400
5	2016-17	125000 (Outside)	2,000	-	2,000
6	2018-19	_		28781 Vanam Manam and 5000 Green Visakha	33,781
Total		**450000**	**2,02,000**	**182,181**	**384181**

Annexure-VII

Annual Highlights

2017-18

Corporate Social Responsibility Department

Rashtriya Ispat Nigam Limited

Contents

CSR Annual Highlights 2017-18

1. Health

Cochlear Implantation

Cochlear Implantation: In order to promote the noble cause of rehabilitating the poor children with hearing impairment, Cochlear, an electronic medical device that replaces the function of the damaged inner ear was implanted to four children through ALIMCO. The ***cochlear implantation was successfully completed for four children*** belong to Visakhapatnam district. The surgery made them enable to hear speech at a nearly normal level.




Infrastructure to Govt. Hospitals

Two ambulances were provided to District Hospital, Sidhi and Sub- health centre, Bahari of Sidhi District, one of the tribal districts of Madhya Pradesh. Smt. Riti Pathak, MP (Lok sa bha) flagged off the Ambulance provided to Dist Hospital Sidhi. These ambulances are utilised for taking the patients to the hospital in case of emergency or to any higher centre for giving the treatment in time to save the lives.


Support to HIV/AIDS infected/affected children

DESIRE Society is actively involved in providing Institutional Care Home(ICH) services to HIV/AIDS infected/affected children at Gajuwaka. The Society takes care of these children (one or both parents died with HIV) by providing their everyday medication, nutritive food and education. With a view to support the noble cause, A TATA Winger Van was provided to DESIRE Society for transportation of these children to Hospitals for medical aid as well as for schooling purpose.

In addition to the above, a washing machine was also provided to the centre for the benefit of children.


Relief to Fire Accident Victims

RINL being a responsible corporate provided immediate relief to the 73 families affected by the Fire accident at Upparapalem, a surrounding village of the plant wherein their houses were gutted by providing essential items. Director (Personnel) Shri. Kishore Chandra Das, handed over the essential items to the families in the presence of the AP State Government officials.

Nethra Jyothi

- A State of the Art Mobile Eye Clinic 'NethraJyothi' has been donated to 'Visakha Eye Hospital Trust', Visakhapatnam. This Mobile Van equipped with latest technologies for diagnosing various eye diseases, is being run by doctors of 'Visakha Eye Hospital Trust'. This has been serving the rural people of Visakhapatnam, Vizianagaram and Srikakulam districts. Free, cataract surgeries have been performed benefiting 813 beneficiaries, who are under Below Poverty Line through this projectduring the year. Eye camps were also organized in the peripheral villages of Jaggayyapeta Lime Stone Mines and Madharam Dolomite Mines.
- Further, Diabetic retinopathy screening for 196 diabetic patients were done at Visakhapatnam.

Support to for Homeless

- A van was provided to **Association for Urban and Tribal Development,** managing Night shelters of GVMC through Visteel Mahila Samithi an extended arm of RINL CSR. The vehicle is utilized for rescue operations & collection of material.
- The homeless staying on the foot paths and other areas in the city are identified and provided with food & shelter by the Association.
- They are also be encouraged to do work and earn their livelihood.

Parivarthan

To address the menstrual health issues faced by girls in Government High schools, RINL has undertaken a capacity building as well as awareness programme -"Parivarthan". A programe on menstrual health was organized in association with Visteel Mahila Samiti at ZP High School, Kanithi. During the programme the precautions to be taken during one's periods and the importance of proper nutrition in having good menstrual health were explained to the high school girl students by Dr.Gargeyi, Senior Doctor of Visakha Steel General Hospital. After the awareness session, sanitary napkins were distributed to the students.

Health Camps

camp was organized at Budawada, a surrounding village of Jaggayyapeta Limestone Mines (JLM) and Bongaram, tribal village at Peda Bayalu in Visakhapatnam District. Free medicines were given to the patients during the camp.

Artificial Limbs to Differently abled

Artificial limbs, wheel chairs and tricycles were distributed to the 80 differently abled persons, Anakapalle, Visakhapatnam.

2. Education

Siksha

With a strong belief that education is a catalyst for social change, free education is being provided to around 1600 children belonging to Below Poverty Line (BPL) families from the surrounding vill ages of Plant & Mines. The project creates a tangible impact in the lives of the economically disadvantaged since majority of the beneficiaries of this project are first generation learners.

Arunodaya Special School

- Arunodaya Special School: A multi-category School/centre, caters to children with learning impairment, mental retardation, cerebral palsy, autism, hearing loss and other learning disabilities. The main objective of the school is to make these children learn to manage/behave themselves and also to make them self dependent by sharpening their inherent talents.
  RINL extends support to this school and free education including vocational training and therapy was provided to around 100 differently abled children from the surrounding villages every year.

- A new school bus was also provided for meeting the transportation requirement of the Special children from the nearb y villages to the school and back.

- 

Chaitanya & Mr. LV Teja students of Arunodaya Special School, won gold medals in aquatics (swimming) competition in the National Games for all disabled held at Gandhi Nagar Gujarat & in Cycling in the National Special Olympiad held at Ranchi respectievely.

Pathashala ki Aabharanam:

With a view to address the infrastructural deficit in the schools, RINL has provided 700 three seater dual desks to Zilla Parishad High schools at Chandrampalem and K.Koppaka,DPN ZPH School, Kasimkota and ZPH school Kannurupalem in Visakhapatnam District and ZPH School at OV Peta in Srikakulam District.

Vivekananda Vidyarthi Nilayam :

A Hostel building was constructed for students belonging to 'Girijan' community at Yendada, Visakhapatnam through Andhra Vanvasi Kalyan Ashram . This project is intended to address the constraints faced by tribal students who are pursuing higher education at Visakhapatnam City.

Chethana

- Chethana is a six month Adult literacy programme, intended for providing basic education for adults who have lost the opportunity and crossed the age of formal education. This program was taken up at 15 centres located in surroundings villages of Plant & 5 tribal villages of Visakhapatnam District.The programme has benefited 500 adults. Certificates were awarded to those who completed the course successfully.

3. Skill Development

Skill Development to Divyangjan

With a view empower the disabled to have better standards of living, RINL Provided Skill developmwent ptoram for 100 Divyangjan (People with Disabilities) residing in the surrounding villages of the Plant and other areas of Visakhapatnam in various Skills viz. Tailoring, Computer Data Entry Operation, Beautician and Mobile Handset repair. The programme immensly benefitted the Divyangjan for their livelihood.

Saksham

- 'Saksham': To empower the unemployed youth with the skills for earning a decent livelihood, Vocational training programmes in various trades viz. Mobile repairing, Arya works, Solar equipment repairs & maintenance, LMV driving, Cutting & tailoring and Beautician course were taken in 10 centers and completed benefitting 300 youth residing in the Rehabilitation colonies & Nadumveedhi a tribal village of Visakhapatnam District and Garbham Mines area. Certificates were awarded to those who have successfully completed the training programme.

- **Home Nurse Course:** A qualified Home nurse is of huge demand, especially in cities, with the increase in the number of senior citizens staying alone with their children settled in far off places in search of greener pastures. Considering the above, A training program in Home Nurse course for unemployed women of Bonangi village has been take up through Jan Shikshan Sansthan. Training was provided to 20 women beneficiaries from the surrounding areas which enabled them to earn a decent livelihood.

onth tailoring programme was also organized for women at Bonangi, a surrounding village of Plant.

4. Environment

Green Visakha

Green Visakha : Block plantation of 75000 saplings was taken up under Green Visakha project at Gangavaram (30000) and Lemarthi (45000).

Surya

'Surya' : Provision of street lights in villages will alleviate the life style of the villagers and would bring improvements in their quality of life. RINL Installed 75 Solar street lights in Kheri Saffa (25) and Kharak Bhura (50) villages of Jind District of Haryana.

5. Rural Development

Ukku Kalavedika Gangavaram

Multipurpose hall constructed at Gangavaram was inaugurated by, Dr.K.Haribabu Honorable MP Visakhapatnam in the presence of Shri.PallaSrinivas Rao,Honorable MLA Gajuwaka, CMD and Directors. The hall was put into operation for the benefit of villagers through Community welfare Centre, Gangavaram. The two floor building constructed at a cost of Rs.1.50cr will serve the residents of RH colony & its surrounding villages for conducting social functions and other skill development programmes.

Development works at Chepaluppada Village

Project for providing Under Ground Drainage (UGD) and BT Road was taken up Chepulapada village, Bheemili of Visakhapatnam district. Shri M Venkaiah Naidu, Hon'ble Vice President of India laid foundation stone for the above project which was taken up for the comprehensive

development of Chepulapada village near Bheemili, Visakhapatnam District.

Construction of Community Hall

A community hall was constructed at Seethanagaram Village, Anakapalli Mandal, Viskahpatnam district under rural development activity. Further construction of a community hall at Sahjadpur village of UP was also taken up in collaboration with MSTC

Roof sheeting work for cyclone affected houses in slum areas of Visakhapatnam

Roof sheeting work for Hud-hud cyclone affected houses in slum areas of Greater Visakha Municipal Corporation was taken up through the funds provided by NMDC.

A.C.sheets were fixed to 4769 beneficiaries houses in 40 wards of GVMC as per the list provided by District Administration.

6. Sports

Promoting Sports for Special Children

Sports for Special Children was organised every year aiming at boosting the confidence levels of the Special children also to provide a platform for the children to showcase their talents. Various special schools in Visakhapatnam Dist. & Vizianagaram Dist. participated in the meet. Around 250 children studying in Special schools of Visakhapatnam District along with 50 teachers and staff have Participate in the event and won appreciation from all quarters.

Financial Assistance to disabled sports person

Access to quality training is an essential factor which plays a key role in the success of any sports person. RINL as a CSR initiative has provided a financial assistance to Shri Jeet Kumar, a para athlete to help him take up intensive coaching for three months in Power Lifting (Bench Press) and achieve better results in the Inter Ministry Bench Press tournaments. Further, the above training enabled him to fine tune his skills to achieve success in the international Paralympic event. The cheque was presented by Hon.Minister of Steel.

7. Sanitation

Installation of RO Water Plants

Shri P Madhusudan, CMD, RINL has inaugurated the RO Plants at Islampeta, Madeena bagh, and Desapatrunipale surrounding villages of the plant in the august presence of Bandaru Stayanarayana Murthy, MLA Pendurthi. The RO Plants with a capacity of 1500 liters per hour, installed through GVMC provides clean and hygienic drinking water for around 10,000 residents of the above villages and surrounding areas. The plants were handed over to GVMC authorities for operation further maintenance.

Supply of Drinking Water to Rehabilitation Colonies

To ensure access to pure drinking water during the summer months to the residents of four Rehabilitation colonies of RINL i.e. Agnampudi, Gangavaram, Pedagantyada & Vadlapudi, a project to supply drinking water for a period of four months was taken up. Every day 80,000 liters of drinking water was supplied through tankers to the residents of RH colonies.

8. Swachh Bharat

'Swachhta Hi Sewa' Campaign (15th Septemebr to 2nd October 2017)

s

"Swachhta Pledge" on the occasion of "***Swachhta Hi Sewa***" campaign in Main Administration Building to highlight the 'Swachhta-Hi-Sewa' campaign undertaken in the country. Sri P Madhusudan, CMD led the campaign in which all the Directors, senior officers of RINL and a large number of employees were present and administered the Swachhta Pledge to mark the occasion. Addressing the employees, Sri Madhusudan said that RINL is moving in a focused way in the cleanliness drive to protect and save the environment and exhorted the employees to participate voluntarily and actively in the promotion of cleanliness and should become torchbearers in the campaign.

This campaign would largely help in ensuring good and clean living, protecting working environment and help in reducing the incidence of diseases, he added. He also said that for RINL swachhta does not end with the plant and township, but that the campaign by RINL would also caters to the peripheral colonies and villages too. Sri PC Mohapatra, Director (Projects), Sri P Raychaudhury, Director(Commercial), Sri KC Das, Director (Personnel), Sri VV Venugopala Rao,

Director(Finance), Executive Directors, General Managers were participated in the campaign. RINL had been taken up a variety of Swachhta activities in the Plant, Township, Mines and Schools etc, to implement the national programme initiated by the Hon'ble Prime Minister of India.

Swachhata Campaigns (Regular)

Swachh Bharat: 2595 Swachh Bharat activities were carried out by various departments of the plant during FY 2017-18.

Safai Pakhwada (Fortnightly Cleanliness Drives in 2017-18)

Safai Pakhwada: As per the direction received from Hon'ble Steel Minister, Govt. of India, to observe cleanliness fortnights (Safai Pakhwada) by all PSU's under the control of Ministry of Steel, 'Safai Pakhwada' has been initiated at RINL since 1st August 2016. Safai Pakhwada' were observed in all the departments in a phased & sustained manner throughout the year Pakhwada Reports at the end of each fortnight were prepared and forwarded to MoS.

Swachta Pakhwada (15th to 31st March 2018)

- Fortnight long Swachta drives "**Swachhta Pakhwada**" was observed from 15th to 31st March 2018 in several department and Mines during May,2016. The Pakhwada witnessed extensive participation at all

levels. During the fortnight, a plethora of activities like Swachhta Pledge, Shramdaan in Plant and mining areas, nities, awareness programmes for school children, workshop on 'Disposal of slag and other waste generated leading to zero waste' etc. were organised.

Inauguration of "Swachh Vedika" at Central Stores

Workshop on 'Slag and Waste Disposal' at RINL

An exclusive intranet portal "Swachh Bharat @ RINL"

- RINL hosted an exclusive intranet portal christened as "***Swachh Bharat @ RINL***" to promote Swachhta in the plant.
- The portal is a repository of information on Swachhta activities amongst the employees and departments to showcase exemplary contribution on implementation of Swachh Bharat Abhiyan

Special Cleanliness Drive in Offices (Diwali 2017)

- Special Cleanliness drive was observed during Diwali 2017. Employees in large number participated in cleaning their office premises.

Contribution to 'Swachh Bharat Kosh'

- In order to strengthen Swachh Bharat Mission and help in achieving the objective of improving cleanliness levels in rural and urban areas, Rs. 50.00 Lakhs was contributd to 'Swachh Bharat Kosh' set up by Govt. of India.

Maintenance of Toilets under Swachh Vidyalaya

RINL provided financial assistance for Maintenance of 86 toilets constructed in 33 schools under "Swachh Vidyalaya". RINL not only funds the activity but also regularly monitoring the maintenance of toilets for better utilisation.

Installation of Toilets

- Installed a Port-a-cabin toilet block at the Simhachalam temple, a historical pilgrim place in south India at Visakhapatnam,for improving the sanitation levels.

Construction of Individual Household Toilets in Nedumveedhi Tribal Village

RINL taken up Construction of 52 nos. of Individual Household Toilets in Nadumveedhi, a tribal village of Paderu Mandalam, Visakhapatnam, as a part of comprehensive development of the village towards a 'Swachh Gram'.

Providing Infrastructure for Waste Recycling

- For effective Solid Waste Management, RINL installed a Compost Machine at Simhachalam temple at Visakhapatnam. This automated machine is capable of recycling all kinds of organic waste into compost within 24 hours. The machine has the capacity to convert around 250 Kg of

organic waste per day.

Renovation of Toilet Blocks at Rangaraya Medical College (RMC), Kakinada

- Construction of new toilet blocks and renovating existing toilet blocks at Pharmacology Department of Rangaraya Medical College (RMC), Kakinada East Godavari Dt. of AP was carried out as part of Swachha Bharat Mission.

Before

After Renovation

Bal Swachhta Jagruti – Creating Awareness to School Children

- **Bal Swachh Jagruthi** Eleven Awareness programmes on good hygiene practices through audio visual medium were conducted to children in the schools situated in the surrounding areas of Plant & Mines covering 1015 children.

Swachhta Puraskar – Awards to Best Performing Departments

- **Swachta Puraskar awards** were instituted to instill competition in implementing Swachh Bharat Abhiyan in their departments and to encourage the innovative work during the Swachta campaigns. These awards were presented by CMD to the best performing departments on 2nd October 2017.

Centenary celebration of Champaran Movement:

In connection with the centenary celebrations of 'Champaran Movement' the following programmes were organized in the peripheral villages involving the beneficiaries of CSR programmes

- ***Walkathon*** was organized in Islampeta and Durga Nagar villages
- Awareness sessions on '***Digi Dhan' and 'Usage of Steel for Village Development'*** were also organised for the beneficiaries & villagers during the campaign.

Awareness on Zero Plastic in Township

Awareness sessions were conducted on plastic waste and its proper disposal to the Students in Schools and the Residents in Ukkuagaram township. The program was organized in association with the Town Administation Department.

Visakha Vimala Vidyana

Residents of Ukkunagaram

9. Promoting Digital Society

Distribution of PoS Machines

In line with the Government decision to promote digital payments and cashless transactions in the country to bring transparency and productivity in the system and with a view to achieve a less-cash society in the Ukkunagaram Township, POS machines were distributed to vendors in the township through Hon'ble Union Minister of Steel **Shri. Chaudhary Birender Singh** in a function organized at Vizag Steel on 23rd April 2017.

Creating Awareness on Digital Transactions

82 awareness sessins were conducted covering 2754 beneficiaries to promote Digital Transactions at the sites where RINL CSR projects are under implementation namely Adult literacy programme, Vocational Skill development programmes, eye camps & Roof sheeting works etc.

10.CSR Beneficiaries Meet

CSR Beneficiary Interaction Meet: An interaction meet with CSR project beneficiaries of various CSR programmes viz, Nethra Jyothi, Desire Society - Institutional care Home, Skill Development for 'Divyangjan' , Vocational training programme & Adult Literacy programme etc was organized at Management Development Centre during the visit of the Panel of judges for the PM's Trophy 2016-17. The panel of Judges first visited the Arunodaya Special School, one of the flagship CSR initiatives of RINL, and then interacted individually with the beneficiaries of RINL CSR and appreciated their accomplishment through RINL CSR projects.

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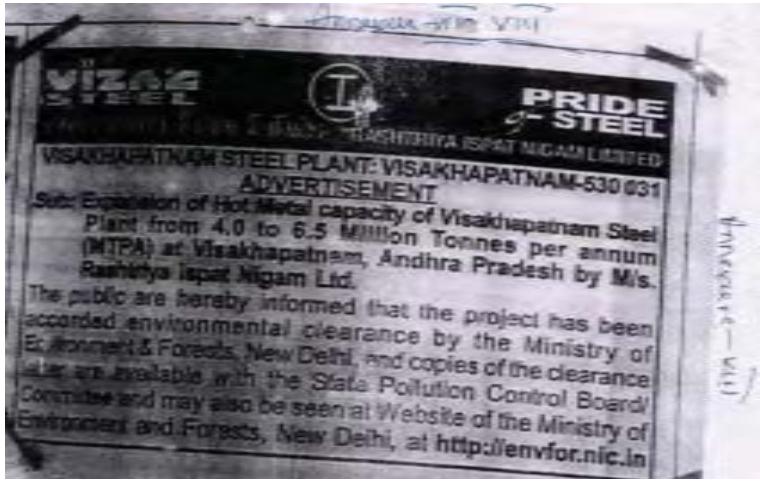
Annexure-VIII



VIZAG STEEL

PRIDE of STEEL

RASHTRIYA ISPAT NIGAM LIMITED

VISAKHAPATNAM STEEL PLANT: VISAKHAPATNAM-530 031

ADVERTISEMENT

Sub: Expansion of Hot Metal capacity of Visakhapatnam Steel Plant from 4.0 to 6.5 Million Tonnes per annum (MTPA) at Visakhapatnam, Andhra Pradesh by M/s. Rashtriya Ispat Nigam Ltd.

The public are hereby informed that the project has been accorded environmental clearance by the Ministry of Environment & Forests, New Delhi, and copies of the clearance letter are available with the State Pollution Control Board/ Committee and may also be seen at Website of the Ministry of Environment and Forests, New Delhi, at http://envfor.nic.in

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Annexure-IX

Package	Front hand over date / Contractual Start date	Actual Completion date / Likely completion date	Status as on November -2017	Status as on December – 2018.
BF-1 Revamping	25/10/2013	31/07/2014	Commissioned and running at 90 % capacity	Commissioned and running at 90 % capacity
BF-2 Revamping	5/5/2016	21/08/2017	Commissioned and running at 60 % capacity	Commissioned and running at 90 % capacity
Sinter Plant-I Revamping	31/10//2016	31/07/2017	Commissioned and running at 70 % capacity	Commissioned and running at 90 % capacity
Kanithi Balancing Reservoir-2	19/07/2016	Likely to completed in 2018 - 2019	15% of construction work completed	80% of construction work completed
3rd Converter	March 2013	Completed in November-2016	100 % completed	100 % completed
4th Caster	June 2014	Completed in December-2017	80 % completed	100 % completed
TB-5	June 2014	November-2017	95 % completed	95 % completed
Sinter Plant -2 Revamping				Not yet started.
COB 5	04/07/2015	LIkely to be completed by Sep, 2019	50% completed	67.5% completed

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Twin LHF	11/11/2016	Likely to be completed by March, 2019	39% completed	83% completed

ANNEXURE D

BASELINE HEALTH STUDY

Annexure D

BASELINE HEALTH STUDY

AS PART OF

EIA-EMP STUDY FOR EXPANSION OF INTEGRATED STEEL PLANT FROM 6.3 MTPA TO 7.3 MTPA LIQUID STEEL WITHIN PREMISES OF VISAKHAPATNAM STEEL PLANT

OF

RASHTRIYA ISPAT NIGAM LIMITED
Visakhapatnam Steel Plant

JANUARY, 2019

RASHTRIYA ISPAT NIGAM LIMITED
Visakhapatnam Steel Plant
(A Govt. of India Enterprise)
Gajuwaka, Visakhapatnam,
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Project Proponent

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PO. Doranda
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EIA Consultant

INDEX

BASELINE HEALTH STUDY WITHIN 5 KM RADIUS OF THE PROJECT

1. INTRODUCTION

Any industrial facility involves various activities such as transportation, combustion, manufacturing as well as chemical processes during its operation and different construction activities that could, either in mobile or stationary situations, generate air pollutants, noise, waste water discharges and solid wastes which may lead to pollution of environmental aspects in and around its vicinity.

Exposure to polluted air, water and land resources, inevitably leads to short-term or long term effects on human health, depending on the exposure to the pollutants.

Ministry of Environment, Forest & Climate Change (MoEFCC) has recommended for carrying out baseline health study within 5 km radius of RINL's Visakhapatnam Steel plant (VSP) to assess the existing health status of the people living in the area. The main aim of the study was to create a health profile of people living within 5 km vicinity of RINL-VSP by assessing the prevalence of diseases, primarily asthma, chronic obstructive pulmonary disease (COPD) and other diseases that may be associated with environmental pollution due to industrial activity.

1.1 Background

RINL's VSP plant had received Environmental Clearance (EC) for increase in production of Liquid Steel from 3.5 MTPA to 6.3 MTPA from MoEFCC vide their letter no.J-11011/196/2005-IA II (I) dated 11-08-2005.

However, after installation of all units for achieving the rated capacity of 6.3 MTPA, RINL started revamping / capital repairs of the existing critical equipment of the plant installed in the year 1990 to ensure safety as well as compliance to newer environmental standards as specified in MoEFCC's notification vide GSR.277(E) dtd. 31st Mar'2012. This led to enhanced capacities by upto 1.0 MTPA. However, this increase in production was done without obtaining prior EC as per EIA Notification 2006, and hence was considered as a "Violation" of the said notification. In view of the above, RINL presented its case before the Expert Appraisal Committee (EAC) for Violation cases and was subsequently granted ToR for carrying out EIA / EMP study.

Successively, EIA / EMP study was conducted and the EIA / EMP report was prepared for expansion of RINL-VSP plant from 6.3 MTPA to 7.3 MTPA Liquid Steel (i.e. 6.5 MTPA to 7.5 MTPA Hot Metal) by revamping and modernization of the plant. The same was submitted to MOEFCC for appraisal in the 13th meeting of EAC (Violation), wherein the proposal was deferred and RINL was suggested to provide additional information vide Sl. No. 13.3.1 of MoM of 13th EAC meeting (Violation committee) 2006 held between 18th-20th September 2018 in MoEFCC, Delhi. The present **baseline health study** within 5 km radius of RINL's VSP plant was also recommended as part of the above additional information by the EAC, MoEFCC.

1.2 Objectives of the study

The main objectives of the study were to create a baseline profile of health data for population living within 5 km radius of RINL's VSP plant and assess the prevalence of

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different types of diseases.

2. STUDY METHODOLOGY

A cross-sectional study was carried out with quantitative approach and with authorization from RINL-VSP. Assistance from District Medical & Health officer (DM&HO) as well as District Coordinator for NTR Vaidya Seva was also taken for collection of secondary data. RINL-VSP worker's detailed information regarding disease profile was obtained with assistance from In-charge, Occupational Health & Safety department-RINL, who is also a qualified epidemiologist, after obtaining informed written consent and explaining the purpose of the study.

The study involved a two-stage data collection survey followed by statistical analysis and interpretation of the data collected with consideration of physical profile of the people surveyed as well as industrial and residential setup of the area surveyed.

Stage-1 of the survey involved a representative household survey based on a Primary health questionnaire, developed in consultation of a qualified Doctor and epidemiologist.

Secondary information related to disease profile in the study area from Government hospitals as well as Specialty hospitals was collected in Stage-2 of the survey.

The morbidity profile of employees working within the RINL-VSP steel plant (Core zone) was also collected in this stage. The employees working within the steel plant are likely to have maximum exposure to industrial pollution, and the same may be used to compare qualitatively the health status of people living in the buffer-zone area with the people working within the core-zone area.

The data collected was analyzed and observations were produced in this report, with an aim to obtain a holistic view of the health of the people in the study area.

2.1 Sources of Data:

The study team utilized both primary and secondary sources of data for study. The primary sources of the data were collected through a structured questionnaire and the secondary data were collected through Government hospitals/PHCs, Government-run health schemes, and RINL-VSP's OHS&RC department. The literature survey for the study included scientific articles, research journals and e-sources.

2.2 Study area

The study has been conducted within 5 km area around RINL's Visakhapatnam Steel Plant (RINL-VSP), located in Visakhapatnam district (hereafter called the study area). The study area predominantly included residents from different wards of Greater Visakhapatnam Municipal Corporation (GVMC).

The study area was divided into 5 geographical zones (viz. Z1 to Z5), based on the type of population (urban/rural) as well as type of industrial activity (apart from RINL-VSP) possibly affecting the area. The characteristic of the identified zones is mentioned in **Table-1**.

Table-1: Characteristics of identified zones of the study area

Zones	GVMC Wards	Mandal	Predominant characteristics	Direction from VSP
Z1	55	Paravada, Pedagantyada	• Rural population • Industrial exposure *(Thermal power plants)*	SW
Z2	54, part of 53	Paravada, Pedagantyada	• Urban population • No industrial exposure*	W
Z3	58, part of 53	Gajuwaka	• Semi-Urban population • No industrial exposure*	W
Z4	51,52,part of 53,59, 60,61,62, 63,64	Gajuwaka, Pedagantyada,	• Urban population • Industrial exposure *(Small-scale chemical based plants, secondary metal processors, cement mixers etc.)*	N & NE
Z5	50	Pedagantyada, Visakhapatnam(U)	• Semi-urban & urban population • Industrial exposure *(Port handling dry cargo)*	NE

Note: **Industrial exposure here implies industrial activities apart from RINL-VSP.*

As observed from the above, all the zones in the study area are different in their demographics and exposure to industrial activity. The detailed properties of each zone with respect to industrial exposure and nature of urbanization is presented in **Table-2** below.

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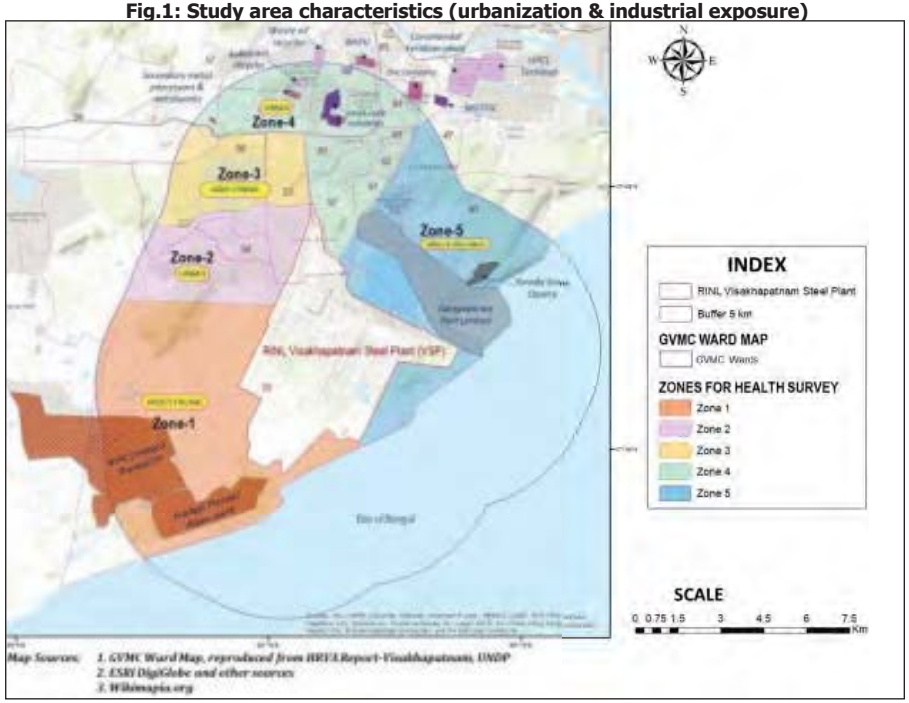
Table-2: Zone-wise industrial exposure and urbanization nature of study area

Zones	Nature of urbanization	Industrial exposure (apart from VSP)						Direction from VSP
		Within 3 km from VSP		Between 3 km to 5 km		Near 5km periphery		
		Name	Industry type	Name	Industry type	Name	Industry type	
Z1	Rural habitation	• Hinduja TPP (2x520 MW)	*Coal-fired Thermal power plant*	• NTPC Simhadri STPP (4x500 MW)	*Coal-fired Thermal power plant*	-	-	SW
Z2	Urban nature, planned dwellings of RINL Township	-	-	-	-	-	-	W
Z3	Semi-urban population	-	-	• New KBR-2 construction site	*Construction activity*			W
Z4	Urban population	• Small-scale lubricant plants	*Waste oil reprocessers (Chemical industry)*	• Navya Waste and Used Oil Re-refining & Recycling Industry	*Waste oil reprocessers (Chemical industry)*	• Bharat Heavy Plate & Vessels limited (BHPV)	*Secondary steel manufacturing*	N, NW
				• Sarita Steel Industry	*Secondary steel manufacturing*	• Zinc Company	*Non-ferrous industry*	
				• RDC Concrete (India) Ltd	*Cement mixing plant*	• Coromondal Fertilizer plant	*Fertilizer plant*	
						• HPCL Terminal	*Petrochemical storage*	
						• Marine Gas Turbine Overhauling Complex (MGTOC)	*Metal works processes*	
Z5	Patches of Urban and semi-urban population	• Gangavaram Port (62 MMTPA)	*Port (handling coal, iron ore & other cargo)*	-	-	-	-	N-NW
		• Yarada Stone quarry	*Mining activity*					

The zone-wise geographical setup and industrial exposure overlain with the administrative boundary of GVMC wards within the study area is presented in **Fig.1**.

Fig.1: Study area characteristics (urbanization & industrial exposure)



2.3 Demographic pattern of the study area population (Zone-wise)

Visakhapatnam is a fairly developed and urban district of which Greater Visakhapatnam Municipal Corporation (GVMC) is constituting about 3.91% of the total urban population of Andhra Pradesh state. The study area population includes people residing in different wards of GVMC. A total of 13 wards of GVMC within the study area were differentiated into 5 zones based on urbanization nature and industrial setup, as detailed above.

The study population for carrying out the primary health survey has been identified based on demographics of the areas as published in census data of 2011. The demographic data of the people residing in the area, zone-wise is presented in **Table-3** below.

Table-3: Zone-wise Demographics of the study area (Census-2011)

Zones	Total population (% distribution)	Males	Females	Population density (per sq. km)
Zone-1	19853 (7%)	10263	9590	417
Zone-2	29081 (10%)	14720	14362	1692
Zone-3	15920 (5%)	8075	7845	1187
Zone-4	206079 (68%)	105193	100886	8134

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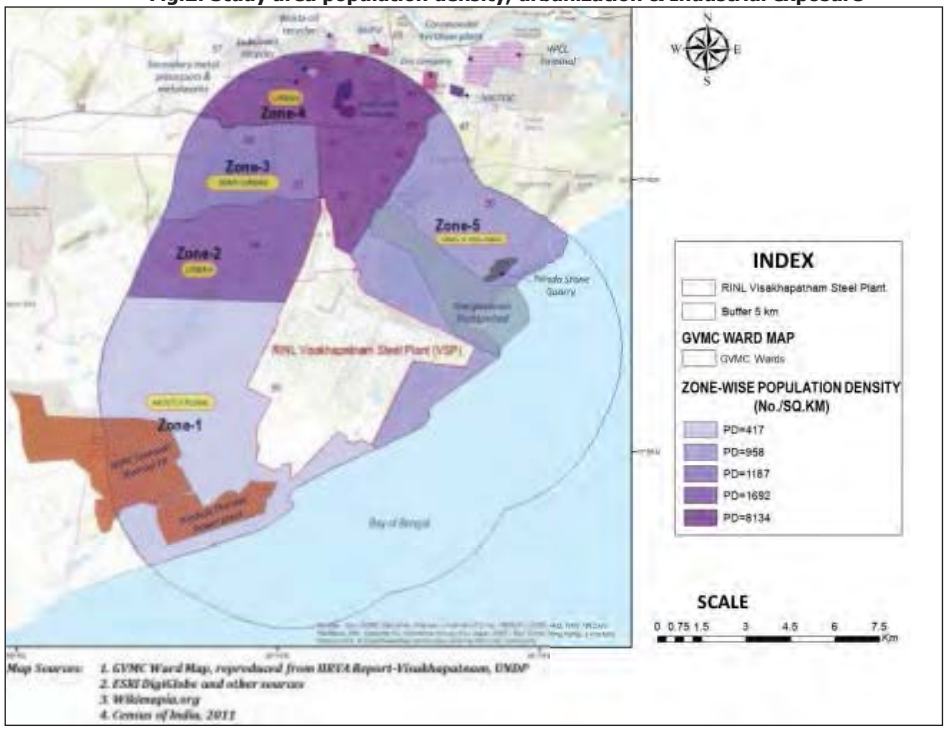
Zones	Total population (% distribution)	Males	Females	Population density (per sq. km)
Zone-5	32608 (11%)	16704	15904	958
TOTAL	**303541 (100%)**	**154955 (51%)**	**148586 49%**	

The population distribution as indicated above has been used to determine the sampling size of the primary health survey. A representation of the zone-wise population density overlaid with anticipated industrial exposure of the people living in each of the zones is shown in **Fig. 2** below. The same has been used to design the zone-wise coverage of respondents for the survey.

Fig.2: Study area population density, urbanization & Industrial exposure



As illustrated in the figure above, owing to higher population density in Zone-4 (Z4), the maximum number of respondents had been selected from the localities therein. Also, exposure to high polluting activities in Zone-1 (due to coal-fired thermal power plants) and Zone-5 (due to coal, iron ore and other dry cargo handling port facility) necessitated higher number of respondents from these localities too.

a. Growth of population

Population of Visakhapatnam district has shown a decadal growth rate of 18.34% from 2001 to 2011, based on population statistics of Census 2011 and 2001. In 2001, the total census population of Visakhapatnam was about 15,69,507 which increased to 18,57,335 in 2011.

As per ward-wise population projections published by Andhra Pradesh Urban Finance and Infrastructure Development Corporation (APUFIDC), the zone-wise populations estimated at the time of study is as mentioned in **Table-4** below**.**

Table-4: Zone-wise projected demographics of the study area (for yr. 2018)

Zones	Total population (as per Census 2011)	Projected population in 2018 (as per ward-wise growth rate from APUFIDC)
Zone-1	19853	57547
Zone-2	29081	31156
Zone-3	15920	21088
Zone-4	206079	216733
Zone-5	32608	36621
TOTAL	**303541**	**363145**

The projected population has also been taken into consideration for determination of the prevalence of diseases and building a cross-sectional profile of the study area with respect to the health status of the residents, utilizing primary as well as secondary information.

2.4 Survey design

The present study used simple random sampling method to carry out a house-to-house cross sectional survey in Visakhapatnam district within 5km radius of RINL's Visakhapatnam Steel plant. The study was carried out over a period of 2 months (October, 2018 to November 2018).

As per district level household and facility survey (DLHS) 2012-13, overall reported prevalence of morbidity in Visakhapatnam was 32.2% within the total population across all age groups and genders. The sample size was calculated using the formula $n=4(pq/L^2)$ where p = prevalence % (from previous studies), q=100-p and L = Allowable Error. For this study, the absolute allowable error, L was presumed to be 5% i.e. at 95% Confidence level. Considering p = reported prevalence of morbidity in Visakhapatnam district, the sample size was calculated as 349, which was increased to 450. Thus, 450 respondents were interviewed, distributed between the identified zones based on the projected population of each zone and significance of the industrial exposure therein.

a. Stage-1: Primary household survey

The primary household survey, was carried out by including a total of 450 respondents across all the zones in the study area. The coverage of the survey between the zones was estimated based on the proportion of population living in each zone (estimated from zone-wise projected population in 2018 in Table-4 above) as well as taking into consideration presence of HIGHLY POLLUTING industries (Thermal power plants and Port handling coal,

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iron ore and other dry cargo), as well as MEDIUM POLLUTING industries (i.e. small-scale Chemical & metalwork industries) in each zone.

A structured health questionnaire was used to collect information from randomly selected households in each zone. After reaching the house, verbal consent of the respondents was taken after explaining them about the study purpose and objective. A semi-structured questionnaire was prepared to collect the participant's response based on the objective of the study, which was both qualitative and quantitative. The same was used to obtain responses of the respondents via a face-to-face interview.

Fig.3: Household interviews in Zones-1 & 2 within study area

Fig.4: Household interviews in Zones-3, 4 & 5 within study area

b. <u>Stage-2: Secondary data collection</u>

The secondary data collection included 1-2 year statistics from Primary Health Centres (PHC), Community Health Centres (CHC) and Mahatma Gandhi Cancer hospital (MGH) serving residents living within the study area. The survey team led by the site coordinator and with guidance of a Medical Doctor visited RINL's Visakha General Hospital, CHC, PHCs and Cancer hospitals located in the area for collecting mortality data for last 1-2 year.

Morbidity statistics of last 5-years of employees working within RINL-VSP's steel plant (Core zone) was collected with assistance from I/c OHS&RC-RINL and RINL's Visakha General Hospital (VSGH). The sources contacted for the secondary information and data obtained are as listed in **Table-5** below.

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Table-5: Sources of secondary data collection

Sl. no.	Source	Type of information collected	Coverage within study area
BUFFER-ZONE			
1.	CHC Agnampudi	One year statistics for institutional cases and deaths due to communicable & Non-communicable diseases	Zones-2,3 & 4
2.	PHC Vadlapudi-Kanithi		Zones-2,3 & 4
3.	PHC Pedagantyada		Zones-4 & 5
4.	PHC Gajuwaka		Zones-1, 4 & 5
5.	Mahatma Gandhi Cancer Hospital & Research Institute (MGH)	One year statistics for cancer cases reported in patients from Pedagantyada and Gajuwaka mandals	All zones covered
6.	District Convenor, NTR Vaidya Seva Scheme	One year statistic of patients provided financial support through the scheme for patients from Pedagantyada and Gajuwaka mandal	All zones covered
7.	District Medical & Health Officer (DM&HO)	Disease profile of Pedagantyada and Gajuwaka mandals	All zones covered
CORE-ZONE			
8.	OHS&RC-RINL/Visakha General Hospital (VSGH)	Five year statistics of reported diseases of RINL employees	RINL-VSP employees

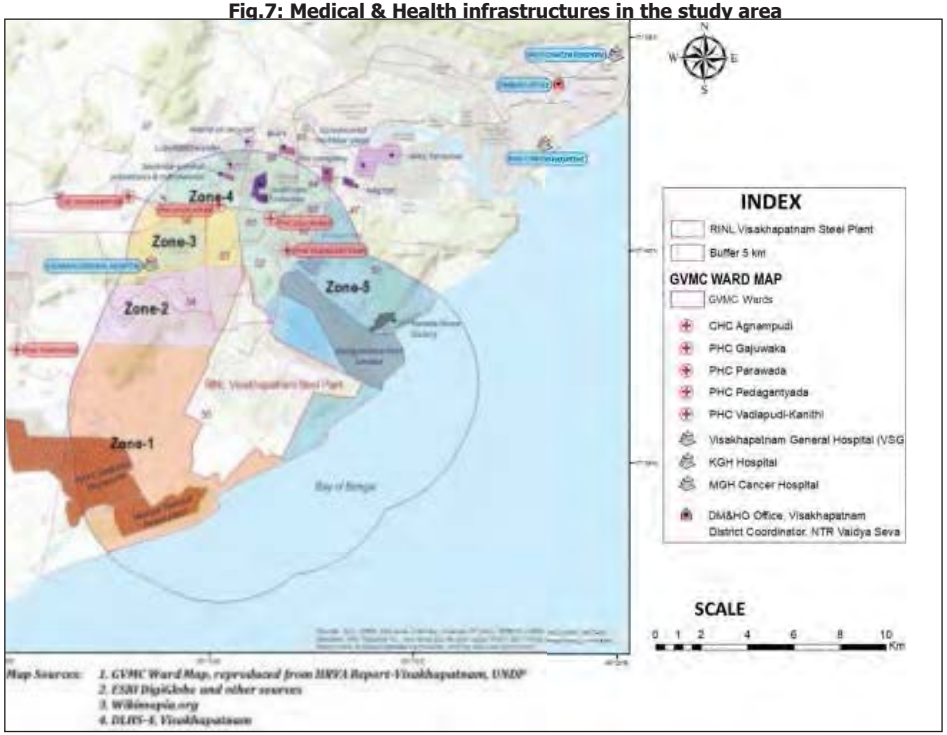
The secondary data was procured from CHC-Agnampudi, PHC-Gajuwaka, PHC-Pedagantyada and PHC-Vadlapudi-Kanithi. Due to unavailability of structured statistics, data could not be procured from PHC Paravada, KGH Hospital and DM&HO Office, Visakhapatnam. The statistics available from NTR Vaidya Scheme was only limited to Agnampudi and nearby areas (i.e. Zones 3 & 4).

Fig.5: Secondary data collection at Primary Health Center (PHC)-Pedagantyada

Fig.6: Interaction with Senior Doctor at General Visakha Hospital (VSGH)

The locations of Medical & Health infrastructures identified for collection of secondary data, is shown in **Figure-7** below.

Fig.7: Medical & Health infrastructures in the study area



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2.5 Variables included in the present study

The indicators/variables of interest for the present study were health and economic well-being which were chosen to represent key access and health-related factors that is expected to influence the overall well-being and health of the people in the study area. The parameters were also chosen in a way to identify probable reasons for a particular level of health condition in the surveyed areas.

2.6 Data collection and management

Data pertaining to the following baseline variables were collected for the present primary analysis:

- **Demographic and socio-economic characteristics** (age, religion, caste, marital status, occupation, type of family, annual income, annual expenditure on health etc.);
- **General socio-economic characteristics of households** (house ownership, type of house, drinking water sources, type of cooking fuel, hygiene practices);
- **Risky personal habits** (involvement in smoking, alcohol consumption, non-smoke tobacco consumption);
- **General health issues and history of respiratory issues** (difficulty in breathing, shortness of breath (SOB), asthma, allergy, tuberculosis);
- **History of cardiovascular diseases** (hypertension, diabetes mellitus, chest pain, congenital and non-congenital heart diseases);
- **Other communicable and non-communicable diseases** (malaria, dengue, enteric diseases like cholera, typhoid); liver and kidney diseases and cancers.

The questionnaires utilized for the study included all the aforementioned variables and as explained before, a face-to-face interview with informed verbal consent from the respondents was used to collect data through the questionnaires. No biologic samples were taken and no clinical investigation was carried out.

2.7 Data analysis

A multiple linear regression model is employed to identify the factors influencing the health expenditure in the study area. In the established health function, the health expenditure as a dependent variable was regressed on the independent factors like income of the family member and age as quantitative variable along with gender and marital status as qualitative variable .

$$Y_i = a + b_1 X_i + b_2X_2 + b_3X_3 + b_4X_4 + U_i$$

Where, Y_I = health expenditure
a = autonomous health expenditure
X_i = Income of the family.
X_2 = age of the family member
X_3 = gender(dummy variable), D=1 for male and D=0 for female
X_4 = marital status(dummy variable), D=1 for married and D=0 for unmarried.
U_i = random error term.

Whereas, b_1, b_2, b_3, and b_4 are parameter of the corresponding independent variables .

We conducted t-tests for testing of hypothesis. All analyses, including the estimation of means, standard errors, r^2 values and t- tests used the survey procedures available in MS EXCEL applying appropriate sampling weights and using Ordinary least square method for estimation.

We wish to test the hypothesis:

- Ho: $b_1=0$ (null hypothesis) – no significant relationship between health expenditure annual income.
- H_1: $b_1\neq0$ (alternative hypothesis) - significant relationship between health expenditure annual income.

Similarly, three (03) respective sets of hypotheses is built up for testing the relationship between health expenditure with age, gender and marital status.

Table-6 below presents the result of the regression analysis conducted for fitting the health function.

Table-6: Regression analysis of health function for the study area

Health function		**a**	**b***	**r^2**
Dependent variable	***Independent variables***			
Y_i (health expenditure)	*X_1(annual income)*	9605.83	0.12 (0.02)	0.05
Y_i (health expenditure	*X_2(age)*	9605.83	71.68 (0.21)	0.05
Y_i (health expenditure	*X_3(gender)*	9605.83	5009.43 (0.76)	0.05
Y_i (health expenditure	*X_4(marital status)*	9605.83	1017.01 (0.09)	0.05

Figures in ( ) indicate t - values **Significant at 5% level.*

It is observed from t–test that the relationship between the variables are statistically highly insignificant i.e, ($t_{cal}<t_{tab}$). The average autonomous expenditure on health is Rs 9605, whereas the extremely low value of r^2 suggests that only 5% of health expenditure decisions depends on income, age, marital status and gender. Thus with the acceptance of all null hypotheses an inference can be drawn that there are other several factors which affects the health expenditure of the people of study area.

3. POPULATION AND HOUSEHOLD CHARACTERISTICS

A socio-economic profile of respondents and households is presented in this section. All together 450 household respondents, distributed over five (05) zones were interviewed during household survey. Number of respondents interviewed during household survey varied from one zone to another according to the population of the villages where 2011 census, projected to the year 2018 has been taken as base for socio-demographic data.

3.1 Background characteristics of Households

Demographic data of surveyed households indicates a large part of the population is Hindu followed by Muslims. Almost all of the surveyed residents belonged to OBC caste, in

particular BCE, which is a special categorization available on the basis of economic backwardness in Andhra Pradesh.

The mean household size in the study area is 3.8 residents per household similar to the 3.8 residents[i] for Visakhapatnam district's population overall. 36.4% of the households surveyed practice Joint family system as opposed to 39.4% of nuclear family practicing households, whereas 24.2% of the households belongs to extended family.

A large percentage of households in the study area (89%) are in possession of BPL (Below Poverty Line) card. The mean annual income of households in the study area is observed to be Rs. 153470, of which almost 12% is spent annually on health by the households. The details of background characteristics zone-wise as well as for the overall study area is presented in **Table-7** below.

Table-7: Background characteristics of households

Background characteristics	**Zone-1**	**Zone-2**	**Zone-3**	**Zone-4**	**Zone-5**	**Overall**
Religion						
Hindu	38	19	28	270	44	399
Muslim	14	01	00	16	01	32
Christians	0	0	02	13	04	19
Others	0	0	0	0	0	0
Caste						
General	0	0	0	0	0	0
Other backward class (OBC)	38	20	21	264	46	389
Scheduled Castes (SC)	14	0	10	25	03	52
Scheduled Tribes (ST)	0	0	0	10	0	10
Type of family						
Joint	32	05	07	117	03	164
Nuclear	19	15	11	87	45	177
Extended	01	00	12	95	01	109
Household size (mean)	**4.25**	**4.05**	**3.33**	**3.88**	**3.72**	**3.8**
Households with BPL card	**49**	**02**	**22**	**279**	**49**	**401**
Mean Annual Household income (in Rs.)	**90711**	**395000**	**109733**	**85507**	**86400**	**153470**
Mean Annual expenditure on health (in Rs.)	**10471**	**17700**	**8616**	**15018**	**8340**	**12029**

Source: 1. Field survey carried out by MECON Ltd. during Oct. 2018 to Nov. 2018

3.2 Profile of population

The surveyed population is categorized based on their age into three classes viz. Children (<15 yrs.), Adults (15-59 yrs.) and senior citizens (60+ yrs.). The height and weight of the respondents was used to calculate BMI (Body Mass Index) and the population was classified into underweight, normal, overweight and obese. All other parameters were as per general classification, also adopted in the survey questionnaire used for the face-to-face interviews in the study area.

The analysis of data collected regarding the personal profile of each interviewed respondent in the study area indicates almost 82% of the population surveyed were adults, which formed the economically active population of the area while people from old age

[i] Census, 2011 data for Visakhapatnam district sourced from Andhra Pradesh District Factbook, 2018

group formed only 15% of the population.

Male and female population comprise almost equal proportion of the population in the surveyed households. A mean sex ratio of 731 was observed in the surveyed population, which was slightly lower compared to 1006[ii] in Visakhapatnam district.

Almost all of the surveyed household population were married, amounting to 78% of the total population.

The occupation profile observed in the surveyed household populations indicate majority of the population working as labour in large and small-scale industries (23%). Around 12% of the population surveyed are professional servicemen whereas 9% are businessmen. Most of the females were either engaged in domestic works or were homemakers/housewives (21%). The details of population profile surveyed zone-wise as well as for the overall study area is presented in **Table-8** below.

Table-8: Profile of surveyed population

Population profile	Zone-1	Zone-2	Zone-3	Zone-4	Zone-5	Overall
Age distribution						
Children (<15 yrs.)	0	0	0	08	0	08
Adults (15-59 yrs.)	44	19	28	244	36	371
Senior citizens (60+ yrs.)	08	01	02	47	13	71
Gender						
Male	29	18	18	173	22	260
Female	23	02	12	126	27	190
Mean Sex ratio						731
BMI (Body Mass Index)						
Underweight (<18.5)	7	01	0	21	07	36
Normal weight (18.5 – 24.9)	31	10	14	145	27	227
Overweight (25 – 29.9)	10	08	13	100	08	139
Obese (>30)	4	01	03	33	07	48
Marital status						
Married	2	19	27	263	42	353
Unmarried	50	01	03	36	07	97
Occupation						
Agriculture	3	01	01	0	0	05
Industry – Large Scale	5	15	04	13	10	47
Industry – Small Scale	11	0	03	35	08	57
Transport	2	0	01	08	0	11
Construction Site	3	0	0	06	06	15
Business as Shopkeeper, Vendor	0	03	03	33	02	41
Service/ professional	0	01	03	47	01	52
Animal Husbandry	0	0	0	0	01	01
Fisherman	01	0	0	0	0	01
Painters	0	0	0	04	01	05
Artisan	0	0	0	04	0	04
Homemaker/housewife	16	0	08	59	05	88

[ii] Census, 2011 data for Visakhapatnam district sourced from Andhra Pradesh District Factbook, 2018

Population profile	Zone-1	Zone-2	Zone-3	Zone-4	Zone-5	Overall
Domestic works	0	0	03	04	0	07
Students	0	0	02	17	0	19
Retired/non-working	0	0	02	18	0	20
Other	02	03	01	47	01	54
Type of duty						
Shift duty (A/B/C)	0	0	0	04	01	05
General shift	52	20	19	167	49	307

Source: 1. Field survey carried out by MECON Ltd. during Oct. 2018 to Nov. 2018

3.3 Socio-economic characteristics of households

As observed from the data collected from surveyed households, 95% of households own a house while 05% reside in rented houses. Many of the houses are built under different government schemes and made available to economically weaker sections for purchase at reasonable rates. The practice of rented housing is also quite significant in areas close to RINL-VSP and other industrial areas as most of the people work as laborers in these industries. The houses are predominantly pakka houses (i.e. houses built up of bricks, cement, iron rods and steel and are permanent in nature) with a small proportion of the surveyed population living in huts and katchha-pakka houses.

Majority of the fuel requirement for household cooking is observed to be met by LPG and wood, with LPG occupying a larger share of 90%.

Almost all potable water requirements is being met by tap water/water tankers supplied by GVMC. Only a small proportion of the households (6%) utilize bore-wells for drinking water use. However, respondents at many of the locations surveyed in Zone-1 reported of poor water quality from hand-pumps installed in the areas close to thermal power plants in the study area.

Health of an individual (or family) is also an important parameter as household hygiene practices and health are directly related. Practicing good hygiene habits prevents people from falling prey to health problems and thus saves tremendous amount of resources such as time and money. Good hygiene practices also save people from lot of diseases that are preventable otherwise. As observed from the surveyed households, every household practices daily cleaning of their houses. The same was also confirmed in actual practice at the time of survey. The details of Socio-economic characteristics of households surveyed zone-wise as well as for the overall study area is presented in **Table-9** below.

Table-9: Socio-economic characteristics of households

Characteristics	Zone-1	Zone-2	Zone-3	Zone-4	Zone-5	Overall
House ownership						
Rented	0	02	01	15	02	20
Own house	52	18	29	284	47	430
Type of house						
Pakka house	42	20	30	251	45	388
Kutccha-Pakka house	07	0	0	42	02	51
Hut	03	0	0	06	02	11
Source of potable water						
Tap water/tankers	17	04	23	262	45	351

Characteristics	Zone-1	Zone-2	Zone-3	Zone-4	Zone-5	Overall
Surface water	04	01	05	02	0	12
Dug well	08	0	02	34	02	46
Tube well/ Bore well/hand pump	10	15	0	0	02	27
Bottled water	01	0	0	01	0	02
Other source	12	0	0	0	0	12
Fuel used for cooking						
Electricity	0	0	0	02	01	03
LPG/Natural Gas	34	20	27	286	42	409
Kerosene	0	0	03	06	0	09
Coal/Lignite/Charcoal	0	0	0	0	0	0
Wood	18	0	0	04	06	28
Crop Waste/Dung Cakes	0	0	0	0	0	0
Other fuel	0	0	0	01	0	0
Household Hygiene Practice						
Daily house cleaning	52	20	28	297	49	388
House cleaning every other day	0	0	02	02	0	04
House cleaning twice a week	0	0	0	0	0	0
House cleaning once a week	0	0	0	0	0	0

Source: 1. Field survey carried out by MECON Ltd. during Oct. 2018 to Nov. 2018

3.4 Risky personal habits

Amongst the total surveyed respondents, only 09% accepted to smoking, 06% conveyed about their non-smoke tobacco consumption and only 20% conceded to alcohol consumption. In view of the above, the respondent results were supplemented with secondary literature regarding prevalence of risky personal habits.

As per Global adult tobacco survey-India Report 2016-17, the distribution of risky personal habits in Andhra Pradesh indicates that among all adults 15 years of age, 24% of the men and 4.6% of the women are smokers consuming all types of smoked tobacco products while 6% of the men and 5.5% of the women of the same age group are users of only smokeless tobacco products.

The baseline Sample Registration Survey (SRS) report published by Census India 2011 indicates among people aged 15 years or above, 16.1% of the men and 0.5% of the women consume alcohol.

Table-10 below indicates the prevalence of risky personal habits contributing to illness in the study area, as supported by secondary literature.

Table-10: Personal risky habits

Habits with health risks	Adults above 15 years of age		
	Men	Women	Overall
Smoking tobacco products	24.0%	4.6%	28.6%
Non-smoke tobacco	6.0%	5.5%	11.5%
Alcohol consumption	16.1%	0.5%	16.6%

Source: Sample Registration Survey (SRS), Census-2011

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3.5 Perception about industrial activities posing health risks

Industrial activities may pose significant health hazards, if not checked. Such activities may enhance risk of adverse health impacts by way of contamination of environmental components, including air, water, soil etc. Information was sought through the questionnaire to know whether any industrial emissions are having a visible/direct impact on the population in the surveyed areas.

a. <u>Perception of all industrial activities in the study area</u>

Almost 34% of the total households surveyed had the perception that thermal power stations were resulting in air pollution due to hazardous air emissions as well as high noise in the environment. Respondents in from Zone-1 also reported effect of ash ponds of the thermal power plants in the groundwater which they were using out from hand-pumps and bore-wells. Also, respondents residing in zone-4 indicated adverse health effects due to emissions from nearby chemical-based industries.

However 38% of the population, residing primarily in Zone 4, were of the opinion that no such industrial activity was causing adverse health effects in their areas. The same was justified as both these zones were having no significant industrial exposure that may pose health risks in the areas. **Table-11** below indicates the perception of the respondents about industrial activities which may pose health risks.

Table-11: Perception about Industrial activities posing health risks

Industrial Activities*	Zone-1	Zone-2	Zone-3	Zone-4	Zone-5	Overall
Chemical industry	05	03	02	54	25	89
Thermal power station	42	02	09	85	15	153
Port activities	00	01	01	12	00	14
Other industrial activity	02	00	05	09	04	20
No such activity	03	16	13	138	06	174

*Note: *Apart from RINL-VSP*
Field survey carried out by MECON Ltd. during Oct. 2018 to Nov. 2018

b. <u>Perception of RINL-VSP in the study area</u>

Respondents were also enquired about their perception of RINL's VSP steel plant in all the zones. The general perception regarding pollution aspects was positive and majority of the respondents were of the opinion that RINL's VSP plant had no adverse effect on the air, water and other aspects of the environment in their localities. However, few respondents in Zone-1 residing near the south-western plant boundary did indicate experience of occasional noise due to the power plant.

An overwhelming 74% of the respondents believed RINL-VSP was contributing significantly to employment generation (both direct and indirect) as well as community development in the area by way of providing financial as well as infrastructural support through their CSR activities.

c. <u>Perception of construction activities of KBR-2 at nearest habitation</u>

An independent perception survey was also carried out at **New Railway Quarters near Kanithi**, the nearest habitation to construction site of KBR-2 of RINL. The primary

objective of this survey was to identify if there were any adverse effects on the environment during the construction phase of the KBR-2.

Table-12: Perception of construction of KBR-2 at New Railway Quarters, Kanithi

Possible effects on environmental aspects	Fraction of respondents	
	YES	NO
Visible dust due to construction activities present?	1	9
High noise generation due to construction activities of KBR-2 present?	2	8
TOTAL	**3** (15%)	**17** (85%)

Note: Field survey carried out by MECON Ltd. during Oct. 2018 to Nov. 2018

As observed from above, only a small fraction of the respondents from the New Railway Quarters (5%) were of the opinion that there were some effects of vehicular movement on the air quality during the construction period leading to visible dust but it was mostly limited to few hours during the day time. A small proportion of the respondents (10%) conveyed about the inconvenience caused due to noise generated during the construction activity of KBR-2. Overall, 85% of the respondents were of the opinion that there were no adverse effects due to construction activities of KBR-2.

4. ENVIRONMENTAL HEALTH AREAS

The overview of health status of people residing in the study area, both in each zone as well as overall, including morbidity of different types of diseases in the areas is detailed in this section.

The primary focus includes communicable and non-communicable diseases prevalent in the area and is quantified using primary data collected through the baseline respondent survey as well as secondary data collected from different medical facilities/schemes in the areas.

4.1 Population living in the study area (5 km buffer area of VSP)

The disease profile of the population residing within the study area has been assessed based on primary data collected from household survey as well as prevalent diseases assessed from secondary information collected from medical facilities, PHCs and CHCs hospitals as well as discussions with Doctors practicing in different parts of the study area are briefly explained in succeeding paragraphs.

Diseases Reported in the Area

The most prominent diseases noted were as follows:

- Infectious disease
- Respiratory diseases
- Cardio-vascular diseases and risks
- Soil, water and sanitation-related diseases
- Mental/psychiatric disorders
- Sexually transmitted diseases (STD)
- Cancers/cases of malignancy

The details of disease profile within the surveyed households as identified based on the

zone-wise primary survey for the overall study area is presented in **Table-13** below.

Table-13: No. of responses regarding the Disease profile within the surveyed respondents (based on Primary survey)

	Zone-1	Zone-2	Zone-3	Zone-4	Zone-5	Overall
Infectious diseases						
Malaria	1	2	1	3	2	9
Dengue	0	1	1	4	3	9
Respiratory disease						
Shortness of breath (SOB)	1	1	1	16	0	19
Blood in cough	0	0	0	5	1	6
Asthma	2	2	1	12	1	18
Cardio-vascular disorders/risks						
Heart disease (non-congenital)	2	3	0	11	0	16
Congenital heart disease	0	0	0	1	0	1
Hypertension	8	4	3	47	3	65
Chest pain	1	2	0	25	0	28
Diabetes	3	0	2	21	1	27
Soil, water & sanitation related (SWaS)						
Liver disease	2	0	0	3	0	5
Gastero/cholera/typhoid	0	0	0	2	0	2
Cancer	0	0	0	7	0	7

Note: Field survey carried out by MECON Ltd. during Oct. 2018 to Nov. 2018

As per the secondary information collected from interaction with Doctors of government hospitals, Primary health center and Community health center in the study area, the broad disease profile obtained was as mentioned in **Table-14**.

Table-14: Disease prevalence as per secondary data collected from PHCs and CHCs being used by population residing within the study area (Secondary data)

	Mean prevalence (%)
Infectious diseases	**5.54%**
Dengue	0.01%
Malaria	0.00%
Filariasis	0.01%
Rabies/dog bites	5.52%
Chickenpox	0.00%
Respiratory disease	**31.7%**
Acute respiratory infections	24.7%
Asthma	4.5%
Bronchitis	2.2%
Pulmonary Tuberculosis	0.2%
Cardio-vascular disorders/risks	**48.4%**
Hypertension	25.0%
Diabetes	23.4%
Soil, water & sanitation related (SWaS)	**8.32%**
Diarrhea	3.26%
Typhoid/Enteric fever	0.01%
Amoebiasis	2.89%

	Mean prevalence (%)
Helminthiasis	2.16%
Sexually Transmitted diseases (STD)	**0.34%**
AIDS	0.13%
Gonococcal Infection	0.10%
Syphilis	0.11%
Mental/psychiatric disorders	**5.7%**

Note: Field survey carried out by MECON Ltd. during Oct. 2018 to Nov. 2018

Both the disease profile obtained by the primary survey along with the secondary data collected from PHCs, CHCs and Government Hospitals was analyzed to identify the overall disease pattern in the study area. The same has been discussed in succeeding sections.

4.1.1 Prevalence of infectious diseases in the study area

The infectious disease with most frequent occurrence reported by respondents in the study area during primary survey were malaria and dengue. This was mostly reported by respondents living in Gajuwaka-Pedagantyada (Zone-4) and Gangavaram-Pedagantyda (Zone-5) in the study area.

The most prevalent infectious diseases identified in the study area based on secondary data collected from PHCs, CHCs and Government hospitals in the study area were as follows:

- Dengue
- Malaria
- Filariasis
- Rabies/dog bites
- Chickenpox

Dengue fever is a viral disease, which is transmitted by the Aedes aegypti mosquitoes. The Aedes mosquitoes breed in clean water in man-made containers such as water coolers, discarded tyres, disposable cups, flower vases and other water storage containers. There are 4 strains of dengue. All the four serotypes of dengue are prevalent in India. A person who contracts the disease multiple times is more susceptible to the potentially fatal dengue hemorrhagic fever (DHF). The spectrum of clinical manifestations of dengue varies from a mild febrile self-limiting illness to a severe, potentially fatal disease.

Malaria is an acute parasitic illness caused by Plasmodium falciparum or Plasmodium vivax. These parasites are transferred in the blood of humans and large mammals by Anopheles mosquitoes. Mosquitoes, of which there are 9 major species, transmit malaria in India. The areas vulnerable to malaria are largely tribal, difficult, remote, forested and forest fringe inaccessible areas with operational difficulties.

Lymphatic Filariasis is a serious debilitating and incapacitating disease. Also known by the name "elephantitis", it is a parasitic disease caused by microscopic, threadlike worms. The transmission of filaria is through mosquitoes called Culex quinquefasciatus. The disease is spread by mosquitoes and mainly affects the lymphatic system. Common symptoms include cough, fever, headache and redness of the skin. Occasionally, filariasis can cause severe lung damage.

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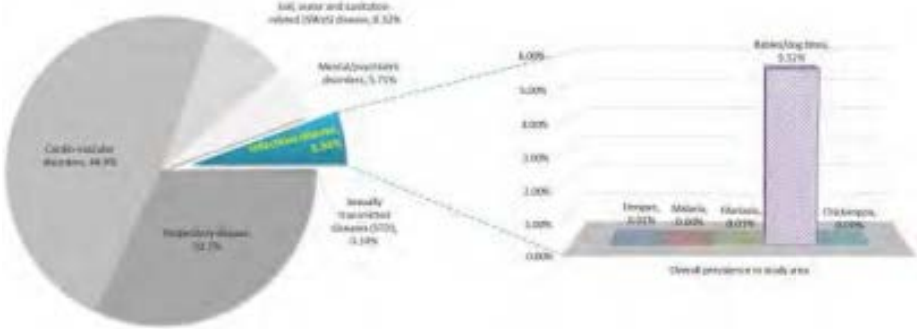
Rabies is a fatal viral infection that targets the brain and nervous system. The disease is zoonotic i.e. it can be transmitted from one species to another, such as from dogs to humans, commonly following a bite from an infected animal. For a human, rabies is almost always fatal if post exposure prophylaxis (PEP) is not administered immediately following an exposure. The rabies virus infects the central nervous system, ultimately affecting the brain and resulting in death.

Chickenpox (varicella) is a viral infection that causes an itchy rash with small, fluid-filled blisters. Chickenpox is highly contagious to people who haven't had the disease or been vaccinated against it. Before routine chickenpox vaccination, virtually all people had been infected by the time they reached adulthood, sometimes with serious complications. Today, the number of cases and hospitalizations is down dramatically.

The infectious diseases affecting people residing in the study area and their prevalence, as collected from all PHCs and CHC within the area, is given in **Fig. 8** below.

Fig-8: Morbidity pattern of infectious diseases in the study area (% of all cases)



It is observed that infectious diseases form only 5.54% of all diseases prevalent within the study area, with dog bites/rabies (5.52%) being the most common infectious disease.

4.1.2 Prevalence of respiratory diseases in the study area

The respiratory disease with most frequent occurrence reported by respondents in the study area during primary survey was asthma. This was mostly reported by respondents living in Pedagantyada-Gajuwaka areas (in Zone-4) of the study area.
The respiratory disease found to be prevalent as reported by Primary Health Centers (PHCs), Community Health centre (CHCs) and other government hospitals within the study area were as follows:

- Acute respiratory infections including Influenza (excluding pneumonia)
- Bronchitis
- Emphysema
- Asthma
- Tuberculosis

Acute Respiratory infections (ARI) pose major public health**.** ARIs are mainly self-limited, but can lead to complications requiring hospitalization due to severe acute

respiratory infections (SARI) which can be fatal at times**.** The causative agents include mainly viruses, up to 60%, (e.g., Respiratory syncytial virus (RSV), Influenza A, Rhinovirus, Adenovirus); bacteria (e.g., Streptococcus pneumoniae, Mycoplasma pneumoniae and Staphylococcus aureus) and fungi (e.g., Pneumocystis jirovecii). There are only few studies enumerating the profile of pathogens causing ARI in hospitalised patients. Most of the respiratory pathogens produce similar symptoms as a result it is difficult to identify them clinically.

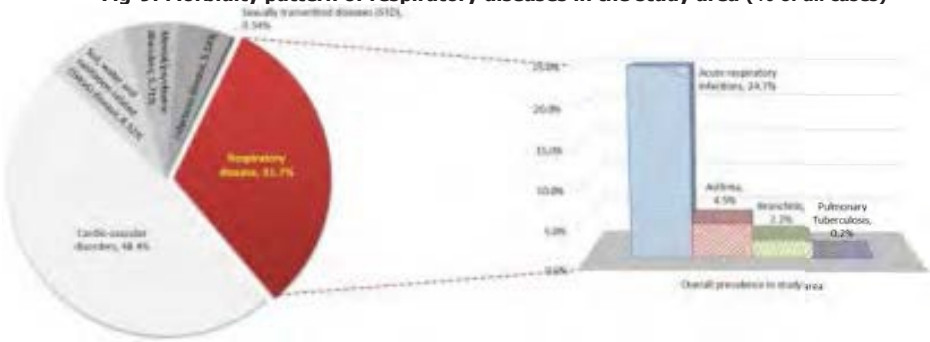
Bronchitis is an inflammation of the mucous membranes of the bronchi (the larger and medium-sized airways that carry airflow from the trachea into the more distal parts of the lung parenchyma). Bronchitis can be divided into Acute and Chronic. Acute bronchitis is one of the most common types of lung infection which can occur at any age and is characterized by the feeling of cough or small sensation in the back of the throat. It can be with or without the sputum. Chronic bronchitis a type of Chronic obstructive pulmonary disease (COPD), which involves a cough that produces sputum for 3 months for 2 consecutive years. Bronchitis can be caused by either a virus or bacteria, though viral bronchitis is much more common. In most cases, bronchitis is caused by the same viruses that cause the common cold or influenza (flu). Bronchitis can also be caused by breathing irritant substances, such as smog, chemicals in household products or tobacco smoke. However, Smoking is the main cause of chronic (long-term) bronchitis and it can affect people who are passive smokers as well as smokers themselves.

Emphysema is a type of COPD involving damage to the air sacs (alveoli) in the lungs. As a result, one's body does not get the oxygen it needs and makes it hard to catch one's breath. The person may also have a chronic cough and have trouble breathing during exercise. The most common cause of it is cigarette smoking.

Asthma is a chronic disease characterized by recurrent attacks of breathlessness and wheezing. During an asthma attack, the lining of the bronchial tubes (airways) swells, causing the airways to narrow, turn more sensitive to irritants in the environment, and thus reducing the flow of air into and out of the lungs. The causes of asthma are not completely understood. However, risk factors for developing asthma include inhaling asthma "triggers", such as allergens (some common to all and some individualized), tobacco smoke and chemical irritants. Asthma cannot be cured, but appropriate management can control the disorder and enable people to enjoy a good quality of life.

Tuberculosis (TB) is an infectious disease caused by Mycobacterium tuberculosis. Tuberculosis commonly affects the lungs, but can also affect other parts of the body. It spreads from person to person through the air, when people who are infected with TB infection cough, sneeze or otherwise transmit respiratory fluids through the air. It is a disease that can be cured with proper treatment.
The respiratory diseases affecting people residing in the study area and their prevalence, as collected from all PHCs and CHC within the area, is given in Fig. 9 below.

Fig-9: Morbidity pattern of respiratory diseases in the study area (% of all cases)



It is observed that overall respiratory diseases form 31.7% of all diseases prevalent within the study area, with acute respiratory infections (excluding pneumonia) being the most common disease, forming more than 3/4th of all the respiratory disease cases. No cases of emphysema were reported as per the secondary data collected from PHCs, CHCs and government hospitals within the study area.

Risk factors

The major risk factors to respiratory diseases include smoking (direct as well as passive), malnutrition, alcoholism, Exposure to smoke either by use of smoke producing cooking fuel, poor housing, poor hygiene practices, and inappropriate house ventilation.

The most prevalent respiratory disease identified in the study area was acute respiratory infection, which is primarily a viral disease and not attributable to industrial activity/pollution.

4.1.3 Prevalence of Cardio-vascular diseases and risks in the study area

The cardio-vascular diseases/risks (CVD) with most frequent occurrence reported by respondents in the study area during primary survey was hypertension. This was mostly reported by respondents living in Pedagantyada-Gajuwaka areas (in Zone-4) of the study area.

The CVDs found to be prevalent as reported by Primary Health Centers (PHCs), Community Health centre (CHCs) and other government hospitals within the study area were as follows:

- Hypertension
- Diabetes

Hypertension, also known as high or raised blood pressure, is a condition in which the blood vessels have persistently raised pressure. It is defined as a systolic blood pressure equal to or above 140 mm Hg and/or diastolic blood pressure equal to or above 90 mm Hg. The risk factors associated with hypertensions are mostly family history and advanced age (non-modifiable age) as well as lack of physical activity, poor diet, overweight and obesity, too much consumption of alcohol, smoking and second hand smoke and Diabetes.

Diabetes mellitus is a group of metabolic diseases in which the person has high blood glucose (blood sugar) level either due to inadequate insulin production or because the body's cells do not respond properly to insulin or both. The main symptoms are Polyuria (frequent urination), Polydipsia (increased thirst) and Polyphagia (increased hunger).

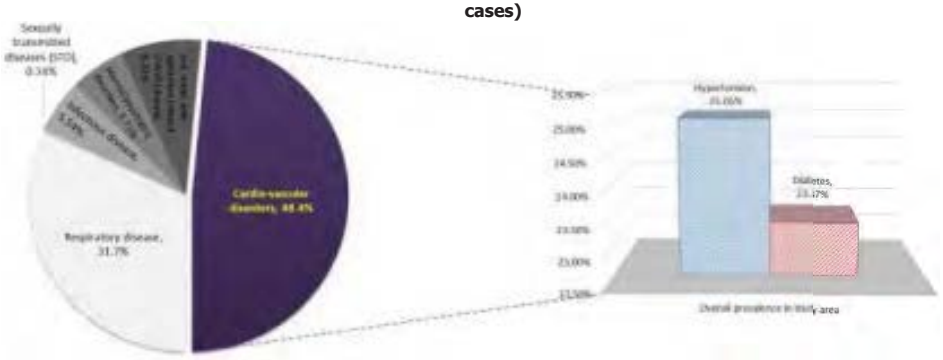
Type 1 diabetes is often known as insulin-dependent diabetes. It is also sometimes known as juvenile diabetes or early-onset diabetes because it usually develops before the age of 40, often during the teenage years. Type 1 diabetes is less common than type 2 diabetes.

Type 2 diabetes is where the body does not produce enough insulin or the body's cells do not respond to insulin. This is known as insulin resistance. Risk factors for type 2 diabetes are obesity, impaired glucose tolerance, high blood pressure, gestational diabetes, sedentary lifestyle, family history and age.

Gestational Diabetes has been diagnosed in women who tend to experience high levels of blood glucose during pregnancy due to reduced sensitivity of insulin receptors.

The CVDs affecting people residing in the study area and their prevalence, as collected from all PHCs and CHC within the area, is given in Fig. 10 below.

Fig-10: Morbidity pattern of CardioVascular disorders in study area (% of all cases)



It is observed that cardio-vascular diseases form 48.4% of all diseases prevalent within the study area, with both hypertension and diabetes (both type-I & II) having almost equal prevalence within the study area.

4.1.4 Prevalence of Soil, water and sanitation-related (SWaS) diseases in study area

Water-borne diseases are caused by organisms that can survive in water and are ingested when contaminated water is drunk. A variety of physical, chemical and biological agents render many water sources less than wholesome and healthy. Many kinds of infections, such as diarrhea, contagious skin and eye infections, are more frequent when scarcity of accessible water supplies makes washing and personal cleanliness difficult and infrequent. Some parasitic helminths spend part of their life cycle in intermediate host organisms that live in fresh water. Humans can be infected when in contact with this water. Water-associated vector-borne diseases.

The soil, water and sanitation related (SWaS) diseases reported by th erespodensts during the primary survey were very few in number. The disease with most frequent occurrence reported by respondents in the study area during primary survey was liver related issues. This was reported by 03 respondents living in Pedagantyada-Gajuwaka areas (in Zone-4) of the study area.

The soil, water and sanitation related (SWaS) diseases found to be prevalent as reported by Primary Health Centers (PHCs), Community Health centre (CHCs) and other government hospitals within the study area were as follows:

- Diarrhea
- Typhoid/Enteric fever
- Amoebiasis
- Helminthiasis

Diarrhea is an infection resulting in having more frequent, loose and watery stools. It is mainly caused by bacterium E. coli, which is spread through contaminated food and water. Between 5% and 30% of cases are caused by other bacteria, especially salmonella, Shigella and campylobacter. Viruses, such as rotavirus and calicivirus, and parasites are other common causes.

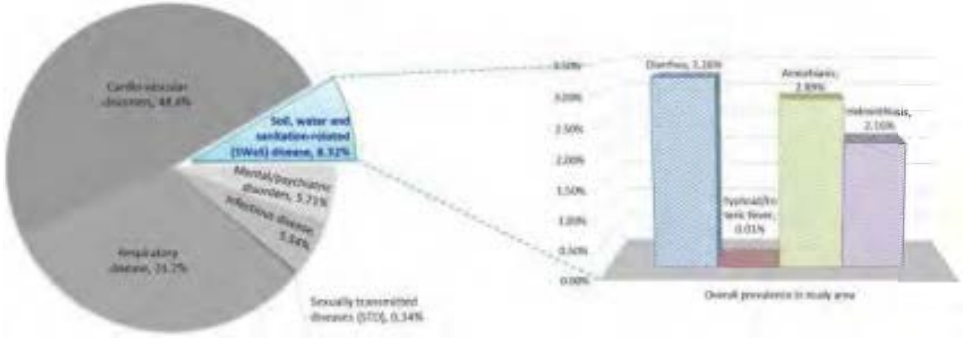
Typhoid/enteric fever is a serious infection caused by a species of salmonella bacteria. The bacteria spreads through food or water - raw fruit, vegetables and shellfish are foods that are commonly responsible. Occasionally, transmission is through direct contact with someone who is infected. Contamination occurs with the feces or urine of an infected person and most cases are a result of contaminated drinking water and poor sanitation.

Amoebiasis is a disease caused by the parasite Entamoeba histolytica. It is a common infection of the human gastro-intestinal tract. Amoebiasis is more closely related to poor sanitation and socioeconomic status than to climate. Transmission occurs via faecal–oral route, either directly by person-to-person contact or indirectly by eating or drinking faecally contaminated food or water. Sexual transmission by oral-rectal contact is also recognized especially among male homosexuals. Vectors such as flies, cockroaches and rodents can also transmit the infection. The use of night soil for agricultural purposes favors the spread of the disease.

Helminthiasis, also known as worm infection, is any macroparasitic disease of humans and other animals in which a part of the body is infected with parasitic worms, known as helminths. A soil-transmitted helminth (STH) infection is a sub-group within the group of helminth infections. It is caused specifically by those helminthes (worms) which are transmitted through soil contaminated with faecal matter and are therefore called soil-transmitted helminth (Intestinal parasitic worms) infections. Soil-transmitted helminths impair the nutritional status of the people they infect in multiple ways. The nutritional impairment caused by soil-transmitted helminths is recognized to have a significant impact on growth and physical development.

The prevalence of the aforementioned diseases amongst people residing in the study area, as collected from all PHCs and CHC within the area, is given in Fig. 11 below.

Fig-11: Morbidity pattern of SWaS diseases in the study area (% of all cases)



It is observed that these diseases form only 8.32% of all diseases prevalent within the study area, with Diarrhea (3.26%) and Amoebiasis (2.89%) being the most common of these diseases.

4.1.5 Prevalence of Mental/psychiatric disorders in study area

Mental health is an integral and essential component of health. The World Health Organization (WHO) defines mental health as a state of well-being in which an individual realizes his or her own abilities, can cope with the normal stresses of life, can work productively and is able to make a contribution to his or her community.

According to various community based surveys, prevalence of mental disorders in India is 6-7% for common mental disorders and 1-2% for severe mental disorders. In India the rate of psychiatric disorders in children aged between 4 to 16 years is about 12% and nearly one-third of the population is less than 14 years of age.

The most prevalent psychiatric disorder as reported by Primary Health Centers (PHCs), Community Health centre (CHCs) and other government hospitals within the study area was identified to be mental/psychiatric disorders due to accidental injuries, forming 5.7% of the total disease cases prevalent in the study area.

4.1.6 Prevalence of Sexually transmitted diseases (STD) in study area

AIDS and syphilis are the most common Sexually transmitted diseases (STD) as confirmed through statistics obtained from local PHCs, CHCs and hospitals.

AIDS is caused by human immunodeficiency virus (HIV). HIV kills or damages the body's immune system cells. There are two types of HIV. Type I and Type II. Type I is more common in India. AIDS is generally caused by unprotected sex with an infected partner. It may also spread through the use of infected syringes of HIV infected people and blood transfusions. Over the years, due to the rise of urbanization and consequent increase in migration of workers from other areas, infection with STDs has risen.

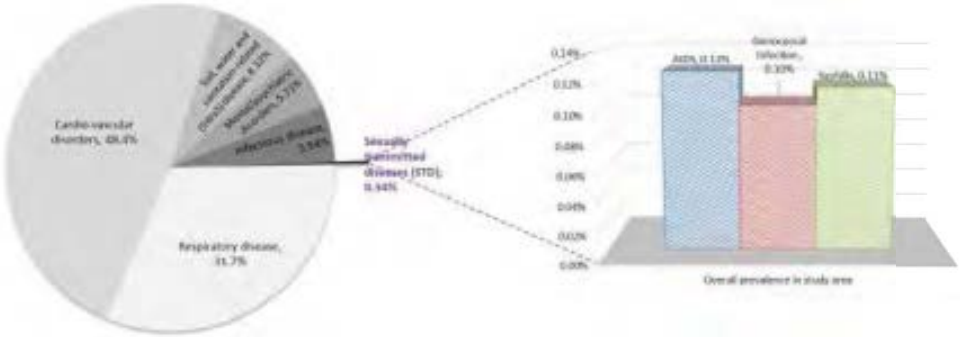
Syphilis is sexually transmitted infection (STI) caused by the spirochete bacterium Treponema pallidum. This disease can be passed to another person through kissing or

close physical contact. The infected person is often unaware of the disease and unknowingly passes it on to his or her sexual partner. The sexual behaviour that spreads syphilis can also spread other Sexually transmitted diseases (STD's) like HIVs, etc.

Gonococcal Infection is a sexually transmitted infection (STI) caused by the bacteria Neisseria gonorrhea. It can infect both men and women and typically affects one or more of the following urethra, throat, rectum & cervix. Most new cases of the infection occur in women. Women who are infected with gonorrhea may also transmit the bacteria to their newborns during childbirth. Gonorrhea infections in babies typically affect their eyes.

The prevalence of the aforementioned diseases amongst people residing in the study area, as collected from all PHCs and CHC within the area, is given in Fig. 12 below.

Fig-12: Morbidity pattern of Sexually transmitted diseases (STD) in the study area (% of all cases)

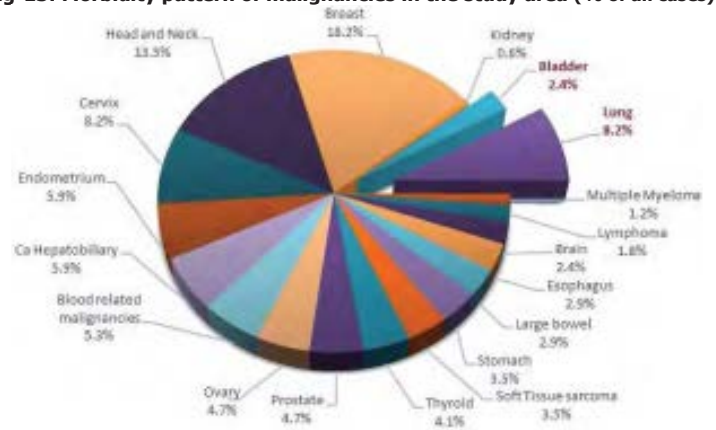


The overall prevalence of all STDs as reported by Primary Health Centers (PHCs), Community Health centre (CHCs) and other government hospitals within the study area makes 0.34% of all prevalent diseases/disorders in the study area, wherein AIDS forms 0.13% and 0.11% cases are of syphilis.

4.1.7 Prevalence of cancers/cases of malignancy in study area

No significant number of cases for malignancy/cancer was identified amongst respondents during the primary survey. All cases reported were of breast cancer. The distribution of cancer malignancies reported in the study area as per secondary data collected from Cancer Hospitals in Visakhapatnam for patients from within the study area is shown in **Fig-13** below.

Fig-13: Morbidity pattern of malignancies in the study area (% of all cases)



The above distribution indicates that the maximum number of malignancies are reported in the study area are of breast cancer (18.2%) followed by cancers of head and neck (13.5%), cervix (8.2%) and lung (8.2%).

As per American Cancer Society, air pollution and occupational exposure are risk factors for malignancy cases of bladder and lung. From the above prevalence diagram, it is observed that only 10.6% of all malignancy cases are of malignancy-types accounted due to air pollution and occupational exposure.

4.2 Occupational Health Safety in Visakhapatnam Steel plant (Core zone)

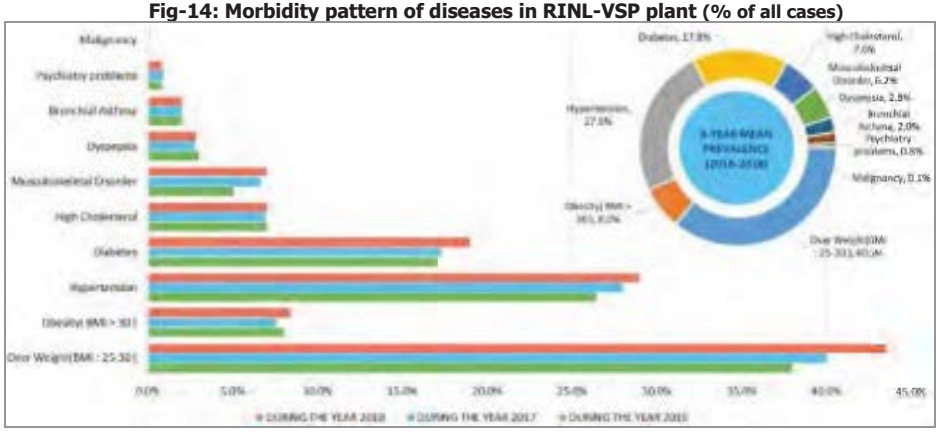
The reported diseases in employees working within RINL's Visakhapatnam Steel plant (RINL-VSP), as inferred from data collected from RINL-VSP's Occupational Health Services & Research Center (OHS&RC) as well as Visakha General Hospital (VSGH) include Cardiovascular risk factors and diseases and small proportion of Musculoskeletal Disorders, Dyspepsia, respiratory problems, mental health issues and even fewer patients with malignancy.

The details of the prevalence of identified diseases noted in RINL VSP steel plant and details of Occupational health of employees working inside RINL's VSP with occupation health facilities are detailed in the succeeding sections.

4.2.1 Prevalence of diseases in RINL-VSP plant area (Core zone)

The morbidity pattern of employees working in Visakhapatnam Steel plant (VSP) over the years 2016 to 2018 is shown in the diagram below mentioned in **Fig. 14** below.

Fig-14: Morbidity pattern of diseases in RINL-VSP plant (% of all cases)



The 3-year mean prevalence of diseases in employees working within VSP plant area indicates that the major diseases/disorders prevalent are hypertension, diabetes and obesity. These are primarily cardio-vascular risk factors, attributable mostly to a sedentary life style and unhealthy food habits.

People working within VSP plant are likely to have the highest risks of exposure to pollutants. However, only a low fraction (2%) were reported with respiratory diseases.

5. MEDICAL INFRASTRUCTURE AVAILABILITY

In Visakhapatnam, there are many Primary Health Centers, Community Health Centers as well as other Government hospitals. Besides, there are also Private Super Specialty Hospitals, which cater to the needs of the public for their health issues.

The residents living within the 5km study area around RINL's VSP steel plant mostly avail medical care through (03) three Primary Health centers (PHCs), one (01) Community health Centre (CHC) and various other Government hospitals. Additionally, super-specialty hospitals provide facilities for treatment of cancers and other serious diseases. The medical care infrastructure available to the residents within the study area are given below.

Table-15: Medical care facilities within the study area

BUFFER ZONE	**PRIMARY HEALTH CENTRES (PHC)**	PHC Gajuwaka
		PHC Pedagantyada
		PHC Vadlapudi
	COMMUNITY HEALTH CENTRE (CHC)	CHC Agnampudi
	SUPER-SPECIALITY HOSPITALS	Mahatma Gandhi Cancer Hospital (MGH)
		King George Hospital (KGH)
		Homi Bhabha Cancer Hospital & Research Centre (TMC)
CORE ZONE	**OCCUPATIONAL HEALTH (RINL EMPLOYEES)**	Occupational Health Services & Research Centre (OHS&RC-RINL) with Visakha General Hospital (VSGH)

Source: Field survey carried out by MECON Ltd. during Oct. 2018 to Nov. 2018

5.1 Cancer Treatment facilities

Cancer malignancies amongst people residing within the study area is mostly taken care by the super-specialty cancer hospitals present in Visakhapatnam, as well as Cancer hospitals outside Visakhapatnam of national repute. The most common cancer hospitals whose detection as well as diagnostic services are availed by the residents of the study area are Mahatma Gandhi Cancer Hospital (MGH), King George Hospital (KGH) and Homi Bhabha Cancer Hospital & Research Centre (TMC).

a. Mahatma Gandhi Cancer Hospital & Research Institute (MGCH&RI)

MGCH&RI is established as a centre of excellence for comprehensive cancer care and prevention. The Institute is one of the largest cancer centres in India. It provides seamless cancer care under one roof through its services including diagnostics, state-of-the-art therapies including Surgery, Chemotherapy, Radiotherapy and symptom management to meet the needs of oncology patients.

Fig-15: Mahatma Gandhi Cancer Hospital & Research Institute (MGCH&RI)

MG Cancer Hospital provides a host of various medical and oncological services which are available for patients. These medical and oncological services are provided by a host of specialists who have highly specialized skills which are of the highest standards. Some of the oncological services available at MGCH&RI are surgical oncology, radiation oncology, heamato oncology, medical oncology, paediatric oncology, preventive oncology, radiology and supportive services.

b. King George Hospital (KGH)

King George Hospital (KGH) is a Government General Hospital located in Visakhapatnam, Andhra Pradesh, India. It was started as civil dispensary in 1845 and upgraded into a 30 bedded hospital in 1857. It had 192 beds and by 1931-32 increased to 270 beds. These

VISAKHAPATNAM STEEL PLANT
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included Gynaecology, Ophthalmology, Maternity, Venerology and Infectious Diseases.

The hospital sees over 1250 outpatients everyday in various departments. The Gynaecology and Maternity block with 40 beds was constructed in 1928. Construction works of the Ophthalmic Block with 80 beds was completed in 1932. The Out Patient (OP) block and Casualty was constructed in 1940. A Children's ward with 36 beds was constructed nearby in 1943 and later merged with the Gynaec block. A new administrative block and the twin Operation Theatres and special ward was constructed in 1951. A new Cardiology Block with Intensive Cardiac Care Unit (ICCU) was inaugurated in June, 1986 and subsequently, the first and second floors with the Open Heart Surgery Unit. The 24-hour Clinical laboratory block was renovated in 1992. The Nuclear Medicine block, the first-of- its-kind in the State Government was opened on 8 October 1993.

Fig-16: King George Hospital (KGH)

c. Homi Bhabha Cancer Hospital & Research Centre (TMC)

Homi Bhabha Cancer Hospital & Research Centre at Visakhapatnam caters to cancer patients from the states of Andhra Pradesh, Orissa, Chattisgarh, Jharkhand and Telangana. Clinical Services were started on the site of the main campus in Aganampudi on 2 June 2014. The facility is entirely operational from *temporary* accommodation consisting of porta cabins and a few brick-and-mortar buildings.

Fig-17: Homi Bhabha Cancer Hospital & Research Centre (TMC)

It offers a range of services: cancer prevention and screening services, cancer diagnostics including biochemistry with tumour markers, histo-cyto-hematopathology and immunohistochemistry, molecular tests, digital radiography, mammography and sonography, the entire range of chemotherapy, and, palliative care services, all on an outpatient basis.

5.2 Occupational Health Services & Research Center (OHS&RC), VSP & Visakha General Hospital (VSGH) – CORE ZONE AREA

Occupational Health Services and Research Centre (OHS&RC) at RINL-VSP (Visakhapatnam Steel Plant) is provided with state-of-the-art equipment for carrying out activities like periodical medical examination, industrial hygiene surveys, toxicological evaluation etc. The unit is manned with two qualified OHS specialists, one toxicologist and trained paramedical staff.

Two (02) first-aid stations are located in the plant, functioning round the clock with qualified doctors, paramedical staff and ambulances.

Supporting facilities for providing specialist care are available at the 150 bedded Visakha Steel General Hospital (VSGH), which is manned with around 100 doctors (including 40 specialists) and around 200 paramedical staff.

Functions of OHS&RC at RINL-VSP

Occupational Health Services & Research Center (OHS&RC) at VSP has been established during November 1992 offering comprehensive services to all employees. Complying with the statutory obligations, all workers are periodically examined and the Health records of employees are stored safely for periodic retrieval and analysis. A specific coding system is developed and followed for efficient and systematic placement. The historical employee health data in also stored in soft form and is linked to online system.

REGULAR ACTIVITIES OF OHS:

- Daily orientation on Preventive Health & Yoga as part of Periodical Medical Examination.
- Man-Maintenance Programme (Periodical Medical Examination which includes Spirometry, Audiometry, Eye examination, Tetanus immunization, Chest x-ray, Laboratory investigations, clinical evaluation and treatment by doctor)
- Toxicological Evaluation
- Statutory Eye examination of crane operators & Heavy Equipment operators
- Treatment / Referral to VSGH / Individual counseling of employees for abnormalities identified in Periodical medical examination as a part of remedial measure.
- Continuous Coordination with Head of WORKS for implementation of administrative and engineering measures for prevention and control of Occupational Hazards.
- Maintenances and analysis of Health Records
- Co-ordination of Emergency Medical care services
- Implementation of BIOMEDICAL WASTE Management Rules.
- Replenishment of First Aid Kits to all departments.
- Industrial Hygiene Surveys
- PPE Surveys and Counseling's to employees to use PPE'S regularly.

- Counseling's to employees with habits of smoking, alcoholism, anxiety and depression
- Ongoing Health Education Programme (class-room & shop-floor based)
- Orientation and awareness training on Occupational Health
- Training in First Aid & Emergency Care
- Consultancy services and faculty support to neighboring industries on Occupational Health.
- Orientation on OH to final MBBS students, Post graduate students and Multipurpose Health Worker training students.

PERIODICAL MEDICAL EXAMINATION OF EMPLOYEES – PERIODICITY:

DEPARTMENTS	PERIODICITY
CO&CCP, BF, SMS, SP, TPP, RMHP, CRMP, Foundry unit of engineering shops, RED, and EMD, departments of Works division	Once in every year
All other departments of works division	Once in every 3 years
All departments of non-works division	Once in every 5 years
All canteen contract workers	Once in every year
All workers in Benzol plant section of CO&CCP	Half-yearly

IMPROVEMENTS IN THE SYSTEM OF PERIODICAL MEDICAL EXAMINATION OF EMPLOYEES:

- Well-defined periodicity communicated to all departments
- Daily quota fixed for each department.
- OHMS periodically reviewed and revised.
- Facility for departmental Coordinators for feeding Online nominations & receiving list of attended employees
- Monthly feed-back to HODs & review in the ED(W) Coordination meetings.
- Facility for communicating test abnormalities to employees through Employee Information System (EIS) and through online report to the respective departmental coordinators. (which facilitates regular treatment and follow up of employees with abnormal health reports)
- MIS Modules for preparing reports and analyzing data.
- Incorporation of Department Code numbers in registration module for easy identification of employee's department and for easy retrieval of employee's health record.
- Special MIS Module developed for evaluation of monthly coverage of departments against the quota given.

6. SUMMARY AND CONCLUSION

The present study was undertaken for M/s RINL-Visakhapatnam Steel Plant (VSP) within 5 km. radius of the plant in Visakhapatnam, as part of additional studies recommended as a requirement for obtaining environmental clearance for the plant by MoEFCC. The study was based on the quantitative primary data collected through surveys and secondary data collected from hospitals, PHCs and CHCs in the area. Under the study, 450 households with predominantly adult population aged 15 to 59 years and above were covered. Additionally, morbidity statistics of the employees working in RINL-VSP (Core zone) was also collected.

The broad aim of the study was to assess the prevalence of different types of diseases in the study area and create a baseline health profile for the population living within the study area based on data collection through primary household survey as well as secondary data collected through nearby government hospitals, PHCs and CHCs which are visited by the population residing within the study area. The broad observations of the study are highlighted below:

- More than a third of the household respondents (39.4%) lived as nuclear families, with the number of members in the house less than 4. The mean Annual household income was Rs. 1,53,470 and 89% of the respondents were in possession of Below Poverty Line (BPL) cards. The mean annual health expenditure was almost 8% of the mean Annual household income.

- Almost half of the respondents (50.4%) belonged to normal weight category followed by 30.9% in the overweight category based on their BMI, of which 17.6% were males and 12.8% were females in the overweight category. Almost 11% of the respondents were obese, of which almost 70% were from the urban areas. This increase in the numbers in the obese category may be due to improper dietary habits and decreased physical activity due to sedentary lifestyle.

- A majority of the population consumes alcohol and tobacco in various forms, of which 28.6% smoke tobacco. The smoking population is contributed mostly by males (24%) with females making only 6% of the proportion.

- Majority of the potable water requirements (78%) is being met by tap water/water tankers supplied by GVMC. Almost all surveyed households used LPG/Natural gas (91%) as their primary cooking fuel. Every household also showed good household cleaning practice (99% cleaned their houses daily). These suggested a fairly good level of household sanitation and hygiene in the surveyed households.

- Almost a third of the respondents (34%) perceived the thermal power stations in the area followed by chemical based industries in the area (20%) as a major industrial activity apart from RINL's VSP plant causing environmental pollution.

- Perception of respondents in the nearest habitation (New Railway Quarters, Kanithi) regarding KBR-2 at the time of its construction revealed that 85% of the respondents felt that there were no adverse effects due to the KBR-2 when it was under construction.

- The primary data collected through household survey indicates highest prevalence of cardio-vascular disorders/risks (64.6%) followed by respiratory disease (20.3%) among the surveyed respondents. The secondary data collected from PHCs, CHCs and government hospitals used by residents of the study area also substantiate the same trend, indicating highest cases of cardio-vascular disorders/risks (48.4%) followed by respiratory diseases (31.7%). The data collected together (primary and secondary), thus, is a fairly good representation of the overall health status of the population living within the study area (buffer zone area).

- The present study recorded 48.4% prevalence of cardio-vascular disorders and risks (CVDs) followed by respiratory diseases (31.7%) in the study area. The most prevalent CVD was hypertension (25%) closely followed by diabetes (23.4%). This

significantly higher morbidity status of CVDs in this study may be attributed to sedentary lifestyle and unhealthy food habits. Almost 3/4th of the respiratory diseases reported in the study area was acute respiratory infection, which is predominantly a viral disease.

- Around 8.32% among all diseases are reportedly soil, water and sanitation-related diseases, of which diarrhea (3.26%) and amoebiasis (2.89%) are most prevalent. Good household sanitation practices, predominant use of LPG as cooking fuel and minimal dependence on groundwater for potable purposes within the study area may be attributed to the low prevalence of these type of diseases.

- The morbidity records of employees working within RINL's Visakhapatnam Steel plant in the last 3 years (Core zone area) are also similar to the distribution observed in the study area (Buffer zone area), indicating 45.6% prevalence of CVDs with 27.8% employees reported with hypertension and 17.8% employees with diabetes. These may also be related to a busy lifestyle with neglect to regular exercise and healthy diet. Although employees working within the steel plant are likely to be the most affected due to exposure to different pollutants, only 2% of the employees were identified with respiratory problems (mostly of Bronchial Asthma).

- Cancer and malignancy prevalence in the area, as inferred from statistics collected from Super-specialty hospitals in the area indicated very low prevalence of lung (8.2%) and bladder (2.4%) cancers. As per American Cancer Society (ACS), exposure to occupational hazards and industrial pollution are potential risks factors for lung and bladder cancers. However, a very low prevalence of these types of malignancies is reported in the study area.

7. LIMITATION OF THE STUDY

The current health baseline, is limited in its scope and generalizability. Some of the limitations in the study are listed as follows:

- Due to paucity of resources, every household could not be considered in the study and a limited sampling methodology was used to collect primary information related to the health profile in the area.

- The primary data collection had little participation of people from affluent families as they were reluctant to participate in the survey. Due to this, more number of respondents had to be surveyed from rural background for increasing the representation of the study area. This led to higher time and resource requirement for conducting the survey.

- Certain diseases as Cancer had no local data available and data pertaining to it was collected from super-specialty hospitals in the area.

ANNEXURE E

DAMAGE ASSESSMENT

1.0 DAMAGE ASSESMENT, REMEDIATION PLAN AND NATURAL & COMMUNITY RESOURCE AUGMENTATION PLAN (NCRAP)

1.1 INTRODUCTION

The objective of Damage Assessment Report (DAR) and Natural & Community Resource Augmentation Plan (NCRAP) includes the study of effects which are caused by change in the environment due to an activity and to identify the corrective measures to compensate or restore or replace those resources such as Land, Biota, Air, Water and others in order to mitigate the adverse effects on such resources. The damage is assessed based on negative changes brought onto the various environmental aspects due to the construction of a proposed facility.

RINL's Visakhapatnam Steel Plant was granted environmental clearance for increase of Hot Metal production from 4.0 to 6.5 MTPA by Ministry of Environment, Forest and Climate Change (MoEFCC) vide their letter no.J-11011/196/2005-IA II (I) dated 11-08-2005. RINL had setup all the facilities envisaged in this expansion programme. However, since then, because of operating the units at high levels of capacity utilization on account of the continuous thrust on production of value added steel, it was deemed necessary that major revamps / capital repairs of the existing critical equipment of the plant should be taken up immediately. This was extremely essential, to ensure paramount safety and in addition would help in meeting the upgraded environmental norms notified by MoEFCC vide Gazette No. GSR.277(E) dtd. 31st March, 2012. Revamping of the furnaces producing hot metal and liquid steel was overdue and this needed to be done urgently.

Keeping in view of the above, RINL contemplated modernizing its facilities along with revamping. The modernization and revamping drive led to enhancement of capacities of some units. Concurrently, RINL had obtained Terms of reference (ToR) vide Letter. No. J-11011/196/2005-IA.II(I) dated 19th September 2016 from MoEFCC. Subsequently, public hearing was also conducted on 15.06.2017 at Trishna Grounds, Sector -2, Ukkunagaram and the final EIA-EMP report was submitted. The project was presented at the 28th meeting of EAC held during 5th to 7th Feb 2018 for environmental appraisal of Industry-I Sector projects. However, as per provisions of the EIA Notification, 2006 and amendments thereto, site activities pertaining to the modernization and revamping of various units had been carried out before grant of Environmental Clearance, and hence were in violation of the notification.

The present Damage Assessment, Remediation Plan and Natural & Community Resource Augmentation Plan (NCRAP) has been prepared to assess damage to natural resources as well as ecological damages caused due to the site activities pertaining to the modernization & revamping of RINL's Visakhapatnam Steel Plant.

The modernization, revamping and consequent expansion activities of RINL under scrutiny for violation of the EIA Notification, 2006 can be attributed primarily due to (a) proposed new units (COB5 & Rebar mill)and (b) expansion/revamping units (BF1&2, SP1 & SMS2) & construction of Kanithi Balancing Reservoir-2, Installation of LPG storage facility, Installation of Nitrogen Buffer vessel and construction of Guard Pond

As inferred from status check on these facilities by way of physical verification of progress of site activities already carried out for each unit, the following was construed-

- Of the new units proposed, COB 5, reservoir, turbo blower, LPG storage facility, Installation of Nitrogen Buffer Vessel, Installation of Twin Ladle Heating furnace in SMS 2 are under construction and are not under operation till date while the proposed Rebar mill is still in planning phase. This suggests that the only impacts concerned with these units pertain to construction phase only.
- The expansion units, viz. BFs 1 & 2, SP1 & SMS2 have been modernized and are under operation. However, despite revamping of these facilities, production has not exceeded the capacities as indicated in the existing EC. This suggests that most of the impacts of the expansion units occurred during the installation/modernization phase rather during their operation.

The above suggests that the modernization & revamping project of RINL is not expected to cause an adverse effect on the land, biota, air and water resources during the construction period. Also, no significant impacts are anticipated due to operation of the revamped units. Overall, it is observed that the revamping and modernization of existing units which included addition of newer, more efficient and environment friendly facilitating units within the existing RINL steel plant, has led to reduction in specific pollution loads as well as improved resource consumption, in-turn largely improving the plant efficiency as well as environmental affability.

The detailed discussion of the damages caused due to the project activities during construction as well as operation of the units is elaborated in the subsequent section. The overall impact of the project when all envisaged facilities are operating has been discussed in **Chapter-4** of the EIA-EMP report.

However, any industrial activity does pose potential for environmental consequences, which can either be avoided or minimized in terms of size, scope and duration. It is based on the recognition that minimizing the environmental impacts of an activity primarily entails managing the environmental consequence(s) of those activities by either avoiding them in the first place or by mitigating them to as low as reasonably practical.

To ameliorate the damages due to the construction activities as well as those that are anticipated due to the operation of facilities under RINL's expansion project that should entail scientific development of the local environment, a **Remediation plan** is necessary. Also, a **Natural & Community Resource Augmentation Plan (NCRAP)** is required to pay for the ecological damage as well as economic benefits derived at the cost of the environment and the local community. Both of these, with respect to RINL's expansion project have been elaborated in the subsequent sections.

1.2 PROJECT DEVELOPMENT

As elaborated in the preceding section, RINL's modernization-cum-expansion programme was the result of a technical assessment of the existing plant with respect to its operating life as well as safety in lieu of a long and continuous operation regime. The revamping/modernization as well as expansion units were contemplated to improve upon these aspects of the plant for sustainable and safe operations.

This modernization and revamping drive has led to enhancement of the plant's capacity by 1.0 MTPA of Crude steel. However, the activities pertaining to the same were carried out without obtaining prior Environmental Clearance, and hence has been considered as a case of violation of the provisions of EIA Notification, 2006 and subsequent amendments thereto.
As per MoEFCC's notification vide S.O. 804 (E) dated 14.03.2017 and subsequent notification/OMs viz. S.O. 1030(E) dtd. 08.03.2018 and OM dated 15.03.2018 for one time

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opportunity for all such projects/activities under violation of the provisions of EIA Notification, 2006 for obtaining prior Environmental Clearance under EIA Notification, 2006, RINL had applied for seeking Terms of References (ToR) for the project in pursuance of the Ministry's Notification dated 14th March, 2017 due to violation of the EIA Notification, 2006 and subsequent Office Memorandum issued on 16/03/2018, vide their proposal no. IA/AP/IND/73713/2018 dated 29.03.2018 and was recommended ToR for undertaking detailed EIA and EMP study by the Expert Appraisal Committee (Violation Committee) in their 8th meeting held on 13th-14thJune, 2018 at MoEFCC, Delhi.

Based on the prescribed ToRs, EIA report was prepared including damage assessment and application for grant of EC was submitted. Subsequently, the proposal was appraised at the 13th meeting of EAC for proposals involving Violation of EIA notification 2006. After detailed deliberations, EAC asked RINL to submit additional details regarding the project. RINL was asked to carry out fresh baseline data for one month and to revise the Damage Assessment portion of the EIA report.

1.3 PROJECT CHRONOLOGY

The key events / highlights of the project pertaining to obtaining of environmental clearance for the project after its conceptualization, are mentioned hereunder in **Table 1.1**.

Table 1.1 : KEY EVENTS/HIGHLIGHTS OF THE PROJECT

Sn	Event/Activity	Date
1	Applied online to MoEFCC for EC amendment of 6.3 MTPA to 7.3 MTPA and hard copy sent through courier	05.02.2015
2	While pursuing the status with MoEFCC– VSP was advised to resubmit the application and application was resubmitted	20.12.2015
3	VSP approached MoEFCC for amendment of EC. MoEFCC advised VSP to apply afresh for TOR	28.01.2016
4	Applied online to MoEFCC enclosing Form-1 & pre-feasibility report	30.06.2016
5	Presentation given to MoEF&CC	28.07.2016
6	TOR issued by MoEFCC for conducting EIA	19.09.2016
7	Public Hearing conducted	15.06.2017
8	Applied online to MoEFCC enclosing final EIA report	27.07.2017
9	Online resubmission to MoEF&CC	09.01.2018
10	MoEF&CC: MoM recommended that VSP'S proposal attracts Violation of EIA notification, 2006.	08.02.2018
11	Applied to MoEFCC for appraisal by Violation Committee.	29.03.2018
12	Proposal included in the agenda for the meeting and TOR issued	14.06.2018
13	Meeting for Amendment of ToRs for using existing base line data.	28.06.2018
14	Applied to MoEFCC for grant of EC by Violation Committee.	28.08.2018
15	Meeting for grant of EC by Violation Committee.	18.09.2018

1.4 NEED OF THE STUDY

The specific Terms of Reference granted to the project, under the provisions of MoEFCC's notification vide S.O. 804 (E) dated 14.03.2017 regarding grant of Environment Clearance to projects in violation of the EIA Notification, 2006 and its subsequent amendments, recommended the following:

- Assessment of damage to be carried out with respect to air, water, land, ecology and other environmental attributes.
- A remediation plan and natural and community resource augmentation plan to be prepared corresponding to the ecological damage assessed and economic benefits

derived due to violation.

The EIA Report had been prepared in line with the above TOR and presented at the 13th EAC meeting. However, EAC sought additional information including one month's baseline environmental monitoring. EAC has asked to rework the damage assessment for the project considering the damages due to the new reservoir.

In accordance with the above, fresh baseline monitoring data was generated and assessment of damage due to the expansion of the plant was revised. The corresponding restitution and mitigation plan along with budget provisions are discussed in this chapter, in the subsequent sections.

1.5 ECONOMIC BENEFITS DERIVED

As discussed earlier, the expansion of the Integrated Steel Plant from 6.3 MTPA to 7.3 MTPA started with revamping and capital repair of existing BF1 followed by BF2. Subsequently, in order to match the increased Hot Metal Production capacity, expansion/ revamping/ modernization of existing facilities also started. The schedule of these plant developmental activities is given in **Table 1.2**.

Table 1.2 : Time Table of Plant Development

Sl. No.	Facility	Commencement	Completion
1	**BF1 Revamping**	October 2013	July 2014
2	**SMS2 Converter 3**	March 2013	Nov. 2016
3	**SMS2 Caster 4**	June 2014	Dec. 2017
4	**COB 5**	July 2015	Yet to finish
5	**BF2 Revamping**	May 2016	August 2017
6	**SP1 Revamping**	October 2016	31.07.2017
7	**SP2 Revamping**	Yet to start	
8	**New Rebar Mill**	Yet to start	
9	**KBR-2**	July 2016	By Oct. 2018
10	**Turbo Blower 5**	June 2014	Nov. 2017
11	**Guard Pond**	March 2018	February 2020

From the above table, it can be seen that the various expansion/modernization programs for different units started at different times. Some have already been completed while and some are still in progress. However, the actual production of hot metal and crude steel have continually increased and reached a maximum of about 5.13 MTPA hot metal and 4.97 MTPA Liquid steel in 2017-18 [approved capacities are at 6.5 MTPA of Hot Metal and 6.3 MTPA of Liquid steel].

1.5.1 Estimation based on production exceeding approved capacity

The two Blast furnaces were operating at near maximum capacity prior to expansion phase. For the capital repairs/expansion of capacity, the existing two blast furnaces were put under repair one after the other. However, although the blast furnaces were put under capital repair during the expansion period, the total production of hot metal from the entire plant has been increasing since 2012-13. This increase is mainly attributable to the simultaneous commissioning of a new blast furnace (BF3).

Therefore, after 2012-13, when the production from BF1 started declining due to ongoing

revamping activities, the production from BF2 was almost constant but the production from new BF3 started to increase gradually. Similarly, when BF1 revamping was completed and BF2 revamping started in 2016, the production from BF1 was normalized around 1.8 MTPA. The contribution from revamped BF1 and new BF3 reached to 1.8 MTPA each.

A significant increase in production was observed after 2016 when the BF1 was normalized after revamping with an output of around 2 MTPA and BF3 was also producing at near max capacity of 2.5 MTPA. And even though there was no output from BF2, the total hot metal production in 2016-17 was 4.4 MTPA. This was the first time when RINL breached the benchmark of 4 MTPA hot metal production and this was mainly due to the newly installed BF3 of 2.5 MTPA capacity.

In August 2017, when the revamping of BF2 was completed, the production from the unit gradually started increasing. The final output figures of all the blast furnaces were 2.0 MTPA, 0.6 MTPA and 2.5 MTPA for BF1, BF2 & BF3 respectively. Total output was 5.13 MTPA.

Therefore, from the above paragraphs, it can be inferred that the gradual increase in hot metal production from 2012-13 to 2017-18 is mainly attributable to newly installed BF3. Secondly, even after the revamping and capacity expansion of BF1 & BF2 from 2.0 MTPA to 2.5 MTPA, none of the units have given an output exceeding the approved limit of 2.0 MTPA.

In such an integrated steel plant where input is basically iron ore, the income from the operation is directly proportional to the hot metal production. And since, the hot metal production from the two revamped units has never exceeded the approved capacity, the economic benefits derived due to the project can be assumed to be nil.

1.5.2 Estimation based on proportionate increase in production capacity

To estimate the notional economic benefits derived due to the violation, the same can be calculated based on the increase in actual production in proportion to the increased production capacities. Again, since the income from an integrated steel plant is directly proportional to the quantity of hot metal produced, therefore it is assumed that prior to commissioning of BF1 after revamping, no economic benefit was obtained.

The estimation of economic benefits derived shall be done in two phases-
Phase 1: when only BF1 was commissioned after revamping from July 2014 till May 2016.
Phase 2: when both BF1 & BF2 were being operated after revamping from May 2016 till date.

In Phase 1, the total capacity of Hot metal production has increased from 6.5 MTPA to 7.0 MTPA. Therefore, 0.5 MTPA of the total 7.0 MTPA hot metal production capacity shall be considered for calculation. This means that 7.1 % of the total income from production and expenses thereof during the period shall be considered for cost estimation.

Similarly in Phase 2, the total capacity of Hot metal production has increased from 6.5 MTPA to 7.5 MTPA. Therefore, 1.0 MTPA of the total 7.5 MTPA hot metal production capacity shall be considered for calculation. This means that 11.4 % of the total income from production and expenses thereof during the period shall be considered for economic benefit estimation. The estimation of costs for different financial years is shown in **Table 1.3**.

Table 1.3 : Year-wise estimated benefits due to violation

Sl. No.	Particulars	2014-15	2015-16	2016-17	2017-18
1	Production Capacity (TPA)	6833333	7000000	7000000	7333333
2	Incremental Capacity (TPA)	333333	500000	500000	833333
3	Incremental Capacity as Percentage of Total Production Capacity	4.9 %	7.1 %	7.1 %	11.4 %
Income & Expenses for actual production and those attributable to Violation (Rs in Crores)					
1	Total Income	10,688.5	10,480.6	12,679.0	14,872.4
2	Total Expenses	10,590.5	12,268.6	14,369.5	16,242.8
3	**Net Profit/Loss**	**62.38**	**-1420.64**	**-1263.2**	**-1369.0**
4	Income corresponding to Violation	508.9	723.8	887.1	1659.9
5	Expenses corresponding to Violation • *Cost of materials consumed* • *Excise duty* • *Finance costs* • *Depreciation and amortization expense* • *Consumption of stores and spare parts* • *Power and fuel* • *Repairs and maintenance* • *Rent* • *Rates and taxes* • *Insurance* • *Handling and scrap recovery* • *Freight outward* • *Miscellaneous expenses*	463	656.7	893.7	1591.8
6	**Net Economic Benefit (4-5)**	**45.9**	**67.1**	**-6.7**	**68.1**

** Other incomes and expenses which are not relevant to the above calculations are not shown.*

From the above table it can be observed that out of the 4 years as per the Balance Sheet, RINL has incurred operational losses when economic benefits were being derived due to the violation. However, breakup of cost for proportionate income and expenses from the revamped units indicate a total profit of **Rs 174.5** Crores over 4 years period of plant operation.

1.6 DAMAGE ASSESSMENT

The environmental damages attributed to RINL's expansion-cum-modernization project can be primarily categorized into the following categories viz.

- Damage due to project location
- Damages caused during construction of units
- Damages caused during operation of units prior to getting EC

Accordingly, remedial measures have been identified based on the severity of the damage as well as the vulnerable agent (infrastructure, natural resource, community etc.) to which the damage was caused.

The detailed damage assessment due to the project activities and damage scoring for each component is elaborated in the subsequent sections.

1.7 DAMAGE DUE TO PROJECT LOCATION

Most of the additional units proposed for the expansion from 6.3 MTPA to 7.3 MTPA shall be/are being installed within the existing premises of the Steel Plant and adjacent to existing similar units' locations keeping in view that some infrastructure facilities of existing units can be shared with the new units. The sites of these new project units were vacant, unutilized plots within existing steel Plant which were used for temporary storage of scrapped material and scrap metal. The plots' only vegetation were common shrubs and grasses. Thus, location of the new units involve minimal disturbance to existing environment as no additional area was acquired outside the plant boundary. Only the new reservoir (KBR-2) is being set up outside the steel plant's premises but on land owned by the steel plant. Part of this land was covered with thickets of common trees and shrubs some of which are considered as "Invasive Species".

The revamping of existing units was carried out within the existing individual complexes of the units. The land of the existing plant units is already under industrial use.

Also, the land over which these new units/revamped units shall be/have been set up, were vacant areas which had been earmarked for such expansion units since inception of the plant. Overall, the project required no additional land and no significant disturbance was caused to the natural eco-system due to the site location of these units.

1.8 DAMAGE DUE TO CONSTRUCTION

1.8.1 Methodology For Assessment Of Damage During Construction Phase

As discussed earlier, some of the units of the proposed expansion plan have already been installed and construction of the rest are still in progress. The construction work of new Rebar Mill is yet to commence. Construction of the project may have had some impacts on land use, ground water, water quality, air quality, noise etc. of the study area. The impacts due to construction activities which were carried out for units which are already installed and others which are being installed are discussed here under.

The identified impacts due to activities associated with the construction of the facility have been studied in relation to the following areas:

- Land environment
- Ambient Air Environment
- Noise environment
- Water environment
- Ecological environment

The expansion of Integrated Steel Plant from 6.3 MTPA to 7.3 MTPA started with revamping and capital repair of existing BF1 followed by BF2. Subsequently, in order to match the increased Hot Metal Production capacity, expansion/ revamping/ modernization of supporting and downstream facilities also commenced. The time line for these plant developmental activities is given in **Table 1.4**.

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Table 1.4 : Time Table of Plant Development

Sl. No.	Unit	2013				2014				2015				2016				2017				2018			
		Jan	April	July	Oct	Jan	April	July	Oct	Jan	April	July	Oct	Jan	April	July	Oct	Jan	April	July	Oct	Jan	April	July	Oct
1.	BF1 Revamping																								
2.	SMS2 Converter 3																								
3.	SMS2 Caster 4																								
4.	COB 5																								
5.	BF2 Revamping																								
6.	SP1 Revamping																								
7.	KBR 2																								
8.	Guard Pond																								

From the above chart, it is inferred that from 4th quarter of 2016 to 3rd quarter of 2017, 5 different construction activities were being undertaken simultaneously but all these activities were at various phases of development. Therefore, it order to estimate the maximum contribution of plant construction activities on ambient environment at any time, cumulative emissions during this period are considered.

To estimate the impacts of construction activities, following assumptions have been made:

- Since the projects are being developed over a significant land area, the site preparation activities are assumed to be carried out evenly during entire period of construction phase.
- The construction and demolition debris arising out of the construction activities are utilized within the area of RINL. No external dumping was done.
- Transport of construction material and equipments was carried out evenly during the entire construction phase.

a. Damage to Land Environment

Land use change is necessary and essential for economic development and social progress. Land use change, however, does not come without costs. Conversion of farmland and forests to urban/industrial use reduces the amount of land available for food, timber production and green cover. Soil erosion, salinization, desertification, and other soil degradations associated with intensive agriculture and deforestation reduce the quality of land resources and future agricultural productivity.

The construction activities did not involve any land acquisition as the proposed expansion was carried out within the existing land area under possession of RINL. Hence, there were no issues regarding Rehabilitation and Resettlement (R&R). All of construction activities are limited within the land in possession of RINL.

However, within the land owned by RINL, the actual land cover included green cover. Construction of new units may have resulted in destruction of green cover and change of land cover from plantation to industrial use. Therefore, in order to estimate the impacts on land due to expansion, the proportion of green cover diverted for industrial use have been estimated for individual units. Google earth satellite imagery of pre-construction and post-construction period were considered for the same.

b. Damage to Air Environment

As the project site is located within a well-developed industrial plant, not much leveling work was involved. However, during the construction phase, a lot of civil work was carried out. This led to generation of fugitive dust

Dust emissions from construction and other civil construction activities are a common problem. Fine particles (PM_{10}) from these sources is a significant cause of air pollution. Owing to their small size, PM_{10} can be carried from sites even in light winds and may therefore have an adverse effect on the local environment and on the health of local residents. Being an important indicator of Ambient Air quality, this factor has been considered for assessment of Degree of Damage.

Gaseous pollutants like NO_X were also contributed to ambient air due to operation of diesel powered machinery and vehicles associated with construction. Gaseous emissions from construction machinery and vehicles were minimized by enforcing strict emission monitoring system. The impacts were confined within the specific plant area where the project was taking place and were expected to be negligible outside the plant boundaries.

During the construction period, the impacts that are associated with air quality are:

- Deterioration of air quality due to dust emissions from construction activities (especially during dry season) like excavation, back filling and concreting, hauling and dumping of excavated material & construction spoils and movement of construction machinery & vehicles over unpaved surfaces..
- Generation of pollutants due to operation of heavy vehicles and movement of machinery and equipment for material handling, earth moving, laying of sands, metal, stones, asphalt, etc.

In order to study the maximum contribution of construction activities on air environment, the ground level concentrations of air pollutants from all the sources are predicted using Air dispersion modelling. The various sources of pollution for the construction activities have been considered for modeling for variable time periods, depending upon the duration of activity.

The damages caused due to increase of pollutants on the ambient air are estimated using AERMOD Air Quality Simulation model released by USEPA. The isopleths have been drawn over a 25 km X 25 km area with the location of the BF1 as the centre. The incremental concentrations have been estimated at every 500 m grid point.

c. Effects on Noise Levels

Noise is generated during construction due to operation of diesel powered excavators, trucks and cranes and handling of heavy metallic equipment. Noise was also generated due to use of explosives to break up some large boulders encountered during construction of the new reservoir. The maximum noise generated by the diesel powered machinery deployed for excavations was 85 dB(A) at ~1 m distance from the machinery.

For hemispherical sound wave propagation through homogeneous medium, one can estimate the noise levels at various locations due to different sources using a model based on the following principle-

$$L_{p2} = L_{p1} - 20 \log_{10} (r_2/r_1),$$

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where L_{p1} and L_{p2} are the sound levels at points located at distance r1 and r2 from the source.

This indicates that noise level decreases by 6 dB(A) for doubling of the distance. Combined effect of all the sources (A,B,C,…. Etc.) can be determined at various locations by the following equation:

$$L_{ptotal} = 10 \log_{10} (10^{Lpa/10} + 10^{Lpb/10} + 10^{Lpc/10} \ldots\ldots\ldots\ldots),$$

Where L_{pa}, L_{pb} and L_{pc} are noise pressure levels at a point due to different sources.

From the above methodology, the incremental noise level at a particular location due to any distant sound source can be estimated.

d. Damage to Water Environment

The surface and ground water bodies may get affected due to construction activities as there is some interaction of site activities with the surface water bodies in the area. However, the impact on any water body cannot be attributable to any single activity. The impact or damage caused may be due to several industrial or anthropogenic activities occurring in the buffer zone over a period of time.

In order to study the damages on water environment, monitored ground water quality is analysed during pre-construction and post-construction stage. Additionally, impacts of surface water bodies due to diversion of natural streams is also studied.

e. Damage to Ecology

Biological impacts of the project were identified and quantified. The likely biological impacts of the project have been identified on the basis of project activities, their possible environmental aspects and consequent impacts. The impacts have been quantified wherever possible by use air pollution dispersion models, noise attenuation models. The Likely Impact Zone has been demarcated by superimposing the air pollution dispersion isopleths on suitable maps.

Details of activities performed for individual units and damages on ambient environment are discussed in following sections.

1.8.2 Damage Assessment

Based on the methodology explained in the preceding paragraphs, assessment of damage has been carried out with respect to various environmental attributes for each unit separately and later collectively for all the units. Following units have been considered-

1. Construction of new KBR 2
2. Construction of new Coke Oven Battery 5
3. Construction of new Guard ponds
4. Revamping of existing BF1 and BF2
5. Revamping of existing SP1
6. Expansion of SMS2 by installation of new converter 3 and caster 4.

Unit-wise damage assessment is carried out in the following paragraphs.

1. Construction of new Kanithi Balancing Reservoir 2

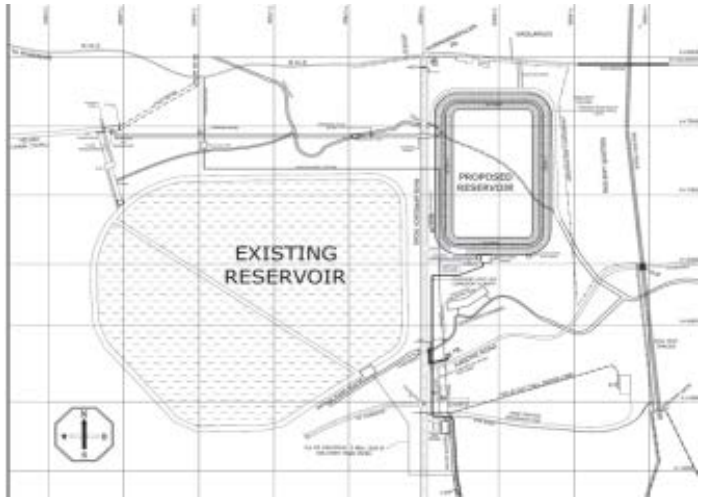
Present water requirement RINL is of around 38 MGD for the existing plant is met from Yeleswaram Reservoir and Godavari River through a 153 km long open canal. Water consumption is expected to go upto 45 MGD when the plant attains its rated capacity (7.3 MTPA steel).

With implementation of measures like Zero Liquid Discharge Schemes & Rain Water Harvesting, another 5 MGD of incremental demand can be met. Still there will be a significant gap in demand and supply of water at 7.3 MTPA stage.

To meet exigencies in case of canal flow disruption, Kanithi Balancing Reservoir (KBR) of 15 Million Cubic Metres (Mm^3) capacity was constructed near plant premises over 300 hectares area in the year 1989.

In order to facilitate inlet water canal maintenance with increased per day water consumption and to take care of the surges in water flow through canal, it is planned to increase in house water storage capacity by constructing an additional water storage reservoir of 12.32 Mm^3 capacity, opposite to the existing reservoir (KBR). Location of the proposed reservoir relative to the existing reservoir is shown in **Figure 1.1**.

Figure 1.1 : Location of the proposed reservoir relative to the existing reservoir



The new water reservoir is being constructed about 4 km north of the plant near NH-5. The new water reservoir is spread over ~80 ha and will be ~20 m deep.

The habitation closest to the proposed reservoir is about 200m away (Railway Colony which has about 200 dwellings) from the excavated site in the East and about 300 m in the North side.

The soil at reservoir site is comprises silty clay and silty gravel up to a maximum depth of 10 m. Thickness of the soil layer (overburden) varies from 2.4 m 10 m. No soil exists below 10 m depth. Water table is at shallow depth (1.2 m - 5.0 m). At proposed KBR site there were three nalas viz Northern, Central and Southern. KBR2 is located in between Central Nala and Southern Nala. However, during construction entry of Central Nala near KBR2 was diverted and temporarily made arrangement in the west side of the KBR2 and confluence with southern nala in the southern direction. Salient features of the construction of new KBR2are given in **Table 1.5.** Photographs of the site are given in **Figure 1.2-1.4.**

Table 1.5 : Salient features of the construction of reservoir

1.	Area, depth and dimension of bund wall, Quantity of material excavated	i) Area: 225acres ii) Depth : 13.53M below G.L iii) Bund wall:3.208KM iv) Excavation Quantity:45Lcum
2.	Ground water Depth in the reservoir area and Details of de-watering	i)Water table 4m below Ground level ii)20 dewatering pumps used
3.	Duration of excavation	21 months
4.	Method of Excavation	Excavators, Rippers, Rock breakers, Controlled Blasting
5.	Method and Location of material dumping	i) Transporting by Trucks ii) In the allotted land within VSP land boundary
6.	Details of modified drainage network of the area.	Re-routing drain passing through reservoir area.
7.	Details of Drilling and Blasting.	i) 7 nos. of drilling machines deployed ii) Controlled blasting. Approx qty 4 lakhs cum

Figure 1.2 : View New Water Reservoir Site on 23-07-18 from approx. 17°40'41.8"N, 83°10'05.0"E

Figure 1.3 : View New Water Reservoir Site on 23-07-18 from approx. 17°40'41.8"N, 83°10'05.0"E

Figure 1.4 : View of New Reservoir Site on 29-10-18 Looking North from approx. 17°40'20"N, 83°10'16"E

Construction of the reservoir has involved the following activities:

1. Clearance of vegetation.
2. Diversion of natural stream passing through the site.
3. Excavation of soil & rocks.
4. Transport and dumping of excavated material
5. Discharge of seepage water
6. Construction of embankment by utilizing part of the excavated soil & rocks
7. Concrete lining of inner side of embankment
8. Construction of intake structure.

The water intake structure is being constructed on the southern side of the reservoir. This shall comprise of concrete structures to house electrically driven pumps with all necessary accessories. Construction of this intake structure shall involve fabrication and erection of steel reinforcements, construction of concrete structures, installation of electrical power supply system, installation of water pipelines and other accessories. The overview of the KBR2 is shown in **Figure 1.5**.

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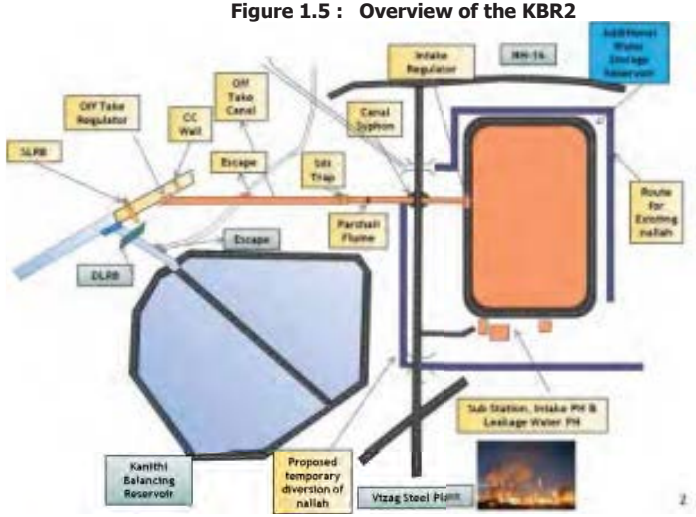
Figure 1.5 : Overview of the KBR2



Damage assessment:

The probable damages due to activities associated with the construction of the reservoir have been studied in relation to the following areas:

- Land environment
- Ambient Air Environment
- Noise environment
- Water environment
- Ecological environment

Damage to Land environment:

The site of the reservoir was an expanse of scrub land. The vegetation comprised of dense thickets of *Prosopis juliflora* with few *Acacia nilotica, Azadirachta indica* and *Borassus flabellifer*) and expanses of grassland as can be seen from the Google Earth Image of 26-01-2011 in **Figure 1.6-1.7**.

Figure 1.6 : Google Earth Image dated 26-01-2011 of New Reservoir Site. Existing Reservoir seen on left.

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Figure 1.7 : Google Earth Image dated 13-04-2018 of New Reservoir Site. Existing Reservoir seen on left.

Approximately 4450000 m^3 of soil and rocks were excavated for creation of the reservoir. Excavation was carried out using mechanical shovels / excavators, which loaded the excavated muck on to tipper trucks. The tipper trucks then transported the material to designated dump sites. A few large boulders, too large to be excavated and broken up by the deployed shovels / excavators, were encountered. These were broken up into manageable sizes by blasting. Prior clearance had been obtained from the concerned authorities for using explosives for blasting rock.

The soil and rocks excavated from the reservoir site have been dumped externally at five locations:

1. Just beyond the north-eastern corner of the new reservoir (between latitudes 17°40'53.1" N & 17°41'04.5" N and longitudes 83°10'20.8" E & 83°10'33.3" E)
2. Just beyond the eastern side of the new reservoir site (between latitudes 17°40'26.5" N & 17°40'52.25" N and longitudes 83°10'30.5" E & 83°10'35.6" E).
3. Just beyond the south-eastern corner of the new reservoir (between latitudes 17°40'14.5" N & 17°40'26.1" N and longitudes 83°10'25.1" E & 83°10'36.2" E)

4. Just beyond the north-western corner of the existing reservoir, ~2.6 km due west of the new reservoir site (between latitudes 17°40'18.7" N & 17°40'39.8" N and longitudes 83°08'20.2" E & 83°08'53.3" E)
5. About 4.5 km due west of the new reservoir site (between latitudes 17°40'12.7" N & 17°40'32.1" N and longitudes 83°07'17.5" E & 83°07'43.9" E).

Top soil has been dumped separately as small dumps not more than 1 m high. ~90 ha area has been utilised for the reservoir and associated structures / facilities and 61.41 ha area has been utilised dumping material excavated from the reservoir. Dumped material spread over 25.91 ha area is being rehandled and being utilised for embankment construction i.e. 35.5 ha of dumps shall remain. The entire dump area shall be biologically reclaimed. Photograph of dump site is given imn **Figure 1.8** below.

Figure 1.8 : Excavated Material from New Reservoir Dumped Externally at approx. 17°40'25"N, 83°07'33"E

Measures considered for minimizing the damage:

- In order to preserve top soil, Top soil has been dumped separately as small dumps not more than 1 m high.
- Dumped material being rehandled and being utilised for embankment construction

Damage on Ambient air quality

As indicated above the new KBR 2 is being dug out near the existing KBR1 on the opposite site of the road. Since this is a fresh project, all the activities like, vegetation removal, ground levelling, drilling & blasting, civil construction work etc shall be involved.

Approximately 4450000 m^3 of soil and rocks were excavated for creation of the reservoir. Excavation was carried out using mechanical shovels / excavators, which loaded the excavated muck on to tipper trucks. The excavated material stored at different locations
The estimated quantity of material transported during construction phase is as follows--

- Total quantity of excavated material and transported – 6675000 T
- Total Concrete transported – 200 T

The project basically involves digging out soil, rocks and other debris from site and storing it in some other areas. Along with this, an embankment is also provided which is constructed of the same material being dug out and some other material.

The main source pollutant generate from the above activities is dust. The emissions are fugitive in nature. The fugitive emissions arising out of these activities have been estimated based on AP-42 considering the quantity of material excavated and handled.

The emissions of NOx during transport of excavated material are estimated based on CPCB guidelines. The estimated emissions for each activity are given in **Table 1.6** below.

Table 1.6 : Pollutant emissions during construction phase of KBR2

Sl. No.	Activity	Emission Factor	Emission Rate (g/sec)
	Excavation /Construction activities		
1	Bulldozing	2.292 Kg/hr	0.064
2	Motor Grading	0.6 g/Km/Vehicle	0.014
3	Truck Loading with debris	0.0002 Kg/T	0.057
4	Truck Unloading	0.0002 Kg/T	0.057
5	Drilling and blasting of rocks	0.59 Kg/Hole	0.074
6	Wind erosion of exposed material	9.03E-07 g/s/m^2	0.027
	Material Transport		
1	Truck transport of cement to site on paved roads		
	PM	17.8 g/Km/Vehicle	0.000000000871 g/s/m^2
	NOx	9.3 g/Km/Vehicle	0.000000000456 g/s/m^2
2	Truck transport of excavated material on unpaved roads		
	PM	5.8 g/Km/Vehicle	0.000003528695 g/s/m^2
	NOx	9.3 g/Km/Vehicle	0.000005702298 g/s/m^2

Based on the above estimated emission values, damage of ambient air quality which would have happened during construction activities of reservoir have been assessed. The assessment has been made by studying increase of ground level concentrations due to construction activities in buffer areas. The incremental concentrations due to the construction activities are given in **Table 1.7** below. The isopleths of PM_{10} and NO_X concentrations are also given in **Figure 1.9** and **Figure 1.10** respectively.

Table 1.7 : GLCs due to construction activities of KBR2

Station ID	PM	NOx
A1	0.026	0.232
A2	1.592	1.880
A3	0.380	0.078
A4	0.115	0.925
A5	0.000	0.000
A6	0.568	0.313
A7	0.109	0.163
A8	0.132	0.005

**** All values in µg/m^3.***

Figure 1.9 : GLCs of PM Emissions due to KBR2

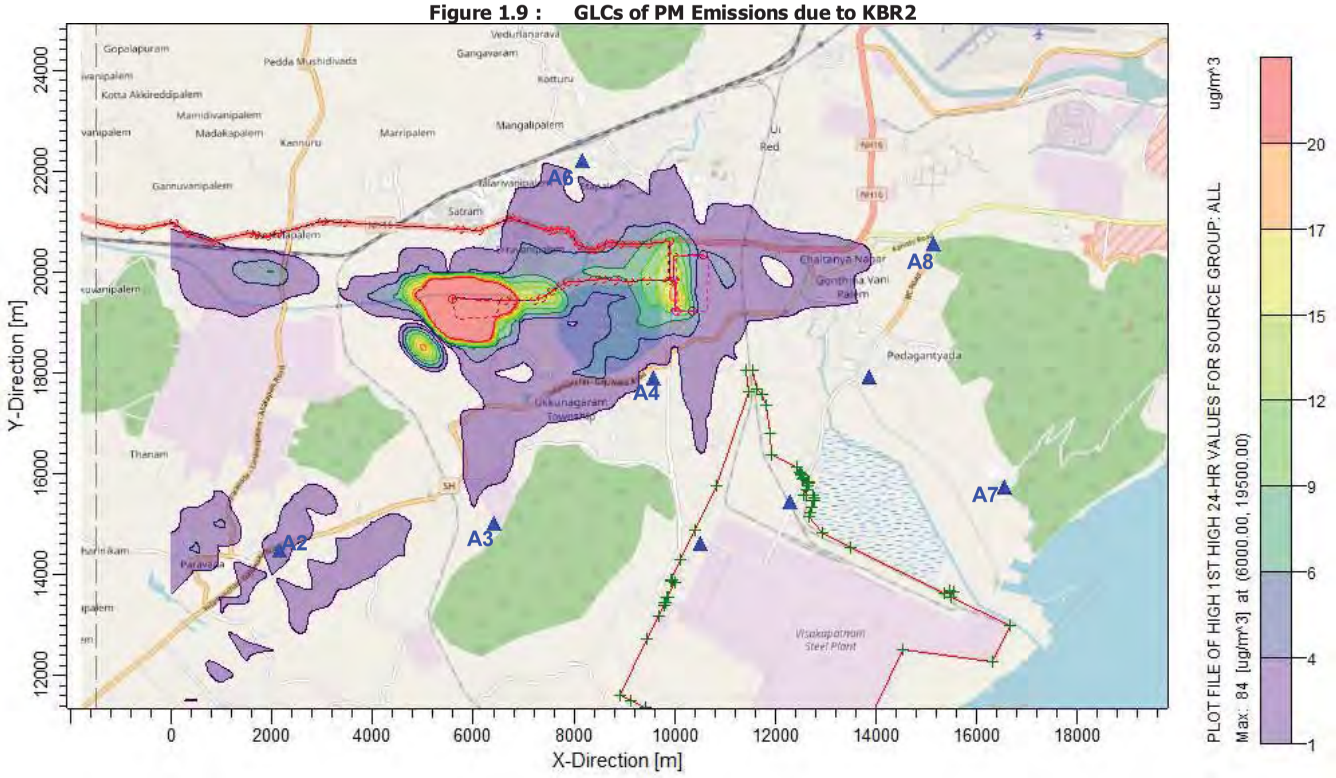

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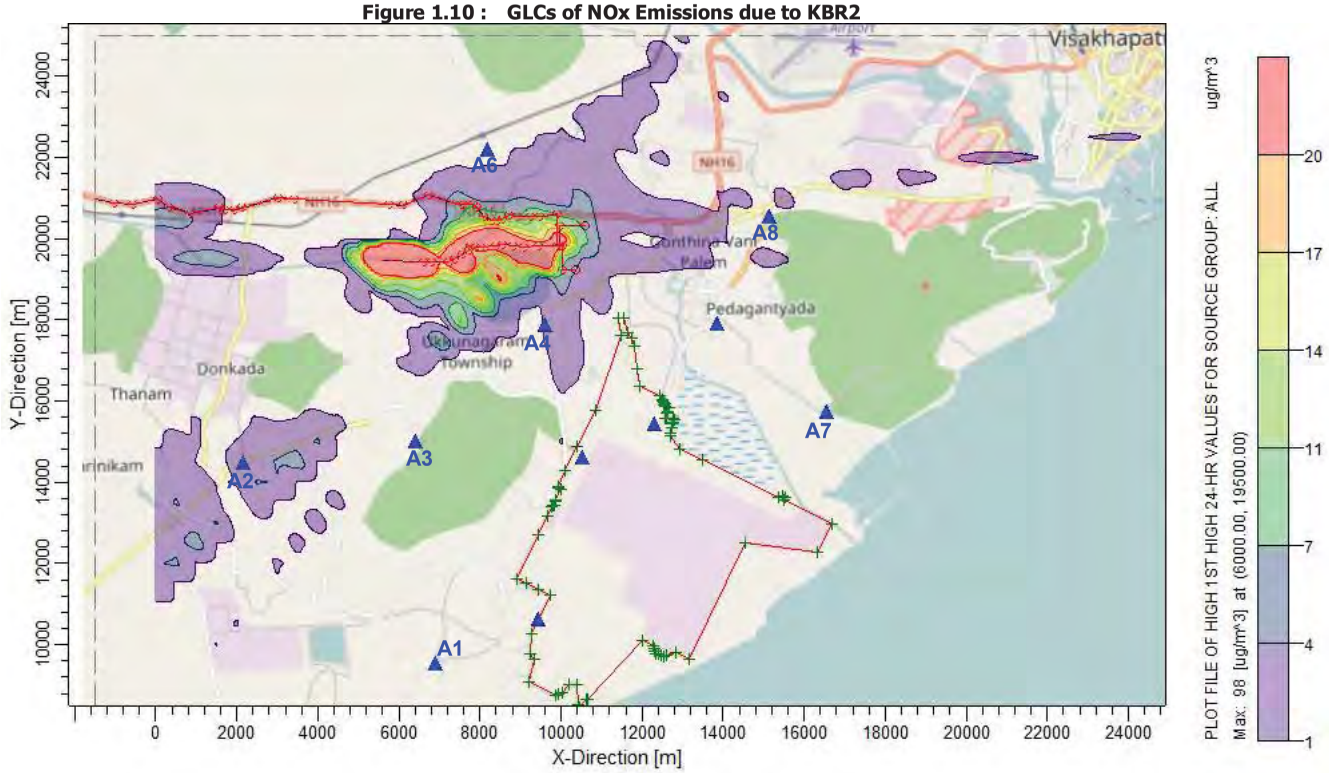
Figure 1.10 : GLCs of NOx Emissions due to KBR2



Based on the above, following conclusions can be drawn:

- During excavation of the reservoir, the fugitive dust was generated due to various excavation activities, the maximum was near to the source and concentrations of PM emissions at nearest habitation i.e. Railway colony which is ~200m away from the site would have increased by about 4 µg/m^3 above the ambient concentrations. Similarly in the northern side beyond NH road the emissions were in the range of 4 to 7 µg/m^3.
- The PM_{10} at this location are in the range of 72 to 75 µg/m^3. The resultant concentrations at nearest inhabited areas during construction period would have been in the range of 76 to 82 µg/m^3 which are within the norms. Though there were minor increases in PM_{10} concentrations during excavation period of KBR2 which would have led to a minor damage to the environment.
- The NOx generated due to construction of KBR-2 were too low to have any measurable change in air quality at the nearest habitation.

Measures considered for minimizing the damage:

- Provided temporary enclosures to restrict the dust during excavation
- Regular water sprinkling on un paved roads
- Muffling was done by sand bags, wire mesh and blast mats to reduce fly rocks and spread of dust from blasting. The fragments were arrested within 15m of the blasting locations.

Damage to Water environment:

Three natural perennial streams flowed through the reservoir site area. One (called the Central Nala) entered the site somewhat in the middle of the western boundary of the reservoir site and flowed towards the south-east across the reservoir site. The second (called the Northern Nala) flows from the north slightly east of the eastern boundary of the reservoir site and flowed south-ward to join the Central Nala east of the south-eastern corner of the reservoir site. The third stream (called the Southern Nala) flows close to but outside the reservoir site. This stream flows from south-west to north-east in the southern part of the reservoir. After confluence with the Central Nala coming from the north-west across the reservoir site east of the south-east corner of the reservoir site, it turns towards the south-east.

During construction of the reservoir the drains were diverted. Prior to commencement of reservoir construction a diversion channel was constructed to divert the Central Nala along the proposed western and southern rim of the proposed reservoir area to the existing southern channel, thus maintaining the overall drainage pattern.

The new reservoir bottom is ~14 m below the original ground level. In the reservoir site, the ground water level is ~4 m below the original ground level. So water has to be discharged from the excavations. Due to this it would drained out the ground water in the surrounding areas.

RINL has constructed an artificial ground water recharging pond on the southern side of the reservoir site. Water seeping into the excavated reservoir water was pumped out into the ground-water recharging pit. The pits were grouted to avoid any further infiltration. The cross section of the reservoir is shown in **Figure 1.11.**

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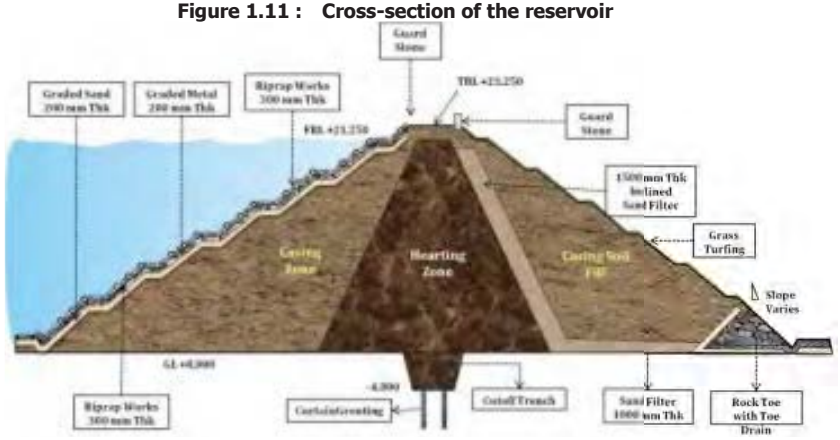
Figure 1.11 : Cross-section of the reservoir



Measures considered for minimizing the damage:

- In order to prevent infiltration of ground water during excavation and to avoid depletion of ground water levels in the surrounding areas, grouting was done.
- Diversion channel was constructed to divert the Central Nala along the proposed western and southern rim of the proposed reservoir area to the existing southern channel, thus maintaining the overall drainage pattern.

Effects on Ambient Noise Levels:

The maximum noise generated by the diesel powered machinery deployed for excavations was 85 dB(A) at ~1 m distance from the machinery. The distance between the nearest residential areas (Railway Colony near the north-eastern corner of the reservoir site) and machine deployment site was 150 m.

Thus without any attenuation by physical barriers, the 85 dB(A) will reduce to 41.5 dB(A) at a distance from the source. The Railway Colony is close to the nearby National Highway on which there is very heavy traffic round the clock. Consequently the day time noise levels in the Railway Colony is ~59 dB(A).

The noise levels at the Railway Colony would have had increased by only 0.08 dB(A) on account of machinery deployed for reservoir construction. In reality, the actual increase was less because of attenuation by the thick vegetation in the intervening area i.e. background noise levels at nearby residential areas were unaffected by deployment of diesel powered machinery at the reservoir site.

Measures considered for minimizing the damage:

- Excavation activities have limited only during day time.
- Temporary enclosures have arranged to further decrease of noise levels.
- Thick vegetation in the intervening area and boundary wall between the reservoir and railway colony further decreases the noise levels

Ground Vibrations & Fly Rock:

Prior to blasting, trial blasting studies were carried out by M/s Mineral on Ground, Hyderabad to determine the maximum amount of explosives which can be used per blast without damaging any nearby buildings. Before carrying out trial blasting, the distance to nearby structures was determined and the quantity of explosives was adjusted accordingly so that the structures were not affected (i.e. only "Controlled Blasting" was carried out).

The minimum distance between buildings and blasting sites is about 380 m. Directorate General of Mines Safety (DGMS), has stipulated that a Safety Zone of 300 m must be maintained between blasting sites and residential areas to avoid risks to human life & property due to fly rock from blasting. Thus the distance between blasting sites and residential areas was adequate.

Damage to Ecology:

As mentioned earlier, the project area comprises of dense scrub and grass lands and bulk of the vegetation comprises of *Prosopis juliflora* which is an invasive species

Sample survey of vegetation of the areas adjacent to the areas cleared for the new reservoir indicates that *Prosopis juliflora* constituted about 92 % of the trees, *Acacia nilotica* about 5% and the balance was mostly *Borassus flabellifer, Azadirachta indica, Ficus* spp. along with a few isolated miscellaneous species.

Due to the spreading nature of the canopy of *Prosopis juliflora*, the green cover of the area (except the grass lands) was almost total although the trees were about 5 – 6 m apart on an average as can be seen from the flowing photograph (**Figure 1.12- 1.14**) inside the dense vegetation adjacent to the area cleared for the reservoir.

Figure 1.12 : Dense Vegetation Adjacent to New Reservoir Site at approx. 17°40'39"N, 83°10'34.7"E

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Figure 1.13 : Dense Vegetation Adjacent to New Reservoir Site at approx. 17°40'12"N, 83°10'07"E

Figure 1.14 : Inside Dense Vegetation Adjacent to New Reservoir Site at approx. 17°40'12"N, 83°10'23"E

The damages on ecology due to reservoir construction are as follows:

1. Loss of green cover due to removal of vegetation
2. Loss of animals' habitat due to clearance of vegetation
3. Damage to vegetation due to deposition of fugitive dust on vegetation.

During clearance of the area for reservoir construction, a total of 23564 trees were felled of which 20982 were *Prosopis juliflora* of girth less than 30 cm. 2053 nos. of trees had girth between 30 cm & 60 cm, 521 trees had girth between 60 cm and 120 cm and 8 trees had girth >120 cm.

The area where the new reservoir is being constructed is surrounded by urban areas. The National Highway from Kolkata to Chennai via Cuttack, Bhubaneshwar, Visakhapatnam, Rajmundry and Vijaywada runs close to the site's northern boundary. There is very heavy traffic round the clock on this road. The size of the area, which is an isolated one, is too small to support any viable population large animals. The only animals found in the reservoir area were common small birds, reptiles (snakes & lizards) and small mammals (squirrels, rats & mice, mongooses etc.).

The excavation and dumping has involved operation of diesel powered heavy earth moving machinery (HEMMs) over unpaved surfaces. Excavation and dumping of soil & rocks have led to generation of fugitive dust and NOx (from diesel engines). The excavated soil and hard rock dumped adjacent to the new reservoir, have been / are being re-handled and used for construction of the reservoir's embankments. The embankment will extend for up to 12 m above the original ground level. The slope of the embankment on the inner side (i.e. inside the reservoir will be lined with concrete panels up to a depth of --- m below the top of the embankment. The work involves handling of excavated soil & rocks and movement of diesel powered HEMMs over unpaved surfaces. This is leading to generation of fugitive dust and NOx.

Water sprinkling was / is being carried out on the unpaved roads to suppress fugitive dust (**Figure 1.15**). However, the excavations and the dumps remain a major source of fugitive dust.

Figure 1.15 : Water Sprinkling on Road Between New Reservoir Site and Dump Site

The likely increase in airborne dust levels and NOx due to increased truck traffic has been estimated by mathematical modeling. The inputs for the mathematical modeling were (besides the increased vehicular movement) hourly meteorological data as monitored during Winter Season, 2016, emission factors suggested by Automotive Research Association of India, Pune after detailed field studies for Heavy Commercial Vehicles, Diesel Trucks manufactured after the year 2000. Emission factors for dust and NOx were considered to be 1.24 g/km and 9.3 g/km respectively.

The NOx was emitted over a wide area. Preliminary calculations have indicated that the quantity of NOx emitted over ~150 ha area was too less to have any measurable impact on the ambient air quality.

The maximum estimated ground level concentration of fugitive dust due to activities of the project was 84 $\mu g/m^3$ and occurred at the debris dumping location. It is to be noted that fugitive dust is generated at the ground level or few metres above the ground (in case of dumps). Fugitive dust does not travel very far unless there are very strong winds and most of the dust usually settles down within a few hundred metres of the source. The dust settling on the leaves of plants reduces the plants' photosynthetic activity and in extreme cases can also lead to the death of the leaves and apical buds. This is often seen adjacent to unpaved haul roads in mine areas. However, in the present project some dust deposition was observed on vegetation facing the dumps and the under-construction embankment, but fatal damage to vegetation by dust deposition was not observed, possibly due to effective dust suppression on unpaved roads.

Summary of Damages during Construction of COB5

- A small portion of unutilized land which was already available with RINL was diverted for the project. The main vegetable of the land was some shrubs.
- Dust generation due to excavation and truck movement was major source of pollution. The same will cease to exist on completion on construction phase of the project.
- Some natural streams passing through the site were diverted.
- Major source of noise pollution was truck movement and blasting activities. The same will cease to exist on completion on construction phase of the project.
- The main vegetable of the land was some shrubs which was removed during construction phase.

Mitigation Measures

Measures considered during excavation and construction:

- Water is being sprinkled on unpaved roads to suppress fugitive dust.
- Garland drain and retaining wall will be constructed at the toe of the dumps to prevent wash off from the dump. The retaining walls shall be 1 m high and 0.5 m thick. The retaining walls will have weep holes leading to garland drain (0.5m X 0.5m). The garland drains will be routed through desilting ponds, before discharging to natural drainage channels.
- After utilization of the material, the dump sites and the other two dumps (whose material will not be utilised), shall be biologically reclaimed. This will be carried out as follows:

  - On completion of external dumping / reclamation of dump sites, top soil (which was excavated during the initial stage of reservoir construction and has been stored in

separate small dumps) will be scattered over the area. Water will be sprinkled over the topsoil.

- Grasses and the shrub *Ipomea carnea* will be planted on the soil to stabilize it.
- 0.5 m x 0.5 m x 0.65 m pits will be excavated at ~3 m intervals.
- These pits will be filled with a mixture of topsoil, compost / organic manure.
- About 0.6 m tall saplings of *Acacia nilotica, Azadirachta indica, Ficus bengalensis, Ficus religiosa,* and *Pongamia pinnata* will be planted in soil filled pits just after the commencement of monsoons. Seeds of *Phoenix sylvestris* will also be planted.

2. Construction of new Coke Oven Battery 5

The new Coke Oven Battery No.5 (COB-5) is being set up over an area of 100 acres within the existing steel plant adjacent to the existing Coke Oven Battery No.4. This site is located at a distance of ~275 m from the nearest boundary of the steel plant.

Construction of the new Coke Oven Battery has involved the following activities:

1. Clearance of land.
2. Digging of foundations
3. Transport and dumping of excavated material
4. Transport and handling of construction materials (steel, concrete, pre-fabricated equipment)
5. Construction of Coke Oven Battery involving construction of steel & concrete structures.

Damage to Land environment:

COB-5 is being set up within the premises of the existing steel plant adjacent to the existing COB-4. The land over which the COB-5 is being set up was partly a vacant area for dumping scrap refractory bricks (from the coke-ovens) and various metallic scrap such as unserviceable structural & pipes etc. and partly for storing thermal coal fuel for the steel plant's captive coal based thermal power plant. The same can be seen in the Google Earth Image of 21 March, 2014 (see **Figure 1.16**).

Figure 1.16 : Google Earth Image of 21st March, 2014 of Site of COB-5 inside Visakhapatnam Steel Plant (Pre-construction Phase)

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The site was cleared as can be seen in the Google Earth Images during March, 2014 to September, 2018 (see **Figures. 1.17-1.24**). The metallic scrap was recovered and used as melting scrap in the plant's Steel Melting Shop. The waste refractory bricks were used up for repair of roads inside the plant. Further storage of coal in the area earmarked for COB 5 was discontinued and the coal stored in this area was used up on a priority basis in the power plant.

Figure 1.17 : Google Earth Image of 19th Nov., 2014 of Site of COB-5 inside Visakhapatnam Steel Plant (Coal Stock in NW side of Site Partly Cleared)

Figure 1.18 : Google Earth Image of 3rd Feb., 2015 of Site of COB-5 inside Visakhapatnam (Coal Stock in NW part of Site Partly Cleared. Clearing of coal stock in SW part of site started)

Figure 1.19 : Google Earth Image of 3rd Nov., 2015 of Site of COB-5 inside Visakhapatnam Steel Plant (Coal Stock in SW part of Site Mostly Cleared. Coal stock in NW part of Partly Cleared. Civil Works at Site Started)

Figure 1.20 : Google Earth Image of 10th Jan., 2016 of Site of COB-5 inside Visakhapatnam Steel Plant (Coal Stock in SW part of Site Completely Cleared. Coal stock in NW part of Mostly Cleared. Civil Works at Site in Progress)

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Figure 1.21 : Google Earth Image of 15th Dec., 2016 of Site of COB-5 inside Visakhapatnam Steel Plant (Coal Stocks Almost Completely Cleared. Structural Erection Works at Site Started)

Figure 1.22 : Google Earth Image of 20th April, 2017 of Site of COB-5 inside Visakhapatnam Steel Plant (Coal Stocks Completely Cleared. Battery Erection Works at Site Started)

Figure 1.23 : Google Earth Image of 21st Dec., 2017 of Site of COB-5 inside Visakhapatnam Steel Plant (Battery Erection Works in Progress)

Figure 1.24 : Google Earth Image of 30th Sept., 2018 of Site of COB-5 inside Visakhapatnam Steel Plant (Coal Stocks Completely Cleared, Battery Erection Works in Progress)

As is clear from the above images, very little vegetation was present in the area earmarked for new COB5 prior to the construction phase. Some scrubby vegetation was present over a small area on the eastern side of the plot. Therefore, no impacts can be attributed to the change in land use due to construction of COB5.

Damage to Ambient air quality

The new coke oven battery 5 is being constructed from ground near the existing coke oven battery complex. Since this is a fresh project, all the activities like, vegetation removal, ground levelling, civil and structural construction work etc shall be involved.
The estimated quantity of material brought from outside the plant is as follows--

- Total Excavated material transported from site – 750000 T
- Total Structural material transported to site – 246500 T
- Total Refractory material transported to site – 60000 T

Based on the above, number of trucks per day has been estimated to be around 40 trucks per day. This number also includes the number of trucks used for transportation of plant equipment and materials. The fugitive emissions due to diesel combustion & road emissions and other construction activities have been calculated based on AP-42 and CPCB guidelines. The same is given in **Table 1.8** below.

Table 1.8 : Particulate matter emissions during construction phase of COB 5

Sl. No.	Activity	Emission Factor	Emission Rate (g/sec)
Demolition and Debris Removal			
1	Land Clearing	0.039 Kg/hr	0.002685
2	Truck Loading with debris	0.018 Kg/T	0.01252
3	Transport of debris on paved road	16.5 g/Km/Vehicle	0.001533
4	Truck Unloading	0.001 Kg/T	0.000696
5	Wind erosion of exposed material	0.85 T/Ha/Year	0.001348
Site Preparation			
1	Bulldozing	0.039 Kg/hr	0.002685
2	Top Soil Removal by Scrapper	0.029 Kg/T	0.020171
3	Scrapper in travel(Paved Road Around Plant)	16.5 g/Km/Vehicle	0.001533
4	Top Soil scrapper unloading	0.02 Kg/T	0.013911
5	Truck Loading with const. material	0.018 Kg/T	0.00626
6	Truck Unloading of construction material	0.001 Kg/T	0.000348
7	Compacting	0.039 Kg/hr	0.002685
8	Motor grading	600 g/Km/Vehicle	0.006944
General Construction			
1	Vehicular traffic within site	16.5 g/Km/Vehicle	0.004783
2	Fine Screening	0.001 Kg/T	0.0000289

Based on the above estimated emission values, GLCs have been estimated due to the construction activities in buffer area. The incremental concentrations due to the construction activities are given in **Table 1.9** below. The isopleths of PM_{10} and NO_X concentrations are also given in **Figure 1.25** and **Figure 1.26** respectively.

Table 1.9 : GLCs due to various COB5 construction activities

Station ID	PM	NOx
A1	0.101	0.663
A2	0.033	0.269
A4	0.161	1.147
A4	0.247	0.857
A5	0.074	0.726
A6	0.077	0.750
A7	0.081	0.298
A8	0.279	2.025

** All values in µg/m³.*

Figure 1.25 : GLCs of PM Emissions due to CO5

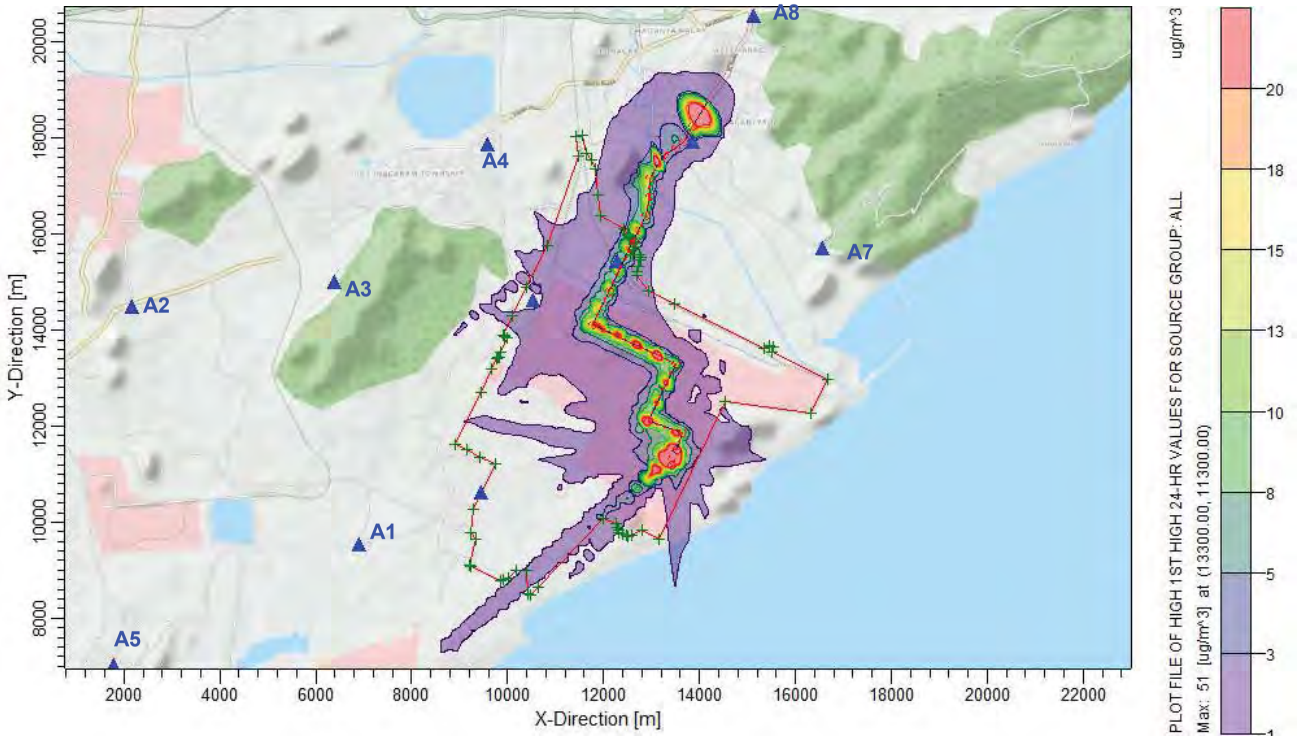
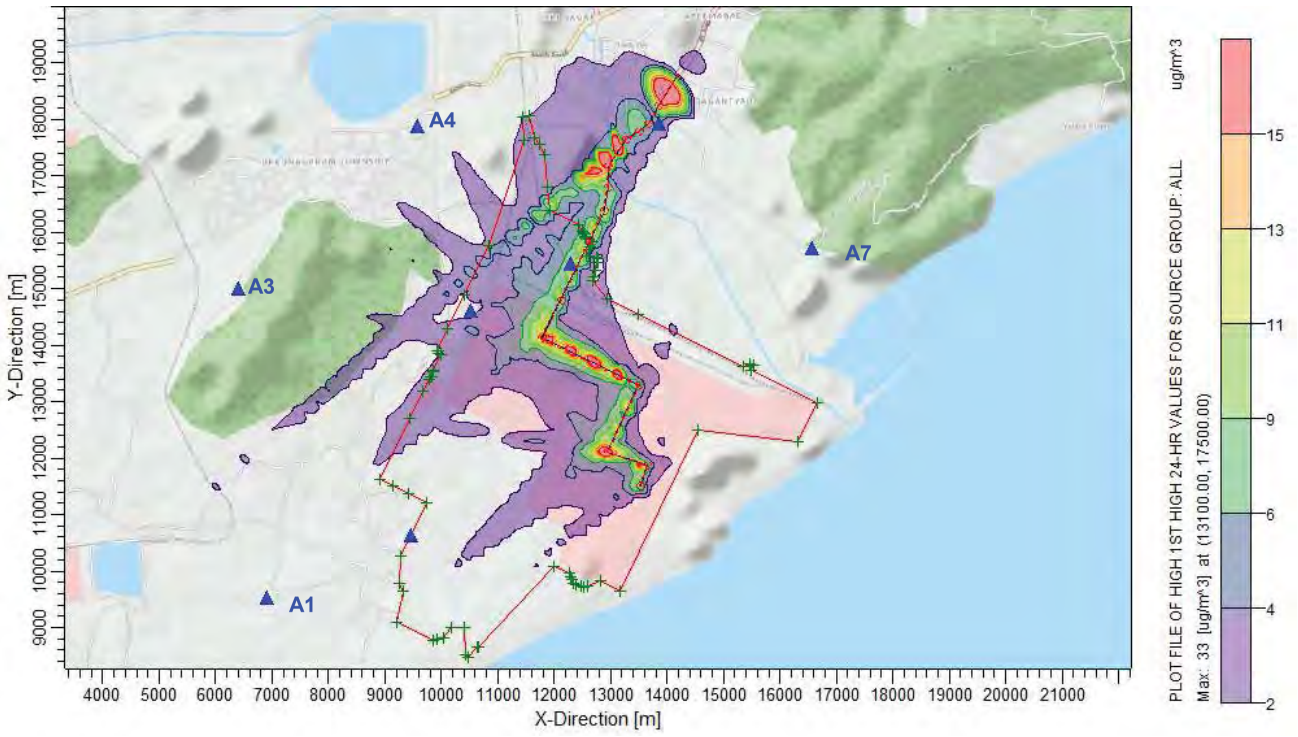


Figure 1.26 : GLCs of NOx Emissions due to CO5



From the above figures, it can be observed that the estimated values of maximum Ground level concentrations are concentrated in and around the construction site and transportation route. The maximum GLC values at A8 (Gajuwaka) is observed to be around 0.279 µg/m^3 and 2.025 µg/m^3 for PM and NOx respectively. Therefore, hardly any damage to ambient air quality can be attributed due to construction of new Coke Oven Battery 5.

Damage to Water environment:

During construction of the project, the water environment could have been affected by:

- Discharge of ground water from deep excavations
- Discharge of storm water laden with debris

During construction, excations were carried for foundations of various structures. Discussions with concerened RINL Officials and civil contractors revealed that water was encountered about 6 m below ground level during summer. Extensive grouting was carried out prior to excavations to limit inflow of ground-water. The water which seeped into the excavations was pumped out into the plant's storm water drainage system. The amount of water which seeped in was not much and contiunous pumping was not required. Since the construction of the foundations was completed over a few weeks, there were no permanent effects on ground water resources.

Most of the soil and debris excavated during the civil construction was used to construct the bund of the ash-pond being constructed inside the plant. Nevertheless, during monsoons, the storm water was contaminated by soil & debris excavated for the civil contruction. The storm water from the southern part of the plant area is routed through a lined channel leading to the sea near Apikonda Village.

Therefore, no significant damage can be attributed to construction of COB5 on water environment.

Effects on Ambient Noise Levels:

Noise is generated during construction due to operation of diesel powered excavators, trucks and cranes and handling of heavy metallic equipment. Based on similar fabrication yards elsewhere, the noise levels at a distance of 15 m from construction site was ~85 dB(A). Without any attenuation, this 85 dB(A) will reduce to 36 dB(A) at the nearest habitation i.e. Appikonda village, which is ~4.2 km from the project site. The net increase in noise level at the nearest habitation will only be about 0.1 dB(A) over and above the existing noise levels that too without any attenuation. In reality, the actual increase would have been much less due to attenuation by the Steel Plant's green belt and effects of sea breezes.

Therefore, no damage on ambient noise environment is anticipated.

Damage to Ecology:

Based on the residual vegetation at the COB Site and that of the adjacent vacant area, it can be concluded that the vegetation of the COB-5 site comprised of naturally growing small trees (*Acacia spp., Prosopis juliflora*), shrubs (*Lantana camara, Calotropis gigantea, Ricinus communis*), herbs such as *Mimosa pudica, Tridax procumbens* and grasses (see **Figure 1.27-1.29**).

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Figure 1.27 : Vegetation in Vacant Plot Adjacent to COB – 5 Comprising of Acacia spp., Prosopis juliflora, Lantana, Calotropis, Tridax procumbens and Grasses

Figure 1.28 : Ricinus communis growing in COB – 5 Site

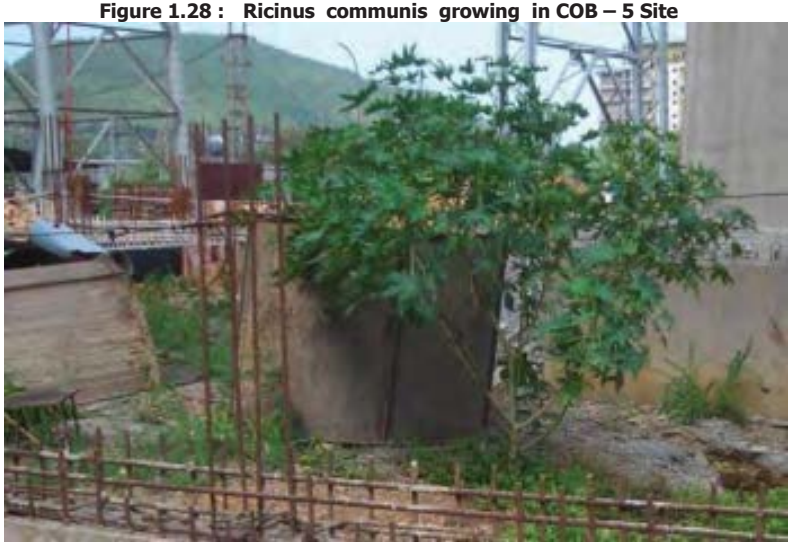

Figure 1.29 : Tridax procumbens and Mimosa pudica growing in COB – 5 Site

Since the project site is located inside the plant adjacent to a major operating unit (COB-4), other than some common birds such as Common Crows (*Corvus splendens*), Jungle Crows (*Corvus marorhynchos*), Common Mynah (*Acridotheres tristis*), Pied Mynah (*Sturnus contra*), Cattle Egret (*Bubulcus ibis*), Red-wattled Lapwings (*Vannelus indicus*), Jungle Babblers (*Turdoides striata*), Spotted Munia (*Lonchura punctulata*) and reptiles such as Garden Lizards and Skinks were observed in the site . Also sveral species of insects including beetles, and grass-hoppers (notably *Poekilocerus pictus*) were observed to be present in vegetation.

The shrubby vegetation was cleared to make way for the new Coke Oven Battery. Since the area involved is very small, the effect on the overall greenery inside the existing steel plant will be hardly of any consequence.

No external injury / damage / lesions, which can be attributable to pollution was visible on the residual vegetation at project site and in the adjacent plot. The vegetation appreared to be healthy.

During construction some fugitive dust was generated due to clearing away of coal stocks (which had to be done anyway as the coal had to be used as boiler fuel) and civil works (site levelling, excavation of foundations etc.). The nearest human habitation (Appikonda Village) is about 4 km away (towards the south west). The intervening area is covered by the plant's green belt as well as other units of the plant. Since the dust from soil excavations is generated at ground level it is unlikely to spread far. The dust was partially suppressed by water sprinkling. It may also be noted that the area is very close to the sea shore and is characterised by strong breezes, which disperse fugitive dust.

The vegetation outside the plant boundaries (but within RINL's acquired area) was also surveyed to look for external damage / injuries which may be attributable to activities in the plant.

Summary of Damages during Construction of COB5

- No damage to land use change.
- Minor damages on ambient air quality.
- Minor damage to water environment.
- No damage to noise environment.
- Minor damages to ecological environment.

Mitigation Measures adopted

During construction, water sprinkling was carried out to suppress fugitive dust. Treated effluent from the VSP's ETP was utilised for this purpose. For removal of vegetation, it was ensured that "slash and burn" was not resorted to.

Once construction activities are completed, all the residual excavated soil & debris shall be collected and dumped in a low lying area in the plant. Water will be sprinkled on the dumped soil to suppress fugitive dust. Subsequently grass seeds will be scattered over the moist soil. Just before monsoons, seeds of common shrubs and trees growing inside the plant (*Calotropis gigantea, Ricinus communis, Leucaena leucophloea*) shall be scattered on the soil.

3. <u>Construction of new Guard Pond:</u>

4 new Guard Ponds are being constructed on the eastern side of the plant over a total area of ~4 ha. Treated effluents from the steel plant's ETP will flow by gravity into these ponds to settle out any residual suspended solids, before flowing out by gravity to the outfall. At any given time 3 of the ponds shall be in use. The 4th shall be emptied to excavate the settled sludge.

Construction of the Guard Pond has involved the following activities:

1. Clearance of vegetation.
2. Excavation of soil & rocks.
3. Transport and dumping of excavated material
4. Construction of embankment by utilising part of the excavated soil & rocks
5. Concrete lining of inner side of embankment

Damage to Land environment:

The site of the Guard Ponds was an expanse of unutilised area with dense vegetation inside the steel plan's premises. The vegetation comprised of dense thickets of *Leucaena leucophloea.* Google earth imageries of project site are given in **Figure 1.30-1.31**.

Figure 1.30 : Google Earth Image dated 07-08-2017 of Guard Pond Site.

Figure 1.31 : Google Earth Image dated 30-09-2018 of Guard Pond Site.

Approximately 38400 m^3 of soil and rocks were excavated for creation of the Guard Ponds. Excavation was carried out using mechanical shovels / excavators, which loaded the excavated muck on to tipper trucks. The tipper trucks then transported the material to designated dump site located adjacent to the project site on the north-eastern side. A few large boulders, too large to be excavated and broken up by the deployed shovels / excavators, were encountered. Part of the excavated debris is utilised for construction of the Guard Ponds' bunds.

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~4 ha dense vegetation inside the premises of the existing steel plant has been converted to industrial use. Since the area involved is only ~0.16% of the plant area (~2550 ha), the change is of minor consequence.

Damage to Ambient air quality:

The new Guard Ponds are being dug near the existing Coke Oven ETP near Gangavaram. Since this is a fresh project, all the activities like, vegetation removal, ground levelling, civil construction work etc. are involved. The estimated quantity of material transported during construction phase is as follows--

- Total debris transported – 76800 T

Based on the above, number of trucks per day has been estimated to be around 40 trucks per day. The project basically involves digging out soil, rocks and other debris from site, temporarily storing it in some other areas and utilizing the same for embankment construction. The fugitive emissions arising out of these activities have been estimated based on AP-42 and CPCB guidelines. The same is given in **Table 1.10** below.

Table 1.10 : Pollutant emissions during construction phase of Guard Ponds

Sl. No.	Activity	Emission Factor	Emission Rate (g/sec)
Construction/Demolition activities			
1	Bulldozing	2.292 Kg/hr	0.064
2	Motor Grading	0.6 g/Km/Vehicle	0.003
3	Truck Loading with debris	0.0002 Kg/T	0.001
4	Truck Unloading	0.0002 Kg/T	0.001
5	Wind erosion of exposed material	9.02E-07 g/s/m^2	0.001
Material Transport			
1	Truck transport of excavated material on unpaved roads		
	PM	5.8 g/Km/Vehicle	0.000000071050 g/s/m^2
	NOx	9.3 g/Km/Vehicle	0.000000114815 g/s/m^2

Based on the above estimated emission values, GLCs have been estimated due to the construction activities in buffer area. The incremental concentrations due to the construction activities are given in **Table 1.11** below. The isopleths of PM_{10} and NO_X concentrations are also given in **Figure 1.32** and **Figure 1.33** respectively.

Table 1.11 : GLCs due to construction of new Guard Pond

Station ID	PM	NOx
A1	0.008	0.055
A2	0.003	0.029
A3	0.012	0.094
A4	0.012	0.072
A5	0.006	0.060
A6	0.004	0.028
A7	0.006	0.025
A8	0.023	0.168

** All values in µg/m^3.*

Figure 1.32 : GLCs of PM Emissions due to Guard Pond

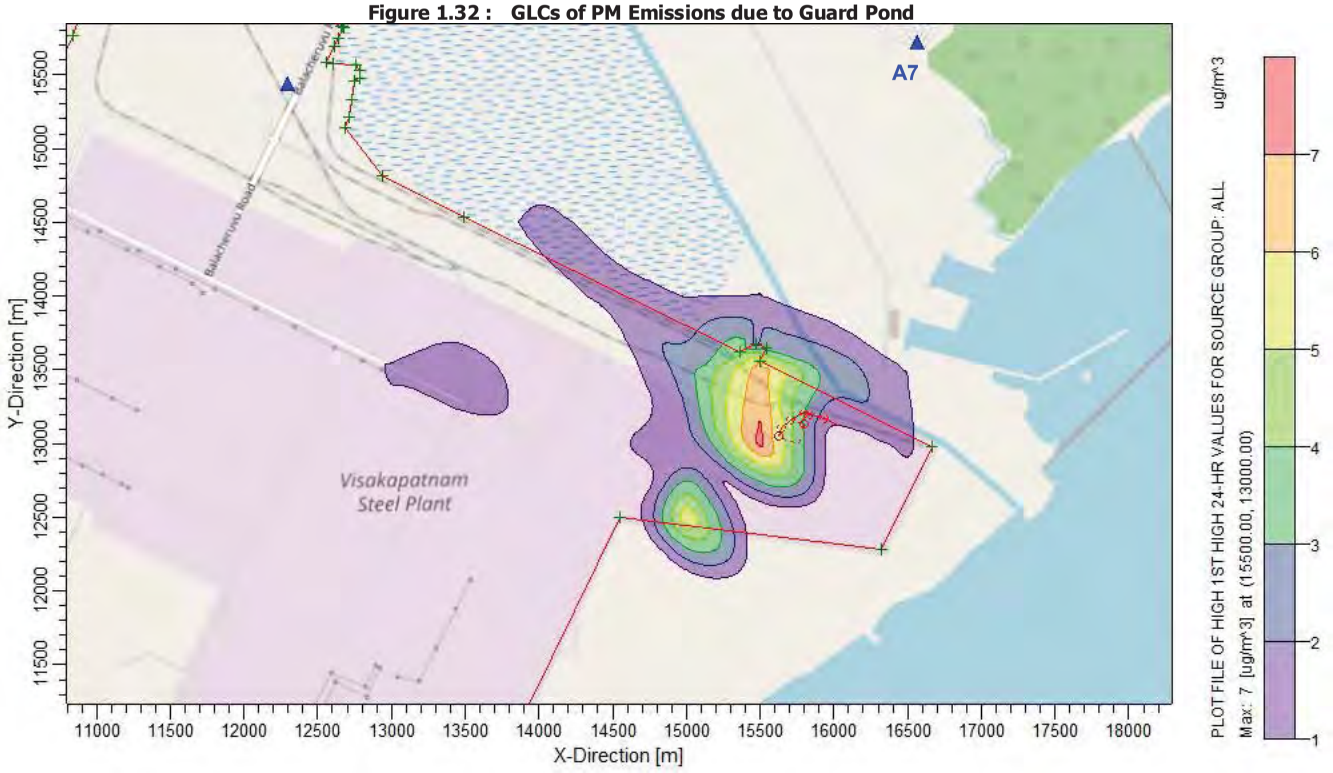
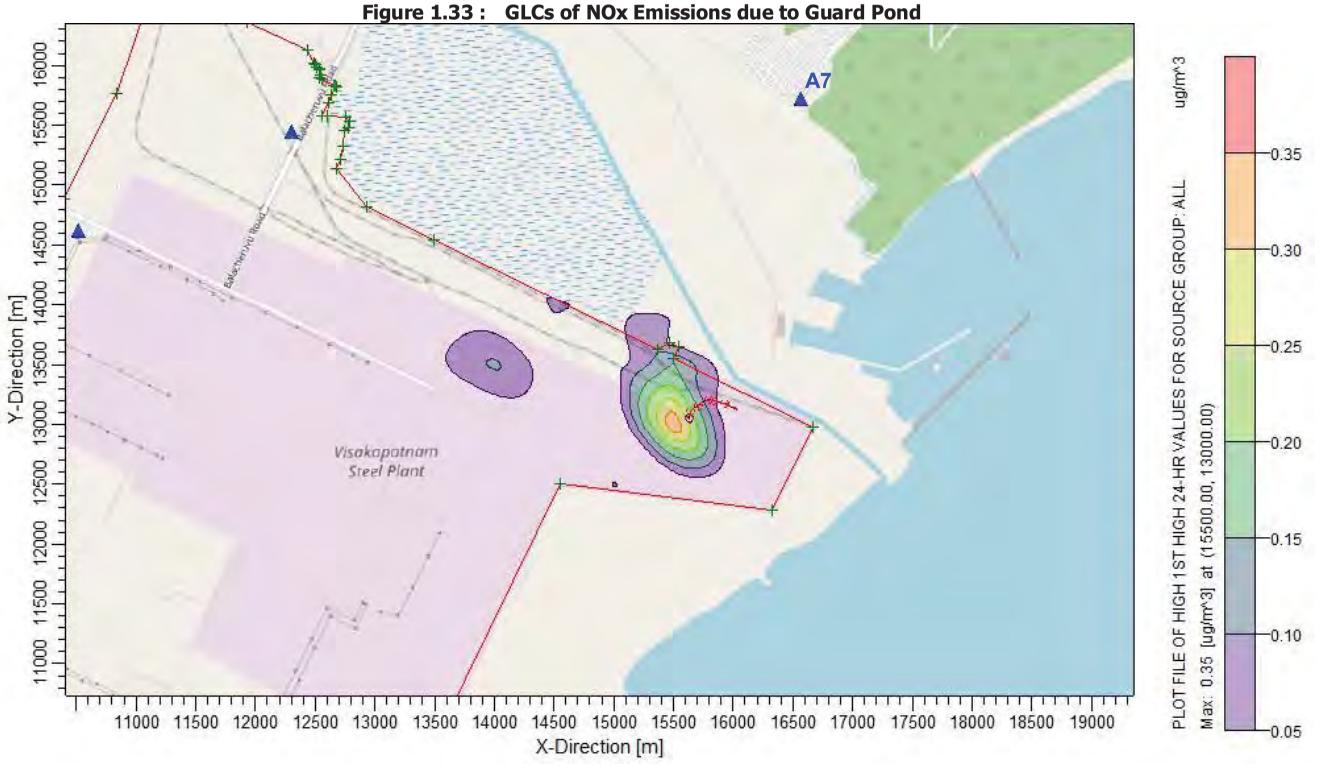


Figure 1.33 : GLCs of NOx Emissions due to Guard Pond



From the above figures, it can be observed that the estimated values of maximum Ground level concentrations are concentrated in and around the construction site. The maximum GLC values at nearest habitat i.e. A7 (Gangavaram) is observed to be around 0.005 µg/m^3 for PM. Therefore, no damage to ambient air quality can be attributed to construction of new Guard ponds.

Damage to Water environment:

The Guard Ponds' bottom is ~3 m below the original ground level. In the project site, the ground water level is ~5 m below the original ground level. So there was no seepage of ground water into the pits. Therefore, no significant damage to ground water resources can be attributed to construction of new Guard ponds.

Moreover, the Guard-Ponds will have impervious lining which is designed to prevent leaching of the Guard Ponds' contents into the ground water.

Effects on Ambient Noise Levels:

Since the residential areas are too far away to be affected by activities at the Guard Pond site, no damage on ambient noise levels is anticipated.

Damage to Ecology:

As mentioned earlier, the project area comprises of dense thickets of *Leucaena leucophloea*. The damages on ecology due to Guard Pond construction are as follows:

1. Loss of green cover due to removal of vegetation
2. Damage to vegetation due to deposition of fugitive dust on vegetation.

During clearance of the area for Guard Pond construction, approximately 9800 trees were felled, all of which were *Leucaena leucophloea* of girth less than 30 cm.

The area where the Guard Ponds are being constructed is located in a rather remote corner of the plant. Because of the dense vegetation the area is inhabited by large numbers of birds, all of them common species. The adjacent area outside is part of Gangavaram Port (in the north) and dense scrub on the sea coast (in the east).

The excavation and dumping has involved operation of diesel powered heavy earth moving machinery (HEMMs) over unpaved surfaces. Excavation and dumping of soil & rocks have led to generation of fugitive dust and NOx (from diesel engines). The excavated soil and hard rock dumped adjacent to the Guard Pond site, have been / are being re-handled and used for construction of the Guard Ponds' embankments. The slope of the embankment on the inner side (i.e. inside the guard ponds) and the guard ponds' bottom will be lined with PCC and HDPE sheets The work involves handling of excavated soil & rocks and movement of diesel powered HEMMs over unpaved surfaces. This is leading to generation of fugitive dust and NOx.

The maximum estimated ground level concentration of fugitive dust due to activities of the project was 7 µg/m^3 and occurred within the construction site. It is to be noted that fugitive dust is generated at the ground level or few metres above the ground (in case of dumps). Fugitive does not travel very far unless there are very strong winds and most of the dust usually settles down within a few hundred metres of the source. The dust settling

on the leaves of plants reduces the plants' photosynthetic activity and in extreme cases can also lead to the death of the leaves and apical buds. This is often seen adjacent to unpaved haul roads in mine areas.

In the present case, the work is localised over a very small area and inside the steel plant. Moreover the area is surrounded by dense thickets of *Leucaena leucophloea* on all sides, which has screened the fugitive dust. The dust settling on the leaves of the vegetation facing the project area have probably reduced the photosynthetic activity of the plants. However these effects are temporary. The construction activity is expected to be completed within 12 months. The leaves will be washed clean by the first spell of rains after completion of construction. The increase in NOx levels are too low to have any additional impact on the vegetation.

Summary of Damages during Construction of Guard Ponds

- No damage to land use change.
- No significant damage on ambient air quality.
- No damage to water environment.
- No damage to noise environment.
- Minor damages to ecological environment.

Mitigation Measures

Water sprinkling is being done on unpaved roads to suppress fugitive dust. The existing trees around the project site are mature and already bearing fruits / seeds. In all likelihood, seed from these trees will naturally revegetate the unutilised soil dump. Nevertheless, after utilisation of the material, the dump site, shall be biologically reclaimed.

This will be carried out as follows:

- On completion of dumping / reclamation of dump sites, topsoil (which was excavated during the initial stage of reservoir construction and has been stored in separate small dumps) will be scattered over the area. Water will be sprinkled over the topsoil.
- Grasses and the shrub *Ipomea carnea* will be planted on the soil to stabilise it.
- 0.5 m x 0.5 m x 0.65 m pits will be excavated at ~3 m intervals.
- These pits will be filled with a mixture of topsoil, compost / organic manure.
- About 0.6 m tall saplings of *Acacia nilotica, Azadirachta indica, Ficus bengalensis, Ficus religiosa,* and *Pongamia pinnata* will be planted in soil filled pits just after the commencement of monsoons.

4. <u>Revamping of Blast Furnaces 1 & 2:</u>

Existing Blast Furnaces (BFs) 1 & 2 have been revamped. Construction of the new BFs has involved the following activities:

- Shutting down of the furnaces.
- Partial dismantling of the outer shell of the furnaces
- Removal of the inner refractory lining of the furnaces
- Removal of the rest of the outer shell
- Reconstruction of the entire furnace and associated systems

The work involved metal cutting, handling of waste refractory bricks & metal, erection of refractories and metal structures.

Damage to Land environment:

Since the revamping of existing BFs 1 & 2 has taken place inside the existing Shop level, no additional land was diverted for industrial use. Hence, no green cover was destroyed. Therefore, revamping of the existing BFs has not changed Land Use in any way.

Damage to Ambient air quality:

Since the activity was for repair and modernization of existing blast furnaces, all the major construction activities were carried out within the existing BF complex. The emissions arising out of the construction activities were captured through space dedusting system of BF and clean air was exhausted to atmosphere. Therefore, no additional emissions were assumed to have occurred due to construction activities.

However, the materials required for the construction activities were transported to site through roads in trucks. This might have resulted in additional fugitive emissions. In order to predict the same, following information has been collected for each blast furnace-

- Total Concrete transported – 58322 T
- Total Structural material transported – 16118 T
- Total weight of Refractories transported – 3000 T

Based on the above, number of trucks per day has been estimated to be around 40 trucks per day. The fugitive emissions due to diesel combustion and road emissions have been calculated based on AP-42 and CPCB guidelines. The above estimates also include the transportation of machinery/equipment to site. The same is given below-

PM – 0.0045 g/s
NOx – 0.0024 g/s

Based on the above estimated emission values, GLCs have been estimated due to the revamping activities in buffer area. The incremental concentrations due to the revamping activities of BF1 & BF2 are given in **Table 1.12** below. The isopleths of PM_{10} and NO_X concentrations are also given in **Figure 1.34** and **Figure 1.35** respectively.

Based on the above, minor damage can be attributed due to revamping of BFs.

Table 1.12 : GLCs due to various BF1 and BF2 revamping activities

Station ID	PM	NOx
A1	0.008	0.055
A2	0.003	0.029
A3	0.012	0.094
A4	0.012	0.072
A5	0.006	0.060
A6	0.004	0.028
A7	0.006	0.025
A8	0.023	0.168

** All values in µg/m³.*

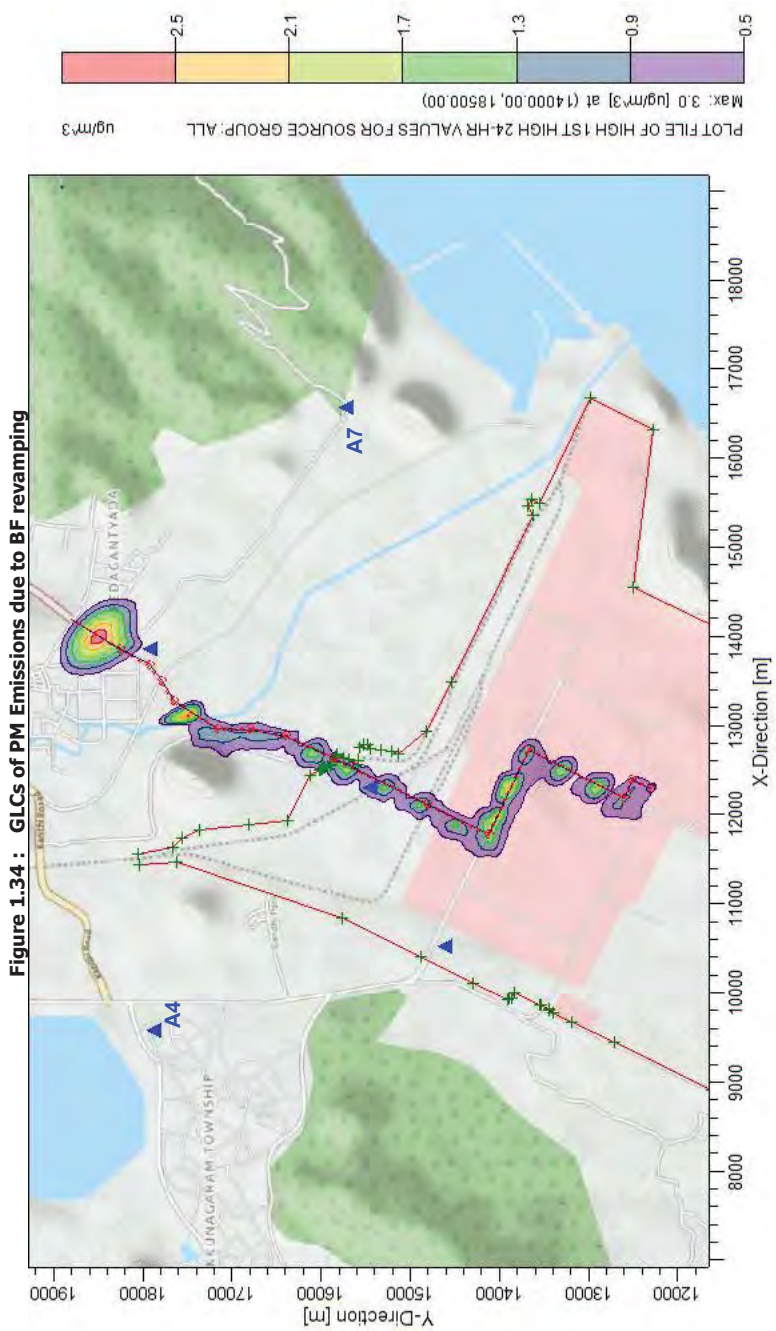


Figure 1.34 : GLCs of PM Emissions due to BF revamping

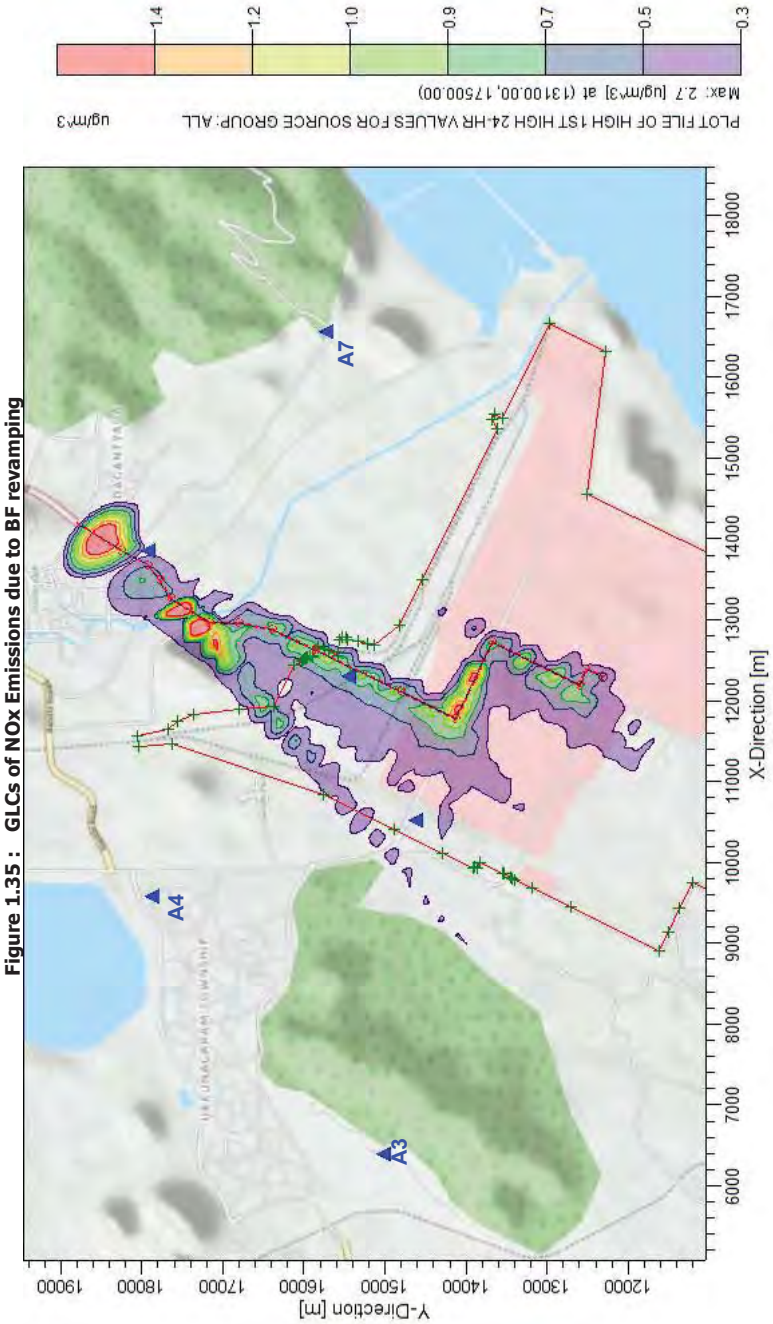


Figure 1.35 : GLCs of NOx Emissions due to BF revamping

From the above figures, it can be observed that the maximum Ground level concentrations are concentrated on the transportation route. The maximum GLC values at a distance of 100 m from source is observed to be less than 2 µg/m^3 and 1 µg/m^3 for PM and NOx respectively. The maximum GLC values at nearest habitation i.e. A8 (Gajuwaka) is observed to be around 0.315 µg/m^3 and 0.168 µg/m^3 respectively for PM and NOx. Therefore, no damage to ambient air quality can be attributed due to revamping of BF1 and BF2.

Damage to Water environment:

As discussed above, the revamping of BF1 and BF2 was carried out within the existing complex. The units are already having all infrastructure facilities including water supply, sanitation etc. The water requirement during the construction phase was met through the already existing water supply facilities. Thus no ground water was extracted for drinking purposes. Also, no effluents or surface runoffs were generated during the revamping process. Therefore, no significant modification in the water environment of the area occurred.

However, a comparative analysis was carried out for cumulative change in groundwater quality for the period before and after the construction activities. The same has been done in cumulative damage on Water environment section later in this chapter.

Effects on Ambient Noise Levels:

During the Blast Furnace revamping work, noise was generated by diesel powered material handling equipment and construction machinery, movement of diesel powered trucks, and metal fabrication. Based on similar fabrication yards elsewhere, the noise levels at a distance of 15 m from construction site was ~85 dB(A). Without any attenuation, this 85 dB(A) will reduce to ~43 dB(A) at the nearest plant boundary (~1.9 km away). The nearest habitation is Islampet Village is 3.8 km away. Without any attenuation, the 85 dB(A) will reduce to ~37 dB(A) at Islampet Village.

The day time noise levels at Islampet Village 67.7 dB(A) – 47.3 dB(A) {avg. 55 dB(A)}. The resultant noise levels due to revamping activities at BF complex would have been 67.7 dB(A) – 47.7 dB(A) {avg. 55.06 dB(A)} i.e. almost negligible.

It is to be noted that the BFs are surrounded by other units of the plant on all sides and there is thick green belt along the plant boundary which would have attenuated the noise generated at the BF complex. Thus the noise levels outside the plant would not have changed from activities associated with the revamping of the BFs.

Therefore, there was no change in ambient noise levels.

Damage to Ecology:

The BF revamping has not led to any change in land use. The changes in air quality have been localized to only along the roads inside the plant. The increase in noise levels too have been confined inside the plant premises. Thus there have been no lasting effects on the ecology of the area.

Summary of Damages during Revamping of BF1 and BF2

- No damage to land use change.
- Minor damage on ambient air environment.
- No damage to water environment.
- No damage to noise environment.
- No damage to ecology.

Mitigation Measures adopted during Construction

During construction, water sprinkling was carried out to suppress fugitive dust generated from handling the waste refractory linings. Treated effluent from VSP's ETP was utilised for this purpose.

Transport of material, use of heavy diesel powered material handling machinery and use of noise metal fabrication machinery was carried out during day time only.

Workers deployed in noisy areas were issued necessary Personal Protective Equipment and their use was enforced.

5. Revamping of Sinter Plant1

The sinter plants have been revamped by replacement of some of the existing equipment by equipment of higher capacity and modification / augmentation of some of the existing equipment

Installation of the new convertor has involved the following activities-

- Replacement of pallets with increased width and modified sealing system.
- Modification of Sinter machine feeding & charging system.
- Replacement of Sinter machine drive & driven sprockets.
- Replacement of ignition furnace with energy efficient multi-slit burners.
- Enhancement of Sinter cooler and its blower fans.
- Removal of hot screen & drum cooler and extension of length of Sinter machine.
- Replacement of pelletizer drum with improved internals.
- Lime addition before pelletizing drums.
- Pneumatic conveying of electrostatic precipitator dust and granulation.
- Upgradation of flux crushing & screening system.
- Fuel grinding system with closed loop screening upgradation of conveying system.
- Replacement of primary mixing drum with better internals.
- Structural Health study and strengthening & repairs.
- Checking of existing foundation and strengthening for all structural members such as Sinter Machine, Sinter Screen building Sinter cooler, double roll crushers, Conveyor supporting structures etc.
- New LCSS & Compressor air building.
- Civil & Structural work for SM-1 bed length extension at Discharge end.
- Civil & Structural work for laying of New BFG, COG, Mixed Gas pipelines at GMS & Pneumatic Conveying system of Lime & ESP Dust.

The work involved dismantling and/or scrapping some of the existing equipment and assembly of new equipment (mostly metallic) along with auxiliaries.

Damage to Land environment:

The entire revamping work was carried out within the existing Sinter Plant of the existing steel plant. Hence no land was diverted (even within the plant).

Additionally, the construction and demolition debris arising out of the revamping activities was utilized within the plant boundary for levelling. Therefore, revamping of the existing SP has not changed Land Use in any way.

Damage to Ambient air quality

Again, since the activity was for repair and modernization of existing sinter plant, all the major construction activities were carried out inside the existing SP complex. The emissions arising out of the construction activities were sucked through space dedusting system of SP, filtered and the clean air was exhausted to atmosphere. Therefore, no additional emissions were assumed to have occurred due to construction activities.

However, the material required for the construction activities was transported to site through roads in trucks. This might have resulted in additional fugitive emissions. In order to predict the same, following information has been collected for the Sinter plant-

- Total Concrete transported – 2734 T
- Total Structural material transported – 5822 T

Based on the above, number of trucks per day has been estimated and fugitive emissions due to diesel combustion and road emissions have been calculated based on AP-42 and CPCB guidelines. The same is given below-

PM – 0.0007 g/s
NOx – 0.0004 g/s

Based on the above estimated emission values, GLCs have been estimated due to the revamping activities in buffer area. The incremental concentrations due to the revamping activities are given in **Table 1.13** below. The isopleths of PM_{10} and NO_X concentrations are also given in **Figure 1.36** and **Figure 1.37** respectively.

Based on the above, minor damage can be attributed due to revamping of SP1.

Table 1.13 : GLCs due to various SP1 revamping activities

Station ID	PM	NOx
A1	0.001	0.005
A2	0.000	0.002
A3	0.001	0.008
A4	0.001	0.006
A5	0.000	0.005
A6	0.000	0.002
A7	0.000	0.002
A8	0.002	0.014

** All values in µg/m³.*

Figure 1.36 : GLCs of PM Emissions due to SP1 revamping

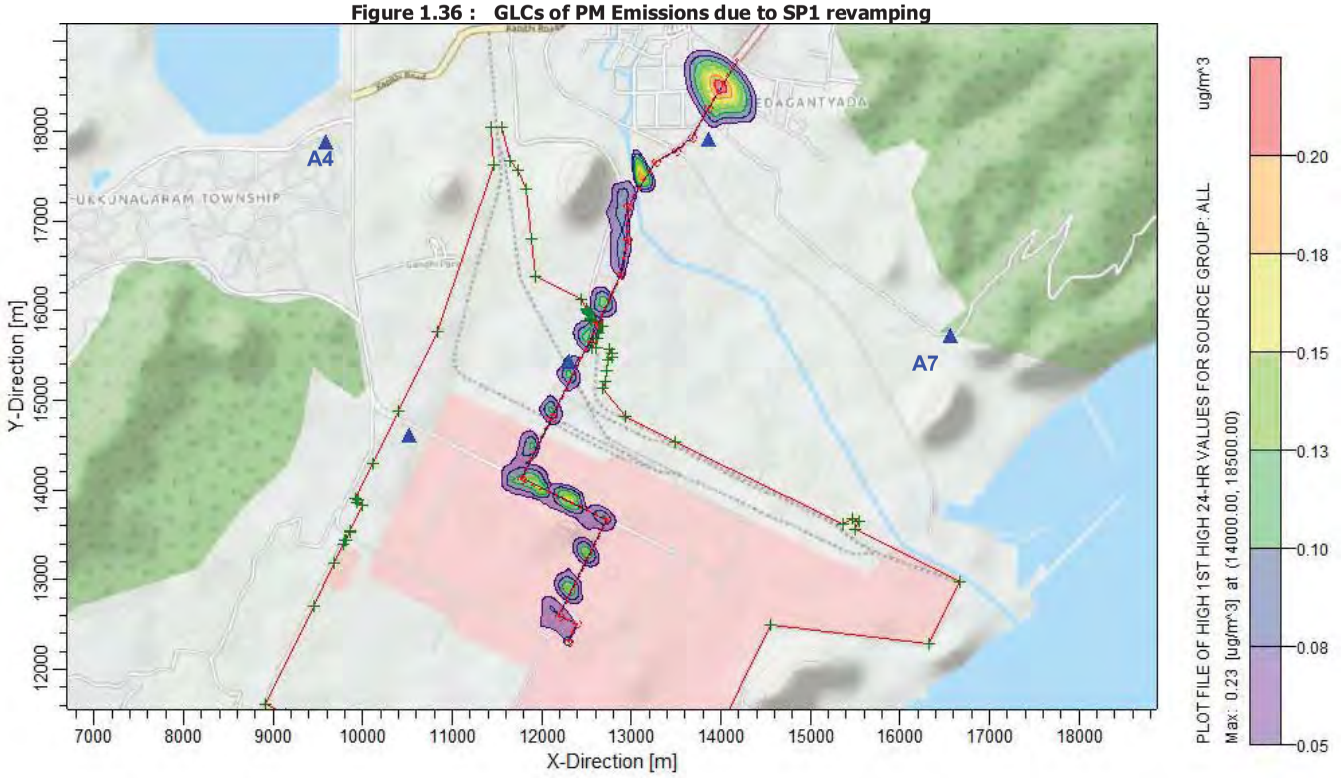


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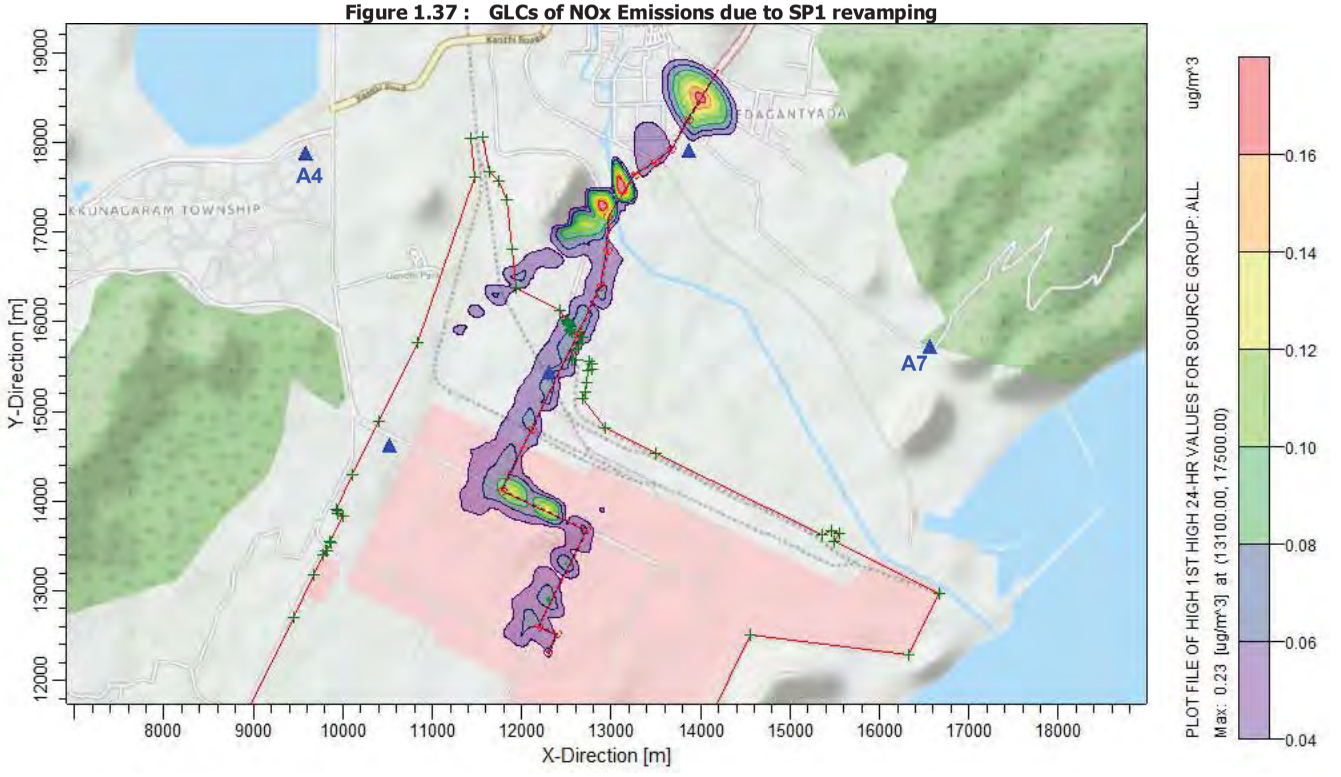
Figure 1.37 : GLCs of NOx Emissions due to SP1 revamping



From the above figures, it can be observed that the maximum Ground level concentrations are concentrated along the transportation route. The maximum GLC values at a distance of 100 m from source is observed to be less than 0.4 µg/m^3 and 0.2 µg/m^3 respectively for PM and NOx. The maximum GLC values at nearest habitation i.e. A8 (Gajuwaka) is observed to be around 0.024 µg/m^3 and 0.014 µg/m^3 respectively for PM and NOx. Therefore, no damage to ambient air quality can be attributed to revamping of SP1.

Damage to Water environment:

As discussed earlier, the revamping of SP1 was carried out within the existing complex. The unit is already having all infrastructure facilities including water supply, sanitation etc. The water requirement during the construction phase was met through the already existing water supply facilities. Thus no ground water was extracted for drinking purposes. Also, no effluents or surface runoff were generated during the revamping process. Therefore, no damage to the water environment of the area is anticipated.

Effects on Ambient Noise Levels:

During the SP revamping work, noise was generated by diesel powered material handling equipment and construction machinery, movement of diesel powered trucks, and metal fabrication. Most of the work was carried out inside an enclosed building. Based on similar fabrication works elsewhere, the noise levels inside the building during construction work was about 90 dB(A), whereas outside the building the noise level was ~75 dB(A). Without any attenuation, this 75 dB(A) will reduce to ~37.7 dB(A) at the nearest plant boundary (~1.1 km away).

The nearest habitation is Appikonda Village is 3.5 km away. Without any attenuation, the 75 dB(A) will reduce to ~27.6 dB(A) at Appikonda Village. The day time noise levels at Appikonda Village 55.2 dB(A) – 44 dB(A) {avg. 52.3 dB(A)}. The noise levels would have increased by only ~0.1 dB(A) maximum due to revamping activities at Sinter Plant complex without any attenuation by vegetation or man-made structures.

It is to be noted that there is thick green belt along the plant boundary which would have attenuated the noise generated at the Sinter Plant complex. Thus the noise levels outside the plant would not have changed from activities associated with the revamping of the Sinter Plant complex.

Thus there were no impacts on ambient noise levels due to revamping of SP1.

Damage to Ecology:

SP revamping has not led to any change in land use. The changes in air quality have been localized to only along the roads inside the plant. The increase in noise levels too have been confined inside the plant premises. Thus there have been no lasting effects on the ecology of the area.

Summary of Damages during Revamping of BF1 and BF2

- No damage to land use change.
- Minor damage on ambient air environment.
- No damage to water environment.

- No damage to noise environment.
- No damage to ecology.

Mitigation Measures adopted during Construction

During construction, all material transport was carried out during day-time only. Most fabrication work was carried out during daytime. All workers were provided with appropriate personal protective equipment, whose use was enforced.

6. Expansion of SMS 2 by Installation of new Converter 3 & Caster 4

A new 150 t convertor has been installed in SMS-2. The new convertor has been installed inside the existing building of SMS-2 which was constructed earlier with provision for additional convertor. Along with the convertor a new Continuous Casting Machine No. 4 (CCM#4) has also been installed.

Installation of the new convertor has involved the following activities-

- Installation of 150 t BOF Converter 3 along with all associated auxiliaries.
- Civil and structural work involving construction of 5-Strands Bloom cum round Continuous casting machine.
- Augmentation of water system
- Auxiliary power wiring, earthing, lighting, Yard and road lighting, etc.
- Augmentation of Utility i.e. LPG, Compressed Air, Oxygen, Nitrogen, Chilled Water generation systems etc. and their distribution systems
- Power distribution system including ventilation system
- Civil works package including piling works along with dismantling & relocation of existing facilities (wherever required) and also construction of roads & drainage network
- Structural works package including sheeting work and dismantling and relocation of existing building structure facilities (wherever required)
- Torpedo car track work along with augmentation of Telecommunication & signaling system

The work involved erection of metal structures, assembly of metallic equipment along with auxiliaries and construction of concrete chimney.

Damage to Land environment:

Since the installation of new Converter 3 and Caster 4 along with associated facilities was carried out inside the existing building, no additional land was diverted for industrial use. Hence, no green cover was destroyed.

Additionally, the construction and demolition debris arising out of the construction activities was utilized within the plant boundary for levelling. Therefore, there was no change in land use on account of installation of new converter in SMS2.

Damage on Ambient air quality

Since the project was for installation of a new converter within existing SMS Complex, all the major construction activities were carried out inside the complex. The emissions arising out of the construction activities was filtered through space dedusting system of SMS and

clean air was exhausted to atmosphere. Therefore, no additional emissions were assumed to have occurred due to construction activities.

However, the material required for the construction activities was transported to site through roads in trucks. This might have resulted in additional fugitive emissions. In order to predict the same, following information has been collected-

- Total Concrete transported – 750000 T
- Total Structural material transported – 179800 T
- Refractory – 900 T

Based on the above, number of trucks per day has been estimated to be around 27 trucks per day. The fugitive emissions due to diesel combustion and road emissions have been calculated based on AP-42 and CPCB guidelines. The above estimates also include the transportation of machinery/equipment to site. The same is given below-

PM – 0.0456 g/s
NOx – 0.0293 g/s

Based on the above estimated emission values, GLCs have been estimated due to the construction activities in buffer area. The incremental concentrations due to the construction activities are given in **Table 1.14** below. The isopleths of PM_{10} and NO_X concentrations are also given in **Figure 1.38** and **Figure 1.39** respectively.

Based on the above, minor damage can be attributed due to installation of new converter in SMS2.

Table 1.14 : GLCs due to various SMS2 expansion activities

Station ID	PM	NOx
A1	0.044	0.355
A2	0.014	0.116
A3	0.066	0.610
A4	0.062	0.465
A5	0.032	0.389
A6	0.021	0.179
A7	0.030	0.160
A8	0.122	1.084

** All values in µg/m³.*

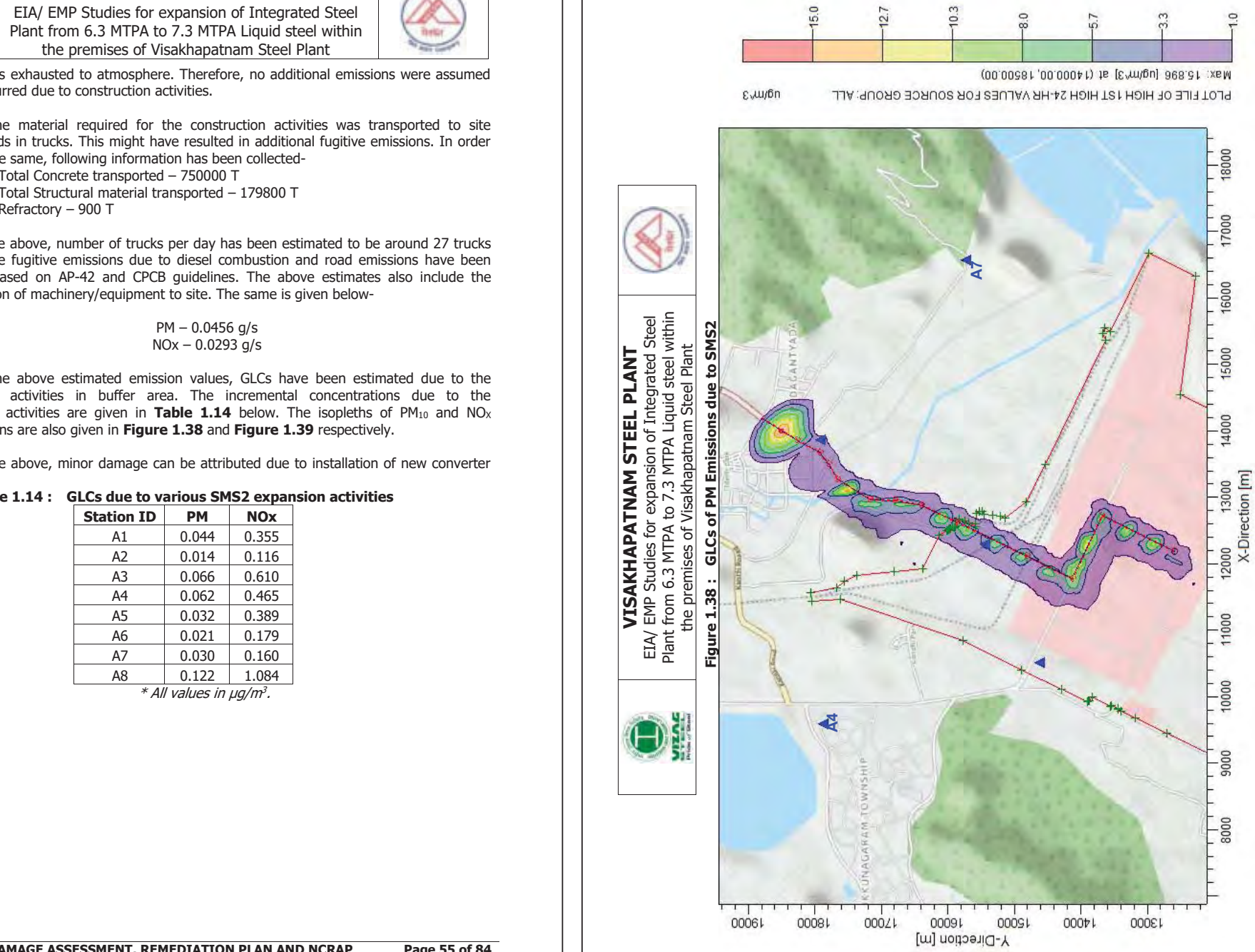


Figure 1.38 : GLCs of PM Emissions due to SMS2

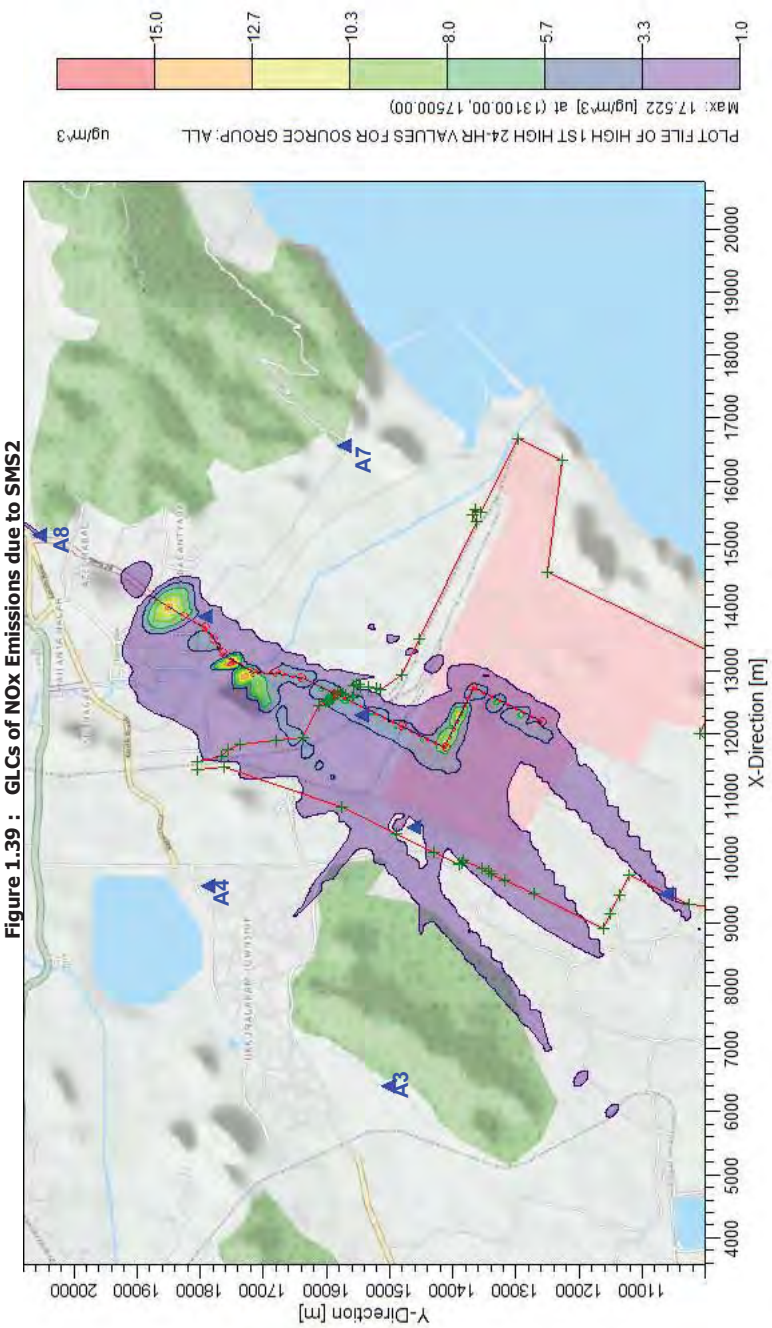


Figure 1.39 : GLCs of NOx Emissions due to SMS2

From the above figures, it can be observed that the maximum Ground level concentrations are concentrated on the transportation route. The maximum GLC values at a distance of 500 m from road is observed to be less than 6 µg/m^3 and 5 µg/m^3 respectively for PM and NOx. The maximum GLC values at nearest habitation i.e. A8 (Gajuwaka) is observed to be around 1.4 µg/m^3 and 1.1 µg/m^3 respectively for PM and NOx. Therefore, no damage can be attributed due to revamping of SMS2.

Damage to Water environment:

As discussed earlier, the installation of new Converter 3 and Caster 4 in existing SMS 2 was carried out within the existing complex. The unit is already having all infrastructure facilities including water supply, sanitation etc. The water requirement during the construction phase was met through the already existing water supply facilities. Thus no ground water was extracted for drinking purposes. Also, no additional effluents or surface runoffs were generated during the revamping process. Therefore, no significant modification in the water environment of the area occurred.

Effects on Ambient Noise Levels:

During the SMS revamping work, noise was generated by diesel powered material handling equipment and construction machinery, movement of diesel powered trucks, and metal fabrication. Most of the work (except the construction of the new chimney) was carried out inside an enclosed building. Based on similar fabrication works elsewhere, the noise levels inside the building during construction work was about 90 dB(A), whereas outside the building the noise level was ~77 dB(A). Without any attenuation, this 77 dB(A) will reduce to ~33.5 dB(A) at the nearest plant boundary (~2.2 km away).

The nearest habitation is Islampet Village is 3.6 km away. Without any attenuation, the 77 dB(A) will reduce to ~29.4 dB(A) at Islampet Village. The day time noise levels at Islampet Village 67.7 dB(A) – 47.3 dB(A) {avg. 55 dB(A)}. The resultant noise levels due to revamping activities at SMS complex would have remained unchanged.

It is to be noted that the SMS are surrounded by other units of the plant on all sides and there is thick green belt along the plant boundary which would have attenuated the noise generated at the BF complex. Thus the noise levels outside the plant would not have changed from activities associated with the revamping of the SMS.

No impact on ambient noise environment is anticipated.

Damage to Ecology:

Since the SMS revamping has not led to any change in land use. The changes in air quality have been localized to only along the roads inside the plant. The increase in noise levels too have been confined inside the plant premises. Thus there have been no lasting effects on the ecology of the area.

Summary of Damages during Revamping of BF1 and BF2

- No damage to land use change.
- Minor damage on ambient air environment.
- No damage to water environment.

- No damage to noise environment.
- No damage to ecology.

Mitigation Measures adopted during Construction

During construction, all material transport was carried out during day-time only. Most fabrication work was carried out during daytime. All workers were provided with appropriate personal protective equipment, whose use was enforced.

7. Cumulative Impacts

Damage to Land environment:

In the ongoing expansion of RINL from 6.3 MTPA to 7.3 MTPA, the majority of job was for revamping of existing old units. As a result of which, RINL got a chance to increase their production capacity from 6.5 MTPA of hot metal to 7.5 MTPA. Therefore, in order to sustain this production, other upstream and downstream facilities were modified or expanded.

All of the revamped units are already a part of the plant site which is classified under industrial use. The under construction COB 5 was also built over an expanse of land under industrial use. The area was earlier used for storage of Boiler coal. As observed from pre-construction phase satellite imagery, no major vegetation was present on the proposed site.

The new guard ponds are being constructed in an expanse of 4 ha of land which was an expanse of unutilized area with dense vegetation inside the steel plan's premises. The vegetation comprised of dense thickets of *Leucaena leucophloea.* The same was cleared for the construction of guard ponds.

The site of the reservoir was an expanse of scrub land. The vegetation comprised of dense thickets of *Prosopis juliflora* with few *Acacia nilotica, Azadirachta indica* and *Borassus flabellifer*) and expanses of grassland. Approximately 4450000 m^3 of soil and rocks were excavated for creation of the reservoir. The same was then transported to designated dump sites at five locations.

~90 ha area has been utilised for the reservoir and associated structures / facilities and 61.41 ha area has been utilised for dumping material excavated from the reservoir. Dumped material which was spread over 25.91 ha area is being rehandled and being utilised for embankment construction i.e. 35.5 ha of dumps shall remain. The entire dump area shall be biologically reclaimed.

In all around, 154 ha of total area which was earlier covered with vegetation shrubs was diverted for industrial use as a result of the ongoing expansion. And even though it has been planned to biologically reclaim all the dump sites and develop thick green belt over it, the quantum of shrubby land diverted for construction purposes i.e. 154 ha which is equivalent to ~6% of the green cover area (~2550 ha) shall be considered for damage assessment.

Damage to Ambient air quality

In order to anticipate the cumulative damages due to the overall construction activities for all the units, all the emissions from all construction activities are considered collectively for prediction of GLCs. The predicted maximum GLC values at individual AAQ monitoring locations are given in **Table 1.15** below. The Isopleths of PM & NOx for emissions due to each unit are presented in **Figure 1.40** and **Figure 1.41** respectively**.**

Table 1.15 : Cumulative value of GLCs due to all construction activities

Station ID	Background PM Conc. (Avg)	PM contribution due to plant construction activities	Background NOx Conc. (Avg)	NOx contribution due to plant construction activities
A1	90	0.155	23.7	0.796
A2	85	1.590	25.2	1.998
A3	84	0.384	17.2	0.093
A4	68	0.345	15.4	0.955
A5	84	0.133	25.6	0.689
A6	81	0.573	19.5	0.379
A7	98	0.203	29.7	0.403
A8	72	0.134	21.2	0.007

** All values in µg/m^3.*

Figure 1.40 : Cumulative GLCs of PM Emissions due to Construction Activities

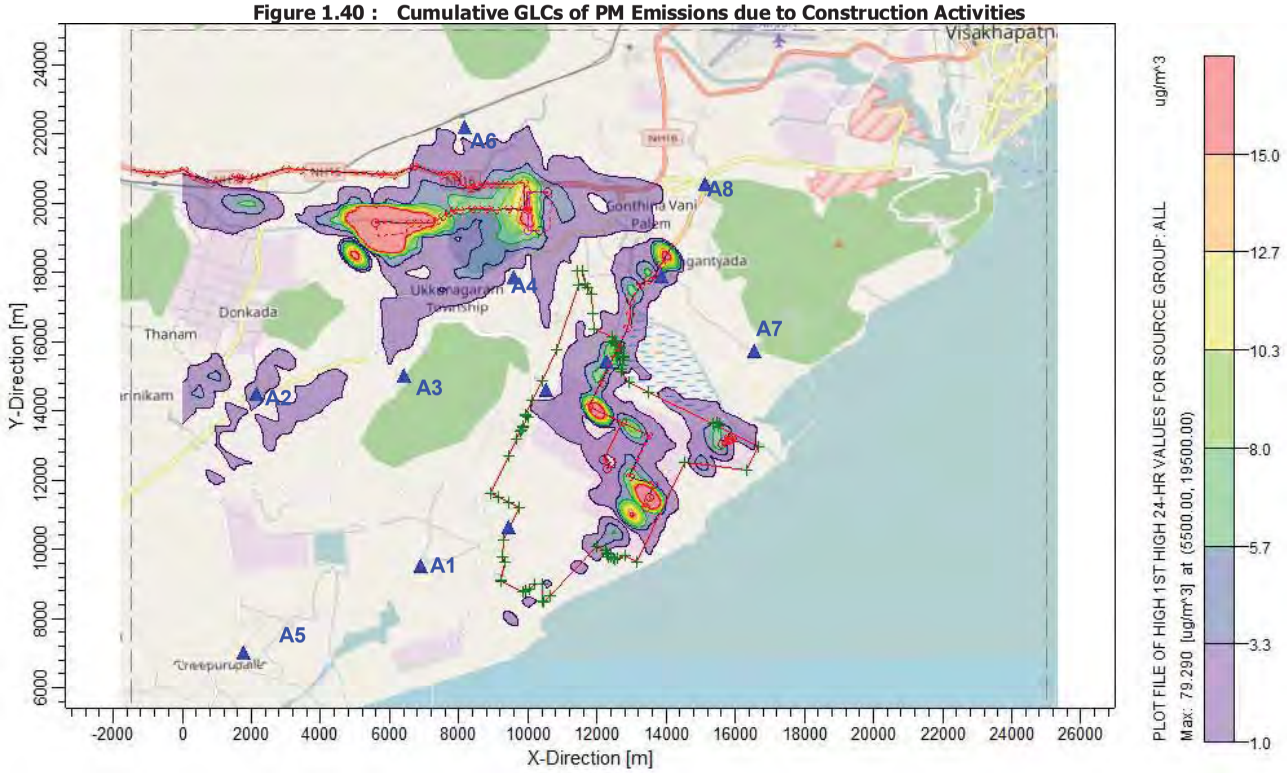


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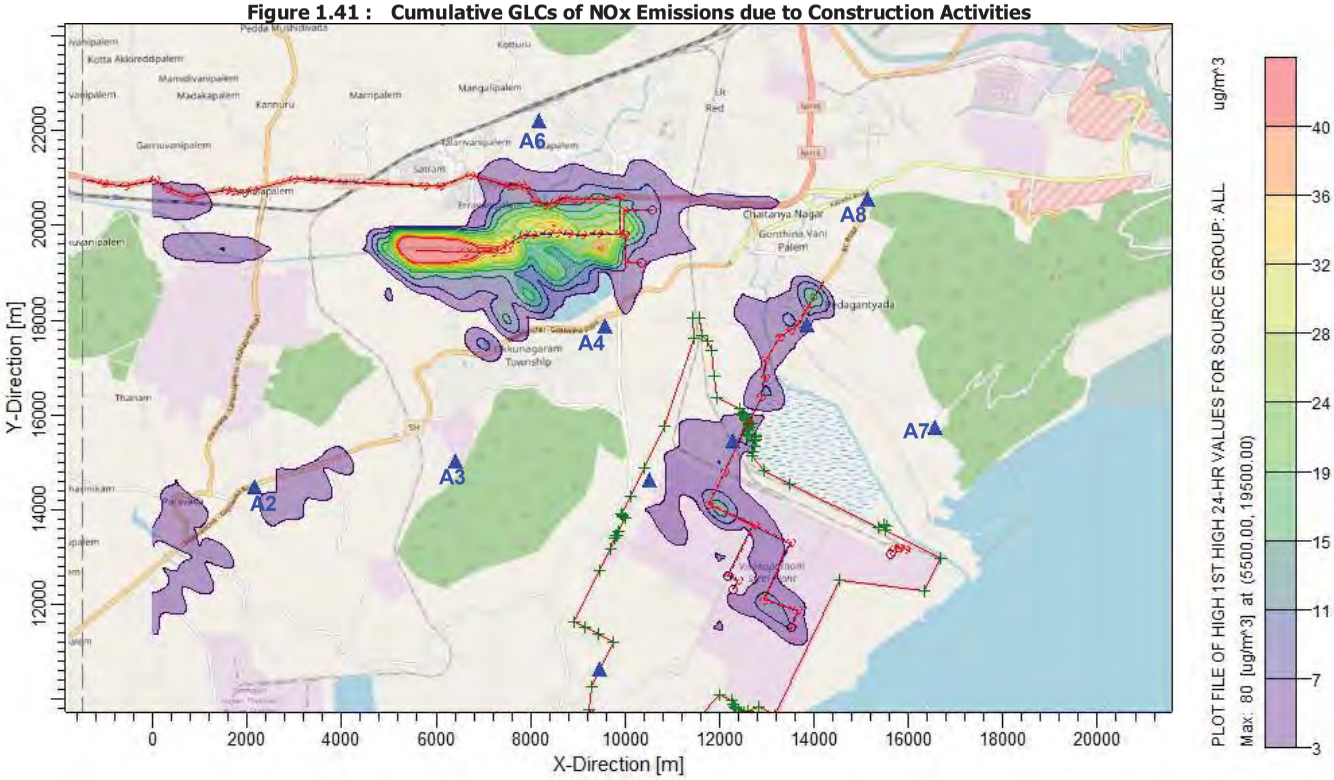
Figure 1.41 : Cumulative GLCs of NOx Emissions due to Construction Activities



From the above figures, it can be observed that the higher concentration values are observed in areas close to KBR2 construction site. The site used for storage of rocks and soil dug out of KBR2 has been anticipated to be the location of maximum PM and NOx concentrations.

The presence of thick vegetation near the waste storage site and all along the transportation route would have contributed to the reduction of fugitive dust emissions. The actual GLC value would have been much less than anticipated due to this.

The anticipated maximum GLC values at nearest AAQ location is estimated to be 1.6 µg/m^3 and 2.0 µg/m^3 for PM and NOx respectively. Therefore, no significant damages due to all the construction and revamping activities were observed. Additionally, the damage caused by the construction activities are temporary and will cease to exist after completion of construction phase.

Damage to Water environment:

Surface Water

As discussed earlier, except in KBR2 area, the surface water bodies are unaffected due to the construction activities as there is minimal interaction of site activities with the surface water bodies in the plant area. Also, the construction activities are being carried out within the plant premises, which is well away from any natural stream, river or lake. Thus, chances of storm water overflowing into the buffer area's surface water bodies is minimal.

In KBR2 area, three natural perennial streams flowed through the site area. Prior to commencement of reservoir construction, a diversion channel was constructed to temporarily divert the Central Nala along the proposed western and southern rim of the proposed reservoir area to the existing southern channel. After completion of KBR2, the stream shall be diverted along the northern periphery of the reservoir to meet the natural stream on west side. A lined channel has been constructed for the same. Therefore, the overall drainage pattern of the area shall not be disturbed.

Ground Water

The new reservoir bottom is ~14 m below the original ground level. In the reservoir site, the ground water level is ~4 m below the original ground level. So water was discharged from the excavations. It is to be noted that RINL has constructed an artificial ground water recharging pond on the southern side of the reservoir site. Water seeping into the excavated reservoir water was pumped out into the ground-water recharging pit.

In order to identify the impacts on ground water regime of the study area caused due to the plant construction phase activities, the ground water quality is compared for 2010 and 2016 utilizing published Ground water quality index. The average water quality with respect to selected parameters is given in **Table 1.16** below.

Table 1.16 : Average ground water quality before and after the construction phase

Selected Parameters of groundwater quality	*2010 (before construction)	**2016 (after construction)
pH	8.05	7.71
Total Dissolved Solids (mg/l)	729	1155
Fluoride (mg/l)	1.05	0.63
Chloride (mg/l)	147	194
Sulphate (mg/l)	63	89
Nitrate (mg/l)	7	1

Note: ** Annual average of 38 locations in study area*
*** Annual average of 7 locations in study area*

Based on the above selected parameters and methodology developed by Surjeet Singh et. al. and published in their technical paper titled "Development of an **Overall Water Quality Index (OWQI)** for Surface Water in Indian Context, 2015" in the journal of *Current World Environment* as well as validation of equal applicability of these OWQI to groundwater as published by RP Singh et al. in their technical paper titled "Water level fluctuation as the sum of environmental and anthropogenic activities in southeast, Punjab (India), 2015" in the Journal of *Environmental and Analytical Toxicology*. The calculated WQIs is given in **Table 1.17** below. Corresponding class and status of water quality is provided in **Table 1.18.**

Table 1.17 : Calculated OWQI before and after the construction phase

Duration	OWQI	Associative grade of water quality
2010 (before construction)	86	Acceptable quality [2]
2016 (after construction)	65	Needs Treatment (Filtration & Disinfection) [3]

Table 1.18 : WQI and corresponding class and status of water quality

WQI Value	Status of Water	Grade of water quality (G_{wq})
0 - 24	Unsuitable for All Purposes	5
25 - 49	Special Treatment (Special Treatment)	4
50 - 74	Needs Treatment (Filtration & Disinfection)	3
75 - 94	Acceptable	2
95 - 100	Pristine Quality	1

References:
1. *Singh RP, Krishan G, Takshi KS (2015) Water level fluctuation as the sum of environmental and anthropogenic activities in southeast, Punjab (India). Journal of Environmental and Analytical Toxicology 5: 298.*
2. *Singh Surjeet, Ghosh, N.C., KrishanGopal, Galkate Ravi, Thomas T. and Jaiswal R.K. 2015. Development of an Overall Water Quality Index (OWQI) for Surface Water in Indian Context. Current World Environment. 10(3): 813- 822*

From the above tables it can be concluded that in comparison to the pre-construction period, the ground water quality of the study area has degraded by one grade, falling of Grade 2 to Grade 3.

Effects on Ambient Noise Levels:

It can be seen from **Table 1.4** (Time Table of Plant Development) in **Clause 1.8.1** of this Chapter, that at any given time, maximum 5 (five) programmes were under execution at the same time. Maximum activity took place during the 4th quarter of 2016 and the 1st 3 quarters of 2017. During the 4th Quarter of 2016, works on SMS2 Convertor 3, SMS2 Caster 4, COB5, SP1 Revamping and BF2 Revamping were in progress. During the 1st – 3rd quarters of 2017, works on SMS2 Caster 4, COB5, BF2 Revamping, SP1 Revamping and KBR 2 were in progress. It may be assumed that maximum noise too was generated during this one year period. The cumulative noise at three locations due to construction activities was estimated. The results are given in **Table 1.19**.

Table 1.19 : Cumulative noise due to construction activities

Location	Year and Quarter	Cumulative Noise from Construction Activities	Existing Noise	Resultant Noise
Steel Plant Township	4th Quarter, 2016	~33.9	61.7 – 48.0	~61.7 - ~48.2
	1st / 2nd / 3rd Quarter, 2017	~41.2		~61.7 - ~48.8
Village Appikonda	4th Quarter, 2016	~38.3	55.2 - 44	~55.3 - ~45
	1st / 2nd / 3rd Quarter, 2017	~38.3		~55.3 - ~45
Village Islampet	4th Quarter, 2016	~39.1	67.7 – 47.3	~67.7 - ~47.9
	1st / 2nd / 3rd Quarter, 2017	~38.7		~67.7 - ~47.9
All values in dB(A)				

From the above table it can be seen that revamping of existing units inside the plant, construction of the new coke-oven battery (COB5) and construction of the new reservoir have had only negligible effects on noise levels in nearby residential areas. The maximum increase in noise levels at the receptors was only ~1 dB(A) and that too without considering any attenuation by the plant's green belt, other vegetation and other buildings. The actual increase was in all likelihood much less than ~1 dB(A) due to attenuation by the plant's green belt, other vegetation and other buildings. Thus in all likelihood the construction activities would not have led to any measurable increase in ambient noise levels.

Damage to Human Health:

During a Health Survey of people of nearby areas, no cases of silicosis were reported. Some cases of respiratory diseases / disorders were reported. But the patients reported that they were suffering from these ailments even before commencement of construction began and their problems have not worsened after commencement of construction activities. Amongst healthy persons no complaints regarding distress due to airborne dust were reported. So it may be concluded that the construction activities have not affected the health of residents of nearby areas.

Damage to Ecology:

Overall, it can be said that revamping of existing units inside the plant and construction of the new coke-oven battery (COB5) have hardly affected the local ecology. Only very limited loss of green cover has occurred due to clearance of a few small common trees, shrubs and grasses. Since the area is located within the existing plant and adjacent to operating units of the plant, there were hardly any animals in the area except common invertebrates, birds and lizards.

However, in case of construction of the new reservoir loss of green cover is much more as about 23564 trees had to be felled. Fugitive dust generated due to excavation of soil, transport of soil over unpaved roads and dumping of soil. The fugitive dust settled on leaves of plants facing the working areas and probably reduced their photosynthetic activity. These effects were temporary only. The deposited dust was washed off by rain. The fugitive dust generation will come down once construction is completed and the exposed soil is revegetated by RINL as well as naturally.

Since the site of the new reservoir is surrounded by urban settlements and is adjacent to very busy National Highway, there were no large animals in the area. The fauna of the area comprised of only common birds, reptiles and small mammals. Most of these have been displaced and / or scared off by construction activities. However some of the birds and reptiles and small mammals are expected to repopulate the undisturbed vegetation along the reservoir boundaries as well as the revegetated areas.

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1.9 DAMAGES DURING OPERATION PRIOR TO GETTING EC

As discussed earlier, the expansion of Integrated Steel Plant from 6.3 MTPA to 7.3 MTPA started with the revamping and capital repair of existing BF1 followed by BF2. Later on, in order to support the increased Hot Metal Production capacity, expansion/ revamping/ modernization of existing facilities also got started.

1.9.1 Damages due to Proposed New Units (COB5 & Rebar Mill)

In order to anticipate the environmental impacts caused due to the operation of a new unit prior to getting EC, it is assumed that production which has occurred after commissioning and continued till date shall be considered for impacts estimation.

For the proposed expansion, the only two new process units which were proposed to be freshly installed are Coke Oven Battery 5 and Rebar Mill. COB 5 is still in construction phase and has not started operation till date while the proposed Rebar mill is still in planning phase.

Therefore, no environmental impacts are attributable to the proposed new units of the 7.3 MTPA expansion plan due to their operation. The only impacts associated with such units are the impacts due to ongoing construction activities which has already been discussed in previous section.

1.9.2 Damages due to Expanded/revamped Units (BFs 1 & 2, SP1 & SMS2)

(i) Damage to Land Environment

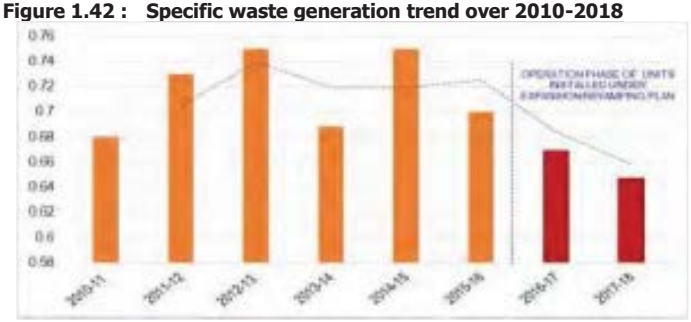
The operation of units under the expansion/revamping project of RINL has been installed within the premises of existing RINL steel plant. Hence, no land acquisition was required for the project and consequently, the existing land use of the area has remained unchanged.

The operation of these units will also generate solid wastes, some of which are hazardous while others are non-hazardous. Some of these wastes shall be reused / re-utilised. Additional solid wastes shall mainly be generated from:

- Coke Oven –Sludge, coke dust, etc
- Sinter Plant – return sinter & ESP Dust
- Blast Furnace – BF sludge, BF Slag, etc
- SMS – LD Slag, SMS Sludge, etc
- Rebar Mill – Mill Scales, scrap, etc

The specific solid waste generation statistics for the plant before and after operation of installed units under expansion/revamping projects of RINL is given in **Figure 1.42**.

Figure 1.42 : Specific waste generation trend over 2010-2018



As evident from the above trend variation of specific waste generation, it is easily deduced that the operation of the units installed under expansion/revamping plan of RINL did not lead to additional generation of solid waste, which might have consequently led to increase in load on the existing land resources for waste management as well as risk of contamination of soil. The decreasing trend indicates increased waste recycling, reuses as well as optimized raw material utilization leading to lesser generation of waste and efficient resource management.

Mitigative Measures Undertaken

As per the existing procedures, all of the wastes generated from the revamped units are reused / re-utilised within the plant. Additionally, other wastes generated during operation / maintenance / annual maintenance of other units / shops etc., like Flue dust from BF, BF/BOF Gas Cleaning Plant sludge, Waste Refractories, iron & steel scrap etc are also utilized appropriately within the plant.

It can be noticed that except some sludge generated from Coke Oven and By Product area, all other wastes are non-hazardous. All the solid wastes are utilized as such in the plant in Sinter Plant/BOF. BF/BOF Slag is sold to cement manufacturers or used for road construction. All hazardous waste were handed over to authorized dealers for disposal as per statutory norms.

(ii) Ambient Air Quality

For the units, which have undergone expansion/revamping, only the proportionate increase in pollution load with respect to increase in production capacity of individual unit shall be considered for damage assessment. For example, since the production capacity of Blast Furnaces 1 & 2 has increased from 2 MTPA to 2.5 MTPA each, 20% of the total expanded capacity (i.e. 0.5 MTPA of 2.5 MTPA capacity) is considered under violation. Therefore, 20 % of the actual pollution load is attributable to violation. The same is estimated to have been caused for the duration since the unit is in operation. The time table for these plant operation activities after revamping is given in **Table 1.20.**

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Table 1.20 : Time Table of Unit operation after revamping

Sl. No.	Unit	Oct 2014	2015				2016				2017				2018			
			Jan	April	July	Oct	Jan	April	July	Oct	Jan	April	July	Oct	Jan	April	July	Oct
1.	BF1 Revamping																	
2.	BF2 Revamping																	
3.	SMS2 Converter 3																	
4.	SMS2 Caster 4																	
5.	SP1 Revamping																	

A graph showing pollution loads of revamped units is prepared based on the monitored values of stack emissions from respective units. Trend of pollution loads when the units are running at full loads at 6.3 MTPA are also plotted onto the same graph. As the units resumed their operations after revamping, a portion of their total emissions is accountable to the violation phase. The trend of the same is also plotted. The graphs are shown in **Figure 1.43- 1.46**.

Figure 1.43 : Graph showing trend of emissions from Blast Furnaces

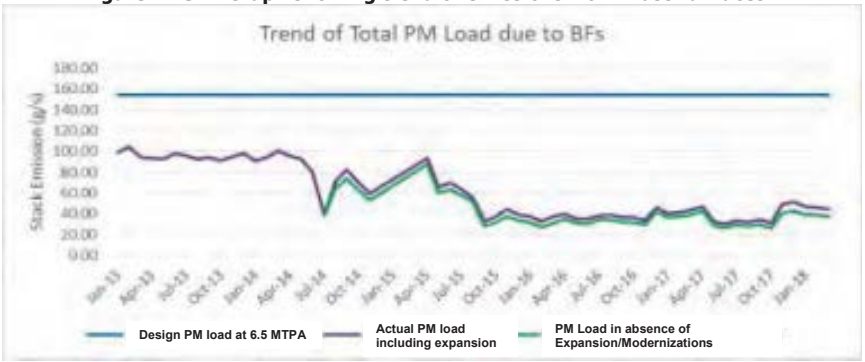


Figure 1.44 : Graph showing trend of emissions from SMSs

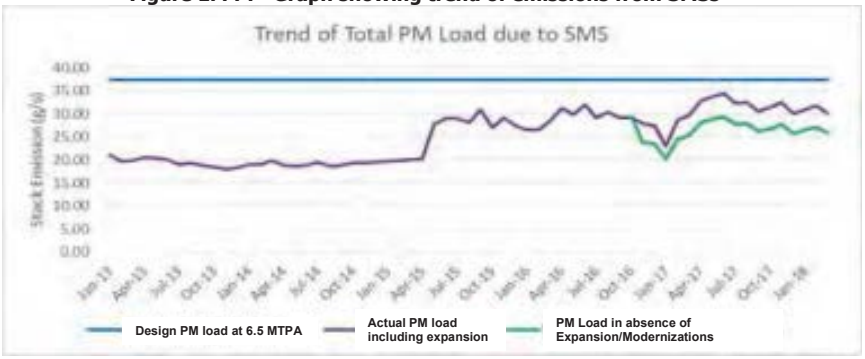


Figure 1.45 : Graph showing trend of emissions from Sinter Plants

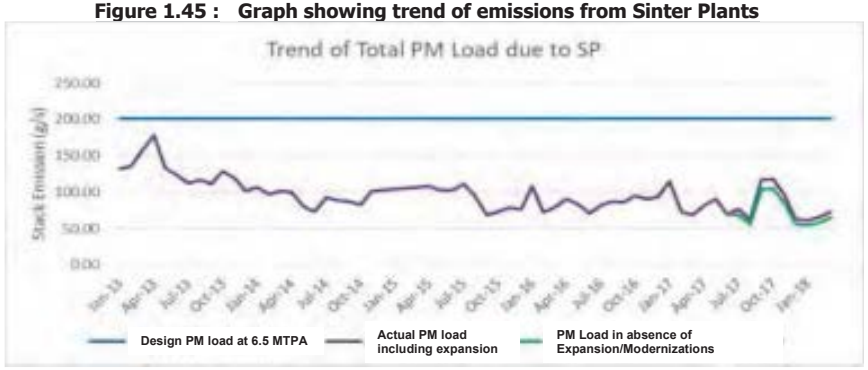
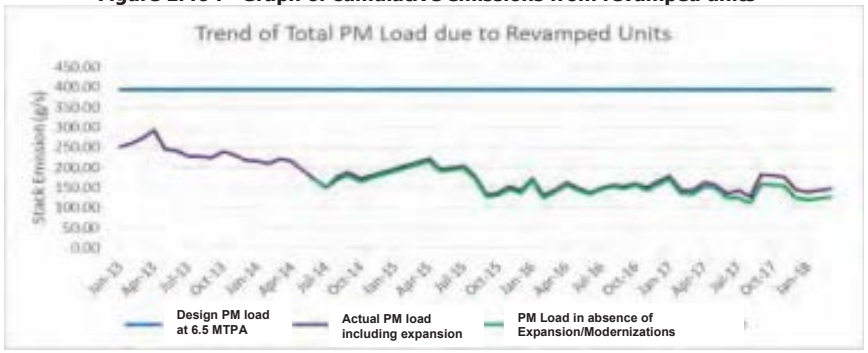


Figure 1.46 : Graph of cumulative emissions from revamped units



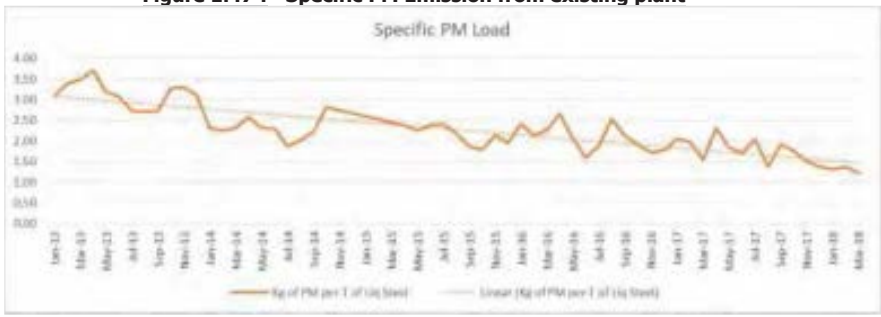
From the above graphs, it can be concluded that even though RINL is gradually increasing the gross hot metal production, the pollution load from the revamped units remained almost constant. And never have the total pollution loads from the units have exceeded the maximum permissible limits at full loads as per EC. However, as a portion of the total load is assumed to have contributed to violation, the maximum PM load attributable to violation is estimated around 23.38 g/s in Nov 2017. At that time, the cumulative pollution loads from the revamped units were 177.39 g/s.

Additional, it can also be observed from the graph that in view of the latest environmental norms, RINL has continually upgraded the pollution control equipment / systems of the existing plant, thereby continually decreasing the emitted pollution load. This has resulted in a reduction in specific pollution loads. This can be attributed to the enhancements in pollution control devices which have been done as part of the revamping activities.

Overall Integrated Steel Plant

In order to access the impacts of ongoing developments in plant units on ambient environment, a graph of total specific pollution loads from all units of VSP is prepared. The same is given in **Figure 1.47**.

Figure 1.47 : Specific PM Emission from existing plant



From the graph, a downward trend is observed in specific emission load from overall plant units. Therefore, an overall positive impact is observed on ambient air due to the ongoing revamping/modernization activities.

Mitigation Measures Undertaken

In order to mitigate various impacts of air pollution during the operation phase, the following measures are implemented in the installed new as well as expansion/revamping units as given in **Table 1.21.**

Table 1.21 : Air Pollution Control Measures in installed Plant Units

Sl. No.	Unit	Details of APC	Design Limit
1.	Raw Material Handling System	• Covered conveyors • DFDS • DE system for material transfer points	• DE stack outlet <50 mg/Nm^3
2.	Sinter Plant	• Process Flue gas cleaning • Stock House dedusting • Sinter cooler DE system	• Stack dust level < 50 mg/Nm^3
3.	Coke Ovens	• Charging & Pushing emissions control • CDQ • Waste heat recovery	• DE stack outlet <50 mg/Nm^3
4.	Blast Furnace	• Cast House Dedusting • Stock House dedusting	• Stack dust level < 50 mg/Nm^3
5.	Steel Melting Shops	• Secondary emission control	• Stack dust level < 50 mg/Nm^3
6.	CRMP Kilns	• Process Flue gas cleaning	• Stack dust level < 50 mg/Nm^3
7.	CPP Boilers	• Process Flue gas cleaning	• Stack dust level < 50 mg/Nm^3

(iii) Effect on Ambient Noise Levels

During construction work, lot of noise was generated at the construction site due to operation of diesel powered construction and material handling machinery, metal fabrication and erection of metallic structures and equipment. However, the noise generated at the construction sites have hardly affected the noise levels at nearby receptors (refer **Table 1.19**). Noise generation due to construction have now ceased. Noise generation by the revamped equipment is not more than the original equipment. Hence ambient noise levels have remained unchanged from what they were prior to the revamping works been taken up.

Mitigative Measures Undertaken

Various measures have been undertaken to reduce noise pollution include reduction of noise at source, provision of acoustic lagging for the equipment and suction side silencers, vibration isolators, selection of low noise equipment, isolation of noisy equipment from working personnel. In some areas, working personnel have been provided with personal protective equipment (PPE) such as ear muffs/ ear plugs and also the duration of exposure of the personnel will be limited as per the norms. The following measures are undertaken:

Technological Measures

- Plugging leakages in high-pressure gas/air pipelines.
- Reducing vibration of high speed rotating machines by regular monitoring of vibration and taking necessary steps.
- Regular lubrication of machinery as per the manufacturers' guidelines
- Design of absorber system for the shift office and pulpit operator's cabin.
- Noise absorber systems in pump houses.
- Noise level at 1m from equipment is limited to 85 dB (A).
- The fans and ductwork are designed for minimum vibration.
- All the equipment in different units are designed/operated in such a way that the noise level does not exceed 85 dB (A).

Management Measures

In a manufacturing plant, with a variety of noise producing equipment, it is not practicable to take technological control measures at all the places. In such cases the following administrative measures are taken:

- High noise zone are marked as "High Noise Zone".
- Workers exposed to noise level are provided with PPE like earmuffs and are advised to use them regularly, while at work.
- Duty hours of workers exposed to noisy work places are regulated to reduce overall noise exposure levels.
- All workers are regularly checked medically for any noise related health problem and if detected, they are provided with alternative duty.
- Periodical monitoring of work zone noise and outside plant premises.

Over and above, all these adopted measures, trees and shrubs belts of substantial density & width have been developed within the surrounding the plant premises to further attenuate the sound levels reaching the receptors within and outside the plant premises.

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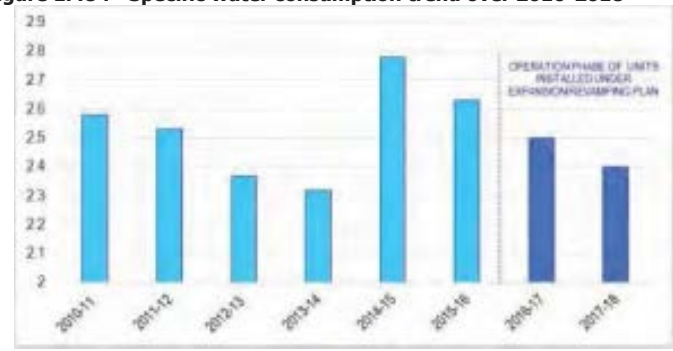
(iv) Effects on Water Resources and Waste Water Management

Total make-up water requirement for the existing steel plant at 6.3 MTPA stage is about 1,36,350 m^3/day (30 MGD) and for township and others it is at 36,360 m^3/day (8 MGD).The water is sourced from existing Yeleru Reservoir. RINL has been accorded permission for withdrawal of 45 MGD from Visakhapatnam Industrial Water Supply Company Limited (VIWSCO). Kanithi Balancing Reservoir has been constructed for storage of raw water.

As indicated in chapter 2, waste water generated in various units of the steel plant are pretreated and recycled within the plant itself. Rejects are discharged into two outfalls and led to waste water treatment / RO plants. From there, the waste water is further recycled and reused within the plant. Only a small portion (200 m^3/hr) of Coke oven and RO plant rejects are discharged into the sea after treatment to meet effluent discharge standards.

The existing water requirement is inclusive of the requirements of the units installed under expansion/revamping units and is less than the quantity of for which RINL has already been accorded permission (45 MGD). Thus, the operational phase does not require any additional water and hence has no negative impact on the existing water regime of the area. The same is evident from the specific water consumption of the plant also, as shown in **Figure. 1.48** below.

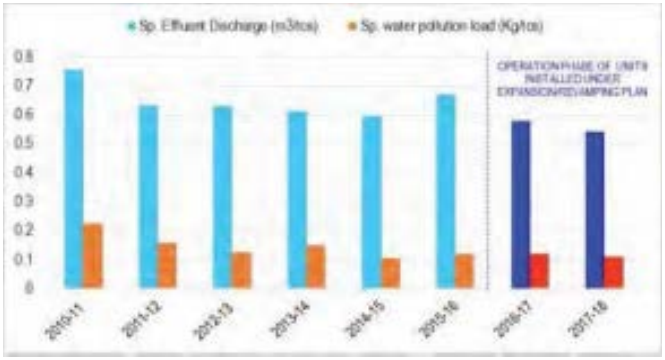
Figure 1.48 : Specific water consumption trend over 2010-2018



The above trend indicates a clear improvement in water utilization by the expansion/revamping project, indicating optimized water consumption and minimal negative impact on the existing water regime due to water use for plant purposes.

Another aspect of environmental damage of the water resources is the effluent discharge by the plant. To quantify the impact due to effluent discharge, the specific effluent discharge and the specific water pollution load for the period before installation of the new units under expansion/revamping project of RINL was done with existing data of the same. The same is shown in **Figure 1.49.**

Figure 1.49 : Specific effluent discharge and specific water pollution load trend over 2010-2018



As evident from the above trend variation of specific effluent discharge and specific water pollution load, it is easily deduced that the operation of the units installed under expansion/revamping plan of RINL did not lead to excessive generation of effluent as well as any increase in water pollution load on the existing water resources. The reducing trend indicates an improvement of plant's recycling, reuses and treatment systems for optimized water consumption and efficient water resource management.

Mitigative Measures Undertaken

Following schemes have been implemented in the existing steel plant for maximum waste water recycling-

- Existing Coke ovens have been provided with separate ETP involving Mechanical, Biological & Chemical treatment of coke oven effluents. The treated waste water is recycled to the maximum possible extent in the plant; the unutilized treated effluent is discharged into the sea.
- Clarification and recycling of DCW from gas cleaning plant of BF and SMS
- Oil skimming and filtration of mills waste water followed by clarification.
- Utilization of CT Blow Down in slag granulation, dust separation and ash handling.

(v) Damage to Ecology

The revamped units do not utilise any ground water. The effluents generated at the revamped units are utilised for industrial purposes within the plant itself. Thus resumption of operations at the revamped units have not affected the water environment either.

Revamping of existing pollution control systems to meet the latest norms / standards have been part of the whole revamping exercise. So although production has increased, quantum of air pollutants has actually decreased. Thus there may have been some improvement in air quality in and around the steel plant. Ecological impacts of the revamping works were confined to the project areas and their immediate vicinity only. The revamping works have not affected the air quality in and around the plant. Air quality may have profound effects on ecology. Since resumption of operations have not affected the air quality, in all likelihood ecology has also not been affected.

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Since air quality, noise levels and water quality have not been affected by resumption of operations at the revamped units, there have been no impacts on human health either.

1.10 BUDGET FOR ENVIRONMENT RESTITUTION AND PROTECTION

RINL's Visakhapatnam Steel Plant (VSP) has always aimed at improving the lives of people living around the steel plant by way of its dedicated Corporate Social Responsibility (CSR) plan and activities therein. Despite RINL-VSP's poor financial performance in the last few years, it has not turned away from its commitment to improving the lives of communities living in the area, and has continually contributed its resources for improvement of the lives of people living in the peripheral areas.

As part of RINL-VSP's commitment to offset even the most insignificant damage that has been caused due to its activities under its expansion/revamping project, a detailed budget of Rs. 200 lakhs has been dedicatedly allocated for the restitution and remediation of the damages identified to the environment as well as the community in the peripheral areas.

The detailed Remedial Measures and Natural & Community Resource Augmentation Plan – Budgetary Allocation is given in **Table 1.22** below:

Table 1.22 : Ecological Damage Assessment and Remediation Plan

Sl. No.	Environmental Attribute	Activity	Issues	Related Damages	Measures already been taken	Remediation plan	Estimated cost
1	Air environment	**I. Construction of new units/facilities:** KBR2 1. Site clearance 2. Excavation activities 3. Transport of excavated material 4. Controlled Blasting to break up occasional large boulders 5. Handling of excavated soil, rocks & debris COB5 1. Site clearance 2. Transport of construction material 3. Construction activity Guard pond 1. Site clearance 2. Excavation & handling of soil **II. Revamping of existing units and operation (BF1&2, SP2&2, SMS1&2)** Revamping stage: 1. Construction activity	1. Fugitive dust emissions due to ground clearing and leveling activities at all new sites 2. Fugitive dust emissions during excavation and handling of soil & debris at KBR2. 3. Emissions due to fuel combustion by diesel powered HEMMs & construction equipment 4. Fugitive emissions from paved/unpaved roads due to vehicular movement. 5. Fugitive emissions from external soil dumps. 1. Emissions due to fuel combustion by vehicles 2. Fugitive dust emission from paved/unpaved roads due to vehicular movement 3. Emissions during Process and during combustion through stacks 4. Fugitive emissions from	1. Deterioration of air quality due to increase in dust concentration leading to respiratory problems. 2. Deposition of particulates on buildings, roads etc. leading to damage to property as well as disturbance to the aesthetics of the area. 3. Air pollutant deposition as well as gaseous emissions from vehicles and heavy machinery can cause damage to leaves of local flora. 4. Increase in air pollutant concentrations in the ambient air due to emissions releasing in the atmosphere through stacks	1. To prevent dispersion of fugitive emissions during excavation activity near reservoir, around the reservoir site especially residential area side covered with GI sheets 2. To prevent Depletion of ground water during excavation Grout curtains were made. 3. Ground water was pumped to nearby rain water harvesting ponds. 4. Regular water sprinkling done to suppress fugitive dust. 5. Covered vehicles to transport raw material, debris etc, 6. Allowed PUC certified vehicles 7. Up gradation pollution control equipment in BF, SP and SMS to meet the standards 8. Dust suppression and dust extraction system at all material transferring points,	1. Plantation near reservoir area 2. Plantation beyond plant boundary 3. Water sprinkling on the roads 4. Health Check-ups through Medical camps 5. Infrastructure support to public health centers /Govt. Hospitals	1200 plants @ Rs 250/plant with 2 years Maint. = Rs **3.0 lakhs** 1200 plants @ Rs 250/plant with 2 years maint. = Rs **3.0 lakhs** 5000L – 5 trips/day x Rs 800 @ 4 times in a month for one year= **Rs 2.0 lakhs** One camp/ qtr. Rs 2.5 L X 4 **= Rs 10 lakhs** Wheel chairs - 25nos @ Rs 15000 Stretchers- 25nos @ Rs5000 Beds -100nos @ Rs5000

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Sl. No.	Environmental Attribute	Activity	Issues	Related Damages	Measures already been taken	Remediation plan	Estimated cost
		2. transportation of construction material and debris 3. Transportation of equipment/machinery Operation stage: 1. Combustion of fossil fuels 2. Conveying raw material 3. Movement of tucks for material movement	the shops 5. Emissions due to fuel combustion by vehicles 6. Fugitive dust emission from roads due to vehicular movement			6. Erection of enclosures around the project site during construction(2 lakhs)	**Total Rs10 lakhs** for 5 PHCs 400 Sqm (ie., 80 RM of 5 M height) @ 500 per Sqm by using inhouse material **Rs.2 Lakhs** **Total = 30 lakhs**
2	Noise levels	**I. Construction of new units/facilities:** (KBR2, COB5, & Guard pond) 1. Vehicular movement 2. Excavation activity 3. Construction activity **II. Revamping of existing units and operation (BF1&2, SP2&2, SMS1&2)** Revamping stage: 1. Revamping activities of existing facilities 2. Vehicle movement	1. Generation of noise due to tucks for transportation of excavated material & machinery 2. Generation of noise due to blasting, using machinery for excavation of soil 3. High noise generation during material handling, metal fabrication & Equipment erection 1. Noise generation during Site preparation activities including debris removal etc., using heavy machinery 2. Noise generation due to Vehicular movement for transportation of	Increase in ambient noise levels in habitation areas may lead to disruption of sleep cycles in people, hearing losses as well as annoyance to patients and children. Increased noise and vibrations may scare away animals in nearby areas	1. Avoided excavation during night time 2. Control blasting was done at KBR2. The maximum allowable peak particle velocity is fixed at 10mm/s which is the safest limit of the structural damage as per DGMS guidelines. 3. Acoustic enclosures for High noise equipment the noise levels will be limited to 85 dB(A) in the working area. 4. Where ever it is not to cover the equipment, personal protective systems are provided to the working personnel. 5. Reducing vibration of high speed rotating machines by regular monitoring of vibration and taking necessary steps	1. Plantation near habitations (covered in sl 1) 2. Cochlear Implantation for poor children with hearing impairment	Five surgeries for implantation of cochlear for 5 children @ Rs 8.0 L = **Rs 40.0 lakhs**. **Total = 40 lakhs**

Sl. No.	Environmental Attribute	Activity	Issues	Related Damages	Measures already been taken	Remediation plan	Estimated cost
		Operation stage: 1. Operation of equipment such as compressors, blowers ID fans etc . Vehicle movement	construction material & labour during construction 3. High noise generation during operation of plant machinery				
3	Water environment	**I. Construction of new units/facilities: (KBR2, COB5, & Guard pond)** 1. Storm water run offs during construction 2. Interference of Ground water table **II. Revamping of existing units and operation (BF1&2, SP2&2, SMS1&2)** 1. Storm water run offs during construction 2. Use of fresh water for plant operations	1. Increase in Suspended Solids in storm water run offs during monsoon season 2. Obstruction of groundwater percolation due to ground water cementing 3. Percolation of contaminated groundwater 1. Generation of effluent from different unit of the plan 2. Use of water from community resources for plant purposes	1. Increase in suspended solids in the nearby surface water bodies 2. Reduction in ground water recharging due to paving, 3. increasing run off factor 4. Contamination of ground water 5. Obstruction of natural drains and consequent disruption of drainage pattern 1. Increase in pollutant load, leading to contamination of community water resources in the area 2. Decrease in water availability due to exhaustion of community water resources	1. Catch pits are provided to arrest suspended solids 2. To prevent Depletion of ground water during excavation Grout curtains were made. 3. Ground water was pumped to nearby rain water harvesting ponds 4. Natural drains were diverted 5. complete recirculating cooling system for the equipment cooling after proper treatment 6. Treated effluent discharged from the plant will be utilised for dust suppression. 7. RINL has developed two nos. of rain water harvesting ponds from which about 5.48 Mil cum water can be recovered per year. 8. Garland drain and retaining wall will be constructed at the toe of the dumps to prevent wash off from the dump	1. Rain water harvesting in communities. 2. Recharge pits 3. Construction of Check dams 4. Supply of Drinking Water(15 lakhs)	3mt X4mt rain water conservations pits @Rs 50,000 X 12 **=6 Lakhs** @Rs 50,000 X 6= **Rs 3.0 Lakhs** Each dam @2.0 Lakhs X3 = **6 Lakhs** 15 trips /day @825 X4 months =**Rs 15 Lakhs** **Total = 30 lakhs**

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Sl. No.	Environmental Attribute	Activity	Issues	Related Damages	Measures already been taken	Remediation plan	Estimated cost
4	Land environment	**I. Construction of new units/facilities: (KBR2, COB5, & Guard pond)** 1. Location of facilities 2. Inflow of people **II. Revamping of existing units and operation (BF1&2, SP2&2, SMS1&2)** 1. Solid wastes generation 2. Handling of chemicals/raw materials	1. Change of land use 2. Green cover 3. Stress on common property resources 1. Storage of solid wastes 2. Spillages of chemicals/raw materials	1. Land used for industrial purpose 2. Degradation of green cover 3. Loss of top soil 4. Increase in demand of land near project site for housing of construction labour. 5. Change in land use of the area due to increase in habitation of construction workers, converting vacant areas to settlements and loss of access to existing land uses such as roads etc. 6. Creation of new land uses such as roads etc. for catering to infrastructural needs of labour 1. Increase in land requirement for disposal of solid wastes generated 2. Change in land use of the area 3. destruction of existing land use such as existing access routes etc.	1. Facilities are proposed in already acquired land for industrial use. 2. Locations are not having any important plant species 3. Necessary infrastructure facilities for labour already in place. 4. Top soil is preserved for biological reclamation of the over burden dumps 5. Maximum utilization of solid wastes 6. Standard SOPs in place for Handling of hazardous chemicals 7. Major raw material transported through covered conveyers.	1. Providing greenbelt resistant native species within the proposed plant units in place of shrubs 2. Biological reclamation of un used excavated soil	60,000 plants x @Rs 100= **Rs 6 Lakhs** Out of 35.50 Ha, 12 Ha land reclaimed for three years @ 11110 per year by broad casting seeds **Rs.4 Lakhs** **Total = 10 lakhs**
5	Ecological	**I. Construction of new**	1. Loss of Green cover	1. Loss of green cover	1. Facilities are coming up in	1. Distribution of free	8000 plants

Sl. No.	Environmental Attribute	Activity	Issues	Related Damages	Measures already been taken	Remediation plan	Estimated cost
	Environment	**units/facilities: (KBR2, COB5, & Guard pond)** 1. Site clearance 2. Excavation activities 3. Transport of excavated material 4. Blasting 5. Dumping of un used soil	2. Air Pollution from construction activity 3. Surface and ground water contamination	leads to increase the pollution 2. potential of the area 2. Clearance of vegetation due to site clearance / preparation leads to 3. generation of fugitive dust, noise, ground vibrations (due to blasting of rocks) 4. dewatering due to excavations 5. Generation of fugitive dust and noise due to movement of heavy vehicles as well as construction activities 6. Emission of particulate matter & gases (NOx, CO) from engines 7. Loss of animals' habitat 8. Damage to vegetation due to dust deposition. 9. Scaring away of fauna 10. Damage to nearby buildings / structures. 11. Increased siltation in receiving water body. 12. Damage to vegetation and human health due to	the already acquired land of RINL and kept for future industrial activity. 2. Proposed areas comprises of dense scrub and grass lands and bulk of the vegetation comprises of *Prosopis juliflora* and comes under low risk category as per environment, forest, science &technology Department, Govt of AP. 3. Catch pits are provided to arrest suspended solids. 4. To prevent Depletion of ground water during excavation Grout curtains were made. 5. Ground water was pumped to nearby rain water harvesting ponds Natural drains were strategically diverted 6. Barricades were provided to restrict the spread of fugitive emissions to nearby residential areas. 7. Top soil was preserved for bio-reclamation of unused soil dumps.	saplings to peripheral villagers preferably native plants 2. Participating in Green Visakha project 3. Release of algae eating and larvae eating fish into water bodies	x@ Rs 100=**8 lakhs** 15,000 block plantation @Rs 200 =**Rs 30 Lakhs** Rs.1 lakh per year for 2 years **=Rs.2 Lakhs** **Total = 40 Lakhs**

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Sl. No.	Environmental Attribute	Activity	Issues	Related Damages	Measures already been taken	Remediation plan	Estimated cost
		II. Revamping of existing units and operation (BF1&2, SP2&2, SMS1&2) 1. Revamping of existing units 2. Process emissions during operation	1. Generation of fugitive dust due to vehicular movement for transport of machinery and construction material. 2. Emission of particulate matter, gases (NOx, SO_2, CO, H_2, CH_4, NH_3, C_2H_6, C_6H_6, Phenols, H_2S etc.) 3. Generation & release of waste water	air emissions from engines as well as dust. 1. Damage to vegetation due to exposure to process emissions: Project site located inside integrated steel plant far from any major ecosystem. 2. Damage to human health due to exposure to process emissions and heat 3. Disturbance to fauna Contamination of receiving water body & surrounding habitats due to discharge of treated effluents: Increased incidence of diseases spread by insects which breed in water	1. Part of treated effluents utilized for industrial purposes in plant. Balance discharged after quality checks. 2. Increased biodiversity due to large surface water body: This is a beneficial impact 3. 5297688 number of trees planted in around by RINL 4. RINL has developed two nos of rain water harvesting ponds from which about 5.48 Mm^3 water can be recovered per year.		
6	Socio-economic Condition	**I. Construction of new units/facilities: (KBR2, COB5, & Guard pond)** 1. Construction activities	1. Emissions (both fugitive and other emissions) due to site activities including domestic activities such as firewood burning for cooking and heating purposes during cold weather conditions, construction activities as well as vehicular	1. Increase of migration of population(short term) leading to 2. increased stress on local infrastructure due to the influx of construction labour 3. Health issues to inhabitants as well as construction workers because of decrease	1. Secure facilities including labour camps with basic facilities like changing rooms, toilets established by the contractors during the construction phase. 2. Adequate provision for potable water supply facilities and sanitation facilities. 3. Arrangement of first aid kits	1. Providing community toilets in nearby villages/communities 2. Providing financial assistance for maintenance of	Two Nos of Porta cabin toilets (4 male & 4 female) @ 10.0 Lakhs each =**Rs 20 Lakhs** Skill dev. programmes for 300

Sl. No.	Environmental Attribute	Activity	Issues	Related Damages	Measures already been taken	Remediation plan	Estimated cost
			movement during construction phase . 2. Influx of construction labour (short-term migration) 3. Creation of new infrastructure for construction workers (short term)	in air quality due to emissions. 4. Sanitation and hygiene issues in area because of large number of people working/residing during construction activities.	at construction sites. Medical assistance from Primary Health Centre in case of medical exigencies also ensured. 4. Provision for Safety equipment (PPE) at site for construction workers and strict monitoring of adherence of safety protocols for construction activities ensured. 5. Supervision of labour activity within the plant works.	toilets in schools 3. Providing facilities / support for education and skill development of local youth.	beneficiaries@ Rs 5000 =**Rs 15.0 lakhs** Digital class rooms @ 1.50 lakhs each X10=**Rs 15.0 lakhs**
		II. Revamping of existing units and operation (BF1&2, SP2&2, SMS1&2) 1. Revamping activities 2. Project operations •Process emissions and fugitive emissions in the air environment •Creation of employment opportunities •Development of indirect employment opportunities	1. Fugitive emissions during revamping of existing units due to vehicular movement and construction activities 2. Increased labour movement and vehicular movement for construction material inside plant area	1. Increased labour movement inside plant area leading to safety issues. 2. Increase in employment generation both direct as well as indirect			**Total = 50 Lakhs**
Grand Total (A)							**200 Lakhs**

Total budget allocated for Natural & Community Resource Augmentation Plan for the next three years i.e. 2018-19, 2019-20 & 2020-21 is **Rs 720 lakhs.**

Natural & Community Resources Augmentation Plan

The remediation plan concentrated on site activity and presented measures related to mitigation / control of pollution during construction. The impact of the construction activity related to transport of materials, employment, and resource consumption have a bearing on the surrounding areas. Hence it is proposed to prepare 'Natural & Community Resources Augmentation Plan' to compensate the impacts. Breakup of cost of activities to be carried out for Natural & Community Resource Augmentation is given in **Table 1.23** below.

Table 1.23 : Breakup of activities to be carried out for Natural & Community Resource Augmentation Plan

Natural Resources Augmentation Plan

Sl. No.	Activity	Year wise implementation Plan & Budgetary Provision during Operation Phase (Rs in lakhs)			Total Budgetary Provision (Rs.in lakhs)
		2018-19	2019-20	2020-21	
1	Raising and maintenance of block/Avenue plantation at various places in GVMC area @Rs 250 X 30,000 nos in three years.	15.00	30.00	30.00	**75.00**
2	Providing drinking water through gravity in tribal villages by conservation of water @Rs 5.0 lakhs /villages. Total 10 villages will be provided drinking water in 3 years.	10.00	20.00	20.00	**50.00**
3	Installation of rainwater harvesting systems in common/public buildings /school buildings @Rs 100000/- building avg. total 45 buildings	5.00	20.00	20.00	**45.00**
4	Development of greenery/plantation /park in the surrounding areas of KB Reservoir	4.00	24.00	24.00	**52.00**
5	Improving of solid waste management systems like provision of Bins, waste management vehicles, machinery, compost machines etc. (@one compost m/c-10 lakhs+20lakhs- one vehicle for garbage collection + 25 bins @10,000 each)	5.00	25.00	25.00	**55.00**

Sl. No.	Activity	Year wise implementation Plan & Budgetary Provision during Operation Phase (Rs in lakhs)			Total Budgetary Provision (Rs.in lakhs)
		2018-19	2019-20	2020-21	
6	Installation of solar street lights/solar power systems etc, in communities	1.00	5.00	5.00	**11.00**
	Total	**40.00**	**124.00**	**124.00**	**288.00**

Community Resources Augmentation Plan

Sl. No.	Activity	Year-wise implementation Plan & Budgetary Provision during Operation Phase (Rs in lakhs)			Total Budgetary Provision (Rs. In lakhs))
		2018-19	2019-20	2020-21	
1	Providing free education to BPL children (around 500 Nos) from surrounding the Plant & Mines Rs @ 20,000/year/child	25.00	100.00	100.00	**225.00**
2	Creation of educational infrastructure in schools like additional class rooms, duel desk benches lab equipment's, sports equipment in surrounding areas the plant & mines for promoting education.	5.00	25.00	25.00	**55.00**
3	Support to Persons with disabilities by providing assistive devices like ,wheel chairs, artificial limbs, hearing aids ,vision aids etc	5.00	10.00	10.00	**25.00**
4	Providing sanitation facilities ,like installation of RO plants, construction toilets, construction of hand wash stations in schools /public places	5.00	16.00	16.00	**37.00**
5	Providing Medical infrastructure like Ambulances, X ray m/cs , equipment to Govt hospitals /PHCs/cancer hospital etc.	10.00	20.00	20.00	**50.00**
6	Empowering unemployed through skill development programmes like LMV tailoring, welding, solar mechanic, mobile repair, plumbing, home Nurse, beautician courses etc @ Rs 7500/head benefiting 460 persons in three years.	10.0	15.00	15.00	**40.00**
	Total	**60.00**	**186.00**	**186.00**	**432.00**

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Total Budgetary Provision made towards the implementation of Natural & Community Augmentation Plan (Rs in lakhs)

Year	2018-19	2019-20	2020-21	Total
Natural Resources Augmentation Plan	40.00	124.00	124.00	288.00
Community Resources Augmentation Plan	60.00	186.00	186.00	432.00
Total Budgetary Provision	**100.00**	**310.00**	**310.00**	**720.0**

Summary of budgetary allocation with respect to Remediation and Natural & Community Resource Augmentation Plan for the present study is provided in **Table 1.25** below.

Table 1.24 : Budgetary allocation with respect to Remediation and Natural & Community Resource Augmentation Plan for the present study

Sl. No	Description	Estimated cost (Lakhs)
1	Estimated cost of damage/remediation with respect to ecological aspects	**200**
2	Natural & Community Resource Augmentation Plan for three years	**720**
3	Total Budget allotted	**920**

RINL will deposit a bank guarantee equivalent to the above mentioned amount of **Rs 920 lakhs** towards remediation plan and natural & community resource augmentation plan.

1.11 CONCLUSIONS

From the above discussion, it can be safely assumed that the contribution of construction as well as operation activities of RINL's expansion/revamping project are **marginal in nature** and are mostly limited to the existing plant complex.

Also, as the plant has never been able to produce even at 6.3 MTPA capacity, which is its rated capacity as per existing Environmental Clearance granted, it has **not been able to derive any actual economic benefit** out of the expansion.

Over the 4 years of plant operation during expansion period, an overall loss is observed by RINL. However, breakup of cost for proportionate income and expenses from the revamped units indicate a cumulative profit of **Rs 174.5** Crores in 4 years period of plant operation.

RINL-VSP aims to compensate for whatever minimal damages identified due to project, by way of a **dedicated Natural & Community resource augmentation plan with an earmarked budget** for implementation of the same. RINL will spend **Rs 920 lakhs** towards remediation plan and natural & community resource augmentation plan for restitution of damages caused due to violation.

Environmental Impact Assessment/ Environmental Management Plan

For

Expansion of Integrated Steel Plant from 6.3 MTPA to 7.3 MTPA Liquid Steel within the premises of Visakhapatnam Steel Plant

MEC/11/S2/Q7H4/EIA-EMP/2482/R.1. **January, 2019**

RASHTRIYA ISPAT NIGAM LIMITED
Visakhapatnam Steel Plant
(A Govt. of India Enterprise)
Gajuwaka, Visakhapatnam,
Andhra Pradesh- 530031

Project Proponent

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Environmental Consultant

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विशाखपट्टणम इस्पात संयंत्र
(भारत सरकार का उपक्रम)
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CIN No-U27109AP1982GOI003404

UNDERTAKING

I hereby undertake that prescribed TOR with respect to EIA/EMP Studies for ongoing expansion of Integrated Steel Plant from 6.3 MTPA to 7.3 MTPA liquid steel within the premises of Visakhapatnam Steel Plant has been complied while conducting the EIA studies. The contents (information and data) as given by our Consultant in the EIA report are factually correct, with full knowledge of the undersigned.

Date: 26-01-2019

Place: Visakhapatnam

(P.L.Sahu)
ED(Projects Services)
Rashtriya Ispat Nigam Limited
Visakhapatnam Steel Plant
Visakhapatnam – 530 031

DECLARATION BY EXPERTS CONTRIBUTING TO THE EIA/ EMP STUDIES FOR EXPANSION OF INTEGRATED STEEL PLANT FROM 6.3 MTPA TO 7.3 MTPA LIQUID STEEL WITHIN THE PREMISES OF VISAKHAPATNAM STEEL PLANT OF M/s RINL-VSP.

I, hereby certify that I was a part of the EIA team in the following capacity that developed the above EIA.

EIA Coordinator
Name: Dr. V.V.S.N. Pinakapani
Signature & Date:

Period of Involvement: June,2018 till date
Contact Information: Ph: 9431706980; email: envenggranchi@mecon.co.in

Functional Area Experts

Sl. No.	Functional Areas	Name of Expert	Involvement (Period & Task)	Signature & Date
1.	Air pollution prevention, monitoring & control (AP)	Dr. VVSN Pinakapani	(June,2018 till date) *Finalization of monitoring locations, evaluation of Ambient Air Quality results, identification of impacts, suggestions & finalization of mitigation measures with client and contribution to overall EIA documentation.*	
		TM: B.S. Ramesh		
		FAE(Cat- B): Gaurav Dubey		
2.	Water pollution prevention, control & prediction of impacts (WP)	Dr. Sumana Chakraborty	(June,2018 till date) *Finalization of sampling locations for surface water and ground water quality monitoring, evaluation of water Quality results, analysis of water balance and suggesting suitable water pollution control as well as conservation management measures, identification of impacts, suggestions & finalization of mitigation measures with client and contribution to overall EIA documentation.*	
		TM: B.S. Ramesh		
3.	Solid and hazardous waste management (SHW)	Dr. Bipul Kumar	(June,2018 till date) *Identification of potential solid & hazardous waste generating sources and their inventorisation, finalization of waste management strategies, identification of impacts, suggestions & finalization of mitigation measures with client and contribution to overall EIA documentation.*	
4.	Socio-economic studies (SE)	Dr. S. Bhattacharya	(June,2018 till date) *Site visit, field survey, assessment of possible changes to socio-economics of the area due to the proposed industrial activity and contribution to overall EIA documentation.*	

मेकॉन लिमिटेड (भारत सरकार का संस्थान)
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Sl. No.	Functional Areas	Name of Expert	Involvement (Period & Task)	Signature & Date
5.	Ecology and biodiversity (EB)	Shri S. Adak	(June,2018 till date) *Site visit, field survey, assessment of possible impacts to the biological and ecological environment of the area due to the proposed industrial activity and contribution to overall EIA documentation.*	
6.	Hydrology, ground water & water conservation (HG)	Dr. S Veezhinathan	(June,2018 till date) *Understanding and representing groundwater conditions, finalization of groundwater sampling locations, finalization of survey findings, TARR calculations and groundwater potential assessment, identification of impacts, suggestion of mitigation measures and contribution to overall EIA documentation.*	
7.	Geological studies (GEO)	Dr. S Veezhinathan	(June,2018 till date) *Assessment of existing Geology and geomorphology of the area, identification of probable impact due to proposed industrial activity and contribution to overall EIA documentation.*	
8.	Soil Conservation (SC)	Dr. S.K. Singh	(June,2018 till date) *Finalization of soil sampling locations, identification of impacts, suggestions & finalization of suitable mitigation measures with client and contribution to overall EIA documentation.*	
9.	Meteorology, air quality modelling and prediction (AQ)	Dr. V.V.S.N. Pinakapani	(June,2018 till date) *Identification of air emission sources and their inventorisation, prediction of cumulative impacts on ambient air quality due to all identified point, mobile and area sources, suggestions & finalization of mitigation measures with client and contribution to overall EIA documentation.*	
		FAA: Gaurav Dubey		
10.	Noise control (NV)	Dr. M. K. Mukhopadhyay	(June,2018 till date) *Finalization of noise sampling locations and analysis of data, identification of impacts, suggestions & finalization of suitable mitigation measures with client and contribution to overall EIA documentation.*	
11.	Land use studies (LU)	Vishal Skaria	(June,2018 till date) *Site visit, supervising development of land use maps of study area using GIS tools, finalization of landuse maps, identification of any probable changes due to the proposed industrial activity and contribution to overall EIA documentation.*	
		FAE(Cat- B): Aftab Jamal		
12.	Risk assessment and hazard management	D Shashiraj	(June,2018 till date) *Identification of major risks associated with the proposed industrial activity and quantifying the extent as well as severity of the identified risks with the help of latest*	

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Sl. No.	Functional Areas	Name of Expert	Involvement (Period & Task)	Signature & Date
	(RH)	**TM:** Piyal Das	*safety software such as PHAST etc., development of suitable on-site and off-site emergency plan and integrating it with the local Disaster Management plan and contribution to overall EIA documentation.*	Piyal Das

Declaration by the Head of the Accredited Consultant Organization

I, C.D. Goswami, hereby confirm that the above mentioned experts prepared the EIA/ EMP studies for expansion of integrated steel plant from 6.3 MTPA to 7.3 MTPA liquid steel within the premises of Visakhapatnam Steel Plant of M/s RINL-VSP. I also confirm that the Consultant Organization shall be fully accountable for any misleading information mentioned in this statement.

Signature:

(C. D. GOSWAMI)
GM
ENV. ENGG. Section
&
Authorised Signatory for
EIA Report and EIA Accreditation

Name: C. D. Goswami

Designation: General Manager (Env. & SD)

Name of the EIA Consultant Organization: MECON Limited

NABET Certificate No. & Issue Date: NABET/EIA/1619/RA 0068 valid upto 02.10.2019

Quality Council of India
National Accreditation Board for Education & Training

CERTIFICATE OF ACCREDITATION

MECON Limited
Vivekanand Path, P.O Doranda, Ranchi - 834002

are accredited as Category - A organization under the QCI-NABET Scheme for Accreditation of EIA Consultant Organizations: Version 3 for preparing EIA/EMP reports in the following sectors:

Sl. No.	Sector Description	Sector (as per) NABET	Sector (as per) MoEFCC	Cat.
1	Mining of minerals including opencast/ underground mining	1	1 (a) (i)	A
2	Offshore and onshore oil and gas exploration, development & production	2	1 (b)	A
3	River Valley projects	3	1 (c)	A
4	Thermal power plants	4	1 (d)	A
5	Nuclear power projects and processing of nuclear fuel	5	1 (e)	A
6	Coal washeries	6	2 (a)	A
7	Mineral beneficiation including pelletisation	7	2 (b)	A
8	Metallurgical industries (ferrous & non-ferrous)	8	3 (a)	A
9	Oil & gas transportation pipeline (crude and refinery/ petrochemical products), passing through national parks/ sanctuaries/coral reefs /ecologically sensitive Areas including LNG terminal	27	6 (a)	A
10	Isolated storage & handling of hazardous chemicals (As per threshold planning quantity indicated in column 3 of Schedule 2 & 3 of MSIHC Rules 1989 amended 2000)	28	6 (b)	B
11	All ship breaking yards including ship breaking units	30	7 (b)	A
12	Industrial estates/ parks/ complexes/ Areas, export processing zones(EPZs), Special economic zones (SEZs), Biotech parks, Leather complexes	31	7 (c)	A
13	Ports, harbours, break waters and dredging	33	7 (e)	A
14	Highways	34	7 (f)	A
15	Townships and Area development projects	39	8 (b)	A

Note: Name of approved EIA Coordinators and Functional Area Experts are mentioned in RA AC minutes dated July 14, 2017 posted on QCI-NABET website.

The Accreditation shall remain in force subject to continued compliance to the terms and conditions mentioned in NABET's letter of accreditation bearing no. QCI/NABET/ENV/ACO/17/0369 dated Aug. 09, 2017.The accreditation needs to be renewed before the expiry date by MECON Limited, Ranchi, following due process of assessment.

Sr. Director |NABET
Dated: Aug. 09, 2017

Certificate No.
NABET/ EIA/1619/ RA 0068

Valid till Date
02.10.2019

For the updated List of Accredited Consultants with approved sectors please refer QCI-NABET website.

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Coverage of TOR Points

Index: ToR Coverage in EIA Report

SN.	TOR Points	Coverage In EIA Report	Remarks
Standard ToR for Violation Cases			
1	Project description, its importance and the benefits,	Chapter 1 Section 1.3 & 1.4 Page 4 - 8	
2	Project site details (location, Toposheet of the study area of 10 km, coordinates, google map, layout map, land use, geological features and geo-hydrological status of the study area, drainage),	Chapter 1 Section 1.3.4, Page 6,7 Chapter 3 Section 3.6 & 3.7 Page 83 - 95	
3	Land use as per the approved Master Plan of the area, Permission/approvals required from the land owning agencies, Development Authorities, Local Body, Water Supply & Sewerage Board, etc,	Water drawal permission attached as Annexure 2.2	Proposed expansion is taking place within the existing plant boundary.
4	Land acquisition status, R&R details,		Proposed expansion is taking place within the existing plant boundary. No R&R Involved.
5	Forest and Wildlife and eco-sensitive zones, if any in the study area of 10 km - Clearances required under the Forest (Conservation) Act, 1980, the Wildlife (Protection) Act, 1972 and/or the Environment (Protection) Act, 1986,		No Forest, Wildlife and eco-sensitive zones in the study area of 10 km
6	Baseline environmental study for ambient air (PM_{10}, $PM_{2.5}$, SO_2, NOx& CO), water (both surface and ground), noise and soil for one month (except monsoon period) as per MoEF&CC/CPCB guidelines at minimum 5 locations in the study area of 10 km,	Chapter 3 Section 3.8-3.12 Page 95 - 121	EIA/EMP is prepared by using existing baseline data generated by NABL Accredited Laboratory of Bhagwati Anna labs for the three months period of Post monsoon season of 2016 at 8 locations.
7	Details on flora and fauna and socio-economic aspects in the study area	Chapter 3 Section 3.14 & 3.15 Page 122 - 146	
8	Likely impact of the project on the environmental parameters (ambient air, surface and ground water, land, flora and fauna and socio-economic, etc),	Chapter 4 Section 4.2 Page 159-184	
9	Source of water for different identified	Chapter 2	

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SN.	TOR Points	Coverage In EIA Report	Remarks
	purposes with the permissions required from the concerned authorities, both for surface water and the ground water (by CGWA) as the case may be, Rain water harvesting, etc,	Section 2.6 Page 51-53	
10	Waste water management (treatment, reuse and disposal) for the project and also the study area,	Chapter 2 Section 2.12.2 Page 64-68 Chapter 4 Section 4.2.2 Page 176-179	
11	Management of solid waste and the construction & demolition waste for the project vis-à-vis the Solid Waste Management Rules, 2016 and the Construction & Demolition Rules, 2016,	Chapter 4 4.2.4 Page 180-183	
12	Energy efficient measures (LED lights, solar power, etc) during construction as well as during operational phase of the project,	Chapter 2 Section 2.12.3 Page 68-76	
13	Assessment of ecological damage with respect to air, water, land and other environmental attributes. The collection and analysis of data shall be done by an environmental laboratory duly notified under the Environment (Protection) Act, 1986, or an environmental laboratory accredited by NABL, or a laboratory of a Council of Scientific and Industrial Research (CSIR) institution working in the field of environment.	Chapter 11 Section 11.6 to 11.9 Page 326 – 394 Table 11.22 Page 395	
14	Preparation of EMP comprising remediation plan and natural and community resource augmentation plan corresponding to the ecological damage assessed and economic benefits derived due to violation.	Chapter 11 Section 11.5 to 11.10 Page 324 - 404	
15	The remediation plan and the natural and community resource augmentation plan to be prepared as an independent chapter in the EIA report by the accredited consultants.	Chapter 11 Page 321 - 404	
Specific ToRs as recommended by EAC			

SN.	TOR Points	Coverage In EIA Report	Remarks
1	The State Government/SPCB to take action against the project proponent under the provisions of section 19 of the Environment (Protection) Act, 1986, and further no consent to operate for expansion project to be issued till the project is granted EC for the expansion.	-	Case filed on RINL by APPCB on 09.01.2019.
2	The project proponent shall be required to submit a bank guarantee equivalent to the amount of remediation plan and natural and community resource augmentation plan with the SPCB prior to the grant of EC. The quantum shall be recommended by the EAC and finalized by the regulatory authority. The bank guarantee shall be released after successful implementation of the EMP, followed by recommendations of the EAC and approval of the regulatory authority.	-	RINL will deposit a bank guarantee equivalent to the amount of Rs 920 lakhs towards remediation plan and natural & community resource augmentation plan.
3	Assessment of ecological damage with respect to air, water, land and other environmental attributes. The collection and analysis of data shall be done by an environmental laboratory duly notified under the Environment (Protection) Act, 1986, or an environmental laboratory accredited by NABL, or a laboratory of a Council of Scientific and Industrial Research (CSIR) institution working in the field of environment.	Chapter 11 Section 11.6 to 11.9 Page 326 – 394 Table 11.22 Page 395	
4	Preparation of EMP comprising remediation plan and natural and community resource augmentation plan corresponding to the ecological damage assessed and economic benefits derived due to violation.	Chapter 11 Section 11.5 to 11.10 Page 324 - 404	
5	The remediation plan and the natural and community resource augmentation plan to be prepared as an independent chapter in the EIA report by the accredited consultants.	Chapter 11 Page 321 - 404	
6	Since Public Hearing (PH) has been conducted on dated 19.07.2017 covering all the issues, committee felt that one time PH as per the order of Hon'ble High Court of Madras has already taken care and hence repeat PH is not required	PH proceedings given in Chapter 7 Section 7.15 Page 279	Noted
7	EIA/EMP may be prepared by using	Chapter 3	Noted

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SN.	TOR Points	Coverage In EIA Report	Remarks
	existing baseline data generated.	Page 77-158	
8	EIA/EMP should cover the validation of current practices also predict cumulative Impact covering total production capacity for each component of environment.	Chapter 2 Section 2.12.3 Page 68-76 Chapter 4 Section 4.2 Page 159-184	
9	Selection of technology and adaption of clean technology for both production & environment be addressed in EIA/EMP report.	Chapter 2 Section 2.12.3 Page 68-76	
10	Fund allocation for Corporate Environment Responsibility (CER) shall be made as per Ministry's O.M. No. 22-65/2017-IA.III dated 1st May, 2018 for various activities therein. The details of fund allocation and activities for CER shall be incorporated in EIA/EMP report.	Chapter 4 Section 4.7 Page 208-209	Noted
	Generic TOR in respect of Industry Sector		
1.	**Executive Summary**	-	Prepared and attached along with EIA
2.	**Introduction**	Chapter 1 Page 1	
i.	Details of the EIA Consultant including NABET accreditation	Section 1.3.2 Page 4	
ii.	Information about the project proponent	Section 1.3.1 Page 4	
iii.	Importance and benefits of the project	Chapter 1 Section 1.4 Page 8 & Chapter 8 Page 305-307	
3.	Project Description	Chapter 2 Page 12 - 76	
i.	Cost of project and time of completion.	Section 2.11 Page 58,59	
ii.	Products with capacities for the proposed project.	Section 2.3 Page 14-18	
iii.	If expansion project, details of existing products with capacities and whether adequate land is available for expansion, reference of earlier EC if any.	Section 2.3 & 2.4 Page 14-48	
iv.	List of raw materials required and their source along with mode of transportation.	Section 2.5 Page 48-51	
v.	Other chemicals and materials required with quantities and storage capacities	Section 2.5 Page 48-51	

SN.	TOR Points	Coverage In EIA Report	Remarks
vi.	Details of Emission, effluents, hazardous waste generation and their management.	Chapter 2 Section 2.12 Page 60-68 Chapter 4 Section 4.2 Page 160-183	
vii.	Requirement of water, power, with source of supply, status of approval, water balance diagram, man-power requirement (regular and contract).	Section 2.6, 2.7, 2.8 & 2.9 Page 52 - 59	
viii.	The project proponent shall furnish the requisite documents from the competent authority in support of drawl of ground water and surface water and supply of electricity.	Section 2.6 Page 52 Annexure 2.2 Section 2.8 Page 58	No ground water is being used for the project. Water drawal permission attached as Annexure 2.2.
ix.	Process description along with major equipment and machineries, process flow sheet (Quantitative) from raw material to products to be provided.	Chapter 2 Section 2.3 Page 14-48	
x.	Hazard identification and details of proposed safety systems.	Chapter 7 Section 7.5 Page 237	
xi.	Expansion/modernization proposals:		
a.	Copy of all the Environmental Clearance(s) including Amendments thereto obtained for the project from MOEF&CC/SEIAA shall be attached as an Annexure. A certified copy of the latest Monitoring Report of the Regional Office of the Ministry of Environment, Forests and Climate Change as per circular dated 30th May, 2012 on the status of compliance of conditions stipulated in all the existing environmental clearances including Amendments shall be provided. In addition, status of compliance of Consent to Operate for the ongoing /existing operation of the project from SPCB/PCC shall be attached with the EIA-EMP report.	Annexure 1.1 Annexure 1.2 Annexure 3.5	
b.	In case the existing project has not obtained environmental clearance, reasons for not taking EC under the provisions of the EIA Notification 1994 and/or EIA Notification 2006 shall be provided. Copies of Consent to	-	Since the construction activities for proposed expansion were started prior to getting EC, the proposal is being

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SN.	TOR Points	Coverage In EIA Report	Remarks
	Establish/No Objection Certificate and Consent to Operate (in case of units operating prior to EIA Notification 2006, CTE and CTO of FY 2005-2006) obtained from the SPCB shall be submitted. Further, compliance report to the conditions of consents from the SPCB shall be submitted.		considered as violation case.
4.	**Site Details**		
i.	Location of the project site covering village, Taluka / Tehsil, District and State, Justification for selecting the site, whether other sites were considered.	Chapter 1 Section 1.3.4 Page 6	Proposed expansion within the existing plant boundary of VSP
ii.	A topo-sheet of the study area of radius of 10 km and site location on 1:50,000/1:25,000 scale on an A3/A2 sheet. (including all eco-sensitive areas and environmentally sensitive places)	Drg. No. MEC./11/S2/Q7H4 /02	
iii.	Co-ordinates (lat-long) of all four corners of the site.	Chapter 1 Figure 1.2 Page 11	
iv.	Google map-Earth downloaded of the project site.	Chapter 1 Figure 1.1 and 1.2 Page 10 & 11	
v.	Layout maps indicating existing unit as well as proposed unit indicating storage area, plant area, greenbelt area, utilities etc. If located within an Industrial area/ Estate/ Complex, layout of Industrial Area indicating location of unit within the Industrial area/ Estate.	Layout Drg. No. VSP-DEG-7.3-EXP-PGL-01	
vi.	Photographs of the proposed and existing (if applicable) plant site. If existing, show photographs of plantation/greenbelt, in particular.	Chapter 11, Figure 11.2-11.4,11.8,11.12-11.15,11.27-11.29 Page 332-357	
vii.	Land-use break-up of total land of the project site (identified and acquired), government/ private - agricultural, forest, wasteland, water bodies, settlements, etc shall be included (not required for industrial area).	Chapter 3 Section 3.6 Page 84-87	
viii.	A list of major industries with name and type within study area (10km radius) shall be incorporated. Land use details of the study area.	Chapter 1 Section 1.3.6 Page 7-8	

SN.	TOR Points	Coverage In EIA Report	Remarks
ix.	Geological features and Geo-hydrological status of the study area shall be included.	Chapter 3 Section 3.7 Page 87-95	
x.	Details of Drainage of the project up to 5km radius of study area. If the site is within 1 km radius of any major river, peak and lean season river discharge as well as flood occurrence frequency based on peak rainfall data of the past 30 years. Details of Flood Level of the project site and maximum Flood Level of the river shall also be provided. (mega green field projects)	Chapter 3 Section 3.5.3 Page 82 Chapter 7 Section 7.13.3 Page 270-275	
xi.	Status of acquisition of land. If acquisition is not complete, stage of the acquisition process and expected time of complete possession of the land.	Not Applicable	Not Applicable; The proposed project is coming in already acquired land.
xii.	R&R details in respect of land in line with state Government policy	Not Applicable	Not Applicable
5.	**Forest and Related Issues (if applicable)**		
i.	Permission and approval for the use of forest land (forestry clearance), if any, and recommendations of the State Forest Department. (if applicable).	Not Applicable	No Forest Land is involved in the project
ii.	Land use map based on High resolution satellite imagery (GPS) of the proposed site delineating the forestland (in case of projects involving forest land more than 40 ha).	Not Applicable	No Forest Land is involved in the project
iii.	Status of Application submitted for obtaining the stage I forestry clearance along with latest status shall be submitted.	Not Applicable	No Forest Land is involved in the project
iv.	The projects to be located within 10 km of the National Parks, Sanctuaries, Biosphere Reserves, Migratory Corridors of Wild Animals, the project proponent shall submit the map duly authenticated by Chief Wildlife Warden showing these features vis-à-vis the project location and the recommendations or comments of the Chief Wildlife Warden-thereon.	Not Applicable	There is no National Parks, Sanctuaries, Biosphere Reserves, Migratory Corridors of Wild Animals within study area
v.	Wildlife Conservation Plan duly authenticated by the Chief Wildlife Warden of the State Government for conservation of Schedule I fauna, if any	Not Applicable	

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SN.	TOR Points	Coverage In EIA Report	Remarks
	exists in the study area.		
vi.	Copy of application submitted for clearance under the Wildlife (Protection) Act,1972, to the Standing Committee of the National Board for Wildlife	Not Applicable	
6.	**Environmental Status**		
i.	Determination of atmospheric inversion level at the project site and site-specific micro-meteorological data using temperature, relative humidity, hourly wind speed and direction and rainfall.	Chapter 3 Section 3.8 Page 95-100	
ii.	AAQ data (except monsoon) at 8 locations for PM_{10}, $PM_{2.5}$, SO_2, NO_X, CO and other parameters relevant to the project shall be collected. The monitoring stations shall be based CPCB guidelines and take into account the pre-dominant wind direction, population zone and sensitive receptors including reserved forests.	Chapter 3 Section 3.9 Page 100-108	
iii.	Raw data of all AAQ measurement for 12 weeks of all stations as per frequency given in the NAAQM Notification of Nov. 2009 along with – min., max., average and 98% values for each of the AAQ parameters from data of all AAQ stations should be provided as an annexure to the EIA Report.	Annexure 3.3	
iv.	Surface water quality of nearby River (60m upstream and downstream) and other surface drains at eight locations as per CPCB/MoEF&CC guidelines.	Chapter 3 Section 3.10 Page 109-117	
v.	Whether the site falls near to polluted stretch of river identified by the CPCB / MoEF&CC.	No	
vi.	Ground water monitoring at minimum at 8 locations shall be included.	Chapter 3 Section 3.10 Page 109-117	
vii.	Noise levels monitoring at 8 locations within the study area.	Chapter 3 Section 3.11 Page 117-119	
viii.	Soil Characteristic as per CPCB guidelines.	Chapter 3 Section 3.12 Page 119-121	
ix.	Traffic study of the area, type of vehicles, frequency of vehicles for transportation of materials, additional traffic due to	Chapter 3 Section 3.13 Page 121	

SN.	TOR Points	Coverage In EIA Report	Remarks
	proposed project, parking arrangement etc.		
x.	Detailed description of flora and fauna (terrestrial and aquatic) existing in the study area shall be given with special reference to rare, endemic and endangered species. If Schedule-I fauna are found within the study area, a Wildlife Conservation Plan shall be prepared and furnished.	Chapter 3 Section 3.14 Page 122-138	
xi.	Socio-economic status of the study area.	Chapter 3 Section 3.15 Page 138-146	
7.	**Impact Assessment and Environment Management Plan**		
i.	Assessment of ground level concentration of pollutants from the stack emission based on site-specific meteorological features. In case the project is located on a hilly terrain, the AQIP Modelling shall be done using inputs of the specific terrain characteristics for determining the potential impacts of the project on the AAQ. Cumulative impact of all sources of emissions (including transportation) on the AAQ of the area shall be well assessed. Details of the model used and the input data used for modelling shall also be provided. The air quality contours shall be plotted on a location map showing the location of project site, habitation nearby, sensitive receptors, if any.	Chapter 4 Section 4.2 Page 159-176	
ii.	Water Quality modelling – in case, if the effluent is proposed to be discharged into the local drain, then Water Quality Modelling study should be conducted for the drain water taking into consideration the upstream and downstream quality of water of the drain.	Not Applicable	No additional effluents shall be discharged
iii.	Impact of the transport of the raw materials and end products on the surrounding environment shall be assessed and provided. In this regard, options for transport of raw materials and finished products and wastes (large quantities) by rail or rail-cum road transport or conveyor-cum-rail transport	Chapter 4 Section 4.2.1 (d) Page 173	

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SN.	TOR Points	Coverage In EIA Report	Remarks
	shall be examined.		
iv.	A note on treatment of wastewater from different plant operations, extent recycled and reused for different purposes shall be included. Complete scheme of effluent treatment. Characteristics of untreated and treated effluent to meet the prescribed standards of discharge under E(P) Rules.	Chapter 2 Section 2.12.2 Page 64-68 Chapter 4 Section 4.2.2 Page 176-179	
v.	Details of stack emission and action plan for control of emissions to meet standards.	Chapter 4 Section 4.2.1(c) Page 164-173	
vi.	Measures for fugitive emission control	Chapter 4 Section 4.2.1 Page 175-176	
vii.	Details of hazardous waste generation and their storage, utilization and disposal. Copies of MOU regarding utilization of solid and hazardous waste shall also be included. EMP shall include the concept of waste-minimization, recycle/reuse/ recover techniques, Energy conservation, and natural resource conservation.	Chapter 4 Section 4.2.4 Page 180-184	
viii.	Proper utilization of fly ash shall be ensured as per Fly Ash Notification, 2009. A detailed plan of action shall be provided.	Not Applicable	No additional fly ash generation for proposed expansion
ix.	Action plan for the green belt development plan in 33 % area i.e. land with not less than 1,500 trees per ha. Giving details of species, width of plantation, planning schedule etc. shall be included. The green belt shall be around the project boundary and a scheme for greening of the roads used for the project shall also be incorporated.	Chapter 4 Section 4.3.3 Page 187-191	
x.	Action plan for rainwater harvesting measures at plant site shall be submitted to harvest rainwater from the roof tops and storm water drains to recharge the ground water and also to use for the various activities at the project site to conserve fresh water and reduce the water requirement from other sources.	Chapter 4 Section 4.3.1 Page 185-186	
xi.	Total capital cost and recurring cost/annum for environmental pollution control measures shall be included.	Chapter 6 Section 6.2.5 Page 226	

SN.	TOR Points	Coverage In EIA Report	Remarks
xii.	Action plan for post-project environmental monitoring shall be submitted.	Chapter 6 Section 6.2.3 Page 219-225	
xiii.	Onsite and Offsite Disaster (natural and Man-made) Preparedness and Emergency Management Plan including Risk Assessment and damage control. Disaster management plan should be linked with District Disaster Management Plan.	Chapter 7 Section 7.13 Page 261-275	
8.	**Occupational Health**		
i.	Details of existing Occupational & Safety Hazards. What are the exposure levels of above mentioned hazards and whether they are within Permissible Exposure level (PEL). If these are not within PEL, what measures the company has adopted to keep them within PEL so that health of the workers can be preserved,	Chapter 4 Section 4.4 Page 192-197	
ii.	Details of exposure specific health status evaluation of worker. If the workers' health is being evaluated by pre designed format, chest x rays, Audiometry, Spirometry, Vision testing (Far & Near vision, colour vision and any other ocular defect) ECG, during pre- placement and periodical examinations give the details of the same. Details regarding last month analyzed data of abovementioned parameters as per age, sex, duration of exposure and department wise.	Chapter 4 Section 4.5 Page 197-199	
iii.	Annual report of health status of workers with special reference to Occupational Health and Safety.	Chapter 4 Section 4.5 Page 197-199	
iv.	Plan and fund allocation to ensure the occupational health & safety of all contract and casual workers.	Chapter 4 Section 4.5 Page 197-199	
9.	**Corporate Environmental Policy**		
i.	Does the company have a well laid down Environment Policy approved by its Board of Directors? If so, it may be detailed in the EIA report.	Chapter 9 Annexure 9.1	
ii.	Does the Environment Policy prescribe for standard operating process / procedures to bring into focus any infringement / deviation / violation of the environmental or forest norms / conditions? If so, it may be detailed in the EIA.	Chapter 9 Page 308	

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SN.	TOR Points	Coverage In EIA Report	Remarks
iii.	What is the hierarchical system or Administrative order of the company to deal with the environmental issues and for ensuring compliance with the environmental clearance conditions? Details of this system may be given.	Chapter 9 Figure 9.1 Page 310	
iv.	Does the company have system of reporting of non-compliances / violations of environmental norms to the Board of Directors of the company and / or shareholders or stakeholders at large? This reporting mechanism shall be detailed in the EIA report	Chapter 9 Section 9.2.1 Page 309	
10.	Details regarding infrastructure facilities such as sanitation, fuel, rest room etc. to be provided to the labour force during construction as well as to the casual workers including truck drivers during operation phase.		Suitable infrastructure facilities such as sanitation, fuel, rest room etc already exist for the workers. Same shall be used for the proposed project. Arrangements are made with local traders / business persons to supply kerosene & fuel-wood to eliminate the possibilities of illegal felling of trees. Arrangements are also made by VSP as well as local district health authorities to hold periodical medical camps for the labourers at regular intervals.
11.	**Enterprise Social Commitment (ESC)**		
i.	To address the Public Hearing issues, 2.5% of the total project cost of (Rs.....crores), amounting to Rs.....crores, shall be earmarked by the project proponent, towards Enterprise Social Commitment (ESC). Distinct ESC projects shall be carved out based on the local public hearing issues. Project estimate shall be prepared based on PWD schedule of rates for each distinct Item and schedule for	Chapter 4 Section 4.7 Page 208-209	Fund allocation for Corporate Environment Responsibility (CER) made as per Ministry's O.M. No. 22-65/2017-IA.III dated 1st May, 2018 for various activities therein.

SN.	TOR Points	Coverage In EIA Report	Remarks
	time bound action plan shall be prepared. These ESC projects as indicated by the project proponent shall be implemented along with the main project. Implementation of such program shall be ensured by constituting a Committee comprising of the project proponent, representatives of village Panchayat & District Administration. Action taken report in this regard shall be submitted to the Ministry's Regional Office. No free distribution/donations and or free camps shall be included in the above ESC budget		
12.	Any litigation pending against the project and/or any direction/order passed by any Court of Law against the project, if so, details thereof shall also be included. Has the unit received any notice under the Section 5 of Environment (Protection) Act, 1986 or relevant Sections of Air and Water Acts? If so, details thereof and compliance/ATR to the notice(s) and present status of the case.	Nil	No previous litigation pending against the project related to environmental matters
13.	A tabular chart with index for point wise compliance of above TORs.	Given	
14.	The TORs prescribed shall be valid for a period of three years for submission of the EIA-EMP reports along with Public Hearing Proceedings (wherever stipulated).		Noted
	The following General Points shall be covered		
i.	All documents shall be properly indexed, page numbered		Noted & Followed
ii.	Period/date of data collection shall be clearly indicated.		Noted & Followed
iii.	Authenticated English translation of all material in Regional languages shall be provided.		Noted
iv.	The letter / application for environmental clearance shall quote the MOEF&CC file No. and also attach the file.		Noted
v.	The copy of the letter received from the Ministry shall be also attached as an annexure to the final EIA-EMP Report.		Noted
vi.	The index of the final EIA-EMP report must indicate the specific chapter and		Noted

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SN.	TOR Points	Coverage In EIA Report	Remarks
	page no. of the EIA-EMP Report.		
vii.	While preparing the EIA report, the instructions for the proponents and instructions for the consultants issued by MOEF&CC vide O.M. No. J-11013/41/2006-IA.II (I) dated 4th August, 2009, which are available on the website of this Ministry shall also be followed.		Noted
viii.	The consultants involved in the preparation of EIA-EMP report after accreditation with Quality Council of India (QCI)/National Accreditation Board of Education and Training (NABET) would need to include a certificate in this regard in the EIA-EMP reports prepared by them and data provided by other organization/Laboratories including their status of approvals etc. Name of the Consultant and the Accreditation details shall be posted on the EIA-EMP Report as well as on the cover of the Hard Copy of the Presentation material for EC presentation.		Noted & Followed
ix.	ToRs' prescribed by the Expert Appraisal Committee (Industry) shall be considered for preparation of EIA-EMP report for the project in addition to all the relevant information as per the 'Generic Structure of EIA' given in Appendix III and IIIA in the EIA Notification, 2006. Where the documents provided are in a language other than English, an English translation shall be provided. The draft EIA-EMP report shall be submitted to the State Pollution Control Board of the concerned State for conduct of Public Hearing. The SPCB shall conduct the Public Hearing/public consultation, district-wise, as per the provisions of EIA notification, 2006. The Public Hearing shall be chaired by an Officer not below the rank of Additional District Magistrate. The issues raised in the Public Hearing and during the consultation process and the commitments made by the project proponent on the same shall be included separately in EIA-EMP Report in a separate chapter and summarised in a		Noted

SN.	TOR Points	Coverage In EIA Report	Remarks
	tabular chart with financial budget (capital and revenue) along with time-schedule of implementation for complying with the commitments made. The final EIA report shall be submitted to the Ministry for obtaining environmental clearance		
	Additional TORs		
1.	Manganese ore/coal linkage documents along with the status of environmental clearance of manganese ore and coal mines	Chapter 2 Section 2.5 Page 49	Additional coal required for the expansion shall be imported from Australia, USA, New Zealand, Mozambique & Indonesia
2.	Quantum of production of coal and iron ore from coal & Manganese ore mines and the projects they cater to. Mode of transportation to the plant and its impact	Chapter 2 Section 2.5 Page 49	Additional coal required for the expansion shall be imported from Australia, USA, New Zealand, Mozambique & Indonesia
3.	Recent land-use map based on satellite imagery. High-resolution satellite image data having 1m-5m spatial resolution like quickbird, Ikonos, IRS P-6 pan sharpened etc. for the 10 Km radius area from proposed site. The same shall be used for land used/land - cover mapping of the area.	Chapter 3 Section 3.6 Page 83 Drg. No. MEC/11/S2/Q7H4/ 03	
4.	PM (PM_{10} and $P_{2.5}$) present in the ambient air must be analysed for source analysis - natural dust / RSPM generated from plant operations (trace elements) of PM_{10} to be carried over.	Chapter 3 Section 3.9 Page 100	
5.	All stock piles will have to be on top of a stable liner to avoid leaching of materials to ground water.	-	Noted & shall be complied
6.	Plan for the implementation of the recommendations made for the steel plants in the CREP guidelines.	Chapter 9 Section 9.4 Page 314	
7.	Plan for slag utilization	Chapter 4 Section 4.2.4 Page 180	
8.	Plan for utilization of energy in off gases (coke oven, blast furnace)	Chapter 2 Section 2.3.7	

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SN.	TOR Points	Coverage In EIA Report	Remarks
		Page 42	
9.	System of coke quenching adopted with justification.	Chapter 2 Section 2.3.1 Page 19	
10	Trace metals Mercury, arsenic and fluoride emissions in the raw material.	Chapter 3 Section 3.16.7 Page 155	
11	Trace metals in waste material especially slag.	Chapter 3 Section 3.16.7 Page 155	
12	Trace metals in water	Chapter 3 Section 3.10 Page 109-117	

Executive Summary

EXECUTIVE SUMMARY

1.0 INTRODUCTION

Visakhapatnam Steel Plant (VSP), the first coast-based integrated iron and steel plant in the country was set up in the year 1990 at Visakhapatnam in Andhra Pradesh by M/s. Rashtriya Ispat Nigam Limited (RINL) - a Navratna PSE under Ministry of Steel, Government of India.

RINL had received Environmental Clearance (EC) for increase in of Liquid Steel production from 3.5 to 6.3 MTPA from Ministry of Environment, Forest and Climate Change (MoEFCC), Govt. of India.

However, after installation of all units for achieving rated capacity of 6.3 MTPA, RINL started revamping / capital repairs of the existing critical equipment of the plant installed in the year 1990. This was absolutely essential to ensure paramount safety and in addition would help in meeting the upgraded environmental norms specified in MoEF's notification vide GSR.277(E) dt 31st March, 2012.

This modernization and revamping drive led to enhanced capacities by upto 1 MTPA. However, since revamping has resulted in producing additional 1 MT without prior EC as per EIA Notification 2006, it may be considered as a "Violation" of the provisions of the EIA Notification, 2006.

RINL has presented the proposal at the 8th EAC meeting held on 13th -14th June 2018 and again at the 9th EAC meeting held on 27 -28th June 2018 for proposals involving violation of EIA notification 2006.

Based on the TOR, EIA / EMP study was conducted and report prepared for expansion of RINL-VSP plant from 6.3 to 7.3 by revamping and modernization plant.

EIA report MEC/11/S2/Q7H4/EIA-EMP/2482/R.0 dated August 2018 was submitted to MOEFCC and the project was appraised at the 13th meeting of Expert Appraisal Committee for the proposal involving violation held on 18th -20th September 2018. The EAC deferred the proposal and suggested RINL to validate the ambient base line data with fresh baseline data generation for one month as the base line data used in the report was two years old and sought additional information. RINL was also asked to revise the EIA report.

2.0 PROJECT DESCRIPTION

The proposal involves revamping of existing Sinter plants, Blast furnaces, Rolling mills and associated auxiliary facilities along with installation of a new 0.84 MTPA coke oven and a rebar mill. The production of hot metal shall increase from 6.5 MTPA to 7.5 MTPA and liquid steel shall increase from 6.3 MTPA to 7.3 MTPA.

2.1 Location of the Project

The location of project is inside the existing plant boundary of RINL. It is located in Village Gajuwaka, District Visakhapatnam, State Andhra Pradesh. The coordinates of the plant are 17°34'29" to 17°38'49" N, 83°09'23" to 83°14'12" E.

The nearest railway station is Duvvada Railway station on Visakhapatnam – Vijaywada Section of Howrah – Chennai main line at an aerial distance of ~8 km North-north-west plant. The nearest National Highway is NH – 5 which links Chennai with Kolkata via Vijaywada, Visakhapatnam, Bhubaneshwar and Cuttack, located ~5.5 km north of the steel plant. The steel plant is linked to NH-5 by a 6-lane road. The nearest airport is Visakhapatnam Airport which is at an aerial distance of ~11 km north-north-east of the

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plant. The nearest port is Gangavaram, which is located just beyond the north-eastern corner of the plant.

2.2 Raw Material Requirement

At present, the total requirement of raw material for the existing plant at 6.3 MTPA is around 23 MTPA. This also includes the boiler coal required for power plant. Majority of which is transported through rail and sea ways. Iron ore lumps are sourced from NMDC's Bailadila mines and transported to the plant from the mines by railway wagons. Fluxes are sourced from RINL's captive mines and are brought to the plant by railway wagons. Indigenous coal (coking and thermal) are brought to the plant by railway wagons. Iron ore fines and imported coal are transported by ships to adjacent Gangavaram Port from where it is transported to plant site through conveyors and railway wagons. After the proposed expansion, around 3.5 MTPA of additional raw material shall be required for the expansion units.

2.3 Utilities Consumption

The indicative consumption of utilities at 6.3 MTPA and 7.3 MTPA stage are given in Table below. No additional water shall be required to be drawn from outside for the new unit.

Sl. No.	Utility	Unit	6.3 STAGE		7.3 STAGE	
1	Power	kWh	523.6		542.6	
2	Water	MGD	38		45	
3	Fuel	Nm^3/hr	**Generation:** CO-155950 BF-1250476 LD-65625	**Consumption :** CO-137257 BF-712703 LD-64726 Surplus gas for Power generation	**Generation:** CO-197231 BF-1444048 LD-76042	**Consumption :** CO-139715 BF-865594 LD-70468 Surplus gas for Power generation

2.4 Land Requirement

No additional land outside the plant is required as the present expansion is within the plant premises. The new coke oven plant (COB-5) is under construction over ~100 acres within the premises of existing Steel Plant adjacent to the existing coke oven complex.

2.5 Project Cost

The estimated total cost for the proposed activities is around Rs. 9439.53 Crores, out of which Rs 4222 Crores is for Revamping & Augmentation of existing units and the balance is for the proposed new units. Of this amount, the cost of Environment Protection control measures is about 6% of the project cost.

3.0 DESCRIPTION OF THE ENVIRONMENT

This EIA/EMP report has been prepared on the basis of one full season baseline environmental data monitored during full Post-monsoon season for three months from October to December 2016 period within 10- km radial distance all around the existing steel plant.

The baseline data includes micro-meteorological conditions, ambient and work zone air quality, noise levels, water quality and soil quality. Site survey has been conducted for studying the flora and fauna, socio-economic conditions, land use, etc. The collected data were analyzed for identifying, predicting and evaluating the contribution due to expansion

of steel plant in ecological damage during construction phase of the project. The maximum anticipated damages were assessed and based on these a "Natural and Community Resource Augmentation Plan" has been prepared.

3.1 Meteorological Data

A micro-meteorological monitoring station was set up on the roof of the Project Building of RINL's Visakhapatnam Steel Plant. Winds indicate that the study area winds are predominantly coming from East. Overall (24 hours), the predominant wind direction E (12.73%), followed by N (7.47%) and NE (6.70%). Calm conditions prevailed for 55.30% of the time. During the entire monitoring period the predominant wind speeds were in the range of 0.4 - 5 m/s.

3.2 Ambient Air quality

Ambient Air Quality (AAQ) was monitored at eight monitoring stations. The results are compared with National Ambient Air Quality Standards (NAAQS). The values of PM_{10}, $PM_{2.5}$, SO_2, NOx, O_3 and CO at all the monitoring stations (**Table-ES1**) were found well within the respective permissible limit for Industrial, Residential, Rural and Other Areas. The presence of Poly-aromatic Hydrocarbons (PAH) i.e. Benzo-a-pyerene (BaP) in particulate matter was analyzed and found within the norms.

Table ES1: Summarized Ambient Air Quality monitoring results

Parameter ($\mu g/m^3$)	Statistical data	Devada (A1)	Gorlavanipalem (A2)	Bhavani Nagar near Nadupudi RF (A3)	Sector 3, VSP Quarters (A4)	Chipurapalli (A5)	Duvvada (A6)	Gangavaram Port Adjacent (A7)	Gajuwaka (A8)
PM_{10}	Min	43.8	45.9	45.6	45.9	48.6	65.8	64.3	74.5
	Max	58.4	61.2	61.2	61.2	61.1	82.6	84.1	83.9
	C_{98}	58.3	60.0	60.7	60.8	60.7	82.5	84.0	83.5
$PM_{2.5}$	Min	21.7	20.2	20.4	20.4	21.3	31.1	26.1	34.7
	Max	30.0	30.2	29.3	29.1	32.8	58.1	51.4	51.4
	C_{98}	29.3	28.4	29.2	28.8	32.8	57.0	51.3	51.3
SO_2	Min	11.6	13.2	12.6	12.3	12.4	12.5	12.8	12.3
	Max	14.5	17.5	15.1	16.1	16.1	17.0	15.6	16.0
	C_{98}	14.4	17.2	15.1	15.7	16.1	16.8	15.8	15.7
NOx	Min	15.8	17.4	16.3	14.8	14.5	14.7	16.1	18.1
	Max	24.1	24.5	25.6	19.3	24.5	22.8	28.1	28.1
	C_{98}	23.2	24.1	25.0	19.2	24.0	22.6	26.3	27.6
CO	Min	0.41	0.50	0.40	0.51	0.41	0.40	0.96	1.00
	Max	0.75	0.70	0.70	9.60	9.60	1.61	1.61	1.60
	C_{98}	0.73	0.70	0.70	5.86	5.90	1.61	1.51	1.55
Benzene	Min	1.18	1.20	1.20	1.85	1.21	1.28	1.26	2.16
	Max	3.12	3.10	4.10	3.95	4.11	4.11	3.22	3.85
	C_{98}	3.01	2.80	4.10	3.77	3.71	3.99	3.17	3.75
BaP (ng/m^3)	Min	0.16	0.20	0.20	0.19	0.15	0.18	0.21	0.26
	Max	0.32	0.30	0.30	0.42	0.41	0.51	0.61	0.56
	C_{98}	0.32	0.30	0.30	0.42	0.41	0.48	0.61	0.56

As per the additional details sought by EAC, fresh baseline AAQ data was generated for one month during post monsoon season of 2018. The summarized data is given is **Table ES2** below.

Table ES2: Summarized Average Ambient Air Quality monitoring results

Parameter	WZAAQ1	WZAAQ2	WZAAQ3	WZAAQ4	Devada (A1)	Gorlavanipalem (A2)	Bhavani Nagar near Nadupudi RF (A3)	Sector 3, VSP Quarters (A4)	Chipurapalli (A5)	Duvvada (A6)	Gangavaram Port Adjacent (A7)	Gajuwaka (A8)
PM_{10} ($\mu g/m^3$)	128	85	185	82	90	85	84	68	84	81	98	72
$PM_{2.5}$ ($\mu g/m^3$)	75	41	83	41	46	46	43	32	43	39	46	39
SO2 ($\mu g/m^3$)	47.7	11.8	26.5	15.8	13.7	20.8	11.5	11.8	14.2	12.4	17.5	12.6
NOx ($\mu g/m^3$)	36.6	22.8	33.4	24.5	23.7	25.2	17.2	15.4	25.6	19.5	29.7	21.2

Parameter	WZAAQ1	WZAAQ2	WZAAQ3	WZAAQ4	Devada (A1)	Gorlavanipalem (A2)	Bhavani Nagar near Nadupudi RF (A3)	Sector 3, VSP Quarters (A4)	Chipurapalli (A5)	Duvvada (A6)	Gangavaram Port Adjacent (A7)	Gajuwaka (A8)
CO (mg/m^3)	2.175	1.263	2.209	1.579	1.224	0.88	1.472	0.887	0.83	1.719	1.546	0.64
Ozone($\mu g/m^3$)	82	35	73	37	66	52	45	29	56	41	63	39
NH3($\mu g/m^3$)	177	48	73	64	62	41	57	26	63	59	71	68
Pb($\mu g/m^3$)	0.1331	0.0117	0.1325	0.0292	0.0290	0.028	0.0414	0.0035	0.004	0.0460	0.0904	<0.0006
As(ng/m^3)	3.1	<1.8	3.5	<1.8	<1.8	2.3	<1.8	<1.8	2.8	<1.8	<1.8	2.0
Ni(ng/m^3)	12.3	4.2	16.0	3.5	14.5	3.8	13.6	<0.61	8.4	10.3	16.7	0.8
Benzene ($\mu g/m^3$)	7.36	<2.08	4.48	2.82	2.56	3.82	<2.08	<2.08	2.77	2.51	4.86	2.72
BaP(ng/m^3)	1.16	<0.21	0.52	0.36	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21

3.3 Ambient noise levels

Ambient noise levels were measured at nine (9) different types of locations**.** The day equivalents during the study period are ranging between 52.0 to 72.9 dB(A). Whereas, the night equivalents were in the range of 42.2 to 66.2 dB(A). The results of day equivalents and the night equivalents are compared with the ambient noise standards of respective industrial, residential, commercial area and sensitive zone standards. Monitored noise levels are within the respective limits for all industrial and most of the residential areas. However, ambient noise levels slightly exceed the limits at monitoring stations in sensitive zones, commercial areas and some residential areas close to industrial activities.

3.4 Water environment

Eight surface water, one sea water and seven ground water samples were collected and analyzed. All the parameters in different surface waters are within the CPCB norms for Classes B of surface water. If water to be used for drinking purpose it is to be suitably treated before drinking by conventional treatment followed by disinfection.

The sea water quality when compared with Coastal Water Quality Criteria specified designated best uses, it was observed that the water quality meets criteria specified for SW-III i.e. for "Industrial Cooling, Recreation (non-contact) and aesthetics".

Results of ground water analysis were compared with IS:10500 (IS:10500; 1991, amendment no.1, 1993 - norms for drinking water) It was noted that Iron levels exceed even the "Permissible Limits" in three samples In all the samples, levels of "Total Dissolved Solids", "Total Hardness", "Total Alkalinity" and "Calcium" exceed the "Desirable Limits" but are within the "Permissible Limits" for Drinking Water. Aluminum levels exceed "Desirable Limits" but are within the "Permissible Limits" in three samples. Magnesium level exceeds "Desirable Limits" but is within the "Permissible Limits" in one sample. All other Ground Water Quality parameters are within the "Desirable Limits". The slight aberration is in all likelihood due to the local geology. It must also be borne in mind, that the study area is a coastal area. Rain water, which is the main source of ground water, in coastal areas contains small amounts of dissolved solids to salt spray.

3.5 Soil Characteristics

To assess the quality of soil in and around the plant, soil samples were collected from eight locations for Physico-chemical analysis. The soils are normal soils which can be classified as "Moderately Alkaline".

3.6 Biological Environment

The study area lies in the Tropical Wet and Dry Climatic Zone and under Eastern Plateau & Hill regions Agro-climatic Zone.

The land cover of the study area comprises of urban & rural settlements, industrial plants, agricultural lands & plantations, barren / waste lands, fallow lands, forests, scrub lands, inland water bodies, sea- beach and the sea. The plants found naturally in the study area are trees such as Tella tumma (*Acacia leucophloea*), Peddamanu (*Ailanthus excelsa*), etc., shrubs such as Tutturabenda (*Abutilon indicum*), Kasivinda (*Cassia tora*) etc. and various herbs, climbers, bamboo, as well as different types of grass. The flora of waste lands is dominated by grasses and small shrubs.

There are two Reserve Forests (RFs) in the study area; Nadupuru RF (~3 km west-south-west of the project site) and Narava RF (~7 km north-west of the project site). Both these RFs are located on hills and a phyto-sociological analysis showed that the tree density is rather low with vegetation dominated by shrubs and herbs. *Prosopis juliflora* and *Acacia nilotica* are the most common tree species.

The animals found in the study area are mammals such as Common Mongoose, Jackal, Indian Fox, Common house rat, Wild Pig etc., reptiles such as Yellow Rat Snake, Cobra Common Krait, Russel's Viper, etc. and birds like Pariah Kite, Common Crow, Grey Partridge, House Sparrow, Grey Wagtail etc.

In beach flora, 4 trees, 2 shrubs, 10 herbs and 1 alga was observed. The distribution pattern of coastal flora shows *Ipomea pes-caprae* was the most frequent, dominant and abundant plant species present in the study area followed by *Spinifex littoreus*. In fauna, 13 molluscs, 3 crustaceans, 2 butterflies and 3 bird species were observed. Considering the distribution pattern of the fauna, molluscs were the most frequently, densely and abundantly distributed group followed by crustaceans, birds and butterflies

The Visakhapatnam Coast is also a major area of commercial fishing with fishes like Oil sardine, Rays, Anchovies, Indian Mackerel, Tunnies and other miscellaneous fishes.

4.0 ANTICIPATED ENVIRONMENTAL IMPACTS & MITIGATION MEASURES

4.1 Impacts due to Project Location

The revamping was done for the existing units. However, additional units proposed for the expansion from 6.3 MTPA to 7.3 MTPA shall be/ are being installed within the existing Steel Plant Boundary and adjacent to existing similar units' locations keeping in view that some infrastructure facilities of existing units can be used for the new units.

The land of the existing plant is in industrial use. Location of new units shall involve little disturbance to the natural eco system as no additional area was acquired outside the plant boundary.

4.2 Impacts during Construction Phase

The expansion of the plant has been / being achieved through major revamping of the existing units. However these units are not producing full its rated capacity. Hence damages are limited only to the construction phase. Corrective measures have been identified based on the severity of the damage as well as the vulnerable agent (infrastructure, natural resource, community etc.) to which the damage was caused.

4.3 Environmental Impacts during Operational Phase in future

RINL has revamped SP1&2 and BF 1&2 which were installed during 1990 during 3 MTPA stage. The revamping has commenced during 2013 for the old units and completed. Due to revamping of specific pollution loads have improved over the years.

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While comparing the pollution loads at 6.3 MTPA stage of the plant and at 7.3MTPA stage after expansion it is observed that there is a marginal increase in SO_2 however, overall decrease in pollution load with respect to PM and NOx from plant units after the ongoing expansion.

Ground level concentrations are predicted over the receptor points within 10km radius and superimposed on ambient air quality to study the impact after proposed expansion. It is observed that there is a decrease in Ground Level Concentration of PM & NOx values, however there is also a marginal increase in SO_2 loads due to new units.

a. Air Quality Management

Impacts:

All measure taken up by RINL in existing units and upcoming units will have a net positive impact on the air environment as compared to the present scenario. While the impacts of fugitive emissions will be within the work zone area, the effect of emissions from the point sources will have an impact on the ambient air quality in surrounding areas. When compared with the pollution loads with 6.3 MTPA stage and 7.3 MTPA stage, there is a marginal increase in SO_2 however, overall decrease in PM & NOx from the proposed units after the ongoing expansion. The decrease of PM and NOx will be mainly due to revamping of existing pollution control equipment of the existing units. The increase in SO_2 mainly attributed to installation new coke oven at 7.3 MTPA stage.
To assess the actual impacts due to proposed changes air quality impact prediction modelling has been conducted considering site specific meteorological data to estimate the incremental Ground level concentrations due to proposed changes. It is found that there is a decrease in Ground Level Concentrations of PM & NOx, however there is also a marginal increase in SO_2 loads due to new units.

Mitigation measures:

In order to mitigate various impacts of air pollution, following measures will be implemented:

- Material handling system
  - DFDS systems in new coke oven plant
  - Sprinkler type dust suppression system in raw material storage area
  - Pneumatic transportation of coke dust from waste heat boilers and CDCP cyclones.
- Coke Ovens-
  - HPLA system for charging emissions control
  - Land based pushing emission control system
  - Mechanical door frame cleaning system
  - Coke dry quenching system
  - H_2S recovery
- Sinter plant
  - Revamping of existing ESP to maintain stack emission concentrations to 50 mg/Nm^3
- Blast Furnace
  - Revamping of existing ESP for Cast house and stock house dedusting to maintain stack emission concentrations to 50 mg/Nm^3
- Steel melting shops
  - Installation of dog houses in all converters.
  - Installation of secondary ventilation and material handling system with ESP/Bag-filter
- Rebar Mill
  - Use of clean by-product gases as fuel.

- Installation of low NOx burner for NOx emission reduction.
- Stack of suitable height for proper dispersal of pollutants.

b. Water resource and Waste water Management

Impacts:

Maximum water requirement for existing plant at 6.3 MTPA was ~7076 m^3/hr (38 MGD). The water is being sourced from existing Yeleru Reservoir. RINL has accorded permission for withdrawal of 45 MGD from Visakhapatnam Industrial Water Supply Company Limited (VIWSCO). Kanithi Balancing Reservoir has been constructed for storage of raw water.

For the proposed expansion of steel plant facilities, total additional water requirement is around 1303 m^3/hr (7 MGD).

Mitigation measures:

As per the existing arrangement of steel plant at 6.3 MTPA stage, waste water generated in various units of the steel plant are pretreated and recycled within the unit itself. Rejects are discharged into two outfalls and led to waste water treatment / RO plants. From there, the waste water is further recycled and reused within the plant. Only a small portion (200 m^3/hr) of Coke oven and RO plant rejects is discharged into the sea after treatment to meet effluent discharge standards. The new COB-5 has been provided with separate ETP.

The existing arrangement shall be followed even after the expansion. The additional waste water generated from the expanded/revamped/ new unit shall be suitable pre-treated and recycled within the plant boundary. No additional effluent shall be discharged outside after the proposed expansion.

c. Noise management

Impacts:

The major noise generating equipment in the plant are high speed blowers of the furnaces, Grinding Crushers and screens etc

Mitigation measures:

Various measures proposed to reduce noise pollution include reduction of noise at source, provision of acoustic lagging for the equipment and suction side silencers, vibration isolators, selection of low noise equipment, isolation of noisy equipment from working personnel. In some areas where due to technological process, it is not feasible to bring down the noise level within acceptable limits of 85 dB(A) (at 1 m from source), personnel working in these areas will be provided with noise reduction aid such as ear muffs/ ear plugs and also the duration of exposure of the personnel will be limited as per the norms

d. Solid Waste Management

Integrated Iron & steel plant generates solid wastes, some of which are hazardous while others are non-hazardous. Some of these wastes are reused / re-utilised and some are not. Additionally, some wastes are also generated during operation / maintenance / annual maintenance of other units / shops etc, like Flue dust from BF, BF/BOF Gas Cleaning Plant sludge, waste refractory bricks, etc. except some sludge generated from Coke Oven and By Product area, all other wastes are non-hazardous. All the solid wastes shall be utilized as such inside the plant in Sinter Plant/BOF. BF/BOF Slag shall be sold to cement manufacturers or used for road construction.

It is estimated that 100% of the granulated BF slag would be sold to the cement making industries for manufacturing of slag cement. Other wastes such as mill scales,

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sludges, dust etc. would be completely recycled in the plant as feed stock at the sinter plant. 60% of the SMS slag would also be used within the steel plant and the balance would be stored for further processing for secondary use. The metallurgical wastes generated and stocked in the plant shall be utilized by converting them into briquettes and micro pellets for consumption at SMS & SP respectively.

e. Biological environment

The proposed expansion activities are taking place within existing plant complex. Hence, there is no forest area within the project site. Some of the impacts identified due to operation of the project are:

- The fauna of the project site and the impact zone comprises of common small species. The impacts of the project will be manifested over a few hundred m radius area around the project site. Thus the impacts on wild-life will be confined more or less to this area and is not expected to have significant impact on the overall ecology of the area.
- Emissions from plant operation may affect the natural vegetation around the proposed plant.
- The proposed expansion activities are taking place within existing RINL steel plant premises and all care will be taken to avoid tree felling / clearance of vegetation unless absolutely necessary.
- All technological measures to minimise air emissions, generation of effluents (including contaminated storm water) and noise generation have been incorporated in the design of the proposed plant.
- An elaborate green belt / cover is envisaged within and around the plant to ameliorate the fugitive emissions and noise from the operation of the proposed plant.
- The proposed project is designed for maximum re-circulation and no effluent will be allowed to be discharged out of plant premises. Effluents generated at the project water will be treated and treated effluents will be re-used and recycled within the steel plant itself. Thus, there will be no impact on the ecological components of surface water bodies in the area.
- Overall the ecological features of the study area will hardly be affected due to the proposed plant.

f. Occupational Health Measures

The principal occupational risks in integrated steel plants include Diseases due to dust inhalation, exposure to extreme temperatures, exposure to toxic and / or inflammable gases, fire and explosion, accidents during handling of liquid metal and slag, accidents during handling of corrosive and / or toxic liquids, Hearing loss and other disorders due to exposure to very high noise, accidents involving various machinery etc.

RINL was the first among the Indian Steel plants to be certified for OHSAS: 18001 Standard for Occupational Health and Safety Management Practices. Continuous efforts on implementation of safety standards, monitoring of Risk Control and other proactive measures have resulted in reduction / elimination of potential hazards.

Safety aspects are considered in the design stage itself for all the equipment. In spite of that, during process of steel making, many hazards may be encountered.

The plant has a dedicated Safety Engineering Department is responsible for formulating and implementing all safety measures , procedures and protocols in the plant, including issue of Personal Protective Equipment, Safety Training Programmes for all regular employees / contractual workers of RINL-VSP at various levels to inculcated safety awareness.

The steel plant has a Central Safety Committee. The Committee has 60 members of whom half are workers' representatives and the rest are representatives of the Management. In addition there are 30 nos. Departmental Safety Committees in the plant to discuss on Safety issues pertaining to their respective departments. Departmental Safety Committee meetings are held once every month.

In RINL-VSP is provided with two fire stations with all necessary equipment. There are more than 200 nos. of trained, competent & experienced Fire Fighting Personnel. The plant is equipped with all contemporary fire fighting and preventing facilities.

Extensive network of fire hydrant points , landing valves and fourteen Fire Fighting Pump Houses are in place.

The annual budget for procurement of PPE, conducting safety trainings, safety audits and safety promotional activities is around Rs.8.0 Crores.

Presently, occupational safety and health surveillance of the plant's workforce is being undertaken by RINL's Occupational Health Services and Research Centre (OHS&RC) which is manned by qualified personnel. The steel plant has a 150 bedded hospital - Visakha Steel General Hospital (VSGH) located in the plant's township. Two first-aid stations are located in the plant, functioning round the clock with qualified doctors, paramedical staff and ambulances.

All employees undergo a Pre-employment Medical Examination followed by a Periodical Medical Examination (PME). The periodicity of the PME is as per the workers' deployment. Health records of employees are stored safely for periodic retrieval and analysis. A specific coding system has been developed and followed for efficient and systematic placement. The historical employee health data is also stored in soft form and is linked to online system.

5.0 ENVIRONMENTAL MONITORING PROGRAMME (EMP)

To ensure the effective implementation of the proposed mitigation measures, elaborate arrangements were made for monitoring of various environmental parameters.

Environmental aspects to be monitored include drainage systems, water quality, emissions and air quality, noise pollution, solid/hazardous waste utilization, green belt development, housekeeping & occupational health.

6.0 PROJECT BENEFITS

RINL has already made a detailed plan for development in the peripheral area. RINL's efforts are going to be converted from Community Development to Sustainable Development

7.0 ADDITIONAL STUDIES-RISK ASSESSMENT

RINL is having a well documented Onsite Emergency Plan for their existing plant covering all the chemicals / gasses handled by RINL. During the current project only one additional chemical / Propane will be handled. RINL shall integrated existing Onsite Emergency Plan for the proposed project also.

8.0 EMP- ORGANISATIONAL SET UP AND IMPLEMENTATION ARRANGEMENT

A separate Environment Management Department (En MD) was set up along with an Environmental Laboratory with latest monitoring instruments. The plant is certified for ISO 14001:2015 for implementing EMS in the organization.

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EnMD also co-ordinates with process units & other departments like Occupational Health, Safety Management, Project Engineering, Horticulture, Social Welfare, CSR Dept., Water Supply Department etc. and also do the liaison work with external agencies like State & Central Pollution Control Boards.

RINL has installed continuous online stack monitoring systems in all major units of the plant. Also automatic ambient air monitoring stations have been setup at four locations around the plant.

9.0 SUMMARY AND CONCLUSION OF EIA/EMP REPORT

RINL has done revamping / capital repairs of the existing critical equipment of the plant installed in the year 1990. This was absolutely essential to ensure paramount safety and in addition would help in meeting the upgraded environmental norms. This modernization and revamping drive led to enhanced capacities by upto 1 MTPA. However, since revamping has resulted in producing additional 1 MT without prior EC as per EIA Notification 2006, it may be considered as a "Violation" of the provisions of the EIA Notification, 2006.

The existing plant units are revamped, pollution control equipments are upgraded and modern process technologies are adopted. Due to this quantum of emissions during operation of the plant will be low though plant's production capacity increased by 1Mt that of the existing plant.

The EIA report has thoroughly assessed all the potential environmental impacts associated with the project. The environmental impacts identified by the study are manageable. The implementation of environmental mitigation measures recommended in the report will bring the anticipated impacts to minimum. A separate Community and Natural Resource Augmentation Plan has been prepared as restitution for the damages which occurred in the nearby areas during construction of expansion of various units of the plant.

10.0 NATURAL AND COMMUNITY RESOURCE AUGMENTATION PLAN

The contribution of construction as well as operation activities of RINL's expansion/ revamping project are marginal in nature and are mostly limited to the existing plant complex.

Also, as the plant has never been able to produce even at 6.3 MTPA capacity, which is its rated capacity as per existing Environmental Clearance granted, it has not been able to derive any economic benefit out of the activities. The same is reflected in the company's continued losses for the preceding years.

Over the 4 years of plant operation during expansion period, an overall loss is observed by RINL. However, breakup of cost for proportionate income and expenses from the revamped units notional economic benefit of Rs 174.5 Crores in 4 years period of plant operation.

RINL-VSP is aimed at improving the lives of people living around the steel plant by way of its dedicated Corporate Social Responsibility (CSR) plan. Despite RINL-VSP's poor financial performance in the last three years, it has not turned away from its commitment to improving the lives of communities living in the area.

As per Ministry's O.M. dated 1st May, 2018, fund allocation towards CER would be about 27.5 Crores. Since for the current financial year already allotted 8.5 Crores, about 19 crores have been allocated for CER activities which will be carried out next 4 years duration.

RINL aims to compensate for whatever minimal damages identified due to the construction of plant units, by way of a dedicated Natural & Community resource augmentation plan with an earmarked budget and defined timeframe for implementation of the same.

RINL will spend Rs 920 lakhs towards remediation plan and natural & community resource augmentation plan for restitution of damages caused due to violation.

EIA/EMP Report

1.0 INTRODUCTION

Visakhapatnam Steel Plant (VSP), the first (and so far only) coast-based integrated iron and steel plant in the country commenced iron & steel production in March, 1990. The plant , which is owned and operated by M/s. Rashtriya Ispat Nigam Limited (RINL) - a Navratna PSE under Ministry of Steel, Government of India, is located in Visakhapatnam District of Andhra Pradesh at an aerial distance of about 8 km south-west of Visakhapatnam city.

RINL had received Environmental Clearance (EC) for increase of Liquid Steel production from 3.5 MTPA to 6.3 MTPA from Ministry of Environment, Forest and climate change (MoEFCC) vide their letter no.J-11011/196/2005-IA II (I) dated 11-08-2005 **(Annexure 1.1).** Renewed Consent for operation for the existing plant was obtained vide APPCB letter no – APPCB/VSP/VSP/108/CFO/HO/2015 dated 27/07/2015 and is valid till 30/04/2019 **(Annexure 1.2)**.

However, after installation of all units for achieving rated capacity of 6.3 MTPA, RINL started revamping / capital repairs of the existing critical equipment of the plant which had commenced operating in the year 1990. This was absolutely essential to ensure paramount safety and in addition would help in meeting the upgraded environmental norms specified in MoEF's notification vide GSR.277(E) dt 31st Mar'2012.

This modernization and revamping drive led to enhancement of capacities by up to 1 MTPA of liquid steel. However, since revamping has resulted in producing additional 1 MTPA liquid steel without prior EC as per EIA Notification 2006, it may be considered as a "Violation" of the provisions of the EIA Notification, 2006.

RINL has presented the proposal at the 8th meeting of Expert Appraisal Committee for the proposal involving violation of EIA Notification, 2006, held on 13th -14th June 2018 and again at the 9th Meeting held June 27 -28th June 2018.

The EAC, confirmed the case to be one of violation of provisions the EIA Notification, 2006 and recommended for issuing the Term of Reference for undertaking EIA and preparation of Environment Management Plan (EMP) **(Annexure 1.3).**

Based on the TOR, EIA / EMP study was conducted and report was prepared for expansion of RINL-VSP plant from 6.3 MTPA to 7.3 MTPA Liquid Steel and 6.5 MTPA to 7.5 MTPA Hot Metal by revamping and modernization plant.

EIA report MEC/11/S2/Q7H4/EIA-EMP/2482/R.0 dated August 2018 was submitted to MOEFCC and the project was appraised at the 13th meeting of Expert Appraisal Committee for the proposal involving violation held on 18th -20th September 2018. The EAC deferred the proposal and suggested RINL to validate the ambient base line data with fresh baseline data generation for one month as the base line data used in the report was two years old and sought additional information. RINL was also asked to re-submit revised EIA report. Copy of minutes of the EAC meeting is attached as **Annexure 1.4.**

1.1 TYPE OF PROJECT & PROJECT STATUS

The proposal involves revamping of existing Sinter plants, Blast furnaces, Rolling mills and associated auxiliary facilities along with installation of a new 0.84 MTPA coke oven battery and a bar mill in place of the Seamless Tube Mill (SLTM), which had been included in the original proposal but was subsequently dropped. The production of hot metal shall increase from 6.5 MTPA to 7.5 MTPA and liquid steel production shall increase from 6.3 MTPA to 7.3 MTPA.

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Most of the proposed changes in plant configuration are taking place within the premises of existing Vizag Steel Plant which is coming under "Metallurgical Industries" falling under Category 'A' [Sl. No. 3(a) of Schedule: "List of projects or activities requiring prior environmental clearance"] in connection with Environment (Protection) Act, 1986. The revamping of some of the existing units is completed and some units are under progress. The details of progress of development of various units is given in **Table 1.1**.

Table 1.1 : Progress of development of various units of VSP

Sl. No.	Plant	Unit	Capacity as per EC	Capacity at 7.3 MTPA stage	Proposed changes	Status
1.	Coke Oven	COB1	0.84	0.84	No change	Operational
		COB2	0.84	0.84	No change	Operational
		COB3	0.84	0.84	No change	Operational
		COB4	0.84	0.84	No change	Operational
		COB5	-	0.84	New	Under construction
2.	Sinter Plant	SP1	2.85	3.64	Expansion	Commissioned and running at 90% capacity
		SP2	2.85	3.04	Expansion	Expansion yet to be started
		SP3	3.61	3.61	No change	Operational
3.	Blast Furnace	BF1	2.0	2.5	Expansion	Commissioned and running at 90% capacity
		BF2	2.0	2.5	Expansion	Commissioned and running at 90% capacity
		BF3	2.5	2.5	No change	Operational
4.	SMS	SMS1	3.5	3.5	No change	Operational
		SMS2	2.8	3.8	Expansion	Construction of additional facilities completed
5.	Rolling Mills	LMMM & SBM	1.65	1.77	Optimization of rolling hours	Operational
		WRM 1 & 2	1.65	1.78	Optimization of rolling hours	Operational
		MMSM & STM	1.75	1.91	Optimization of rolling hours	Operational
		SLTM	0.6	-	Not installed	Not installed
		Rebar Mill	-	0.6	Proposed in place of SLTM	Construction yet to start
		Semis	0.67	0.51	-	-
6.	CPP	Coal based	315 MW	315 MW	No change	Operational

Sl. No.	Plant	Unit	Capacity as per EC	Capacity at 7.3 MTPA stage	Proposed changes	Status
		Gas based	120 MW	120 MW	No change	Operational
		Coke Oven Waste heat recovery	29 MW	43 MW	Increase	COB5 under construction
		BF-TRT	39 MW	39 MW	No change	Operational
		NEDO sinter cooler	20.6 MW	20.6 MW	No change	Operational
		Solar Power Plant	-	5 MW	New	Operational
7.	Lime & Dolo Plant	-	2625 TPD	2625 TPD	No change	Operational
8.	Air Separation Units	-	2700 TPD	2700 TPD + 1700 TPD for meeting other needs	Increase	2700 TPD (Operational) 1700 TPD (Not Commissioned)
9.	Additional facilities	Turbo Blower-5				Completed
10.		Kanithi Balancing Reservoir-2				Ongoing
11.		Installation of LPG storage facility				Ongoing
12.		Installation of Nitrogen Buffer vessel				Ongoing
13.		Guard Pond				Ongoing

It is to be noted that all the facilities listed above except Kanithi Balancing Reservoir – 2 have come up / coming up within the existing premises of the steel plant. The new reservoir is being constructed about 3 km north of the steel plant close to the existing water reservoir on land owned by RINL.

1.2 PURPOSE OF THE REPORT

The objective of the study report is to take stock of the prevailing quality of environment, to assess the impacts of industrial activity on environment and to plan appropriate environmental control measures to minimise adverse impacts and to maximise beneficial impacts of the project. Additionally, preparation of Remediation plan and natural and community resource augmentation plan corresponding to the ecological damage assessed and economic benefits derived due to violation is also to be carried out. The following major objectives have been considered:

- Assess the existing status of environment.
- Pollution control and ameliorative measures implemented to minimize the impacts.
- Assessment of ecological damage and economic benefits derived from the project.
- Preparation of remediation plan and natural & community resource augmentation plan.
- Suggesting a monitoring programme to assess the efficacy of the various adopted environmental control measures.
- Assess financial considerations for suggested environmental control plans.
- Clearances from statutory authorities

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1.3 IDENTIFICATION OF THE PROJECT AND PROJECT PROPONENT

1.3.1 The Project Proponent

Rashtriya Ispat Nigam Limited (RINL) owns Visakhapatnam Steel Plant (VSP) which is the first shore based integrated steel plant Public sector in the country located at Visakhapatnam in Andhra Pradesh. The plant was commissioned in August 1992 with a capacity to produce 3 million tonnes per annum (MTPA) of liquid steel. The plant has been built to match international standards with state-of-the-art technology, incorporating extensive energy saving and pollution control measures. VSP has an excellent layout capable of expanding up to 16 MTPA.

The plant achieved high levels of performance in production and technological norms. Right from the year of its integrated operation, VSP established its **presence both in the domestic and international markets with its superior** quality of products. It has been conferred with the honour of "Mini Ratna" by Department of Public Enterprises in the year 2006. VSP has been awarded all the three international standards certificates, namely, ISO 9001:2008, ISO 14001:2004 and OHSAS 18001:2007. The recent feather in the cap is the 'Capability Maturity Model Integrated (CMMI) – Level 3' certification from 'Software Engineering Institute (SEI) of Carnegie Mellon University', USA for implementation of IT systems in VSP. RINL- VSP is the first Indian steel plant to get this certification. The company has emerged as a good corporate citizen and has contributed substantially for the development of the region.

Project Division of RINL is the responsible authority for the proposed project. The contact information is given below:
General Manager,
Project - Technology
Tele: 08912518501/ MB.No-9949024980
Fax: 08912518501

1.3.2 The Consultant

The report titled "EIA/EMP Studies for Expansion of Integrated Steel Plant from 6.3 MTPA to 7.3 MTPA Liquid Steel within the premises of Visakhapatnam Steel Plant" has been prepared by MECON Limited, a Public Sector undertaking under the Ministry of Steel Government of India. MECON Limited is accredited by QCI/NABET for preparing EIA/EMP reports in 16 major sectors, including Metallurgical industries (ferrous & nonferrous) – both primary and secondary vide their certificate no. Certificate no: NABET/EIA/1619/RA0068. This certificate is valid up to 2nd October, 2019.

1.3.3 The Project

RINL had received Environmental clearance for expansion of Hot metal from 4.0 to 6.5 MTPA from Ministry of Environment, Forest and climate change (MoEFCC) vide their letter no.J-11011/196/2005-IA II (I) dated 11-08-2005.

However, since then the plant is operating at high levels of capacity utilization and continuous thrust on production of value added steel. It was deemed necessary that major revamps / capital repairs of the existing critical equipment of the plant should be taken up immediately. This was extremely essential, to ensure paramount safety and in addition, it would help in meeting the upgraded environmental norms specified vide MoEFCC notification vide GSR.277(E) dt 31st March, 2012. Revamping of the furnaces producing hot metal and liquid steel were overdue and needed to be done urgently.

Keeping in view of above RINL had decided to modernize its facilities along with revamping. This modernization and revamping drive led to enhanced capacities.

However, RINL had obtained TOR on 19th September 2016 vide ltr. No. J-11011/196/2005-IA.II(I). Public hearing was held on 15/06/2017 at Trishna Grounds, Sector -2, Ukkunagaram and final EIA report was submitted. The project was presented at the 28th meeting of EAC (Industry – I) held during 5th to 7th Feb 2018.

The committee observed that since RINL has already started the proposed modernization and revamping activities which lead to increase of production capacity without prior Environmental Clearance, the project should be considered as Violation of the provisions of the EIA Notification 2006.

RINL has presented the proposal at the 8th meeting of Expert Appraisal Committee for the proposal involving violation of EIA Notification, 2006, held on 13th -14th June 2018 and again at the 9th Meeting.

The EAC, after detailed deliberations on the proposal in terms of the provisions of the MoEF&CC Notification dated 14th March, 2017, confirmed the case to be one of violation of the provisions of the EIA Notification, 2006 and recommended following specific TORs:

(i) The State Government/SPCB to take action against the project proponent under the provisions of section 19 of the Environment (Protection) Act, 1986, and further no consent to operate for expansion project to be issued till the project is granted EC for the expansion.

(ii) The project proponent shall be required to submit a bank guarantee equivalent to the amount of remediation plan and natural and community resource augmentation plan with the SPCB prior to the grant of EC. The quantum shall be recommended by the EAC and finalized by the regulatory authority. The bank guarantee shall be released after successful implementation of the EMP, followed by recommendations of the EAC and approval of the regulatory authority.

(iii) Assessment of ecological damage with respect to air, water, land and other environmental attributes. The collection and analysis of data shall be done by an environmental laboratory duly notified under the Environment (Protection) Act, 1986, or an environmental laboratory accredited by NABL, or a laboratory of a Council of Scientific and Industrial Research (CSIR) institution working in the field of environment.

(iv) Preparation of EMP comprising remediation plan and natural and community resource augmentation plan corresponding to the ecological damage assessed and economic benefits derived due to violation.

(v) The remediation plan and the natural and community resource augmentation plan to be prepared as an independent chapter in the EIA report by the accredited consultants.

(vi) Since Public Hearing (PH) has been conducted on dated 19.07.2017 covering all the issues, committee felt that one time PH as per the order of Hon'ble High Court of Madras has already taken care and hence repeat PH is not required.

(vii) EIA/EMP must be prepared by generating fresh base line data as validity of early base line data is expired.

The above point is modified in 9th EAC meeting held held during June 27 -28th as ***"EIA/EMP may be prepared by using existing base line data generated during the period of October to December, 2016."***

(viii) EIA/EMP should cover the validation of current practices also predict cumulative Impact covering total production capacity for each component of environment.

(ix) Selection of technology and adaption of clean technology for both production & environment be addressed in EIA/EMP report.

(x) Fund allocation for Corporate Environment Responsibility (CER) shall be made as per Ministry's O.M. No. 22-65/2017-IA.III dated 1st May, 2018 for various activities therein. The details of fund allocation and activities for CER shall be incorporated in EIA/EMP report.

The Terms of Reference (ToR) have been prescribed for preparation of EIA/EMP report for the present project vide letter no F.No.IA-J-11011/196/2005-IA-II(I) dated 02/08/2018 which is enclosed as **Annexure 1.3.**

As per the TOR, EIA report vide MEC/11/S2/Q7H4/EIA-EMP/2482/R.0 dated August 2018 was submitted to MOEFCC.

The project was appraised at the 13th EAC meeting held on 18th -20th September 2018. The EAC suggested RINL to validate the ambient base line data with fresh baseline data generation for one month as the base line data used in the report was two years old and also sought additional information. RINL was also asked to re-submit revised EIA report (**Annexure 1.4**) considering additional information.

Accordingly EIA report is revised based on the additional information and additional baseline data.

1.3.4 Location of the Project

All components of the project are located on land owned by RINL located in Gajuwaka Sub-District of District Visakhapatnam, State Andhra Pradesh. The salient feature of environmental setting of the project site are given in **Table 1.2**.

Table 1.2 : Salient Features of environmental setting of Project Site

Sl.No	Particulars	Details
1	Project Location	Gajuwaka, Visakhapatnam
2	Nearest Railway Station	Duvvada Railway station(9.4 km, N)
3	Nearest Airport	Visakhapatnam Airport (12 .5 km, NE)
4	Road Access	NH 10 connecting Howrah and Chennai adjacent
5	Toposheet No.	65 O/2
6	Altitude Latitude Longitude	10 m AMSL 17°34'29" to 17°38'49" N 83°09'23" to 83°14'12" E
7	Climatic Conditions	Mean Wind speed: 11.3kmph Average Annual Rainfall: 955 mm Temperature is 28.4 degrees Celsius
8	**Land Details**	
a	Area	The total land area in possession with RINL is 19703 Acres of which the plant area is 8003 ha. **Capacity Augmentation will be taken up in 8003 ha.**

Sl.No	Particulars	Details
9	**Water Requirement**	
a.	Source	Yeleru Reservoir
b.	Daily Requirement	31,815 m3/day (7 MGD) of which 27,270 m3/day (6 MGD) would be required for the operation of plant and 4,545 m3/day (1 MGD) for the township and others
10	**Environmental Sensitivity**	
a	Water Bodies	Kanithi Balancing Reservoir (4.2 km's N), Bay of Bengal (Adjacent)
b	Archaeological/ Historical/ Ancient Monuments	Ancient site Totlakonda (Buddhist complex) 34 km's NE
c	Forest	Nadupuru Reserve Forest 2.13km's NW
d	Sanctuaries/ National Parks	Kambalakonda Wildlife Sanctuary 9.7 km's NE
e	Seismicity	According to the seismic-zoning map of India, the project area falls in Zone III of seismicity as per IS: 1893 (Part-1) 2002 and can be classified as moderate -risk earthquake areas

A Google Earth Image of the RINL Steel plant area showing the location of units revamping/construction done is given as **Fig. 1.1**.

Study area covering 10 km radius around the proposed project area is shown on google earth in **Drg MEC/11/S2/Q7H4/01**. Study area covering 10 km radius around the proposed project area is shown on Toposheet in **Drg MEC/11/S2/Q7H4/02**.

1.3.5 Nature & Size of the Project

RINL has proposed for revamping of the equipment of 6.3 MTPA expansion programme. RINL adopted the 'Best Available Technologies (BAT)' which help in reduction of pollution and increase in productivity. After revamping of the existing units, the plant can achieve 7.3 MTPA of liquid steel production by addition of one converter and caster. After revamping and modernization plant the final rated capacity of the major units are –

Coke Ovens and By-products Recovery Plant	-	from 3.2 to 4.0 MTPA
Sinter Plant	-	from 9.31 to 10.53 MTPA
Blast Furnace	-	from 6.5 to 7.5 MTPA
SMS	-	from 6.3 to 7.3 MTPA
Saleable Steel	-	from 5.71 to 6.57 MTPA

1.3.6 Industries within 10km of the plant

Visakhapatnam is one of the major industrial cities of the country. Stimulated by Visakhapatnam Port (located ~12 km from the steel plant) and rich agricultural land along the coast, major iron ore and bauxite deposits in nearby areas of Chhattisgarh and Odisha, other industries have come up in nearby areas. There are 351 operating industries Under Consent Management of Andhra Pradesh Pollution Control Board in Visakhapatnam District. Another 76 industries are closed. The major industries within 10 km of the steel plant include:

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1. Gangavaram Port – Adjacent to Plant Boundary
2. Naval Dockyard (of Indian Navy) – 9.8 Km
3. Oil Refinery of Hindustan Petroleum Corporation Limited – 7 Km
4. LPG Bottling Plant of HPCL– 8.5 Km
5. LPG Bottling Plant of Indian Oil Corporation Limited – 10 Km
6. NTPC's 2000 MW cap. Simhadri Thermal Power Station – 5.6 Km
7. Hinduja National Power Corporation's Ltd.'s 1040 MW Thermal Power Plant – 2.8 Km
8. BHEL's Heavy Plates and Vessels Plant – 5.1 Km

1.4 NEED FOR THE PROJECT

The various units of the steel plant at 3.5 MTPA capacity had already attained rated production capacity by 2001-02 and since then were being operated at full capacity.

By 2013, capital repairs of BF1 and BF2 were already due. Immediate major revamps / capital repairs of existing critical equipment of the plant was deemed necessary due to consistent operation at high levels of capacity utilization. Therefore, VSP undertook repair of these units with latest technologies available at that time.

The changing of inner refractory lining of blast furnace with latest technologically advanced bricks resulted in decrease of width of refractory lining and an overall increase in useful volume of blast furnace from 3200 m^3 to 3800 m^3 without any changes to the outer shell of the blast furnace. This gave VSP a chance to increase the overall production capacity of the existing blast furnaces from 2.0 MTPA to 2.5 MTPA without any major change to the existing infrastructure. Therefore, VSP also went ahead with the repair of BF2 for similar changes.

Parallelly, in order to support and utilize the increased hot metal production, VSP proposed augmentation of upstream and downstream facilities. Existing Sinter Plants 1 & 2 were already due for capital repairs. VSP utilized the opportunity to augment the existing facilities to increase the production capacities as well as improve the pollution control facilities. A new coke oven battery of 0.84 MTPA capacity was also required to support the increased production capacity of the upgraded blast furnaces.

In downstream, VSP had planned to install dog houses in the existing converters of SMS1 without any increase in production capacity. To utilize the additional hot metal from upgraded blast furnaces, VSP proposed for addition of a new Converter no 3, Caster no 4 and Twin LF along with auxiliary facilities of 1 MTPA capacity in existing SMS 2 complex. At 6.3 MTPA stage, the rolling mills' capacity of the plant was at 5.72 MTPA. SLTM planned during 3.5 MTPA to 6.3 MTPA has not been installed.

As part of capital repairs, VSP has proposed to augment the existing rolling mills by means of optimization of rolling hours. This would result in increase of rolling capacity of VSP to 5.97 MTPA. Additionally, in order to utilize the increased production capacity, VSP now proposes to install a 0.6 MTPA bar mill in place of the previously proposed SLTM. After all the above proposed changes, the rolling capacity of the VSP shall increase to 6.57 MTPA at 7.3 MTPA stage.

1.5 BASELINE DATA GENERATION, FIELD STUDIES AND SECONDARY INFORMATION COLLECTED

This EIA/EMP report has been prepared on the basis of one full season baseline environmental data monitored during full Post-monsoon season for three months from

October to December 2016 period within 10 - km radial distance all around the existing steel plant. The baseline data available with RINL, had been generated by a NABL accredited laboratory (Bhagavati Ana Labs, Hyderabad) as per the TOR for the purpose of earlier EIA studies. However, some of the environmental attributes studied by MECON during that period has also been utilized for preparing this report.

The baseline data includes micro-meteorological conditions, ambient and work zone air quality, noise levels, water quality and soil quality. Site survey has been conducted for studying the flora and fauna, socio-economic conditions including public consultation, land use, etc. Additional information has also been collected from several State and Central Government agencies / departments pertaining to above. The collected data have been analysed in detail for identifying, predicting and evaluating the environmental impacts of the proposed project. The maximum anticipated impacts on environment are assessed and suitable environmental management plan has been suggested.

In addition, as suggested by EAC, one month baseline monitoring was also carried out within core zone (plant premises) and buffer zone (beyond plant premises).

1.6 COVERAGE OF THE REPORT

This report contains information on the existing environment and evaluates the predicted environmental and socio-economic impacts of the expansion of the plant when it will achieve full rated capacity. The EIA report is prepared as per the generic structure specified in EIA Notification, 2006.

The report including this introduction chapter includes:

- Project Description
- Description of the Environment
- Anticipated Environmental Impacts and Mitigation Measures
- Analysis of Alternatives
- Environmental Monitoring Programme
- Additional Studies
  - Social Impact Assessment
  - Risk Assessment
  - On-site Emergency Plan
- Project Benefits
- EMP - Administrative aspects of implementation
- Summary and Conclusion
- Disclosure of Consultant

In addition to the above additional chapter has been included as per the TOR on "Remediation plan and natural and community resource augmentation plan corresponding to the ecological damage assessed and economic benefits derived due to violation".

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Fig. 1.1 : Google Earth Image Showing Location of the steel Plant& major units considered

Fig. 1.2 : Google Earth Image Showing 10km radius around the steel Plant Boundary

2.0 PROJECT DESCRIPTION

2.1 INTRODUCTION

VSP is based on BF-BOF route producing iron and steel with total hot metal production capacity of 6.5 MTPA and steel production capacity of 6.3 MTPA as per previous EC granted. Environment clearance for the expansion of steel production capacity from 3.5 MTPA to 6.3 MTPA was granted in August 2005. VSP is proposing for increasing the liquid steel production capacity from 6.3 MTPA to 7.3 MTPA.

2.2 TYPE OF PROJECT

The above proposal involves revamping / expanding of existing Sinter Plants, Blast Furnaces, Steel Melting Shop, Rolling Mills and associated auxiliary facilities along with installation of a new 0.84 MTPA coke oven battery and a rebar mill. The production of hot metal shall increase from 6.5 MTPA to 7.5 MTPA and liquid steel shall increase from 6.3 MTPA to 7.3 MTPA, the rolling capacity increase to 6.67 MTPA by addition of a rebar mill of 0.6 MTPA.

This proposed changes in plant configuration shall take place within the premises of existing Visakhapatnam Steel Plant which is coming under "Metallurgical Industries" falls under Category 'A' [Sl. No. 3(a) of Schedule: "List of projects or activities requiring prior environmental clearance"] in connection with Environment (Protection) Act, 1986. Since, some of the units were constructed before getting prior Environmental Clearance from MoEFCC, the project is being treated as a Violation Case by MoEFCC. The details of progress of development of various units is given in **Table 2.1**.

Table 2.1 : Progress of development of various units of VSP

Sl. No.	Plant	Unit	Capacity as per EC	Capacity at 7.3 MTPA stage	Changes at 7.3 MTPA	Status
1.	Coke Oven	COB1	0.84	0.84	No change in capacity	Operational
		COB2	0.84	0.84		Operational
		COB3	0.84	0.84		Operational
		COB4	0.84	0.84		Operational
		COB5	-	0.84	New	Under construction
2.	Sinter Plant	SP1	2.85	3.64	Enhancement of capacity by Revamping/ modernization including ESP	SP1- Revamped and running at 90% capacity
		SP2	2.85	3.04		Expansion yet to be started for SP2
		SP3	3.61	3.61	No change in capacity	Operational
3.	Blast Furnace	BF1	2.0	2.5	Enhancement of capacity by	Revamped and running

Sl. No.	Plant	Unit	Capacity as per EC	Capacity at 7.3 MTPA stage	Changes at 7.3 MTPA	Status
					Revamping /modernization of BF-1 & BF-2 **including ESP**	at 90% capacity
		BF2	2.0	2.5		Revamped and running at 90% capacity
		BF3	2.5	2.5	No change	Operational
4.	SMS	SMS1	3.5	3.5	No change in capacity.Only Revamping of facilities Secondary Dedusting with Dog house **installed.**	Operational with Centralized Secondary Dedusting System.
		SMS2	2.8	3.8	Expansion.Converter-3 with Secondary Dedusting & Caster-4 Twin-LF	Installed and running at 88 % capacity Under Construction
5.	Rolling Mills	LMMM & SBM	1.65	1.77	Production increase through Optimization of rolling hrs **and energy conservation**.	SBM Operational at 85 % capacity
		WRM 1 & 2	1.65	1.78		Operational at 100 % capacity
		MMSM & STM	1.75	1.91		STM Operational at 85 % capacity
		SLTM	0.6	-	Not installed	Not installed
		Rebar Mill	-	0.6	Proposed in place of SLTM	Construction yet to start
		Semis (Blooms/Rounds/ Billets)	0.67	0.51	-	-
6.	CPP	Coal based	315 MW	315 MW	Revamping of ESPs	Being Revamped in phases
		Gas based	120 MW	120 MW	No change	Operational
		Coke Oven Waste heat recovery	29 MW	43 MW	Increase	COB5 under construction
		BF-TRT	39 MW	39 MW	No change	Operational
		NEDO sinter cooler	20.6 MW	20.6 MW	No change	Operational

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Sl. No.	Plant	Unit	Capacity as per EC	Capacity at 7.3 MTPA stage	Changes at 7.3 MTPA	Status
		Solar Power Plant	-	5 MW	New- Renewable Energy	Operational
7.	Lime & Dolo Plant	-	2625 TPD	2625 TPD	No change	Operational
8.	Air Separation Units	-	2700 TPD	2700 TPD + 1700 TPD for meeting other needs	Increase	1700TPD Yet to be commissioned
9.	Additional facilities	Turbo Blower-5			Standby blower to TB-4	
10.		Kanithi Balancing Reservoir-2			To meet exigencies during repair/shutdown of KBR-1 , under construction	
11.		Installation of LPG storage facility			Augmentation of facilities required for SMS-1&2	
12.		Installation of Nitrogen Buffer vessel			Augmentation of facilities required for SMS-2	
13.		Guard Pond			To meet environmental guidelines	

2.3 PLANT DETAILS

VSP is producing 6.3 MTPA steel through BF-BOF-CCP route. Iron ore (lumps and fines) is being obtained from Bailadila Mines in Chhattisgarh, Mines in Odisha operated by OMC & through open tenders. The ore fines are sintered in a sinter plant.

Metallurgical coal, both Indian and imported, is charged into Coke Ovens to produce coke, which is charged in Blast Furnaces along with Iron ore, sinter and fluxes. From the volatile matter evolved in Coke ovens Ammonia, Tar & Naphtha are separated. Chemicals like Naphthalene and Sulphur are recovered.

The hot metal from blast furnaces is taken in ladles/Torpedo Ladle to LD Convertors where high purity oxygen is blown into the hot metal to convert it into steel.

The liquid steel produced in LD Convertors is cast into blooms & billets through Continuous Casting route which are fed to various mill to make long products.

Gases evolved in Coke Oven, Blast Furnace and LD Convertors are cleaned in Gas Cleaning Plant. The cleaned coke oven gas, blast furnace gas and LD Gas are used either singly or mixed together as fuel in various shops. Excess LD gas is stored in gas holders after cleaning.

Auxiliary units include two Captive Power Plants (CPP), one having both coal based and gas based power generation and other entirely BF gas based and two Air Separation Plants (ASP).BF slag is granulated and sold. Slag from SMS I and II are kept in slag yard for natural weathering for future use and all waste materials of metallurgical value are recycled. Fines of Iron Ore, Fluxes, Coke and Mill Scales etc. are fed to sintering plant to produce sinter.

Iron & steel scrap generated at the plant are recycled in the SMS. Tar sludge and sludge from the ETP attached to the Coke Oven & Byproducts Plant are mixed with the coking coal being fed to the coke ovens. Process flow along with material balance is given **Fig 2.1**. The existing plant lay out is shown in **Drg. No. VSP-DEG-7.3-EXP-PGL-01**.

The production capacities of major technological & auxiliary facilities at 6.3 MTPA steel production capacity stage for which clearance from MOEF has been obtained earlier are given in **Table 2.2** as follows.

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Table 2.2 : Configuration of major Units at 6.3 MTPA &proposed changes at 7.3 MTPA stage

Department	Configuration as per EC for 6.3 MTPA Expansion	Production Capacity (MTPA)		Proposed changes at 7.3 MTPA Stage	Production Capacity (MTPA)
Coke Ovens and Coal Chemicals	- 4 batteries, 7 m Tall, 67 ovens, CDQ	4 X 0.84 = 3.36		- 5 batteries, 7 m Tall, 67 ovens, CDQ	5 X 0.84 = 4.2
Sinter Plant	- SP-1 – 312 m^2 grate area - SP- 2 - 312 m^2 grate area - SP – 3 – 1 X 408 m^2 grate area	2.85 + 2.85 + 3.61 = 9.31		- SP-1 – 378 m^2 grate area - SP- 2 – 336 m^2 grate area - SP – 3 – 1 X 408 m^2 grate area	3.64 + 3.04 + 3.61 = 10.29
Blast Furnace	- BF1of 3200 m^3 volume - BF2 of 3200 m^3 volume - BF3 of 3800 m^3 Volume	2.0 + 2.0 + 2.5 = 6.5		- BF1of 3800 m^3 volume - BF2 of 3800 m^3 volume - BF3 of 3800 m^3 Volume	2.5 + 2.5 + 2.5 = 7.5
SMS	SMS – I - 3 X 150 t BOF - 1 X 150 t LF - 6 X Four strand Bloom Caster - 1 X 150 t IRUT SMS – II - 2 X 150 t BOF - 2 X 150 t LF - 1 X 150 t RH-OB - 1 HM Desulphurization Plant - 2 X 6 Strand Billet Caster - 1 X 6 Strand Billet cum round Caster	3.5 + 2.8 =6.3		SMS – I - 3 X 150 t BOF - 1 X 150 t LF - 6 X Four strand Bloom Caster - 3 X 150 t IRUT SMS – II - 3 X 150 t BOF - 2 X 150 t LF - 1 X 150 t Twin LF - 1 X 150 t RH-OB - 1 HM Desulphurization Plant - 2 X 6 Strand Billet Caster - 1 X 6 Strand Billet cum round Caster - 1 X 5 Strand Bloom cum round caster	3.5 + 3.8 =7.3
Rolling Mills	- LMMM - WRM1 - MMSM - SBM	0.9 1.05 1.05 0.75		- LMMM + SBM - WRM1 +WRM2 - MMSM & STM - Rebar Mill	1.77 1.78 1.91 0.6

Department	Configuration as per EC for 6.3 MTPA Expansion	Production Capacity (MTPA)	Proposed changes at 7.3 MTPA Stage	Production Capacity (MTPA)
	- WRM2 - STM - Semi	0.6 0.7 0.663 =5.713	- Semi	0.51 =6.57
Captive Power Generation	- 3X60 MW Coal & Gas based - 2X67.5 MW Coal & Gas based - 1X120 MW BF & CO Gas Based - 2X7.5 MW + 14 MW CDQ Waste heat recovery - 2X12.5 MW + 14 MW BF TRT - 20.6 MW NEDO Sinter Cooler	180 MW 135 MW 120 MW 29 MW 39 MW 20.6 MW =523.6 MW	- 3X60 MW Coal & Gas based - 2X67.5 MW Coal & Gas based - 1X120 MW BF & CO Gas Based - 2X7.5 MW + 2X14 MW CDQ Waste heat recovery - 2X12.5 MW + 14 MW BF TRT - 20.6 MW NEDO Sinter Cooler - 5 MW Solar power Plant	180 MW 135 MW 120 MW 43 MW 39 MW 20.6 MW 5 MW =542.6 MW
Refractory Material Plant	- 5 X 325 TPD Kilns - 2 X 500 TPD Kiln	2625 TPD	- 5 X 325 TPD Kilns - 2 X 500 TPD Kiln	2625 TPD
Oxygen Plant	- 2700 TPD	2700 TPD	- 2700 TPD + 1700 TPD	4400 TPD

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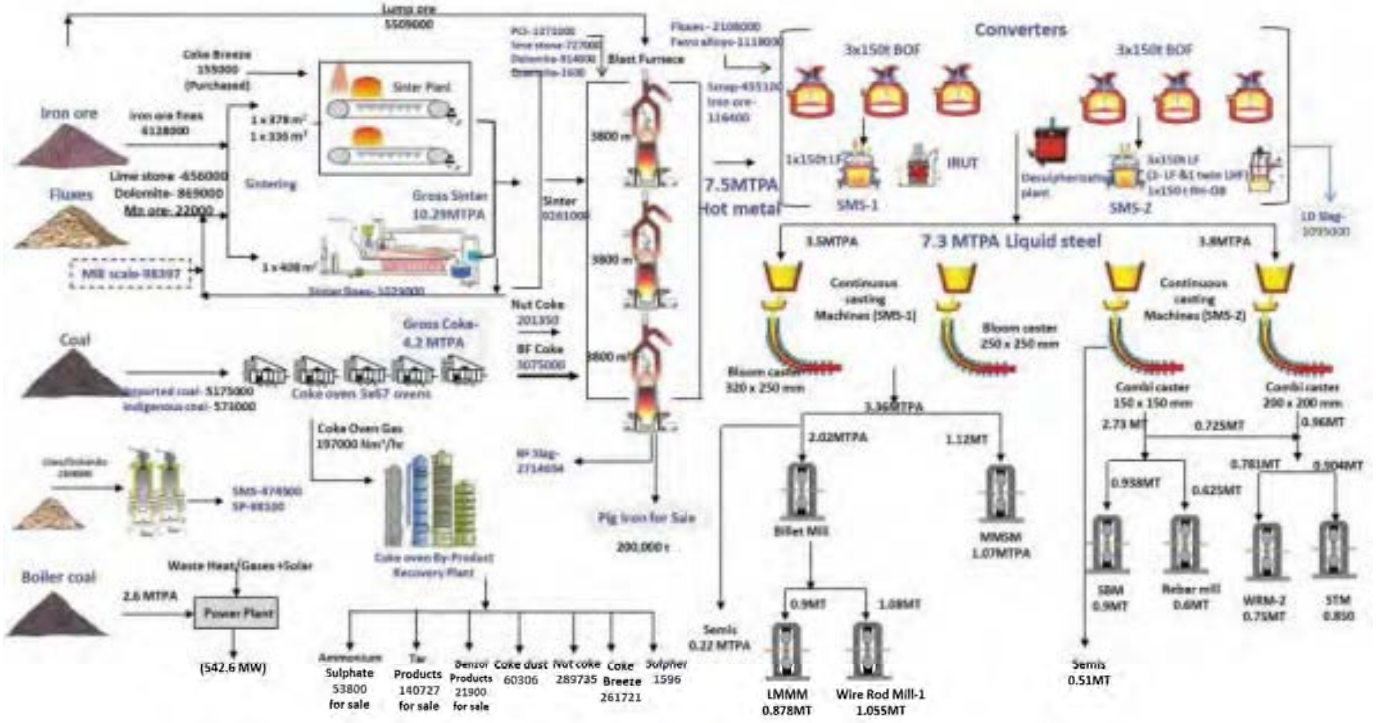
Fig. 2.1 : Process Flow & Material Balance at 7.3 MTPA Stage



2.3.1 Coke Oven and Byproducts Plant

The coke oven complex at VSP consists of By-product Recovery type Top-Charge (BPR-TC) batteries. Three identical BPRTC batteries, having 67 ovens were installed at the inception of the steel plant. Ovens are 7 meter tall, 16 metre long, 410 mm wide (avg.), 41.6 m^3 useful volume. The fourth BPR-TC battery of similar design and capacity was commissioned in 2009. At present all the four batteries are in operation. The existing batteries are supported by matching coal preparation and handling facilities, coke dry cooling system, coke sorting and handling, by-products plant, back pressure turbine station, Condensation cum Extraction Turbine from CDCP-4, interplant pipelines for process fluids and utilities. VSP is proposing to install an additional Coke Oven Battery-5 of 0.84 MTPA gross coke capacity with similar specifications of existing COB4. Different major units of the existing coke oven complex are briefly described below.

Coke Oven Battery

Coke oven batteries are characterised by following dimensions and features:

Type	Top charge
Heating system	PVR, underjet, compound
Oven dimensions	
- Length, mm	16,000
- Height, mm	7,000
- Width (coke side), mm	435
- Width (pusher side), mm	385
- Width (average), mm	410
- Effective volume, m^3	41.6
- Oven pitch, mm	1,400
- Heating flues per wall	32
- Pitch of heating flues, mm	480
- Heating level, mm	900
Charging hole	3
Gas off-take hole	2
Aspiration system	Steam ejection
Oven doors	Self-sealing, screw type
Construction	Silica refractory
Coal tower	
- Number	2 (one each for two batteries)
- Capacity, ton	4,000
Oven machines (for 4 batteries)	
- Charging car	8 nos.
- Pusher car	6 nos.
- Coke guide/transfer car	7 nos.
- Hot coke car	7 nos.
- Electric loco	6 nos.

Additional and special features of coke oven battery 4 are given below:

- Self-sealing, diaphragm type, plunger and three latch type disc spring loaded doors
- Magnetic charging hole lids,

- HPLA system,
- Spillage collecting conveyors on pusher side,
- Water sealed AP caps,
- Land Based Pushing Emission Control System,
- Advanced, oven machines with hydraulic drives.
- Computerised combustion control system.

Coke Dry Cooling Plant (CDCP)-

Design features of the CDCP are given below:

CDCP units	4 (one for each battery) + 1 at 7.3 MTPA Stage
Chamber per unit	4 (two working + 1 no hot standby + 1 no cold stand by)
Recovery boiler	1 (for each chamber)
Coke temperature, deg C	
Charged into chamber	950 to 1,050
Cooled coke	200 to 250
Circulating gas temperature, deg C	
Hot before heat recovery	760 to 800
Cooled in heat recovery boiler	180 to 200
Steam parameter from recovery boiler	
Pressure, KSCA	39 to 40
Temperature, deg C	430 to 450
Capacity per unit, ton per hour coke	50 to 52
Steam Recovery from Each Boiler, tph	20 to 25
Power Generation, MW –	
Back pressure turbine station	2 x 7.5
Condensing turbine station	1 x 14

By-Product Recovery Plant

The facilities of the by-product plant are intended for removal of impurities from the crude coke oven gas that is generated from the coke oven batteries and process the extracts for in-plant use as well as to recover marketable products. The facilities are matching for handling the crude gas generation from the four initial batteries, and hence additional equipment/facilities were installed to process the crude gas generation from the fifth battery. In totality, the nominal capacity of the by-product plant, with the installation of the facilities under implementation, is 1,97,000 Nm^3 per hour from all 5 batteries and will be able to handle the crude gas generation from simultaneous operation of four existing batteries. The major processing units of the existing by-product plant, including those under installation at present, are given below:

Coke oven gas condensation, cooling section and gas cleaning

- Primary gas coolers with cooling surface area of 2,425 sqm - 13 nos.
- Electrostatic tar precipitators – 7 nos.
- Mechanised decanters for separation of tar, capacity 380 m^3 - 8 nos.
- Condensation pump house including flushing liquor pumps for circulation to batteries.
- Different tanks for flushing liquor, crude tar, gas condensate, etc.
- Exhauster house with five Exhausters machines, each of capacity 76,000 Nm^3 per hour.

Ammonium-sulphate section

- Bubbler type saturators with associated vessels, pumps, etc.- 5 sets in operation and additional 2 sets under installation
- Associated centrifuges, fluidized bed dryers and auxiliary equipment for drying and handling of ammonium sulphate crystals produced in the above saturators.
- Weighing and bagging machines for dried ammonium sulphate.
- Storage shed for ammonium sulphate bags and dispatch facilities by rail and road transport.
- Ammonia stripping columns for stripping ammonia from excess flushing liquor by steaming. Stripped liquor is discharged to effluent treatment plant.

Final gas cooling and Benzol recovery section

- At present two streams of final gas cooling and Benzol recovery facilities are in operation, each having a gas handling capacity of 60,000 Nm^3 per hour. One more stream of same capacity is under installation.
- Each of the existing two streams of Benzol recovery section has two scrubbers installed in series for scrubbing of coke oven gas with direct contact of solar oil.
- The third stream will have three scrubbers installed in series for scrubbing of coke oven gas with direct contact of solar oil.
- Benzolised oil from the scrubbers is sent to the distillation section for stripping of crude Benzol.

Benzol distillation section

- Benzolised oil is received in distillation section from both the above streams through interplant piping. Stripping of crude Benzol is carried out in two streams and the de-benzolised oil is returned to recovery section through interplant piping for use as scrubbing media.
- One more similar stream of Benzol distillation section is under installation to process the benzolised oil to be received from third stream of Benzol recovery plant.
- Crude Benzol is recovered in two fractions viz. CB-I (boiling up to 150 deg C) and CB-II (boiling above 150 deg C).

Hydro refining and extractive distillation plant

- Refining and rectification of crude Benzol is carried out by adopting hydro refining and extractive distillation process.
- The plant produces pure benzene, pure Toluene, Xylene, Solvent naphtha by processing the entire quantity of crude Benzol of about 30,000 tons per year (tpy).

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Tar distillation plant

- The existing tar distillation section process the crude tar generated from condensation and cooling of coke oven gas.
- Capacity of the plant is to process the crude tar of about 1,15,000 tpy.
- Tar distillation is carried out in a single column unit associated with pipe still, two stage evaporators, columns, condensers and coolers.
- Naphthalene, anthracene, wash oil, creosote oil, road tar, fuel tar, hard pitch, soft pitch and are the products from this plant.
- Hard Pitch of softening point 75 to 90 deg C is produced and dumped in open cooling pit.
- Storage tanks for Tar and Oil.
- Product loading station.

Other units of By-product plant

- Reagent storage.
- Cleaning of return coke oven gas for the coke ovens heating.
- Gas bleeder for excess coke oven gas.
- Dry purification of coke oven gas from H_2S as Sulphur recovery.
- Crude and finished product storage for Benzol and products loading

COAL HANDLING

Coal is reclaimed, as and when required, by stacker cum reclaimer or wheel on boom reclaimer and conveyed to the blending bunkers of the coke oven batteries by a dedicated conveyor system. The average rate of unloading at the tippler is 850 tons per hour (TPH) and the reclaiming circuit operates at 550 TPH. Reclaimed coal from the storage yard is conveyed to coal towers through the following units for blending and crushing to the required degree.

- Foreign matter removing section,
- Proportionate section consists of 16 bins; 6 bins constructed recently, total 22 bins
- Coal crushing section.

COKE HANDLING

At present two (2) coke sorting plants are in operation. Coke sorting plant No.1 serves the Battery Nos 1 and 2. Coke sorting plant No 2 serves Battery Nos 3 and 4. Both the plants have complete facilities to handle different grades of coke and disposal of excess coke. The major facilities of coke handling plant are as follows:

- Coke screening section,
- Crushing sections,
- Coke bunkers,
- Conveying system,
- De-dusting units,
- Return coke bunker.

Coke dust generated at various points is collected and transported through pipelines by vacuum system and finally stored in bunkers. From the bunkers, it is loaded in road tankers for transportation to the Sinter Plant or to the Blast Furnaces for CDI.

Bag filter based dedusting systems have been provided for sucking the dust laden gas from various material transfer points.

RATIONALE FOR INSTALLATION OF COKE OVEN BATTERY 5

At present, VSP is operating 4 similar coke oven batteries each having a production capacity of 0.84 MTPA gross coke.

The three coke oven batteries which were installed at the inception of the steel plant have undergone several repairs in stages. However, even after required repairs, the coke production near to the design capacity cannot be achieved. Hence, VSP have decided to rebuild these batteries, one after another.

All the four batteries have to be operated at high production level (i.e. 340 to 360 oven pushings per day) to meet the enhanced requirement of BF coke for the 6.3 MT steel production. Even at this level of coke production, there is a marginal coke shortfall which has to be met through purchases from external sources. However, for further expansion of steel plant from 6.3 MTPA to 7.3 MTPA, installation of a new battery is necessary to eliminate the dependence on external suppliers.

Therefore, one more coke oven battery of similar specifications as COB5 is being installed. The total gross coke production capacity of VSP shall be 4.2 MTPA.

Initially, it was proposed to install the new COB5 as a replacement battery to facilitate the rebuilding of the existing batteries. Only 4 of the total 5 batteries shall be operated simultaneously at any point of time and any additional demand shall be made up by purchasing coke from market. However, with the increase in hot metal capacity of existing blast furnaces, the demand for coke has increased. As the prices of coke have increased and availability is reduced in open market, RINL is now proposing to operate all the five batteries simultaneously. The material flow diagram of typical Coke Oven Battery is shown in **Fig 2.2.**

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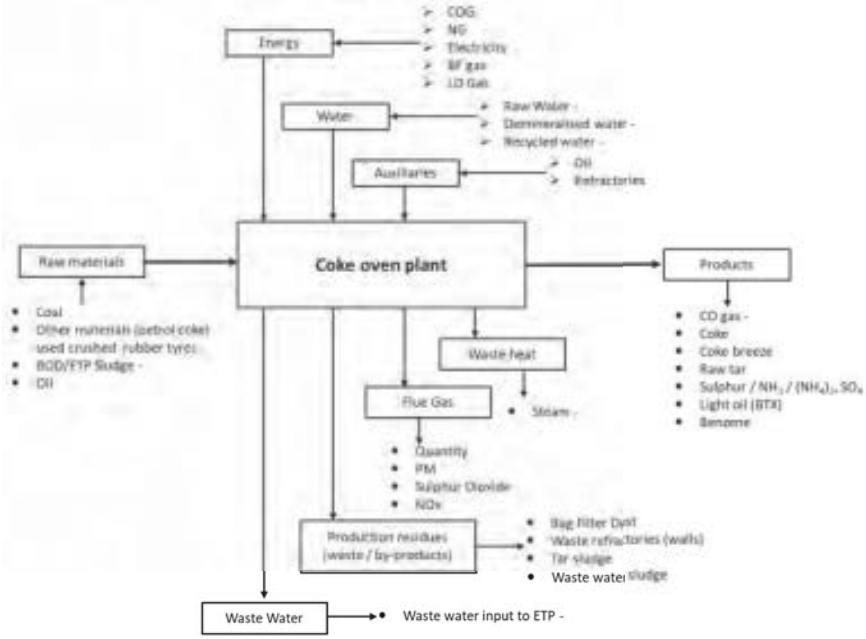
Fig. 2.2 : Material Flow of 0.8 MTPA Coke oven battery



Selection of coke oven & byproduct clean technology from production point of view:

- Exhauster VVVF drive for better control of gas suction and energy conservation.
- Coke Dry Quenching Plant sensible heat recovery with steam generation 52 TPH at 40 KSCA, 440 deg C and total power generation in combination 39 MW.
- For 7m tall Battery oven pushing number reduces for same production capacity, corresponding productivity improves, charging and pushing emission reduces
- Hydraulically pressed telescopic chute and screw feeder in charging car reduces spillage/emissions.
- Machine mounted Hydro-jet door cleaning system
- Computerized combustion control system
- Auto ignition system in GCM bleeder
- Top Charge level shall be maintained by leveler for uniform top pressure & for preventing over pressurization of oven.
- Both Side gas main pressure is to be equal to stop cross flow of raw C.O. gas through ready ovens. This will in turn prevent bricks of the free space zone from being overcooled & thus from getting damaged.
- Auto temperature control of gas at free space eliminate COG cracking and free carbon particle formation resulting in choking of AP base, goose neck, isolation valves etc & thus to prevent gassing/blazing of oven doors due to over pressurization of oven.

- Cantilever type of service platforms independent of buckstays will enhance the life of anchorage / battery

Clean Coke Oven & Byproduct Technology Implementation from Environmental Consideration:

- Dry fog Dust suppression system at Coal Handling Plant
- Land based Pushing Emission Control System
- Bag filter based dedusting for coke handling plant and CDCP.
- Sulphur Recovery from Coke Oven Gas to reduce SO2 emission during COG combustion.
- Stage Combustion / Recirculation of Flue Gas for Energy Conservation and NOx control
- Modern self-regulating leak-proof door
- Specially designed charging lids with spherical surface
- Water / Pneumatic sealed A.P. lids and goose neck spigot joint
- Over roof small anchorage to prevent opening of mortar joints of fire clay refractory to reduce oven top leakages
- Effluent Treatment Process : Physical , Chemical & Biological Process Control to maintain desired Tar & Oil Separation, pH , Flow Rate control , Temperature , Retention Time , Anoxic and Aeration Process , NH3, CN- & SCN- , COD, BOD and Phenol

2.3.2 Sinter Plants

At 6.3 MTPA stage, VSP had 3 sinter plants SP1, SP2 & SP3 of capacities 2.85 MTPA, 2.85 MTPA and 3.61 MTPA capacities respectively. The basic design and operating parameters of all three sinter plants at 6.3 MTPA stage are given in **Table 2.3**.

Table 2.3 : Design and operating parameter of sinter plants

SN	Item description	Unit	SP1	SP2	SP3
1	Sinter machine area	m^2	312	312	408
2	Productivity	$t/m^2/h$	1.06	1.06	1.12
3	Annual sinter production	MTPA	2.85	2.85	3.611
4	Size of finished sinter	mm	5 - 40	5 - 40	5 - 40
5	Annual working regime	d/y	330	330	330
6	No. of working hours/ day	h/d	24	24	24
7	Gaseous energy consumption for ignition Kcal / ton of sinter	kcal/t	36000	36000	15000
8	Coke breeze consumption/ ton of gross sinter	kg/ t	64.5	69.16	60.8
9	Under-grate suction	mm WC	1410-1420	1410-1420	1600
10	Sinter m/c bed height (including 40 - 50 mm hearth layer)	mm	650	500	700
11	Cooler type	-----	Straight Line	Straight Line	Circular Cooler
12	Temperature of cooled sinter	deg. C	<100	<100	<100
13	Dust content in inlet to ESP and Emission flue gases at sinter process stack outlet	mg/Nm^3	3000 / 115	3000/ 115	3000/50

The sinter plant complex consists of the following main technological units:

- Storage and proportioning

- Mixing
- Balling
- Sintering and cooling
- Waste heat recovery
- Cold sinter crushing
- Sinter screening
- Waste gas de-dusting
- Fan building
- Plant de-dusting

Electrostatic precipitators of adequate capacity are installed for de-dusting of waste gas from sinter machine. The revamped ESP will cater to the additional pollution load due to increase production and maintain emission less than 50 mg/Nm^3. The collected dust is recycled in the process.

One ESP has been provided for plant de-dusting purpose in each unit. The unit ensures less than 50 mg/Nm^3 of dust in the outgoing gases from stack and maintain work zone dust concentration 3 mg/Nm^3 at a distance 5-8 m from source.

Rationale for carrying out upgradation work

Sinter Machines #1 & 2 were commissioned in 1989 and 1991 respectively with a rated capacity of 5.256 MTPA and have been in continuous operation for the last 20 years. VSP has been taking various measures from time to time and reached the peak level of around 110% capacity utilization with a production of 5.89 MT/year in 2005-06. However, the production & productivity are now declining, mainly due to aging of equipment and present production has come down to less than the rated capacity, in spite of short term measures being taken continuously for improvement by VSP. Availability of sinter machines for production is coming down year by year which is attributed mainly to aging of both the sinter machines and other related auxiliaries. The quality of sinter is also not consistent due to technological obsolescence and aging of the machines etc. These therefore are areas of concern as these machines feed sinter to blast furnaces.

BF-1 and BF-2 of VSP are also being revamped and Category-1 repairs along with up gradation is being undertaken. After the Category-1 repairs and adoption of new technologies, the production capacity of hot metal from the above two furnaces has increased by about 1 MTPA. This has necessitated an additional requirement of 1.1 MTPA of sinter to meet the increased production capacity of the Blast Furnaces.

There is also a need to meet the higher levels of desired and expected environmental, pollution requirements, which can be achieved only by significant revamping and up gradation of technological and pollution control equipment.

In order to arrest decline and to improve the much desired overall consistency in operation of Sinter plants to produce quality sinter and also to meet the additional requirements of sinter arising out of Category-1 repairs/ up gradation of Blast furnaces, a preliminary study was conducted by VSP and felt the need of immediate major repair/ revamping in long term perspective. Accordingly, a study for the various aspects of operating units was carried out. Based on the study measures for revamping and up gradation of Sinter Machines#1 & 2 were suggested with the following objectives:

- To enhance productivity & production with sustained operation and also to meet the enhanced level of sinter requirements
- To reduce energy consumption through adoption of energy efficient technologies.
- To meet environmental norms through reduction in stack emissions etc,
- Reduction in breakdowns and improve the reliability of the equipment.
- Improving the sinter quality for better Blast Furnace performance.

As per the Feasibility Report, following activities were planned for upgradation of sinter plants-

- Replacement of existing pallets of old design by new SG- Iron pallets of latest design with an increased width which will increase the productivity and will have much higher life than existing pallets. Most steel plants both in India and abroad are already using SG. Iron pallets.
- Replacement/ modification of internals of entire ESPs and reduce stack emissions to meet the latest environmental norms.
- Adoption of new energy efficient ignition system (which has already been adopted by most other Sinter Plants) to reduce the energy consumption from present 36 M Cal/ton of sinter to 18-20 M Cal/ton of sinter
- Replacement of hot screen system and drum cooler by a new segregation chute as already being adopted in Sinter M/c #3
- Replacement of pelletisation drums with new drums having better internals for improved pelletisation as well as productivity.
- Revamping of sinter machine charging system including modification of surge hopper, drum feeder and segregation plates.
- Installation of hearth layer charging system with a new cut off gate and swinging hopper.
- Installation of double cone valve below the waste gas main for reducing ingress of air.
- Replacement of metallic conveyors with heat resistant belt conveyors.
- Modifications of straight line cooler fans to meet enhanced cooling requirement of the sinter after revamping of sinter machines.

Based on the recommendations of the Feasibility report, VSP has carried out the augmentation of SP1 and SP2. Modernization of SP1 has already been completed. Modernization works of SP2 are yet to be started. Production capacity of SP1 has increased from 2.85 MTPA to 3.64 MTPA. Production from SP2 is expected to increase from 2.85 MTPA to 3.04 MTPA.

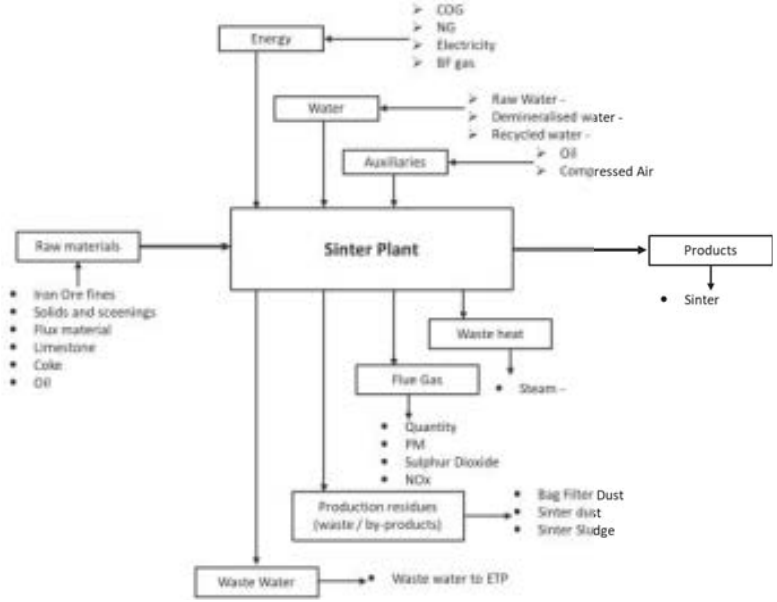
The basic design and operating parameters of all three sinter plants at 7.3 MTPA stage are given in **Table 2.4**. The typical material balance diagram of Sinter Plant is shown in **Figure 2.3**.

Table 2.4 : Design and operating parameter of sinter plants after revamping

SN	Item description	Unit	SP1	SP2	SP3
1	Sinter machine area	m^2	378	336	408
2	Productivity	$t/m^2/h$	1.216	1.14	1.12
3	Annual sinter production	t/y	3.64	3.04	3.611
4	Size of finished sinter	mm	5 - 50	5 - 50	5 - 50
5	Annual working regime	d/y	330	330	330
6	No. of working hours/ day	h/d	24	24	24
7	Gaseous energy consumption for ignition Mcal / tonne of gross sinter	Mcal/t	18	20	15

SN	Item description	Unit	SP1	SP2	SP3
8	Coke breeze consumption/ tonne of gross sinter	kg/ t	60.8	60.8	60.8
9	Under-grate suction	mm WC	1400	1400	1600
10	Sinter m/c bed height (including 40 - 50 mm hearth layer)	mm	650	500	700
11	Cooler type	-----	Linear	Linear	Circular
12	Temperature of cooled sinter	deg. C	<100	<100	<100
13	Dust content in exhaust gases at stack	mg/Nm^3	Below 50	Below 50	Below 50

Fig. 2.3 – Typical Material Flow Diagram of Sinter Plant



Selection of Sinter Plant Clean Technology from Production Point of View-

- Sinter Cooler Sensible Heat Recovery –Power Generation 20.6 MW from Sinter Machines 1 & 2.
- Implemented in SP-3 (408 m^2) for generation of process heat and preheating of combustion air by sensible heat recovery from sinter cooler
- High-Efficiency Multi slit Burner in Ignition Furnace eliminates "NO FLAME" areas and supplies minimum heat input for ignition, therefore saving energy.
- Intensive Mixing & Granulation System of Raw material Feed in Sinter Plant for effective agglomeration
- The hot cooler off-air is re-circulated to the sinter machine as part of energy conservation measures.

- Auto Control Minimize stoppages , Consistent strand speed, bed composition & bed height helps to maintain uniform permeability of sinter bed
- Optimization of water addition in sinter Raw mix
- Facility to Control of coke breeze size
- Minimization of air in-leakage for maintaining under grate suction and improving productivity. Reinforcement of sealing between palettes.
- High plant productivities even when the sinter machine is operated with a higher bed height and low solid fuel consumption.

Clean Sinter Plant Technology Implementation from Environmental Consideration-

- Continuous Monitoring of Process and Dedusting Stack emission.
- Addition instant calcined lime facility for binding and utilizing heat of reaction for moisture control in sinter raw feed.
- Minimization of oil content to minimize VM passage to ESP
- Centralized ESP based Dedusting system to cater to all material transfer points.
- Process Waste Gas Cleaning ESP with higher treatment time for effective control ultra-fine dust emission
- Pulse - Energization of ESPs discharge electrodes for high resistivity sinter dust emission control.

2.3.3 Blast Furnace

At 3.5 MTPA stage, VSP had 2 Blast furnaces each of capacity 2.0 MTPA. The two blast furnaces had attained rated production capacity by 2001-02 and were being operated at full capacity since then.

After getting prior EC in 2005 for 3.5 MTPA to 6.3 MTPA expansion program, VSP has installed another blast furnace of 2.5 MTPA production capacity.

All the blast furnaces operate with sized iron ore, sinter, coke, coal dust, fluxes and additives. The hot metal produced is transferred to the Steel Melting Shops (SMS) for desulphurization and then charged in BOF. A part of the hot metal from the BFs is sent to pig casting machine for cold pigs production as and when SMS is not in a position to accept the hot metal due to some reasons.

The liquid slag is granulated at cast house slag granulation unit. The BF top gas is cleaned in dust catcher and gas cleaning system, and distributed to the stoves, runner drying and boiler for steam generation. Excess BF gas is utilized in gas based captive power plant for power generation. The Technological parameters of the installed blast furnaces at 6.3 MTPA stage is given in **Table 2.5** below.

Table 2.5 : Technological parameters of the installed Blast furnaces

SN.	Product	Unit	Parameter		
			BF1	BF2	BF3
	Annual Production	**MTPA**	**2.0**	**2.0**	**2.5**
1.	Gross hot metal Production	TPD	5715	5715	7150
2.	Useful Volume	m^3	3200	3200	3800
3.	Granulated slag	TPD	2100	2100	2600

SN.	Product	Unit	Parameter		
			BF1	BF2	BF3
4.	Slag Rate	kg/thm	330	330	320
5.	No. of operating	day/yr	350	350	350
6.	No. of shifts per day	No.	3	3	3
7.	% tapping duration of hot metal tapping per day	No.	75	75	91
8.	BF Gas generation / THM	Nm^3	1585	1585	1585
9.	BF Gas CV	$Kcal/Nm^3$	750	750	855
10.	Productivity	$t/d/m^3$ (UV)	1.79	1.79	1.88
11.	Working Days / year		350	350	350
12.	Sinter in Burden	%	78	78	70-80
13.	Pellet	%	-	-	10
14.	Coke Rate	Kg/thm	534	534	385
15.	PCI rate	Kg/thm	--	--	150
16.	Operating Top Pressure	bar	2	2	2.5
17.	Hot Blast Temp	Deg C	1050	1050	1250
18.	O2 enrichment	%	1.5	1.5	5

Blast Furnace Gas Cleaning Plant

The dust-laden blast furnace gas after dust catcher is cleaned in the gas-cleaning tower in 2 stages. The dust laden hot gas from the dust catcher enters the 1st stage of the wet type scrubber/venturi type GCP tower from the top and cooled to saturation temperature, by direct contact with water, in the upper part of tower where the gas stream enters the water spraying zone.

In the 1st stage, besides saturation, coarse dust particles are also entrapped into the water droplets. Dust laden effluent water slurry (separated from the gas stream) is discharged through sealing system to the launder for treatment and recycling.

Part of the pre-cleaned gas coming out after the 1st stage cleaning is used for pressure equalizing of the BF top equipment.

The pre-cleaned gas from the 1st stage now enters the 2nd stage cleaning equipment housed in the same tower. In 2nd stage the gas flows through the regulated/restricted passage. Water is also injected on to the gas up-stream of the regulated/restricted passage. When entering the regulated/restricted passage the gas flow is accelerated. The highly turbulent mixture of gas and water causes the fine cleaning of the gas. The effluent water is collected in the bottom of the tower and directed to the sump at ground level. The effluent water from the sump is delivered to the launder for discharging all the effluent water to the effluent treatment plant.

The clean gas, coming out of the GCP tower passes through water droplet separator/demister, wherein water droplets get separated out from the gas stream. The gas entering the demister passes through fixed directional vanes inducing a spinning action in the gas stream. Free moisture is collected as a result of the centrifugal forces produced by the spinning action. Condensed/effluent water is directed to the bottom of the GCP tower.

Clarified water from the effluent treatment plant is pumped back to saturator and scrubber stages of GCP.

The clean gas with dust content of <5 mg/Nm^3 from the moisture separator is delivered to the top-gas recovery turbine (TRT) for generating power from the back pressure of the gas.

The low pressure gas from TRT is used to meet the fuel requirements of stoves and other consumers of the steel plant, directly or as mixed gas.

Coal Dust Injection (CDI) System:

Use of injectants (like Coal) to achieve reduced use of Coke and to improve the furnace performance is a proven technology. Dense phase conveying mode is implemented. Generally, dense phase conveying involves more than 30 kg of pulverized coal per kg of conveying gas. The advantage with the dense phase operation is that it consumes less energy and results into low wear rates.

A centralized Bag Filter (Pulse Jet Type) based dust extraction system is provided to extract coal dust generated at various transfer points (conveyors, ground hopper, bunker, etc.) of coal / coal dust conveying system for recycling in the process.

Pig Casting Machine (PCM)

Hot metal produced from the BF is transported to the Steel Melting Shop through torpedo ladles. Extra hot metal is poured into the Pig-casting machine for production of pigs. Three Nos. of double strand pig casting machine of capacity 1700 t/d each has been installed for production of pig iron.

Slag Granulation Plant

Each blast furnace has been provided with a Slag granulation plant having the most efficient, latest and proven technology of the time for 100 % processing of slag generated.

The purpose of SGP is to produce granulated slag by quenching of molten slag by impingement of pressurized water across the flow of liquid slag and also to separate the granulated slag from the water so as to obtain a product with low moisture content.

Rationale for carrying out upgradation work done leading to enhanced Capacities

BF-1 (Godavari) & BF-2 (Krishna) were commissioned in March, 1990 & March, 1992 respectively. Since inception, BF-1 & BF-2 had produced 29.8 Mt & 28.6 Mt till 31.03.09 respectively and have been in continuous production for the last 18 & 16 years respectively. Normal repairs were undertaken earlier to upkeep the health of the equipment. The furnaces had been in operation for about 17 years, without any major overhauling of Furnace wall & Hearth. Normally, the Russian BFs are recommended for Category – 1 capital repairs after 18-20 Mt throughputs & after 14 to 16 years of operation. So, both the furnaces were overdue for the major repairs. Moreover, it is experienced that the refractory wear is accelerated at the end of the campaign in hearth, which needed immediate repair for safe functioning.

Hence repair / modernization of these furnaces were envisaged that would not only improve the health of the furnace but would also ensure cleaner environment and make them more energy efficient. This modernization/ revamping was planned by incorporating modern features e.g., pulverized coal injection with adequate amount of oxygen enrichment of air blast and improvement in burden material.

The adoption of improved design cooling system and upgradation of thinner refractory to counter the increased heat load due to the above modern features, has resulted in increase in furnace volume from 3200 m^3 to 3800 m^3 which in turn led to increase in hot metal production. However, no additional construction activity has been undertaken outside the furnace proper.

Due to increase in capacity of hot metal an additional Turbo Blower was also required to be added to the production facilities. Turbo Blower-5 was installed as a stand by Blower to Turbo Blower-4 to ensure uninterrupted supply of cold blast to Blast Furnace No.3. This standby blower is required to take up the modernization of the existing Blowers to meet the increased requirement of cold blast in Blast Furnaces. Continuously, only three Blowers will be working feeding cold blast to three Blast Furnaces respectively.

The Technological parameters of the blast furnaces after capital repairs at 7.3 MTPA is given in **Table 2.6** below.

Table 2.6 : Technological parameters of the installed blast furnaces at 7.3 MTPA

SN.	Product	Unit	BF 1&2 Revamped	BF3
	Annual Production	**MTPA**	**2.5 Each**	**2.5**
1.	Gross hot metal Production	TPD	7150 Each	7150
2.	Useful Volume	m^3	3800	3800
3.	Granulated slag	TPD	2600	2600
4.	Slag Rate	kg/thm	320	320
5.	No. of operating	day/yr	350	350
6.	No. of shifts per day	No.	3	3
7.	% tapping duration of hot metal tapping per day	No.	75	90
8.	BF Gas generation	Nm^3/hr	550000	550000
9.	BF Gas CV	Kcal/Nm^3	850	885
10.	Productivity	t/d/m^3 (UV)	1.88	1.88
11.	Working Days / year		350	350
12.	Sinter in Burden	%	60-80	60-80
13.	Pellet	%	0-30	0-30
14.	Coke Rate	Kg/thm	385-390	385-390
15.	PCI rate	Kg/thm	150	150
16.	Operating Top Pressure	bar	2.44	2.5
17.	Hot Blast Temp	Deg C	1150	1250
18.	Hot Blast Press	Bar	4.5	4.5
19.	O2 enrichment	%	5~6	5~6
20.	TRT	MW	12.5 MW	14.0 MW
21.	Cast House & Stock House DE system Stack Emission	mg/Nm^3	Under 50	Under 50

Selection of Blast Furnace Clean Technology from Production Point of View-

- Avg. Iron Ore Quality for best use in RINL Blast Furnace and Sinter Plant with composition : Fe- 66.85% , Al_2O_3 – 1.61 % , SiO_2 – 1.41 %
- For this hot metal quality is also very good with impurities S-0.003% , Si- 0.61%

- Avg. Slag Quality with low viscosity maintained with : Basicity 1.06 , Al_2O_3 – 18.52 % , 33.77 SiO_2 %
- In house produced Average Coke Quality is also good : C 85.43 %, Ash 13.97 % , VM -0.6% , M10 -6.64 value ,CSR- 65.3 ,CRI- 24.91
- Hot Blast Temperature 1250 deg C and Pressure Increase to 4.5 Bar for improving productivity
- PCI injection up to 150 kg/thm to reduce coke rate
- O_2 enrichment up to 5-6% to facilitate PCI
- TRT power generation utilizing potential energy of BF Top Gas for all BFs
- Close Loop Cooling of BF Shell, water conservation.
- Insulation Efficiency of refractory lining improved, heat loss reduces, cooling efficiency increased and above all productivity improved
- Sensible heat recovery from Stove exhaust flue gas is installed

Clean Blast Furnace Technology Implementation from Environmental Consideration

- Cast House Fume Extraction and Stock House Dedusting System revamping.
- Automation , safety interlock to reduce operation hazard, safety and control
- GCP revamping to ensure particle reduction in clean gas up to 5mg/ Nm^3
- Stage Combustion in stove to reduce NOx emission

2.3.4 Steel Melting Shop

VSP is currently operating SMS -1 complex, which is capable of producing 3.5 MTPA liquid steel. The SMS -1 complex was fully commissioned on 2nd August 1992 and has been consistently producing 3.5 MTPA liquid steel.

After getting prior EC, VSP further increased the steel production capacity of the plant from 3.5 MTPA liquid steel to 6.3 MTPA liquid steel. The Steel Melting Shops constitute the following major plant facilities:

- SMS – I
  - 3 X 150 t BOFs
  - 1 X 150 t LF
  - 6 X Four strand Bloom Casters
  - IRUT
- SMS – II
  - 2 X 150 t BOFs
  - 2 X 150 t LFs
  - 1 X 150 t RH-OB
  - 1 HM Desulphurization Plant
  - 2 X Six Strand Billet Caster
  - 1 X Five Strand Billet cum round Caster

The production capacity of SMS -2 complex with above units is 2.8 MTPA liquid steel. SMS -2 was built wth provision for installation of one more Convertor, one more Billet Caster and associated facilities in the existing layout.

Three (3) nos. of 150 t capacity Convertors are installed in SMS I and two (2) nos. of 150 t capacity Convertors are installed in SMS II. The shape of the Convertors is symmetrical top

with fixed Convertor bottom. Facilities for inert gas purging from Convertor bottom have been provided. Medium for inert gas blowing is argon / nitrogen depending upon the grade of steel. Top conical portion of Convertor vessel is of water-cooled type.

The major technological parameters of SMS I and SMS II are given in **Table 2.7**.

Table 2.7 : Technological Parameters of Basic Oxygen Furnaces

SN.	Item	Unit	SMS I	SMS II
1.	Liquid steel production	t/yr	3,500,000	2,800,000
2.	Convertors installed	Nos.	3	2
3.	Convertors in operation	Nos.	3	2
4.	Nominal heat weight	t	133	150
5.	O_2 flow rate / Blowing Pressure	Nm^3/min / MPa	600 /1.6	600 /1.6
6.	Blowing Time / Tap-to-tap time	Min / min	14.4/49.4	14~16/ 40
7.	Specific consumption of oxygen for blowing	Nm^3/t Nm^3/hr	50.3 22400 per 56 heats & 29600 for 74 heats	50.3 22400 per 56 heats & 29600 for 74 heats
8.	Convertor lining life, approx.	Heats	4500	3000
9.	No. of heats/d (max.)/ Convertor	No.	29.1	29.1
10.	Operating time / Production Time	Days	324.8 (Production time)	344.8/325.8
11.	Metallic yield	%	90.5	91.1
12.	Effective Cylindrical Height / Diameter	m	7.8/5.6	7.93 /5.51
13.	h/d ratio		1.4	1.44
14.	Specific Volume	m^3/t	1.00	1.0
15.	Total Gas Flow to GCP	Nm^3/h	102046	1,15,000
16.	Water Flow cooling System / Ventury of GCP	m^3/h	2300/360	1500/ 360
17.	Recovered Clean Gas	Nm^3/ton	80	80
18.	Gas Flow to Gas Holder	Nm^3/h	2,30,000	2,30,000
19.	Gas Cleaning in Wet ESP flow	Nm^3/h	2 X 40,000	2 X 40,000
20.	Dust content at ESP outlet dry basis	mg/Nm^3	5	5
21.	ESP based centralized Secondary Dedusting System	m^3/h	15,00,000	2X11,16,500

Injection Refining & Up temperature (IRUT)

Presently, VSP has one online IRUT along the track of Convertor-B of SMS 1. The IRUT has refractory snorkel attached to a moving arm with lowering and lifting arrangement. The purging of inert gas creates a slag free area. The snorkel is immersed partially to enclose the slag free area. The absence of slag within the snorkel and the inert atmosphere created by stirring ensures high rate of alloy recovery and good control of composition. The facilities of the existing IRUTs are as given below:

- Ladle stirring: Stirring of liquid steel for homogenization of composition and temperature is mainly done through the ladle bottom. IRUT also have the facility of top purging with

top lance. The top lance for purging is used only in emergency during blockage of porous plug.

- Temperature and sampling: Temperature and samples are taken in the IRUT with temperature and sample lances.
- Chemical heating: The temperature of liquid steel is raised when required by addition of aluminum and blowing of oxygen through refractory coated oxygen lance.
- Material addition system: The IRUT has mechanized material handling system consisting of bunkers, weigh hoppers, vibro-feeders, conveyors and addition chute.

Presently, the IRUT has six (6) nos. bunkers of which, two are used for storage of coolants such as scrap, two for ferromanganese and two for ferro-silicon. The bunkers are filled up through bottom discharge bucket by shop cranes. The IRUT also has a single strand wire feeding machine for addition of aluminum wire.

Ladle Furnace

Three nos. 150T ladle furnaces are installed as part of secondary metallurgy facility for alloying, raising the temperature and homogenizing the liquid steel. The units are installed in separate bays between ladle preparation and tundish preparation and comprise of alloying station, bottom purging facilities, temperature and sampling unit, control room, self-propelled transfer car, an EOT crane for maintenance, fume extraction system etc.

Liquid steel tapped from the Convertors is fed to the casters through the secondary metallurgy route of IRUT, ARS and Ladle furnace. Value added steel requiring low Oxygen and Sulfur content is routed through the Ladle furnace.

Gas Holder

2 nos. of 80,000 m^3 capacity (approx.) dry seal gas holder are provided for storage of BOF gas rich in CO for further use in the plant units, either by mixing with BF gas or with mixed gas.

Proposed changes in Ongoing Expansion

At present, RINL has further expansion provision of the plant capacity by adding one more BOF of 150 t capacity in SMS -2 Complex to take care of the additional Hot Metal production from existing Blast Furnaces after Category – I Capital Repairs. The BOF will be designed with provision for adoption of combined blowing/ inert gas stirring process. The BOF is provided with hollow trunnions for installation of combined blowing facilities.

VSP during installation stage proposed for installation of a 5-strands Bloom-cum-Round Caster instead of 6-strand Billet Caster in SMS -2 Complex along with associated auxiliary facilities, thereby meeting the requirement of the rolling mills & rebar mill under implementation and also to meet the MOU with Indian railways for the supply of rounds for the axle plant.

By undertaking the above expansion program, the combined liquid steel production capacity at RINL, Visakhapatnam will rise from 6.3 MTPA to 7.3 MTPA.
The major technological parameters of SMS I and SMS II at 7.3 MTP stage are given in **Table 2.8.**

Table 2.8 : Technological Parameters of Basic Oxygen Furnaces- Convertor 3 under 7.3 MTPA stage

SN.	Item	Unit	SMS II- Conv -3
1.	Liquid steel production	t/yr	1,000,000
2.	No. of Convertors installed	Nos.	1
3.	No. of Convertors in operation	Nos.	1
4.	Nominal heat weight	t	150
5.	O2 flow rate / Blowing Pressure	Nm^3/min / MPa	600 /1.6
6.	Blowing Time / Tap-to-tap time	Min / min	14~16/ 40
7.	Specific consumption of oxygen for blowing	Nm^3/t	50.3
8.	Convertor lining life, approx.	Heats	3000
9.	No. of heats/d (max.)/ Convertor	No.	32
10.	Operating / production time	Days	315.1
11.	Metallic yield	%	90.4
12.	Effective Cylindrical Height / Diameter	m	7.93 /5.51
13.	h/d ratio		1.44
14.	Specific Volume	m^3/t	1.0
15.	Total Gas Flow to GCP	Nm^3/h	1,14,800
16.	Water Flow cooling System / Venturi of GCP	m^3/h	1500 / 382
17.	Recovered Clean Gas	Nm^3/ton	80
18.	Gas Flow to Gas Holder	Nm^3/h	# to 2,30,000 Nm^3/h for all three converters
19.	Dust content at ESP outlet dry basis	mg/ Nm^3	5
20.	ESP based centralised Secondary Dedusting System	m^3/h	1*1406000
21.	ID Fan Station capacity / static pressure	m^3/h & mmWG	2 * 7,50,000 / 455
22.	Bag Filter based MH Dedusting System	m^3/h	Connected to the existing system only.

#N.B. At a time out of three maximum two converters will be in blowing operation.

Dog House

Andhra Pradesh Pollution Control Board has advised VSP to take necessary steps for reduction of fugitive emissions and adhere to the latest environmental norms.

For this, Dog Houses (enclosures to the Convertors) along with hoods were required to be installed for proper collection and evacuation of secondary fumes generated during charging & tapping. Enclosure (Dog House) for proper fume collection & evacuation is proposed to be added to the existing Convertors of SMS I and also in the new Convertor 3 in SMS2.

The doghouse are of steel plate construction, attached to bolted-steel frames. Heat protection shield are provided on the charging side doors and the charging fume hood, as required. The doghouse will be provided with the following facilities:

- Sliding doors on the charging side with motorized trolleys, for providing access to the Convertor for charging hot metal & scrap. The doors will be provided with a window for temperature & sampling.
- Sliding door on the tapping side with electric drive.
- Fume collection hood on the charging side, connected to the fume collecting duct
- Connection to the fume collecting duct on the tapping side.
- Different Suction hoods from fume generation stations at Torpedo Re-ladling Station, Desulphurisation / De-gassing Station, Convertor Charging point, Convertor Blowing / tapping station, On line rinsing Station, Ladle Break Out Stand are connected to centralised Secondary Dedusting System. With all combination of above working suction points maximum suction quantity will be considered while selecting secondary dedusting system capacity.

Selection of SMS Clean Technology from Production Point of View:

- Replacing vessel in SMS-I for increasing h/d ratio and specific volume of production for improving productivity.
- Improved cooling system of Copper Mould for caster for improving productivity
- Reduction in tap to tap time by Bottom stirring , Argon/ Nitrogen blowing
- Installation of modern diagnostic facility to improve reliability
- Improved refractory to reduce tap to tap time, increase lining life
- Slag splashing facility to improve refractory life
- Optimum Ladle pre-heating and Tundish Heating
- Integration of casting and rolling
- SMS- GCP – ID Fan VVVF Drives Control installed for all Convertor

Clean SMS Technology Implementation from Environmental Consideration

- Introducing Level-2 Automation with Safety interlock to reduce operation hazard.
- Gas Holder installation for BOF fuel gas recovery.
- Centralised Secondary Dedusting system with dog house for both SMS-1 & SMS-2
- Revamped Steam Exhaust System of caster
- Walking Beam Cooling bay for round and billet transfer
- Independent bag filter based de-dusting system for Bulk Material Handling at Convertor Top

2.3.5 Continuous Casting Machine # 4 (CCM#4)

CCM#4 is second main technological unit under 7.3 MTPA expansion project to cater to the additional 1.0 MTPA liquid steel production in SMS-2.

The entire quantity of liquid steel produced in the BOF shop will be continuously cast into Billets/ Blooms/ Rounds in existing 3 casters and in CCM#4, which is a 5 strand bloom-cum-round caster.

The CCM#4 has the latest design with state-of-the-art technology and equipped with modern features such as butterfly type ladle turret, self-propelled tundish transfer cars for flying tundish system, multi-point unbending/ continuous straightening, high speed moulds, hydraulic mould oscillator, automatic mould level controller for controlled flow of liquid steel, casting powder feeding devices, mould EMS and F-EMS to improve surface & internal quality, auto breakout detection, multi zone spray and air-mist cooling system,

withdrawal and straightening units, flexible dummy bar, automatic torch cutting machine, dummy bar handling and run-out roller tables, walking beam cooling bed, transfer roller tables, unloading and charging grids in storage bays, computerized process control system (Level II) etc. The technological parameters of the CCM#4 is given below in **Table 2.9**.

Table 2.9 - Technological parameter of Bloom cum Round Caster

S. N.	Description	Design Feature
1.	Annual production of blooms & rounds, t/yr	1,000,000
2.	Liquid steel to be cast , t/yr	1,020,000
3.	Heat size, t	150 t (Normal.), 160 t (Max)
4.	Heat delivery cycle, min	40 (min.) / 50 min. (avg.)
5.	No. of strands	5
6.	Type of machine	Radial with curved mould
7.	Base radius, m	12
8.	Design range of the product to be cast	
	a. Rounds (mm) - dia	200 - 510
	b. Bloom (mm x mm)	200 sq., 250 sq., 320x400; 300x450
9.	*Machine equipped to cast* a. Bloom (mm x mm) b. Rounds(mm) - dia	 200 sq. 410Ø; 450Ø; 430Ø; 380Ø;
10.	Metallurgical Length, m	~38
11.	Bloom length, m Round length , m	6 -12 4.0 - 6.5
12.	Distance between strands, mm	1800
13.	Type of unbending	Multi-point unbending
14.	Casting time, min.	50
15.	Casting speed, m/min for different sizes	0.45 to 2.2
16.	Machine speed, m/min	~4.0
17.	Preparation time, avg.	50
18.	No. of heats per sequence	12
19.	Avg. no. of heats/day	24 (max. 26)
20.	Caster availability, days/yr.	320
21.	Yield, %	96
22.	Design production capacity of CCM , t/yr	1,000,000

The cast blooms will be fed to the structural mill and rounds shall be supplied to the axle plant. Part of cast products will also be sold as semis.

Provisions for environmental considerations in CCM#4

Suitable provisions have been provided while implementation of CCM#4 and its auxiliary facilities to fulfill the twin objectives of energy conservation and pollution control. The details are:

- Steam generated during casting process is exhausted through the centrifugal exhaust fans to the atmosphere above the building roof.
- The fumes generated during torch cutting operation are exhausted to maintain clean working environment.
- The scales generated at the strand cutting area are being collected in scale pit along with water. These scales are recovered and sent to the sinter plant for recycling.
- The small cut pieces generated in the strand cutting area are being reused in steelmaking.
- The contaminated water from the scale pit is recycled after treatment at the water treatment plant of CCM.
- Oil skimmers are installed in scale pit for removal of oil in the water before re-circulation.

2.3.6 Rolling mills

After all the phases of expansion taken place so far, RINL has at present six long product mills installed within the integrated steel plant complex. Three mills of Phase-I (Medium Merchant & Section Mill, Wire Rod Mill and Light & Medium Merchant Mill) are attached to SMS-1 and three mills of Phase-II are attached to SMS-2. As per the proposed plan for Phase-II expansion from 3 MTPA to 6.3 MTPA, four rolling mills were proposed to be attached to SMS-2. Three mills namely, wire rod mill-2 (WRM-2), special bar mill (SBM) and structural mill (STM) are already installed and operational but the 4thmill which was a seamless tube mill (SLTM), could not be implemented for various reasons. The space for installation of SLTM is however, left unaffected and is available for installation of any one appropriate rolling mill.

With all the six mills in operation there will be about 1.73 million tonnes of cast billets for sale. This amount will be reduced to about 1.2 million ton when the three mills attached to SMS-2 attain their full design capacity.

At this production level, with only three rolling mills in new complex, VSP will have substantial quantity of billets for sale. VSP, therefore, needs a rolling mill which can convert the billets into new range of value added products.

VSP already has two wire rod mills, multiple structural/section mills and one special bar mill. Addition of similar long product mills is considered to be not the right choice for VSP as it will only further increase the volume of same product. The Rebar Mill, on the other hand, will add a new range of long products. Thus, by installing a Rebar Mill at the place of SLTM, VSP will be able to reduce the substantial quantity of saleable billets from their product basket. Considering the above, VSP is proposing to install a rebar mill of 0.6 MTPA capacity in the space available for earlier proposed SLTM. Additionally, RINL is also proposing to optimize the rolling hours of the existing mills to enhance the overall rolling capacity of the steel plant.

The proposed rebar mill shall have one reheating furnace, a 8-stand roughing train, a 4-stand intermediate train, a block of 4 pre-finishing stands, followed by two groups of finishing block each with 4 stands. Thus rolling will be carried out in single strand in roughing, intermediate and pre-finishing sections while two strand rolling will be carried out in finishing section. After each group of finishing blocks separate, thermo-mechanical treatment section will be arranged for quenching and self-tempering of rebars for achieving high strength products.

VISAKHAPATNAM STEEL PLANT
EIA/ EMP Studies for expansion of Integrated Steel Plant from 6.3 MTPA to 7.3 MTPA Liquid steel within the premises of Visakhapatnam Steel Plant

The modern high-capacity rebar mills have the following technological features:

- Multi-strand slit rolling
- Thermo-mechanical treatment of rebars
- Single family rolling

Multi-strand slit rolling

The slit rolling process is a technology for increasing the production rates of small diameter reinforcing bars. A combination of special roll pass design and guiding equipment is used to shape and divide the hot rolled stock longitudinally into 2, 3 or 4individual strands which are further rolled to finished sizes.

Thermo-mechanical treatment of rebars

The thermo–mechanical treatment process is widely used for the production of high strength rebars instead of cold twisting process, which is labor-intensive, or by micro–alloying. The rebars, after finish rolling, are rapidly water cooled through a water cooled jacket pipe in a controlled manner, which forms a martensitic layer on the bar surface. A subsequent self-tempering of the martensite takes place by the heat of the core and a final product is obtained with the desired mechanical properties.

Single family rolling

In order to cater to the immediate market demands of size changes, single family rolling concept has been developed. The mill pass design therefore will follow the single family rolling concept for faster size change as well as free size rolling concept with close dimensional control. Technological parameters of Rolling mills are given in **Table 2.10.**

Table 2.10 : Technological Parameters of Rolling Mills

Parameter	LMMM-Billet	LMMM-Bar	WRM-1	MMSM	WRM-2	SBM	STM
Capacity	2015000	710000	1050000	1050000	600000	750000	700000
Furnace Type	Walking Beam Reheating Furnace	Roller Hearth Tunnel Furnace	Walking Hearth Reheating Furnace	Walking Beam Reheating Furnace	Walking Beam Reheating Furnace	Walking Beam Reheating Furnace	Walking Beam Reheating Furnace
Specific Heat Cons. (Kcal/ kg)	430	19	253	362	260-290	286	282
Combustion Air VVVF	No	No	No	No	Yes	Yes	Yes
Recuperator/ Regenerator CA pre-heating	Air Recuperator	No	Air + Gas recuperator	Air + Gas recuperator	Air Recuperator	Air Recuperator	Air Recuperator
ECCS Steam TPH	20	No	No	10	No	No	No
Sp. Power kWH/t	82		120.24	75	206	100	110
Stack Temperature	250	360	250-300	250-300	360	300	300
Continuous Stack Monitoring	Yes	Yes	Yes	yes	Yes	Yes	Yes

In Existing Rolling Mill revamping Rolling Hours are optimised by following measures:

- Quick Changing of Roll Stand facilities
- Single family rolling with minimum size change time.

- Level 2 integration of Mill and Furnace
- WRM-2 provision of hot charging facilities

Selection of Rolling Mills Clean Technology from Production Point of View

- Hot charging facility of blooms/billets to Reheating furnace to reduce gaseous fuel energy consumption
- Integration of casting and rolling
- Recuperator for sensible heat recovery from furnace flue gas and combustion air pre-heating for energy conservation.
- Installation of regenerative digitized control energy efficient burner in WRM
- Auto combustion process control to maintain desired excess air, combustion temperature
- Refractory insulation for energy conservation.
- VVVF drive control of combustion air fan for precision control, optimize resources and energy conservation.
- Leakage Control through inspection window and Billet entry & exit gate opening

Clean Technology Implementation in Rolling Mills from Environmental Consideration

- Stage combustion inside furnace to limit combustion temperature and NOx generation.
- Scale pit for water recovery and oil emulsion removal
- Recycle of mill scale in sinter plant
- Recycle of water after treatment for cooling and scale carrying
- High Rise Stack for pollutant dispersion and natural draft

2.3.7 Captive Power Plants

At present, RINL-VSP has a total power generation capability of 523.6 MW. This comprises of a coal/gas based power plant – CPP1 of 315 MW and a solely gas based power plant – CPP2 of 120 MW. The rest of the power is being generated from waste heat/energy recovery from existing coke ovens, sinter cooler and Blast furnaces.

For the expansion from 3.5 MTPA to 6.3 MTPA, a 67.5 MW coal based power plant was proposed to be established on BOO basis. However, it was installed as a captive power plant. An additional 2 X 67.5 MW coal based power plant was also proposed to be set up on BOO basis. The same was converted to BF gas based captive power plant of 120 MW capacity inside the boundary to effectively utilize the by-product gases from Blast Furnace and coke ovens, which otherwise would have been flared.

The breakup of the total power generation capacity of RINL is given in **Table 2.11**.

Table 2.11: Breakup of captive power generation of RINL-VSP-

Sl. No.	Unit	Capacity	Fuel
1	**CPP 1**	3X60 MW + 2X67.5 MW	Coal – (199 MW) Gas – (116 MW)
2	**CPP 2**	1X120 MW	Excess BF & CO Gas
3	**CDQ**	2X7.5 MW +1X14 MW	Waste heat from coke cooling

4	**NEDO Sinter cooler**	20.6 MW	Waste heat from sinter cooling
5	**Blast Furnace TRT**	2X12.5 MW + 14 MW	BF Top gas pressure
Total		523.6 MW	

As it can be seen from the above table, about 62 % of the total generation is from waste energy recovered from various units of the steel plant. Only 199 MW is generated using boiler grade coal. The power generation capacities at 6.3MTPA and at 7.3 MTPA are shown in flow diagram at **Fig 2.4 (a)** and **2.4 (b)** respectively.

After the proposed expansion, with the installation of new coke oven battery 5, additional 14 MW of power shall be generated, which shall be used for making up the power requirement for expansion units. In addition to this, RINL is also in the process of installation of a 5 MW Solar power plant.

Fig. 2.4 **: (a) Power Generation capacity at 6.3 MTPA**

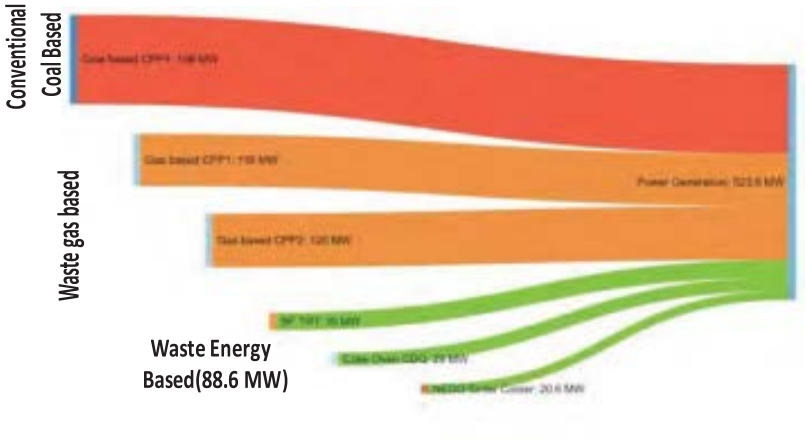
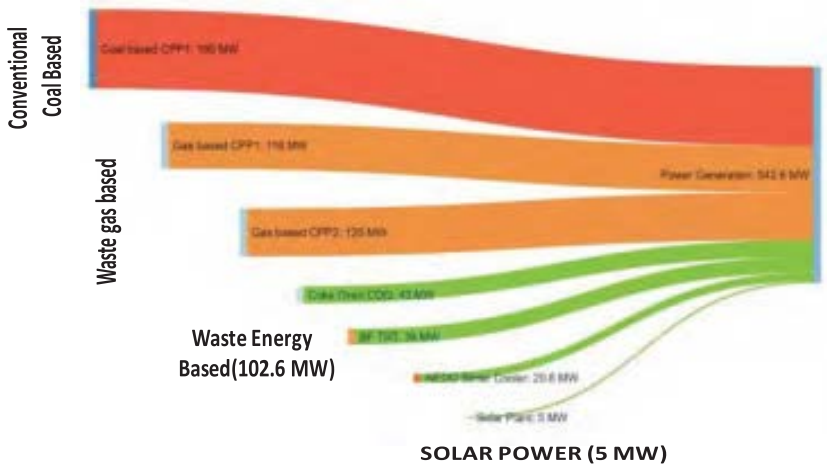
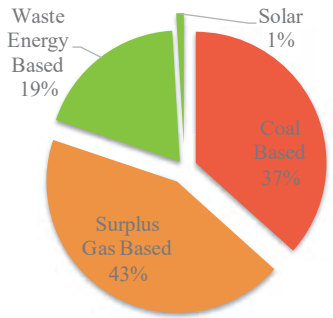


Fig. 2.4 : (b) Power Generation capacity at 7.3 MTPA





2.3.8 Calcining & Refractory Material Plant (CRMP)

At 3.5 MTPA liquid steel capacity, the Calcining and Refractory Material Plant (CRMP) comprised of five (5) numbers of rotary kilns, 45 m long, 3.5 m internal diameter with a slope of 4%. The rotary kilns were designed for a speed range of 0.5 rpm to 1.6 rpm. The kilns are designed for feeding a mix of limestone and raw dolomite in the proportion of 5:1 with stone size 25 mm to 50 mm. Each kiln was provided with a vertical type preheater for preheating the stones before feeding into the rotary kiln. Contact cooler has been provided

for cooling the product. The installed nominal capacity of each kiln is 325 tpd and the kilns are designed to operate 330 days a year.

As a part of expansion from 3.5 MPTA to 6.3 MTPA liquid steel capacity, Visakhapatnam Steel Plant has commissioned 2 x 500 TPD Beckenbach Annular Shaft Kilns (BASK) complete with all accessories and auxiliary systems and ancillary to meet the production of 6.3 MTPA liquid steel.

The major facilities of the Calcining Plant along with the other associated facilities at 6.3 MTPA liquid steel capacity are:

- Raw Material Handling System
- Calcined Flux Handling System
- Most updated fully automatic Control system operation under negative pressure
- Common facilities like Electrics, Instrumentation and Level-1 Automation system and Telecommunication and CCVM system, Utility system. Air Conditioning and Ventilation system, Fire protection system, Water system, Electric hoists.

Selection of Refractory Material Plants Clean Technology from Production Point of View:

- Optimization control by automation system implementation
- Combustion control inside kiln to maintain desired air –fuel ratio and reduce stack loss and un-burn CO emission
- Characteristics of Lime dust i.e. hygroscopic, protection measures implemented in lime dust storage and hopper insulation
- Quality of compressed air i.e. instrument grade moisture free.
- Waste gas temperature limit to 120-130 deg C.
- Beckenback Annular Shaft Kiln (BASK) equipped with fully automatic control and supervision system.
- Automatic control of the fuel and combustion air to each burner.
- Additional set of cooling air pipes through lower refractory bridges similar to the ones through upper refractory bridges, absorbing heat from the lower refractory bridges.
- Waste gas heat recovery system via a recuperator and co current and counter current flow of combustion gases in the shaft kiln.
- The dust content in the exhaust gas at the stack outlet is 50mg/Nm^3.

Clean Refractory Material Plants Technology Implementation from Environmental Consideration-

- Bag filter based process waste Gas Cleaning Plant
- Bag filter based dedusting system to cater all material transfer points
- Temperature control of the waste gas to ensure bag life
- Low air Filtration speed (0.9-1.2 m/min) maintain through filter bag for increasing bag life and reduce pressure drop

2.3.9 Air Separation Units

The air separation units produce oxygen, nitrogen and argon. The oxygen of 99.5% purity is required for blowing in LD Convertors in steel making, preheating of Convertors, cutting of blooms and billets etc. Nitrogen of 99.9% purity is required for coke dry quenching, inert

gas purging and blanketing, pneumatic transport of Desulphurising compound, flux charging etc. Argon of 99.99 per cent purity is required for the steel refining facilities.

At 3.5 MTPA stage, the RINL had three units, each of capacity 500 tons/day of oxygen, producing a total of 1500 tons of oxygen, nearly 1850 tons of nitrogen and about 23 tons of argon per day.

Additional capacity for 2700 TPD oxygen was installed to meet the 6.3 MTPA stage requirements. At the 7.3 MTPA stage another 1700 TPD oxygen is required (i.e. a total of 5900 TPD to cover steel-making as well as other needs such as combined blowing, peak loads due to simultaneous consumption of Oxygen for Oxygen blowing in LD Converters at SMS & Oxygen enrichment at BF & standby needs.

2.3.10 Additional Facilities

1. **Non-Conventional energy initiatives : Solar power plant (5 MW)**

Solar Photo Voltaic (PV) power plant of 5 MW capacity has been installed by VSP. The plant consists of 17760 Nos. of solar PV modules of Poly b Crystalline Technology each of 310 Wp capacity which have been installed on galvanized module mounting structures. The total land occupied for installation of the 5 MW solar PV power plant is 18 acres.

DC power is generated from the module on receipt of solar irradiation. The solar PV modules are connected in series in a string to build up the voltage and multiple strings of solar modules are then combined in parallel to multiply the string output currents in string combiner Boxes (SCBs). 40 Nos. of SCB are used in VSP plant.

The DC power is converted to AC power by using Inverters. The output of the inverter is stepped up to 11kV by using step up transformers. The 11 kV power output generated from the transformers is connected to HT panel and the same is evacuated through two nos. of 11 kV cables buried underground and are connected to the Central Power Receiving Station (CPRS) 11 kV Switch Board of VSP located at distance of 4 km from the solar PV power plant.

2. **Kanithi Balancing Reservoir-2**

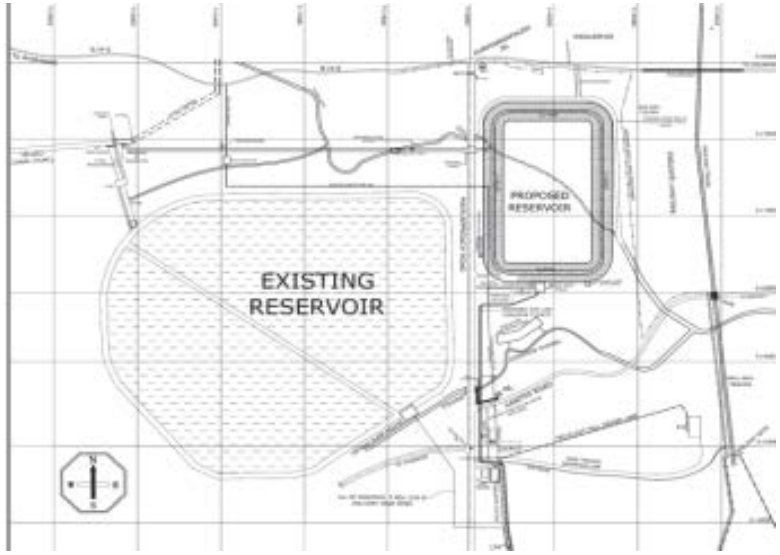
Visakhapatnam Steel Plant (VSP) is a coast based integrated steel plant. VSP has embarked on capacity addition by upgrading its technological units thereby taking its total capacity to 7.3 MTPY.

Present water requirement of around 38 MGD for the existing plant is met from Yeleswaram Reservoir and Godavari River through 153 Km long open canal. Water consumption is expected to go up to 45MGD after commissioning of 7.3 MTPY expansion units. With the measures like implementation of Zero Liquid Discharge Schemes & Rain Water Harvesting, another 5 MGD of incremental demand can be met. Still there will be a significant gap in demand and supply of water at 7.3 MTPY stage.

To meet the canal shutdown requirements, Kanithi Balancing Reservoir (KBR) of 15 Million Cubic Metres (Mm^3) capacity was constructed near plant premises over 300 hectares in the year 1989.

In order to facilitate inlet water canal maintenance with increased per day water consumption and to take care of the surges in water flow through canal, it is planned to increase in house water storage capacity by constructing an additional water storage reservoir of 12.32 Mm^3capacity, opposite to the existing reservoir at an estimated cost of Rs 465.85 Crores. Location of the proposed reservoir relative to the existing reservoir is shown in **Figure 2.5**.

Fig. 2.5 : Location of Proposed Kanithi Balancing Reservoir -2



3. **Developing Guard Ponds in VSP**

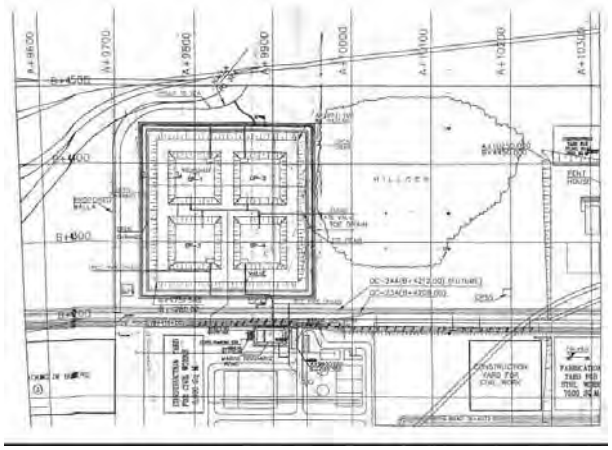
RINL is proposing to develop four (4) earthen bund Guard Ponds each 9,600 m^3 capacity with 3.5 m height (3m water depth and 0.5 m freeboard) and with impermeable/leak proof PCC lining and HDPE sheet. At any given time three (3) Guard Ponds shall be operational and one pond will be kept empty as reserve to store the effluents in case the effluent quality fails to meet the standards. The guard ponds will be constructed within the plant premises near the existing ETP.

RINL has obtained clearance from APPCB for discharge of effluent into the sea. APPCB will collect the samples from the filled Guard Ponds and get the same analyzed in their lab and give clearance for marine disposal, if the results are within the discharge norms.

VSP had furnished the action plan for construction of four (4) Guard Ponds, each of two (2) days' capacity of treated effluents to ascertain quality of water before discharging to Sea. Treated effluent from ETP (maximum 200 m^3/Hr) is being discharged to sea through Gangavaram outfall. A marine discharge pipeline and pump house with pumps each of capacity 135 m^3/hr @70m head have been provided to pump this effluent to the sea. The

total area required for the four Guard Ponds is about 200 m X 200 m within the existing plant boundary. Location of the proposed guard pond is shown in **Figure 2.6**

Fig 2.6 : Location of the proposed guard pond



4. Buffer Vessel for Nitrogen

RINL is proposing to install one vertical, cylindrical type, single shell vessel of volume of 200 m^3 designed for gas storage and associated pipeline network for meeting the gas requirements of expansion projects. Nitrogen Buffer Vessel will be necessary to cater to the periodic nature of consumption of nitrogen in SMS2. Nitrogen can thus be stored in the buffer vessel and withdrawn intermittently through inter connected pipe work for consumption. Nitrogen will be made available at a pressure of 38 to 40 Kscg for storage purpose in Nitrogen buffer vessels.

5. Propane/LPG storage

RINL is proposing to install Mounded Propane/LPG storage & handling system to meet the Propane/LPG requirements for their existing production facilities. Three (3) Nos. of Mounded Storage vessels of 75 MT Propane capacity are being planned.

Propane/LPG shall be received in licensed special purpose Tank Lorries. Propane/LPG shall be unloaded from the tankers through unloading pump/compressor system and stored in the mounded vessels. From the vessels, it shall then be pumped to Vaporizers and supplied to the in-plant consumers through pressure regulating stations at required pressure to maintain adequate differential pressure across the pressure regulator even during low ambient temperatures and to regulate the set outlet pressure at 1.5 - 2.0 kg/cm^2.

A liquid booster pump with standby shall be installed between storage vessels and vaporizers. To raise the liquid temperature well above the boiling point at the delivery pressure and to generate the (heat) energy that is required to maintain the gaseous state of the Propane/LPG, it is proposed to provide Electrically Heated Water Bath type vaporizers.

Gas detectors at all the critical areas in the Propane / LPG area are proposed along with Audio-visual alarms showing the location of gas leakage on the control panel. Automatic fire detection and/or protection system based on heat detection through thermal fuse/ quartz bulb/ EP detectors are also proposed in all critical areas as per OISD standards/ TS/ approved drawings.

2.4 PLANT SITE AND LAND REQUIREMENT

The proposed expansion is being carried out in vacant land available within the existing steel plant. RINL has a total 8827 ha area in their possession that comprises of plant facilities & auxiliaries along with greenbelt and colony.

All the units envisaged under the expansion programme are being implemented on land already in RINL's possession. COB5 is being set up on ~100 acres vacant area inside the existing plant premises. The new reservoir is being built over ~200 acres area outside the plant but in RINL's possession. All other works under the expansion programme envisage revamping / upgrading existing units without increasing the concerned unit's area.

Out of the total acquired land of 8827 ha, green cover has been developed over an area of 2710 ha. A thick greenbelt of minimum 10 m width has been developed around the plant boundary. In addition to this, several patches of land have been developed as greenbelt in and outside the plant boundary over the acquired land area.

On the whole about 39.1% of the land has been afforested by planting about 5.31 million trees. This will help to attenuate noise ls and dust generated due to operation of plant / project development activities. The detailed breakup of the greenbelt location in the project site is given in **Table 2.12**. Greenbelt in project area is provided in **Annexure 2.1**.

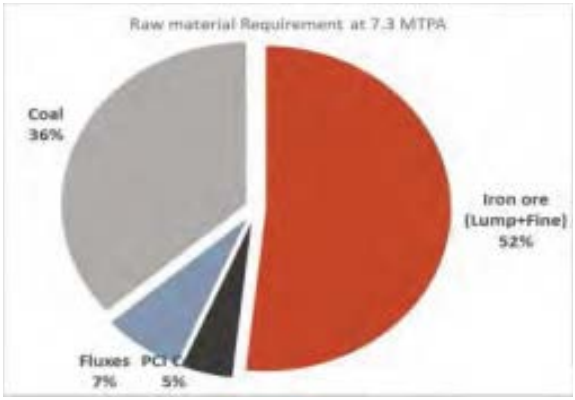
Table 2.12 : Details of breakup of Greenbelt over the acquired area

Sl. No.	Description	Area (Acres)
a)	North & West side of Township	975
b)	North & West side of Sector 12	1980
c)	Coastal Area	745
d)	Kappari Konda	100
e)	Golla Konda	50
f)	City Center Hillock	60
g)	Area around Hill Top Guest house	256
h)	K. Kotapadu	700
Total		**4866/1970ha**

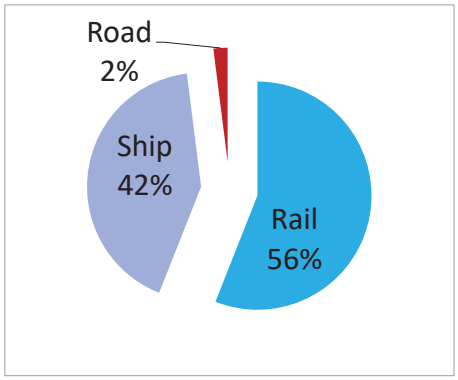
2.5 RAW MATERIAL REQUIREMENT

At present, the total requirement of raw material for the existing plant at 6.3 MTPA is around 23 MTPA. This also includes boiler coal required for the power plant. Most of the raw material is transported through rail and ships. Coal and iron ore fines are transported through ship to adjacent Gangavaram Port from where it is transported to the plant site through means of

railways and conveyors. After the proposed expansion, around 3.5 MTPA of additional raw material shall be required. The same shall be obtained from existing sources.



About 98% of the raw material is transported through railways and ships.



At 7.3 MTPA

For the supply of iron ore and domestic coal, MoU have been signed with following parties-

- Mahanadi Coal Fields for supply of boiler grade coal.
- Singareni Collieries Company Limited (SCCL) for coal.
- NMDC for supply of Iron Ore Lump / Fines.

Manganese ore for the Plant is sourced from RINL's captive mines at Garbham. EC for the mine has been accorded by MoEFCC's.

The annual raw material requirement before and after the proposed expansion for the proposed production units is given in **Table 2.13**.

Table 2.13 : Annual Raw material requirement at 6.3 MTPA and 7.3 MTPA stages

SN	Raw material	Sources	Mode of Transport	Gross annual requirement (t)	
				At 6.3 MTPA	At 7.3 MTPA
		Coke ovens			
1	Coking Coal	Indigenous – Coal India Ltd.	By rail	602688	573000
		Imported – Australia, USA, New Zealand, Mozambique	By Ship to GPL then by Conveyor to plant	3415232	5175000
2	Sulphuric Acid	Local sources	By road	40880	40880
		Sinter Plant			
3	Iron ore fines	OMC, Open tenders & Bailadila	By ship to GPL/ by rail to plant	6696400	6130000
4	Purchased Coke Breeze	Open tenders	By rail	200896	155000
5	Lime Stone Fines	Captive Mines at Jaggayyapeta	Rail	706400	656000
6	Dolomite Fines	Captive Mines at Madharam	Rail	774000	869000
7	Manganese Ore fines	Captive mines at Garbham	Road	10000	22000
		Blast Furnace			
8	Iron ore lump	Bailadila	By rail	4370000	5800000
9	Purchased Coke	Open tender/NINL steel plant	China- By Ship to GPL then by Conveyor to plant/ Rail	591450	0
10	PCI Coal	Indonesia	By Ship to GPL then by Conveyor to plant	375000	1070000
11	Lime stone	Captive Mines at Jaggayyapeta	Rail	706400	730000
12	Dolomite	Captive Mines at Madharam	Rail	774000	910000
13	Quartzite	Local sources	By rail	69000	16000
14	Iron Ore	Bailadila	By rail	96400	116400
15	Scrap	Internal	By rail	400100	455100
16	Aluminium	Open tender	By rail	6400	7400
17	Ferro Alloys	Open tender	By road	81900	111900
14	Iron Ore	Bailadila	By rail	96400	116400
15	Scrap	Internal	By rail	400100	455100
16	Aluminium	Open tender	By rail	6400	7400
17	Ferro Alloys	Open tender	By road	81900	111900

SN	Raw material	Sources	Mode of Transport	Gross annual requirement (t)	
				At 6.3 MTPA	At 7.3 MTPA
Captive Power Plant & Boilers					
18	Boiler Coal	Imported/Indigenous (Singareni Collieries and Mahanadi Coalfields)	By Ship to GPL then by Conveyor to plant in case of imported / By rail in case of indigenous	2600000	2600000
Lime & Dolo Kilns					
19	Limestone & Dolomite	Imported	By Ship to GPL then by Conveyor to plant	1232200	2108000

2.6 WATER REQUIREMENT

At 6.3 MTPA stage, the plant water requirement is 29 MGD and for township and other sites estimated at 9 MGD for 6.3 MTPA stage. The additional water required for the proposed augmentation is estimated to be 7 MGD. The water will be sourced from existing Yeleru Reservoir. RINL has received permission for withdrawal of 45 MGD from Visakhapatnam Industrial Water Supply Company Limited (VIWSCO). Copy of the permission is enclosed as **Annexure2.2.** Water Balance diagram for 6.3 MTPA and 7.3 MTPA stages are provided below in **Figure 2.6 (a) and (b)**.

Fig. 2.6 : (a) – Water Balance for 6.3 MTPA Stage

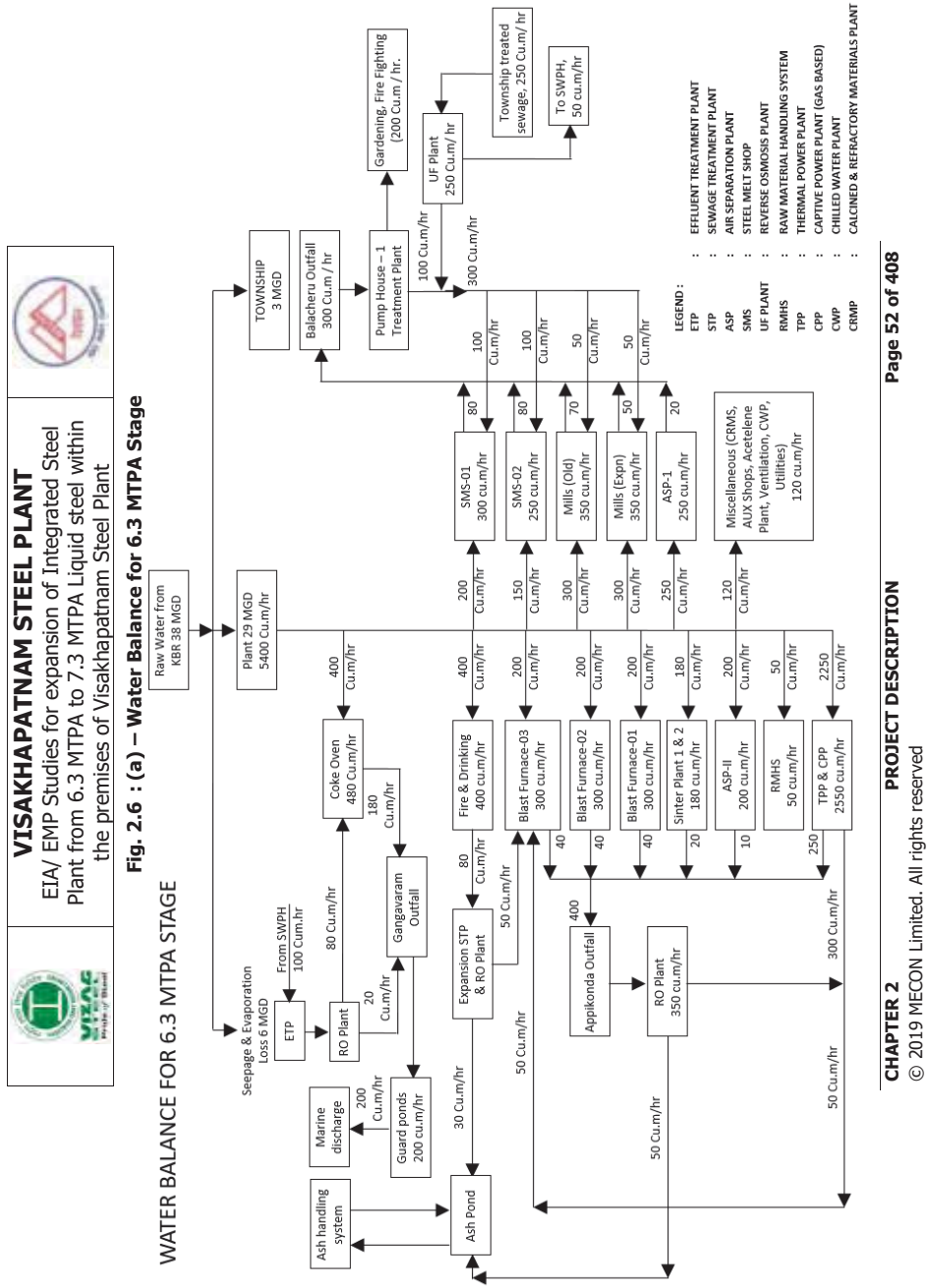
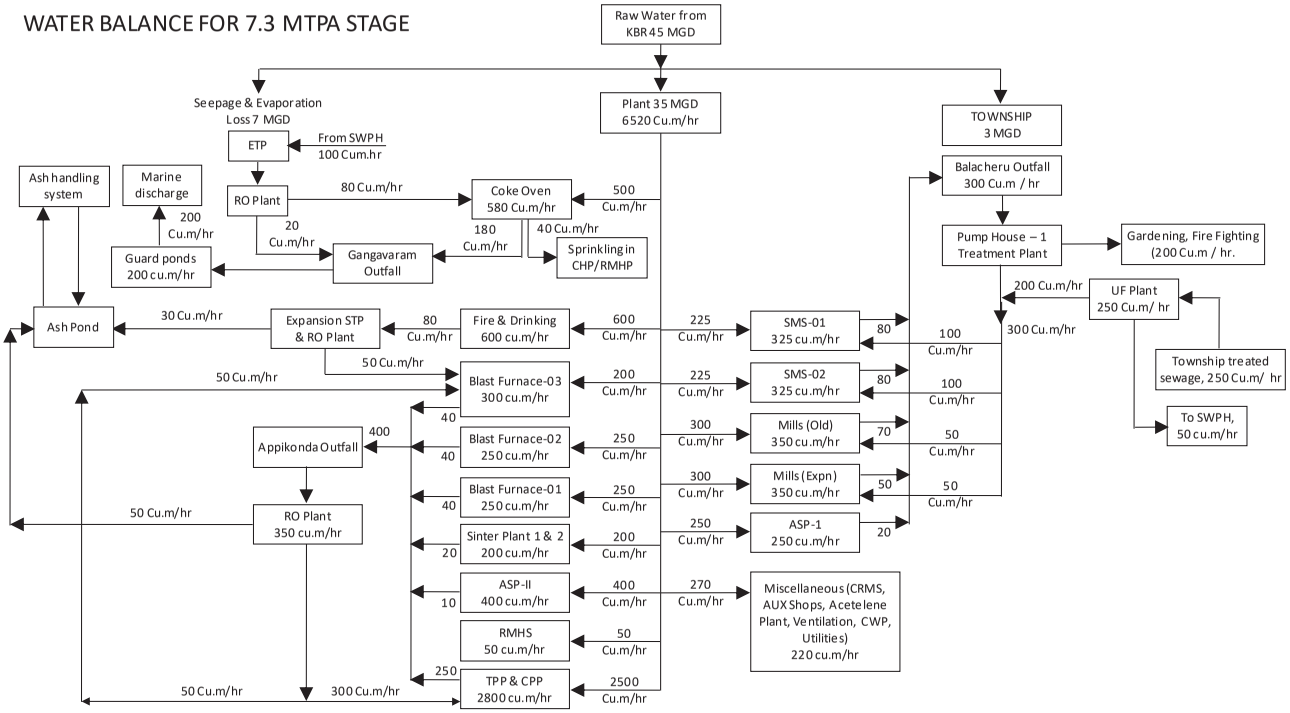


Fig. 2.6 : (b) Water Balance for 7.3 MTPA Stage



2.7 FUEL FACILITIES

At present, the main gas producing units are the three blast furnaces, four coke-oven batteries and six BOFs. On completion of the ongoing expansion, COB5 will also supply fuel gas to the existing plant.

The by-product gases from these plants, BF gas, Coke-oven gas and BOF gas have considerable calorific value and are used as fuel by different consumers in the steel plant. The major consumers are the blast furnace stoves, under firing of Coke-oven batteries and reheating furnaces and other units of Rolling Mills. Surplus gases are used in the power plant. These fuel gases, after being cleaned in respective Gas Cleaning Plants, are distributed to different consumers through piping network.

For optimum use of fuel gases, BF gas enriched with Coke-oven gas and BOF gas has been envisaged to be used by most of the consumers.

Sl. No	Type of gas	Units where used
1	Unmixed BF gas	Power plant CPP2
2	Unmixed Coke oven gas	Under firing of coke oven batteries 1 &2, SMS1 &2, CRMP
3	Mixed gas (calorific value of 840 to 2500 Kcal/Nm^3)	COBs 3,4 & 5 Sinter Plants 1, 2 & 3, Mills and power generation.

Expansion of the plant

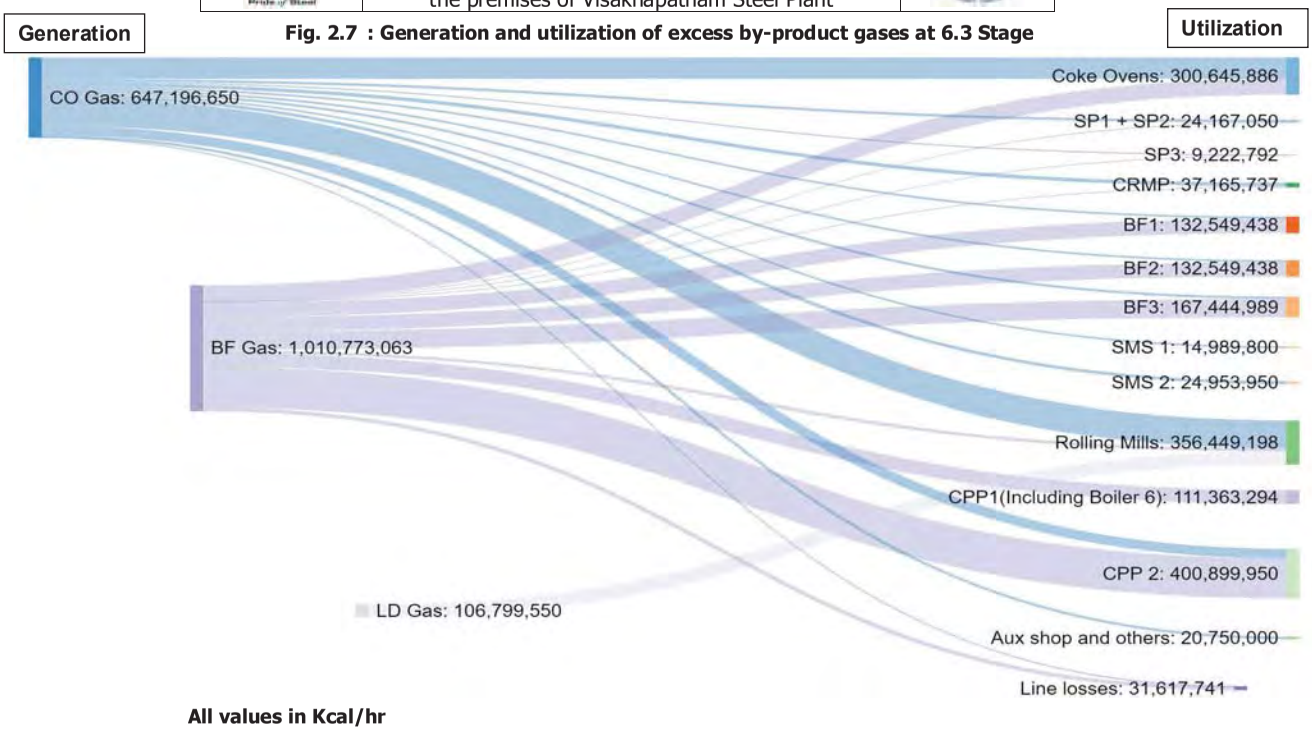
A new coke oven battery will be added under the expansion programme and production of Hot metal and liquid steel will increase which will lead to increased production of C.O. gas, BF gas and LD gas. As per the fuel gas balance, production of CO gas will be 197231 Nm^3/hr and consumption of C.O. gas will be 139715 Nm^3/hr resulting in availability of surplus gas of 57515 Nm^3/hr. This surplus gas will be available for power plant.

In case of BF gas after consumption of 865594 Nm^3/hr, there will be surplus gas of 578454 Nm^3/hr is available for power generation. About 76042 Nm^3/hr of LD gas will be expected to be generated after expansion. After cleaning, the same will be stored in the existing gas holders.

Small quantity of LPG will also be used in different heating and/or cutting in various in-plant consumer units

The fuel gas balance for the plant at 6.3 MTPA and 7.3 MTPA stage is furnished in **Annexure 2.3.** The hourly generation and utilization of by-product gases at 6.3 MTPA stage and 7.3 MTPA Stage are shown in **Figure 2.7 and Figure 2.8** respectively below.

Fig. 2.7 : Generation and utilization of excess by-product gases at 6.3 Stage



All values in Kcal/hr

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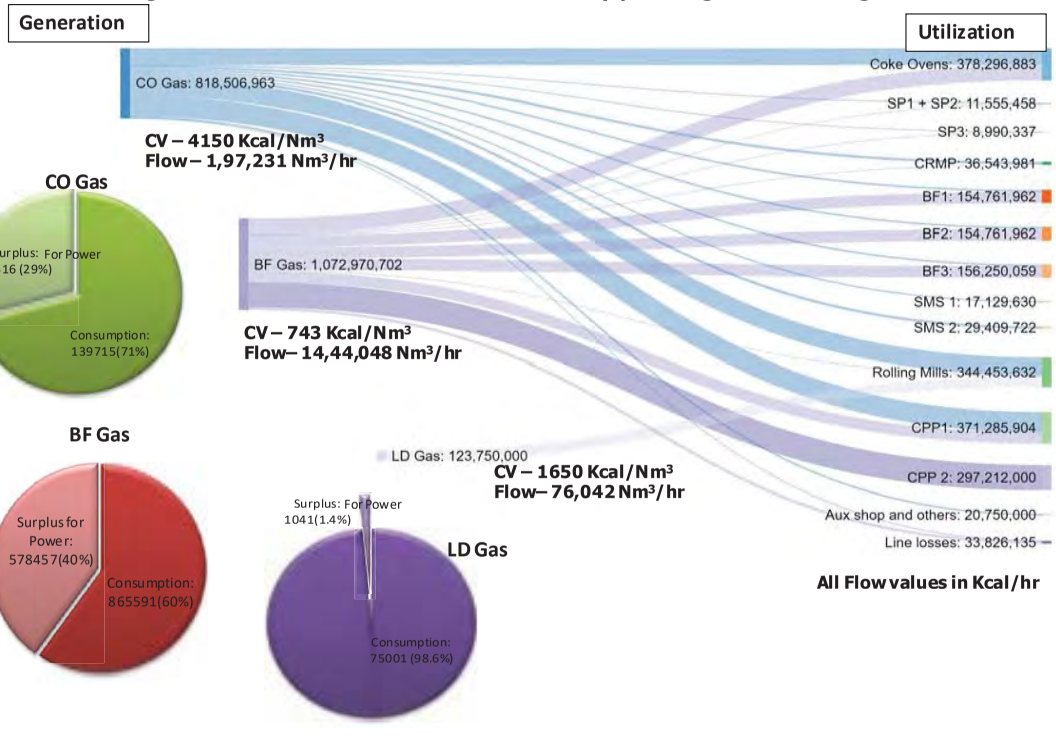
Fig. 2.8 : Generation and utilization of excess by-product gases at 7.3 Stage



All Flow values in Kcal/hr

2.8 ELECTRIC POWER

The power requirement for operating the steel plant including township at 6.3 MTPA stage was 470 MW. The additional power required for the proposed augmentation is 76 MW. The present maximum power generation capacity of RINL is 523.6 MW. This includes 131.5 MW power generation from coal based boilers and balance from gas based boilers and waste heat recovery. After present ongoing expansion, additional 14 MW of power shall be generated from CO5 CDQ waste heat recovery and 5 MW shall be obtained from Solar power plant. Around 3.4 MW additional power shall be required for present proposal.

The power generation from waste heat recovery and gas based boiler is highly dependent upon plant performance and can't be solely relied upon. During normal operations, if there is any additional power generation, the same is transferred to GRID and if any shortfall occurs in the plant, the balance power is drawn from APTRANCO.

2.9 STEAM BALANCE

A large amount of energy from byproduct gases and waste heat is produced and recovered in the steelmaking process. It accounts for 50%–60% of the gross energy consumption of the steelmaking process presenting sometimes an imbalance between production and consumption at different points in the steam distribution network. Since this network does not have a centralized control, this imbalance necessitates opening of relief valves to vent excess steam to the atmosphere.

Steam for various utilities is generated in TPP, PRDS & Rolling mills, and the same is distributed throughout the plant through a network of pipes. The present steam generation is 290.46 TPH and requirement at 6.3 MTPA stage is 277.58 TPH. After the proposed expansion, no additional steam shall be required for expansion units. Existing setup shall be sufficient to handle the additional requirements, if any. The breakup of steam requirements of various units is given in **Table 2.14**.

Table 2.14 : Present Breakup of Steam Requirements

Sl. No.	Unit	Quantity (TPH)
1	COKE OVENS	32.68
2	CCP-BENZOL PRODUCTS	4.02
3	BF HOT METAL	24.06
4	SMS-1	2.51
5	BILLET MILL	14.04
6	MMSM	4.01
7	CRMP	4.51
8	ASP	1
9	AUX. SHOPS	1
10	OTHERS	7.35
11	BF-3 HUMIDIFICATION	16

Sl. No.	Unit	Quantity (TPH)
12	SMS-2, CONVERTOR	0.2
13	SMS-2, CASTER	0.2
14	SMS-2, LF & RH	21
15	NEW CRMP	5
16	LOSS	2
17	TPP Internal	138
Total		**277.58**

2.10 SPECIFIC CONSUMPTION & EMISSIONS

Various specific parameters before and after the present proposal are given in **Table 2.15**.

Table 2.15 : Specific Consumptions and emissions

Sl. No.	Parameter	Value at 6.3 MTPA	Value at 7.3 MTPA	Unit
1	Water Consumption	3.03	3.0	m^3/tcs
2	Coke Rate	487	449	Kg/tcs
3	Energy Consumption	6.37	5.78	Gcal/tcs
4	Pollution Load			
	PM	2.78	1.83	Kg/tcs
	SO_2	5.57	4.94	Kg/tcs
	NOx	5.43	3.69	Kg/tcs
	CO_2	2.79	2.30	t/tcs
5	Effluent Discharge	0.28	0.24	m^3/tcs
6	Solid Waste	0.79	0.77	t/tcs
7	Raw material consumption	3.77	3.73	t/tcs

2.11 PROJECT COST

The estimated total cost for the proposed activities is around Rs. 9439.53 Crores, out of which Rs 4222 Crores is for Revamping & Augmentation of existing units and the balance is for the proposed new units. Breakup of project cost is given in **Table 2.16.**

Table 2.16– Breakup of project cost

S. No	Facility	Cost (Rs. Crores)
	Revamping Units	
1	Revamping of Sinter Plant 1 & 2	489
2	Revamping of SMS-1	354
3	Revamping of Blast Furnace 1	656
4	Revamping of Blast Furnace 2	943
5	Revamping and Modernization of Continuous Casting Department	633.1

S. No	Facility	Cost (Rs. Crores)
6	Revamping and upgradation of Walking beam type reheating Furnaces of the light and medium merchant mill (LMMM) 203	203
7	Rebuilding of coke oven battery no. 1	944.42
Sub - Total		**4222.52**
New Units		
1	Installation of Conv.3 & Caster4 (SMS -2)	975
2	Installation of LPG storage facility	15.07
3	Installation of Nitrogen Buffer vessel	3.5
4	Installation of Twin Laddle Heating furnace in SMS 2	106
5	Installation of Re bar mill	431
6	Installation of Coke Oven Battery -5	2857.66
7	Guard Pond	12.55
8	Turbo Blower -5	280
9	Kanthi Balancing Reservoir	465.85
10	Revamping & Upgradation of Electrostatic Precipitators of Two Boilers in Thermal Power Plant (TPP)	70.38
Sub - Total		**5217.01**
Total		**9439.53**

The project during the operation phase is likely to directly employ additional 1600 people and additional 3000 people indirectly. The estimated completion period for the project is around 60 months after the grant of necessary statutory clearances.

2.12 ENVIRONMENTAL POLLUTION MITIGATION MEASURES

2.12.1 Air Pollution Mitigation

In an integrated Steel plant, air pollutants are generated at different stages of production. Air pollutants include particulate matter and various gases. The pollutants may be released as point source emissions or fugitive emissions. In order to reduce the impacts on ambient environment, all efforts have been made to adopt latest state of art technology and to install adequate pollution control measures for different processes and de-dusting stacks and for different fugitive emission sources.

During the construction phase of the proposed project, appropriate mitigation measures have been implemented to reduce the impact on these activities on ambient air quality.

For operation stage of the plant, several APCs have been installed to limit the emission levels within the prescribed norms. Details of the existing & proposed Air Pollution Control Devices in the Integrated Steel Plant is given in **Table 2.17**.

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Table 2.17 : List of existing &proposed Air Pollution Control Measures

Sl. No.	Plant Unit	Location	PCE Description				
			ESP	Bag Filter	Wet Scrubber	DFDS	Cyclone
1	**RMHP**	Junction Houses	-	16	-	9	8
2	**Coke Ovens**	Junction Houses	-	1	28	-	-
3	**CRMP**	Kilns	-	7	-	-	-
		Junction Houses	-	8	-	-	-
4	**Sinter Plants**	Air Cleaning	5	-	-	-	-
		Gas Cleaning	5	-	-	-	-
		Material Handling	-	6	34	-	-
		Junction Houses	-	-	-	5	-
5	**Blast Furnaces**	Cast House	5	-	-	-	-
		Stock House	5	-	-	-	-
		Junction Houses	-	4	-	2	-
6	**SMS1**	CVS	2	-	-	-	-
		Secondary Dedusting System (Dog House)	2	-	-	-	-
		Material Handling & Junction House	-	3	-	-	-
7	**SMS2**	Secondary Dedusting System (Dog House)	3	-	-	-	-
		Material Handling & Junction House	-	4	-	-	-
		Twin LF (Proposed)	-	1	-	-	-
8	**CPP1**	Boiler Exhaust	6	-	-	-	-
		Junction Houses	-	3	-	-	-
9	**ES&F**	Space Dedusting	-	4	-	-	-
Total			**33**	**56**	**62**	**16**	**8**

In addition to above, the following mitigation measures are employed for the existing plant operation period to reduce the pollution level to acceptable limits:

- Monitoring of ambient air quality through online AAQ monitoring system at four locations.
- Continuous emission monitoring facilities in all Stacks to ensure proper functioning of different pollution control systems attached to major stacks.
- Air monitoring in the Work-zone to ensure proper functioning of fugitive emission control systems.
- Adequate plantation in and around different units.
- Vehicles and machineries being regularly maintained so that emissions conform to the applicable standards.
- Workers are provided with appropriate personal protective equipment to protect them from inhaling dust.

Scheme of Air pollution control in various units of the steel plant are shown in **Figure 2.9 – Figure 2.11**

Fig. 2.9 : Air Pollution control equipment in SP1&SP2 at 7.3 Stage

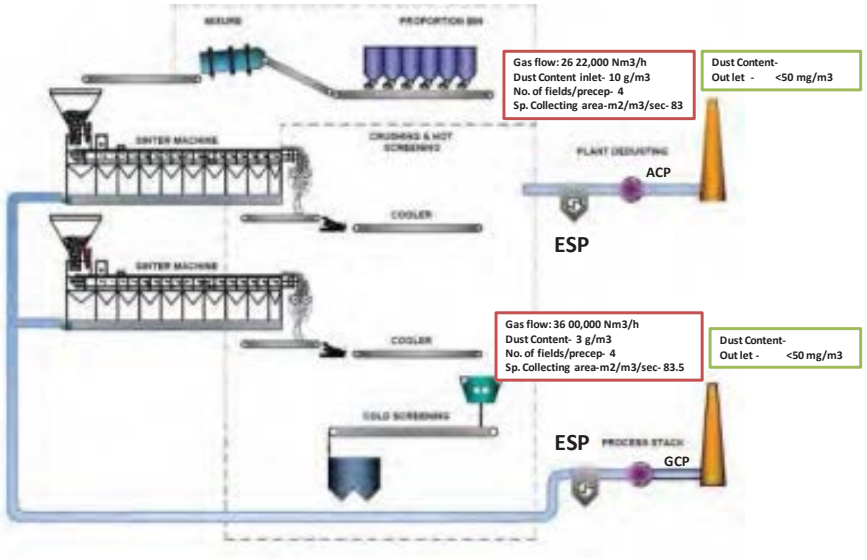

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Fig. 2.10 -Air Pollution control equipment in BF1&2 at 7.3 Stage

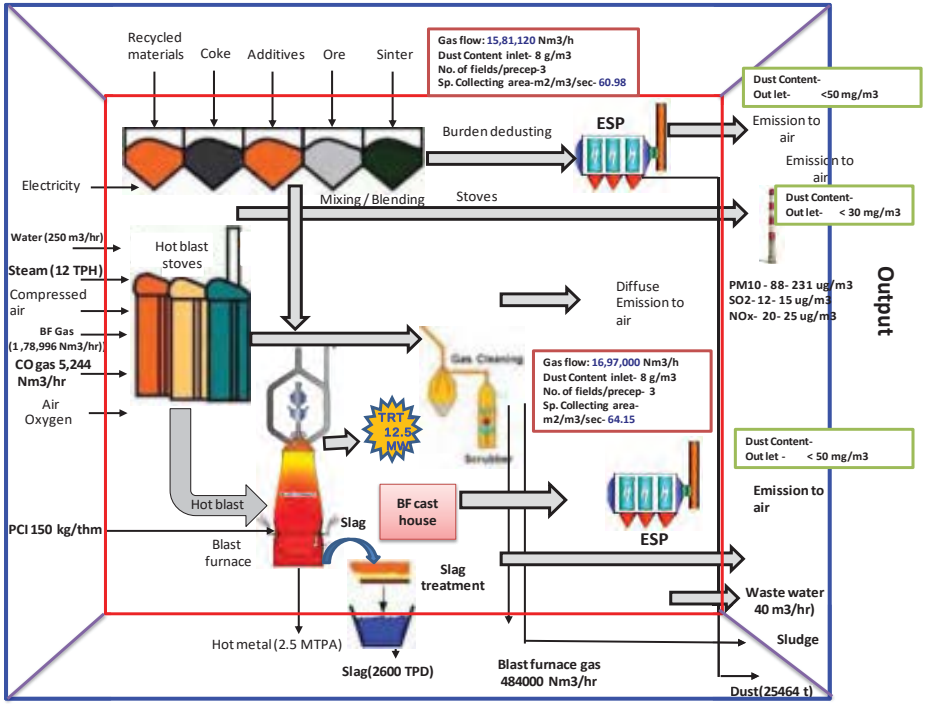
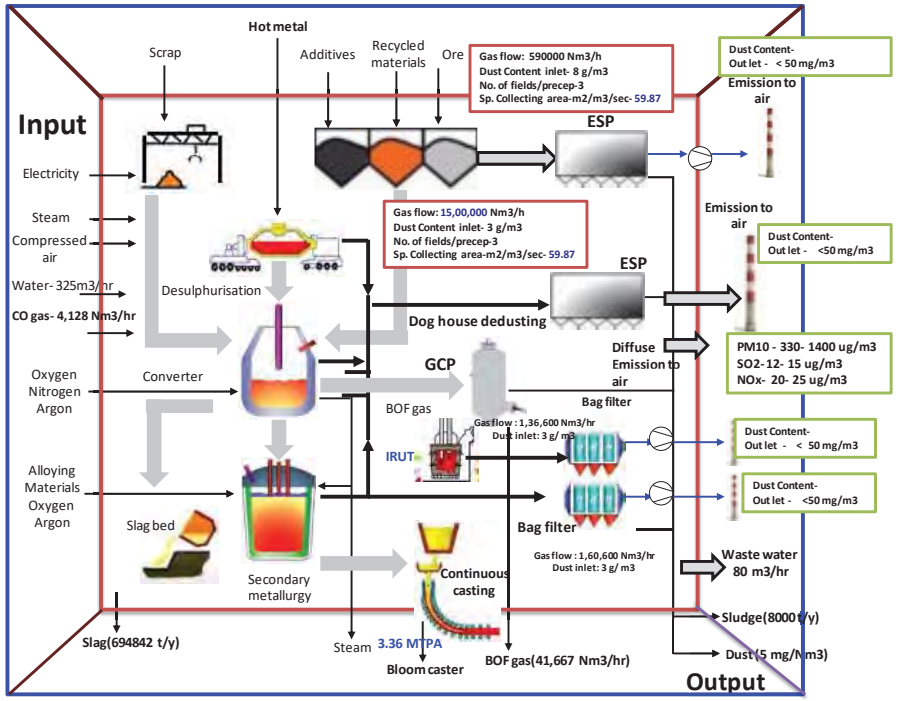


Fig. 2.11 - Air Pollution control equipment in SMS 1&2 at 7.3 Stage



2.12.2 Water Pollution Mitigation

Wastewater discharges from an integrated steel plant can be broadly divided into two parts. Non-contact water discharges and contact water discharges.

Water is used in a series of heat exchangers in coke oven gas treatment, blast furnaces, basic oxygen furnaces, and rolling operations and boilers. This non-contact water is generally contain high levels of dissolved solids comprising mostly of salts of calcium and magnesium which were originally present in the raw / feed water. Due to repeated re-circulation and high temperature, concentration of these salts increase, necessitating bleeding off of part of circulating water.

Water is also used for contact cooling e.g. quenching, Coke oven gas treatment, slag handling etc. This contact water discharges may be contaminated with different pollutants and needs to be treated prior to discharge. The details of waste water generation and recirculation for 6.3 MTPA stage and 7.3 MTPA stage are given **Figure 2.12 (a) and (b)**.

Fig. 2.12: (a) Waste Water generation and Recirculation at 6.3 MTPA stage

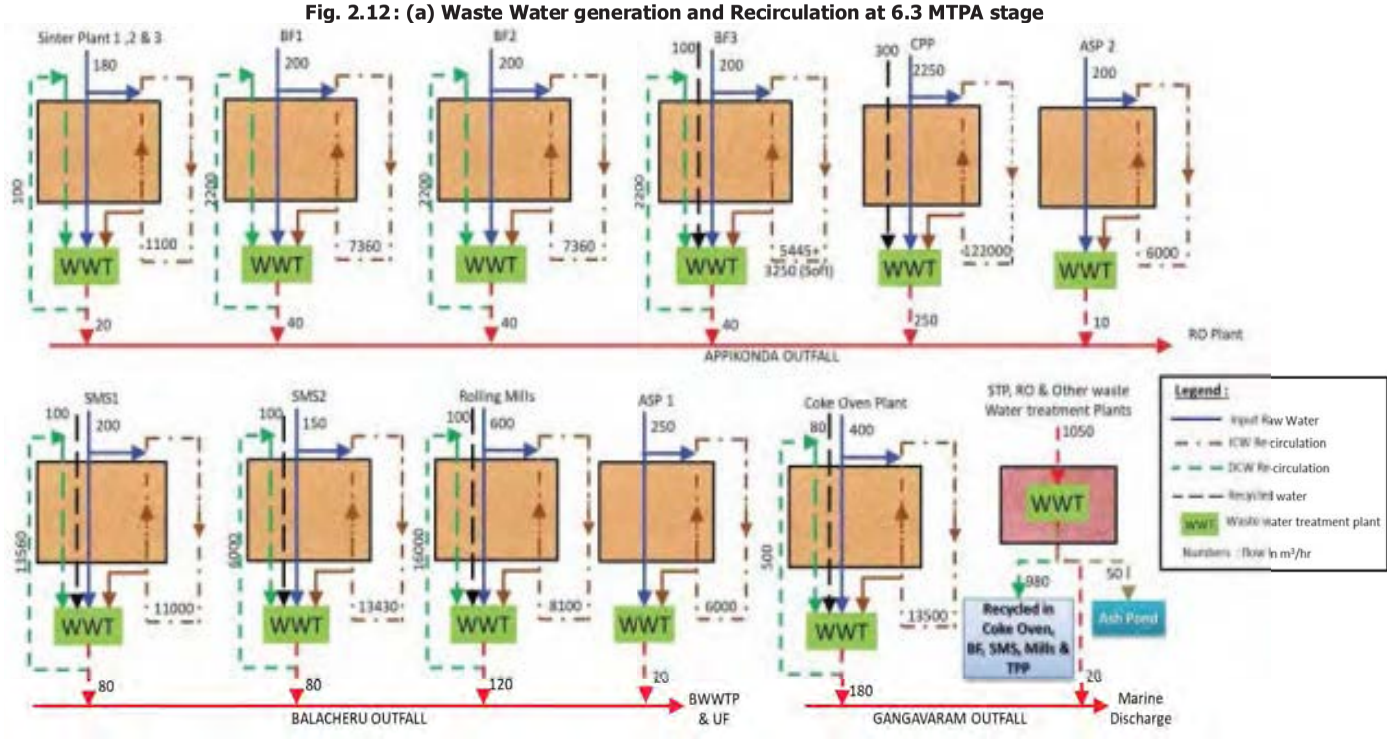
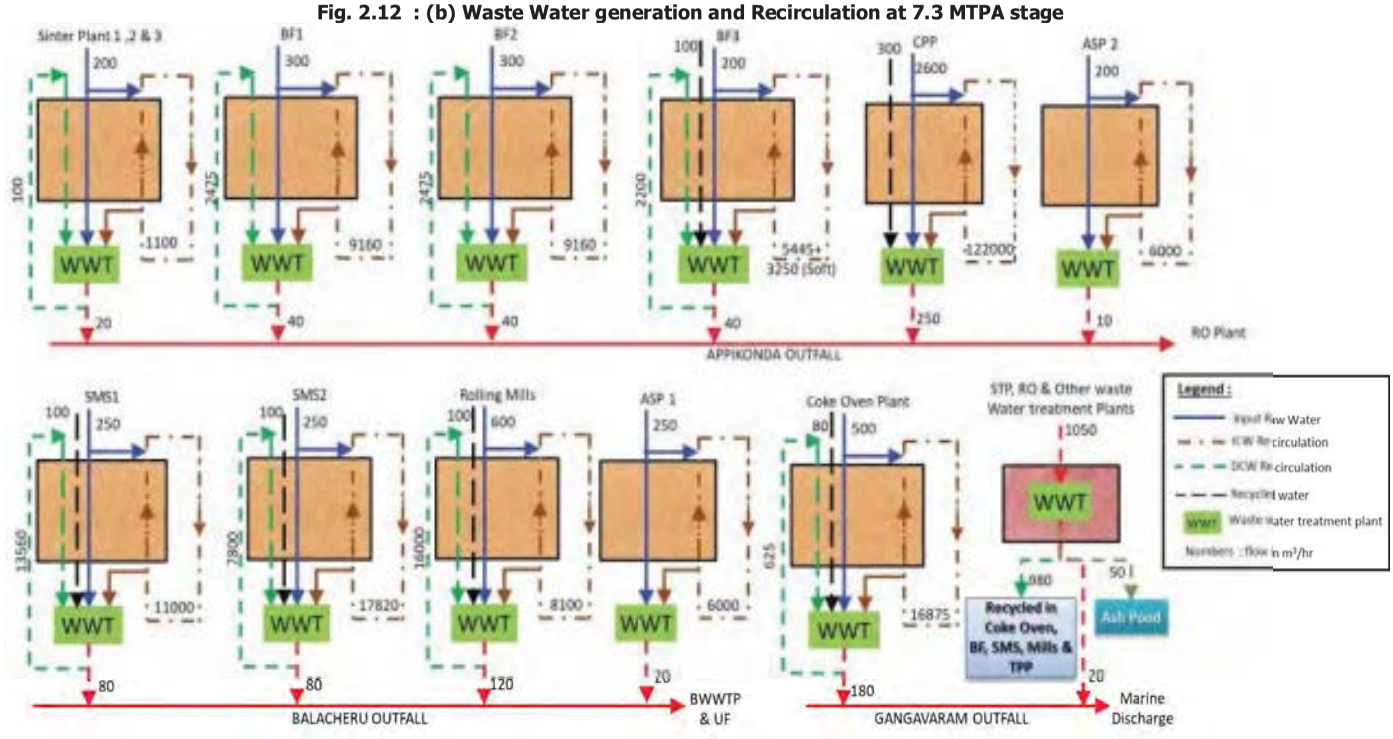


Fig. 2.12 : (b) Waste Water generation and Recirculation at 7.3 MTPA stage



Each individual plant unit is provided with some water treatment plant for pre-treatment of waste water generated from the unit and rejects are discharged into common drains. The reject water collected in various drain is further treated in water treatment plant/RO and recycled within the plant itself. Only the RO rejects and Coke Oven ETP rejects are discharged into the sea. List of waste water treatment units provided is given in **Table 2.18**.

Table 2.18 : List of Waste water treatment plants

Sl. No	Details	Number
1	Coke Oven Mechanical Biological & Chemical Treatment Plant (120 m^3/hr)	2
2	Effluent Treatment Plant (280 m^3/hr)	1
3	Sewage Treatment Plant (Township) (300m^3/hr)	1
4	Waste Water Treatment Plants for individual Plants Coke Ovens Sinter Plants Blast Furnaces SMS Rolling Mills	 1 1 3 3 3
5	Spillage Recycling Systems (TDP, BDP, BRP, ASP, CPH, NAFC, CPU, TOS)	8
6	Appikonda Waste Water Treatment Plant	1
7	Gangavaram Waste Water Treatment Plant	1
8	Balachruvu Waste Water Treatment Plant	1
9	Ultra-Filtration Plant	1
Total		26

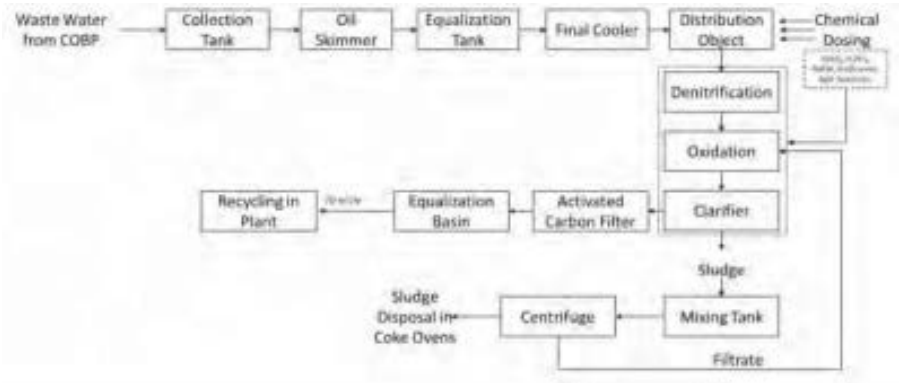
(a) Proposed Coke Oven By-product Effluent Treatment Plant for COB 5

A new Effluent Treatment Plant (ETP) has been proposed for COB5. Around 70 m^3/hr of effluent shall be generated from COB5 and associated facilities. MBC technology has been proposed for the new ETP. The major treatment steps involved in the process are-

- Oil Skimming
- Equalization
- Cooling
- Chemical Dosing
- De-Nitrification
- Oxidation
- Clarification
- Activated Carbon filtration
- Equalization
- Sludge dewatering

The sludge shall be re-circulated in De-Nitrification and Oxidation basin and the excess sludge shall be thickened in Filter press and the thickened sludge will be blended with the coal being fed into the coke ovens. The treated water from ETP will be used in the BPP plant complex itself. The scheme for the proposed ETP is shown in **Figure 2.13** below.

Fig. 2.13 : Coke oven Plant ETP Scheme



2.12.3 Selection & Adoption of Clean Technologies

The existing plant of RINL was constructed with the best available technologies at the time of inception. However, with advancement in time, the technologies available in the market has also advanced. With the present ongoing expansion from 6.3 MTPA to 7.3 MTPA, RINL has also proposed to adopt various latest technologies in the existing plant. The details of various Clean Technologies being adopted for the existing and proposed units is given in **Table 2.19**.

Table 2.19 - Details of Clean technologies selected and adopted for the existing and proposed expansion

Unit	Proposed Changes to Increase Production	Other Benefits
Coke Oven	• Installation of a New 0.8 MTPA Coke Oven Battery	**Process Optimization** • For 7m tall Battery oven pushing number reduces for same production capacity, corresponding productivity improves, charging and pushing emission reduces • Hydraulically pressed telescopic chute and screw feeder in charging car reduces spillage • Modern self-regulating leak-proof door • Specially designed charging lids with spherical surface • Water / Pneumatic sealed A.P. lids and goose neck spigot joint • Machine mounted Hydro-jet door cleaning system • Computerized combustion control system • Auto ignition system in GCM bleeder • Top Charge level shall be maintained by leveller for uniform top pressure & for preventing over pressurization of oven. • Both Side gas main pressure is to be equal to stop cross flow of raw C.O. gas through ready ovens. This will in turn prevent bricks of the free space zone from being overcooled & thus from getting damaged. • Auto temperature control of gas at free space eliminate COG cracking and free carbon particle formation resulting in choking of AP base, goose neck, isolation valves etc & thus to prevent gassing/blazing of oven doors due to over pressurization of oven. • Over roof small anchorage to prevent opening of mortar joints of fire clay refractory to reduce oven top leakages

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Unit	Proposed Changes to Increase Production	Other Benefits
		Improved Energy Efficiency/Energy Recovery • Coke Dry Quenching Plant sensible heat recovery with 52 TPH steam generation at 40 KSCA, 440 deg C and total power generation in combination 39 MW. • Exhauster VVVF drive for better control of gas suction and energy conservation. • Stage Combustion / Recirculation of Flue Gas for Energy Conservation and NOx control **Environmental Benefits** • Dry fog Dust suppression system at Coal Handling Plant • Land based Pushing Emission Control System • Bag filter based dedusting for coke handling plant and CDCP. • H_2S Recovery from Coke Oven Gas to reduce SO_2 emission during COG combustion in Steel Making Process • Effluent Treatment Process : Physical , Chemical & Biological Process Control to maintain desired Tar & Oil Separation, pH , Flow Rate control , Temperature , Retention Time , Anoxic and Aeration Process , NH_3, CN^- & SCN^- , COD, BOD and Phenol
Sinter Plant	• Replacement of existing pallets of old design by new SG- Iron pallets of latest design with an increased width. • Replacement of pelletisation drums with new drums having better internals for improved	**Process Optimization** • Optimization of water addition in sinter Raw mix • Facility to Control coke breeze size • Minimization of air in leakage for maintaining under grate suction and improving productivity. Reinforcement of sealing between palettes.

Unit	Proposed Changes to Increase Production	Other Benefits
	pelletisation as well as productivity. • Revamping of sinter machine charging system including modification of surge hopper, drum feeder and segregation plates. • High plant productivities even when the sinter machine is operated with a higher bed height and low solid fuel consumption. • Installation of hearth layer charging system with a new cut off gate and swinging hopper. • Replacement of metallic conveyors with heat resistant belt conveyors. • Modifications of straight line cooler fans to meet enhanced cooling requirement of the sinter after revamping of sinter machines. • Adoption of new energy efficient ignition system	**Improved Energy Efficiency/Energy Recovery** • Sinter Cooler Sensible Heat Recovery –Power Generation 20.6 MW from Sinter Machine 1&2. • Sinter Cooler Sensible Heat Recovery implemented in SP-3 (400 m^2) for generation of process heat and preheating of combustion air by sensible heat recovery from sinter cooler. • High-Efficiency Multi slit Burner in Ignition Furnace eliminates "NO FLAME" areas and supplies minimum heat input for ignition, therefore saving energy. • The hot cooler off-air is re-circulated to the sinter machine as part of energy conservation measures. • Addition instant calcined lime facility for binding and utilizing heat of reaction for moisture control in sinter raw feed. • Specific energy consumption reduced from 0.57 Gcal/T of sinter to 0.55 Gcal/T of sinter. **Environmental Benefits** • Continuous Monitoring of Process and Dedusting Stack emission. • Minimization of oil content to minimize VM passage to ESP • Centralised ESP based Dedusting system to cater to all material transfer points. • Process Waste Gas Cleaning ESP with higher treatment time for effective control ultra-fine dust emission • Pulse - Energisation of ESPs discharge electrodes for high resistivity sinter dust emission control. • Reduction in Specific coke breeze requirement thereby reducing SO_2 generation.

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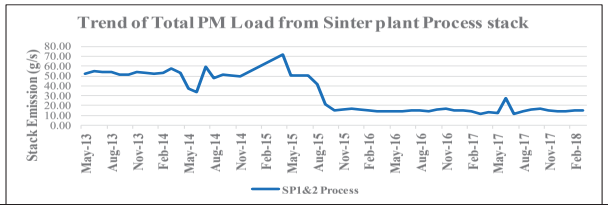
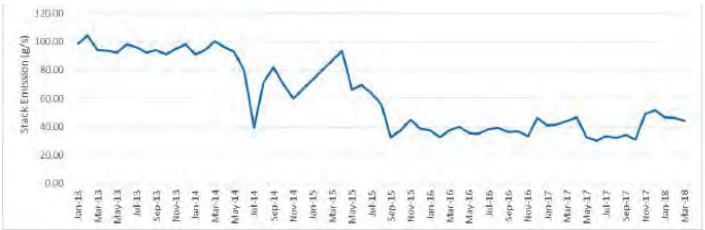
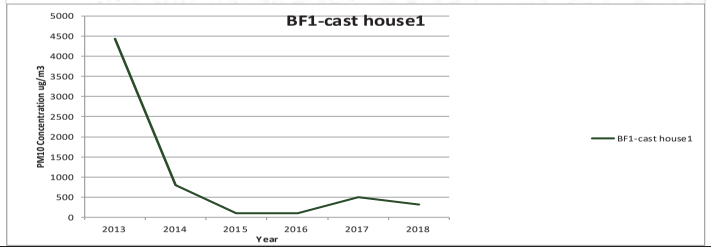
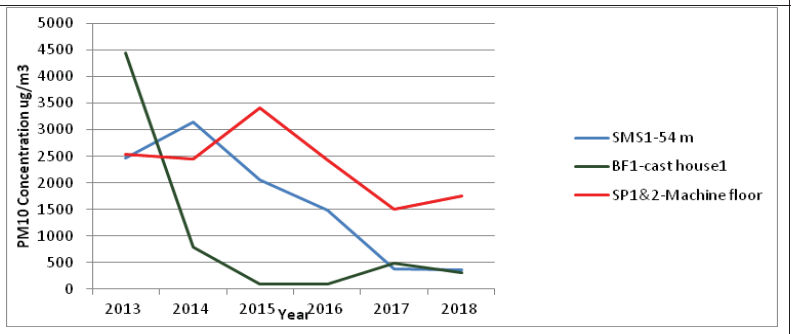
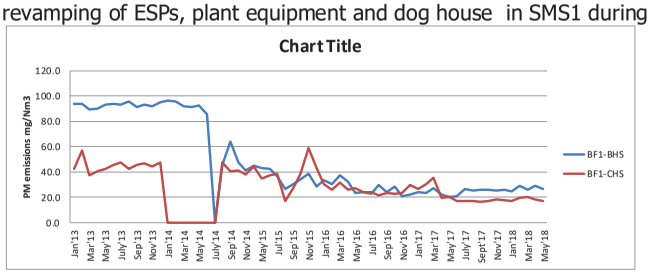
Unit	Proposed Changes to Increase Production	Other Benefits
		
Blast Furnace	• Capital repair / modernization of BF1 & BF2 to improve the health of the furnace. • Incorporation of modern features like pulverized coal injection with adequate amount of oxygen enrichment of air blast and improvement in burden material. • Adoption of improved design cooling system • Upgradation of thinner refractory to counter the increased heat load resulting in increase in furnace volume from 3200 m^3 to 3800 cu.m	**Process Optimization** • Hot Blast Temperature 1250 deg C and Pressure Increase to 4.5 Bar for improving productivity • O_2 enrichment up to 5-6% to facilitate PCI • Insulation Efficiency of refractory lining improved, heat loss reduced, cooling efficiency increased and above all productivity improved **Improved Energy Efficiency/Energy Recovery** • PCI injection up to 150 kg/thm to reduce coke rate • TRT power generation utilizing potential energy of BF Top Gas for all BFs • Sensible heat recovery from Stove exhaust flue gas is installed • Specific energy consumption of BF reduced from 3.3866 Gcal/THM to 3.12 Gcal/THM. **Environmental Benefits** • Close Loop Cooling of BF Shell for water conservation. • Cast House Fume Extraction and Stock House Dedusting System revamping. • Automation , safety interlock to reduce operation hazard, safety and control • GCP revamping to ensure particle reduction in clean gas up to 5mg/ Nm^3

Unit	Proposed Changes to Increase Production	Other Benefits
		• Stage Combustion in stove to reduce NOx emission  
SMS	• Installation of a new Convertor 3 in SMS 2 along with associated facilities to handle the additional hot metal. • Installation of new Continuous casting Machine 4 in SMS 2.	**Process Optimization** • Replacing vessel in SMS-I for increasing h/d ratio and specific volume of production for improving productivity. • Improved cooling system of Copper Mould for caster for improving productivity • Reduction in tap to tap time by Bottom stirring , Argon/ N_2 blowing • Installation of modern diagnostic facility to improve reliability

Unit	Proposed Changes to Increase Production	Other Benefits
		• Improved refractory to reduce tap to tap time, increase lining life • Slag splashing facility to improve refractory life • Optimum Ladle pre-heating and Tundish Heating • Introducing Level-2 Automation with Safety interlock to reduce operation hazard. • Product quality improvement **Improved Energy Efficiency/Energy Recovery** • Integration of casting and rolling • SMS- GCP – ID Fan VVVF Drives Control installed for all Convertor • Gas Holder installation for BOF fuel gas recovery • Walking Beam Cooling bay for round and billet transfer **Environmental Benefits** • Centralised Secondary Dedusting system with dog house for both SMS-1 & SMS-2 • Revamped Steam Exhaust System of caster • Independent bag filter based de-dusting system for Bulk Material Handling at Convertor Top

Unit	Proposed Changes to Increase Production	Other Benefits
		 Fugitive emissions have decreased in Sinter plant and BF1 and in SMS due to revamping of ESPs, plant equipment and dog house in SMS1 during expansion  The above Fig shows the reduction of PM emissions from stack from BF1 after revamping

Unit	Proposed Changes to Increase Production	Other Benefits
Rolling mills	• Installation of a new rebar mill of 0.6 MTPA capacity.	**Process Optimization** • Auto combustion process control to maintain desired excess air, combustion temperature • Leakage Control through inspection window and Billet entry & exit gate opening • Increasing yield improvement **Improved Energy Efficiency/Energy Recovery** • Integration of casting and rolling • Hot charging facility of billets to Reheating furnace to reduce gaseous fuel energy consumption • Recuperator for sensible heat recovery from furnace flue gas and combustion air pre-heating for energy conservation. • Installation of regenerative digitized control energy efficient burner in WRM • Refractory insulation for energy conservation. • VVVF drive control of combustion air fan for precision control, optimize resources and energy conservation. **Environmental Benefits** • Stage combustion inside furnace to limit combustion temperature and NOx generation. • Scale pit for water recovery and oil emulsion removal • Recycle of mill scale in sinter plant • Recycle of water after treatment for cooling and scale carrying • High Rise Stack for pollutant dispersion and natural draft
CPP	• Revamping of Existing ESPs of boilers 1-5	**Environmental Benefits** • Reduction in flue gas PM concentration to <50 mg/Nm^3.

3.0 DESCRIPTION OF ENVIRONMENT

3.1 INTRODUCTION

EIA is the most important aspect of overall environment management strategy. EIA needs a datum on which the prediction can be done. Information on the existing baseline environmental status is essential for assessing the likely environmental impacts of the proposed project in future. For studying the existing baseline environmental status the following basic steps are required:

- *Delineation of project site and study area.*
- *Delineation of the environmental components and methodology*
- *Identification of study period.*
- *Delineation of the location of project and description of its surroundings based on secondary data.*

After delineation of the above for the present case, various environmental attributes such as physiography and drainage, meteorology, air quality, water quality, soil quality, noise levels, ecology and socio-economic environment etc. have been studied / monitored by NABL Consultant and furnished by M/s RINL to MECON in order to establish baseline for different environmental components.

3.2 PROJECT SITE & STUDY AREA

The project site is where the proposed new/expansion activities are concentrated is designated as the project site.For this study, the project site is Visakhapatnam Steel Plant of M/s RINL located in village Gajuwaka, district Visakahapatnam in Andhra Pradesh state. The study area or buffer zone for the present study is taken as 10km radius around the plant site. In the buffer zone, the impacts on the environment will be significant, needing specific environment mitigation plans and evaluated using mathematical models. It is necessary to evaluate the impacts of the project activities, so that the surrounding area and communities are prevented from adverse impacts. The location of the project site and 10km buffer zone is marked in **Drg. MEC/11/S2/Q7H4/02.**

3.3 STUDY PERIOD

MoEFCC has allowed M/s RINL to utilize baseline monitoring data generated by NABL accredited laboratory and already available for the period of October – December, 2016 (post-monsoon). The same has been furnished to MECON for the present study. The NABL Certificate of the accredited consultant which generated the baseline data is attached as **Annexure 3.1**.

The baseline environmental data generation and other field studies for the preparation of Environmental Impact Assessment were conducted during one full season of post monsoon season i.e. October 2016 to December 2016.

EIA report MEC/11/S2/Q7H4/EIA-EMP/2482/R.0 dated August 2018 was submitted to MOEFCC. In 13th meeting of Expert Appraisal Committee for the proposal involving violation held on 18th -20th September 2018, the project was appraised. The EAC deferred the proposal and suggested RINL to validate the ambient air quality base

line data with fresh baseline data generation for one month and issued ADS. Accodingly MECON has conducted baseline air quality for one month from 15th October 2018 – 20th November 2018**. The monitoring results are enclosed along with this report as replies to ADS as annexure.**

The same has been considered as the *study period* for assessing the baseline status of the environmental attributes in the study area. The results of this study have been included in this report. Further, the baseline data furnished by M/s RINL has been augmented by monitoring data for selected parameters/attributes already carried out by MECON for the same duration in the same study area.

3.4 ENVIRONMENTAL COMPONENTS AND METHODOLOGY

The environmental components studied and the methodologies followed for the preparation of EIA-EMP report are given in **Table 3.1**.

TABLE 3.1: ENVIRONMENTAL COMPONENTS AND THE METHODOLOGIES

Sn	Area	Environmental Attributes	Parameters & Frequency	Methodology
1	Project Area, Study Area	Air	- **Micro-meteorology** (Air temperature, wind speed & direction, relative humidity, precipitation) - **Monitoring frequency:** 1 *hour intervals continuously for 3 months*].	Field Monitoring & Analysis
			- **Ambient Air Quality** • PM_{10}, $PM_{2.5}$, SO_2, NO_x, CO, Benzene and Benzo-(a)-pyrene furnished by M/s RINL. • Selective sample analysis done during Oct. 2016 to Dec. 2016 for O_3, NH_3, Pb, As & Ni by MECON - **Monitoring frequency:** *24-hourly /8-hourly/1-hourly samples, twice a week for 12 weeks*].	
			- **Noise Levels** - **Monitoring frequency:** *1 hour intervals continuously for 24 hours once in a season.*	
2	Study Area	Water	- **Water Quality** [*Grab samples, Once*] • Surface [parameters as per CPCB Water Quality Criteria & IS: 10500(2012)] • Ground [parameters as per IS: 10500(2012)] - **Monitoring frequency:** *Grab samples taken Once in the season*	Field Monitoring & Analysis
3	Study Area	Soil	- **Soil Quality** (physical characteristics including texture, bulk density,	Field Monitoring &

Sn	Area	Environmental Attributes	Parameters & Frequency	Methodology
			permeability, porosity, Chemical properties as pH, Electrical Conductivity, CEC, Exchangeable Ca/Mg/K/Na, SAR, Available NPK, Organic carbon & organic matter, Water soluble chlorides. - **Monitoring frequency:** *Once in the season*	Analysis
4	Study Area	Ecological Features	**Flora & Fauna** *[Once in a season]*	Field Study / Secondary Data
5	Study Area	Socio-economic Features	Parameters related to **Socio-economic aspects** (agricultural situation, employment, income, consumption and saving etc.) *[Once in a season]*	Field Study (Public Consultation by questionnaire survey) / Secondary Data
6	Study Area	Geology & Hydrology	• Formation of Rocks • Water use & impact *[Once in a season]*	Field study / Secondary Data
7	Interface of Study Area & Project Site	Infrastructure	**Traffic Density** [*1 hour intervals continuously for 24 hours once in the season*].	Field Monitoring & Compilation
8	Study area	Land Use	**Land use types** *[Once in the season]*	Land schedule records, satellite image processing

3.5 LOCATION AND GEOGRAPHICAL SETTINGS

3.5.1 Regional Setting

Project site:

The project site is in Visakhapatnam Steel Plant, Village Gajuwaka, District Visakhapatnam, Andhra Pradesh. The geographical grids of the study area approximately range from latitudes 17°45'13.36"N to 17°29'11.77"N and longitudes 83°3'43.25"E to 83°19'26.71"E. The proposed area is devoid of any greenery and the general topography of the area is plain with slight undulation. The proposed project area is industrial land and relatively barren.

Study area:

The study area is located in Visakhapatnam district of Andhra Pradesh. Visakhapatnam district is one of the north coastal districts of Andhra Pradesh. The district is sandwiched between the Eastern Ghats and Bay of Bengal. The district is bounded on the south-east by the Bay of Bengal, on the north-east by Vizianagaram district, on the north-west by Odisha and on the south-west by East Godavari district. Paderu and Araku villages in the district are having broad picturesque valleys with an

altitude of about 900 m above MSL. Araku valley is inhabited by aboriginal tribes with different sects. The Bay of Bengal is flanking the study area on its South Eastern side.

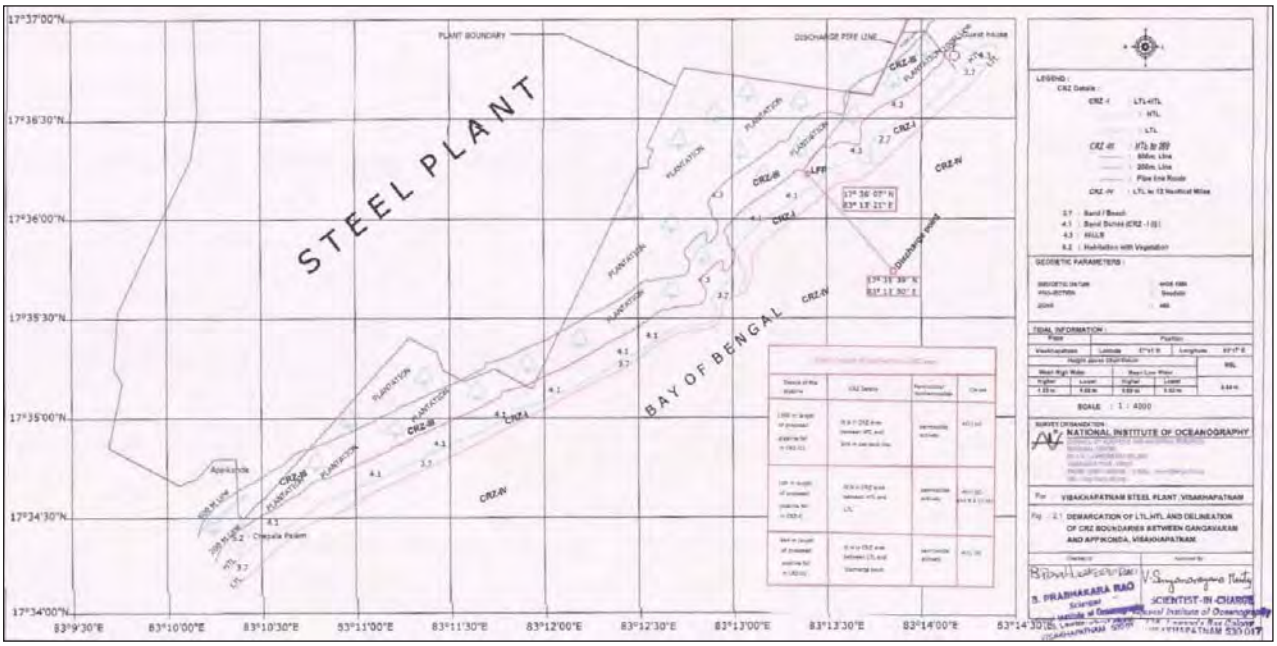
The Nadupuru Reserve forest (RF) and parts of Narava Konda RF are located in the Western and North-north western parts of the study area. Part of the Dolphin Hill cluster is located on the East-north eastern side of the study area while the West-north western side of the study area is dotted by Ukkunagaram Hills and Thanam Hills. A few isolated hills such as Kappari Konda, Golla Konda etc. are scattered over the study area.

RINL's Visakhapatnam Steel plant complex, which is the major industry in the study area is located in the Southern part. A number of other industries are also present within the study area, namely EIPL terminal of VPT, BPCL Visakha storage facility, Rashtriya Chemicals & Fertilizers Limited, HPCL Terminal, Andhra Petrochemicals Ltd, Coromandel Fertilisers Ltd, HPCL Steel Plant, Hindustan Shipyard Ltd., BHEL-(HPVP) Plant and a Zinc Plant in the North Eastern side of the study area while the South-western side has NTPC Simhadri Thermal Power Plant and Hinduja Thermal Power Plant.

The Gajuwaka tehsil wherein the most prominent land use is residential and industrial facilities, is in general a plain area with moderate number of trees. However, the few hilly ranges present within the study area are having dense shrubs with few trees.

There are no major rivers passing through the study area and the project area. A small stream of Boramma Gedda river is flowing nearby the proposed site, which is more than 900m away from the plant boundary. The Bay of Bengal lies on the Eastern side adjacent to the project (possession) boundary. However, no plant facilities are existing or proposed to be setup within the CRZ area, limiting all plant units to >1.0 km away from the coast of Bay of Bengal. However, RINL is installing a pipeline for marine discharge of treated effluents and mobile container sea water RO units for desalination of sea water within the CRZ area.The same has been granted CRZ clearance by MoEFCC vide F.No. 11-121/2010-IA.III dated 12.02.2014 (refer **Annexure 3.2**). The plant boundary with the proposed RO desalination plant and pipeline overlaid with HTL-LTL line of the coast of Bay of Bengal is shown in **Figure. 3.1** below.

FIG 3.1: RINL BOUNDARY WITH HTL-LTL LINE OF COAST OF BAY OF BENGAL



There is no Biosphere Reserve, Tiger Reserve, Elephant Reserve or Wildlife Sanctuary within 15 km of the project site. Also, no habitat for migratory birds, archaeological site, defense installation, airports exist within 10 km of the periphery of the proposed project. The nearest National Park, Kambalakonda National Park is about 17 km north-east of the project site across Visakhapatnam city. However, a patch of mangroves exists near Eastern Naval Command's air base and naval base area, approximately 8 km NNE of the project site.

NH-5 connecting Chennai to Srikakullam passes almost along E-W at approximately 4.0 km North from the site. The site is approximately 5.0 km SW of Visakhapatnam city. The nearest commercial airport is Visakhapatnam Airport which is about 9.6 km away from the site. The nearest Railway station is Duvvadu Railway station at a distance of 7.5 km and the nearest port, Visakhapatnam port is nearly 11 km away from the site.

The area is not a seismically active or land slide prone zone. The study area falls in the "Moderate Damage Risk Zone" i.e. Zone-III of Earthquake Hazard as per BMTPC: Vulnerability Atlas-2nd Edition based on Seismic Zone of India map IS:1893-2002, so the area has *moderate vulnerability to earthquakes.* As per Wind & Cyclone Hazard map published in BMTPC: Vulnerability Atlas-2nd Edition based on IS 875(3)-1987 and cyclone data from IMD, GOI, the study area has *moderate to very high risk of damage due to Cyclones.* Additionally, as per Flood Hazard map published in BMTPC: Vulnerability Atlas-2nd Edition based on Flood Atlas, Task Force Report, CWC, GoI, there are few flood prone areas within the study area.

3.5.2 Topography

The topography of the study area is sloping from north to south with hillock ranges in NW, NE and SW directions. The area is in a valley surrounded by small mountain ranges.

The area within 10 km radius also consists of flat coastal plains on the South-eastern part. Geomorphologically, Visakhapatnam has hilly terrain with valleys, middle pediplains and alluvial coastal plains. The city is located between the Eastern Ghats mountain range and the Bay of Bengal. This is mainly occupied by the structural hills and valleys, which is part of the Eastern Ghats. The hill range trends parallel to coast. The average alttitude of hills is over 900 m amsl. Physiography of the study area is shown in **Drg. MEC/11/S2/Q7H4/02**.

3.5.3 Drainage

3.5.3.1 *Visakhapatnam District*

The most important rivers drained in the Visakhapatnam district are Machikund, Tandava, Varaha, Sarada and Gostani. Most of the rivers are ephemeral in nature. However, some of the tributaries of Machikund are perennial with indications of substantial ground water discharge. Almost all the rivers and streams experience flash floods during rainy season. A good number of springs exist in Paderu and Araku areas. The district is characterized by sub-dendritic to dendritic nature of drainage pattern and is of coarse texture. In general the density is in the range of 0.6 to 1

km/km^2. Many of the hill streams in Paderu valley disappear on entering the plains due to high permeability of the pediment gravels. The disappearance of streams in and along the hill slopes is contributing to the ground water, which is again discharged through the silty soils at lower elevations.

3.5.3.2 *Study Area*

The Study area is drained by Narava Gedda River which is a seasonal river. The river Narava Gedda flows in the North-north eastern side of the steel plant site and drains into the Bay of Bengal. Two Canals, namely Yeluru Canal (running East to West) and Raiwada Canal (running North to South) meet the Kanithi Balancing Reservoir, the largest surface fresh water body in the study area. A small stream, Borramma Gedda runs across North-eastern part of the study area meeting the salt pans near Mutuchu Konda and ultimately draining into the Bay of Bengal. The drainage pattern of the study area is sub-dendritic to dendritic.

The site is not close to polluted stretch of any river identified by the CPCB/MoEF&CC. A small stream, Borramma Gedda, is flowing near the proposed site and is the nearest marine-water stream to the proposed site. It is >900 meters away from the plant site boundary in the ENE direction from the site. The Bay of Bengal lies on the Eastern side adjacent to the project (possession) boundary. No existing facilities of the plant is within 1.0 km of the High Tide Line (HTL); there are no proposals to set up any new facility within 1.0 km of the HTL i.e. RINL shall ensure that the plant is well outside the Coastal regulation Zone (CRZ which extends up to 500 m on the landward side of the HTL). However, RINL is installing a pipeline for marine discharge of treated effluents and mobile container sea water RO units for desalination of sea water within the CRZ area, for which it has already obtained CRZ clearance from MoEFCC. The general drainage pattern and water bodies in the study area is indicated in the Digital elevation map attached as **Drg. MEC/11/S2/Q7H4/06**.

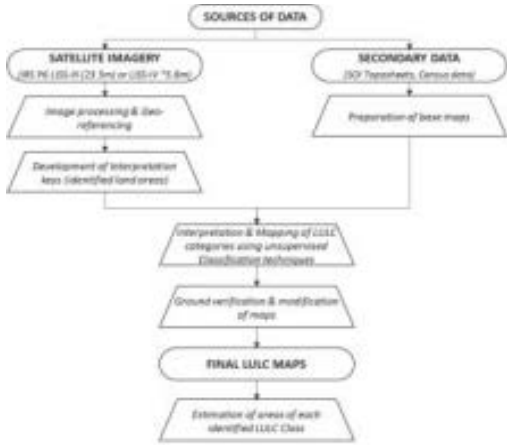
3.6 LAND USE AND LAND COVER CLASSIFICATION

Land-use pattern in the study area was interpreted from IRS ResourceSAT2 LISS-IV (Mosaic dataset) imagery dated 12.02. 2016 & 07.03.2016 and the Land Use / Land Cover information from Natural Resources Census Project of National Remote Sensing Centre (NRSC), ISRO, Hyderabad, India is shown in **Drg. No. MEC/11/S2/Q7H4/03.** The methodology adopted for the land use study as well as details of the land use/land cover of the study area is briefed in the subsequent sections.

3.6.1 Methodology

The land use/land cover map is prepared by adopting the interpretation techniques of the image in conjunction with collateral data such as topographical maps and census records. Image classification can be done by using visual interpretation techniques and digital classification using any of the image processing software. The present study has utilised ERDAS and ArcView Softwares for reprocessing, enhancements and classifying the rectified satellite data for preparation of land use land cover map and assessing land use land cover and land developmental activities.

The imagery is interpreted initially based on the secondary data available and image characteristics and ground verified based on limited site-survey to check each class of land use/land cover spread over the entire study area and subsequently, the final land use/land cover analysis is made after necessary corrections. A methodology flow for the same is indicated below:



3.6.2 Land use/land cover in the project area

An extent of 19,703 acres (7973.521 ha) of land is in posession of Visakhapatnam Steel Plant, RINL, in the name of Ministry of Steel, Govt. of India and Power of Attorney (POA) has been executed in favour of RINL-VSP.

As per the POA executed by Ministry of Steel, Govt. of India in favour of RINL-VSP, the land acquired for RINI-VSP can be utilized for Project and Project related purposes incidental thereto. The land utilization as on date is given in **Table 3.2.**

TABLE 3.2: LAND USE PATTERN IN PROJECT AREA

Sn	Description		Area, (Acres)	Remarks
1.	**PLANT**	Existing facilities	6300	*Already utilized*
		COB 5 & Byproduct plant	100	*Under utilization*
		Planned expansion in phases up to 20 MTPA	*2600	*Within existing Plant boundary For 20 MTPA Expansion, additional area is required.*
2.	**GREEN BELT**		4866	*As per MoEFCC Guidelines - includes 700 acres at K.Kotapadu.*
3.	**TOWNSHIP & AUXILIARIES**	Existing Township, CISF Colony and	3390	*Includes Educational Institutions, Sports*

Sn	Description		Area, (Acres)	Remarks
		associated facilities		*Complex, Hospital, Shopping Complexes etc.*
		Kanithi Balancing Reservoir-1	965	*Includes diversion channels (major storm water drains)*
	TOWNSHIP & AUXILIARIES	Administration building, Project office, TTI, CISF Barracks, Main approach road etc.,	387	*Under utilization*
		Future TLT & Reservoir 2	250	*Under utilization*
		Solar power plant	35	*Under utilization*
		Land leased to Power Grid, AP TRANSCO, NTPC, etc.	370	*Under utilization*
		Balance	440	*Earmarked for future activities as Stockyard, 400 KV Sub-station, Desalination plant, Expansion of Solar power plant, Pelletization plant, Road & Rail corridor for PCPIR & NTPC etc.*
	TOTAL LAND IN RINL POSESSION		**19703**	

***Source**: Data furnished by RINL*

3.6.3 Land use/Land cover in the study area

The Level-II land use/land cover of the study area has been analysed based on classification of recent satellite imagery (LISS IV dtd. 12.02.16/07.03.16) of the study area.

The following are the observed Land use-Land cover features in the study area with RINL's plant as epicenter and 10 km radial distance around it. A brief of landcover classes observed in the study area is presented below:

- **Water Bodies** : 57.7% (32559.26 ha) of the study area is covered with Bay of Bengal, water logged areas, streams and reservoirs
- **Builtup Land**: 25.2% (14208.59 ha) of the study area is builtup Land with villages, Industry and towns.
- **Waste Land** : 2.5% (1384.11ha) of the study area is waste Land with mining, quary, barren land and scrub
- **Agricultural Land** : 9.5% (5379.4 ha) of the study area is Agricultural Land with plantation, irrigation, single crop, double crop and fallow land
- **Forest Land** : 2.4% (1379.16 ha) of the study area is Forest Land with Nadipudi Reserve forest, and other open forests
- **Wet Land**: 1.7% (973.74 ha) of the study area is wet Land with mangroves and mud flats.
- **Other areas**: 0.9% (531.49 ha) of the stuy area comprise of Aquacultural ponds, coastal sands and salt pans.

The detailed pattern of land use/land cover in the study area is elaborated in **Table 3.3** below:

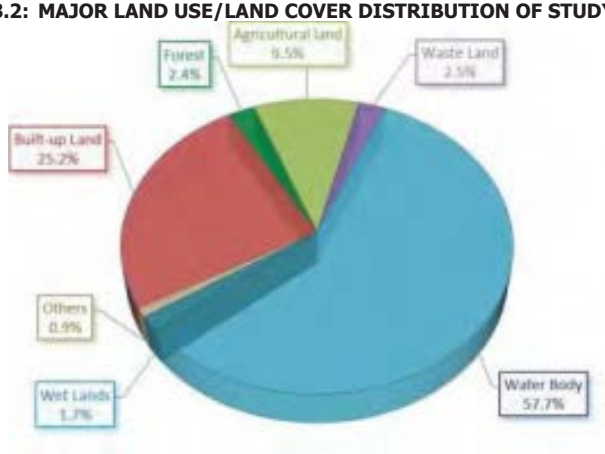
TABLE 3.3: LAND USE/LAND COVER STATISTICS OF STUDY AREA

S.No.	Level-I	Level-II	Area (Hectares)	Area (%)
1	**Built-up Land**			
1.1		Village/Settlements/Town	4504.27	7.98
1.2		Industry/Institutional Land	8952.71	15.87
1.3		Layout/New Development	751.61	1.33
2	**Forest**	Reserved/Protected Forest		
2.1		Dense/Open Forest	1310.94	2.32
2.2		Degraded Scrub	62.43	0.11
2.3		Forest Blank	5.79	0.01
3	**Agricultural land**			
3.1		Plantation	1605.33	2.85
3.2		Irrigated/Double Crop	704.43	1.25
3.3		Other Agriculture Land/Single Crop	1746.42	3.10
3.4		Fallow Land	1323.22	2.35
4	**Waste Land**			
4.1		Land with/without Scrub	1056.98	1.87
4.2		Rocky/Stony/Barren Land	234.92	0.42
4.3		Quarry/Mining Land	92.21	0.16
5	**Water Body**			
5.1		Stream/River/Canal	660.61	1.17
5.2		Tank/Reservoir/Pond	1503.35	2.66
5.3		Bay of Bengal	30232.02	53.59
5.4		Water Logged	163.28	0.29
6	**Wet Lands**			
6.1		Mudflat/Marshy Land	914.13	1.62
6.2		Mangroves	59.61	0.11
7	**Others**			
7.1		Coastal Sand/Sand Dunes	303.90	0.54
7.2		Aquaculture Ponds	121.39	0.22
7.3		Salt Pans	106.20	0.19
Total			**56415.75**	**100.00**

***Source:** Data generated during Oct. 2016 – Dec. 2016 by accredited Lab & furnished by RINL*

The existing land cover of the study area, as identified from satellite imageries, is graphically illustrated in **Fig. 3.2** below.

FIG 3.2: MAJOR LAND USE/LAND COVER DISTRIBUTION OF STUDY AREA



3.7 GEOLOGY & HYDROGEOLOGY

3.7.1 Geology

Vishakapatinam district is underlain by variety of geological formations from the oldest Archaeans to Recent Alluvium. The Archaean group of rocks includes Khondalites and Charnockites of Eastern Ghat super group and Granitic gneisses of Migmatite group. The Gondwana rocks which are represented by sandstones are in very limited aerial extent. The recent alluvium is prevalent along the rivers.

General Geological Succession

Age	Formation
Recent	Coastal Alluvium, River Alluvium and Residual Soils
Sub-Recent	Laterite and Laterite capping
Archaeans	Khondalite suite of rocks intruded by Charnockite and quartzite

Geologically the study area is covered by Khondalite and Alluvium – Sand silt dominant. The study area is predominantly composed of Khondalite. The study area is underlined by Alluvium and Khondalite. The geology of the study area with respect to that of the Andhra Pradesh state is presented in **Figure-3.3.**

VISAKHAPATNAM STEEL PLANT
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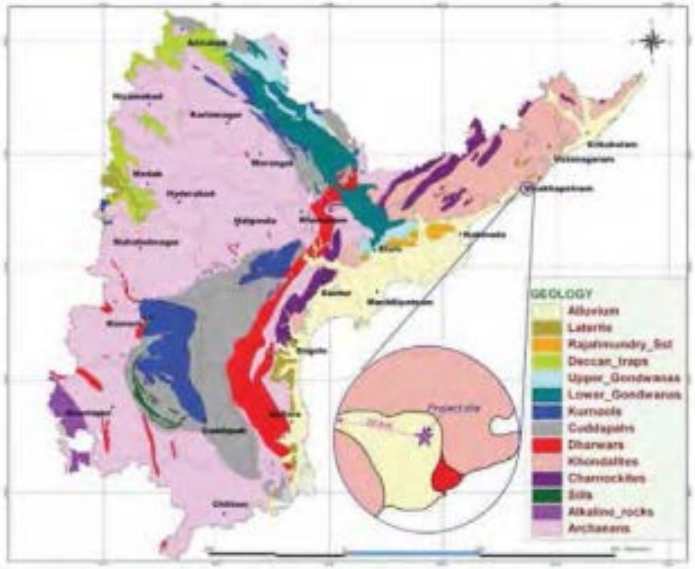
FIG 3.3: GEOLOGY OF THE STUDY AREA W.R.T. ANDHRA PRADESH



Source: Website of Ground Water Department of Andhra Pradesh at http://apsgwd.gov.in/

3.7.2 Geomorphology & Soil Types

3.7.2.1 *Geomorphology:*

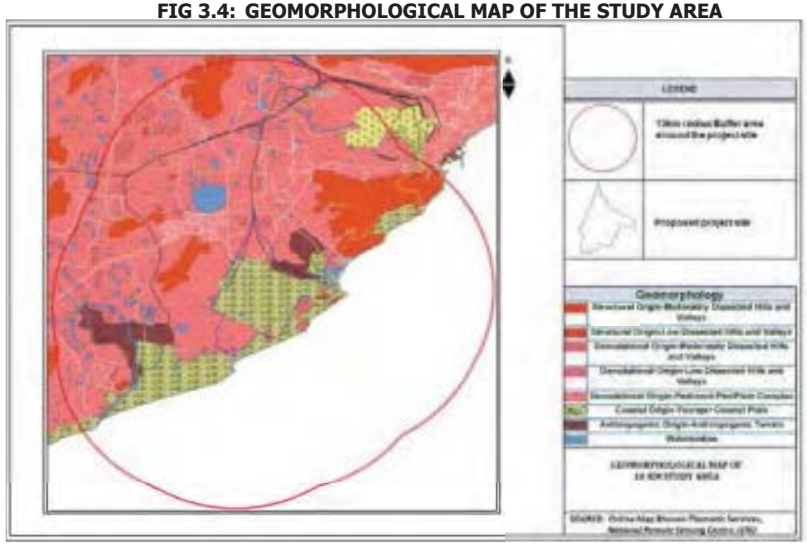
The geomorphology and structures of the area plays the vital role in identifying the ground water potential zones. Geomorphologically, Vishkapatinam district is divided into three regions, viz., northern hilly terrain with valleys, middle pediplains and alluvial coastal plains. The northern half of the district is mainly occupied by the structural hills and valleys, which is part of the Eastern Ghats. The hill range trends parallel to coast. By virtue of their topography, these hilly terrains largely form run off areas and are not suitable for ground water development. The valleys fill areas underlain by weathered formations & possesses high infiltration and high permeability. These areas form good to moderate aquifers depending on their thickness. The hard rock terrain exposed in the Tandava-Varaha-Sarada-Gosthani river basins constitutes the vast denudational pediplains, exhibiting the gradational phase of denudational-residual -inselberg -pediment areas. Pediment is well developed around the khondalite outcrops (in the study area also), whereas in the Charnockite outcrops, it is not extensively developed. The pediment area accelerates surface run off with moderate to less infiltration along the jointed and weathered zone. The Tandava, Varaha, Sarada and Gosthani rivers and their tributaries have contributed to the formation of extensive flood plain areas. There is not much surface drainage in the plains because of the high infiltration and permeable characteristics of the sediments. The coastal plain is a feature of the marine

deposition, which is very extensive, wide and even extends to several kilometers inland.

The geomorphic units of the study area are showed in **Fig. 3.4** below and enumerated below:

- *Moderately dissected hills and valleys of structural origin*
- *Low dissected hills and valleys of structural origin*
- *Moderately dissected hills and valleys of denudational origin*
- *Low dissected hills and valleys of denudational origin*
- *Pediment-Pedi plain complex of denudational origin*
- *Coastal plains*
- *Anthropogenic Terrain of anthropogenic origin, and*
- *Water bodies*

FIG 3.4: GEOMORPHOLOGICAL MAP OF THE STUDY AREA



3.7.2.2 *Soil Types:*

The different soils in the Visakhapatnam district are red loams, sandy loams, sandy soils and black cotton soils. Red loamy soils are predominate and occupy about 70% in the district. Sandy loamy soils are largely confined to the coastal areas and to certain stretches in the interior mandals of Chodavaram, Narsipatnam, K.Kotapadu and Madugula. Black cotton soils occur in parts of K.Kotapadu, Devarapalli, Chedikada, Paderu and Hukumpeta mandals.

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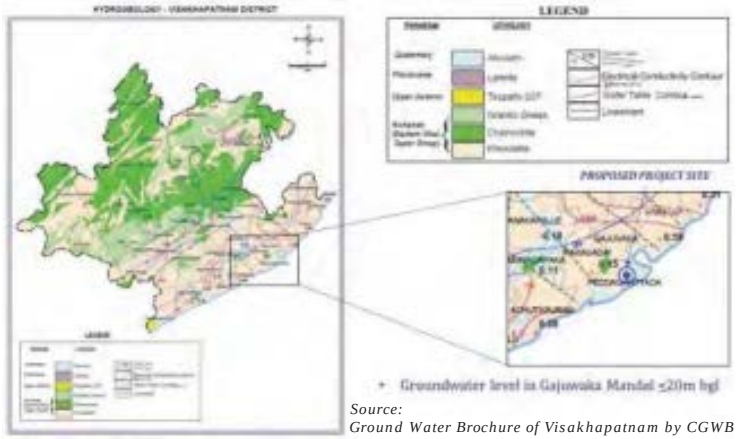
3.7.3 Hydrogeology

The Visakhapatnam district is underlain by variety of geological formations from the oldest Archaeans to Recent Alluvium. The Archaean group of rocks includes Khondalites and Charnockites of Eastern Ghat super group and Granitic gneisses of Migmatite group. The Gondwana rocks which are represented by sandstones are in very limited aerial extent. The recent alluvium is prevalent along the rivers. Prominent lineaments are trending in NE-SW, NW-SE and ENE-WSW as shown in **Fig.3.5**.

FIG 3.5: HYDROGEOLOGICAL MAP OF VISAKHAPATNAM DISTRICT



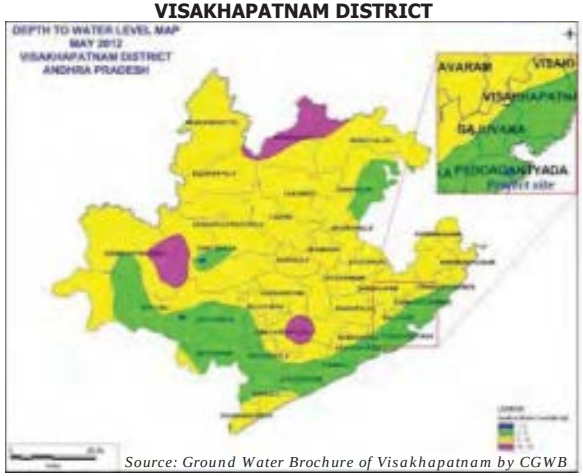
Source:
Ground Water Brochure of Visakhapatnam by CGWB

Ground water occurs in almost all geological formations. From the ground water point of view, the aquifers in the district can be broadly classified into hard formations (khondalites, charnockites, granitic gneisses etc.) and soft formations (sand stones and alluvium). Ground water occurs under unconfined to semi-confined conditions in the hard formations, while it occurs under unconfined to confined conditions in soft formations. The yields in the weathered zones of hard formations range from 25 to 100 m^3/day. The bore wells drilled in the hard formations, generally tap the fractured and fissured zones. The yields of the bore wells in these formations range between 5 to 25 m^3/hr. Sand stones are exposed in the small isolated places around Nakkavanipalem and Elamanchili. In these formations, ground water occurs under both unconfined and confined conditions. The depth of dug wells in alluvium formations ranges from 2 to 10 mbgl and the yields generally ranges from 40 to 250 m^3/day. The depth of filter points/tubewells varies from 9 to 35 m with discharges ranging from 15 to 30 m^3/hour. The transmissivity values of the aquifers in the consolidated formations generally vary from 1 to 772 m^2/day, whereas specific capacity ranges from 1 to 290 lpm/mdd.

3.7.3.1 *Ground Water Level Scenario*

As per report of Central Groundwater Board of Visakhapatnam, the groundwater levels for Visakhapatnam district show varied water level zones due to underlying terrain and also different geological set up with complex type of hydrogeomorphical structures present in the district. Premonsoon (May, 2012) depth to water level map reveals, in general, the water levels are deep particularly in the hilly area of the district. Depth to water levels varies from 5 to 10 mbgl, except at Chintapalli, where water level recorded 15.78 mbgl. In the southern part of the district i.e., near to the coast, the water levels are comparatively shallow (<5.00m) except in Payakaraopeta and Nakkapalli mandals where it is in between 5 and 10m bgl. During the post monsoon period (November, 2012), in general, the water levels follow nearly same trend. Water levels in the most part of northern area show less than 5 m. except at Potinamallaya Palem (5.80 m). The Shallow water levels, <2m, were observed in South-Western part of the district. The shallow water level was recorded at Addaroddu (0.30 m). The shallow water levels in the area might be due to location of wells close to surface water bodies/ in topographic low levels. From the trend of both pre and post monsoon levels it can be safely concluded that the area, in general, is not prone to water logging. The pre-monsoon and post-monsoon water levels are presented in **Fig. 3.6** and **Fig. 3.7**.

FIG 3.6: DEPTH TO WATER LEVEL – PRE-MONSOON (MAY, 2012) VISAKHAPATNAM DISTRICT



Source: Ground Water Brochure of Visakhapatnam by CGWB

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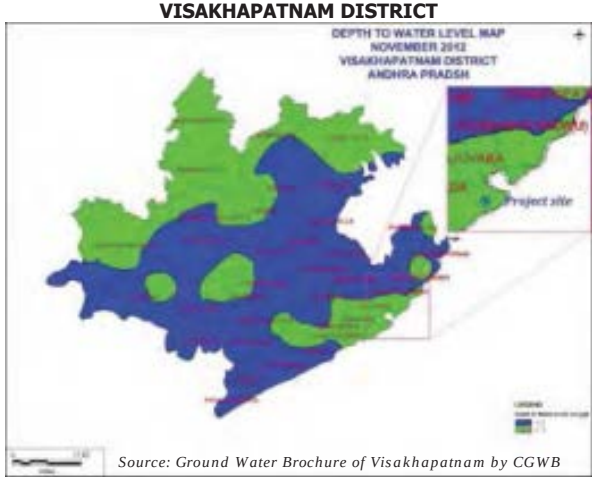
FIG 3.7: DEPTH TO WATER LEVEL – POST-MONSOON (NOV, 2012) VISAKHAPATNAM DISTRICT



Source: Ground Water Brochure of Visakhapatnam by CGWB

The water table elevation ranges between <1 m above MSL (Bheemunipatnam) and 927 m above MSL (Dimbriguda). The water table contours are almost parallel to the topographic contours. The general ground water flow direction is towards southeast directing towards the sea.

3.7.3.2 *Ground Water Resources*

As per the present ground water resource estimation (2008-2009) the total annual ground water recharge in the district is estimated to be 78,383 ha.m. (Command area = 11,794 ham and Non Command area = 66,689 ham) and the net annual ground water availability in the district after allowing the unavoidable natural discharges is 71689 ham (command area 10683 ham. and in Non-command area 61,006 ham.) The gross ground water draft for all purposes is estimated as 23,100 ham out of which 6300 ham is in command area and 16,800 ham is in Non-Command area. Thus the ground water available for future irrigation needs after allocating the ground water for future domestic and industrial needs is 38,264 ham in the entire district, which is 3,282 ham in Command area and 34,982 ham in non-command areas of the district.

The status of Gajuwaka mandal in terms of groundwater resources is given in **Table 3.4** below:

TABLE 3.4: GROUND WATER RESOURCES OF GAJUWAKA MANDAL (VISAKHAPATNAM DISTRICT)

Administrative sub-unit	Net annual Ground water Availability (ham)	Existing gross ground water draft for all uses(ham)	Ground water Balance (ham)	Stage of ground water Development %	Category
Command area	0	0	0	0	
Non-Command	941	116	825	12	Safe
Total	***941***	***116***	***825***	***12***	***Safe***

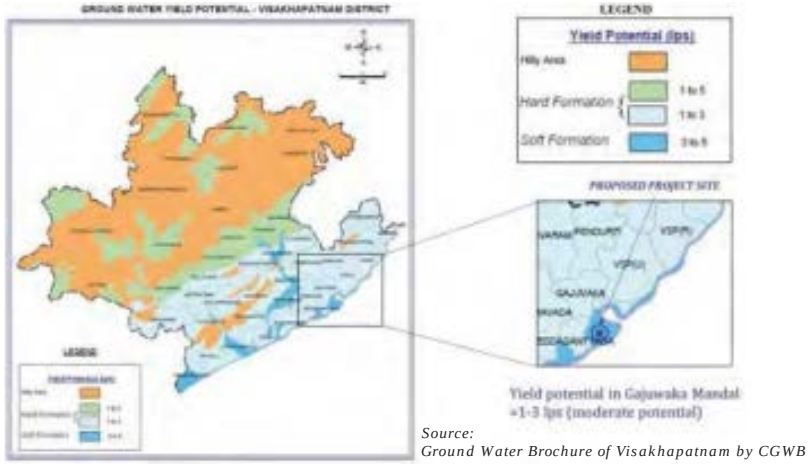
Source: Ground Water Brochure of Visakhapatnam by CGWB

Hence, as per the ground water resources of the district, the Gajuwaka mandal (wherein lies the project site) falls under **Safe category.**

3.7.3.3 *Status of Ground Water Development*

The level of ground water development in the district is in the order of 32% of the annual replenishable resource. There is a huge scope for further development of ground water in order to increase the irrigated area. Though surface water is abundant, during summer season, its availability is very less due to swift nature of streams and rivers of the district. The district is underlain by consolidated formations and to a limited extent by unconsolidated formations, therefore DTH and DR rigs respectively, were suggested for deployment. Based on the yield potential of the aquifers the district is classified as low (1 to 3 lps), Low to Moderate (1 to 5 lps) and Moderate (3 to 5 lps) yield potential areas as shown in **Fig. 3.8** below.

FIG 3.8: GROUNDWATER YIELD POTENTIAL OF VISAKHAPATNAM DISTRICT



Source:
Ground Water Brochure of Visakhapatnam by CGWB

3.7.3.4 *Stage of Groundwater development in the study area*

The study area watersheds spread about 126 sq km at an average altitude of 11 to 15 m above mean sea level. The rain fall infiltration method has been used for calculating replenishable recharge of groundwater. The annual replenishable recharge was calculated for 126 Sq km as per CGWB rainfall infiltration method. The following inputs have been considered for estimating TARR,

Annual Rainfall	*1202mm (IMD)*
Infiltration co – efficient	*0.09 (0.03 to 0.14 as per CGWB)*
Water shed area	*126 sq. km*
Population in the water shed	*20000 (approx.)*
Per capita consumption	*200 litres/day*
Influent to basin	*Nil*
Total annual replenishable recharge	*= 1.202 x 0.09 X 126 sq.km = 13.6 Million m^3/year*
Withdrawl due to population	*= 20,000 X 200 = 40,00,000 l/day = 1.46 Million m^3/yr*
Natural discharge by non-monsoon season	*= 5% on 13.6 Million m^3/year = 0.68 Mm^3*
Balance	*= 13.6 – 0.68 – 1.46 = 11.46 Million m^3*

The stage of groundwater development has been computed for the study area as given below.

$$\text{Stage of groundwater development} = \frac{\text{Annual groundwater development}}{\text{Net annual groundwater availability}} \times 100$$

$$= \frac{1.46 \times 100}{11.46} = 12.7\ \%$$

As per CGWB categorization the study area falls under **safe zone**.

There is no groundwater extraction envisaged for RINL's proposed project and hence, the calculated stage of ground water development in the study area will remain same at 12.7 % (i.e. **Safe Zone**).

3.7.3.5 *Conclusions*

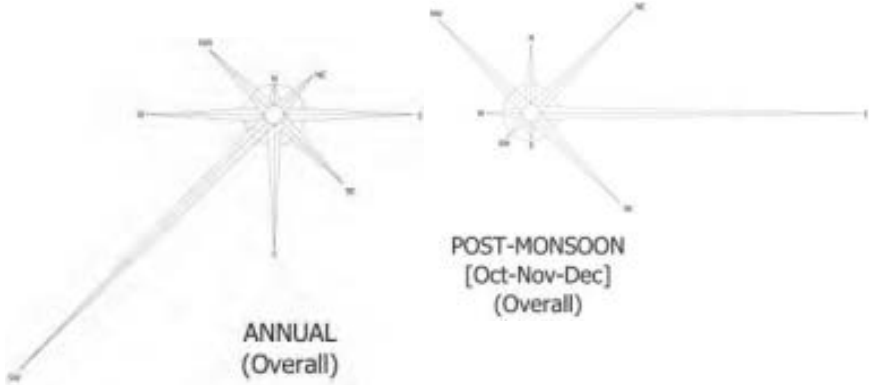
- *The existing groundwater is in water table condition encountered at an average depth of 8 m to 10 m bgl and in phreatic aquifer condition.*
- *The proposed project does not have any significant impact on the existing ground water regime and after operation of the plant as no groundwater withdrawal is envisaged for the proposed activtiers. The study area will still continue to be in the safe zone of groundwater development.*
- *The terrain is favourable for groundwater recharge; hence the authorities are planning for groundwater recharge from the proposed plant structures. It is expected that the groundwater depletion due to increase in population will be taken care by rainwater recharge.*

- *The study reveals that project area is located in a replenishable groundwater area and the existing annual replenish able groundwater is computed based on the rainfall infiltration method shows about 13.56 Mm^3/year.*
- ***Plant operation shall not have any impact on drainage pattern and the existing pattern is expected to remain as it is.***

3.8 METEOROLOGY

Prevailing meteorological conditions govern the dispersion (and hence dilution) of air pollutants. Therefore, study of meteorological conditions form an integral part of environmental impact assessment studies. To select the locations of the ambient air quality monitoring stations, information published by Indian Meteorological Department (IMD) at Visakhapatnam was used. Annual pattern of IMD data at Visakhapatnam shows that overall predominant wind direction is from SW (30% of days) & E (12% of days). The wind roses as per IMD Visakhapatnam area are shown in **Fig. 3.9**.

FIG 3.9: WINDROSE AS PER IMD VISAKHAPATNAM



Source: Data from IMD station at Visakhapatnam from Climatological Atlas of India

3.8.1 Micro-meteorology at Site

In order to determine the prevailing micro-meteorological conditions at the project site, a micro-meteorological monitoring station was set up on the roof of the Project Building of RINL's Visakhapatnam Steel Plant.

Various meteorological parameters were recorded at one hour intervals continuously throughout the three month long monitoring period. The location of the meteorological data monitoring stations is marked in Drg. No. **MEC/11/S2/Q7H4/08.** The following parameters have been recorded:

- *Wind speed*
- *Wind Direction*
- *Atmospheric Temperature*
- *Relative Humidity*
- *Solar Radiation*
- *Rainfall*

Table 3.5 gives the summary of meteorological data collected during the monitoring period. **Tables 3.6(a), (b) & (c)** give the monitored wind frequency distribution for overall, day and night hours. Overall day, Day time (0600hrs.– 1800 hrs.) and night time (1800 hrs. – 0600 hrs.) Wind-rose diagrams have been prepared and presented as **Fig.3.10 (a), (b) & (c)** respectively.

TABLE 3.5: SUMMARIZED MONITORED MICRO-METEOROLOGICAL DATA AT VISAKHAPATNAM (OCT. - DEC, 2016)

Period	Wind Speed (m/sec)			Temperature (°C)			Relative Humidity (%)		Solar Radiation (Watt/m^2)			Rainfall		
(Oct-Dec'16)	Max.	Min.	Avg.	Max.	Min.	Avg	Max.	Min.	Max.	Min.	Avg.	24hrs Highest (mm)	Total (mm)	No. of rainy days
	5.7	<0.4	0.56	38.4	17.0	26.6	100	26	1015	0	205.1	33.5	178.50	16

Source: *Monitoring data collected by MECON Env. Lab during Oct. 2016 – Dec. 2016*

FIG 3.10: (A)-WIND ROSE (OVERALL)

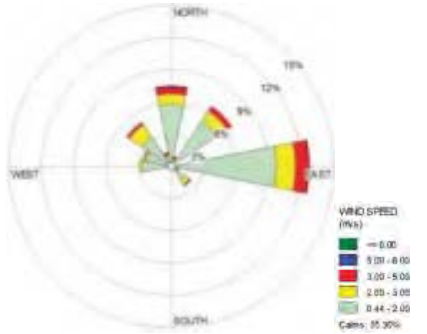


TABLE 3.6: (A) WIND FREQUENCY DISTRIBUTION IN POST-MONSOON SEASON (OCT'16 TO DEC'16) (OVERALL)

Wind Direction (towards)	Wind Speed Ranges (m/s)					Total (%)
	0.4 - 2.0	2.0 - 3.0	3.0 - 5.0	5.0 - 6.0	>= 6.0	
N	5.75	1.00	0.63	0.09	0.00	7.47
NNE	0.68	0.14	0.18	0.00	0.00	1.00
NE	5.12	1.09	0.50	0.00	0.00	6.70
ENE	0.14	0.00	0.05	0.00	0.00	0.18
E	9.69	1.77	1.22	0.05	0.00	12.73
ESE	0.63	0.05	0.05	0.00	0.00	0.72
SE	1.63	0.45	0.14	0.00	0.00	2.22
SSE	0.45	0.00	0.00	0.00	0.00	0.45
S	0.32	0.05	0.05	0.00	0.00	0.41
SSW	0.14	0.00	0.00	0.00	0.00	0.14
SW	0.14	0.05	0.05	0.00	0.00	0.23
WSW	0.50	0.00	0.00	0.00	0.00	0.50
W	2.76	0.23	0.00	0.00	0.00	2.99
WNW	2.36	0.23	0.09	0.00	0.00	2.67
NW	3.26	1.40	0.27	0.00	0.00	4.94
NNW	0.95	0.18	0.18	0.05	0.00	1.36
Sub-Total	**34.51**	**6.61**	**3.40**	**0.18**	**0.00**	**44.70**
Calms (Wind speed <0.4 m/s or <1.6 km/hr)						***55.30***

Source: *Monitoring data collected by MECON Env. Lab during Oct. 2016 – Dec. 2016*

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FIG 3.10: (B)-WIND ROSE (DAY)

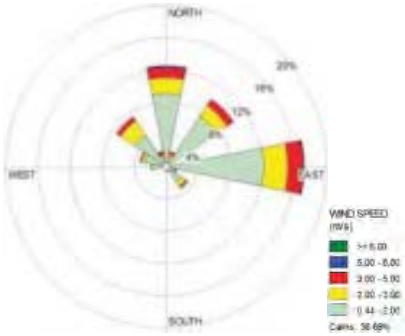


TABLE 3.6: (B) WIND FREQUENCY DISTRIBUTION IN POST-MONSOON SEASON (OCT'16 TO DEC'16) (DAY)

Wind Direction (towards)	Wind Speed Ranges (m/s)					Total (%)
	0.44 - 2.0	2.0 - 3.0	3.0 - 5.0	5.0 - 6.0	>= 6.0	
N	9.06	1.99	1.27	0.18	0.00	12.50
NNE	1.36	0.27	0.36	0.00	0.00	1.99
NE	7.52	1.63	0.91	0.00	0.00	10.05
ENE	0.27	0.00	0.09	0.00	0.00	0.36
E	12.14	2.99	1.90	0.09	0.00	17.12
ESE	1.18	0.09	0.09	0.00	0.00	1.36
SE	2.26	0.72	0.27	0.00	0.00	3.26
SSE	0.54	0.00	0.00	0.00	0.00	0.54
S	0.54	0.00	0.09	0.00	0.00	0.63
SSW	0.18	0.00	0.00	0.00	0.00	0.18
SW	0.09	0.09	0.09	0.00	0.00	0.27
WSW	0.27	0.00	0.00	0.00	0.00	0.27
W	1.81	0.18	0.00	0.00	0.00	1.99
WNW	2.72	0.45	0.18	0.00	0.00	3.35
NW	4.71	2.17	0.54	0.00	0.00	7.43
NNW	1.18	0.36	0.36	0.09	0.00	1.99
Sub-Total	**45.83**	**10.96**	**6.16**	**0.36**	**0.00**	**63.32**
Calms (Wind speed <0.44 m/s or <1.6 km/hr)						***36.68***

Source: *Monitoring data collected by MECON Env. Lab during Oct. 2016 – Dec. 2016*

FIG 3.10: (C)-WIND ROSE (NIGHT)

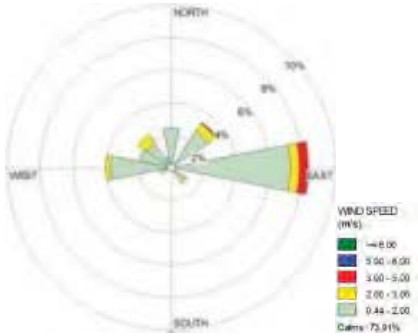


TABLE 3.6: (C): WIND FREQUENCY DISTRIBUTION IN POST-MONSOON SEASON (OCT'16 TO DEC'16) (NIGHT)

Wind Direction (towards)	Wind Speed Ranges (m/s)					Total (%)
	0.4 - 2.0	2.0 - 3.0	3.0 - 5.0	5.0 - 6.0	>= 6.0	
N	2.45	0.00	0.00	0.00	0.00	2.45
NNE	0.00	0.00	0.00	0.00	0.00	0.00
NE	2.72	0.54	0.09	0.00	0.00	3.35
ENE	0.00	0.00	0.00	0.00	0.00	0.00
E	7.25	0.54	0.54	0.00	0.00	8.33
ESE	0.09	0.00	0.00	0.00	0.00	0.09
SE	1.00	0.18	0.00	0.00	0.00	1.18
SSE	0.36	0.00	0.00	0.00	0.00	0.36
S	0.09	0.09	0.00	0.00	0.00	0.18
SSW	0.09	0.00	0.00	0.00	0.00	0.09
SW	0.18	0.00	0.00	0.00	0.00	0.18
WSW	0.72	0.00	0.00	0.00	0.00	0.72
W	3.71	0.27	0.00	0.00	0.00	3.99
WNW	1.99	0.00	0.00	0.00	0.00	1.99
NW	1.81	0.63	0.00	0.00	0.00	2.45
NNW	0.72	0.00	0.00	0.00	0.00	0.72
Sub-Total	**23.19**	**2.26**	**0.63**	**0.00**	**0.00**	**26.09**
Calms (Wind speed <0.4 m/s or <1.6 km/hr)						***73.91***

Source: *Monitoring data collected by MECON Env. Lab during Oct. 2016 – Dec. 2016*

The frequency table as indicated in **Tables 3.6(a), (b) & (c)** indicate that the study area winds are predominantly coming from East, North and North East directions. During daytime, East (E) is the predominant wind direction (prevailing for 17.12% of the time) followed by N (12.50%) and NE (10.05%). Calm conditions prevailed for 36.68% of the daytime. During night, the predominant wind direction is E (8.33%), followed by W (3.99%) and NE (3.35%). Calm condition prevailed for 73.91% of the time. Overall (24 hours), the predominant wind direction is also E (12.73%), followed by N (7.47%) and NE (6.70%). Calm conditions prevailed for 55.30% of the time.

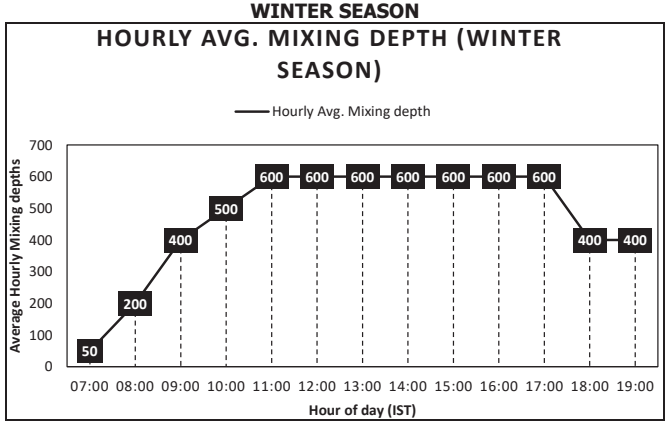
During the entire monitoring period the predominant wind speeds were in the range of 0.4 - 5 m/s.

3.8.2 Atmospheric Inversion Level

The knowledge of thermal inversion of the atmosphere at the project site is very useful in interpretation of pollution measurement data and particularly so in recognizing the responsibility for pollution episodes (growing emission or meteorology).

The average atmospheric mixing height is seen to vary from a minimum of about 50m to a maximum of about 600m during the study period in the study area, based on *Atlas of Spatial Distribution of Hourly Mixing Depth over Indian Region* published by CPCB for nearest Radio Sonde station at Visakhapatnam. Graph showing the variation of average height of ABL during the post-monsoon season is shown in **Fig 3.11**.

FIG 3.11: DIURNAL VARIATION OF AVERAGE HEIGHT OF INVERSIONS FOR WINTER SEASON



Source: *Atlas of Spatial Distribution of Hourly Mixing Depth over Indian Region published by CPCB for nearest Radio Sonde station at Visakhapatnam*

3.9 AMBIENT AIR QUALITY

To quantify the effects of proposed activities it is necessary to initially evaluate the existing air quality in and around the plant. The existing ambient air quality, in terms of Respirable Particulate Matter (PM_{10} and $PM_{2.5}$), Sulphur-dioxide (SO_2), Oxides of Nitrogen (NOx), Carbon Monoxide (CO), Ozone (O_3), Ammonia (NH_3), Lead (Pb), Arsenic (As), Nickel (Ni), Benzene (C_6H_6) and Benzo(a)Pyrene (BaP) has been measured through a planned field monitoring.

3.9.1 Location of Ambient Air Quality (AAQ) Monitoring Stations

To assess the ambient air quality, eight (08) numbers of ambient air quality monitoring stations had been set up in the study area.

For selection of the monitoring stations, Wind rose of IMD observatory at Visakhapatnam has been utilized to identify the tentative monitoring locations based on dominant wind directions. As indicated earlier, the annual predominant wind directions in the study area in general are from NW - NNW – N sectors. All predominant downwind sectors are considered for fixing up the monitoring stations.

Table 3.7 gives the list of AAQ monitoring stations. The location of stations has been shown in **Drg. MEC/11/S2/Q7H4/08.**

TABLE 3.7: AMBIENT AIR QUALITY (AAQ) MONITORING STATIONS

Sn	Station Code	Location	Direction& Distance from center of project	Direction w.r.t Wind from plant site	Geographical Coordinates	
					Latitude	Longitude
1	A1	Devada	2.3 km, SW	Upwind	17°35'7.98"N	83°8'17.73"E
2	A2	Gorlavanipalem	7.5 km, W	Crosswind	17°37'50.83"N	83°5'38.41"E
3	A3	Bhavani Nagar near Nadupudi RF	3.7 km, W	Crosswind	17°38'6.29"N	83°8'2.47"E
4	A4	Sector 3, VSP Quarters	2.0 km, W	Crosswind	17°39'38.34"N	83°9'51.60"E
5	A5	Chepurapalli	8.5 km, SW	Upwind	17°33'48.08"N	83°5'23.00"E
6	A6	Duvvada	5.3 km, NW	Downwind	17°41'59.47"N	83°9'5.31"E
7	A7	Gangavaram Port Adjacent	2.4 km, NE	Downwind	17°38'25.63"N	83°3'47.44"E
8	A8	Gajuwaka	5.3 km, NE	Downwind	17°41'2.90"N	83°13'0.86"E

Source: *Data collected during Oct. 2016 – Dec. 2016 by accredited Lab & furnished by RINL*

3.9.2 Ambient air quality (AAQ) monitoring schedule

As mentioned earlier, the EIA report has been prepared on the basis of Ambient Air Quality data generated in the study area for one full season monitoring covering post monsoon season, 2016. Samples of 24 hourly duration were taken for PM10, PM2.5, SO_2 & NOx on each monitoring day for two days a week for twelve weeks (i.e. 24 samples were collected at each location). In case of CO and Ozone (O_3), eight hourly and one hourly samples were taken at the monitoring locations for as per the field monitoring plan, respectively. Data collection for O_3, NH_3, Pb, As & Ni was carried out at selective locations.

3.9.3 Methods of Sampling and Analysis

The methods of sample collection, equipment used and analysis procedures as followed are given in **Table 3.8** and National Ambient Air Quality Standards are given in **Table 3.9.**

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TABLE 3.8: METHODOLOGY OF SAMPLING & ANALYSIS AND EQUIPMENT USED

Sn	Parameters	Method followed
1.	PM_{10}	Gravimetric. IS:5182 (Part 23)
2.	$PM_{2.5}$	Gravimetry
3.	NOx	Jacobs and Hochheiser modified (Na-arsenite) Method. IS:5182 (Part VI)
4.	SO_2	Improved West & Gaecke method: IS:5182 (Part II)
5.	CO	NDIR Method
6.	O_3	UV photometric
7.	NH_3	Indophenol blue method
8.	Pb	AAS method after sampling on EPM 2000 filter paper
9.	As	AAS method after sampling on EPM 2000 filter paper
10.	Ni	AAS method after sampling on EPM 2000 filter paper
11.	C_6H_6	Adsorption and Desorption followed by GC analysis
12.	Benzo(a)Pyrene	Solvent extraction followed by HPLC analysis

TABLE 3.9: NATIONAL AMBIENT AIR QUALITY STANDARDS

Sn	Parameter	Time Weighted Average	Concentration in Ambient Air	
			Industrial, Residential, Rural & Other Areas	Ecologically Sensitive Area (Notified by Central Government)
1	Sulphur Dioxide (SO_2); (µg/m^3)	Annual*	50	20
		24 Hours**	80	80
2	Nitrogen Dioxide (NOx);(µg/m^3)	Annual*	40	30
		24 Hours**	80	80
3	Particulate Matter, PM_{10};(µg/m^3)	Annual*	60	60
		24 Hours**	100	100
4	Particulate Matter, $PM_{2.5}$;(µg/m^3)	Annual*	40	40
		24 Hours**	60	60
5	Carbon Monoxide (CO);mg/m^3)	8 Hours **	02	02
		1 Hour **	04	04
6	Ozone (O_3) ; (µg/m^3)	8 Hours **	100	100
		1 Hour **	180	180
7	Ammonia (NH_3) ; (µg/m^3)	Annual*	100	100
		24 Hours**	400	400
8	Lead (Pb); (µg/m^3)	Annual*	0.50	0.50
		24 Hours**	1.0	1.0
9	Arsenic (As); (ng/m^3)	Annual*	06	0.6
10	Nickel (Ni); (ng/m^3)	Annual*	20	20
11	Benzene (C_6H_6) ; (µg/m^3)	Annual*	05	05
12	Benzo(a)Pyrene (BaP); (ng/m^3)	Annual*	01	01

NOTE: **Annual arithmetic mean of minimum 104 measurements in a year at a particular site taken twice a week 24 hourly at uniform intervals*
***24 hrly or 08 hrly or 01 hrly monitored values, as applicable, shall be compiled with 98% of the time in a year. 2% of the time, they may exceed the limits but not on 2 consecutive days.*

3.9.4 Ambient Air Quality Results

Station wise detailed monitoring data are furnished in **Annexure 3.3**. The summarized results of ambient air quality monitoring (covering PM_{10}, $PM_{2.5}$, NOx, SO_2, CO, NH_3, O_3, Pb, As, Ni, Benzene and BaP) are given in **Table 3.10.**

PM_{10} levels:
Minimum level of PM10 recorded in the study area was 43.8 µg/m3 at Devada and the maximum level recorded was 85.0µg/m3 at plant site.

$PM_{2.5}$ levels:
Minimum level of PM2.5 recorded in the study area was 20.2 µg/m3 at Gorlavanipalem and the maximum level recorded was 58.1µg/m3 at Kurmanapalem.

Sulfur Dioxide (SO_2):
Sulfur dioxide gas is an inorganic gaseous pollutant. Sulfur dioxide emissions are expected to be emitted wherever combustion of any fuel containing sulfur takes place. The sulfur in the fuel will combine with oxygen to form sulfur dioxide. Sulfur trioxide and sulfuric acid mist are the other important pollutants in the sulfur group. In general some of the important sources of sulfur dioxide are Power stations, sulfuric acid plants, oil refining, boilers in utilities in any industry and domestic use of coal. The following sources of Sulfur dioxide in the study area are identified:

- Emissions from domestic fuel (coal, diesel, etc.)
- Emissions from DG sets used by industries and local residents
- Emissions from Power plants

Literature indicates that the presence of sulfur dioxide in the photochemical smog reaction enhances the formation of visibility enhancing aerosols. Aerosols can corrode metal surfaces, fabrics and the leaves of plants. Sulfur dioxide is irritating to the eyes and respiratory system. Excessive exposure to sulfur dioxide causes bronchial asthma and other breathing related diseases as it affects the lungs.

Minimum and maximum level of SO_2 recorded within the study area was in the range of 14.4 µg/m^3 to 17.2 µg/m^3 with the 98th percentile ranging between 14.4 µg/m_3 to 17.2 µg/m^3. The 24 hourly average values of SO_2 were compared with the national ambient air quality standards and it was found that all sampling stations recorded values lower than the applicable limit of 80µg/m^3 for residential and rural areas.

Oxides of Nitrogen:
Oxides of Nitrogen are also an inorganic gaseous pollutant like Sulfur dioxide. Oxides of Nitrogen emissions are expected to be emitted wherever combustion at high temperatures takes place. Nitrous oxide and Nitric Acid Mist are the other important pollutants in the inorganic nitrogen group. In general some of the important sources of oxides of Nitrogen are Boilers (utilities) in any industry and Auto exhaust. In a metropolitan town NOx levels are predominantly due to automobile emissions.

The following sources of oxides of nitrogen in the study area are identified:

- Emissions from industrial and domestic burning of coal.
- Emissions from automobiles.

- Emissions from Powerplants

Oxides of nitrogen have far greater significance in photochemical smog reaction than any of the other inorganic gaseous contaminants. NOx in the presence of sunlight will undergo reactions with a number of organic compounds to produce all the effects associated with photochemical smog. NOx has inherent ability to produce deleterious effects by themselves like toxicity. It acts as an asphyxiating substance when in concentrations great enough to reduce the normal oxygen supply from the air.

Minimum and maximum level of NOx recorded within the study area was in the range of 19.2 µg/m^3 to 27.6 µg/m^3 with the 98th percentile ranging between 19.2 µg/m^3 to 27.6 µg/m^3. The 24 hourly average values of NOx were compared with the national ambient air quality standards and it was found that all the sampling stations recorded values much lower than the applicable limit of 80 µg/m^3 for residential and rural areas.

Benzene (C_6H_6):
The 98th percentile concentration of Benzene ranges from 2.8 to 4.2 µg/m^3. Minimum concentration was recorded at Devada with the concentration of 0.18 µg/m^3 where as maximum concentration was recorded at Project Site with the concentrations of 4.2 µg/m^3 respectively.

Benzo (a) pyrene (BaP)
The 98th percentile concentration of Benzo (a) pyrene ranges from 0.3 to 0.61 ng/m^3. Minimum concentration was recorded at Vadacheepurapalli with the concentration of 0.15 ng/m^3 where as maximum concentration was recorded at Adjacent Gangavaram Port with the concentrations of 0.61 ng/m^3 respectively.

Carbon Monoxide (CO):
The sources of CO are from domestic burning of coal, Emissions from automobiles and Emissions from nearby industries. Minimum CO level of 0.4 mg/m^3 at Kurmanapalem and the maximum level recorded was 1.1mg/m^3 at Project Site.

Ozone (O_3):
The C_{98} values of ozone in the study area were observed to be ranging from 44 to 87 µg/m^3, which are well within the prescribed limits of 180 µg/m^3 for 1-hourly monitored values. A slightly higher value in Gangavaram area is attributed to higher concentration of industrial activities in the area.

Ammonia (NH_3):
The C_{98} values of Ammonia (NH_3) in the study area were observed to be ranging from 68 to 202 µg/m^3, which are well within the prescribed limits of 400 µg/m^3 for 24-hourly monitored values. A slightly higher value of ammonia in Gangavaram area is again attributed to higher concentration of industrial activities in the area.

Metals i.e. Lead (Pb), Arsenic (As) & Nickel (Ni):
The C_{98} values of metals i.e. Lead (Pb), Arsenic (As) & Nickel (Ni) in the study area were observed to be ranging from <0.0007 to 0.074 µg/m^3 for Pb, 2.6 to 3.0 µg/m^3 for As and 1.0 to 16.7 µg/m^3 for Ni, which are well within the prescribed limits of 1.0

µg/m^3 for Pb, 6.0 ng/m^3 for As and 20.0 ng/m^3 for Ni respectivley. A slightly higher values of these metals is observed in VSP quarters just beside RINL's plant as well as in Gangavaram area which can be attributed to industrial activities concentrated in the area.

Trace metals in Particulate matter:
The particulate matter sampled at selective locations was also analysed for trace metals viz. Iron as Fe,Manganese as Mn,Lead as Pb, Mercury as Hg, Zinc as Zn, Chromium as Cr, Nickel as Ni, Copper as Cu and Arsenic as As and the results are sumarised at **Table 3.11**. The above results, when compared with standards available for parameters published by World Health Organisation (WHO) air quality guidelines (WHO 2000) & CPCB, it was observed that all values were well within the available applicable norms.

Conclusion:
The results for all parameters when compared with National Ambient Air Quality Standards (NAAQS), 2009 of Central Pollution Control Board (CPCB) indicate that the air quality is within norms at all the monitoring locations for all parameters except PM10. The higher concentrations of PM10 in the ambient air is attributed to salt at stations located close to the coastal areas, while for other areas, the use of wood for heating/cooking purposes by local residents, presence of a number of other industries such as power plants, fine material including coal handling areas of port and higher vehicular movement due to urban nature of the residential areas are the primary reasons for higher particulate values.

3.9.5 Fresh One month Ambient Air Quality Data as per ADS

As per the additional details sought by EAC, fresh AAQ data generation was carried out at site and in buffer zone. The station wise summarized and detailed monitoring data is furnished in **Annexure 3.4**.

The results indicate that air quality is within norms for all the monitoring locations for all parameters as prescribed by NAAQS, 2009. However, values of PM10 and PM2.5 are relatively high at A1 and A7. It can be attributed to material handling areas of port including coal at Gangavaram Port as well as higher vehicular movement. The high results of PM10 at A1 may be attributed due to higher vehicular movement in residential area, industrial activities and activities near ash pond.

Ni values are found high in A7. Ni values are also relatively high at A1, A3 and A6 though the values are within norms. Higher values of Ni in ambient air have also been reported in studies in Vishakhapatnam area in literature (Ref. Atmospheric Pollution Research 7 (2016) 725-733). The possible reason is mainly due to anthropogenic activities.

Further, A5 station has reported values of As though within norms. The concentration of As might be due to proximity of thermal power plant in the vicinity of this monitoring station.

TABLE 3.10: SUMMARISED AMBIENT AIR QUALITY MONITORING RESULTS FOR PM_{10}, $PM_{2.5}$, SO_2, NOx, CO, C_6H_6 & BaP

Parameter	Statistical data	Devada (A1)	Gorlavanipalem (A2)	Bhavani Nagar near Nadupudi RF (A3)	Sector 3, VSP Quarters (A4)	Chipurapalli (A5)	Duvvada (A6)	Gangavaram Port Adjacent (A7)	Gajuwaka (A8)
[1]PM_{10} (µg/m^3)	Mean	52.7	53.1	53.9	53.7	56.1	74.2	74.9	80.5
	Min	43.8	45.9	45.6	45.9	48.6	65.8	64.3	74.5
	Max	58.4	61.2	61.2	61.2	61.1	82.6	84.1	83.9
	C_{98}	**58.3**	**60.0**	**60.7**	**60.8**	**60.7**	**82.5**	**84.0**	**83.5**
[1]$PM_{2.5}$ (µg/m^3)	Mean	24.8	24.8	25.3	24.6	27.2	40.2	33.9	41.7
	Min	21.7	20.2	20.4	20.4	21.3	31.1	26.1	34.7
	Max	30.0	30.2	29.3	29.1	32.8	58.1	51.4	51.4
	C_{98}	**29.3**	**28.4**	**29.2**	**28.8**	**32.8**	**57.0**	**51.3**	**51.3**
[1]SO_2 (µg/m^3)	Mean	12.8	15.3	13.9	13.7	14.1	14.5	13.8	13.8
	Min	11.6	13.2	12.6	12.3	12.4	12.5	12.8	12.3
	Max	14.5	17.5	15.1	16.1	16.1	17.0	15.6	16.0
	C_{98}	**14.4**	**17.2**	**15.1**	**15.7**	**16.1**	**16.8**	**15.8**	**15.7**
[1]NOx (µg/m^3)	Mean	19.1	21.1	21.1	16.8	18.9	19.2	20.6	23.1
	Min	15.8	17.4	16.3	14.8	14.5	14.7	16.1	18.1
	Max	24.1	24.5	25.6	19.3	24.5	22.8	28.1	28.1
	C_{98}	**23.2**	**24.1**	**25.0**	**19.2**	**24.0**	**22.6**	**26.3**	**27.6**
[1]CO (mg/m^3)	Mean	0.54	0.60	0.60	1.20	1.08	1.19	1.20	1.22
	Min	0.41	0.50	0.40	0.51	0.41	0.40	0.96	1.00
	Max	0.75	0.70	0.70	9.60	9.60	1.61	1.61	1.60
	C_{98}	**0.73**	**0.70**	**0.70**	**5.86**	**5.90**	**1.61**	**1.51**	**1.55**
[1]Benzene (µg/m^3)	Mean	1.96	2.00	2.20	2.70	2.10	2.74	2.70	2.94
	Min	1.18	1.20	1.20	1.85	1.21	1.28	1.26	2.16
	Max	3.12	3.10	4.10	3.95	4.11	4.11	3.22	3.85
	C_{98}	**3.01**	**2.80**	**4.10**	**3.77**	**3.71**	**3.99**	**3.17**	**3.75**
[1]BaP (ng/m^3)	Mean	0.23	0.20	0.20	0.30	0.25	0.29	0.40	0.42
	Min	0.16	0.20	0.20	0.19	0.15	0.18	0.21	0.26
	Max	0.32	0.30	0.30	0.42	0.41	0.51	0.61	0.56
	C_{98}	**0.32**	**0.30**	**0.30**	**0.42**	**0.41**	**0.48**	**0.61**	**0.56**

SUMMARISED AMBIENT AIR QUALITY MONITORING RESULTS FOR O_3, NH_3, Pb, As & Ni (AT SELECTED LOCATIONS)

Parameter	Statistical data	Devada (A1)	Bhavani Nagar near Nadupudi RF (A3)	Sector 3, VSP Quarters (A4)	Duvvada (A6)	Gangavaram Port Adjacent (A7)	Gajuwaka (A8)
[2]Ozone (µg/m³)	Mean	57	37	35	39	74	52
	Min	46	28	29	30	57	43
	Max	65	45	44	49	87	60
	C_{98}	65	45	44	49	87	60
[2]NH_3 (µg/m³)	Mean	134	66	46	93	195	115
	Min	120	55	33	80	188	87
	Max	157	77	71	104	203	145
	C_{98}	155	76	68	103	202	143
[2]Pb (µg/m³)	Mean	0.004	0.0051	0.008	<0.0007	0.046	0.028
	Min	0.002	0.004	0.0007	<0.0007	0.015	0.013
	Max	0.006	0.006	0.014	<0.0007	0.076	0.047
	C_{98}	0.006	0.006	0.014	<0.0007	0.074	0.046
[2]As (ng/m³)	Mean	2.8	2.6	2.3	2.0	2.8	2.3
	Min	2.7	2.3	<2.0	<2.0	2.6	<2.0
	Max	3.0	2.7	2.7	2.7	2.9	2.6
	C_{98}	3.0	2.7	2.7	2.6	2.8	2.6
[2]Ni (ng/m³)	Mean	8.4	1.4	9.06	0.8	4.6	3.8
	Min	4.4	0.8	<0.7	<0.7	1.5	1.7
	Max	10.8	2.6	16.8	1.0	6.8	5.4
	C_{98}	10.7	2.4	16.7	1.0	6.6	5.3

Source: *[1]Monitoring data collected during Oct. 2016 – Dec. 2016 by accredited Lab & furnished by RINL*
[2]Monitoring data collected by MECON Environmental Lab during Oct. 2016 – Dec. 2016

Note: *Eight (08) hourly sampling for CO, C_6H_6 & BaP*
One (01) hourly sampling for O_3.
Selective Sample Analysis for O_3, NH_3, Pb, As & Ni i.e. 3 samples at selected locations

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TABLE 3.11: SUMMARISED RESULTS OF TRACE ELEMENTS ANALYSED ON MICROWAVE PLASMA ATOMIC EMISSION SPECTROSCOPE (MPAES) IN PM10 IN AMBIENT AIR (AT SELECTED LOCATIONS)

Sl. No.	Parameters	Iron as Fe (ng/m³)	Manganese as Mn (ng/m³)	Lead as Pb (µg /m³)	Mercury as Hg, (ng/m³)	Zinc as Zn (ng/m³)	Chromium as Cr (µg/m³)	Nickel as Ni (ng/m³)	Copper as Cu (ng/m³)	Arsenic as As (ng/m³)
	Method sensitivity	*Detection Limit : 3.47 ng/m³*	*Detection Limit: 0.7 ng/m³*	*Detection Limit : 0.7ng /m³*	*Detection Limit : 0.035 ng/m³*	*Detection Limit : 7.0 ng/m³*	*Detection Limit: 0.7 ng/m³*	*Detection Limit: 0.7ng/m³*	*Detection Limit : 0. 7 ng/m³*	*Detection Limit : 2.0 ng/m³*
	STANDARDS	**-**	**150#**	**1***	**1000#**	**-**	**-**	**20***	**-**	**6***
	AAQ monitoring station									
1	Devada, A1	122	28.1	0.004	0.05	<7.0	1.2	8.4	3.6	2.8
2	Bhavani Nagar near Nadupudi RF, A3	210	18.8	0.0051	<0.035	<7.0	1.5	1.4	3.0	2.6
3	Sector 3, VSP Quarters, A4	168	32.2	0.004	<0.035	<7.0	0.75	4.5	2.3	1.2
4	Duvvada, A6	92	7.7	<0.0007	<0.035	<7.0	3.1	0.8	2.6	2.0
5	Gangavaram Port Adjacent, A7	363	139.4	0.046	0.06	29.2	2.5	4.6	7.7	2.8
6	Gajuwaka, A8	420	64.8	0.028	<0.035	37.7	3.1	3.8	4.7	2.3

Source: *Monitoring data collected by MECON Environmental Lab during Oct. 2016 – Dec. 2016*

Note: *#Guideline values set by the World Health Organisation (WHO) air quality guidelines (WHO 2000) for Europe, 2nd Edition, pg 32-33. (@www.euro.who.int/data/assets/pdf_file/0005/74732/E71922.pdf)*
**National Ambient Air Quality Standards for India (CPCB, 2009)*

3.10 WATER QUALITY

Sources of water in the study area are surface water in sea / creeks & reservoir and ground water.

3.10.1 Water Quality Monitoring stations, Frequency and Mode of Sampling

Water samples have been collected once during post-monsoon season, 2016 from fifteen (15) locations, which are listed in **Table 3.12**. Aditionally, a sea water sample was also taken. The locations of the surface water and ground water sampling points are marked in **Drg. No. MEC/11/S2/Q7H4/11**.

TABLE 3.12: WATER SAMPLING LOCATIONS, POST-MONSOON SEASON, 2016

Code	Name of the Station	W.R.T. Site Remarks		Sample type
		Distance (Km)	Direction	
GW1	Dasaripeta	2.6	SW	GROUND WATER
GW2	Parwada	7.8	W	
GW3	Golla Konda Quarter	3.2	N	
GW4	Shanivada	7.1	NW	
GW5	Gajuwaka	6.9	NE	
GW6	Gangavaram	2.8	NE	
GW7	Yarada	6.4	NE	
SW1	Islampeta	6.0	SW	SURFACE WATER
SW2	Desapatrunipalem	1.4	E	
SW3	Kanithi Reservior	4.1	WNW	
SW4	Duvvada	7.8	NW	
SW5	Kurmanapalem	5.5	NNW	
SW6	Vadlapudi	6.4	N	
SW7	Sathivanipalem	10.0	N	
SW8	Kotta Narava	9.0	N	
SeaW	Sea water near VSP from Bay of Bengal	7.7	S	SEA WATER

3.10.2 Methodology

In order study the existing water quality within the study area, grab samples of groundwater and surface water were collected from fifteen (15) locations as well as one sample of sea water was also collected, as given in aforementioned table.

The results of analysis of ground water, surface water and sea water are given in **Tables 3.13, 3.14 and 3.15 respectively**. Ground water samples were analysed for different parameters as per IS: 10500 whereas the analysis results of all surface water samples were compared with CPCB Water Quality Criteria for Surface Water As Per Use. The results for sea water have been compared with the standards specified in Primary Water Quality Criteria for Designated Best Uses for Coastal Waters [As per "The Environment (Protection) Rules, 1986 (as given in **Table 3.16**).

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TABLE 3.13: RESULTS OF GROUND WATER ANALYSIS DURING POST MONSOON, 2016

Sn	Parameter	Requirement (Desirable limits)	Permissible limits in the absence of alternate source	Dasaripeta (GW1)	Parwada (GW2)	Golla Konda Quarter (GW3)	Shanivada (GW4)	Gajuwaka (GW5)	Gangavaram (GW6)	Yarada (GW7)
A. ORGANOLEPTIC AND PHYSICAL PARAMETERS										
1	Colour, Hazen units, Max	5	15	< 5	< 5	< 5	5	< 5	< 5	< 5
2	Odour	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
3	pH Value	6.5 to 8.5	No Relaxation	7.90	7.60	7.35	7.60	7.35	8.10	8.05
4	Taste	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
5	Turbidity, NTU ,Max	1	5	4.6	3.4	1.6	2.8	3.4	3.6	3.4
6	Total dissolved solids, mg/l	500	2000	1189	1241	1280	1082	1080	1020	1196
7	Electrical Conductivity, (µS/cm)	-	-	1980	2050	2130	1800	1800	1700	1990
B. GENERAL PARAMETERS CONCERNING SUBSTANCES UNDESIRABLE IN EXCESSIVE AMOUNTS										
8	Aluminium (as Al), mg/l	0.03	0.2	< 0.01	0.03	0.05	0.18	<0.01	< 0.01	0.12
9	Boron (as B), mg/l,	0.5	1.0	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
10	Calcium (as Ca), mg/l	75	200	140	120	128	104	120	140	136
11	Chloride (as Cl),mg/l	250	1000	130	210	185	154	190	250	238
12	Copper(as Cu), mg/l	0.05	1.5	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
13	Fluoride (as F), mg/l	1.0	1.5	0.5	0.6	0.4	0.8	0.6	0.8	0.7
14	Iron (as Fe),	1.0	No	0.08	0.05	0.08	0.04	1.35	1.64	1.12

Sn	Parameter	Requirement (Desirable limits)	Permissible limits in the absence of alternate source	Dasaripeta (GW1)	Parwada (GW2)	Golla Konda Quarter (GW3)	Shanivada (GW4)	Gajuwaka (GW5)	Gangavaram (GW6)	Yarada (GW7)
	mg/l		Relaxation							
15	Magnesium(as Mg), mg/l	30	100	41.3	21.9	21.9	24.3	19.4	17.01	21.9
16	Manganese (as Mn), mg/l	0.1	0.3	0.01	0.02	0.01	0.01	0.01	0.01	0.01
17	Nitrate (as NO_3), mg/l	45	No Relaxation	0.9	0.6	1.2	1.3	0.5	0.5	1.5
18	Sulphate (as SO4), mg/l	200	400	92	90	83	96	90	75	96
19	Total alkalinity(as $CaCO_3$), mg/l	200	600	280	230	260	330	240	280	285
20	Total hardness(as $CaCO_3$), mg/l	200	600	520	390	410	360	380	420	410
21	Zinc (as Zn), mg/l	5	15	0.06	0.04	0.07	0.06	0.05	0.02	0.03
22	Selenium (as Se), mg/l	0.01	No relaxation	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
23	Phenolic compounds (C_6H_5OH), mg/l, *max*	0.001	0.002	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
24	Anionic detergents (as MBAS), mg/l	0.2	1.0	< 0.1	< 0.1	< 0.1	< 0.1	< 0.10	< 0.10	< 0.10
25	Mineral Oil, mg/l	0.5	No relaxation	Absent	Absent	Absent	Absent	Absent	Absent	Absent

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Sn	Parameter	Requirement (Desirable limits)	Permissible limits in the absence of alternate source	Dasaripeta (GW1)	Parwada (GW2)	Golla Konda Quarter (GW3)	Shanivada (GW4)	Gajuwaka (GW5)	Gangavaram (GW6)	Yarada (GW7)
C. PARAMETERS CONCERNING TOXIC SUBSTANCES										
26	Cyanide (as CN), mg/l	0.05	No relaxation	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
27	Lead (as Pb), mg/l	0.01	No relaxation	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
28	Mercury,(as Hg), mg/l	0.001	No relaxation	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
29	Total arsenic (as As), mg/l	0.01	No relaxation	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
30	Total chromium (as Cr), mg/l	0.05	No relaxation	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05

Source: *Monitoring data collected during Oct. 2016 – Dec. 2016 by accredited Lab & furnished by RINL*

Seven ground water samples were collected. It was noted that Iron levels exceed even the "Permissible Limits" in three samples (GW5, GW6, GW7). In all the samples, levels of "Total Dissolved Solids", "Total Hardness", "Total Alakalinity" and "Calcium" exceed the "Desirable Limits" but are within the "Permissible Limits" for Drinking Water. Aluminum levels exceed "Desirable Limits" but are within the "Permissible Limits" in three samples (GW3, GW4, GW7).Magnesium level exceeds "Desirable Limits" but is within the "Permissible Limits" in one sample (GW1). All other Ground Water Quality parameters are within the "Desirable Limits". The slight aberration is in all likelihood due to the local geology. It must also be borne in mind, that the study area is a coastal area. Rain water, which is the main source of ground water, in coastal areas contains small amounts of dissolved solids to salt spray.

TABLE 3.14: RESULTS OF ANALYSIS OF SURFACE WATER

COMPULSORY PARAMETERS

Sn	Parameter	Class A*	Class B*	Class C*	Class D*	Class E*	Islampeta (SW1)	Desapatrunipalem (SW2)	Kanithi Reservior (SW3)	Duvvada (SW4)	Kurmanapalem (SW5)	Vadlapudi (SW6)	Sathivanipalem (SW7)	Kotta Narava (SW8)
1	pH Value	6.5-8.5	6.5-8.5	6.0-9.0	6.5-8.5	6.5-8.5	8.5	7.75	8.37	7.80	7.62	8.14	8.01	8.18
2	Dissolved Oxygen(as O2),mg/l,min.	6	5	4	4	-	4.0	5.0	6.0	4.0	5.6	4.2	5.1	6.3
3	BOD, mg/l,max	2	3	3	-	-	3	2	1	3	2	3	2	2
4	Total Coliform bacteria, MPN/100ml, max.	50	500	5000	-	-	2200	410	58	1600	410	3500	540	70
5	Free Ammonia(as N),mg/l,max	-	-	-	1.2	-	0.06	<0.01	0.01	<0.01	<0.01	0.1	0.06	0.02
6	Electrical Conductivity, µmhos/cm, max.	-	-	-	-	2250	824	1044	603	620	1630	1650	1523	1107
7	Sodium Absorption Ratio (SAR)	-	-	-	-	26	6.4	2.5	3.5	5	26	4.6	5.0	6.0
8	Boron,	-	-	-	-	2	<0.05	0.211	0.123	0.152	2	0.638	0.796	0.211

ADDITIONAL PARAMETERS

A. ORGANOLEPTIC AND PHYSICAL PARAMETERS

Sn	Parameter	Requirement (Desirable limits)	Permissible limits in the absence of alternate source	Islampeta (SW1)	Desapatrunipalem (SW2)	Kanithi Reservior (SW3)	Duvvada (SW4)	Kurmanapalem (SW5)	Vadlapudi (SW6)	Sathivanipalem (SW7)	Kotta Narava (SW8)
9	Colour, Hazen units	5	15	<5	<5	<5	<5	<5	<5	<5	<5
10	Odour	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
11	Taste	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
12	Turbidity, NTU	1	5	1.4	1.9	0.5	0.7	1	1	2	0.75

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13	Total dissolved solids, mg/l	500	2000	519	625	373	400	1016	1100	1020	708

B. GENERAL PARAMETERS CONCERNING SUBSTANCES UNDESIRABLE IN EXCESSIVE AMOUNTS

Sn	Parameter	Requirement (Desirable limits)	Permissible limits in the absence of alternate source	Islampeta (SW1)	Desapatrunipalem (SW2)	Kanithi Reservior (SW3)	Duvvada (SW4)	Kurmanapalem (SW5)	Vadlapudi (SW6)	Sathivanipalem (SW7)	Kotta Narava (SW8)
14	Aluminium (as Al), mg/l	0.03	0.2	0.17	3.0	0.15	0.17	0.22	0.09	<0.01	<0.01
15	Calcium (as Ca), mg/l	75	200	13	40	16	11	64	66	61	26
16	Chloride (as Cl),mg/l, max.	250	1000	137	84	35	55	137	196	196	157
17	Copper(as Cu), mg/l, max.	0.05	1.5	<0.01	0.01	0.02	<0.01	0.01	0.01	<0.01	<0.01
18	Fluoride (as F), mg/l, max.	1.0	1.5	0.345	0.675	0.421	0.576	0.89	1.0	0.81	0.82
19	Iron (as Fe), mg/l, max.	0.3	No Relaxation	2.3	3.4	1.4	1.81	2.303	0.831	<0.05	<0.05
20	Magnesium (as Mg), mg/l	**30**	100	2	14	6	5	15	16	17	22
21	Manganese (as Mn), mg/l	0.1	0.3	0.21	0.20	0.04	0.24	0.08	0.09	0.08	<0.01
22	Nitrate (as NO_3), mg/l	45	No Relaxation	3.4	<1	<1	<1	3.8	1	<1	<1
23	Sulphate (as SO4), mg/l	200	400	4	69	12	24	206	165	104	41
24	Total alkalinity (as $CaCO_3$), mg/l	200	600	184	260	204	180	252	352	348	340
25	Total hardness (as $CaCO_3$), mg/l	200	600	40	160	68	48	224	232	224	160
26	Zinc (as Zn), mg/l	5	15	0.072	<0.05	0.174	<0.05	<0.05	<0.05	<0.05	<0.05

C. PARAMETERS CONCERNING TOXIC SUBSTANCES

Sn	Parameter	Requirement (Desirable limits)	Permissible limits in the absence of alternate source	Islampeta (SW1)	Desapatrunipalem (SW2)	Kanithi Reservior (SW3)	Duvvada (SW4)	Kurmanapalem (SW5)	Vadlapudi (SW6)	Sathivanipalem (SW7)	Kotta Narava (SW8)
27	Cyanide (as CN), mg/l	0.05	No relaxation	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
28	Lead (as Pb), mg/l	0.01	No relaxation	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
29	Mercury, (as Hg), mg/l	0.001	No relaxation	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
30	Nickel (as Ni), mg/l	0.02	No relaxation	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
31	Total arsenic (as As), mg/l	0.01	0.05	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
32	Total chromium (as Cr), mg/l	0.05	No relaxation	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

Source: *Monitoring data collected by MECON Environmental Lab during Oct. 2016 – Dec. 2016*

Class A: *Drinking water source without conventional treatment but after dis-infection*	***Class B:*** *Outdoor bathing (organised)*
Class C: *Drinking water source after conventional treatment and after dis-infection*	***Class D:*** *Propagation of Wild life and Fisheries*
Class E: *Irrigation, Industrial Cooling, and Controlled Waste Disposal*	***Below E:*** *Not meeting A, B, C, D & E Criteria*

The Surface water results are compared to A,B,C,D & E classes of CPCB Water Quality Criteria. It can be seen from the results that during post monsoon season, 2016, the surface waters which are used for drinking water, are to be suitably treated before drinking by conventional treatment followed by disinfection. Water quality at Islampeta (SW1), Duvvada (SW4), Vadlapudi (SW6) and Sathivanipalem (SW7) meet water quality standards for drinking water with conventional treatment as well as for propagation of fisheries. Water quality at Desapatrunipalem (SW2), Kanithi Reservior (SW3), Kurmanapalem (SW5) and Kotta Narava (SW8) is also good enough for outdoor bathing purposes. When compared with IS:10500 standards, the surface water quality at almost all locations for most of the parameters was observed to be within permissible limits. However, Fe(iron) was found to be higher at almost all locations. Concentration of toxic substances at all locations was found to be within desirable limits and arsenic was found to be within the permissible limits.

TABLE 3.15: RESULTS OF ANALYSIS OF SEA WATER

Sn.	Parameter	Sea water near VSP from Bay of Bengal (SeaW)
1	pH	8.0
2	Colour & Odour	<5 & Agreeable
3	Dissolved Oxygen (as O_2), mg/l	6.04
4	Turbidity, NTU	0.4
5	Floating matters,mg/l	None
6	Suspended solids, mg/l	12.0
7	Oil & Grease, mg/l	4
8	Mercury (as Hg) mg/l	<0.0005
9	Cadmium,mg/l	<0.01
10	Lead,mg/l	<0.01
11	Dissolved Iron (as Fe) mg/l	0.06
12	Dissolved Manganese(as Mn) mg/l	<0.01
13	Coliforms, MPN/100 ml	340
14	Sludge deposits, solid refuse, floating solids, oil & grease, scum	None

Source: *Monitoring data collected by MECON Env. Lab during Oct. 2016 – Dec. 2016*

The sea water quality when compared with Coastal Water Quality Criteria (**Table 3.16**) specified designated best uses, it was observed that the water quality meets criteria specified for SW-III i.e for "Industrial Cooling, Recreation (non-contact) and aesthetics".

TABLE 3.16: PRIMARY WATER QUALITY CRITERIA FOR DESIGNATED BEST USES FOR COASTAL WATERS [AS PER "THE ENVIRONMENT (PROTECTION) RULES, 1986

Sn.	Parameters	SW-I	SW-II	SW-III	SW-IV	SW-V
1	pH	6.5 – 8.5	6.5 – 8.5	6.5 – 8.5	6.0 – 9.0	6.0 – 9.0
2	Dissolved oxygen (as O_2), mg/l, min	5 or 60% of saturation value, whichever is higher	4 or 50% of saturation value, whichever is higher	3 or 40% of saturation value, whichever is higher	3 or 40% of saturation value, whichever is higher	3 or 40% of saturation value, whichever is higher
3	Colour & odour	No noticeable colour or offensive odour	No noticeable colour or offensive odour	No noticeable colour or offensive odour	No noticeable colour or offensive odour	None in such concentrations that would impair any usages specifically assigned to this class
4	Floating Matters	No visible, obnoxious floating debris, oil slick, scum	Nothing obnoxious or detrimental for use purpose	No obnoxious floating debris, oil slick, scum	10 mg/l max. (including Oil & grease & scum / petroleum products)	-
5	Oil & grease (including petroleum products)	0.1 mg/l max.	-	-	-	-
6	Suspended solids	None from sewage & industrial origin	-	-	-	-

Sn.	Parameters	SW-1	SW-II	SW-III	SW-IV	SW-V
7	Heavy metals a) Mercury (as Hg) b) Lead (as Pb) c) Cadmium (as Cd)	 0.001 mg/l 0.001 mg/l 0.01 mg/l	-	-	-	
8	Turbidity, NTU max.	-	30	30		
9	Faecal coliforms, MPN/100 ml, max	-	100	500	500	500
10	BOD, 3 days at 27° C, max	-	3 mg/l	-	5 mg/l	
11	Dissolved Iron (as Fe)	-	-	0.5 mg/l max.	-	-
12	Dissolved Manganese (as Mn)	-	-	0.5 mg/l max.	-	-
13	Sludge deposits, solid refuse, floating solids, oil & grease, scum	-	-	-	-	None except for such small amount that may result from discharge of appropriately treated sewage & or industrial waste

SW-1 *: Salt Pans, Shell fishing, mariculture and ecologically sensitive zone.*
SW-II *: Bathing, Contact Water Sports and Commercial Fishing*
SW-III *: Industrial Cooling, Recreation (non-contact) and aesthetics*
SW-IV *: Harbour Waters*
SW-V *: Navigation and Controlled Waste Disposal*

3.11 NOISE LEVELS

In order to have an idea about the existing ambient noise level of the study area, noise monitoring has been carried out at nine (9) locations during post monsoon season, 2016. All the stations are listed in **Table 3.17**. These stations are also marked alongwith the AAQ monitoring stations in **Drg. No. MEC/11/S2/Q7H4/09.**

TABLE 3.17: AMBIENT NOISE MONITORING STATIONS

Sn	Location	Stn Code	W.r.t. Project Site		Type
			Distance, km	Direction	
1	Project Site	N1	-	-	Industrial Area (I)
2	Devada	N2	2.2	SW	Sensitive Zone (S)
3	Gorlavanipalem	N3	7.8	W	Residential Area (R)
4	Nadupudi	N4	3.0	W	Sensitive Zone (S)
5	Appikonda	N5	0.5	SW	Sensitive Zone (S)
6	VadaChipurapalli	N6	8.9	SW	Residential Area (R)
7	Kurmannapalem	N7	8.2	N	Commercial Area (C)
8	Gangavaram Port Adjacent	N8	2.8	NE	Residential Area (R)
9	Gajuwaka	N9	6.9	NE	Commercial Area (C)

Note: I- Industrial Area, R- Residential Area, C- Commercial Area, S- Sensitive Zone

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3.11.1 Noise Monitoring Frequency

Monitoring was carried out once during post monsoon Season, 2016. Leq. The day levels of noise have been monitored during 6 am to 10 pm and the night levels during 10 pm to 6 am. Noise level has been recorded at hourly intervals for 24 hours continuously at eight ambient air quality stations by operating the portable sound level meter device.

3.11.2 Results and Discussions

The summarized results of ambient noise monitoring are given in **Table 3.18**. The results have been compared with the standard specified in Schedule III, Rule 3 of Environmental Protection Rules also given in **Table 3.18**.

TABLE 3.18: SUMMARISED RESULTS OF NOISE MONITORING

Location Hours	Noise level Monitoring stations								
	Project Site (N1)	Devada (N2)	Goralavanipalem (N3)	Nadapuru (N4)	Appikonda (N5)	Vadachepurapalli (N6)	Kurmanapalem (N7)	Gangavaram Port (N8)	Gajuwaka (N9)
06:00	67.8	43.6	45.6	49.2	44	48.3	65.8	60.2	65.4
07:00	69.3	50.1	54.3	50.1	51.4	50.1	70.2	65.8	68.9
08:00	70.1	54.3	51.2	55.6	50.3	54.3	71.8	69.1	71.2
09:00	74.3	55.1	52.6	53.1	51.7	55.4	72.6	71.2	72.2
10:00	73.2	54.2	54.6	54.3	52.8	56.1	73.8	70.5	73.4
11:00	72.8	55.6	51.4	53.6	53.4	53.8	72.8	72.3	72.1
12:00	74.5	51.4	55.3	50.8	54.2	54.2	70.1	70.4	73.2
13:00	72.3	50.9	46.7	52.6	52.3	54.3	71.3	71.2	74.1
14:00	71.6	50.7	50.8	51.8	51.4	54.7	72.8	70.3	72.6
15:00	72.3	50.6	51.4	53.1	52.9	53.6	70.1	71.8	73.1
16:00	74.1	51.6	52.8	53.4	53.7	54.7	71.4	65.8	74.8
17:00	73.5	50.4	55.4	52.1	54.8	53.8	70.3	66.9	73.1
18:00	74.6	49.8	51.2	52.8	55.2	52.7	70.2	67.2	70.1
19:00	74.3	51.2	52.3	53.6	50.6	51.4	68.9	66.3	69.8
20:00	73.2	50.6	51.5	52.1	50.1	50.3	68.5	65.1	68.3
21:00	72.8	50.3	49.8	50.7	45.7	50.1	66.7	64.3	67.1
22:00	69.1	46.8	45.3	49.6	43.2	49.1	63.1	62.8	66.3
23:00	68.5	45.9	44.7	48.4	42.8	48.7	62.4	61.4	65.2
24:00	67.9	43.8	43.6	48.1	42.3	49	61.8	60.3	64.8
01:00	64.2	45.1	43.4	45.6	42.7	46.5	60.1	60.1	64.2
02:00	64.1	46.3	43.1	44.9	43.8	45.2	61.4	60.3	65.8
03:00	65.3	48.2	42.8	43.7	42.3	44.3	61.3	60.1	64.8
04:00	65.3	43	42.9	43.1	42.8	46.7	60.5	60.3	63.9
05:00	64.3	44.1	42.3	45.6	43.2	47.1	62.3	61.7	63.1
Min.	64.1	43.0	42.3	43.1	42.3	44.3	60.1	60.1	63.1
Max.	74.6	55.6	55.4	55.6	55.2	56.1	73.8	72.3	74.8
Lday	**72.9**	**52.0**	**52.3**	**52.7**	**52.3**	**53.4**	**70.9**	**69.0**	**71.8**
Lnight	**66.2**	**45.3**	**43.2**	**46.2**	**42.2**	**46.8**	**61.0**	**60.2**	**64.4**
CPCB Stds.	***I***	***S***	***R***	***S***	***S***	***R***	***C***	***R***	***C***
	75	***50***	***55***	***50***	***50***	***55***	***65***	***55***	***65***
	70	***40***	***45***	***40***	***40***	***45***	***55***	***45***	***55***

Source: *Monitoring data collected during Oct. 2016 – Dec. 2016 by accredited Lab & furnished by RINL*

The results indicate that noise levels observed in some of the rural areas are primarily owing to vehicular traffic, other anthropogenic activities and industrial activities. The day equivalents during the study period are ranging between 52.0 to 72.9 dB(A). Whereas, the night equivalents were in the range of 42.2 to 66.2 dB(A). The results of day equivalents and the night equivalents are compared with the ambient noise standards of respective industrial, residential, commercial area and sensitive zone standards. Monitored noise levels are within the respective limits for all industrial and most of the residential areas. However, ambient noise levels slightly exceed the limits at monitoring stations in sensitive zones, commercial areas and some residential areas close to industrial activities.

3.12 SOIL CHARACTERISTICS

To assess the quality of soil in and around the proposed area, soil samples were collected from six locations in Nov, 2016. **Table 3.19** lists the soil sampling locations. These locations are also marked in **Drg. No. MEC /11/S2/Q7H4/12.**

TABLE 3.19: LIST OF SOIL SAMPLING LOCATIONS

Sample No.	Location	W.R.T. Site	
		Distance km	Direction
S1	Pedda Konda	0.5	E
S2	Gollapalem	8.8	SW
S3	Kotta Gorlavanipalem	8.3	W
S4	Nadupuru Reserve Forest	3.8	W
S5	Gollakonda Quarters	2.9	N
S6	Islampet	0.5	W
S7	Turakalapalem	7.8	NE
S8	Sediment	5.1	SW

Source: *Data collected during Oct. 2016 – Dec. 2016 by accredited Lab & furnished by RINL*

3.12.1 Criteria Adopted for Selection of Sampling Locations

For studying the soil types and soil characteristics, 8 sampling locations were selected to assess the existing soil conditions representing various land use conditions and geological features.

3.12.2 Methodology and Sampling

The homogenized soil samples collected at different locations were packed in a polyethylene plastic bag and sealed. The sealed samples were sent to laboratory for analysis. The important physical, chemical parameter concentrations were determined from all samples.

3.12.3 Results and Discussions

The results of analysis of all soil samples from eight (8) locations are given in **Tables 3.20**.

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TABLE 3.20: SOIL QUALITY RESULTS

Sn	Parameters	Unit	Pedda Konda (S1)	Gollapalem (S2)	Kotta Gorlavanipalem (S3)	Nadupuru RF (S4)	Gollakonda Quarters (S5)	Islampet (S6)	Turakalapalem (S7)	Sediment (S8)
	PHYSICAL PROPERTIES									
1	Texture	-	Sandy loam	Sandy clay loam	Sandy clay loam	Sandy clay loam	Sandy clay loam	Sandy clay loam	Sandy clay loam	Sandy loam
a	Sand	%	75	73	62.5	66.2	62.1	68.3	63.1	79
b	Silt	%	8.4	5.4	4.4	4.8	3.8	5.1	4.9	9.6
c	Clay	%	16.6	21.6	33.1	29	34.1	26.7	32	11.4
2	Bulk Density inferred	g/cc	1.6	1.5	1.5	1.5	1.5	1.5	1.5	1.5
3	Permeability inferred	Cm/hr	Moderate	Mod slow	Mod slow	Mod slow	Mod slow	Mod slow	Mod slow	Moderate
4	Porosity	%	43	40	39	40	38	41	37	46
	CHEMICAL PROPERTIES									
5	pH(1:5 Aq. Extraction)		7.56	7.69	7.92	7.86	7.63	7.71	7.59	7.81
6	Conductivity (1:5 Aq. Extraction)	µS/cm	236	89	198	199	105	136	92	186
7	Cation Exchange Capacity	(meq/100gm)	30.61	17.91	15.22	21.2	24.76	8.69	30.35	36.93
8	Exchangeble Calcium	(meq/100gm)	516025.8	300015	212010.6	360018	380019	12106.1	241212.1	621331
9	Exchangeble Magnesium	(meq/100gm)	--	490.4	2432.0	1020.83	4383.6	--	192115.8	--
10	Exchangeble Potassium	(meq/100gm	2.69	2.4	1.92	1.97	1.76	2.51	2.4	2.61
11	Exchangeble Sodium	(meq/100gm)	4882.12	250.11	390.17	860.4	980.43	340.14	260.1	7643.32
12	Sodium Absorption Ratio (SAR)	----	3.97	0.04	0.07	0.58	0.99	0.93	0.02	4.16

Source: *Monitoring data collected during Oct. 2016 – Dec. 2016 by accredited Lab & furnished by RINL*

3.12.4 Interpretation of Results

Physical Characteristics:
As per the physical data, soils are coarse to moderately fine texture, having moderate bulk density, imperatively moderate water holding capacity, and moderate to slow permeability. As per physical characters soils are rated as moderate to good for agriculture.

Chemical Characteristics:
As per chemical characters soil reaction (pH) soils are neutral to slightly alkaline and electrical conductivity (EC) is non saline (normal).

Organic matter is low to sufficient. Macro nutrient like nitrogen is low to sufficient and phosphorus is very low to medium, potassium is low. Calcium, magnesium are moderate to high and base saturation is moderate to high. Sodium is below the limit to make soil saline or sodic or alkali.

Cation Exchange capacity is moderate to high indicating good fertility. Exchangeable Ca is high with very high base saturation, Ex. Mg is moderate with moderate base saturation, Ex K is low and Ex Na is also low not indicating any alkalinity. Sodium adsorption ratio indicates the soils are normal.

As observed during field visit of 10 km buffer area from boundary of steel plant, the different soils in the area are red loams, sandy loams, and black soils. Red loamy soils are predominating. Sandy loamy soils are largely confined to the coastal areas and to certain stretches in the interior .Thus as per analysis of soils data and field observation the land can be classified as class IIIes land i.e. Moderately good soils on gentle slopes (with terraces), subject to water erosion, as per land capability classification (USDA) i.e. moderate land for sustained agriculture.

3.13 TRAFFIC DENSITY

The traffic studies was carried out near the entrance of RINL-VSP which is adjacent to National Highway. Traffic density was recorded at hourly intervals for 24 hours continuously by counting the numbers and types of vehicles passing through the stations. The same is provided in **Table 3.21**.

TABLE 3.21: TRAFFIC DENSITY AT VSP MAIN GATE

Hours	2- Wheelers Motor cycle or scooter		3 & 4 Wheelers		Medium Vehicles		Heavy Vehicles		Total	
	Nos.	*@0.75 PCU*	*Nos.*	*@1.0 PCU*	*Nos.*	*@2.0 PCU*	*Nos.*	*@3.7 PCU*	*Nos.*	*PCU's / Hr*
07.00-08.00	510	382.5	150	150	75	150	18	66.6	753.0	749.1
08.00-09.00	594	445.5	185	185	68	136	18	66.6	865.0	833.1
09.00-10.00	680	510	200	200	78	156	19	70.3	977.0	936.3
10:00-11:00	650	487.5	180	180	115	230	16	59.2	961.0	**956.7**
11:00-12:00	415	311.25	100	100	112	224	24	88.8	651.0	724.1
12:00-13:00	500	375	150	150	78	156	15	55.5	743.0	736.5
13:00-14:00	560	420	160	160	88	176	14	51.8	822.0	807.8
14:00-15:00	460	345	170	170	98	196	15	55.5	743.0	766.5
15:00-16:00	514	385.5	180	180	115	230	15	55.5	824.0	851.0
16:00-17:00	561	420.75	190	190	116	232	24	88.8	891.0	931.6
17:00-18:00	545	408.75	120	120	127	254	25	92.5	817.0	875.3
18:00-19:00	350	262.5	119	119	157	314	23	85.1	649.0	780.6
19:00-20:00	280	210	90	90	42	84	22	81.4	434.0	465.4
20:00-21:00	120	90	65	65	28	56	21	77.7	234.0	288.7
21:00-22:00	110	82.5	38	38	10	20	23	85.1	181.0	225.6
Worst case Baseline PCU/hr (i.e. maximum hourly PCU observed):										**956.7**
Total width of the Road in meters (Arterial Roads):										9.2
Carrying capacity of the road (the road is 2 lane 2 way road) as per: IRC:106-1990 (PCU's per hour)										**1500**

Source: *Monitoring data collected during Oct. 2016 – Dec. 2016 by accredited Lab & furnished by RINL*

3.13.1 Results and Discussions

The above study indicates that the PCU of the present study is **956.7 PCU/hr** and the carrying capacity of the existing road is **1500 PCU/hr,** as estimated based on IRC: 106-1990 *"Guidelines for capacity of Urban roads in plain areas"*. There will not be any incremental load on the road due to the proposed project as all the raw materials will be transported through rail network. This suggests that the road

infrastructure present has the carrying capacity sufficient for *business-as-usual* scenario of traffic movement and there will be no impact on the same due to the proposed activities.

3.14 BIOLOGICAL ENVIRONMENT

3.14.1 Objectives of the study

The present study was undertaken with the following objectives:

- *To assess the nature and distribution of vegetation in and around the project site within the study area;*
- *To assess the type of wild animals within the study area;*
- *To assess the biodiversity of natural system present in the study area;*
- *To ascertain migratory routes of fauna and possibility of breeding grounds within the study area;*

3.14.2 Methodology of the Ecology Study

The study area taken for the study is 10 km radius with the Plant site as centre. The different methods adopted were as follows:

- *Inventorisation of flora / fauna: A preliminary list of flora and fauna found in the study area was prepared by conducting field survey and was finalized after discussions from Forest Offices of the Forest Division (falling within the study area).*
- *Discussion with local people so as to elicit information about local plant and animals found within the study area.*
- *The present study is based on field studies conducted during Post-monsoon season of 2016.*

The study area is located on the outskirts of a major industrial city (Visakhapatnam). The project site is Visakhapatnam Steel Plant and is about 5 km from the shores of the Bay of Bengal. The study area comprises of settlements [7.98% of the study area], industrial areas (Visakhapatnam Steel Plant and other industries) [15.87% of the study area], and Bay of Bengal [53.59% of the study area]. There is no Biosphere Reserve, Tiger Reserve, Elephant Reserve or Wildlife Sanctuary within 50 km of the project site. The nearest National Park, Kambalakonda National Park is about 17 km north-east of the project site across Visakhapatnam city.

Ecology of the area was studied by actual field studies / observations and collecting information from published literature (particularly the book "Flora of Visakhapatnam District, Andhra Pradesh by G.V. Subba Rao & G.R. Kumari (ed. P.S.N. Rao; Pub. Botanical survey of India) and records of the State Forest Department.

3.14.3 Ecology of the Project Site

The project site is land under industrial usage, within the existing premises of Visakhapatnam Steel plant. The vegetation of the project site has been cleared. Only some isolated shrubs herbs and grasses remain. Based on the residual vegetation at the COB-5 Site and that of the adjacent vacant area, it can be concluded that the vegetation of the COB-5 site comprised of small trees (*Acacia spp., Prosopis*

juliflora), shrubs (*Lantana camara, Calotropis gigantea, Ricinus communis*), herbs such as *Mimosa pudica, Tridax procumbens* and grasses.

3.14.4 Ecology of the study area

Study Area Flora

The land cover of the study area comprises of urban & rural settlements, industrial plants, agricultural lands & plantations, barren / waste lands, fallow lands, forests, scrub lands, inland water bodies, sea- beach and the sea. The plants found naturally in the study area are listed in **Table 3.22**.

TABLE 3.22: LIST OF PLANTS FOUND NATURALLY IN THE STUDY AREA

Sl. No.	Local Name	Scientific Name	Family
		TREES	
1.	Tella tumma	*Acacia leucophloea*	Mimosaceae
2.	Sundra	*Acacia chundra*	Mimosaceae
3.	Nalla-tumma	*Acacia nilotica*	Mimosaceae
4.	Sandiliyamu	*Aegle marmelos*	Rutaceae
5.	Peddamanu	*Ailanthus excelsa*	Simarubiaceae
6.	Vooduga	*Alangium salvifolium*	Alanginaceae
7.	Nallaregu	*Albizzia amara*	Mimosaceae
8.	Dirisena-chettu	*Albizzia lebbeck*	Mimosaceae
9.	Erra avalu	*Allophylus serratus*	Sapindaceae
10.	Naramamidi	*Alseodaphne semecarpifolia*	Lauraceae
11.	Jeedimamidi	*Anacardium occidentale*	Anacardiaceae
12.	Pampini	*Anogeissus latifolia*	Combretaceae
13.	Pullagummadi	*Antidesma diandrum*	Euphorbiaceae
14.	Advinimma	*Atalantia monophylla*	Rutaceae
15.	Tella-mada	*Avicennia officinalis*	Acanthaceae
16.	Vepu	*Azadirachta indica*	Meliaceae
17.	Kadmi	*Barringtonia acutangula*	Barringtoniaceae
18.	Ari	*Bauhinia racemosa*	Caesalpiniaceae
19.	Bodaddam	*Bauhinia variegata*	Caesalpiniaceae
20.	Godari	*Bauhinia retusa*	Caesalpiniaceae
21.	Tati, Tadi	*Borassus flabellifer*	Arecaceae
22.	Balli	*Bridelia tomentosa*	Euphorbiaceae
23.	Sara	*Buchanania lanzan*	Anacardiaceae
24.	Jilledi Puwu	*Calotropis gigantea*	Asclepiadaceae
25.	Nakkina, Nalla-balusu	*Canthium dicoccum*	Rubiaceae
26.	Araya	*Careya arborea*	Barringtoniaceae
27.	Jeelugu	*Caryota urens*	Arecaceae
28.	Giridi	*Casearia elliptica*	Flacourtiaceae
29.	Veska	*Casearia graveolens*	Flacourtiaceae
30.	Reta	*Cassia fistula*	Caesalpiniaceae
31.	Galimanu	*Cedrela toona*	Meliaceae
32.	Billa, Billudu	*Chloroxylon swietenia*	Meliaceae
33.	Rana-billa	*Cipadessa fruticosa*	Meliaceae
34.	Kobbari-chettu	*Cocos nucifera*	Arecaceae
35.	Nakeri, Bhootan-kusum	*Cordia myxa*	Ehretiaceae
36.	Tellavulimidi	*Cretaeva religiosa*	Capparidaceae

Sl. No.	Local Name	Scientific Name	Family
37.	Pachari	*Dalbergia paniculata*	Fabaceae
38.	Chillangi	*Dalbergia spinosa*	Fabaceae
39.	Chinna kalinga	*Dillenia pentagyna*	Dilleniaceae
40.	Velthuru	*Dichistachys ciniera*	Mimosaceae
41.	Vullinda	*Diospyros chloroxylon*	Ebenaceae
42.	Nironddi	*Diospyros crispa*	Ebenaceae
43.	Alli	*Diospyros ferrea*	Ebenaceae
44.	Yerragatha	*Diospyros montana*	Ebenaceae
45.	Tellagatha	*Diospyros sylvatica*	Ebenaceae
46.	Guttemanu	*Elaeocarpus tectorius*	Elaecarpaceae
47.	Neridi	*Elaedendron glaucum*	Celastraceae
48.	Rach usinka	*Embelica officinalis*	Euphorbiaceae
49.	Balabhadrika	*Erythrina stricta*	Fabaceae
50.	Badhida-chettu	*Erythrina variegata*	Fabaceae
51.	Adavigorinta	*Erythroxylon monogynum*	Linaceae
52.	Marri	*Ficus bengalensis*	Moraceae
53.	Boddamarri	*Ficus hispida*	Moraceae
54.	Year juvvi	*Ficus retusa*	Moraceae
55.	Ravi	*Ficus religiosa*	Moraceae
56.	Juvvi	*Ficus tomentosa*	Moraceae
57.	Pitta juvvi	*Ficus tsieia*	Moraceae
58.	Peddakandregu chettu	*Flacourtia indica*	Flacourtiaceae
59.	Kandregu	*Flacourtia jangomas*	Flacourtiaceae
60.	Pidatha	*Garcinia spicata*	Clusiaceae
61.	Garugudu	*Garuga pinnata*	Burseraceae
62.	Karugummadi	*Gmelina asiatica*	Verbenaceae
63.	Potrika	*Grewia laevigata*	Tiliaceae
64.	Nalli	*Grewia pilosa*	Tiliaceae
65.	Bankarara	*Grewia asiatica*	Tiliaceae
66.	Thada	*Grewia tiliaefolia*	Tiliaceae
67.	Chrijana	*Grewia hirsute*	Tiliaceae
68.	Chinni, Danti	*Gymnosporia spinosa*	Celastraceae
69.	Gubathada	*Helecteres isora*	Sterculiaceae
70.	Pala	*Holarrhena antidysenterica*	Apocynaceae
71.	Dudippa	*Hymenodictyon excelsum*	Rubiaceae
72.	Korivi	*Ixora arborea*	Rubiaceae
73.	Gumpena	*Lannea coromandelica*	Anacardiaceae
74.	Mamidi	*Mangifera indica*	Anacardiaceae
75.	Alli	*Memecylon edulae*	Melastromaceae
76.	Pala	*Manikera hexandra*	Sapotaceae
77.	Togaru	*Morindia tinctora*	Rubiaceae
78.	Karivepaku	*Murraya koenigii*	Rutaceae
79.	Tammi	*Ochna jabotapita*	Ochnaceae
80.	Konda-ita	*Phoenix loureirii*	Palmae
81.	Ita	*Phoenix sylvestris*	Palmae
82.	Chilakadudduga	*Polyalthia cerasoides*	Annonaceae
83.	Pungu	*Pongamia pinnata*	Fabaceae
84.	-	*Prosopis juliflora*	Fabaceae
85.	Yerrakarrachettu	*Protium serratum*	Burseraceae
86.	Yegisa	*Pterocarpus marsupium*	Fabaceae
87.	Lolugu	*Pterospermum suberifolium*	Sterculiaceae

Sl. No.	Local Name	Scientific Name	Family
88.	Korintha	*Pterolobium indicum*	Caesalpiniaceae
89.	Kunkudu, Ritta	*Sapindus emerginatus*	Sapindaceae
90.	Posku	*Schleichera oleosa*	Sapindaceae
91.	Nalla Jeedi	*Semecarpus anacardium*	Anacardiaceae
92.	Somitha	*Soymida febrifuga*	Meliaceae
93.	Adavi mamidi	*Spondias mangifera*	Anacardiaceae
94.	Barinika	*Strebulus asper*	Moraceae
95.	Arivita	*Syzygium braceatum*	Myrtaceae
96.	Chinta	*Tamarindus indica*	Caesalpiniaceae
97.	Thadi, Thani	*Terminalia belirica*	Combretaceae
98.	Karaka	*Terminalia chebula*	Combretaceae
99.	Yerrakarra	*Toona ciliata*	Meliaceae
100.	Ankudu	*Wrightia tinctoria*	Apocynaceae
102.	Bili-nekkera	*Ximenia americana*	Olacaceae
103.	Kondatangedu	*Xylia xylocarpa*	Mimosaceae
104.	-	*Zizyphus mauritiana*	Rhamnaceae
105.	Gotti	*Zizyphus xylopyrus*	Rhamnaceae
		SHRUBS	
1.	Tutturabenda	*Abutilon indicum*	Malvaceae
2.	-	*Acacia caesia*	Mimosaceae
3.	Mulla Korintha	*Acacia pinnata*	Mimosaceae
4.	Alchi	*Acanthis ilicifolius*	Acanthaceae
5.	Urgu	*Alangium salviifolium*	Alangiaceae
6.	Pilli teegelu	*Asparagus racemosus*	Liliaceae
7.	Pedimi	*Benkara malabarica*	Rubiaceae
8.	Jilledi	*Calotropis procera*	Asclepiadaceae
9.	Balusus	*Canthium parviflouum*	Rubiaceae
10.	Nalluppi	*Capparis sepiaria*	Capparidaceae
11.	Palaki	*Capparis zeylanica*	Capparidaceae
12.	Kalivi	*Carissa carandas*	Apocynaceae
13.	Pedda Vaka	*Carissa spinarum*	Apocynaceae
14.	-	*Carmona retusa*	Boraginaceae
15.	Chilakadudduga	*Caesaria tomentosa*	Flacourtiaceae
16.	Thangedu	*Cassia auruculata*	Caesalpiniaceae
17.	Pagadi	*Cassia Montana*	Caesalpiniaceae
18.	Kasivinda	*Cassia tora*	Caesalpiniaceae
19.	Danti	*Celastrus paniculata*	Celastraceae
20.	Pisinika	*Clerodendrom infortunatum*	Verbenaceae
21.	-	*Colebrookea oppositifolia*	Lamiaceae
22.	Peddaputika baddu	*Combretum roxburghii*	Combretaceae
23.	-	*Desmodium spp.*	Fabaceae
24.	Veluthuru	*Dichrostachys cinera*	Mimosaceae
25.	Pulledu	*Dodonaea viscosa*	Sapindaceae
26.	-	*Eugenia rothii*	Myrtaceae
27.	Brhmajemudu	*Euphorbia nivulla*	Euphorbiaceae
28.	Jamudu	*Euphorbia tirucalli*	Euphorbiaceae
29.	Kattimandu	*Euphorbia trigona*	Euphorbiaceae
30.	Pedda-Kanregu	*Flacourtia ramontchi*	Flacourtiaceae
31.	Kanregu	*Flacourtia sepiaria*	Flacourtiaceae
32.	Nalla-baddu	*Flemingia strobilifera*	Fabaceae
33.	Sugandhapala	*Hemidesmus indicus*	Asclepiadaceae

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Sl. No.	Local Name	Scientific Name	Family
34.	Challagummadi	*Gmelina asiatica*	Verbenaceae
35.	-	*Glycine wightii*	Fabaceae
36.	Golugu	*Glycosmis pentaphylla*	Rutaceae
37.	Guvvatada	*Grewia abutilifolia*	Tiliaceae
38.	Jaana	*Grewia orbiculata*	Tiliaceae
39.	Adavi chamanti	*Helectres isora*	Sterculiaceae
40.	-	*Hibiscus ovalifolius*	Malvaceae
41.	Pentapeeda kakibeera	*Hugonia mystax*	Linaceae
42.	Kokilaksi	*Hygrophila auriculata*	Acanthaceae
43.	Pala-teega	*Ichnocarpus frutescens*	Apocynaceae
44.	-	*Indigofera spp.*	Fabaceae
45.	Thutu-kada	*Ipomea carnea*	Convolvulaceae
46.	-	*Ixora spp.*	Rubiaceae
47.	-	*Jatropha gossypiifolia*	Euphorbiaceae
48.	Addasaramu	*Justicia adhatoda*	Acanthaceae
49.	Sitammavari poda	*Lantana camara*	Verbenaceae
50.	Gorinta chettu	*Lawsonia inermis*	Lythraceae
51.	Amkador	*Leea indica*	Leeaceae
52.	-	*Maerua oblongifolia*	Combretaceae
53.	-	*Malvastrum coromandelianum*	Malvaceae
54.	-	*Maytenus hookeri*	Celastraceae
55.	Alli	*Memecylon edulae*	Melastromaceae
56.	Attipatti	*Mimosa pudica*	Mimosaceae
57.	Golimi	*Murrya paniculata*	Rutaceae
58.	-	*Naravelia zeylanica*	Ranunculaceae
59.	-	*Opuntia spp.*	Cactaceae
60.	Papidi	*Pavetta indica*	Rubiaceae
61.	-	*Perugularia daemia*	Asclepiadaceae
62.	-	*Pisonia aculeata*	Nyctaginaceae
63.	Korintha	*Pterobium indicum*	Caesalpiniaceae
64.	Manga	*Randia dumetorum*	Rubiaceae
65.	Pedda manga	*Randia malabaricum*	Rubiaceae
66.	Amudham	*Ricinus communis*	Euphorbiaceae
67.	Nucha-kura	*Rothia indica*	Fabaceae
68.	Pariki	*Scutia myrtina*	Rhamnaceae
69.	Adavi-benda	*Thespesia lampas*	Malvaceae
70.	Tummateega	*Tylophora indica*	Asclepiadaceae
71.	Pedda-benda	*Urena lobata*	Malvaceae
72.	Kampurodda	*Vernonia divergens*	Asteraceae
73.	Godari	*Woodfordia fruticosa*	Lythraceae
74.	Pariki	*Zizyphus oenopila*	Rhamnaceae
		HERBS	
1.	-	*Abelomoschus crinitus*	Malvaceae
2.	Alasyakampa	*Acanthus ilicifolius*	Acanthaceae
3.	Uttareni	*Achyranthes aspera*	Amaranthaceae
4.	-	*Aerva spp.*	Amaranthaceae
5.	Parapalanam	*Ageratum conyzoides*	Asteraceae
6.	Gurugu koora	*Allmania nodiflora*	Amaranthaceae
7.	Ponnagantikura	*Alternanthera sessilis*	Amaranthaceae
8.	-	*Alysicarpus spp.*	Fabaceae
9.	-	*Andrographis elongata*	Acanthaceae

Sl. No.	Local Name	Scientific Name	Family
10.	Adabeera	*Anisomeles indica*	Lamiaceae
11.	-	*Asystasia gangetica*	Acanthaceae
12.	-	*Barleria spp.*	Acanthaceae
13.	-	*Biophytum reinwardtii*	Oxalidaceae
14.	Pulicenta	*Biophytum sensitivum*	Oxalidaceae
15.	-	*Blumea spp.*	Asteraceae
16.	-	*Boerhavia diffusa*	Nyctaginaceae
17.	-	*Bulbostylis spp.*	Cyperaceae
18.	-	*Canascora decussata*	Gentianaceae
19.	-	*Caralluma spp.*	Asclepiadaceae
20.	Chinnavaka	*Carissa spinarum*	Apocynaceae
21.	-	*Cassia absus*	Caesalpiniaceae
22.	-	*Cassia hirsuta*	Caesalpiniaceae
23.	-	*Cassia lechenaultiana*	Caesalpiniaceae
24.	-	*Cassia mimosoides*	Caesalpiniaceae
25.	-	*Cassia occidentalis*	Caesalpiniaceae
26.	Tagirise	*Cassia tora*	Caesalpiniaceae
27.	Vaminta	*Cleome gynandra*	Cleomaceae
28.	-	*Cleome monophylla*	Cleomaceae
29.	Kukkavaminta	*Cleome viscosa*	Cleomaceae
30.	-	*Commelina spp.*	Commelinaceae
31.	-	*Corchorus spp.*	Tiliaceae
32.	Kondagiligicca	*Crotalaria spp.*	Fabaceae
33.	Netha-kina	*Cyanotis cristata*	Commelinaceae
34.	-	*Cyathula prostrata*	Amaranthaceae
35.	-	*Cyperus spp.*	Cyperaceae
36.	-	*Datura repens*	Solanaceae
37.	-	*Dentella repens*	Rubiaceae
38.	-	*Desmodium triangulare*	Fabaceae
39.	Moordoo	*Desmodium triflorum*	Fabaceae
40.	Chiva-madu	*Desmodium velutinum*	Fabaceae
41.	Chenchalicettu	*Digera muricata*	Amaranthaceae
42.	Enugabira	*Elephantopus scaber*	Asteraceae
43.	-	*Emilia sonchifolia*	Asteraceae
44.	Vishnukranthum	*Evolvulus alsinoides*	Convolvulaceae
45.	-	*Fimbristylis spp.*	Cyperaceae
46.	-	*Gisekia pharnaceoides*	Molluginaceae
47.	Chadrasi koora	*Glinus lotoides*	Molluginaceae
48.	Sesalesikura	*Glinus oppositifolius*	Molluginaceae
49.	Parapalanam	*Glossocardia bosvallia*	Asteraceae
50.	-	*Gnaphalium spp.*	Asteraceae
51.	-	*Hedyotis spp.*	Rubiaceae
52.	Nagadanthi	*Heliotropium indicum*	Boraginaceae
53.	-	*Heliotropium ovalifolium*	Boraginaceae
54.	Atakanara	*Hibiscus lobatus*	Malvaceae
55.	-	*Hibiscus vitifolius*	Malvaceae
56.	Ratnapurusha	*Hybanthus enneaspermus*	Violaceae
57.	-	*Impatiens spp.*	Balsaminaceae
58.	Tutikura	*Ipomea aquatica*	Convolvulaceae
59.	-	*Launea spp.*	Asteraceae
60.	-	*Leucas indica*	Lamiaceae

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Sl. No.	Local Name	Scientific Name	Family
61.	-	*Lindenaria procumbens*	Scrophulariaceae
62.	-	*Ludwigia spp.*	Onagraceae
63.	-	*Micrococca mercurialis*	Euphorbiaceae
64.	Peddanidrakanti	*Mimosa pudica*	Mimosaceae
65.	-	*Mollugo spp.*	Molluginaceae
66.	Kukka-thulasi	*Ocimum americanum*	Lamiaceae
67.	-	*Osbeckia spp.*	Melastomataceae
68.	-	*Parthenium hysterophorus*	Asteraceae
69.	Chittibenda	*Pavonia odorata*	Malvaceae
70.	-	*Pedalium murex*	Pedaliaceae
71.	Nalla usirika	*Phyllanthus maderaspatensis*	Euphorbiaceae
72.	Erra usirika	*Phyllanthus urinaria*	Euphorbiaceae
73.	-	*Phyllanthus virgatus*	Euphorbiaceae
74.	Kupanti	*Physalis minima*	Solanaceae
75.	-	*Pilea microphylla*	Urticaceae
76.	-	*Pimpinella spp.*	Apiaceae
77.	-	*Plectranthus spp.*	Lamiaceae
78.	Rajuma	*Polycarpea corymbosa*	Caryophyllaceae
79.	-	*Polygala arvensis*	Polygalaceae
80.	-	*Polygonum plebeium*	Polygonaceae
81.	-	*Portulaca spp.*	Portulacaceae
82.	-	*Psilotrichum elliotii*	Amaranthaceae
83.	-	*Rostellularia spp.*	Acanthaceae
84.	-	*Scleria spp.*	Cyperaceae
85.	-	*Scoparia dulcis*	Scrophulariaceae
86.		*Sesuvium portulachstrum*	Aizoaceae
87.	Madanaku	*Spermacoce articularis*	Rubiaceae
88.	-	*Spilanthes calva*	Asteraceae
89.	-	*Striga angustifolia*	Scrophulariaceae
90.	-	*Tephrosia spp.*	Fabaceae
91.	Galijeru	*Trianthema portulacastrum*	Aizoaceae
92.	Palleru	*Tribulus terrestris*	Zygophyllaceae
93.	-	*Tridax procumbens*	Asteraceae
94.	Bankatuttara	*Triumfetta rhomboidea*	Tiliaceae
95.	Dabbu Jambu	*Typha angustata*	Typhaceae
96.	Anghriparnika	*Uraria lagopodiodes*	Fabaceae
97.	-	*Vernonia spp.*	Asteraceae
98.	-	*Wahlenbergia erecta*	Campanulaceae
99.	-	*Waltheria indica*	Sterculiaceae
100.	Marulutige	*Xanthium indicum*	Asteraceae
101.	-	*Zornia gibbosa*	Fabaceae
		CLIMBERS	
1.	Gurivinda	*Abrus precatorius*	Papilionaceae
2.	Korintha	*Acacia intsia*	Mimosaceae
3.	Adavimalle	*Aganosma caryophyllata*	Apocynaceae
4.	-	*Argyreia cymosa*	Convolvulaceae
5.	Pilli-theegalu	*Asparagus racemosus*	Liliaceae
6.	Gacha	*Caesalpinia bonducella*	Caesalpiniaceae
7.	Murugudutige	*Calycopteris floribunda*	Combretaceae
8.	Konda-thivva	*Cappari horrida*	Capparidaceae
9.	Buddakakara	*Cardiospermum halicacabum*	Sapindaceae

Sl. No.	Local Name	Scientific Name	Family
10.	-	*Catharanthus spp.*	Apocynaceae
11.	-	*Cayratia spp.*	Vitaceae
12.	Maneru	*Celastrus paniculatus*	Celastraceae
13.	-	*Ceropegia bulbosa*	Asclepiadaceae
14.	-	*Cissus spp.*	Vitaceae
15.	-	*Clematis spp.*	Ranunculaceae
16.	Sankupushpam	*Clitoria ternate*	Papilionaceae
17.	Dondakaya	*Coccinia grandis*	Cucurbitaceae
18.	Shirtal Boddi	*Combretum albidum*	Combretaceae
19.	-	*Cucumis trigonus*	Cucurbitaceae
20.	Seetamma-savarum	*Cuscuta reflexa*	Convolvulaceae
21.	Nalla-tiga	*Derris scandens*	Fabaceae
22.	-	*Dolichos trilobus*	Fabaceae
23.	Adavinabhi	*Gloriosa superba*	Liliaceae
24.	Sugundhapala	*Hemidesmus indicus*	Periplocateae
25.	-	*Hewittia scandens*	Convolvulaceae
26.	Pala-theega	*Ichnocrapus frutescens*	Apocynaceae
27.	Purititige	*Ipomea eriocarpa*	Convolvulaceae
28.	Balabantatige	*Ipomea pes-caprae*	Convolvulaceae
29.	Chikunuvvu	*Ipomea pes-tigridis*	Convolvulaceae
30.	Mukkutummudu-theega	*Leptadenia reticulate*	Asclepiadaceae
31.	-	*Merremia spp.*	Convolvulaceae
32.	-	*Milletia spp.*	Fabaceae
33.	Undra-kampa	*Mimosa pudica*	Mimosaceae
34.	Yenugu-dulagonda	*Mucuna pruriens*	Fabaceae
35.		*Opilia amentacea*	Opiliaceae
36.	Tellajumiki	*Passiflora foetida*	Passifloraceae
37.	Jittupakku	*Perugularia daemia*	Asclepiadaceae
38.	Kumari-teega	*Smilax zeylanica*	Smilcaceae
39.	-	*Tetrastigma spp.*	Vitaceae
40.	Tippa-teega	*Tinospora cordifolia*	Menispermaceae
41.	-	*Trichosanthes spp.*	Cucurbitaceae
42.	Kakapala	*Tylophora indica*	Asclepiadaceae
43.	Surugudu	*Ventilagao dentculata*	Rhamnaceae
44.	Nalleru	*Vitis quadrangularis*	Vitaceae
		BAMBOOS	
1.	Sadhanam Veduru	*Dendrocalamus strictus*	Poaceae
2.	Mulla Veduru	*Bambusa bambos*	Poaceae
		GRASSES	
1.	Yedagaddi	*Andropogon contortus*	Poaceae
2.	Chippera-gaddi	*Aristida spp.*	Poaceae
3.	-	*Brachiaria spp.*	Poaceae
4.	-	*Chloris spp.*	Poaceae
5.	Gurram thoka gaddi	*Chrysopogon montanus*	Poaceae
6.	Kanchini	*Cymbopogon martini*	Poaceae
7.	Ghericha	*Cynodon dactylon*	Poaceae
8.	-	*Dactyloctenium aegyptium*	Poaceae
9.	-	*Dichanthium caricosum*	Poaceae
10.	-	*Digitaria spp.*	Poaceae
11.	Othagaddi	*Echinochloa colona*	Poaceae
12.	Sabari gaddi	*Elalopsis binata*	Poaceae

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Sl. No.	Local Name	Scientific Name	Family
13.	-	*Eragrostis spp*	Poaceae
14.	-	*Eriochloa spp.*	Poaceae
15.	Kurdana gaddi	*Ischaemum pilosum*	Poaceae
16.	Kodijuttu gaddi	*Oplismenus burmannii*	Poaceae
17.	-	*Paspalidium spp.*	Poaceae
18.	Nendra gaddi	*Schima nervosum*	Poaceae
19.	-	*Setaria intermedia*	Poaceae
20.	Nakkakora	*Setaria pumila*	Poaceae
21.	Ravanasurini	*Spinifex littoreus*	Poaceae

Source: *Monitoring data collected by MECON Environmental Lab during Oct. 2016 – Dec. 2016*

The flora of waste lands is dominated by grasses and the following plant species:

- *Prosopis juliflora*
- *Cassia tora*
- *Calotropis spp.*
- *Parthenium hysterphorus*
- *Ageratum conyzoides*
- *Indigofera spp.*
- *Jatropha gossypiifolia*
- *Lantana camara*
- *Tribulus terrestris*
- *Trianthema portulacastrum*
- *Tridax procombens*
- *Mimosa pudica*
- *Mucuna pruriens*

In settlements, besides the above species, *Ricinus communis* is also seen growing in waste lands and garbage dump areas. *Cuscuta* is seen on *Lantana* bushes.

Scattered trees, shrubs and herbs are seen growing on fallow lands in the rural areas. The tree species include *Azadirachta indica, Mangifera indica, Tamarindus indica, Borassus flabellifer, Acacia nilotica, Ailanthus excelsa, Prosopis juliflora, Phoenix syslvestris.* The shrub and herb species are those which are already growing in waste lands as mentioned above.

Scrub land vegetation is dominated by *Prosopis juliflora* and *Lantana camara*, which have formed dense thickets in places.

PHOTO 3.A: TYPICAL DENSE THICKET OF PROSOPIS IN STUDY AREA

There are two Reserve Forests (RFs) in the study area; Nadupuru RF (~3 km west-south-west of the project site) and Narava RF (~7 km north-west of the project site). Both these RFs are located on hills. During the 1st week of November, 2016 the vegetation was seen to be very dense but there were few trees; the vegetation was dominated by thickets of shrubs and herbs (see **Photo 3.B**).

PHOTO 3.B: HILL WITH DENSE SCRUB (NADUPURU RF) IN STUDY AREA, WSW OF PROJECT SITE

The phyto-sociological characteristics of the trees growing in Nadupuru RF are given in **Tables 3.23** and **3.24**.

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TABLE 3.23: TREES GROWING IN NADUPURU RF

Sn	Plant species	No. of Quadrat (10 m x 10 m)										
		a	b	c	d	e	f	g	h	i	j	Total
1	*Prosopis juliflora*	2	3	-	4	-	3	2	3	4	1	22
2	*Acacia nilotica*	2	1	3	-	-	-	1	-	1	-	8
3	*Chloroxylon switenia*	-	-	2	2	-	-	-	-	-	1	5
4	*Azadirachta indica*	-	-	-	-	2	1	-	1	-	-	4
5	*Anacardium occidentale*	-	-	-	-	2	-	-	-	1	-	3
6	*Ficus hispida*	2	-	-	-	1	-	-	-	-	3	6
7	*Phoenix syslvestris*	-	-	-	-	1	-	-	1	-	-	2
8	*Wrightia tinctoria*	1	-	-	1	-	-	-	-	-	1	3
9	*Lannea coromandelica*	-	2	-	1	-	-	1	-	-	-	4
10	*Zizyphus spp.*	-	-	-	-	1	1	1	-	-	-	3
11	*Ailanthus excelsa*	-	-	-	-	-	1	1	1	-	-	3
12	*Cordia myxa*	-	-	1	-	-	-	-	-	1	-	2
13	*Bauhinia spp.*	-	1	-	-	1	-	-	-	-	-	2
	Total	**7**	**7**	**6**	**8**	**8**	**6**	**6**	**6**	**7**	**6**	**67**

Source: *Monitoring data collected by MECON Environmental Lab during Oct. 2016 – Dec. 2016*

TABLE 3.24: PHYTO-SOCIOLOGICAL FEATURES OF PLANTS GROWING IN NADUPURU RF

Sl. No.	Plant species	Freq. (%)	Density (No./ha)	Abundance	RF	RD	Sp. Div
1	*Prosopis juliflora*	80	220	2.75	21.05	32.84	
2	*Acacia nilotica*	50	80	1.60	13.16	11.94	
3	*Chloroxylon switenia*	30	50	1.67	7.89	7.46	
4	*Azadirachta indica*	30	40	1.33	7.89	5.97	
5	*Anacardium occidentale*	20	30	1.50	5.26	4.48	**2.237**
6	*Ficus hispida*	30	60	2.00	7.89	8.96	
7	*Phoenix syslvestris*	20	20	1.00	5.26	2.99	
8	*Wrightia tinctoria*	30	30	1.00	7.89	4.48	
9	*Lannea coromandelica*	30	40	1.33	7.89	5.97	
10	*Zizyphus spp.*	30	30	1.00	7.89	4.48	
11	*Ailanthus excelsa*	30	30	1.00	7.89	4.48	
12	*Cordia myxa*	20	20	1.00	5.26	2.99	
13	*Bauhinia spp.*	20	20	1.00	5.26	2.99	
	Total	**380**	**670**		**100**	**100**	

Source: *Monitoring data collected by MECON Environmental Lab during Oct. 2016 – Dec. 2016*

From the above tables it can be seen that the tree density in Nadupuru RF is rather low. The vegetation is dominated by shrubs and herbs. *Prosopis juliflora* and *Acacia nilotica* are the most common tree species. The species diversity of trees is also on the lower side.

Fauna

The animals found in the study area are listed in **Table 3.25**.

TABLE 3.25: LIST OF TERRESTRIAL ANIMALS FOUND IN THE STUDY AREA

Sn	Common Name	Scientific Name	Schedule of Wild Life Protection Act in Which Listed
		MAMMALS	
1.	Common Mongoose	*Herpestres edwardsii*	III
2.	Jackal	*Canis aureus*	II
3.	Indian Fox	*Vulpes bengalensis*	II
4.	Common house rat	*Rattus rattus*	V
5	Wild Pig	*Sus scrofa*	III
6	Squirrel	*Funambulus pennanti*	IV
8	Fulvous fruit bat	*Rousettus leschnaulti*	-
9	Jungle Cat	*Felis chaus*	II
10	Rhesus Macaque	*Macaca mulatta*	II
11	Porcupine	*Hystrix indica*	IV
12	3-Striped Palm Squirrel	*Funambulus palmarum*	IV
13	Hare	*Lepas nigricollis*	IV
14	Palm Civet	*Paradoxurus hermaphroditus*	II
15	Common civet	*Viverricula indica*	II
		REPTILES	
1.	Yellow Rat Snake	*Ptyas mucosus*	II
2.	Cobra	*Naja naja*	II
3.	Common Krait	*Bungarus caeruleus*	IV
4.	Russel's Viper	*Daboia russelii*	II
5	Saw Scaled Viper	*Echis carinata*	IV
6.	Green Tree Snake	*Ahaetula nasuta*	IV
7.	Garden Lizard	*Calotes versicolor*	-
8.	Common Skink	*Mabuya carinata*	II
9.	Wall Lizard	*Hemidactylus spp.*	-
10.	Snake Skink	*Lygosoma punctatum*	-
11.	Indian Chameleon	*Chameleon calcaratus*	II
12.	Indian Starred Tortoise	*Geochelone elegans*	IV
13.	Land Tortoise	*Trionyx spp.*	IV
		BIRDS	
1	Pariah Kite	*Milvus migrans*	-
2	Common Crow	*Corvus splendens*	V
3	Grey Partridge	*Francolinus pondicerianus*	IV
4	House Sparrow	*Passer domesticus*	-
5	Grey Wagtail	*Motacilla cineara*	IV
6	Common Tailorbird	*Orthotomus sutorius*	IV
7	Drongo	*Dicrurus adsimilis*	IV
8	Crow Pheasant	*Centropus sinensis*	IV
9	Blue Jay / Indian Roller	*Coracias benghalensis*	IV
10	Jungle Babbler	*Turdoides striatus*	IV
11	Red Whiskered Bulbul	*Pycnonotus jocosus*	IV
12	Red Vent Bulbul	*Pycnonotus cafer*	IV
13	Koel	*Eudynamis scolopacea*	IV
14	Pegion	*Columba livia*	IV
15	Spotted Dove	*Streptopelia chinensis*	IV
16	Red Turtle Dove	*Streptopelia tranquebarica*	IV

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Sn	Common Name	Scientific Name	Schedule of Wild Life Protection Act in Which Listed
17	Hoopoe	*Upupa epops*	IV
18	Indian Robin	*Saxicoloides fulicata*	IV
19	White Throated Fantail Flycatcher	*Rhipdura albicollis*	IV
20	Lesser Whistling Teal	*Dendrocygna javanica*	IV
21	Grey Tit	*Parus major*	IV
22	Spotted Munia	*Lonchura punctulata*	IV
23	Red Munia	*Estrilda amandava*	IV
24	Purple Sunbird	*Nectarinia asiatica*	IV
25	Red Headed Merlin	*Falco chicquera*	IV
26	Shikra	*Accipiter badius*	IV
27	House Swift	*Apus affinis*	IV
28	Green Bee-eater	*Merops orientalis*	IV
29	Red Headed Bunting	*Emberiza bruniceps*	IV
30	Tree Pitpit	*Anthus trivalis*	IV
31	Magpie Robin	*Copsychus saularis*	IV
32	Grey Shrike	*Lanius excubitor*	IV
33	Red Rumped Swallow	*Hirindo daurica*	IV
34	Indian Pitta	*Pitta brachyura*	IV
35	Open Billed Stork	*Anastomus oscitans*	IV
36	Indian Whiskered Tern	*Chilodonias hybrida*	IV
37	Indian Nightjar	*Caprimulgus indicus*	IV
38	Jungle Bush Quail	*Perdicula asiatica*	IV
39	Jerdon's Chloropsis	*Chloropsis cochinchinensis*	IV
40	Mahratta Wood-pecker	*Picoides mahrattensis*	IV
41	Jungle Crow	*Corvus marorhynchos*	IV
42	Stone Curlew	*Burhinus oedicnemus*	IV
43	Indian Tree-pie	*Dendrocitta vagabunda*	IV
44	Red Wattled Lapwing	*Vannelus indica*	IV
45	Rose Ringed Parakeet	*Psittacula kramerii*	IV
46	White Breasted Kingfisher	*Halcyon smyrnensis*	IV
47	Intermediate Egret	*Egretta intermedia*	IV
48	Cattle Egret	*Bubulcus ibis*	IV
49	Little Egret	*Egretta garzetta*	IV
50	Large Egret	*Ardea alba*	IV
51	Pond Heron	*Ardeola grayii*	IV
52	Small Indian Cormorant	*Phalacrocorax niger*	IV
53	Pied Bush-chat	*Saxicola caprata*	IV
54	Forest Spotted Owlet	*Athene blewitti*	IV
55	Purple Moorhen	*Porphyrio porphyrio*	IV
56	Pied Kingfisher	*Ceryle rudis*	IV
57	Red Jungle fowl	*Gallus gallus*	IV
58	White breasted water-hen	*Amaurornis phoenicurus*	IV
59	Pied Mynah	*Sturnus contra*	IV
60	Common Mynah	*Acridotheres tristis*	IV
61	Brahminy Kite	*Haliastur indus*	IV
62	Shaheen Falcon	*Falco perigrinus perigrinator*	IV
63	Scarlet Minivet	*Pericrocotus flammeus*	IV

Sn	Common Name	Scientific Name	Schedule of Wild Life Protection Act in Which Listed
64	White Scavenger Vulture	*Nephron percnopterus*	IV

Source: *Monitoring data collected by MECON Environmental Lab during Oct. 2016 – Dec. 2016*

In the study area, due to lack of suitable habitat, diversity of animals is low. The patches of forest in the study area are too small to support viable populations of large wild animals.

Beach Flora and Fauna

Transects were taken on Yarada beach. At Yarada Beach, which is south of Visakhapatnam city but just north of Gnagavaram Port, there was good diversity of flora and fauna. Although Yarada beach is a tourist attraction, the level of human interference on the coastal area was low.

In flora, 4 trees, 2 shrubs, 10 herbs and 1 alga was observed during the study. Out of the 17 species observed, family Arecaceae was the most dominant family. *Ipomea pes-caprae, Spinifex littoreus* and *Boerhavia diffusa* are the only three species of flora found at RK Beach. *Ulva lactuca* was the only algal species which was found during the complete study. It was found only on a patch of rock present on RK Beach. A mangrove patch present near the port (and Eastern Naval Command area) was surveyed. It showed presence of three species viz. *Avicenia officinalis, Acanthus ilicifolius* and *Sessuvium portulachstrum*. The species richness of flora was more at Yarada Beach. The distribution pattern of coastal flora shows *Ipomea pes-caprae* was the most frequent, dominant and abundant plant species present in the study area followed *by Spinifex littoreus.* The list of flora observed during the survey is given in **Table 3.26**.

TABLE 3.26: LIST OF FLORA FOUND IN COASTAL AREAS IN STUDY AREA

Sl. No.	Botanical Name	Family	Habitat
1	*Acanthus ilicifolius*	Acanthaceae	Herb
2	*Avicennia officinalis*	Acanthaceae	Small tree
3	*Boerhavia diffusa*	Nyctinaceae	Herb
4	*Borassus flabellifer*	Arecaceae	Tree
5	*Cocos nicifera*	Arecaceae	Tree
6	*Cyperus spp.*	Cyperaceae	Herb
7	*Fimbristylis sp*	Cyperaceae	Herb
8	*Heliotropium curassavicum*	Boraginaceae	Herb
9	*Indigofera spp.*	Fabaceae	Herb
10	*Ipomea pes-caprae*	Convolvulaceae	Herb
11	*Launaea sarmentosa*	Asteraceae	Herb
12	*Opuntia spp.*	Cactaceae	Herb
13	*Phoenix sylvestris*	Arecaceae	Tree
14	*Prosopis juliflora*	Fabaceae	Small tree / shrub
15	*Sesuvium portulachstrum*	Aizoaceae	Herb
16	*Spinifex littoreus*	Poaceae	Herb
17	*Typha angustata*	Typhaceae	Herb
18	*Ulva lacuta*	Ulvaceae	Alga (marine)

Source: *Monitoring data collected by MECON Environmental Lab during Oct. 2016 – Dec. 2016*

In fauna, 13 molluscs, 3 crustaceans, 2 butterflies and 3 bird species were observed during the study. The fauna of Yarada Beach was more diverse area found during

the study. Class bivalvia of mollusca was dominant. Species like *Paphia textile* and *Sunetta effosa* were the species which were most common in the study area. Fiddler crabs and Mottled Sally Lightfoot were the crabs which were seen. The birds sighted during the study were also the most commonly sighted ones and are least concern according to IUCN.

The species richness of fauna is more on Yarada Beach. Considering the distribution pattern of the fauna, molluscs were the most frequently, densely and abundantly distributed group followed by crustaceans, birds and butterflies. The list of molluscs observed is given in **Table 3.27.**

TABLE 3.27: MOLLUSCS FOUND IN STUDY AREA

Sl. No.	Scientific Name	Class	Family
1	*Babylonia spirata*	Gastropoda	Babyloniidae
2	*Olivia faba*	Gastropoda	Olividae
3	*Paphia textile*	Bivalvia	Veneridae
4	*Sunneta effosa*	Bivalvia	Veneridae
5	*Nerita oryzarum*	Gastropoda	Neritidae
6	*Anadara gubernaculum*	Bivalvia	Arcidae
7	*Mesocibota bistrigata*	Bivalvia	Arcidae
8	*Cardita calyculata*	Bivalvia	Carditidae
9	*Donax scortum*	Bivalvia	Donacidae
10	*Sepia aculeata*	Cephalopoda	Sepiidae
11	*Gastrana polygona*	Bivalvia	Tellinidae
12	*Meritrix meritrix*	Bivalvia	Veneridae
13	*Placuna placenta*	Bivalvia	Placunidae

Source: *Monitoring data collected by MECON Environmental Lab during Oct. 2016 – Dec. 2016*

The Arthropods observed during the survey are listed in **Table 3.28**.

TABLE 3.28: ARTHROPODS OBSERVED ON BEACHES IN STUDY AREA

Sl. No.	Common Name	Scientific Name	Family
	CRUSTACEANS		
1	Fiddler Crab	*Uca spp.*	Ocypodidae
2	Mottled Sally Lightfoot	*Grapsus grapsus*	Grapsidae
3	Ghost Crab	*Ocypode spp.*	Ocypodidae
	BUTTERFLIES		
1	Common Lime Butterfly	*Papilio demoleus*	Papilionidae
2	Common Bottle-blue	*Graphium sarpedon*	Papilionidae

Source: *Monitoring data collected by MECON Environmental Lab during Oct. 2016 – Dec. 2016*

TABLE 3.29: FAUNA OF INTERTIDAL ZONE

Stn. No.	Biomass (g/kg)	Benthos Groups	Nos.	Rank	Shannon-Weiner Diversity Index
Yarada Beach near Low Tide Line (LTL)	0.006	Polychaete Worms	3	-	-
Yarada Beach Inter Tidal Zone	0.032	Polychaete Worms	7	-	-
Yarada Beach near High Tide Line (HTL)	0.005	Copepods	2	1	
		Polychaete Worms	1	2	0.637

Source: *Monitoring data collected by MECON Environmental Lab during Oct. 2016 – Dec. 2016*

Nekton

The Visakhapatnam Coast is a major area of commercial fishing. The marine fish and shrimp production statistics during 2010 – 2015 as available with the State Fisheries are given in **Table 3.30**.

TABLE 3.30: MARINE FISH AND SHELL-FISH PRODUCTION (2010 – 2015) IN VISAKHAPATNAM AREA

Name of Fish / Shell-fish	2010 - 11	2011 - 12	2012 - 13	2013 - 14	2014 - 15
Sharks	607	460.2	342.3	119.2	80.8
Skates	114	253	207.3	196.9	120.2
Rays	545	256.4	218.7	141.7	132.7
Oil sardine	1008	3491	3484	3854	5290.8
Other sardines	741	1344	1870	2248	2540
Hilsa shad	19	34	184	99	102
Other Shads	437	303	498.8	312	350
Thrisocies	439	587	429	1139	1241
Anchovies	2289	2216	3159	4663	4521
Other Clupeids	516	876	1774	2988	3100
Harpodon nehereus	127	28	0	0	0
Chirocemtrus	495	520	397	290	320
Polynemids	839	1149	777	339	410
Chorinemus	367	562	441	257	260
Trichuridae	2004	1637	3644	7830	6845
Carngids	3545	4241.4	1897	2964	2857
Indian Meckerel	7873	11669.4	15774	14090	12345
Other mackerels	2502	5036.8	3462	4057	5621
Scomberomorus commerson	1599	914	592	503	680
Scomberomorus guttatus	749	676	439	311.8	350
Scomberomorus leneoitus	408	419	141	117	120
Tunnies	6496	6142.3	4090.9	10037.6	10998.5
Mugil spp.	951	497	148	83.7	110.2
Eels	700	214.6	195	124	154.2
Catfishes	692	547	659	481	598
Threadfin breams	638	934	1447	838	911
Pig-face breams	416	435	332	293	302
Other perches	1151	1156	1294	1605	1826
Scianids	562	362	153	320	540.1

Name of Fish / Shell-fish	2010 - 11	2011 - 12	2012 - 13	2013 - 14	2014 - 15
Leiognathus	742	491	2329	1147	1325.5
Black pomfrets	985	409	3618.4	1921.8	1628.6
Silver pomfrets	729	524.5	285.3	363.2	251.5
Sole	662	219	303	358	421
Penaeus mondon	1148	497.9	453.7	612.8	750.4
Penaeus indicus	967	677.9	538.6	419.6	520.4
Metapenaeus spp.	3707	1817.9	1125.3	4230.4	4829.3
Non-penaid prawns	1037	4188.1	7214.1	6120.5	5650.3
Manne-crustaceans	3341	1266.1	2299	2231.4	2310.8
Other crustaceans	14	34	49	56	46
Lobsters	410	220.7	17.9	5.1	12
Squid & Cuttlefish	2468	688.1	2019.6	931.6	805.8
Other Molluscs	471	380	41.81	96.4	110.8
Miscellaneous fish	12202	16983.2	13496.6	11110.9	15986.2
TOTAL	**67712**	**75358.6**	**81841.3**	**89906.4**	**97365.1**

All figures in t

Source: State Fisheries Deptt., Visakhapatnam
Monitoring data collected by MECON Environmental Lab during Oct. 2016 – Dec. 2016

The Visakhapatnam coastline is also a minor nesting beach of the Olive Ridley Turtle (*Lepidochelys olivacea*). During 2014 -15, 320 turtle nests were noted from a ~20 km stretch of coastline including Ramakrishna Beach, the main sea beach of Visakhapatnam city by Visakha Society for Protection and Care of Animals (VSPCA), a Non Governmental Organisation, which is actively engaged in protection of marine turtles and their nests in association with the State Forest Department. During the turtle nesting season, VSPCA personnel patrol the beaches at night looking for nesting turtles. They guard the turtles until the nesting is complete. Subsequently the nests are excavated and the eggs reburied inside protected enclosures on the beach. When the eggs hatch and the hatchlings emerge, they are collected and released into the sea. These steps not only protect the nests / eggs but also ensure that all hatchlings reach the sea.

3.15 SOCIO-ECONOMIC ENVIRONMENT

Steel plays a very important role in the society in countless things, demand of steel is increasing in day to day life. The iron and steel industry is one of the most important industries in India.During 2014 through 2015, India was the third largest producer of raw steel and the largest producer of sponge iron in the world.National steel policy – 2005 has the long-term goal of having a modern and efficient steel industry of world standards in India. The focus is to achieve global competitiveness not only in terms of cost, quality, and product-mix but also in terms of global benchmarks of efficiency and productivity.In this perspective, RINL is going for expansion of the steel plant located at Visakhapatnam city, AP.

The growth of industrial sectors and infrastructure developments in villages and towns are bound to create its impact on the socio-economic aspects of the local population. The impacts may be positive or negative depending upon the developmental activities. To assess the impacts on the local people, it is necessary to study the existing socio-economic status of the local population, which will be helpful for making efforts to further improve the quality of life in the study area. To study

the socio-economic aspects of people in the study area around the RINL project site, the required data has been collected from various secondary sources and supplemented by the primary data.

The baseline socio economic data including demographics of the study area, economic situation of the area, and general perception of the people residing within 10 km of the project site has been conducted by an accredited team of experts and furnished by RINL.

3.15.1 Methodology adopted for the Desktop Study

The methodology adopted for the study is based on the review of secondary data, such as Census of India 2011, Andhra Pradesh Administrative Atlas for the parameters of demography, occupational structure of people within the study area of 10-km radius around the project site.

Socio-economic environment includes description of demography, basic amenities housing, water facilities, health care services, transportation and education. Information on the above said factor has been collected to define the socio-economic profile of the study area (10 km radius), which is also a part of Environmental Impact Assessment study for the proposed activities.

3.15.2 Administrative Details

The 10 km radius study area constitutes Visakhapatnam district. In the study area, there were total 4 mandals existing with 14 villages and 22 wards. Administrative details are presented in **Table 3.31** and ward wise details are given in **Table 3.32**.

TABLE 3.31: ADMINISTRATIVE DETAILS OF THE STUDY AREA

Mandals	Village	Ward
Paravada	12	0
Pedagantyada	0	6
Gajuwaka	0	16
Anakapalle	2	0
Total	**14**	**22**

Source: *Primary census abstract 2011, district Visakhapatnam, AP*
**Data collected by accredited experts & furnished by RINL*

TABLE 3.32: ADMINISTRATIVE DETAILS OF WARDS IN STUDY AREA

Ward No	Area comes under the ward
50	New Gajuwaka B.C. Road, Banoji Colony, Sanjeevgiri Colony, Banoji Thota, Gangavaram, Godduvanipalem, Nethaji Colony, Vikasnagar, Venkannapalem, Pithanivanipalem.
51	Pedagantyada, Pitanivanipalem, Ayyannapalem, Neelapuveedhi, Sithanagar, Nadupuru, Nellimukhu.
52	Uppara Colony, Swatantra Nagar, Pedanadupuru, Chinanadupuru, VUDA Colony, Matha Nagar, China Korada, Peda Korada, Burmacolony.
55	Palavalsa, Devada, Appikonda, Chinnipalem, K.T. Naidupalem, Desapatrunipalem, Steel Plant Sector - XI
61	Santh Nagar, Gonthinavanipalem, VUDA Colony Phase - II, Sri Ram Nagar, Sri Nagar, Sundarayyacolony, Karnavanipalem, Chaitanya Nagar, Chinagentyada.
62	Nehru Nagar, Pydimamba Colony, Dayal Nagar, Simhagiri Colony, Seetharam Nagar, Dallivanipalem, T.G.R. Nagar, Siddeswaram, Vempal Nag

Ward No	Area comes under the ward
45	Kakarlova, Nouseenbagh, Naval Park, Amzar Park, Yarada Village.
46	Zink Quarters (P), China Mulagada, Peda Mulagada, Gundesivani Palem, Pilakavanipalem, Srinivasa Nagar, Rama Nagar, Sri Haripuram, Kunchamma Colony, Gollapalem
56	Lankelapalem, E-Marripalem, Manthripalem, Pedamadaka, Aganampudi Old, Galavanipalem, Talarivanipalem, Sector - II R.H. Colony, Chittivanipalem, B.C. Colony,
57	Sector - II R.H. Colony, Sanivada, Dibbapalem, Nanginarupudu, Vedulanarava, Sathivanipalem, Duvvada, Gangavaram, Narava.
58	Kurmannapalem, Golla Jaggarajupeta, Yadava Jaggarajupeta, Kapu Jaggarajupeta, Steel Plant Sector - II & III, SC Colony, Fakeertekeya, Rajeev Nagar
59	Tunglam, BHPV, Natayyapalem
60	L.B.S. Nagar, Srinivasa Nagar, Yerrareddy Colony, Sramika Nagar, Auto Nagar, Old Gajuwaka, M.M.T.C. Colony, APIIC Quarters, Pantulugarimeda, Chittinaidu Colony
63	Mehar Nagar, Kailas Nagar, Gajuwaka Main Road, Simhagiri Colony, New Gajuwaka B.C. Road, Indira Colony, Azeemabad, Seetha Nagaram.
64	Appanna Colony, Old Gajuwaka, Vinayaka Nagar, New Gajuwaka, Gajuwaka MRO Office, Bojjanna Konda, APSEB, Vinayaka Nagar, Ashok Nagar, Gajuwaka Main Road, Zink Quarters (P), Maruthinagar.
65	Akkireddy Palem, Ramnagar, Mindi, Sheela Nagar, Chukkavanipalem
58	Kurmannapalem, Golla Jaggarajupeta, Yadava Jaggarajupeta, Kapu Jaggarajupeta, Steel Plant Sector - II & III, SC Colony, Fakeertekeya, Rajeev Nagar
59	Tunglam, BHPV, Natayyapalem

Source: *Primary census abstract 2011, district Visakhapatnam, AP*
**Data collected by accredited experts & furnished by RINL*

3.15.3 Population Details

Demographic details such as number of persons per household, total area, population density, sex ratio, SC and ST population, and literacy rate and employment pattern are summarized are following:

Population Structure:

The 10 km radius study area constitutes Visakhapatnam district. In the study area, there were total 4 mandals existing with 14 villages and 22 wards.

- As per 2011 Census, total population of the study area was 4,01,471 out of which male population was 2,04,189 and female population was 1,97,282
- Total number of households were 1,01,887 with average occupancy of 3.94 persons per household
- Total geographical area of 14 villages was 9272 ha and overall population density was 601 persons/sq. km
- Total child (below 6 years of age) population was 40380(10.05%)
- Total SC population was 22,486(5.60%) and ST population was 5436(1.35%)
- Sex ratio (number of females per 1000 males) of total population was 966 and 0-6 child sex ratio was 948.

Details of the demographics of the study area is presented in **Annexure 3.4**.

3.15.4 Literacy Details

According to census 2011, Visakhapatnam district literacy rate was 59.85%.

- According to census 2011, in the study area, overall literate population was 2,80,840(70%) male literates 55% and female literates 45%

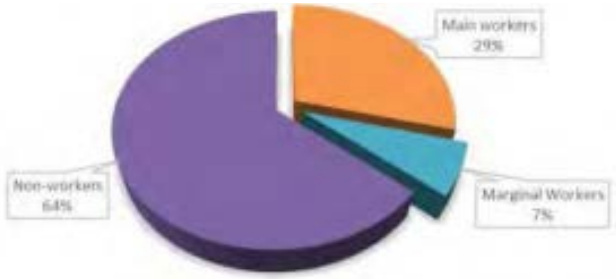
- According to 2011 Census, total worker population in the study area was 1,43,603 (36%). Main workers were (29%) and marginal workers were (7%).Total non-working population was (64%)

Above given data indicates that study area literacy rate was more than district literacy rate. Female literacy was less than male literacy by 10%.

3.15.5 Employment Pattern

Economic resource base of any region mainly depends upon its economically active group i.e. the working population involved in productive work. Work may be defined as participation in any economically productive activity. Such participation may be physical or mental in nature. Work not only involves actual work but also effective supervision and direction of work. It also includes unpaid work on farm or in family enterprise. Employment pattern is shown in **Figure 3.12**.

FIG 3.12: EMPLOYMENT PATTERN



There are different types of workers that may be classified as - those persons who had worked for at least six months or 183 days are treated to be Main Workers, on the other hand if person categorized as worker has participated in any economic or productive activity for less than six months or 183 days during the last one year is treated as Marginal Worker. Non–workers are those who have not worked any time at all in the year preceding the enumeration.

The workers coming under the main and marginal workers category are those involved in activities such as cultivation, agriculture, livestock, forestry, fishing, hunting, plantations, orchards and allied activities, mining and quarrying, manufacturing, processing, servicing and repairs in household industry, construction, trade and commerce, transport, storage and communication and other services.

- According to 2011 Census, total worker population in the study area was 1,43,603(36%).
- Main workers were 1,14,506 (29%) and marginal workers were 29,097(7%).Total non-working population was 2,57,868 (64%)

Main Workers Employment Pattern:

Main workers are classified in four categories as cultivators, agricultural workers, household industry workers and other workers.

As per 2011 Census, out of total 1,14,506 main workers in the study area. There were total 3730 cultivators (3%), 5746 were agricultural workers (5%), 2713 population were under household industry workers (3%) and other workers were 1,02,317 (89%).

3.15.6 Cultural and Aesthetic Environment

Visakhapatnam city is famous tourist spot in India. Simhachlam temple, kailasa Giri, beaches, parks are main attractions in the city.

3.15.7 Infrastructure Resource Base

Village-wise status of infrastructural facilities available in the study area with respect to education, medical facility, water supply, communication and transportation facility and power supply, banking facilities etc. are presented in **Table 3.33**. Analysis of data of 14 villages indicates that infrastructural facilities/basis amenities.

According to DCHB 2011, the data revealed that out of 14 villages majority of the villages availed primary and middle school facilities in the villages, 50% villages availed primary health centre and sub centre and other facilities were mobile health clinic, and medicine shop, 12 village population availed public bus service for transportation purpose other facilities were private bus, taxi etc.

Tap water and hand pump water was major drinking water source in the study area. All type of roads constructed in the villages. Drainage pattern was not satisfactory, more than 90% villages there were open drainage facility. Only 3 village population having post office facility, in 4 villages banking facility was available. All village population engaged in self help groups, power facility was available in all villages.

TABLE 3.33: INFRASCTRUCTURE FACILITIES AVAILED IN NUMBER OF VILLAGES

(ALL VALUES IN NUMBERS)

Private Pre - Primary School	**Govt Primary School**	**Govt Middle School**	**Private Middle School**	**Govt Secondary School**	**Govt Senior Secondary School**
2	14	12	2	7	1
Tap Water-Treated	**Covered Well**	**Hand Pump**	**Tube Wells/ Borehole**	**River/Canal**	**Tank/Pond/ Lake**
14	2	14	3	2	3
Primary Health Centre	**Primary Health Sub Centre**	**Veterinary Hospital**	**Mobile Health Clinic**	**Non Government Medical facilities**	**Non Government Medical facilities**
8	7	4	4	1	7
Open Drainage	**No Drainage**	**Open Pucca Drainage Covered**	**Open Pucca Drainage Uncovered**	**Open Kuccha Drainage**	**Post Office**
13	1	5	7	6	2
Sub Post Office	**Telephone**	**PCO**	**Mobile Phone Coverage**	**Public Bus Service**	**Private Bus Service**
6	13	5	14	12	3
Commercial	**Agricultural**	**Self - Help**	**Public**	**Mandis/**	**Weekly Haat**

Bank	Credit Societies	Group	Distribution System	Regular Market	
3	1	14	14	2	2
Railway Station	**Auto/ Modified Autos**	**Taxi**	**Black Topped (pucca) Road**	**Gravel (kuchha) Roads**	**Foot path**
0	13	3	14	14	14
Agricultural Marketing Society	**ASHA**	**Power For Domestic Use**	**Power For Agriculture Use**	**Power For Commercial Use**	**Power For All Users**
1	13	14	14	14	14

Source: *District census handbook 2011, district Visakhapatnam, AP*
**Data collected by accredited experts & furnished by RINL*

3.15.8 Landuse pattern

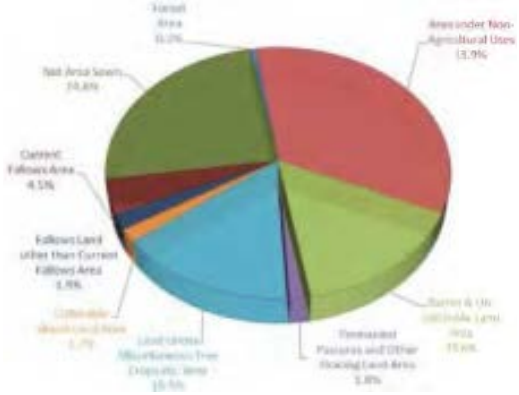
Landuse pattern indicates the different type of uses of the land.Landuse pattern helps to know the settlement area, forest land, agricultural area etc. Landuse pattern is described below in **Table 3.34** and **Figure 3.13**.

TABLE 3.34: LAND USE PATTERN (IN Ha)

Total Geographical Area	Forest Area	Area under Non-Agricultural Uses	Barren & Un-cultivable Land Area	Permanent Pastures and Other Grazing Land Area
9272	46.68	3145	1445	168
Land Under Miscellaneous Tree Crops etc. Area	**Culturable Waste Land Area**	**Fallows Land other than Current Fallows Area**	**Current Fallows Area**	**Net Area Sown**
1433.32	158	180	415	2281

Source: *District census handbook 2011, district Visakhapatnam, AP*
**Data collected by accredited experts & furnished by RINL*

FIG 3.13: PATTERN OF LAND USE IN THE STUDY AREA



As observd from the statistics, the total geographical area of the 14 villages within study area was 9272 Ha. out of which forest land was 46.68 ha(0.50%), area under

non-agricultural uses was 3145 ha (33.91%), barren and un-cultivable land area was 144 ha(15.58%), permanent pastures and other grazing land area was 168 ha(1.81%), land under miscellaneous tree crops etc. was 1433.32 ha(15.45%), culturable waste land area was 158(1.70%),fallows land other than current fallows area was 180 ha (1.94%), current fallows area was 415 ha (4.47%) and net area sown was 2281 ha(24.6o%).

3.15.9 Agricultural commodities

Study area was urban dominant and more than 80% population comes under other workers. Agricultural activities were performed only in villages. Main agricultural commodities in the villages were Bajara, Paddy and Sugar cane.Village wise commodities is given below in **Table 3.35**.

TABLE 3.35: AGRICULTURAL COMMODITIES

Village Name	Agricultural Commodities (First)	Agricultural Commodities (Second)
Thanam	Bajra	Paddy
Paravada	Bajra	Paddy
Pentaseema Bonangi	Paddy	Sugar Cane
Payakarao Bonangi	Bajra	Paddy
Swayambuvaram	Bajra	Paddy
Cheepurupalle (West)	Bajra	Paddy
Cheepurupalle (East)	Paddy	Sugar Cane
Ravada	Bajra	Paddy
Edulapaka Bonangi	Bajra	Paddy
Thadi	Bajra	Paddy
Thanam	Bajra	Paddy
Jagannadhapuram	Paddy	Sugar Cane
Seethanagaram	Paddy	Sugar Cane

Source: *District census handbook 2011, district Visakhapatnam, AP*
**Data collected by accredited experts & furnished by RINL*

3.15.10 Survey Methodology

To collect the primary data in the study area, structure survey formats were used in the study area (HH format, FGD format and official information format). Major part of the study area is falling in Visakhapatnam urban area, hence respondents selected randomly in the urban areas. Village/ward sampling were done based on distance and direction from the steal plant.

Total population of the study area was 4,01,471, therefore 0.05% of population, (201) sample size chosen for the survey. Respondents selected randomly for the survey and male, female, youth groups were selected fairly for the survey. Visits in Gram Panchayats, Govt schools also performed to collect the official information of that area. Transit walk in surveyed area also performed to know the condition of road, transport and other facilities. Surveyed areas were Gajuwaka ward, Pedagantyada ward, Parawada ward, Cheepurupalle (West), Rajiv Nagar and Zink Quarters.

The above survey and associated study was carried out by accredited experts and furnished by RINL.

Salient observations of the study area:

- **Population**
  The study area was urban dominant, more than 80% of population lives in urban area. All types of religion and cast population were observed during the survey.
- **Employment pattern**
  Main employment pattern in the study area were private job, labour work and business etc. Study area was urban dominant, agriculture activities were less in the study area.
- **Crop pattern**
  Agriculture activities were performed only in village area only and main crops were Bajra & Paddy. Irrigation facility was used by very few farmers
- **Education Facilities**
  Vizag city availing a good number of higher education facilities, all type of courses were available in the city and the population residing in the study area were satisfied with the education facilities
- **Medical Facility**
  All type of better medical facilities available in the study area, district hospital (GVMC), urban health centers, sub centers were adequately available in the study area. Respondents were satisfied with the medical facilities.Visakhapatnam is famous for its doctors and state of the art hospitals

  Better health facilities were seen in the study area. All ward areas were availed urban health facilities in nearby areas. District hospital was also availed in the city. Respondents were satisfied with the medical facilities
- **Transportation**
  All type of transportation facilities were available in the study area. Govt & Pvt bus facilities, railway station, autos were availed in the study area. Overall project areas availed good transportation facility
- **Market**
  In the study area wholesale markets were available in all wards and respondents were satisfied with the market facilities.Visakhapatnam town was main centre for all facilities in the study area.
- **Drainage and sanitation**
  Open and closed both type of drainage facility was observed in the wards, in some words drainage was not in good condition, respondent said that maintenance of the drainage is needed in the area, public toilets were observed in urban areas of the study area.
- **Language**
  Official as well as mother tongue of the study area was Telugu. Other languages often spoken in the study area was English, Odia and Hindi.
- **Health**
  During survey, it was observed that majority of the population suffering respiratory diseases, malaria and lung diseases. The reason behind the health problems were inadequate sanitation facility, heavy transportation and industrialization in the study area.
- **Migration for employment**
  From the nearby states like Odisha, Telangana work force migrating in the city for employment. Due to industries in the Visakhapatnam town

surrounding villagers also preferred the town for employment purpose.Majority of the workforce belongs to labour class

- **House pattern**
  In urban area majority of the houses were in pakka form, in villages semi pakka and kaccha house pattern observed.
- **Recreation facility**
  Temples, community halls, theaters, beaches were main attraction in the study area, its tourist place therefore tourist from other states also visit the town frequently

3.15.11 People's Perception

To know the awareness and opinion of the population residing in the study area, RINL related questions were asked to respondents, Majority of the population were aware about the RINL steal plant and is activities. Respondents gave positive response about the plant, they said RINL is providing employment as well as doing developmental activities in the surrounding areas. Air pollution issue reported by some respondents. During the survey of villages/urban areas surrounding the project area, respondents reported about inadequate facilities in there areas.Following are the few requirements suggested by the respondents from RINL.

- Hospitals / Primary Health care centers with Ambulance facility
- Community halls etc.
- Amenities/Facilities.
- Drainage facilities
- Vocational courses

3.15.12 Conclusion

Analysis of socio - economic impacts both adverse and beneficial in the EIA study it will improve the socio economic condition of the people.On the basis of primary and secondary data collection following conclusion has come:

- The project is for expansion of Visakhapatnam steal plant from 6.3 to 7.3 MTPA to by revamping and augmentation of existing facilities by, RINL.
- The expansion project is not going to cause any land acquisition for the project purpose. Moreover, it can be added that the project may help in providing employment to the population
- The expansion project will fulfill the demand of Ispat in other related industries
- The expansion project has a strong positive prospect of industrialization in its vicinity.
- Development of social infrastructure(CSR activities)
- The expansion project is likely to bring about positive changes in life style and quality of life for people located in that area
- Increased production may affect surrounding population health by different type of pollution(air,soil)

3.16 BASELINE STATUS OF EXISTING PLANT

To establish the baseline scenario for different environmental components in the project site, environmental data generation has been done continually by RINL through accredited experts, with respect to the following:

- Ambient Air Quality
- Stack emissions from the existing units
- Fugitive Emissions
- Work zone air quality
- Work zone noise levels
- Waste water discharge Quality
- Solid waste characterization

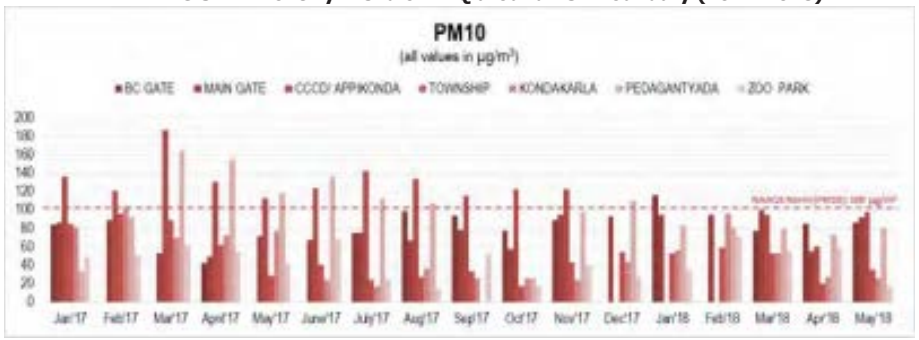
VSP is submitting the compliance status of the steel plant periodically to Andhra Pradesh Pollution Control Board (APPCB) and MoEFCC's Regional Office. The certified compliance status is enclosed as **Annexure 3.5**.

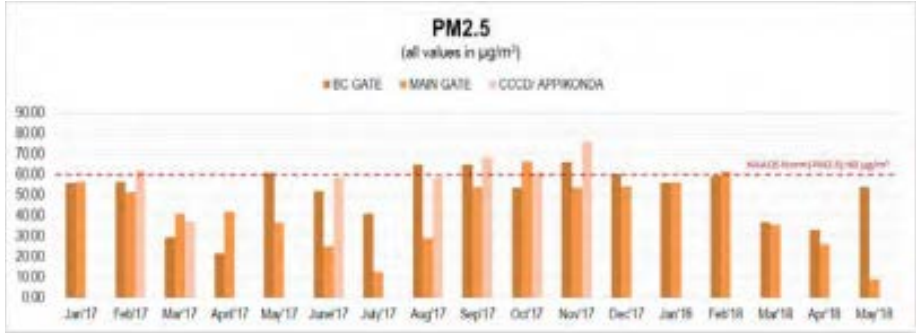
3.16.1 Ambient Air Quality

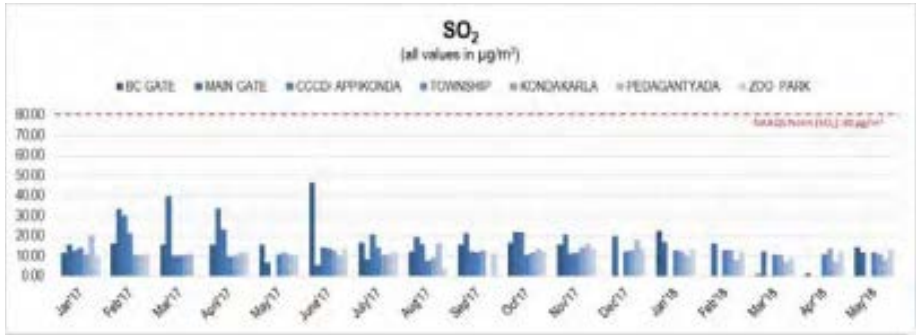
VSP has setup 3 Continuous monitoring station, in the vicinity of existing plant, around the plant boundary. Apart from continuous ambient monitoring, VSP is regulary conducting manual ambient air quality monitoring at 4 other loctions outside the plant area.

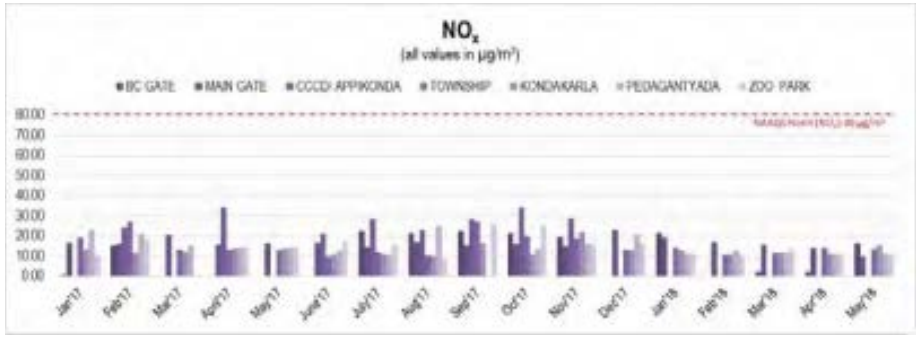
In order to study the variations in the AAQ, the data recorded for January 2017 to May 2018 are analyzed and presented in following paragraphs. Monthly trend of Ambient Air Quality around VSP area, as recorded by AAQ Monitoring Stations is given in **Fig 3.14** below.

FIG 3.14: Monthly Trend of AAQ around VSP Boundary (2017-2018)









The above indicates that all values for SO_2 and NOx are well within the NAAQS Norms. However, few values for PM_{10} & $PM_{2.5}$ are exceeding the norms in few months.

The metal analysis of Work Zone air quality inside the plant was also carried out at six (6) locations for Cd, Cu, Ni, Pb, Cr, Zn, Fe & Mn. The results are shown in **Table 3.36** below.

TABLE 3.36: METAL CONCENTRATION IN WORK ZONE AIR QUALITY

Sampling locations	Metal Concentrations in Work Zone air quality (in µg/m³)							
	Cd	Cu	Ni	Pb	Cr	Zn	Fe	Mn
Near BF-1 cast house	<0.002	<0.002	0.189	<0.002	0.003	<0.018	2.254	<0.002
Near BF-2 cast house	<0.002	0.006	0.547	<0.002	0.007	<0.018	6.592	0.017
Near SMS-1-converter	<0.002	0.006	<0.002	<0.002	0.010	<0.018	14.322	0.107
Near SMS-2-converter	<0.002	0.232	0.016	<0.002	0.067	<0.018	8.897	0.632
Near RMHP near ground hopper	<0.002	<0.002	<0.002	<0.002	0.015	<0.018	8.404	0.088
Near COCCP	<0.002	0.004	<0.002	0.121	0.015	<0.018	5.755	0.299
Detection limit	*0.002*	*0.002*	*0.002*	*0.002*	*0.002*	*0.018*	*0.009*	*0.002*
OSHAS Permissible Exposure Limit (TWA)	***5***	***1000***	***1000***	***50***	***1000***	***-***	***5000***	***5000***
OSHAS Threshold Limit Value ((TLV(R)) / NIOSH Recommended Exposure Limit (REL)	*-*	*-*	*15*	*0.05*	*500*	*5000*	*1000*	*1000*

PEL is a TWA, some are Short Term Exposure Limits (STEL) or Ceiling Limits. A Time Weighted Average (TWA) is a TLV(R) based on a 8-hour workday and a 40-hour workweek. TLV(R) of a chemical substance establishes the reasonable level to which a worker may be repeatedly exposed, day after day, over a working lifetime without adverse health effects. NIOSH : National Institute for Occupational Safety and Health

Source : *http://www.conservation-us.org/docs/default-source/resource-guides/chart-of-heavy-metals-their-salts-and-other-compounds-nbsp-.pdf*

3.16.2 Emissions From Stacks

Stack emissions monitoring is being conducted regularly at regular intervals by VSP. The average results of the stack monitoring for major stacks during 2017-2018 are given in **Table 3.37**.

TABLE 3.37: STACK EMISSIONS FROM DIFFERENT UNITS OF VSP

Sn	STACK	Flow (Nm³/hr)	PM (mg/Nm³)		SO_2 (mg/Nm³)		NOx (mg/Nm³)	
			NORM (PM)	*Monitored value*	*NORM (SO_2)*	*Monitored value*	*NORM (NO_x)*	*Monitored value*
1	BF : STOCK HOUSE 1 *	1723978.6	*50*	24.7	-	-	-	-
2	BF : STOCK HOUSE 2 *	1701511.4	*50*	19.1	-	-	-	-
3	BF : CAST HOUSE 1 *	825596.9	*50*	18.0	-	-	-	-
4	BF : CAST HOUSE 2 *	808421.6	*50*	29.4	-	-	-	-
5	SINTER PLANT : SPACE DEDUSTING (ACP)*	2165696.3	*50*	92.6	-	-	-	-
6	SINTER PLANT : PROCESS (GCP) *	2384539.3	*50*	23.4	-	-	-	-
7	LMMM : WALKING BEAM FURNACE(WBF) (PROCESS)	175494.4	*50*	16.7	-	-	-	-
8	LMMM : ROLLER HEARTH FURNACE(RHF) (PROCESS)	7282.7	*50*	13.8	-	-	-	-
9	WRM	113106.2	*50*	16.9	-	-	-	-
10	MMSM	132757.8	*50*	19.1	-	-	-	-
11	TPP : BOILER 1*	401996.8	*50*	128.2	-	-	-	-
12	TPP : BOILER 2*	395354.7	*50*	99.5	-	-	-	-
13	TPP : BOILER 3*	402586.2	*50*	140.6	-	-	-	-
14	TPP : BOILER 4*	402202.8	*50*	116.5	-	-	-	-
15	TPP : BOILER 5	402397.5	*50*	95.0	-	-	-	-
16	CRMP : FK 1 &2 (PROCESS)	255461.9	*50*	112.3	-	-	-	-
17	CRMP : FK 3&4 (PROCESS)	253898.4	*50*	86.3	-	-	-	-

Sn	STACK	Flow (Nm³/hr)	PM (mg/Nm³)		SO_2 (mg/Nm³)		NOx (mg/Nm³)	
			NORM (PM)	*Monitored value*	*NORM (SO_2)*	*Monitored value*	*NORM (NO_x)*	*Monitored value*
18	CRMP : FK 5 (PROCESS)	151297.5	*50*	42.4	-	-	-	-
19	SMS : CVS (SPACE DEDUSTING)	332392.1	*50*	20.0	-	-	-	-
20	BATTERY-1	189906.9	*50*	23.9	*800*	190.1	*500*	76.7
21	BATTERY-2	190580.9	*50*	26.9	*800*	183.2	*500*	78.9
22	BATTERY-3	186866.1	*50*	23.5	*800*	182.1	*500*	79.7
23	BATTERY-4	190502.7	*50*	23.3	*800*	192.7	*500*	81.6
24	SP-3 WASTE GAS	1090681.3	*50*	14.5	-	-	-	-
25	SP-3 DE-DUSTING	683285.1	*50*	29.2	-	-	-	-
26	BF-3 CH DE-DUSTING	1068759.1	*50*	14.6	-	-	-	-
27	BF-3 SH DEDUSTING	410506.8	*50*	18.9	-	-	-	-
28	SMS-2 MH DEDUSTING	186188.6	*50*	20.4	-	-	-	-
29	SMS-2 SE CONTROL SYSTEM	1322801.8	*50*	17.7	-	-	-	-
30	SMS-2 LFRH-1	101090.8	*50*	16.4	-	-	-	-
31	SMS-2 LFRH-2	101402.3	*50*	17.1	-	-	-	-
34	WRM-2:WBF	72557.3	*50*	26.1	-	-	-	-
35	TPP: BOILER-6	504243.3	*50*	60.9	-	-	-	-

** Modernisations is in progress.*
** Upgradation of ESP's is in progress @ Rs.143.8 Cr*
Source*: Monitoring data collected & furnished by RINL*

From the above tables, it can be seen that most of the monitored values of stack emissions from all major stacks of VSP are within MoEFCC norms, except for Boiler stacks.

3.16.3 Fugitive Emissions

The fugitive emissions for Coke Oven batteries and other plant units at VSP are monitored and the monitored results for 2017-2018 are tabulated in **Table 3.38 & Table 3.39** below:

TABLE 3.38: FUGITIVE EMISSIONS FROM CO BATTERIES (%)

Sn	Parameters	Coke Oven Battery-1	Coke Oven Battery-2	Coke Oven Battery-3	Coke Oven Battery-4
1	Percentage Leaking Doors (PLD) Norm = 10%	4.92	2.84	5.22	9.85
2	Percentage Leaking Offtakes (PLO) Norm=4%	3.29	2.69	2.39	3.43
3	Percentage Leaking Lids (PLL) Norm=1%	0.66	0.89	0.70	0.80
4	Charging [#emission Norm=75 sec./charge]	123	120	121	121

Note :- *#High values due to non-availability of Technology, Such as Screw feeders*
Source: *Monitoring data collected & furnished by RINL*

TABLE 3.39: FUGITIVE EMISSIONS FROM OTHER PLANT UNITS OF VSP

PLANT UNITS	FUGITIVE EMISSION PARAMETERS (in mg/m³)			
	SPM	RSPM	SO_2	NOx
ZONE /SMS				
CONVERTOR 8 METER LEVEL	1456.00	411.50	12.88	15.07
CONVERTOR 54 METER LEVEL	1421.00	367.00	12.61	15.92

PLANT UNITS	FUGITIVE EMISSION PARAMETERS (in mg/m³)			
	SPM	RSPM	SO_2	NOx
MIXER AREA	1268.50	527.00	11.58	11.96
LF AREA	2348.50	614.50	15.27	12.01
IRUT AREA	2403.50	581.00	11.92	12.32
LP BAY	831.00	228.00	11.52	12.16
CCCD MACHINE FLOOR	1078.00	465.50	13.35	12.58
ZONE /SMS 2				
CONVERTER FLOOR	2685.50	1131.50	12.51	13.16
NEAR LF				
NEAR CCCD	876.50	180.00	12.87	10.05
SECS(ESP AREA)	364.00	90.00	11.65	-
ZONE / BF				
CAST HOUSE 1	1044.50	306.50	15.08	11.59
CAST HOUSE 2	646.50	203.00	13.43	12.20
BHS 1 (VIBRAFEEDER)	2020.00	511.50	14.80	12.19
BHS 2 (VIBRAFEEDER)	3614.00	854.00	14.26	12.32
BHS 3 SCREEN FLOOR	4128.50	830.00	11.86	11.50
PCM 1&2	765.50	234.00	13.11	12.85
CAST HOUSE 3 METAL TAPPING AREA	413.00	111.00	13.55	13.32
CAST HOUSE 3 LADLE POURING AREA	665.50	131.50	15.58	12.04
ZONE / CRMP				
FLUX KILN BUILDING GROUND FLOOR	943.00	283.50	9.03	20.65
BRICK PLANT GROUND FLOOR	1698.00	186.50	8.57	24.27
MILL HOUSE AREA	-	-	-	-
NEAR AREA SHOP OFFICE	-	-	-	-
VERTICAL SHAFT KILN BUILDING GROUND FLOOR	-	-	-	-
VERTICAL SHAFT KILN BUILDING TOP FLOOR	-	-	-	-
ZONE / SP				
SMB MACHINE FLOOR	9327.50	1753.50	12.28	12.48
SMB S11&H11MACHINE DISCHARGE END	2145.50	269.50	12.82	14.98
SSP SCREEN FLOOR	17631.00	1835.50	12.00	12.86
SMPP GROUND FLOOR	14536.00	694.00	15.35	15.84
LIME UNLOADING AREA	3212.00	1684.50	13.01	12.31
RMB BC 16 & 17	4902.00	1018.50	8.81	23.97
RECEVING BINS GROUND FLOOR	2454.00	520.00	9.71	18.32
YARD EQUIPT. AREA	12402.00	3265.50	10.01	19.12

Source: *Monitoring data collected & furnished by RINL*

The results indicate achievement of standards for fugitive emission control for all four (4) batteries. However, charging time is higher for all the batteries due to unavailability of suitable technologies in the mentioned batteries for charging time control.

3.16.4 Effluent quality

The existing plant is generating effluents at the rate of 400-450 m^3/hr and discharging through 3 outlets viz. **Outlet-1**: Trade Effluents from TPPs, **Outlet-2**: Effluents from Effluent Treatment Plant & **Outlet-3**: Effluent from Township Sewage Treatment Plant.

The effluent quality of aforementioned outlets are monitored by VSP. The average values as observed during recent monitoring during 2017-2018 are given in **Table 3.40**.

TABLE 3.40: EFFLUENT QUALITY DISCHARGED THROUGH VSP OUTLETS

Sn	Parameters monitored	Norms	Outlet-1: Trade Effluents from TPPs	Outlet-2: Effluents from ETP	Outlet-3: # Effluent from Township STP
1	Daily discharge (KL))	-	3490.9*	3537.2*	2815.2*
2	pH	6.0-9.0	7.4	6.8	7.5*
3	TSS	100.0	44.7	92.2	12.0*
4	Oil & grease	10.0	4.0	6.5	-
5	Phenols	1.0	0.1	0.6	-
6	COD	250.0	-	227.7	-
7	BOD	30.0		9.1	10.3*
8	Ammonical nitrogen	50.0	3.1	27.7	-
9	Cyanide	0.2	-	0.1	-
10	Iron	1.0	1.7	-	-
11	Copper	1.0	0.1	-	-

***No norms (Units: all in mg/l except pH)**
 # Total water is being recycled in the plant after UF Treatment and not being discharged.
Source*: Monitoring data collected & furnished by RINL*

As indicated above, analysis results of supernatant effluent from effluents discharged through various outlets are indicate that concentrations are well within the applicable limits.

3.16.5 Noise levels

Noise levels were monitored during April 2017 – September 2017 at three (3) locations near plant boundary. The monitoring details are given in **Table 3.41**. From the results it can be seen that the noise levels are well within the applicable norms.

TABLE 3.41: NOISE LEVELS MONITORED DURING APRIL'17 TO SEP.'17

LOCATION			April'17		May'17		Jun'17		July'17		Aug'17		Sep'17	
			Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night
		NORM	75.0	70.0	75.0	70.0	75.0	70.0	75.0	70.0	75.0	70.0	75.0	70.0
1	Main Gate	*Min.*	52.3	35.1	57.9	45.4	48.7	35.4	38.3	35.8	39.4	36.9	40	35.6
		Max.	59.8	36.4	48.7	39.8	57.9	37.8	47.6	38.3	47.9	40.1	48.6	40.3
2	BC Gate	*Min.*	58.4	45.2	64.2	52.1	58.9	49.4	47.1	46.0	47.4	46.1	50.2	46.6
		Max.	64.8	48.4	58.9	46.9	64.2	45.4	58.2	50.1	57.3	48.3	56.4	48.8
3	CCCD	*Min.*	58.9	50.0	70.3	64.3	60.3	58.4	58.5	49.0	57.9	56	59.3	56.4
		Max.	66.5	61.8	60.3	58.8	67.6	61.4	68.1	62.3	68.4	61.1	66.8	60.2

Note: Norm for Day time (06 AM to 10 PM) is 75 dB(A)
Norm for Night time (10 PM to 06 AM) is 70 dB(A)
Source: *Monitoring data collected & furnished by RINL*

3.16.6 Solid & Hazardous wastes

The existing plant generates a number of Solid wastes which contain both Hazardous and non-Hazardous categories of wastes. Major shops which generate solid wastes are BF, SMS, Coal and coke oven shops and Rolling mills. VSP is recycling most of the wastes generated in the plant.

The solid wastes generated from the various shops during 2016-17 and percentage of utilization is given in **Table 3.42**.

TABLE 3.42: SOLID WASTES GENERATED & UTILIZED BY VSP (2017-18)

Description of solid waste	Plant unit (generating unit)	Recycled in	Generation	Recycled	Sold	Stacked	Utilization (%)
I. PROCESS SOLID CO-PRODUCTS							
NUT COKE	CCCD	*BF*	116292	128180	74529	-86417	174.31
COKE BREEZE	CCCD	*SP*	190091	372072	0	-182528	196.02
		BF		547			
COAL MILL REJECTS	TPP		4723	0	4723	0	100
LIME FINES	CRMP	*SP*	28834	108729			
	SMS		139609		48952	0	100
	B.FILT/CRMP	*BRIQUETTE*	6170	23385			
	DE SYSTEMS		6453				
			181066	132114	48952	0	100
LIME STONE SCREENING(-25 mm)	CRMP	*SP*	197610	111495	0	86115	56.42
DOLOMITE SCREENING(-25 mm)	CRMP	*SP*	72240		0	72240	0
II.DUST FROM ESP'S, DE SYSTEMS							
COKE DUST/SLUDGE	CCCD	*SP/BF*	69512	234	68672	560	99.19
		CO BATT		46			
FLUE DUST	BF	*SP*	36930	36930	0	0	100
STOCK HOUSE DUST	BF	*SP*	35054	35054	0	0	100
CAST HOUSE DUST	BF	*SP*	4409	4409	0	0	100
ACP ESP DUST	SP	*SP*	60448	60448	0	0	100
GCP ESP DUST	SP	*SP*	32575	32575	0	0	100
DE DUST(ORE)	RMHP	*SP*	1512	1512	0	0	100
DE DUST(COAL)	RMHP	*SP*	724	724	0	0	100
III. SLUDGES FROM WATER TREATMENT PLANT							
MET.WASTE-SHIFTED	WMD	*SP*	195626	195626	0	0	100
	BDM		29579				
MILL SCALE	BM	*SP*	4379	77139	0	-11278	117.12
	SBM		2970				
	WRM-1		10266				
	WRM-2		5311				
	STM		4784				
	MMSM		8570				
SMS SLUDGE	SMS	*SP*	16174	16174	0	0	100
CCM SCALE + GCM FINES	SMS	*SP*	11110	11110	0	0	100
IV. SLAGS							
GRANULATED BF SLAG	BF		1655381	2540	2349984	-855513	142.11
		SP		54041			
		SMS+Scrap recoverd from LD slg		56673			
LD SLAG	SMS	*BF*	694842	3810	14057	573189	19.53
		TRAFFIC		3573			
		CED		3556			
		CONSTRU		0			
		WT Slag		0			
V. SCRAPS							
	SMS	*SMS*	163447	435704			
	BILLET BILL	*FOUNDRY*	21800	1021			
	BAR MILL		17269				

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Description of solid waste	Plant unit (generating unit)	Recycled in	Generation	Recycled	Sold	Stacked	Utilization (%)
STEEL SCRAP	WRM(1&2)	*STRL.SHOP*	22987	374	126	-178759	169.24
	MMSM		24068				
	MAINT. SCRAP		8548				
	TURN&BORING CHIPS	*FOUNDRY*	221	0			
	BOULDERS	*SMS*	2635	0	12940	5008	78.43
CAST IRON SCRAP	BF(HM+PCM)		15313	0			
	CI FINES	*SP*	7123	6723	0	400	94.38
VI. FLY ASH							
FLY ASH	TPP		780572	0	0	780572	0
VII. OTHERS							
USED/REJECTED		*Mg. BRICKS CONV PATCH*		2933			
REFRACTORY BRICKS	TOTAL PLANT	*DF BAY MS*	3917	389	923	-328	108.37
RECOVERED BY SSD		*SP*		0			
		BF SILICA BRICKS		0			
Grand Total	**GRAND TOTAL**		**4710080**	**1787726**	**2574906**	**203261**	**92.62**

Source: *Monitoring data collected & furnished by RINL*

The hazardous wastes generated from different units of VSP and their utilization is presented in **Table 3.43** below.

TABLE 3.43: HAZARDOUS WASTES GENERATED & UTILIZED BY VSP (2017-18)

Sn	Waste generated	Quantity (tonnes)	Quantity dispatched			Quantity utilized in-house (tones)	Quantity in storage (tonnes)
			To disposal facility	To recycler or co-processor or pre-processor	Others		
1	ETP Sludge (MBC & ETP)	4916	-	-	-	4642.5	391
2	Used oil/ Waste lubricating oil/ vacuum oil/ transformer oil/ waste grease.	298.82	-	87.8*	-	313.81	95.06
3	Tank bottom sludge of tar and oil storage tanks.						
4	Tar Sludge from tar decanters	2640.5	-	-	-	3018.49	2313
5	Acid tar from Ammonium sulphate plant (ASP)	240.9		-		254.26	
6	Benzol sludge from decanters of benzol distillation plant	329.4	-	-	-	329.4	-
7	Containers and containers liners of hazardous wastes & chemicals (mostly oil & grease barrels)	76	-	-	76#	0	0
8	Oil soaked cotton waste & rubber items	17.305	4.605**	-	-	0	16.3
9	Asbestos waste	14.90	5.985**	-	-	0	11.6

Source: *Monitoring data collected & furnished by RINL*

Note: *Some items sold/recycled quantities are more than generation quantity dunng the year, which is from previous stock.*
**-sold to Lakshminarayana Industries, Buchiyyanagar, Rajamundry*
***-sent to CWMP, Ramky Pharma City Paravada.*
#-containers sold to Samarth Traders, Jalgaom and Sairam Enterprises, Visakhapatnam

3.16.7 Trace Metal/Toxic Metal/Toxic Content From Steel Plant Operations

For covering the below mentioned additional ToR points, studies were conducted. The additional ToR points pertaining to Trace Metals, Toxic metal and toxic content from Steel Plant Operations are as follows.

- Trace metals Mercury, arsenic and fluoride in the raw material.
- Trace metals in waste material especially slag.
- Details on toxic metal content in the waste material and its composition and end use (particularly of slag).
- Details on toxic content (TCLP), details on toxic metal content in the waste material and its composition and end use (particularly of slag).

For covering the above ToR points studies were conducted as follows:

- Trace metal, mercury, arsenic and Fluoride emission from Raw material.
- Trace metal content in waste material (slag) and toxicity test by Toxicity Characteristic Leaching Procedure (TCLP) Studies

The results from the aforementioned analysis are presented in subsequent sections.

(a) Trace Metal Content in Waste Material (Slag)

With a view to assess the trace metal contents in waste material (slag) slag samples were collected and analysed from plant locations as mentioned hereunder. The locations were selected to cover the slag generated from steel process. The results are presented in **Table 3.44**.

- BF-Granulated slag
- SMS, LD Slag

TABLE 3.44: TOXIC METAL CONTENTS IN SLAG SAMPLES

Samples	Cd	Cu	Ni	Ag	Co	Pb	Cr	Zn	Total Toxic Metals		Contribution of Fe, Mn, Al & Ba	
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	% (kg/100kg)	mg/kg	%
BF-Granulated Slag	<1.0	<1.0	<1.0	<5.0	9.8	<1.0	15.2	<10.0	12728	1.27	12702	99.8
SMS,LD Slag	19.7	<1.0	<1.0	<5.0	<5.0	<1.0	282.5	<10.0	67975	6.80	67672	99.6
BDL Values	**1**	**1**	**1**	**5**	**5**	**1**	**1**	**10**				
Total	19.7	0	0	0	9.8	0	297.7	0				
% Heavy Metal of total toxic metal	**0.02%**	**0%**	**0%**	**0%**	**0.01%**	**0%**	**0.37%**	**0%**				

Samples	B	Ba	Fe	Mn	Al	As	Hg	Cr (VI)	Total Toxic Metals		Contribution of Fe, Mn, Al & Ba	
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	% (kg/100kg)	mg/kg	%
BF-Granulated Slag	<5.0	472	3159	1748	7323	<3.0	0.613	<5.0	12728	1.27	12702	99.8
SMS, LD Slag	<5.0	32	58959	6138	2543	<3.0	0.466	<5.0	67975	6.80	67672	99.6
BDL Values	**5**	**1**	**5**	**1**	**1**	**3**	**0.026**	**5**	**-**	**-**	**-**	**-**
Total	0	504	62118	7886	9866	0	1.079	0	80702	8.1	80374	-
% Heavy Metal of total toxic metal	**0**	**0.62%**	**76.97%**	**9.77%**	**12.23%**	**0%**	**0%**	**0%**	**-**	**-**	**-**	**99.6%**

Further, to assess the toxicity of the slag samples "Toxicity Characteristic Leaching Procedure (TCLP)" was carried out. The results are presented in **Table 3.45**.

TABLE 3.45: TOXICITY TEST OF SLAG SAMPLES BY TOXICITY CHARACTERISTIC LEACHING PROCEDURE (TCLP) TEST

TCLP Results in mg/kg																		
Samples	**Cd**	**Cu**	**Ni**	**Ag**	**Co**	**Pb**	**Cr**	**Zn**	**B**	**Ba**	**Fe**	**Mn**	**Al**	**As**	**Hg**	**Cr (VI)**	**Total Heavy Metal**	
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	%
BFs-Granulated	<1.0	<1.0	<1.0	<5.0	<5.0	<1.0	<1.0	<10.0	<5.0	<1.0	10.4	8.4	<1.0	<3.0	0.034	<5.0	19	0.0019
SMS, LD Slag	<1.0	<1.0	<1.0	<5.0	<5.0	<1.0	<1.0	<10.0	<5.0	1.2	<5.0	<1.0	<1.0	<3.0	<0.025	<5.0	1	0.0001
BDL Values	**1**	**1**	**1**	**5**	**5**	**1**	**1**	**10**	**5**	**1**	**5**	**1**	**1**	**3**	**0.025**	**5**	-	-
Total	0	0	0	0	0	0	0	0	0	1.2	10.4	8.4	0	0	0.034	0	20	0.002
% of total Heavy Metal (kg/100kg)	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**6.0%**	**52.0%**	**42.0%**	**0.0%**	**0**	**0.2%**	**0**	**100**	**-**
TCLP Results in mg/l																		
TCLP Slag Samples	**Cd**	**Cu**	**Ni**	**Ag**	**Co**	**Pb**	**Cr**	**Zn**	**B**	**Ba**	**Fe**	**Mn**	**Al**	**As**	**Hg**	**Cr(VI)**	**Total Heavy Metal**	
	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	%
BFs-Granulated	<0.01	0.015	0.017	<0.05	0.052	0.036	<0.01	<0.1	<0.05	<0.01	0.52	0.42	0.03	<0.03	0.0034	<0.05	1.09	0.00011
SMS, LD Slag	<0.01	<0.01	<0.01	<0.05	<0.05	<0.01	<0.01	<0.1	<0.05	0.06	<0.05	<0.01	0.03	<0.03	0.0005	0.06	0.15	0.00002
BDL	**0.01**	**0.01**	**0.01**	**0.05**	**0.05**	**0.01**	**0.01**	**0.1**	**0.05**	**0.01**	**0.05**	**0.01**	**0.01**	**0.03**	**0.0005**	**0.05**	-	-
Total	**0**	**0.015**	**0.017**	**0**	**0.052**	**0.036**	**0**	**0**	**0**	**0.06**	**0.52**	**0.42**	**0.06**	**0**	**0.0039**	**0.06**	**1.24**	**-**
Limit concentration limit values (mg/l) as per Hazardous and Other Wastes Rules 2016, Schedule II (Class A).	**1**	**25**	**20**	**5**	**80**	**5**	**5**	**250**	**-**	**100**	**-**	**10**	**-**	**5**	**0.2**	**5**		

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(b) Trace Metal Content in Raw material

The trace metal content of raw material was carried out via ore dressing investigation by the Ore Dressing Division, Indian Bureau of Mines for RINL foe samples collected from 2001 to 2012. The results are presented in **Table 3.46** below.

TABLE 3.46:TRACE METALS IN THE RAW MATERIAL

TYPICAL DOMESTIC COAL ANALYSIS	
Parameter	**Concentration**
Ultimate Analysis	
Carbon (C)	43.06%
Hydrogen (H)	3.23%
Sulphur (S)	0.69%
Nitrogen (N)	1.02%
Oxygen (O)	10.94%
Moisture	11.47%
Ash	41.44%
Lead (Pb)	0.006%
Mercury (Hg)	Nil

NMDC-DANTEWADA CHATISH GARH IRON ORE COMPOSITION	
CONSTITUENT	**%**
Fe	62.10
Fe_2O_3	88.68
Al_2O_3	3.05
SiO_2	3.64
CaO	0.033
MgO	0.014
Na_2O	0.085
K_2O	0.045
P	0.056
Mn	0.046
TiO_2	0.20
LOI	4.0

4.0 ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

RINL-VSP has proposed for expansion of Integrated Steel Plant production capacity from 6.3 MTPA to 7.3 MTPA. The proposal involves revamping of existing Sinter plants, Blast furnaces, Rolling mills and associated auxiliary facilities along with installation of a new 0.8 MTPA coke oven, a new converter in SMS2 and a rebar mill.

Most of the revamping activities including the installation of the new converter have already been completed. The new coke oven battery is still in construction phase.

In this chapter, emphasis has been given on the following environmental attributes associated with the proposed expansion activities –

- Impacts due to project location
- Actual contribution of existing plant on ambient environment
- Estimated impacts of plant at maximum rated capacity of 6.3 MTPA
- Impacts in future after expansion to 7.3 MTPA capacity.

Since, most of the plant units have already been constructed/revamped, the impacts during construction phase are not estimated. In place of this, a detailed study **"Damage Assessment"** has been carried out to study the damages caused during construction phase. The same is given in **Chapter 11.**

The existing environmental conditions have been described in the previous chapter. The anticipated impacts due to this project at various stages of development have been predicted. Mitigation measures planned to be implemented for the proposed project have also been discussed in this chapter.

4.1 IMPACTS DUE TO PROJECT LOCATION

The revamping was done for the existing units. However, additional units proposed for the expansion from 6.3 MTPA to 7.3 MTPA shall be/ are being installed within the existing Steel Plant Boundary and adjacent to existing similar units' locations keeping in view that some infrastructure facilities of existing units can be used for the new units.

The land of the existing plant is in industrial use. Location of new units shall involve little disturbance to the natural eco system as no additional area was acquired outside the plant boundary.

The land over which the new units shall be/ have been set up was a vacant area which has been earmarked for such expansion units since inception.

4.2 IMPACTS DURING OPERATION PHASE AT 7.3 MTPA

In general for prediction of impact due to expansion of plant will be done studying the contributions of expansion units on ambient air quality.

However, for proposed expansion, revamping has already done for existing units and two new units which were proposed to be freshly installed are Coke Oven Battery 5 and Rebar Mill. COB 5 is still in construction phase and has not started operation till date while the proposed Rebar mill is still in planning phase. Though RINL had obtained EC for (6.5MTPA Hot metal) 6.3MTPA liquid steel in 2005 and till date the plant capacity not yet reached upto the capacity for which EC accorded as shown in **Figure 4.1** below.

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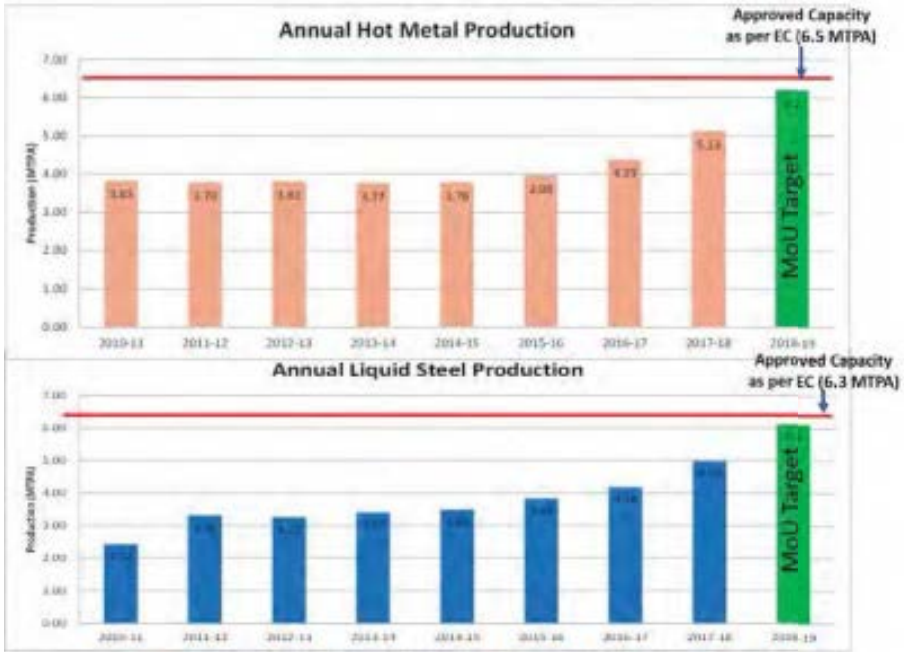
Fig. 4.1 :Hot metal and Liquid Steel Production of RINL



Therefore, no environmental impacts are attributable to the proposed new units of the 7.3 MTPA expansion plan due to their operation. The only impacts associated with such units are the damages caused due to ongoing construction activities which are discussed in detail in Chapter 11.

RINL is regularly monitoring various environmental attributes such as meteorology, ambient air quality, water quality, noise levels, etc. Also to monitor the function and effectiveness of the pollution control measures applied to various units of the plant, work zone monitoring is also being conducted periodically. By 2013, all the units proposed for 3 MTPA to 6.3 MTPA expansions were fully commissioned. The contribution of all the units at 6.3 MTPA on ambient environment and contribution from the plant after expansion plant are addressed in the preceding paragraphs.

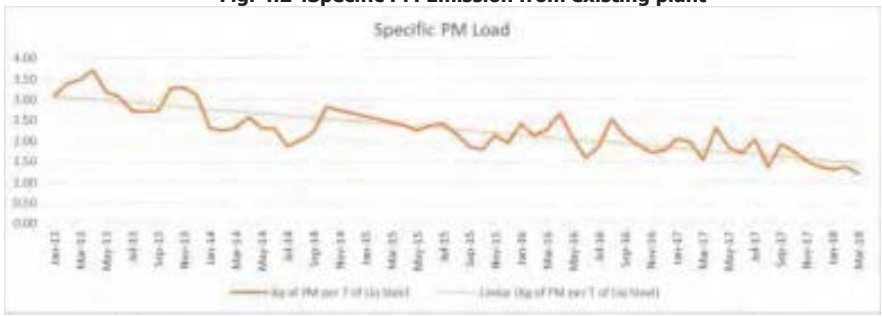
4.2.1 Air Environment

a) Actual contribution of Existing Plant

RINL has installed all units for producing 6.3MTPA steel production by 2013. However it is not reached its rated capacity because major units SP1&2 and BF 1&2 installed during 1990 during 3 MTPA stage and requires revamping. Hence the revamping has commenced during 2013 for the old units and completed. Due to revamping of specific pollution pollution loads

are improved over the years. A graph of total specific pollution loads from all units of VSP is given in **Figure 4.2**.

Fig. 4.2 :Specific PM Emission from existing plant



From the graph, a downward trend is observed in specific emission load from overall plant units. Therefore, an overall positive impact is observed on ambient air due to the ongoing revamping/modernization activities.

Based on the productions of various units, consumption fuel and monitored stack emissions from all existing stacks of VSP are given in **Table 4.1**.

Table 4.1 :Values of stack emissions at present

Sl No	Stack Location	Hgt (m)	Dia (m)	Max Temp (°C)	Flow rate (Nm^3/hr)	Exit Vel (m/s)	Pollution Load (g/s)		
							PM	SO_2	NOx
1.	CO Battery 1	120	4.2	200	189357	6.0	1.6	7.2	2.7
2.	CO Battery 2	120	4.2	200	193268	6.1	1.6	6.8	3.9
3.	CO Battery 3	120	4.2	200	189357	6.0	1.3	5.5	3.1
4.	CO Battery 4	120	4.2	200	190265	6.1	1.0	6.0	6.7
5.	SP3 Process	120	9	150	1026987	6.4	2.8	47.1	71.3
6.	SP3 SDD	120	8	100	681264	4.7	3.4	0.0	0.0
7.	CRMP 1&2	60	3	130	280354	14.9	7.5	8.5	4.6
8.	CRMP 3&4	60	3	130	269167	14.3	5.0	7.4	4.3
9.	CRMP 5	60	3	130	138684	7.4	1.3	3.7	2.0
10.	CRMP 6	60	1.5	130	77284	16.4	1.1	2.4	1.3
11.	CRMP 7	60	1.5	130	77284	16.4	1.1	2.4	1.3
12.	BF3 Stove	80	4.1	450	385000	28.4	5.3	2.7	3.2
13.	BF3 CH	100	5	80	1061575	17.8	2.0	35.5	23.1
14.	BF3 SH	80	6.5	45	416357	3.7	1.6	0.0	0.0
15.	LMMM WBF	87	3.4	250	175357	9.4	0.8	5.7	3.3
16.	LMMM RHF	40	0.86	55	7257	3.8	0.02	0.2	0.1
17.	WRM1 WBF	45	2.54	290	111268	11.5	0.6	3.1	1.4
18.	WRM2 RHF	80	1.5	290	72015	21.4	0.3	5.2	1.4
19.	MMSM WBF	80	3	285	132654	9.8	0.7	2.9	2.1
20.	SBM RHF	65	1.5	290	56012	16.6	0.8	4.0	1.1
21.	STM RHF	65	1.5	290	59472	17.7	0.8	4.3	1.2

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Sl No	Stack Location	Hgt (m)	Dia (m)	Max Temp (°C)	Flow rate (Nm^3/hr)	Exit Vel (m/s)	Pollution Load (g/s)		
							PM	SO_2	NOx
22.	TPP Boiler 6	180.5	4.2	217	502856	16.6	6.8	83.8	41.9
23.	CPP 2	103.5	5	230	636585	15.2	8.8	26.5	22.1
Units Proposed for Augmentation/Expansion									
24.	SP1&2 Process	120	9	150	2653482	16.4	13.7	121.6	184.3
25.	SP1&2 SDD	120	8	100	2183575	15.1	35.7	0.0	0.0
26.	BF1 Stove	80	3.5	400	304417	22.5	4.2	2.1	2.5
27.	BF1 CH	100	5	80	821567	13.8	3.8	20.4	11.9
28.	BF1 SH	80	6.5	45	1712456	15.3	12.5	0.0	0.0
29.	BF2 Stove	80	3.5	400	97527	7.2	1.4	0.7	0.8
30.	BF2 CH	100	5	80	815324	13.7	3.6	7.9	6.9
31.	BF2 SH	80	6.5	45	1735984	15.5	18.5	0.0	0.0
32.	SMS1 CVS	80	3.6	40	333594	9.6	5.1	0.0	0.0
33.	SMS1 SDD	70	5.4	111	906625	14.2	12.6	0.0	0.0
34.	SMS2 SDD 1&2	80	5.1	109	1365894	23.8	7.0	0.0	0.0
35.	SMS2 SDD 3	80	5.1	109	648242	9.3	9.0	0.0	0.0
36.	SMS2 FLUX DD	80	3.6	40	185684	5.3	0.8	0.0	0.0
37.	SMS2 FE1	100	1.97	230	101984	15.7	0.2	3.3	1.9
38.	SMS2 FE2	100	1.97	230	101387	15.6	0.2	3.3	1.9
39.	TPP Boiler 1&2	180.5	4.2	217	806235	26.6	23.1	134.4	67.2
40.	TPP Boiler 3&4	180.5	4.2	217	656347	21.6	14.4	109.4	54.7
41.	TPP Boiler 5	180.5	4.2	217	401265	13.2	6.2	66.9	33.4
Total							228.1	740.6	567.5

Based on the above data, total pollution loads for all the units installed at present are given below-

PM - 821 Kg/hr
SO_2 - 2666 Kg/hr
NOx - 2043 Kg/hr

b) <u>Estimated Contribution of 6.3 MTPA Plant at Full Capacity</u>

Most of the units of 6.3 MTPA expansions have been installed by 2013 as per the details given in EC/Consent to Establish. However, the plant has not yet reached rated capacity of 6.3 MTPA, emission loads are estimated when plant reaches its maximum rated capacity. Emission values for all the existing stacks of VSP at 6.3 stage are given in **Table 4.2**.

Table 4.2 :Values of stack emissions at 6.3 MTPA stage

Sl No	Stack Location	Hgt (m)	Dia (m)	Temp (°C)	Flow rate (Nm^3/hr)	Exit Vel (m/s)	Pollution Load (g/s)		
							PM	SO_2	NOx
1.	CO Battery 1	120	4.2	200	216090	6.9	3.0	36.0	12.0
2.	CO Battery 2	120	4.2	200	216090	6.9	3.0	36.0	12.0
3.	CO Battery 3	120	4.2	200	216090	6.9	3.0	36.0	12.0
4.	CO Battery 4	120	4.2	200	216090	6.9	3.0	36.0	12.0
5.	SP3 Process	120	9	150	2297280	14.2	31.9	105.3	159.5
6.	SP3 SDD	120	8	100	1100000	7.6	15.3	0.0	0.0

Sl No	Stack Location	Hgt (m)	Dia (m)	Temp (°C)	Flow rate (Nm^3/hr)	Exit Vel (m/s)	Pollution Load (g/s)		
							PM	SO_2	NOx
7.	CRMP 1&2	60	3	130	416000	22.1	5.8	12.6	6.8
8.	CRMP 3&4	60	3	130	416000	22.1	5.8	11.4	6.6
9.	CRMP 5	60	3	130	208000	11.0	2.9	5.6	3.0
10.	CRMP 6	60	1.5	130	120000	25.5	1.7	3.7	2.0
11.	CRMP 7	60	1.5	130	120000	25.5	1.7	3.7	2.0
12.	BF3 Stove	80	4.1	450	385000	19.6	5.3	2.7	3.2
13.	BF3 CH	100	5	80	1340000	22.4	18.6	35.5	23.1
14.	BF3 SH	80	6.5	45	470000	4.2	6.5	0.0	0.0
15.	LMMM WBF	87	3.4	250	196248	10.5	2.7	6.4	3.7
16.	LMMM RHF	40	0.86	55	7893	4.2	0.1	0.2	0.1
17.	WRM1 WBF	45	2.54	290	120709	12.5	1.7	3.4	1.5
18.	WRM2 RHF	80	1.5	290	79600	23.6	1.1	5.7	1.5
19.	MMSM WBF	80	3	285	141576	10.4	2.0	3.0	2.2
20.	SBM RHF	65	1.5	290	85800	25.5	1.2	6.2	1.7
21.	STM RHF	65	1.5	290	91100	27.0	1.3	6.6	1.8
22.	TPP Boiler 6	180.5	4.2	217	587880	19.4	8.2	98.0	49.0
23.	CPP 2 120 MW	104	5	230	1000000	23.9	13.9	6.9	8.3
Units Proposed for Augmentation/Expansion									
24.	SP1&2 Process	120	9	150	3600000	22.3	70.7	165.0	500.0
25.	SP1&2 SDD	120	8	100	2720310	18.8	83.1	0.0	0.0
26.	BF1 Stove	80	3.5	400	308000	20.1	4.3	2.1	2.6
27.	BF1 CH	100	5	80	972000	16.3	13.5	25.8	15.0
28.	BF1 SH	80	6.5	45	2225000	19.9	57.5	0.0	0.0
29.	BF2 Stove	80	3.5	400	308000	20.1	4.3	2.1	2.6
30.	BF2 CH	100	5	80	972000	16.3	13.5	31.1	27.2
31.	BF2 SH	80	6.5	45	2225000	19.9	30.9	0.0	0.0
32.	SMS1 CVS	80	3.6	40	590000	16.9	8.2	0.0	0.0
33.	SMS2 SDD 1&2	80	5.1	109	1630000	28.4	22.6	0.0	0.0
34.	SMS2 FLUX DD	80	3.6	40	207500	5.9	2.9	0.0	0.0
35.	SMS2 FE1	100	1.97	230	136600	21.0	1.9	4.4	2.6
36.	SMS2 FE2	100	1.97	230	136600	21.0	1.9	4.4	2.6
37.	TPP Boiler 1&2	180.5	4.2	217	1000000	33.0	40.3	166.7	83.3
38.	TPP Boiler 3&4	180.5	4.2	217	1000000	33.0	40.3	166.7	83.3
39.	TPP Boiler 5	180.5	4.2	217	500000	16.5	20.1	83.3	41.7
Total							555.5	1112.6	1085

Based on the above data, total pollution load for all the units installed at 6.3 MTPA stage for which EC was granted is given below-

PM - 2000 Kg/hr
SO_2 - 4005 Kg/hr
NOx - 3906 Kg/hr

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c) Impacts In Future After Expansion To 7.3 MTPA Capacity

In order to study the impact due to increase in production capacity of the steel plant, major changes proposed in various units as mentioned below are considered while estimating emissions

- **Coke Oven Battery 5 –** In order to cater to the increased coke requirement for the proposed expansion, a new coke oven battery 5 is proposed having similar configuration of the existing COB4. The under-fire heating of coke oven battery shall be fueled by mixed gas. H2S recovery shall be provided in the proposed COB.
- **Sinter Machines 1&2 –** The existing sinter machines 1 & 2 were commissioned with the inception of plant in 1989-90. The plants were designed with ESP having output PM concentration of 115 mg/Nm^3. As part of the present expansion of existing sinter machines 1 & 2, several of the existing facilities are also being augmented. The existing ESPs are being revamped for getting an output PM concentration of <50 mg/Nm^3. Existing burners are being replaced with more energy efficient and technologically advances low NOx burners. This will result in SO2 and NOx emissions and lesser fuel requirement. Several other technological advances are also proposed in the balling mill which will result in a decrease in coke rate from 70 to 60.8 Kg/T of gross sinter. As a result of all the above proposed changes, even after the expansion of capacity of sinter machines 1 & 2, there shall be a specific reduction in SO_2 & NOx loads.
- **Blast furnace 1 &2 –** The existing blast furnace 1 & 2 is already having all infrastructure facilities to produce 2.5 MTPA of hot metal. Only changes required include the changed lining of internal refractory. In order to produce additional 0.5 MTPA of hot metal, existing hot air ovens are revamped to produce 10 % extra hot air. This has resulted in a marginal increase in flue gas generation from stoves.
- **SMS 1 –** No increase in production capacity of the existing SMS1 is envisaged for the proposed expansion. The existing convertors have been provided with dog houses facility.
- **SMS 2 –** With the expansion of hot metal production in blast furnaces, a new converter 3 has been installed in SMS 2. Along with the converters, associated facilities have also been installed. A separate dog house has been provided for the new converter. The pollution load of cleaned air having PM concentration <50mg/Nm^3 shall be reflected in total pollution load of the plant.
- **Rebar Mill –** An additional rebar mill of 0.6 MTPA capacities has been proposed to be installed as part of the present proposal. The reheating furnaces of the mill shall be fueled by additional by-product gases generated as a result of the expansion.
- **CPP1 –** The existing boilers 1,2,3,4&5 of CPP1 were installed with the inception of plant in 1989. The existing ESPs of the boilers are being revamped for an output PM concentration of 50 mg/Nm^3.

All the above proposed measure in existing units and upcoming units will have a positive impact on the air environment as compared to present scenario. While the impact of fugitive emissions will be within the work zone area, the effect of emissions from the point sources will have an impact on the ambient air quality in the surrounding area.

For prediction of impacts for the proposed projects, in order to study the impacts due to increase in pollution load, in general, additional contributions from the new/augmented units

will be added to the existing back ground concentrations and predictions will be done accordingly.

The maximum emissions estimated from various units at 7.3 MTPA expansion stage and the details of the stacks are given in **Table 4.3**.

Table 4.3 :Stack emission details

Sl No	Stack Location	Hgt (m)	Dia (m)	Temp (°C)	Flow rate (Nm^3/hr)	Exit Vel (m/s)	Pollution Load (g/s)		
							PM	SO_2	NOx
1.	CO Battery 1	120	4.2	200	216090	6.9	3.0	36.0	12.0
2.	CO Battery 2	120	4.2	200	216090	6.9	3.0	36.0	12.0
3.	CO Battery 3	120	4.2	200	216090	6.9	3.0	36.0	12.0
4.	CO Battery 4	120	4.2	200	216090	6.9	3.0	36.0	12.0
5.	SP3 Process	120	9	150	2297280	14.2	31.9	105.3	159.5
6.	SP3 SDD	120	8	100	1100000	7.6	15.3	0.0	0.0
7.	CRMP 1&2	60	3	130	416000	22.1	5.8	12.6	6.8
8.	CRMP 3&4	60	3	130	416000	22.1	5.8	11.4	6.6
9.	CRMP 5	60	3	130	208000	11.0	2.9	5.6	3.0
10.	CRMP 6	60	1.5	130	120000	25.5	1.7	3.7	2.0
11.	CRMP 7	60	1.5	130	120000	25.5	1.7	3.7	2.0
12.	BF3 Stove	80	4.1	450	385000	19.6	5.3	2.7	3.2
13.	BF3 CH	100	5	80	1340000	22.4	18.6	35.5	23.1
14.	BF3 SH	80	6.5	45	470000	4.2	6.5	0.0	0.0
15.	LMMM WBF	87	3.4	250	196248	10.5	2.7	6.4	3.7
16.	LMMM RHF	40	0.86	55	7893	4.2	0.1	0.2	0.1
17.	WRM1 WBF	45	2.54	290	120709	12.5	1.7	3.4	1.5
18.	WRM2 RHF	80	1.5	290	79600	23.6	1.1	5.7	1.5
19.	MMSM WBF	80	3	285	141576	10.4	2.0	3.0	2.2
20.	SBM RHF	65	1.5	290	85800	25.5	1.2	6.2	1.7
21.	STM RHF	65	1.5	290	91100	27.0	1.3	6.6	1.8
22.	TPP Boiler 6	181	4.2	217	587880	19.4	8.2	98.0	49.0
23.	CPP 2	104	5	230	1000000	23.9	13.9	6.9	8.3
Units Proposed for Augmentation/Expansion									
24.	SP1&2 Process	120	9	150	3600000	22.3	50.0	164.1	250.0
25.	SP1&2 SDD	120	8	100	2622000	18.1	36.4	0.0	0.0
26.	BF1 Stove	80	3.5	400	338800	22.1	4.7	2.4	2.8
27.	BF1 CH	100	5	80	1260000	21.1	17.5	33.4	19.4
28.	BF1 SH	80	6.5	45	1300000	11.6	18.1	0.0	0.0
29.	BF2 Stove	80	3.5	400	338800	22.1	4.7	2.4	2.8
30.	BF2 CH	100	5	80	972000	16.3	13.5	31.1	27.2
31.	BF2 SH	80	6.5	45	2225000	19.9	30.9	0.0	0.0
32.	SMS1 CVS	80	3.6	40	590000	16.9	8.2	0.0	0.0
33.	SMS1 SDD	70	5.4	111	1164063	18.2	16.2	0.0	0.0
34.	SMS2 SDD 1&2	80	5.1	109	1630000	28.4	22.6	0.0	0.0
35.	SMS2 SDD 3	80	5.1	40	1069200	15.3	14.9	0.0	0.0
36.	SMS2 FLUX DD	80	3.6	40	207500	5.9	2.9	0.0	0.0
37.	SMS2 FE1	100	1.97	230	136600	21.0	1.9	4.4	2.6
38.	SMS2 FE2	100	1.97	230	136600	21.0	1.9	4.4	2.6

Sl No	Stack Location	Hgt (m)	Dia (m)	Temp (°C)	Flow rate (Nm^3/hr)	Exit Vel (m/s)	Pollution Load (g/s)		
							PM	SO_2	NOx
39.	TPP Boiler 1&2	181	4.2	217	1000000	33.0	13.9	166.7	83.3
40.	TPP Boiler 3&4	181	4.2	217	1000000	33.0	13.9	166.7	83.3
41.	TPP Boiler 5	181	4.2	217	500000	16.5	6.9	83.3	41.7
New Proposed Units									
42.	CO Battery 5	120	4.2	200	216090	6.9	3.0	18.0	12.0
43.	Rebar RHF	50	1.7	275	70596	15.9	1.0	5.1	1.4
44.	SMS2Twin LF	70	2	150	150000	18.8	2.1	0.0	0.0
Total							424.6	1142.9	853.3

Based on the above data, total pollution loads for all the units after proposed expansion are given below-

PM - 1521 Kg/hr
SO_2 - 4114 Kg/hr
NOx - 3072 Kg/hr

The comparison of air pollution loads at difference stages of the plant is shown in **Table 4.4** below.

Table 4.4 :Comparative pollution loads before and after the present Proposal

Sl. No	Scenario	Pollution Load (Kg/hr)		
		PM	SO_2	NO_x
1	Existing plant at 6.3 MTPA Full load	2000	4005	3906
2	After proposed expansion at 7.3 MTPA in future	1529	4114	3072
3	Net increase from 6.3 MTPA to 7.3 MTPA (2-1)	-471 (-23.6%)	109 (2.7%)	-834 (-21%)

From the above table, it can be observed that there is a marginal increase in SO_2, however overall decrease in pollution load from the proposed units after the ongoing expansion.

The decrease of PM and NOx mainly due to revamping of existing pollution control equipment of the existing units by increasing efficiency of the ESPs and replacing conventional burners with low NOx burners. The increase in SO2 mainly attributed to installation new coke oven at 7.3 MTPA stage.

Above are the emissions expected releases from the stack at 7.3 MTPA stage. Once the pollutants are emitted into the atmosphere, the dilution and dispersion of the pollutants are controlled by various meteorological parameters like wind speed and direction, ambient temperature, mixing height, etc.

To assess the actual impacts due to proposed changes air quality impact prediction modelling has been conducted considering site specific meteorological data to estimate the incremental Ground level concentrations due to proposed changes.

In the present project revamping of existing units have already done. However, these units are not producing its rated capacity. Even total plant has not reached its rated capacity of 6.3 MTPA. To obtain ultimate contribution from the plant when plant reaches it capacity 7.3 MTPA on ambient air, few following assumptions/considerations were made:

(a) A contribution from existing plant with present production capacity is being reflected on the air quality.
(b) The present contribution of all existing units proposed to be revamped is predicted at individual monitoring station using the monitored emission values.
(c) Modified AAQ values have been obtained for each monitoring location by subtracting the existing contribution of units.
(d) GLCs have been predicted for existing units proposed to be revamped when they are operating at full rated capacity (at 6.3 MTPA stage).
(e) The GLCs have also been predicted considering emissions from all new units and revised pollution loads from all existing units after revamping/ expansion (7.3MTPA stage).
(f) The incremental contribution after proposed expansion will be the difference of contribution of existing units at full load and predicted contribution in future.
(g) The cumulative maximum AAQ in future at 7.3 MTPA operational stages are obtained by adding Modified AAQ values at individual station with GLCs due to emissions from new units and revised emissions from existing units.
(h) GLCs have been predicted for fugitive emissions due to handling and transportation of additional quantities of raw material for proposed expansion and added with Cumulative AAQ.

Following the above, the GLCs are predicted for contribution of RINL-VSP on ambient air quality. The US Environmental Protection Agency's (EPA's) AERMOD computer code is used to estimate atmospheric dispersion and concentrations of the released emissions in the immediate vicinity of the proposed sources. The modelling is conducted to be inclusive of the weather conditions that are possible and representative of the sources.

Both airborne and surface concentrations are modelled with AERMOD. Hourly derived air concentrations (DAC) are modelled for an array of receptors covering the sources and surrounding areas. Peak values of time-integrated air concentrations at these major receptors points are derived from these hourly values, with modelled results reported as total incremental air concentrations in DAC-hours occurring over the selected time period. Total pollutants concentration over the plain areas are evaluated with AERMOD using the same array of receptors, with results reported as microgram per m^3.

The GLCs has been predicted over a 25 km X 25 km area with the location of the BF1 as the center. GLCs have been calculated at every 500 m grid point. The same are given in **Table 4.5**.

Table 4.5 :Comparative GLCS at 6.3 MTPA and 7.3 MTPA stage

PM				
Sl No	**AAQ location**	**Existing units at 6.3 MTPA with full rated capacity**	**GLCs due to new units and revised existing units at 7.3 MTPA stage**	**Difference**
A1	Devada	1.6	1.1	-0.5
A2	Gorlavanipalem	0.9	0.6	-0.3
A3	Bhavani Nagar near Nadupudi RF	7.2	5.2	-2.1
A4	Sector 3, VSP Quarters	3.7	2.6	-1.1
A5	Chepurapalli	4.1	2.7	-1.3
A6	Duvvada	2.0	1.3	-0.7
A7	Gangavaram Port Adjacent	4.0	2.7	-1.3
A8	Gajuwaka	2.2	1.3	-0.8
SO_2				
Sl No	**AAQ location**	**Existing units at 6.3 MTPA with full rated capacity**	**GLCs due to new units and revised existing units at 7.3 MTPA stage**	**Difference**
A1	Devada	2.6	2.7	0.2
A2	Gorlavanipalem	1.5	1.6	0.1
A3	Bhavani Nagar near Nadupudi RF	10.3	11.0	0.7
A4	Sector 3, VSP Quarters	6.1	6.5	0.4
A5	Chepurapalli	5.8	6.2	0.3
A6	Duvvada	3.0	3.2	0.2
A7	Gangavaram Port Adjacent	5.8	6.0	0.3
A8	Gajuwaka	3.4	3.6	0.2
NOx				
Sl No	**AAQ location**	**Existing units at 6.3 MTPA with full rated capacity**	**GLCs due to new units and revised existing units at 7.3 MTPA stage**	**Difference**
A1	Devada	2.8	2.0	-0.8
A2	Gorlavanipalem	1.6	1.2	-0.5
A3	Bhavani Nagar near Nadupudi RF	11.3	8.2	-3.1
A4	Sector 3, VSP Quarters	6.3	4.8	-1.6
A5	Chepurapalli	6.7	4.7	-2.0
A6	Duvvada	3.5	2.4	-1.0
A7	Gangavaram Port Adjacent	6.1	4.5	-1.7
A8	Gajuwaka	4.1	2.8	-1.3

Concentrations are in µg/m^3 and of 24 hours averaging time

The above tables reveal that, after proposed expansion, there is a decrease in Ground Level Concentration of PM& NOx values, however there is also a marginal increase in SO2 loads due to new units.

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Isopleths of PM, SO_2 and NOx at 7.3 MTPA due to new units and existing units with revised emissions are shown in **Figure 4.3-4.5**.

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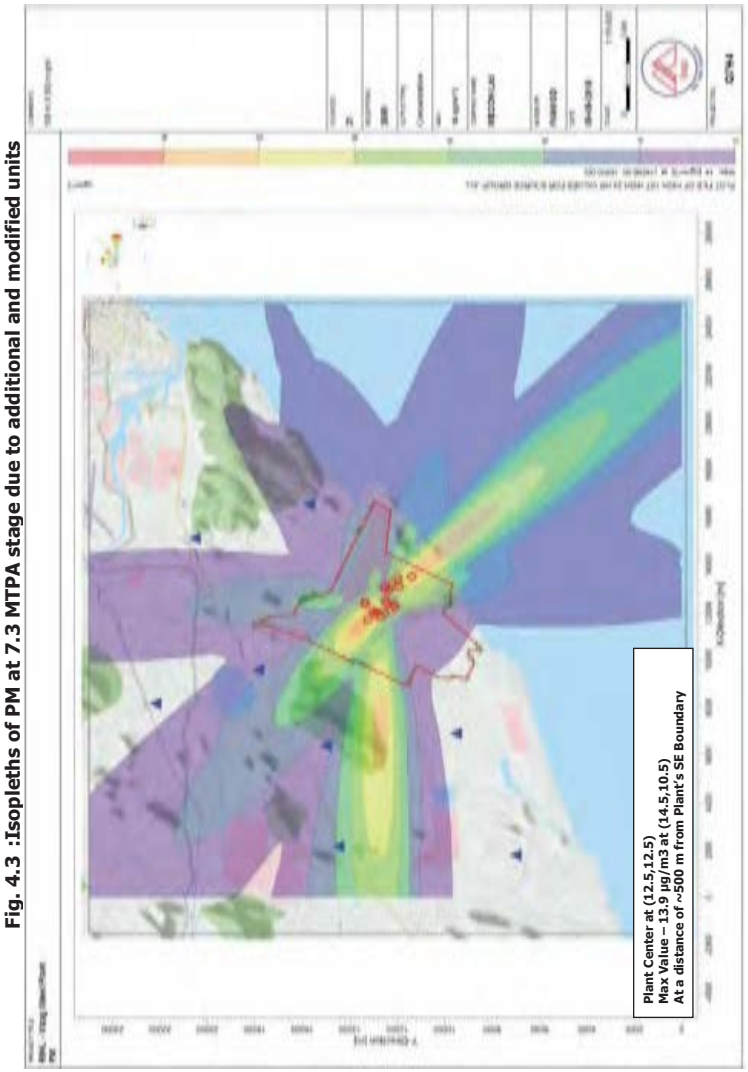


Fig. 4.3 :Isopleths of PM at 7.3 MTPA stage due to additional and modified units

Fig. 4.4 : Isopleths of SO2 at 7.3 MTPA stage due to additional and modified units

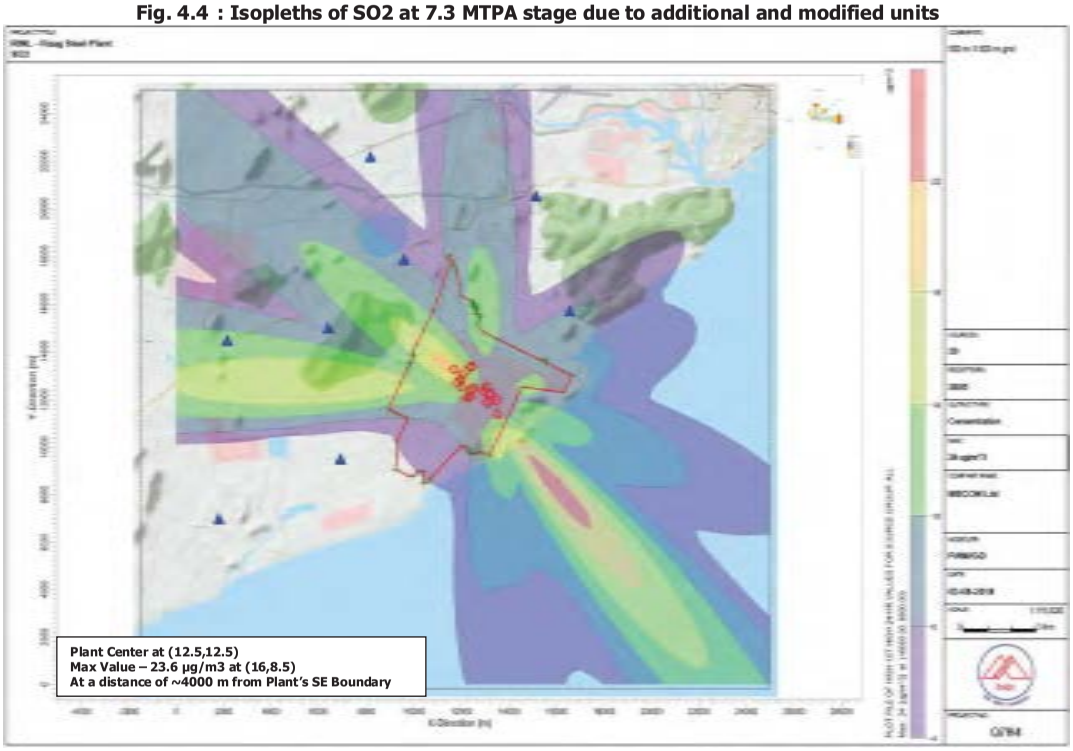
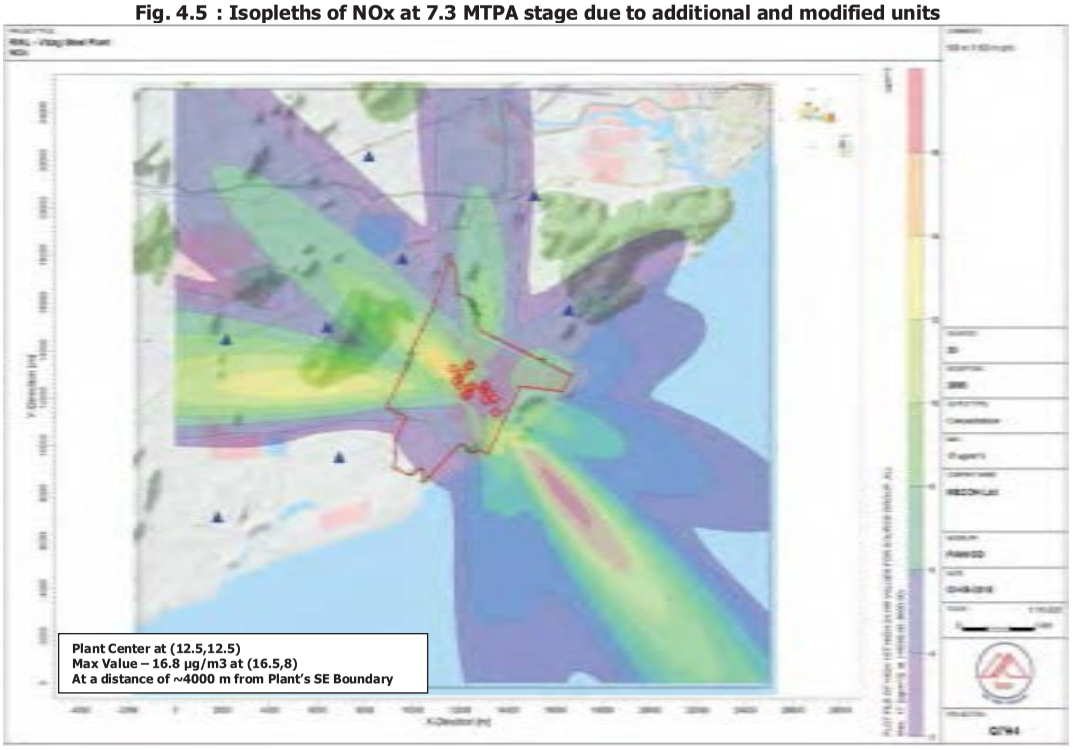


Fig. 4.5 : Isopleths of NOx at 7.3 MTPA stage due to additional and modified units



From the isopleths, the maximum values obtained at plain areas is observed to be 13.9 µg/m^3, 23.6 µg/m^3 & 16.8 µg/m^3 for PM, SO_2 & NOx respectively.

d) Impacts due to handling and transportation of Additional Raw material at 7.3 MTPA Capacity

Major portion of the raw material coming to VSP and major portion of finished product is despatched through rail. The same will be continued even after the present proposal. Only a very small quantity of the manganese ore is received through road. It is expected that after expansion no appreciable change in road traffic is anticipated.

For the proposed project, it is proposed to use the existing wagon tippler facility for unloading of additional quantity raw materials from wagon along with conveyors.

From tippler area and the stockyard, major area source emissions will be the fugitive dust. Fugitive emissions are generated during wagon tippling, transfer of material at junction boxes, during crushing and stocking the material. In order to minimize the fugitive emissions from the handling area, dust suppression systems have been proposed at all the dust generating sources.

The impacts due to the handling of additional raw material from existing tippler facility and stockyard are studied by estimating the emissions from all the dust emission sources. In the present case the emissions are mainly due to displacement of material while loading and unloading. The amount of dust generated is dependent on a number of variables like,

- nature of handling of material
- The physical characteristics of the material handled (degree of compaction, content of silt, moisture content.)
- Meteorological conditions

The rate of fugitive dust (emission factor) emitted from the activities while handling the material is estimated from the literature.

e) Impacts due to Despatch of Additional Finished products at 7.3 MTPA Capacity

VSP is dispatching around 96 % of the total finished products through railways & sea route. Only a small portion (4%) is being transported through roads. The same trend shall continue even after the expansion.

Out of the total additional finished products at 7.3 MTPA stage (0.86 MTPA), only 34000 TPA shall be despatched though trucks. Therefore, no appreciable change in road traffic is anticipated due to transportation of additional quantity of finished products after expansion. Therefore no significant impacts on AAQ due to this is envisaged.

The cumulative GLCs after the present proposal has been calculated as shown in **Table 4.6**.

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Table 4.6 : Predicted resultant AAQ at 7.3 MTPA stage

Stn ID	AAQ location	PM				
		One-month fresh AAQ* (avg) (A)	Contribution of existing units in present AAQ at ~5 MTPA (B)	GLCs due to new units and existing units after revamping/ expansion (C)	GLCs due to material Handling (D)	Cumulative AAQ in Future as per freshly monitored AAQ (A+C-B+D)
A1	Devada	90	0.8	1.3	0.0	90.5
A2	Gorlavanipalem	85	0.5	0.7	0.0	85.2
A3	Bhavani Nagar near Nadupudi RF	84	3.9	6.2	0.0	86.3
A4	Sector 3, VSP Quarters	68	2.0	3.2	0.2	69.4
A5	Chepurapalli	84	2.2	3.4	0.0	85.2
A6	Duvvada	81	0.9	1.5	0.0	81.6
A7	Gangavaram Port Adjacent	98	1.9	3.1	0.2	99.4
A8	Gajuwaka	72	0.9	1.4	0.0	72.5
*NOTE: *Freshly monitored in Oct. to Nov. 2018 as per suggestion of MoEFCC*						

Stn ID	AAQ location	SO_2			
		One-month fresh AAQ* (avg) (A)	Contribution of existing units in present AAQ at ~5 MTPA (B)	GLCs due to new units and existing units after revamping/ expansion (C)	Cumulative AAQ in Future as per freshly monitored (A+C-B)
A1	Devada	13.7	2.0	2.8	14.5
A2	Gorlavanipalem	20.8	1.1	1.6	21.3
A3	Bhavani Nagar near Nadupudi RF	11.5	8.0	11.3	14.8
A4	Sector 3, VSP Quarters	11.8	4.6	6.6	13.8
A5	Chepurapalli	14.2	4.5	6.3	16
A6	Duvvada	12.4	2.3	3.2	13.3
A7	Gangavaram Port Adjacent	17.5	4.4	6.1	19.2
A8	Gajuwaka	12.6	2.6	3.6	13.6
*NOTE: *Freshly monitored in Oct. to Nov. 2018 as per suggestion of MoEFCC*					

Stn ID	AAQ location	NOx			
		One-month fresh AAQ* (avg) (A)	Contribution of existing units in present AAQ at ~5 MTPA (B)	GLCs due to new units and existing units after revamping/ expansion (C)	Cumulative AAQ in Future as per freshly monitored (A+C-B)
A1	Devada	23.7	1.5	2.1	24.3
A2	Gorlavanipalem	25.2	0.8	1.2	25.6
A3	Bhavani Nagar near Nadupudi RF	17.2	6.0	8.4	19.6
A4	Sector 3, VSP Quarters	15.4	3.4	4.8	16.8
A5	Chepurapalli	25.6	3.5	4.8	26.9
A6	Duvvada	19.5	1.8	2.5	20.2
A7	Gangavaram Port Adjacent	29.7	3.3	4.5	30.9
A8	Gajuwaka	21.2	2.1	2.9	22.0
*NOTE: *Freshly monitored in Oct. to Nov. 2018 as per suggestion of MoEFCC*					

Concentrations are in µg/m^3 and of 24 hours averaging time

From the above tables, it can be observed that even after the proposed expansion of steel plant from 6.3 MTPA to 7.3 MTPA, the resultant AAQ levels will be within the prescribed limits of NAAQS. Moreover, a positive impact on AAQ is predicted at 7.3 MTPA with reference to emissions at 6.3 MTPA stage.

Additionally, due to the proposed expansion activities, revamping of existing old units & implementation of latest technologies, a significant decrease in specific CO_2 emission from 2.79 t/tcs to 2.3 t/tcs is also observed.

Existing Mitigation measures

In order to mitigate air pollution, following measures have been provided in the installed units as given in **Table 4.7** below.

Table 4.7 : Air Pollution Control Measures in Existing Plant Units

Sl. No.	Unit	Details of APC	Design Limit
1.	Raw Material Handling System	•Covered conveyors •DFDS •DE system for material transfer points	• DE stack outlet <50 mg/Nm^3
2.	Sinter Plant	•Process Flue gas cleaning •Stock House dedusting •Sinter cooler DE system	• Stack dust level < 50 mg/Nm^3
3.	Coke Ovens	•Charging & Pushing emissions control •CDQ •Waste heat recovery	• DE stack outlet <50 mg/Nm^3
4.	Blast Furnace	•Cast House Dedusting •Stock House dedusting	• Stack dust level < 50 mg/Nm^3

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Sl. No.	Unit	Details of APC	Design Limit
5.	Steel Melting Shops	Secondary emission control	• Stack dust level < 50 mg/Nm^3
6.	RMP Kilns	•Process Flue gas cleaning	Stack dust level < 50 mg/Nm^3
7.	CPP Boilers	•Process Flue gas cleaning	Stack dust level < 50 mg/Nm^3

In addition to above, following measures are proposed for the expansion units-

- Material handling system
  - DFDS systems in new coke oven plant
  - Sprinkler type dust suppression system in raw material storage area
  - Pneumatic transportation of coke dust from waste heat boilers and CDCP cyclones.
- Coke Ovens-
  - HPLA system for charging emissions control
  - Land based pushing emission control system
  - Mechanical door frame cleaning system
  - Coke dry quenching system
  - H_2S recovery
- Sinter plant
  - Revamping of existing ESP to maintain stack emission concentrations to 50 mg/Nm^3
- Blast Furnace
  - Revamping of existing ESP for Cast house and stock house dedusting to maintain stack emission concentrations to 50 mg/Nm^3
- Steel melting shops
  - Installation of dog houses in all converters.
  - Installation of secondary ventilation and material handling system with ESP/Bag filter
- Rebar Mill
  - Use of clean by-product gases as fuel.
  - Installation of low NOx burner for NOX emission reduction.
  - Stack of suitable height for proper dispersal of pollutants.

4.2.2 Water Environment

a. Impacts

Maximum water requirement for existing plant at 6.3 MTPA was around 7076 m^3/hr (38 MGD). The water is being sourced from existing Yeleru Reservoir. RINL has accorded permission for withdrawal of 45 MGD from Visakhapatnam Industrial Water Supply Company Limited (VIWSCO). Kanithi Balancing Reservoir has been constructed for storage of raw water.

For the proposed expansion of steel plant facilities, total additional water requirement is around 1303 m^3/hr (7 MGD). The existing allocation of 45 MGD of water supply shall be sufficient for the same. No additional water shall be required to be drawn in addition to the present accorded supply limit. The estimated maximum specific water consumption is around 3.18 m^3/T of steel production. RINL has proposed for installation of a second Kanithi Balancing Reservoir (KBR-2) to store the additional quantity of water.
As per the existing arrangement of steel plant at 6.3 MTPA stage, waste water generated in various units of the steel plant are pretreated and recycled within the unit itself. Rejects are discharged into two outfalls and led to waste water treatment / RO plants. From there, the

waste water is further recycled and reused within the plant. Only a small portion (200 m^3/hr) of Coke oven and RO plant rejects is discharged into Sea after treatment to meet effluent discharge standards. RINL has obtained CRZ clearance for the same vide MoEFCC's letter no – F.No. 11-121/2010-IA.III dated 12-02-2014 attached as **Annexure 3.2.** Marine Environmental Impacts Assessment Study was conducted for the same through National Institute of Oceanography.

The existing arrangement shall be followed even after the expansion. The additional waste water generated from the expanded/revamped/ new unit shall be suitable pre-treated and recycled within the plant boundary. No additional effluent shall be discharged outside after the proposed expansion.

Average total make-up water requirement for the plant is estimated at about 235 cum per hour whereas the total blow down from the recirculation systems of by product plant along with side stream filtration, condenser cooling circuit of turbine and from chilled water plant is expected to be about 56 cum per hour. As the quality of water required for the dust suppression system is similar to the expected quality of blow down water, it is proposed to use the blow down water for coal handling and dust suppression system.

In-plant Water System

In order to meet the plant water requirement, the industrial make-up water will be available from the existing make up water network. For this the existing make up water network will be connected suitably with existing DN 700 header. The required quantity make up water will be available on a continuous basis throughout the year. The required quantity of DM and Soft make up water will be available from existing DM and Soft water network.

Three independent re-circulating indirect cooling water circuit will be provided for cooling of equipment (PGC, Exhauster etc) in by product plant, condenser cooling circuit and chilled water plant respectively. Necessary make-up water for water losses through evaporation, blow down and drift loss will be added to cooling tower cold well basin from make-up water network.

Hot return indirect cooling water will be cooled in cooling tower and will be collected in cold well. The cold water from cold well will be pumped back to above consumers. All pumps will be located in a pump house.

Make-up Water System
Industrial grade make-up water will be distributed from the existing make up water network to various consumers of coke oven battery, by product plant, coal handling, miscellaneous consumers like gas scaling, bearing cooling, door cleaning etc.

Soft Water

The soft water required in the byproduct plant shall have total hardness of less than 5 mg/l expressed as $CaCO_3$. About 30 cu m per hour of soft water will be required. The above quantity will be supplied from existing soft water network

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Demineralized (DM) Water

The DM make up water required in the coke dry cooling plant is about 5 cum per hour. The above quantity will be supplied from existing DM water network

Potable Water System

All the water required for drinking and sanitation purpose will be supplied from existing drinking water network of plant.

The water consumption for the past few years in RINL shows a decline in water consumption. In the same way the capacity augmentation project also shows decreased water consumption.

The normal rainfall of the area is due to South-West monsoon contributing 725 mm. from June to September. The water requirement in the proposed project will be for both processing as well as for non-processing (residential and commercial) areas. Pre-treatment of the water especially softening is required before any application. Water requirement will be mainly industrial and domestic applications. In addition to that water will also be required for greenbelt development/ greenery, amenities & specialized infrastructure and roads & utilities. Also, this water will be required for meeting the fire protection demand.

b. <u>Mitigative Measures Undertaken</u>

In view of overall water conservation, optimization of consumption of make-up water and to ensure minimum discharge of effluents, it is proposed to adopt complete recirculating cooling system for the equipment cooling after proper treatment. The effluent discharged from the plant will be utilised for dust suppression system, land scrapping, gardening, etc. after adequate treatment to such an extent that the liquid effluent discharged from the plant is minimum.

Phenolic Effluent Treatment Plant

Toxic effluents generated in various units of coke ovens and by-product plant will be collected in the treatment plant. The amount of effluent generated will be about 70 cum per hour which includes Ammoniacal liquor after ammonia and H_2S stripping unit. The combined effluent also contains large amount of tar and oil and toxicants like phenol, cyanide, rhodanide etc. The effluent treatment plant will be designed to remove tar and oil and other toxicants. The treated effluent from the phenolic effluent treatment plant will meet the pollution control board norm for deep sea discharge through the existing marine discharge pipeline. Dry sludge from the treatment plant will be mixed with coal whereas the collected tar and oil will be sent back to the byproduct plant for further use.

Following additional schemes are proposed for the expansion units of the steel plant for maximum waste water recycling-

- Clarification and recycling of DCW from gas cleaning plant of BF and SMS
- Utilization of CT Blow Down in slag granulation, dust separation and ash handling.
- Treated waste water of individual units along with treated plant sanitary effluent to be further treated in ETP.

- Clarified water from CETP to be used for dust suppression, slag quenching, greenbelt maintenance, landscaping, etc.
- Part of the treated water from CETP further treated in RO and fed to fresh makeup Circuit
- The new Coke ovens 5 have been provided with separate ETP.
- Oil skimming and filtration of rebar mill waste water followed by clarification.

4.2.3 Noise Environment

a. Impacts on Noise Levels

The plant and machinery inside the proposed units are sources of noise. Generally, this noise is generated due to-

1. High speed blowers of the furnaces
2. Grinding Crushers and screens

The noise levels of these equipment and machinery are in the range of 90-100 dB(A). As such acoustic enclosures, hoods, laggings and screens are provided in such areas to the extent possible so that the sound pressure level in working areas are restricted below 85 dB(A) for 8 hours duty.

Whenever this is not practicable, administrative and personnel protection measures like provision of rotation of workers to minimize exposure time as well as provision of ear muffs to workers exposed to high noise areas are envisaged.

b. Noise Pollution Control Measures

Various measures proposed to reduce noise pollution include reduction of noise at source, provision of acoustic lagging for the equipment and suction side silencers, vibration isolators, selection of low noise equipment, isolation of noisy equipment from working personnel. In some areas where due to technological process, it is not feasible to bring down the noise level within acceptable limits of 85 dBA (at 1 m from source), personnel working in these areas will be provided with noise reduction aid such as ear muffs/ ear plugs and also the duration of exposure of the personnel will be limited as per the norms. The following measures will be undertaken:

➢ **Technological Measures**

- Plugging leakages in high-pressure gas/air pipelines.
- Reducing vibration of high speed rotating machines by regular monitoring of vibration and taking necessary steps.
- Noise absorber systems in pump houses.
- Noise level at 1m from equipment will be limited to 85 dB (A).
- The fans and ductwork will be designed for minimum vibration. Maximum allowable vibration level shall be as per VDI – 2056 guidelines.
- All the equipment in different new units and in units where capacity expansion is taking place will be designed/operated in such a way that the noise level shall not exceed 80 dB (A).

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➢ **Management Measures**

In a steel plant, with a variety of noise producing equipment, it may not be practicable to take technological control measures at all the places. In such cases the following administrative measures shall be taken:

- High noise zone will be marked as "High Noise Zone".
- The Workers exposed to high noise level will be provided with protection devices like ear muffs as per present practice and will be advised to use them regularly, while at work. Ambient noise level around the plant is well within the norms and the conditions will be the same even after proposed project. In existing steel plant units the noise sources are mostly high pressure compressors, exhausters, turbines leaking gas/air pipelines.
- In shops where measures are not feasible, attempts shall be made to provide operators with sound proof enclosure to operate the system.
- In a steel plant, with a variety of noise producing equipment, it may not be practicable to take technological control measures at all the places. In such cases the following administrative measures shall be taken.
- All workers will be regularly checked up medically for any noise related health problem and if detected, they will be provided with alternative duty.

Over and above all these, trees and shrubs of substantial widths will be planted to achieve sound attenuating effect. The trees and shrubs already planted inside plant and in the township have already shown that noise level in the township is within norms.

4.2.4 Solid Waste

Proposed new units and the augmented units will generate solid wastes, some of which are hazardous while others are non-hazardous. Some of these wastes shall be reused / re-utilised. VSP is also not exception to that. Additional solid wastes shall mainly be generated from:

- Coke Oven – Coal tar, Sludge, Ammonium sulphate, coke dust, etc
- Sinter Plant – return sinter & ESP Dust
- Blast Furnace – BF sludge, BF Slag, etc
- SMS – LD Slag, SMS Sludge, etc
- Rebar Mill – Mill Scales, scrap, etc

Integrated Iron & steel plant generates solid wastes, some of which are hazardous while others are non-hazardous. Some of these wastes are reused / re-utilised and some are not. Additionally, some wastes are also generated during operation / maintenance / annual maintenance of other units / shops etc, like Flue dust from BF, BF/BOF Gas Cleaning Plant sludge, Waste Refractories, etc. Except some sludge generated from Coke Oven and By Product area, all other wastes are non-hazardous. All the solid wastes shall be utilized as such inside the plant in Sinter Plant/BOF. BF/BOF Slag shall be sold to cement manufacturers or used for road construction.

All hazardous waste shall be handed over to authorized dealers for disposal as per statutory norms. The additional quantities of solid wastes to be generated after the proposed

expansion along with the reuse / recycle and disposal methodology for the same is presented in **Table 4.8.**

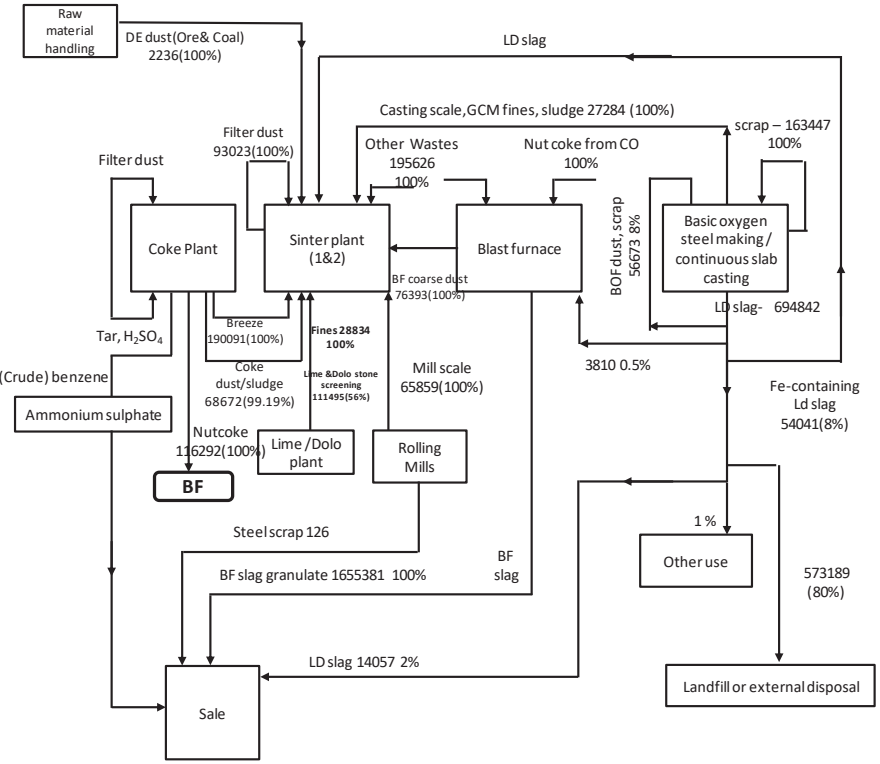
Table 4.8 : Source of Generation / Characterization of Solid Wastes

SN.	Solid wastes	6. 3 MTPA stage Tones	7.3 MTPA stage Tones	Increase	utilization
1	BF Slag	5292000	6132000	840000	100% For cement
2	LD Slag	1323000	1533000	210000	60% re use
3	DE Dust	945000	1095000	150000	100% in sinter
4	Sludge	945000	1095000	150000	In sinter
5	Fly ash	693000	693000	0	cement
6	Mill scale	94500	109500	15000	100% in Sinter

100% of the granulated BF slag would be sold to the cement making industries for manufacturing of slag cement. Other waste such as mill scale, sludges, dust etc would be 100% recycled into the sinter plant. 60% of the SMS slag would also be used within the steel plant and the balance would be stored for further processing for secondary use. **Fig 4.6** shows present generation of solid wastes and its utilization.

The metallurgical wastes generated and stocked in the plant shall be utilized by converting them into briquettes and micro pellets for consumption at SMS & SP respectively.

Fig. 4.6 : Solid waste management in RINL during 2017-18



VSP has signed MoU with various parties for lifting of Solid wastes generated at plant site. Details of quantities of BF Slag for lifting by various parties are provided in **Table 4.9**.

Table 4.9 – BF Slag Quantity allocation to various parties.

S.No	Name	MoU/ Segment Qty. allocation for 2018-19 (Tons)
1	SRI VISHNU SAI SARAVANA ENTERPRISES	20,000
2	MY HOME INDUSTRIES PRIVATE LIMITED	5,00,000
3	OCL INDIA LIMITED	3,64,800
4	ANDHRA CEMENTS LIMITED	4,00,000
5	ACC LIMITED	1,50,000

6	THE RAMCO CEMENTS LIMITED	60,000
7	SAGAR CEMENTS LIMITED	4,50,000
	Total	**19,44,800**

Tar sludge/solid sludge generated in by-product plant will be transported to coal yard for mixing with coal. Alternatively, mechanized handling system will be explored to facilitate charging into ovens.

The hazardous wastes estimated to be generated at 7.3 MTPA stage and their utilization is presented in **Table 4.10** below.

Table 4.10 –Hazardous Wastes Generated & Utilization at 7.3 MTPA

Sn	Waste generated	Quantity (tonnes)	To disposal facility
1	ETP Sludge (MBC & ETP)	6145	In-house Utilization
2	Used oil/ Waste lubricating oil/ vacuum oil/ transformer oil/ waste grease.	346	Recycled
3	Tank bottom sludge of tar and oil storage tanks.		In-house Utilization
4	Tar Sludge from tar decanters	3060	
5	Acid tar from Ammonium sulphate plant (ASP)	279	In-house Utilization
6	Benzol sludge from decanters of benzol distillation plant	382	In-house Utilization
7	Containers and containers liners of hazardous wastes & chemicals (mostly oil & grease barrels)	88	Sold
8	Oil soaked cotton waste & rubber items	20	Disposal by Authorized Parties
9	Asbestos waste	17	Disposal by Authorized Parties

4.2.5 Ecological environment

Impacts

The proposed expansion activities are taking place within existing plant complex. Hence, there is no forest area within the project site. Some of the impacts identified due to operation of the project are enlisted below:

- The fauna of the project site and the impact zone comprises of common small species. The impacts of the project will be manifested over a few hundred m radius area around the project site. Thus the impacts on wild-life will be confined more or less to this area and is not expected to have significant impact on the overall ecology of the area.
- Emissions from plant operation may affect the natural vegetation around the proposed plant.
- The threshold limit for continuous exposure of SO_2 on plants is about 50 µg/m^3 and that for NOx is 100 µg/m^3 (Env. Engg., Chapter 7 by H. S. Peavy, D. R. Rowe, G.T. Chobanoglous. Mc.Graw-Hill Book Co.1986). The level of air pollutants due to operation of the present project will be much below the above said level, and as such it is expected that the natural vegetation in the area will not be affected. So, as far

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as agriculture crops are concerned, as they will remain in the field for three to six months only, the impact on the same is also not anticipated.

Mitigation Measures

- The proposed expansion activities are taking place within existing RINL steel plant premises and all care will be taken to avoid tree felling / clearance of vegetation until absolutely necessary.
- All technological measures to minimise air emissions, generation of effluents (including contaminated storm water) and noise generation have been incorporated in the design of the proposed plant.
- An elaborate green belt / cover is envisaged within and around the plant to ameliorate the fugitive emissions and noise from the operation of the proposed plant.
- The proposed project is designed for maximum re-circulation and no effluent will be allowed to be discharged out of plant premises. Effluents generated at the project water will be treated and treated effluents will be re-used and recycled within the steel plant itself. Thus, there will be no impact on the ecological components of surface water bodies in the area.
- Overall the ecological features of the study area will hardly be affected due to the proposed plant.

Mitigation Measures for Reducing Impacts on Faunal Species

- Direct Disturbance: A tall masonry boundary wall has been erected all around the site so that no large animals can enter the project site. Further, a green belt erected within the boundary all around the plant area will further reduce the impact of direct disturbance by attenuating fugitive emissions and noise.
- Noise: The maximum noise generation at the project site will be about 85 dB(A). The nearest plant boundary is ~300 m from site of COB-5. Without any attenuation, this 85 dB(A) will reduce to 59 dB(A) at the nearest habitation. The net increase in noise level at the nearest plant boundary will be about 2.5 dB(A) over and above the existing noise levels that too without any attenuation. In reality, the actual increase would have been much less due to attenuation by the Steel Plant's green belt and effects of sea breezes. Animals are expected to be affected by the slight increase in noise level on account of the proposed COB-5.
- The nearest village Apikonda is ~4.2 km from the site of COB-5. It has been estimated that the noise levels at Apikonda may increase by only 0.1 dB(A) over and above the existing levels on account of the proposed project and tat too without any attenuation. Thus the noise levels at Apikonda will remain unchanged.
- Strong Light during Night: In order to avoid disturbance to the fauna in the nearby forests, it is proposed that all the light posts erected along the boundary wall will face inwards and downwards (with reflectors facing the plant and downwards), so that the light does not spread outside the plant boundary.

4.3 ADDITIONAL MANAGEMENT PRACTICES

4.3.1 Rain water Harvesting

The maximum water consumption of Visakhapatnam Steel Plant (VSP) at 7.3 MTPA expansion is estimated around 45 MGD. At present, the water requirement of VSP is met from Yeleswaram Reservoir through a 153 Km long open canal and is stored in Kanithi Balancing Reservoir (KBR) at VSP. Because of severe scarcity of water being faced by VSP, it was planned to collect & utilize the rain water in various diversion channels inside VSP, which is presently going into the sea.

Two rain water harvesting pump houses are envisaged to recover water from diversion channels, one near 18 MLD treatment plant and the other behind police station in Kanithi Road. Capacity of each pump house is 8500 m^3/hr and total lifting capacity is 17000 m^3/hr. During the rains, the rain water will be directly collected & lifted into the reservoir (KBR).

Pump House at 18 MLD consists of six (6) pumps: Four (4) Nos of 1750 m^3/hr, one (1) No 1000 m^3/hr and one (1) no. 500 m^3/hr capacity. Pump House behind Police Station in Kanithi Road consists of six (6) pumps: Four (4) Nos of 1750 m^3/hr, one (1) No 1000 m^3/hr and one (1) no. 500 m^3/hr capacity.

Two (2) no.s of Rain water harvesting ponds are also envisaged under this scheme – one near 18 MLD pump house (0.2 Mil CuM) and another near pump house behind Police Station in Kanithi Road (0.2 Mil CuM), to collect any excess water which cannot be lifted directly into the reservoir. As per the average rain fall data for the year 2005 to 2009, approximately 5.48 Mil CuM of water can be collected/recovered per year from both the pump houses.

Total cost of the project is Rs 11.75 crores and annual savings by rain water harvesting is Rs 7.0 Crores approx considering Rs 13.00 per CuM, which is being paid to state government. Other benefits of the RWH system include-

- Useful recovery and utilization of rain water
- Alternate source of availability of 3.36 MGD of water.
- Avoiding of flooding in the down streams

The location of the Rain water harvesting facilities are shown in **Figure 4.7** below.

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Fig. 4.7 : Location of Rain Water Harvesting Facilities

4.3.2 House Keeping

Proper housekeeping is the key to proper environmental management. This creates proper working environment for the work force and safe working conditions. VSP has taken up a massive drive for improving the house keeping conditions. Initial results have been encouraging. However efforts are on to improve the condition further. The following are a few examples:

- Regular cleaning of plant roads to avoid accumulation of dust/garbage
- Regular cleaning of shop floors
- Endeavoring to keep all dedusting systems in perfect conditions
- Keeping plenum ventilation systems of premises in perfect working order to avoid accumulation of dust on equipment inside the pressurized room. The air filters must be regularly cleaned.
- Keeping air conditioning plants in perfect running conditions for control/ instrumentation rooms.
- Raw materials spilled from the conveyors at the junction houses will be recovered and put back on the conveyors / raw material handling system.
- The Materials Management Department will undertake an exercise for identifying / inventorising all condemned equipment (including vehicles, wagons, machinery etc.) steel structurals, wire ropes etc. inside the plant. Of these, the ferrous material will be salvaged / recovered and utilized in the plant (as scrap in the Steel Melting Shop). The non-utilisable scrap will be auctioned off.
- Encouraging gardening inside steel plant units and in township.
- Maintaining adequate green belts inside and along the plant for not only suppression of

noise and pollutant transportation but also aesthetics.

- Proper functioning of pollution control systems to minimize dust fall on plant and outside areas.
- Proper control of fugitive dust from sources inside plant including open stockyards.
- Avoiding accumulation and dumping of wastes and damaged equipment and items anywhere inside the plant affecting aesthetics.
- Developing a positive outlook in the employees for keeping the work place, both in factory, office or laboratory, clean and well maintained.
- Maintaining hygienic conditions in areas like canteens, near drinking water sources and toilets.

4.3.3 Green Belt Development

Green belt, is an important sink for air pollutants, it also absorbs noise. Enhancing green cover not only mitigates pollutants but also improves the ecological conditions / aesthetics and reduces the adversities of extreme weather conditions. Trees also have major long-term impacts on soil quality and the ground water table. By using suitable plant species, green belts can be developed in strategic zones to provide protection from emitted pollutants and noise.

Plant species suitable for green belts should not only be able to flourish in the area but must also have rapid growth rate, evergreen habit, large crown volume and small / pendulous leaves with smooth surfaces. All these traits are difficult to get in a single species. Therefore a combination of these is sought while selecting trees for green belt.

The green belt should be planted close to the source or to the area to be protected to optimize the attenuation within physical limitations.

The green belt / cover will serve the following purposes:

- Compensate the damage to vegetation due to setting up and operation of the proposed plant expansion.
- Prevent the spread of fugitive dust generated due to project and allied activities.
- Attenuate noise generated by the project.
- Reduce soil erosion
- Help stabilise the slope of project site.
- Increases green cover and improve aesthetics.
- Provide habitat to small reptiles (garden lizards, geckos, agamid lizards), mammals (squirrels, shrews) and birds

a) Existing Green Cover / Plantation

The existing project have already developed green cover / plantation in strategic location as given in **Table 4.8**. However, additional green cover has been planned for the coming years.

For the year 2017-18, RINL has planted 88348 no. of trees and till July 2018 another 8000 Nos trees are added.
Apart from this, RINL has taken up large scale plantation in the peripheral such as Lamerthy Village, Agnampudi Village, Gangavaram, Deshpatripalem, Balacheru Gate and GVMC Areas.

Parliamentary Standing Committee on Science and Technology, Environment and Forest in 2011 advised PSUs and other industries in Visakhapatnam to take up massive plantation

drive under Green Visakha Programme. The total target for Visakhapatnam as a whole was 40 lakhs trees to be planted in GVMC area.

The target set for VSP was 4.5 lakhs.

Initially it was stipulated that entire plantation programme will be outside the industry area i.e., outside VSP area. However, as per District Collector, Visakhapatnam instructions industries should take up 50% of the plantation in their area and balance in outside their area.

Status of plantation as on date is given in **Table 4.11.**

Table 4.11 - Status As On Date

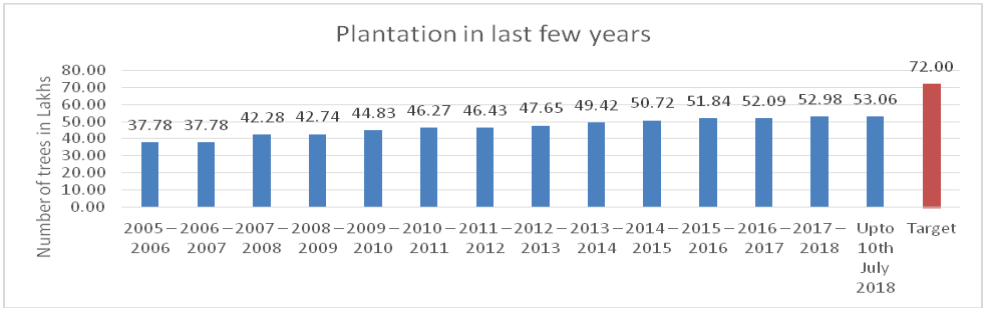
Sl. No.	Year	Target	Planted as on date		Total	Balance target	
			Outside	Inside			
1.	2012-2013	25000	25000	Avenue	25000	Nil	GVHC area panwada – 67.5 Ha.
2.	2013-2014	75000	75000	-	75000	Nil	
3.	2014-2015	100000	100000	-	100000	Nil	
4.	2015-2016	125000 (Inside)	-	150400	150400	-25400	
5.	2016-2017	125000 (Outside)	2000	-	2000	123000	AU
	Total	450000	202000	150400	352400	97600	
Plantation during the Month of June 2018 = 2000 saplings							

The area and number of trees made during the last few years is given in **Table 4.12**. Plantation made during the last few years is also shown in **Fig 4.8.**

Table 4.12 : Area and number of trees made during the last few years

Sl. No.	Description	Details
1.	Area earmarked for Green Belt	1970 Ha.
2.	Area available for afforestation (after utilizing for expansion the Plant)	750 Ha.
3.	Total area	2720 Ha.
4.	Total Number of Plants Planted up to 2017 – 2018	5297688
GREEN BELT	Plantation of trees all around the VSP land Boundary to a width of 500 Mtrs.	
Total Plantation Programme		7,200,000
Total Plantation by end of May, 2018		5303240
Total Plantation by end of June, 2018		5305720
Balance to be achieved		1894280

Fig. 4.8 : Plantation made last Few Years



RINL has dedicated department having experts in developing green belt.The plantation have been selected on the basis of soil quality, place of plantation, chances of survival, commercial value (timber value, ornamental value, etc.), etc. The type species and surveyed plants location wise are included in the following tables **Table 4.13 & 4.14**.

Table 4.13 : Type of species planted and number of plants planted

Sl. No.	Species	Number of Plants Planted	Remarks
1.	*Casurina equisetifolia*	2453257	To effectively combat TUSNAMI attacks and to act as Wind barriers during Cylones, as the Plant is located in close proximity to Sea.
2.	*Acacia auriculiformis*	534088	To contain Air Pollution and for Carbon Sequestration.
3.	*Eucalyptus spp.*	947475	
4.	Miscellaneous	743722	
5.	Mango	29441	
6.	Coconut	8318	
7.	Cashew	46888	
8.	Guava	5561	
9.	*Salvadora*	12000	
10.	Neem	44314	
11.	Babul	31362	
12.	Teak	1814	
13.	*Borassus flabellifer*	50000	Naturally grown
14.	*Pongamia pinnata*	140000	To produce Bio-Diesel
15.	*Jatropha spp.*	255000	
	TOTAL	**5303240**	

Table 4.14 : Total number of surveyed plants Location wise

Sl. No.	Location	Total Plants	Surveyed Plants	Add new
1.	(vsgh) aganampudi rd.	755	510	
2.	Aganumpudi	0	0	57000
3.	Apiic gajuwaka	710	0	
4.	Apikonda area	7800	7000	
5.	Apperal park	1776	1510	
6.	Avenue plantation	3176	2500	
7.	Boddapuvanipalem hill	16440	11907	

8.	Bypass road gantyada	720	300	
9.	Chitanya public school sector-12	6000	10800	
10.	Gangavaram bc road	1251	0	
11.	Gangavaram port road	1027	0	
12.	Gvmc & barial ground gajuwaka	69	50	
13.	Hb.colony gantyada	676	0	
14.	Jagannath temple sector – 8	1000	860	
15.	Main approach rd vadlapudi	520	450	
16.	Mro office & police station opposite hill	33488	25863	
17.	Near temple sector – 12	5000	4450	
18.	Nehru marg chaitanya school	1162	1110	
19.	Outside pherphery plant	1161	980	
20.	Pakeertakia	1650	1354	
21.	Paravada hill – 1	8000	6800	
22.	Paravada hill – 2	35000	32800	
23.	Police station road gajuwaka	1020	400	
24.	Rajeev nagar phase 1 & 7	6421	4921	
25.	Rajeev nagar phase 6	1814	0	
26.	Rly. Gate to main gate side wall	1702	1620	
27.	Sai baba temple sector – 2	2000	4000	
28.	Schools & vuda colony	211	0	
29.	Sector – 12 areas	11074	0	
30.	Sector – 7	600	600	
31.	Sector – 9	550	980	
32.	Sivalayam sector – 6	5000	10000	
33.	tti	800	800	
34.	Two head hill and small hills	15354	0	
35.	Vadlapudi & jaggarajupeta	2355	1950	
36.	Vennepalem hill	9718	8231	
37.	Zone – 1 area	7000	6000	
38.	Gangavaram block	0	0	30000
39.	Lemerthy	0	0	45000
40.	VSGH inside	0	0	1600
41.	VSGH road	0	0	1060
42.	Telugu talli junction	0	0	6000
43.	DAV Back side	0	0	1600
44.	Zone – 1 Patch			1450
45.	Pragathi Margh patch	0	0	600
46.	DSP Opp	0	0	275
47.	Ukkustadium	0	0	150
Total		**193000**	**148746**	**144735**
Grand Total			**293481**	

As a part of expansion programme and to meet the target of 72 laksh plant RINL shall develop green belt within the plant and outside the plant boundary.

The areas, which need special attention regarding green belt development in the industrial area, are:

- Around Waste Dumps
- Along Plant Boundary
- Avenue Plantation (inside the plant)
- Around Various Shops

- Around Office and Other Buildings
- Stretch of Open Land
- In and Around Township

The species suitable for plantation in various areas are given in **Table 4.15** below.

Table 4.15 –Species suitable for plantation

Species	Suitable Areas
Acacia nilotica	Stretch of Open Land, Around Waste Dumps,
Aegle marmelos	Stretch of Open Land, In and Around Township
Albizzia procera	In and Around Township, Around Office and Other Buildings
Alstonia scholaris	Stretch of Open Land, Around Various Shops, In and Around Township, Around Waste Dumps, Avenue plantation
Anacardium occidentale (Cashew)	Stretch of Open Land
Azadirachta indica (Neem)	Stretch of Open Land, Around Various Shops, In and Around Township, Around Waste Dumps
Bauhinia acuminate	Stretch of Open Land, In and Around Township, Around Office and Other Buildings
Butea monsperma	
Cassia fistula	Avenue plantation, Around Various Shops, In and Around Township, Around Office and Other Buildings
Casurina equisetifolia	Stretch of Open Land and along plant boundaries near sea.
Delonix regia	Avenue plantation, In and Around Township, Around Office and Other Buildings
Ficus religiosa	Stretch of Open Land, Around Various Shops, In and Around Township, Around Office and Other Buildings
Pongamia pinnata	Avenue plantation, Around Various Shops, In and Around Township, Around Office and Other Buildings
Polyalthia longifolia	Avenue plantation, Around Various Shops, In and Around Township, Around Waste Dumps
Swietenia spp. (Mahogany)	Stretch of Open Land, In and Around Township
Tabebuia rosea	In and Around Township, Around Office and Other Buildings
Tectona grandis	Stretch of Open Land, In and Around Township
Terminalia arjuna	Avenue plantation, In and Around Township

b) Post Plantation Care

Immediately after planting the seedlings, watering will be done. The wastewater discharges from different outfalls will be used for watering the plants during non-monsoon period. Further watering will depend on the rainfall. In the dry seasons watering will be regularly done especially during February to June. Watering of younger saplings will be more frequent. Manuring will be done using organic manure (animal dung, agricultural waste, kitchen waste etc.). Younger saplings will be surrounded with tree guards. Diseased and dead plants will be uprooted and destroyed and replaced by fresh saplings. Growth / health and survival rate of saplings will be regularly monitored and remedial actions will be undertaken as required.

The trees will be watered using the effluent from the sewage treatment plant and treated discharges from plant. Plantation will be manured using sludge from the sewage treatment plant. In addition kitchen waste from the town-ship and plant canteen can be used as manure either after composting or by directly burying the manure at the base of the plants.

c) Phase Wise Green Belt / Cover Development Plan

Green belt will be developed in a phase wise manner right from the construction phase of the proposed project. In the first phase along with the start of the construction activity the plant boundary, the township boundary, around the proposed waste dumps, and the major roads will be planted.

In the second phase the office building area will be planted. In the third phase when all the construction activity is complete plantation will be taken up in the plant area where expansion units are coming up, in stretch of open land around the expansion units and along the roads leading to expansion units.

4.4 OCCUPATIONAL SAFETY

4.4.1 Anticipated impacts

The work place is divided in terms of activities e.g. raw material handling, loading, handling of processed raw materials (e.g. calcined lime, coke, sinter), handling of hot metal and molten slag, processing of metal, handling of finished products and wastes etc. . The principal occupational risks in integrated steel plants are:

- Diseases due to dust inhalation
- Exposure to very high temperatures
- Exposure to very low temperatures (in oxygen plant)
- Exposure to toxic and / or inflammable gases
- Working in confined spaces where suffocating / toxic / inflammable gases may be present
- Fire and explosion which may also lead to generation / release of toxic gases
- Accidents during handling of liquid metal and slag
- Accidents during handling of corrosive and / or toxic liquids
- Hearing loss and other disorders due to exposure to very high noise
- Accidents involving various machinery
- Accidents involving electrical installations, including fire
- Accidents in raw material handling area
- Accidents in finished product handling area.
- Accidents involving fall from height
- Accidents involving railway rolling stock and heavy vehicles.
- Accidents during construction, repair and maintenance

The most common safety issues are given in **Table 4.16**.

Table 4.16 - Most Common safety issues

S.NO	NATURE OF HAZARD	SOURCES
1	Fire Hazard	Release/leakage of Oxygen, Hydrogen, Acetylene, CO gas, BF gas, LD gas, Mixed gas, Benzene vapours, Fuel Oil, LSHS, Coal Tar Fuel and Hot liquid metal. Fire in Acetone, Benzene, and Calcium carbide storage.
2	Explosion Hazard	Release/leakage of Hydrogen, Acetylene, CO gas, BF gas, LD gas and Mixed gas.
3	Toxic Hazard	Release of CO gas, BF gas, Mixed gas, and Chlorine.
4	Cold Burns	Exposure to liquid oxygen, liquid nitrogen and liquid argon
5	Asphyxiation	Release of Nitrogen, Argon, Oxygen, CO gas, BF gas, LD gas, Mixed gas

S.NO	NATURE OF HAZARD	SOURCES
6	Fire/Explosions due to Spillage of Liquid Metal	Spillage/Transfer of liquid metal, liquid steel and hot slag
7	Heat Radiations due to coke, hot metal / molten slag Handling	Spillage of hot coke, liquid metal and hot slag
8	Accidents due to Material Handling Equipment	Connected with all Material Handling Equipment's

4.4.2 Management measures

A. Safety Management & Practices in RINL

RINL was the first among the Indian Steel plants to be certified for OHSAS: 18001 Standard for Occupational Health and Safety Management Practices. Continuous efforts on implementation of safety standards, monitoring of Risk Control and other proactive measures have resulted in reduction / elimination of potential hazards.

Safety is a prime concern for RINL and accomplishes its objectives with a motto "We produce Steel with Safety & Zeal". The plant has a dedicated "Safety Engineering Department" headed by the General Manager (Safety and Environment). He is assisted by the Dy. General Manager (Safety). There are around 50 Safety officers under him to look after the safety activities in all the departments. This department regularly scrutinizes, supervises and ensures implementation of safe working practices in various departments of the company.

The implementation of OHSAS: 18001 has facilitated a safe working environment in the organization and has helped in the documentation of Hazard Identification and Risk Assessment for activities in various departments of the plant. Participation of various cross section of employees from all departments was ensured in preparation of Documents, Procedures, implementation and maintenance of the safety system. All the activities of RINL-VSP are identified and Hazard Identification & Risk Assessment is prepared. It has been observed that OHSAS: 18001 implementation has brought significant change in the safety culture and over all standards of Occupational Health and Safety. System is reviewed regularly every month involving all the departmental heads.

Safety aspects are considered in the design stage itself for all the equipment. In spite of that, during process of steel making, many hazards may be encountered. The following are some of the identified hazards:

- Heat, Dust and Noise Hazards
- Chemical Hazards
- Material Handling Hazards
- Burns due to hot metal / Hot objects
- Cold burns
- Slips & Falls
- Fall from Heights
- Gas Hazards
- Explosion Hazards
- Electrical and Fire Hazards

For managing these hazards "Occupational Health and Safety Management System" becomes key function of the top management. RINL manages the above safety and health

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hazards by adopting appropriate control measures to reduce / eliminate hazards for maintaining a safe and healthy environment at work place.

Several safety management practices are being adopted aiming to achieve Zero Accidents and to meet the safety requirements of the company. Important efforts in this direction includes:

B. Implementation of OHSMS:

RINL has successfully upgraded its system from OHSAS 18001:1999 to its latest 2007 version.

- Hazard Identification and Risk Assessment (HIRA) was prepared for more than 5000 activities.
- Training on Behavioural Based Safety Management (BBS) is being imparted to all employees on regular basis.
- Roles, Responsibilities, Accountability and Authority for performing various activities are ear marked and Communication & Consultation is done with all the concerned as part of measures taken to implement the OH&S Management System.
- All OHSMS related documents and records are converted as e-issues and uploaded to VSP intranet portal which can be viewed by every employee for reference. All these documents and records are reviewed at regular intervals and are amended whenever required as part of Preventive and Corrective Actions.

C. Safety Inspections:

- All the identified Contractual Agency Jobs, Shop-Floors and Equipment in various departments are inspected as per the schedule.
- The unsafe points identified or the non-conformances noticed are communicated to the concerned HOD for liquidation. Compliance of the same is monitored by the Zonal Safety Officers.
- Safety during all the major repairs and capital repairs is monitored round the clock and safety officers are deployed exclusively for this purpose.
- All the height related jobs performed by the qualified workers are closely monitored to ensure safety. Usage of certified safety appliances like safety belt and safety net are ensured while executing such jobs.

D. Safety Training:

Safety Engineering Department conducts Safety Training Programmes for all regular employees / contractual workers of RINL-VSP at various levels to inculcated safety awareness. About 20,000 nos. of regular/contractual employees undergo training on several subjects of safety every year.

Special Training Programmes by external safety experts on various topics are being conducted on different topics such as Material Handling, Legal awareness on Safety Implementation of The Factories Act, Electrical Safety, BBSM, Road Safety, First Aid etc.

Regular Employees Training

The safety programs include General safety, Safety in Material Handling, Gas Safety, Electrical Safety, Fire Safety, Crane Safety, OH&S Management, Conveyor Belt Safety, Safety during welding, safety with rotating equipment, etc.

Special Training Programmes by external safety experts on various topics are also being conducted in co-ordination with Management Development Centre and Technical Training Institute.

Contractor Workers

- Once in a year, refresher safety training is imparted to all the contractors' workers and their safety passes are renewed only after such training. Training material/literature in local language is distributed to all the workers during safety training.
- Only those workers, who have undergone Job Specific and Site Specific Safety Training, are permitted to work at site only those.
- Special safety training programmes on Gas Cutting, Welding, and Conveyor Belt Safety are conducted regularly.
- Height test is conducted for workers to work at heights and safety precautions to be taken during painting and roof sheeting jobs etc. are also imparted from time to time.

E. Focus on Behaviour Based Safety Management

- Behaviour Based Safety Management (BBSM) training is being imparted during the one-day training programs which are being held 4 times a week at Suraksha Bhavan and monthly once at Technical Training Institute (of RINL) to bring attitudinal change towards safety and to inculcate improved safety culture in the employees.
- In addition to the above, Behavioural Based Safety (BBSM) training was imparted for all the employees of various departments at their premises.

F. Safety audits:

OHSMS Internal Audits are conducted once in a quarter in all major departments to improve the safety performance. Surveillance Audits are being conducted once in six months by an external certifying agency M/s. BVCI to assess the functioning of the system of safety in various departments of the plant.

Safety Audit is being conducted once in six months by the respective Zonal Safety Officers in all the major departments and the Safety Audit is conducted by a third party external experts once in a year as a part of the legal requirements.

G. Emergency Preparedness:

On site emergency mock drills are conducted to test the emergency preparedness for fire, electric shock, gas leak, rescue from heights, burn injuries in departments as well as plant level. 260 departmental mock drills are conducted every year. Two plant level mock drills are being conducted in a year in the presence of the Factories Dept Officials, to know the preparedness of the rescue operations.

H. Safety committees:

The steel plant has a Central Safety Committee. The Committee has 60 members of whom half are workers' representatives and the rest are representatives of the Management. The Central Safety Committee's responsibility is to assist and guide the management in implementing Health and Safety measures effectively throughout the organisation. The Committee meets once every quarter. The points raised by the members are addressed on priority basis.

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In addition there are 30 nos. Departmental Safety Committees in the plant to discuss on Safety issues pertaining to their respective departments. Departmental Safety Committee meetings are held once every month.

I. Equipment Safety:

Equipment safety was properly addressed and was given due attention during its design stage itself. Safety devices like inter-locks, limit switches, battery backup system, emergency push buttons, safety valves, route relay inter locking for rail traffic, pull cords, earth fault protections, flame proof electrical fittings etc. are provided in the plant and their functioning is tested periodically and necessary corrective actions are taken.

J. Fire Safety:

In RINL-VSP is provided with two fire stations. It has 4 water tenders, 5 foam tenders, one DCP tender and one hydraulic platform (41m), trailer pumps, water monitors to fight any type of fire. A large number of fire extinguishers are provided throughout the plant and are inspected at regular intervals. There are more than 200 nos. of trained, competent & experienced Fire Fighting Personnel. The plant is equipped with all contemporary fire fighting and preventing facilities.

Extensive network of fire hydrant points (580), landing valves (>2000) and fourteen Fire Fighting Pump Houses are in place. More than 395 Nos. of Central Manual Call Points (CMCPs) and Fire Detection and Alarm (FDA) systems are installed in all major production departments and fire sensitive areas to inform the Fire Wing in the event of any fire mishap and request necessary assistance. Fire Fighting extinguishers (8025 Nos.) of all types like, CO2, Water, Foam and DCP are available in all the departments for minimizing damage by dealing with the fire immediately.

K. Protocols:

Protocols have been prepared for all critical jobs like, jobs in confined spaces, jobs near gassy areas, underground drains, etc. where prior permission from other departments is required to undertake any work. The role/responsibility of each dept./officer is defined and indicated on these permits till safe completion of the job.

Special drives are conducted for monitoring the implementation of Permit-To-Work and Shut-Down systems and usage of PPEs etc.

L. Gas Safety

- Gas Safety is given top most priority at RINL.
- Periodic Inspections are carried out in the Gas equipment and pipe lines.
- Regular monitoring of gas leakages in the gas prone areas.
- Gas detectors are provided at vulnerable areas.
- On-line CO gas analyzers installed at gas prone control rooms.
- U - Seals are provided in gas lines for better isolation.

M. Road Safety:

Road safety indeed is a matter of concern for RINL. Company has been continuously creating awareness on safety among the employees and contract workers. To prevent road accidents, various initiatives are taken like Awareness Campaigns, Road safety week celebrations, Special Road Safety training programs, Speed barriers, Speed Breakers, Signals Lights, Speed Limit Boards etc.

N. Personnel Protective Equipment (PPE):

The PPE provided in the plant are

a) Protective helmets
b) Safety boots.
c) Dust masks, canisters etc. for respiratory protection
d) Ear plugs , ear muffs etc. for noise protection
e) Goggles, spectacles for protection of eyes.
f) Safety belts, Safety harnesses for protection against falls.
g) Canvas gloves, Leather gloves, PVC gloves, Rubber gloves etc. for Hand protection
h) Aprons for Body protection.
i) Heat resistant Coat-Kevlar aluminium suit.
j) Molten metal resistant jackets and trousers
k) Molten metal resistant gloves-Kevlar gloves;
l) Face shields or vented goggles;

Appropriate safety PPEs such as Safety Helmet, Safety Shoes, Goggles, Hand gloves, Aprons, Safety belts, Nose Masks, Ear Muffs etc. are provided to all employees as per the requirement at work place. The usage and importance of these appliances are being communicated through workshops and classroom training. Safety personnel carry out regular inspections to enforce the use of appropriate PPE.

The Safety Engineering Department is responsible for the purchase and issue of all PPE. PPE are distributed to both company employees and contractors' employees. If any PPEs are damaged before their scheduled replacement, fresh equipment is issued.

O. Accident Investigation:

All the incidents/accidents of the plant and near miss cases are discussed in all Departmental Safety Committee meetings and remedial measures are implemented wherever such situation exists. As a pro-active measure, all major accidents happening in other steel plants are discussed and remedial measures are implemented wherever similar situation exists in our plant.

- Root cause analysis is carried out to prevent the recurrence.
- All Near Miss Incidents & Reportable Accidents - Jointly analysed by central and shop floor Officers
- All Road Accidents - By a team of Safety, Personnel and Concerned dept.
- Fatal & Fire Accidents - By a Standing Committee
- Recommendations are ensured for compliance.

P. Budget for safety.

The annual budget for procurement of PPE, conducting safety trainings, safety audits and safety promotional activities is around Rs.8.0 Crores.

4.5 OCCUPATIONAL HEALTH

Presently, occupational safety and health surveillance of the plant's workforce is being undertaken by RINL's Occupational Health Services and Research Centre (OHS&RC).

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Occupational Health Services and Research Centre (OHS&RC) is provided with state-of-the-art equipment for carrying out activities like periodical medical examination, industrial hygiene surveys, toxicological evaluation etc. The unit is manned with two qualified OHS specialists, one toxicologist and trained paramedical staff. The In-Charge of the OHS&RC is a M.B.B.S doctor with M.D. degree and is an AFIH (Associate Fellow of Industrial Health), which is a Statutory requirement as per Indian Factories Act.

The steel plant has a 150 bedded hospital - Visakha Steel General Hospital (VSGH) located in the plant's township. VSGH is manned by about 100 doctors (which includes 40 specialists) and around 200 paramedical staff.

Two first-aid stations are located in the plant, functioning round the clock with qualified doctors, paramedical staff and ambulances.

All employees undergo a Pre-employment Medical Examination followed by a Periodical Medical Examination (PME). The periodicity of the PME as per the workers' deployment is given in **Table 4.17**.

Table 4.17– Periodicity of the PME

Departments	Periodicity
All workers in Benzol plant section of CO&CCP	Half Yearly
CO&CCP, BF, SMS, SP, TPP, RMHP, CRMP, Foundry unit of engineering shops, RED, and EMD, departments of Works division	Once every Year
All other departments of works division	Once every 3 Years
All departments of non-works division	Once every 5 Years
All canteen contract workers	Once every Year

1. General Physical Examination
2. Chest X-ray
3. ECG
4. Eye tests (Activity tests – Power, Colour blindness etc.)
5. Hearing tests with tuning fork (Audiometer being procured)
6. Detailed blood examination including blood sugar, blood urea, serum creatinine.
7. Urine examination.
8. Liver function tests are carried out in doubtful cases only.

Health records of employees are stored safely for periodic retrieval and analysis. A specific coding system has been developed and followed for efficient and systematic placement. The historical employee health data is also stored in soft form and is linked to online system.

Improvements in the system of PME of employees include:

1. Well-defined periodicity communicated to all departments
2. Daily quota fixed for each department.
3. OHMS periodically reviewed and revised.
4. Facility for departmental Coordinators for feeding Online nominations & receiving list of attended employees
5. Monthly feed-back to HODs & review in the ED (W) Coordination meetings.
6. Facility for communicating test abnormalities to employees through Employee Information System (EIS) and through online report to the respective departmental coordinators. (which facilitates regular treatment and follow up of employees with abnormal health reports)
7. MIS Modules for preparing reports and analyzing data.

8. Incorporation of Department Code numbers in registration module for easy identification of employee's department and for easy retrieval of employee's health record.
9. Special MIS Module developed for evaluation of monthly coverage of departments against the quota given.

OHS statistics for the past 3 years are given in **Table 4.18.**

Table 4.18 – OHS Statistics for the past 3 years

Year	MMP coverage	Industrial Hygiene Surveys	Crane Operators Eye Examination	No. of employees covered under health education
2017-18	9562	345	1739	6030**
2016-17	10122	349	1647	5840
2015-16	9442	356	1443	6220
*** Special classes on yoga awareness conducted at shop floors*				

The Occupational Health Services and Research Centre's activities include: .

- Man Maintenance Programme (Periodical Medical Examination which includes Spirometry, Audiometry, Eye examination, Tetanus immunization, Chest x-ray, Laboratory investigations, clinical evaluation and treatment by doctor)
- Toxicological Evaluation
- Statutory Eye examination of crane operators & Heavy Equipment operators
- Treatment / Referral to VSGH / Individual counseling of employees for abnormalities identified in Periodical medical examination as a part of remedial measure.
- Continuous Coordination with Head of WORKS for implementation of administrative and engineering measures for prevention and control of Occ.Hazards.
- Maintenances and analysis of Health Records
- Daily orientation on Preventive Health & Yoga as part of Periodical Medical Examination
- Co-ordination of Emergency Medical care services
- Implementation of BIOMEDICAL WASTE Management Rules.
- Replenishment of First Aid Kits to all departments.
- Industrial Hygiene Surveys
- PPE Surveys and Counseling's to employees to use PPE'S regularly.
- Counseling's to employees with habits of smoking, alcoholism, anxiety and depression
- Ongoing Health Education Programme (class-room & shop-floor based)
- Orientation and awareness training on Occupational Health
- Training in First Aid & Emergency Care
- Consultancy services and faculty support to neighboring industries on Occupational Health.
- Orientation on OH to final MBBS students, Post graduate students and Multipurpose Health Worker training students.

4.6 CORPORATE SOCIAL RESPONSIBILITY

RINL since inception laid utmost importance on societal and environmental concerns and in the forefront of addressing the societal needs of its business activities. While employing State-of-the-art technology for achieving lower pollution levels coupled with energy efficient operations adequate concern and commitment has been demonstrated to help the society.

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Even prior to the Rules/guidelines on Corporate Social Responsibility, RINL had been taking several steps for development of the peripheral areas surrounding the Steel Plant at Visakhapatnam, including provisions for drinking water supply, education, Health care community infrastructure, etc.

Guided & inspired by the objective of enhancing the living standards of the people, VSP had launched various community development programs through its CSR Department. RINL-Vizag Steel Plant has always treated its periphery as a key stakeholder. The main objective of VSP's Community Development Programme has been to create synergy and synthesis with the environment.

Subsequent to the enactment of the Companies Act, 2013 and the notification of the CSR Rules, 2014, RINL has taken the following steps:

- The RINL CSR and Sustainability policy has been formulated in line with the Companies Act 2013, CSR Rules 2014 and the DPE guidelines, 2014. CSR initiatives in RINL are taken up as per CSR policy of RINL which is approved by the RINL Board. A CSR Committee headed by Independent Director is in place.

- As per the statute, in every financial year, it is required to spend atleast 2% of the average net profits during the preceding fiscals on CSR endeavors. In terms of RINLs CSR & Sustainability Policy, the Board Sub-Committee (CSR Committee) recommends to the RINL Board for approval, the budget and the broad CSR activities to be carried out. Though RINL is not obligated to spend statutorily during the last two years due to losses on account of downturn in steel industry, CSR budgets are allocated to sustain the momentum of CSR projects/programmes/activities, which have significant social & economic impact.

- CSR activities are mostly concentrated in peripheral areas of the plant and areas which either have a presence of the company or are in the vicinity of the Branch offices, stockyards, Liaison offices, etc. Projects/initiatives are also taken up on request made by District Administration, State Govt. Departments, and elected People's Representatives at various fora. CSR activities undertaken are in line with activities stipulated under Schedule VII of the Companies Act, 2013, such as eradicating hunger, poverty and malnutrition, preventive health care, availability of safe drinking water, promoting education, vocational skills, empowerment of women, environmental sustainability, promotion of rural sports, rural development projects, etc.

- CSR initiatives are taken up through a process which involves projects identification through baseline survey and/or on the basis of proposals received from various voluntary agencies having relevance to societal needs, outlay, beneficiaries, each and coverage, as stipulated under Schedule VII of the Companies Act, 2013.

- CSR Policy and activities taken up in every financial year are also uploaded into Company's website and is available under a separate icon 'CSR'.

VSP's expenditures under CSR in the last 4 years under different focus areas as given in **Table 4.19** below.

Table 4.19 : VSP's expenditures under CSR in the last 4 years & current year

Year	Amount spent (in Rs. Lakhs)
2014-15	1403
2015-16	873
2016-17	853
2017-18	960
2018-19	702 (Dec'18)

Bringing cheers to the most marginalized local stake holders in and around Steel Plant is the main objective of VSP which is being fulfilled through CSR activities. The main focus of CSR activities are on-

- Health Care
- Education
- Skill Development
- Environment care
- Rural Development
- Sports
- Sanitation
- Swachh Bharat

4.6.1 Health Care

- **Cochlear Implantation:** In order to promote the noble cause of rehabilitating the poor children with hearing impairment, Cochlear, an electronic medical device that replaces the function of the damaged inner ear was implanted to four children through ALIMCO. The cochlear implantation was successfully implanted for four children belong to Visakhapatnam district. The surgery made them enable to hear speech at a nearly normal level.

- **Infrastructure to Govt. Hospitals -** Two ambulances were provided to District Hospital, Sidhi and Sub- health centre, Bahari of Sidhi District, one of the tribal districts of Madhya Pradesh. Smt. Riti Pathak, MP (Lok sa bha) flagged off the Ambulance provided to Dist Hospital Sidhi.

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- **Support to HIV/AIDS infected/affected children** - DESIRE Society is actively involved in providing Institutional Care Home (ICH) services to HIV/AIDS infected/affected children at Gajuwaka. The Society takes care of these children (one or both parents died with HIV) by providing their everyday medication, nutritive food and education. With a view to support the noble cause, A TATA Winger Van was provided to DESIRE Society for transportation of these children to Hospitals for medical aid as well as for schooling purpose. In addition to the above, a washing machine was also provided to the centre for the benefit of children.

- **Nethra Jyothi** - A State of the Art Mobile Eye Clinic 'Nethra Jyothi' has been donated to 'Visakha Eye Hospital Trust', Visakhapatnam. This Mobile Van equipped with latest technologies for diagnosing various eye diseases, is being run by doctors of 'Visakha Eye Hospital Trust'. This has been serving the rural people of Visakhapatnam, Vizianagaram and Srikakulam Districts. Free, cataract surgeries have been performed benefiting 813 beneficiaries, who are under Below Poverty Line through this project during the year. Eye camps were also organized in the peripheral villages of Jaggayyapeta Lime Stone Mines and Madharam Dolomite Mines.


- **Support to Homeless** - A van was provided to Association for Urban and Tribal Development, managing Night shelters of GVMC through Visteel Mahila Samithi an extended arm of RINL CSR. The vehicle is utilized for rescue operations & collection of material. The homeless staying on the foot paths and other areas in the city are identified and provided with food & shelter by the Association. They are also be encouraged to do work and earn their livelihood.

- **Health Camps** - Medical camp was organized at Budawada, a surrounding village of Jaggayyapeta Limestone Mines (JLM) and Bongaram, tribal village at Peda Bayalu in Visakhapatnam District. Free medicines were given to the patients during the camp.

- **Artificial Limbs to Differently abled** - Artificial limbs, wheel chairs and tricycles were distributed to the 80 differently abled persons, Anakapalle, Visakhapatnam.

4.6.2 Education

- **Siksha -** With a strong belief that education is a catalyst for social change, free education is being provided to around 1600 children belonging to Below Poverty Line (BPL) families from the surrounding villages of Plant & Mines. The project creates a tangible impact in the lives of the economically disadvantaged since majority of the beneficiaries of this project are first generation learners.

- **Arunodaya Special School:** A multi-category School/centre, caters to children with learning impairment, mental retardation, cerebral palsy, autism, hearing loss and other

learning disabilities. The main objective of the school is to make these children learn to manage/behave themselves and also to make them self-dependent by sharpening their inherent talents.


- RINL extends support to this school and free education including vocational training and therapy was provided to around 100 differently abled children from the surrounding villages every year.
- A new school bus was also provided for meeting the transportation requirement of the Special children from the nearby villages to the school and back.

- Mr. MNDRK Chaitanya & Mr. LV Teja students of Arunodaya Special School, won gold medals in aquatics (swimming) competition in the National Games for all disabled held at Gandhi Nagar Gujarat & in Cycling in the National Special Olympiad held at Ranchi respectievely.

- **Pathashala ki Aabharanam -** With a view to address the infrastructural deficit in the schools, RINL has provided 700 three seater dual desks to Zilla Parishad High schools at Chandrampalem and K. Koppaka, DPN ZPH School, Kasimkota and ZPH school Kannurupalem in Visakhapatnam District and ZPH School at OV Peta in Srikakulam District.

- **Vivekananda Vidyarthi Nilayam -** A Hostel building was constructed for students belonging to 'Girijan' community at Yendada, Visakhapatnam through Andhra Vanvasi Kalyan Ashram. This project is intended to address the constraints faced by tribal students who are pursuing higher education at Visakhapatnam City.


- **Chethana -** Chethana is a six month Adult literacy programme, intended for providing basic education for adults who have lost the opportunity and crossed the age of formal education. This program was taken up at 15 centres located in surroundings villages of Plant & 5 tribal villages of Visakhapatnam District. The programme has benefited 500 adults. Certificates were awarded to those who completed the course successfully.

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4.6.3 Skill Development

- **Skill Development to Divyangjan** - With a view empower the disabled to have better standards of living, RINL Provided Skill development ptoram for 100 Divyangjan (People with Disabilities) residing in the surrounding villages of the Plant and other areas of Visakhapatnam in various Skills viz. Tailoring, Computer Data Entry Operation, Beautician and Mobile Handset repair. The programme immensely benefitted the Divyangjan for their livelihood.

- **Saksham** - To empower the unemployed youth with the skills for earning a decent livelihood, Vocational training programmes in various trades viz. Mobile repairing, Arya works, Solar equipment repairs & maintenance, LMV driving, Cutting & tailoring and Beautician course were taken in 10 centers and completed benefitting 300 youth residing in the Rehabilitation colonies & Nadumveedhi a tribal village of Visakhapatnam District and Garbham Mines area. Certificates were awarded to those who have successfully completed the training programme.

4.6.4 Environment Care

- **Green Visakha** - Block plantation of 75000 saplings was taken up under Green Visakha project at Gangavaram (30000) and Lemarthi (45000).

- **Surya -** Provision of street lights in villages will alleviate the life style of the villagers and would bring improvements in their quality of life. RINL Installed 75 Solar street lights in Kheri Saffa (25) and Kharak Bhura (50) villages of Jind District of Haryana.


4.6.5 Rural Development

- **Ukku Kalavedika Gangavaram** - Multipurpose hall constructed at Gangavaram was inaugurated by, Dr. K. Haribabu Honorable MP Visakhapatnam in the presence of Shri. Palla Srinivas Rao, Honorable MLA Gajuwaka, CMD and Directors. The hall was put into operation for the benefit of villagers through Community welfare Centre, Gangavaram. The two floor building constructed at a cost of Rs.1.50cr will serve the residents of RH colony & its surrounding villages for conducting social functions and other skill development programmes.

- **Development works at Chepaluppada Village -** Project for providing Under Ground Drainage (UGD) and BT Road was taken up Chepulapada village, Bheemili of

Visakhapatnam district. Shri M Venkaiah Naidu, Hon'ble Vice President of India laid foundation stone for the above project which was taken up for the comprehensive development of Chepulapada village near Bheemili, Visakhapatnam District.Advanced Specialised Physiotherapy Training.

- **Construction of Community Hall** - A community hall was constructed at Seethanagaram Village, Anakapalli Mandal, Viskahpatnam district under rural development activity. Further construction of a community hall at Sahjadpur village of UP was also taken up in collaboration with MSTC

- **Roof sheeting work for cyclone affected houses in slum areas of Visakhapatnam -** Roof sheeting work for Hud-hud cyclone affected houses in slum areas of Greater Visakha Municipal Corporation was taken up through the funds provided by NMDC.

- A.C. sheets were fixed to 4769 beneficiaries houses in 40 wards of GVMC as per the list provided by District Administration

4.6.6 Sports

- **Promoting Sports for Special Children -** Sports for Special Children was organized every year aiming at boosting the confidence levels of the Special children also to provide a platform for the children to showcase their talents. Various special schools in Visakhapatnam Dist. & Vizianagaram Dist. participated in the meet. Around 250 children studying in Special schools of Visakhapatnam District along with 50 teachers and staff have Participate in the event and won appreciation from all quarters.

- **Financial Assistance to disabled sports person -** Access to quality training is an essential factor which plays a key role in the success of any sports person. RINL as a CSR initiative has provided a financial assistance to Shri Jeet Kumar, a para athlete to help him take up intensive coaching for three months in Power Lifting (Bench Press) and achieve better results in the Inter Ministry Bench Press tournaments. Further, the above training enabled him to fine tune his skills to achieve success in the international Paralympic event. The cheque was presented by Hon. Minister of Steel.

4.6.7 Sanitation

- **Installation of RO Water Plants -** Shri P Madhusudan, CMD, RINL has inaugurated the RO Plants at Islampeta, Madeena bagh, and Desapatrunipale surrounding villages of the plant in the august presence of Bandaru Stayanarayana Murthy, MLA Pendurthi. The RO Plants with a capacity of 1500 liters per hour, installed through GVMC provides clean

and hygienic drinking water for around 10,000 residents of the above villages and surrounding areas. The plants were handed over to GVMC authorities for operation further maintenance.

- **Supply of Drinking Water to Rehabilitation Colonies -** To ensure access to pure drinking water during the summer months to the residents of four Rehabilitation colonies of VSP i.e. Agnampudi, Gangavaram, Pedagantyada & Vadlapudi, a project to supply drinking water for a period of four months was taken up. Every day 80,000 liters of drinking water was supplied through tankers to the residents of RH colonies.

4.6.8 Swachh Bharat

- RINL organized a mass "Swachhta Pledge" on the occasion of "Swachhta Hi Sewa" campaign in Main Administration Building to highlight the 'Swachhta-Hi-Sewa' campaign undertaken in the country.
- **An exclusive intranet portal "Swachh Bharat @ RINL" -** RINL hosted an exclusive intranet portal christened as "Swachh Bharat @ RINL" to promote Swachhta in the plant.
- The portal is a repository of information on Swachhta activities amongst the employees and departments to showcase exemplary contribution on implementation of Swachh Bharat Abhiyan

- **Contribution to 'Swachh Bharat Kosh' -** In order to strengthen Swachh Bharat Mission and help in achieving the objective of improving cleanliness levels in rural and urban areas, Rs. 50.00 Lakhs was contributd to 'Swachh Bharat Kosh' set up by Govt. of India.

- **Maintenance of Toilets under Swachh Vidyalaya -** RINL provided financial assistance for Maintenance of 86 toilets constructed in 33 schools under "Swachh Vidyalaya". RINL not only funds the activity but also regularly monitoring the maintenance of toilets for better utilisation.

- Installed a Port-a-cabin toilet block at the Simhachalam temple, a historical pilgrim place in south India at Visakhapatnam, for improving the sanitation levels.

- **Construction of Individual Household Toilets in Nedumveedhi Tribal Village -** RINL taken up Construction of 52 nos. of Individual Household Toilets in Nadumveedhi, a tribal village of Paderu Mandalam, Visakhapatnam, as a part of comprehensive development of the village towards a 'Swachh Gram'.
- **Providing Infrastructure for Waste Recycling -** For effective Solid Waste Management, RINL installed a Compost Machine at Simhachalam temple at Visakhapatnam. This automated machine is capable of recycling all kinds of organic waste into compost within 24 hours. The machine has the capacity to convert around 250 Kg of organic waste per day.
- **Renovation of Toilet Blocks at Rangaraya Medical College (RMC), Kakinada -** Construction of new toilet blocks and renovating existing toilet blocks at Pharmacology Department of Rangaraya Medical College (RMC), Kakinada East Godavari Dt. of AP was carried out as part of Swachha Bharat Mission.

Area wise breakup of CSR Expenditure for the last 4 years is given in **Table 4.20**.

Table 4.20 - Focus area wise CSR Expenditure (Rs. Lakhs)

Sl. No.	Focus Area	Sch. VII	2014-15	15-16	16-17	17-18	18-19 Till July'18
1	Drinking Water Supply	i	46.75	42.61	28.57	10.87	9.52
2	Health Care	i	17.58	30.20	209.37	55.22	3.03
3	Sanitation	i	81.17	15.36	26.90	87.56	
4	Education	ii	611.44	586.29	522.97	598.12	180.70
5	Skill Development and Livelihood	ii	11.65	37.79	10.65	37.49	
6	Forest and Environment, Animal welfare etc.	iv	83.43	120.80	11.93	107.12	
7	Protection of Heritage Art & Culture	v	0.00	0.00	18.75	0.00	
8	Sports	viii	0.00	0.00	6.00	4.68	
9	Rural Development	x	44.05	38.14	15.00	55.74	
10	Other Non-project Activities	xii	507.81	2.13	2.54	3.51	
	Total		**1403.88**	**873.32**	**852.68**	**960.31**	**193.25**

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4.7 CORPORATE ENVIRONMENTAL RESPONSIBILITY:

As per the statute, in every financial year, it is required to spend atleast 2% of the average net profits during the preceding fiscals on CSR endeavors. However, though RINL has lost three years consequent losses, spent significant amount towards community development as indicated in **Table 4.15**. These activities are mostly concentrated in peripheral areas of the plant. Also for the current year i.e 18-19 fund allotted about 8.5 Crores.

The investment for the expansion of the plant estimated as Rs. 9439 Crores. As per Ministry's O.M. No. 22-65/2017-IA.III dated 1st May, 2018, fund allocation towards CER would be about 27.5 Crores. Since for the current financial year already allotted 8.5 Crores though it is not obligatory as company is incurring losses, considering this about 19 crores have been allocated for CER activities which will be carried out next 4 years duration. The details of fund allocation and activities for CER are given below **Table 4.21.**

Table 4.21 : Focus area wise CER Expenditure Plan 2019-2023

Sl. No	Sector	Amount to be spent (Rs. Lakhs)			
		2019-20	2020-21	2021-22	2022-23
1	**Promoting Education**				
i	Construction of Additional class rooms in Govt. schools/ institutions	60	60	60	60
ii	Providing duel desk benches to Govt. schools/ institutions	30	30	30	30
iii	Providing infrastructure like digital class rooms, Lab equipments, RO Plants etc.to Govt. schools/ institutions	40	40	40	40
iv	Providing support/facilities to Special Education & Therapy	40	40	40	40
v	Support to education for children belonging to BPL families/ slum areas etc.	80	80	80	80
	Sub-total	**250**	**250**	**250**	**250**
2	**Health Care**				
i	Providing Medical equipments to Govt. Hospitals	20	20	20	20
ii	Providing wheel chairs & adaptive devices to 'Divyangjan'	10	10	10	10
iii	Organising medical/eye camps and providing free cataract surgeries to BPL patients	5	5	5	5
iv	Providing ambulances, stretchers, beds etc to Govt. Hospitals & Primary health centres	15	15	15	15
	Sub-total	**50**	**50**	**50**	**50**
3	**Skill Development and Livelihood**				
i	Providing infrastructure to Skill development centres	10	10	10	10
ii	Organising skill development/vocational training programmes for unemployed youth /women	20	20	20	20
iii	Organising skill development programme for persons with disabilities	20	20	20	20
	Sub-total	**50**	**50**	**50**	**50**
4	**Sanitation & Drinking Water supply**				
i	Installation RO Plants in villages	10	10	10	10
ii	Supply of drinking water in surrounding villages	10	10	10	10
iii	Providing infrastructure for supply potable drinking water in tribal villages	10	10	10	10
iv	Construction of community toilets and toilet blocks in Schools/ educational institutions	10	10	10	10

Sl. No	Sector	Amount to be spent (Rs. Lakhs)			
		2019-20	2020-21	2021-22	2022-23
v	Infrastructure support for solid waste management in the communities etc	10	10	10	10
	Sub-total	**50**	**50**	**50**	**50**
5	**Environment care**				
i	Taking up avenue plantation and Plantation in communities	20	20	20	20
ii	Installation of solar power/lights	20	20	20	20
iii	Providing infrastructure for rain water harvesting, construction of check dams /recharge pits etc	10	10	10	10
	Sub-total	**50**	**50**	**50**	**50**
6	**Rural Development**				
i	Laying roads construction of drains, other infrastructure for development of surrounding villages	25	25	25	25
	Sub-total	**25**	**25**	**25**	**25**
Total		**475**	**475**	**475**	**475**
Grand Total		**1900**			

The major points raised by the public are given below:

- Increase green belt in the surrounding areas to control pollution
- CSR funds to spent in Local Area
- Skill Development programmes to be organized for the youth in surrounding areas
- Safe drinking water to be provided in the surrounding villages
- Local youth to be involved in CSR activities

The above activities indicated in the CER plan is in line with the points that came up in the Public hearing.

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5.0 ANALYSIS OF ALTERNATIVES

The proposed project is Capacity Expansion from 6.3 MTPA to 7.3 MTPA by revamping and augmentation of existing facilities Gajuwaka, Visakhapatnam, Andhra Pradesh. Hence, no alternative sites are considered.

The following alternative technologies and methods are selected and tested to get the best results from the present capacity expansion by revamping and Augmentation of existing facilities.

5.1 SECONDARY METALLURGY

The options that are evaluated for upgradation of the secondary metallurgy are:

- Option-1 - Installation of new ladle furnace
- Option-2 - Installation of two online IRUTs

5.1.1. Option-1 : Installation of Second Ladle Furnace

This option discusses the installation of one Ladle furnace. Installation of online ladle furnace along the Convertor track is not advisable due to the following reasons:

i) Shortage of adequate space adjacent to the Convertor track.
ii) The benefit of the ladle furnace of maintaining liquid steel buffer will be limited as this will block the track and effect operation of the Convertor.

Hence, the option for offline ladle furnace is evaluated. The ladle furnace may be installed on the western side of track of Convertor A.

Major highlights of ladle furnace

Advantages
The installation of one offline ladle furnace will be beneficial in the following ways:

1) Value added steel requiring low oxygen and sulphur content cannot be blown with oxygen in IRUT. The ladle furnace is a possible solution for treatment of these grades of steel. With addition of ladle furnace, VSP may increase production of value added steel.
2) In case of downstream problems, buffer for liquid steel can be maintained for a longer time compared to the IRUTs as there is no blockage of Convertor track.
3) Maintaining required superheat for casting can be done with improved control in ladle furnace.

Issues
The issues related to the installation of ladle furnace are as outlined below:

Logistics of feeding liquid steel:

The liquid steel from the Convertors can only be handled in the distribution aisle (DF bay), as this bay is equipped with 3 Nos. 200+63/20 ton ladle handling cranes. The tundish preparation bay (BD bay) is equipped with 3 Nos. 50/10T cranes.

The cranes of the distribution aisles are mainly utilized for feeding liquid steel to the caster, placing of ladle covers, unloading empty ladle after casting, deslagging the empty ladles, placing on transfer cars for sending to ladle preparation area, transfer of liquid steel to existing ladle furnaces, transfer of liquid steel to the IRUT of Convertor B from A and C, if required and other operational and maintenance jobs as required. The utilization of these cranes is very high with four casters in operation and even more with five casters in operation.

The utilization of the cranes will further increase with the installation of second ladle furnace. The existing ladle furnace has to be kept underutilized due to logistics problems of crane and considerable heats preferred through the ladle furnace have to be taken through the online route of ARS and IRUTs. Hence, installation of second ladle furnace does not appear to be a solution to the problems encountered in the secondary metallurgy area.

Study of alternatives to resolve logistic problems of cranes:

An alternative study was made to resolve the problem of liquid steel feeding in ladle furnace. In this alternative the possibility of liquid steel feeding was checked between LP bay and TP (tundish preparation) bay as shown in the drawing. This will require construction of new aisle capable for 220T crane to feed the liquid steel from the Convertor track to the ladle furnace. The new aisle will be required to be constructed with its own foundation and structures.

The study shows that the maximum crane width possible is 10.5 m. The crane width may be even less if the foundation is seen to be interfering with adjacent underground facilities. Maneuvering of cranes with ladle in such a limited space will be difficult. Moreover, the construction of the new bay will call for relocation of important facilities like MCC rooms, FES ducts and other underground facilities, incurring considerable capital cost.

Considering the above complexities, this alternative has been ruled out.

Power source:

Presently there is no 33 kV power supply source available in SMS-1 area for feeding new LF. In case 33 kV power supply source is required in future, the same will be studied and arranged accordingly.

Enabling jobs:

In order to install the ladle furnace, a part of the tundish preparation area and the fume extraction system of the existing IRUTs will be required to be relocated.

5.1.2. Option-2 : Two Online IRUTs

This option discusses the installation of two online IRUTs along tracks of the Convertor A and C (in place of existing Argon Rinsing Station), similar to that existing for Convertor B.

Offline IRUTs have not been considered due the problems of crane logistics as explained for ladle furnace above.

Advantages

The installation of two online IRUTs will be beneficial in the following ways:
All Convertors will have their dedicated chemical heating facilities with final alloy addition and homogenization of composition and temperature through argon stirring. The heats from Convertor A & C will not be required to be transferred to the IRUT of Convertor B.

The treatment at IRUTs will be possible without increasing crane utilization in the distribution aisle. The treatment time is generally less than the ladle furnace. No major enabling job involved. Additional power requirement is less.

Issues

The control on required superheat for casting is not as good as ladle furnace. Maintaining liquid steel buffer for longer time will not be possible due to blocking of Convertor track.

The oxygen content of the steel increases with blowing. Hence, value added steel requiring low oxygen and low sulphur will have to be sent to the existing ladle furnace, if temperature is required to be adjusted.

5.1.3. Discussion on options

Installation of second ladle furnace has an advantage of treating value added steel and maintaining the liquid superheat with greater control. Also, buffer of liquid steel can be maintained for a longer time. However, due to the problem of crane logistics the same will be underutilized as that of the existing ladle furnace and the advantage of the ladle furnace cannot be obtained.

Moreover, the power distribution system will be required to be augmented for installation of ladle furnace.

Installation of IRUTs on the other hand has disadvantages related to treating of value added steel, maintaining of liquid steel buffer and precise control on superheat. However, two online IRUTs have advantages related to crane logistics and the system is expected to be workable with certain limitations. The value added steel will be required to be routed through the existing Ladle furnace. The existing problems of underutilization of the ladle furnace due to crane logistics is expected to improve as the transfer of ladles from Convertor A and C to the IRUT along Convertor B will not be required. Lack of control on superheat which imposes limitations on caster operation presently, is expected to improve substantially with dedicated chemical heating facilities for each Convertor.

Based on the above, it is proposed to install two new IRUTs instead of a new ladle furnace.

5.2 REQUIREMENT OF 3RD LHF

The LHF's are provided to produce quality steels. The ladle heating furnace treatment will include homogenization of analysis and steel temperature, heating up of the liquid steel, alloy addition, desulphurization, and inclusion control by inert gas bubbling, composition accuracy and wire feeding. Hence the treatment of LHF before casting is a prerequisite in SMS-2.

Variations in the cycle times of the BOF operation have to be caught up by the ladle heating furnace to meet the sequences at the caster.

Presently, 2 nos. of LHFs have been installed in SMS-2 under 6.3 MTPA stage. However, these two LHFs will have to process approx. 75 heats/day, as elaborated in below **Table 5.1**.

Table 5.1 : Estimation of production of SMS -2 after addition of BOF #3

S. No.	Item	Value
1	Avg heat size, ton	150
2	Avg tap-to-tap time, minutes	49.7
3	Two BOF availability, days	100
4	Three BOF availability, days	265
5	No. of heats/ day during two BOF operation	54
6	No. of heats/ day during three BOF operation	75
7	Production of liquid steel with two BOF operation, MT *(During 100 days only 2 BOF are available – 54x100x150 = 810000)*	810000
8	Production of liquid steel with three BOF operation, MT *(During 265 days all 3 Convertor available – 75x265x150 = 2981250)*	2981250
9	Total production of liquid steel per year, MT	3791250

Thus, each LHF will have to treat 37.5 heats/day with an average cycle time of 38.4 minutes. As these LHFs will be serving to four casters and one RH degasser, crane logistics would lead this cycle time to around 50 minutes, which means a maximum of 57.6 heats can be treated by two LHFs put together against the target production of 75 heats in an ideal condition.

After installation of CCM#4, when all four casters are operating, it is essential that the heat delivery cycle is maintained closely to facilitate longer sequence casting.

Operating two LHFs will certainly lead to delay in supply of ladles to the casters. A third LHF will not only help in easing the operations in BOF side and in CCM side it will also ensure to achieve the rated capacity of 7.3 MTPA expansion target.

Also, it has been now a practice worldwide to have a dedicated LHF for each Convertor. Presently all the SAIL plants in their expansion programme are implementing the LHF unit, where ever it differed, based on each Convertor to have one LHF

In the present day of practice where the trend is to have maximum number of heats from each Convertor and all the integrated steel producers are attempting 3/3 operation as it is prudent to have each Convertor with a dedicated LHF.

5.2.1. Reason for Twin LHF

One of the main objectives of the ladle heating furnace, from a logistic and productivity point of view, is to act as a buffer in between BOF operation and the subsequent processing unit. Therefore the ladle furnace capacity must be considerably higher than the primary melting unit and the caster.

Twin station LHF when compared to regular LHF, will provide better operational flexibility with less heat cycle time of only 35 minutes against 50 minutes and thus the capacity to treat more number of heats per day (approximately 40 heats/day) to match in enhanced production requirement of the shop.

Keeping view of the following:

- Target production requirements
- Process optimization between Convertor and Caster.
- 100% availability of LHF during exigency
- As a buffer station to achieve high sequence casting
- Possible treatment at LHF after RH treatment
- Less heat cycle time of only 35 minutes against 50 minutes
- Meeting the required availability of LHF during schedule maintenance and also during any breakdown.
- Additional heats can be treated with Twin LHF which is economical.

Proposal for installation of third LHF with twin station is put up herewith. This Twin LHF will be located between column no. 28 to 31 of FG Bay (secondary refining aisle) of SMS-2 as shown in the Sketch for Twin LHF enclosed with this report.

5.2.2. Facilities proposed and their advantages

Salient features of Twin station LHF
The Twin-LHF concept has two heating positions served by one electrode heating system swiveling between the both heating positions.

The steel is tapped from the BOF into the tapping ladle which is placed onto the ladle transfer car.

After tapping the full ladle, it exchanged from tapping ladle transfer car into LHF treatment car and transport to the treatment station, secondary treatment can start immediately. Once the ladle has been treated in the ladle heating furnace, the ladle car will be moved to the ladle pick up position, stirring will be disconnected and the ladle will be picked up by overhead crane and transferred to the next processing unit.

5.2.3. Advantages of Twin LHF

1. With twin type LHF, it will be possible to process 2 ladles simultaneously. So storage and heating of an extra ladle is possible
2. Heat delivery time to CCM will be reduced facilitating better sequencing
3. Lesser investment due to the usage of:
   - 1 Transformer,
   - 1 Electrode Arm,
   - 1 Set of electrodes
   - 1 FAFA system
   - But two ladle transfer car and associated facilities like wire feeding system temp. & sample measurement system, emergency lance etc.
4. Lesser space requirement
5. Transformer utilization will be more

5.3 SUGGESTIONS FOR IMPROVEMENT OF LOGISTICS

Following have been proposed for improvement of logistics:

1) Installation of will enable value added steel of LMMM blooms to be cast in caster#6. Caster#2 will not be required to cast value added LMMM blooms. This will have the following benefits.
   - All LMMM blooms can be cast at one end and MMSM blooms at other end. This will improve the logistics of blooms handling and dispatch in bloom yard as crisscross transfer and mixing of blooms can be avoided.
   - Change of sections in Caster#2 will not be required and the same may be dedicated for casting MMSM blooms only.
2) Ladle Cover manipulator – Installation of ladle cover manipulator for each caster, will reduce the load of DF bay cranes.
3) Ladle tracking system- Installation of ladle tracking system will enable the shop to monitor ladle engagement and help in improved planning of ladle management.
4) Snorkel exchange car in IRUT – Snorkel exchange car in IRUT will enable the Convertor transfer cars to be released during snorkel exchange.

The logistics of the shop may be further improved through the following:

1) Interbay ladle transfer car from DF bay to BD bay near Caster#1 – It has been pointed out through simulation, that the utilization of Crane#2 in DF bay is very high, whereas the Crane#1 is underutilized. This is attributable to the fact that only one transfer track is available near LF#1 for empty ladle transfer to LP bay. Installation of another transfer track near caster#1 will enable crane#1 to be used more frequently for deslagging and the cranes will not be required to travel the distance as it is presently required. The empty ladle from BD bay will be transferred to the transfer car on the fourth track for onward transmission to LP bay. However, one BD bay crane will be required to be modified for ladle handling.
2) Change in slag handling practice – Presently the slag from the ladles are poured in refractory lined containers. These containers are then emptied near the bay ends. This has resulted in accumulation of jams at both ends and additional crane occupation is required to clear the slag/metal jam from the container. As per the practice followed in all modern steel plants, ladles are either directly deslagged in slag pits at the bay ends or are poured in intermediate slag pots and emptied later at the pits. This reduces crane handling and accumulation of jams in the shop and increases working space. VSP may also think of adopting the same.
3) Tundish deskulling - Presently the tundishes are deskulled at both ends of BD bay resulting in accumulation of jams at both ends. All tundish deskulling jobs may be done at one end and relining jobs at the other ends. This will reduce accumulation of jams at both ends and manpower for dedicated jobs like deskulling, skull cutting, jam cleaning and relining can be deployed at one place only.

6.0 ENVIRONMENTAL MONITORING PROGRAM

The monitoring and evaluation of the management measures envisaged are critical activities in implementation of the Project. Monitoring involves periodic checking to ascertain whether activities are going according to the plans. It provides the necessary feedback for project management to keep the program on schedule. The purpose of the environmental monitoring programme is to ensure that the envisaged purpose of the project is achieved and results in desired benefits.

To ensure the effective implementation of the proposed mitigation measures, the broad objectives of monitoring plan are:

- To evaluate the performance of mitigation measures proposed in the EMP.
- To evaluate the adequacy of Environmental Impact Assessment
- To suggest improvements in management plan, if required
- To enhance environmental quality.
- To implement and manage the mitigative measures defined in EMP.
- To undertake compliance monitoring of RINL proposed project operation and evaluation of mitigative measure.

6.1 ENVIRONMENTAL ASPECTS TO BE MONITORED

6.1.1 General

RINL's modernisation programme is still going on and under this several measures have been proposed in the environmental mitigation measures for mitigation of adverse environmental impacts. The present project is also a part of modernisation programme measures for control pollution for the present project also implemented along with other measures.

These shall be implemented as per proposal and monitored regularly to ensure compliance to environmental regulation, to implement National Ambient air quality stands issued by ministry and also to maintain a healthy environmental conditions around the steel works.

A major part of the sampling and measurement activity shall be concerned with long term monitoring aimed at providing an early warning of any undesirable changes or trends in the natural environment that could be associated with the plant activity. This is essential to determine whether the changes are in response to a cycle of climatic conditions or are due to impact of the plant activities. In particular, a monitoring strategy shall be ensured that all environmental resources, which may be subject to contamination, are kept under review and hence monitoring of the individual elements of the environment shall be done. During the operation phase Environmental Management Department (EnMD) shall undertake all the monitoring work to ensure the effectiveness of environmental mitigation measures. The suggestions given in the Environmental Monitoring Programme (EMP) shall be implemented by RINL by following an implementation schedule.

In case of any alarming variation in, ground level concentration in ambient air, stack emission, work zone air and noise monitoring results, performance of effluent treatment facilities, wastewater discharge from outfalls, etc. shall be discussed in the EnMD and any variance from norms shall be reported for immediate rectification action at higher management level.

The environmental aspects to be monitored to ensure proper implementation and effectiveness of various mitigative measures envisaged / adopted during the design and commissioning stage of the proposed units are described here under.

6.1.2 Drainage System

The effectiveness of the drainage system depends on proper cleaning of all drainage pipes/channels. Regular checking is being done to see that none of the drains are clogged due to accumulation of sludge/sediments. The clogged drains are cleaned as soon as possible, preferably the same day. The catch-pits linked to the storm water drainage system from the raw material handling areas are regularly checked and cleaned to ensure their effectiveness. This checking and cleaning is rigorous during the monsoon season, especially if heavy rains are forecast.

6.1.3 Water Quality

Effluents from all outfalls, Sewage treatment plant from Township and Plant are monitored and tested in Environmental control laboratory four times in a month as per ASPCB, Andhra Pradesh guidelines / directives. However the frequency of monitoring may be increased if required in accordance with the stipulations of APPCB, Andhra Pradesh or other statutory authorities. In addition to above APPCB also carrying out monitoring of certain parameter in some of the plant equipment/area as a quality measures for measurement of pollutants going to outfalls.

6.1.4 Emissions and Air Quality

Ambient air quality is being monitored regularly in accordance with CPCB / State pollution control board, Andhra Pradesh (SPCB). Work zone air quality is being monitored as per directives of SPCB to assess the levels of particulate matter, NOx and SO_2.

Four nos Continuous Ambient Air Quality monitoring stations have been installed & commissioned. All major stacks will be provided with on-line monitoring system. The emissions from all the stacks are being monitored once a month using the manually operated stack emissions monitoring equipment. However the frequency of monitoring may be increased if required in accordance with the stipulations of APPCB or other statutory authorities.

6.1.5 Noise Pollution

At present Noise levels are being monitored inside the plant once in a year The EnMD is keeping a record of noise levels and take necessary organizational actions like rotation of workmen, availability and use of personal protective devices, damage to enclosures or insulation layers over enclosures and piping.

6.1.6 Solid / Hazardous Waste Generation & Utilisation

Maximum re-cycling and utilization of generated waste as per CREP shall be done. Hazardous waste shall be disposed-off as per applicable statutory conditions.

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6.1.7 Green Belt Development

Agro Forest department of RINL is looking after all plantation program within the plant area and town ship area. As discussed in previous chapter RINL has planted trees in almost all possible locations and continuously encourage others to plant trees in their garden, locality etc. However following plan shall also be made for future program also

- Annual plans for tree plantation with specific number of trees to be planted shall be made. The fulfillment of the plan shall be monitored by the Agro Forest department every six months.
- In association with Forest Department, AP, local tree species shall be selected and planted
- A plan for post plantation care will be reviewed in every monthly meeting. Any abnormal death rate of planted trees shall be investigated.
- Watering of the plants, manuring, weeding, hoeing will be carried out for minimum 3 years

6.1.8 House Keeping

Housekeeping is identified as one of the main thrust areas in all the departments. Senior officer is made in-charge for the housekeeping group for good housekeeping in their respective departments The EnMD are keeping a very close monitoring of housekeeping activities and organizing regular meetings of joint forum at the shop level (monthly), zonal level – (once in two months) and apex level (quarterly). The CED (Civil Engineering Department) is taking care the general housekeeping of shops.

6.1.9 Occupational Health

Routine medical examination of personnel is being carried out as a systematic programme at plant medical unit as present. The same procedure will be followed for personnel worked for expansion project also.

6.1.10 Interaction With State Pollution Control Board

EnMD are in regular interaction with SPCB and send them quarterly progress report on EMP. Any new regulations considered by State/Central Pollution Control Board for the Industry are been taken care of.

6.2 MONITORING PLAN

6.2.1 General

The target of the EnMD is implementing the environmental monitoring plan on a short-term basis would be to:

- Prepare specific unit operation plan for different shops of RINL;
- Interpret requirements of the EIA documentation into an environmental education plan;

- Assist engineering team with the incorporation of EMP requirements in contract specifications and contract terms and conditions;
- Undertake and/or co-ordinate all internal compliance monitoring and evaluation and secure external monitoring through suitable state level NGOs or any other consulting firm;
- Advice the EnMD on all matters related to environmental requirements of the project;
- Provide all necessary specialized environmental expertise as needed during the project period.

The long-term objective of EnMD would be to build environmental awareness and support, both within and outside the RINL management. The other long-term tasks would be to develop environmental training programme for the target groups of different units of RINL.

The environmental monitoring plan contains:

- Performance indicators
- Environmental monitoring programme
- Progress Monitoring and Reporting Arrangements
- Budgetary provisions
- Procurement Schedules

6.2.2 Performance Indicators

The physical, biological and social components identified to be particularly significant in affecting the environment at critical locations have been suggested as Performance Indicators (PIs). The performance indicators will be evaluated under three heads:

a) Environmental condition indicators to determine efficiency of environmental management measures in control of air, noise and water pollution and solid waste disposal.
b) Environmental management indicators to determine compliance with the suggested environmental management measures.
c) Operational performance indicators that have been devised to determine efficiency and utility of the proposed mitigation measures.

The Performance Indicators and monitoring plans will be prepared for the project for effective monitoring.

6.2.3 Environmental Monitoring Programme

The Environmental Monitoring Plan (EMP) during operation stages envisaged for the proposed project, for each of the environmental condition indicator is given in **Table 6.1A & B**.

The monitoring plan specifies:

- Parameters to be monitored
- Location of the monitoring sites
- Frequency and duration of monitoring
- Special guidance
- Applicable standards
- Institutional responsibilities for implementation and supervision

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Table 6.1 : Part A - Environmental Monitoring Plan during Operation Stage

Environmental Issue/ Impacts	Mitigation Measure	Reference to Contract Documents	Approximate Location	Time Frame	Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
1. Environmental Protection Measures	Proper functioning of all Environmental Protection Measures as envisaged in **Chapter 4** for controlling/abating pollution.	Project/Statutory/CREP requirement	Different units of the operating plant	Continuously	Production cost	Concerned Plant Units/EnMD, RINL	EnMD, RINL
2. Meteorology	Meteorological parameters through a continuously monitoring system.	-	Station located within plant premises	Continuously	Use existing equipment. No addition cast kept	EnMD, RINL /Pollution Monitoring Agency,	EnMD, RINL
3. Stack emissions / Performance of stack emissions pollution control facilities	Out let of all process & de-dusting (major) stacks in different units.	-Do-	All existing and new units through continuous monitoring devices as per CREP.	Through out operation stage	For new units online stack monitoring shall be installed the cost of which included in Project cost	-Do-	-Do-

Environmental Issue/ Impacts	Mitigation Measure	Reference to Contract Documents	Approximate Location	Time Frame	Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
4. Ambient air quality at Plant Boundary	Continuous automatic AAQ stations installed Monitoring at plant boundary at four locations.	-Do-	**4 no. of stations are installed near Main Gate, BC Gate, Pedagantyada and Appikonda which cover predominant down wind directions**	Continuously	All ready procured	-Do-	-Do-
5. Solid waste/ Hazardous Waste generation and utililisation	Maximum re-cycling and utilization of generated solid waste as per EMP	-Do-	All existing and new units of the proposed expansion plan generating & utilization solid wastes	-Do-	Project cost	Concerned Plant Units/EnMD, RINL	-Do-
6. Green Belt	Already good green cover exists, efforts to further strengthen the green cover	-Do-	Planting trees in the open area	-Do-	-Do-	Agro forest Department, RINL	-Do-
7. House Keeping	Cleanliness of work place	Corporate responsibility	All units of RINL	-Do-	-Do-	All responsible units	Respective units
8. Occupational Health	Health of workers / Staff	-Do-	-Do-	-Do-	-Do-	Plant Medical Unit	-Do-

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Environmental Issue/ Impacts	Mitigation Measure	Reference to Contract Documents	Approximate Location	Time Frame	Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
9. Socio-economic Development	Structured interactions with the community to disseminate the measures taken by the steel plant and also to elicit suggestions for overall improvement for the development of the area	-Do-	Stake Holders	-Do-	-Do-	Corporate social responsibility wing, RINL	-Do-
10. Performance of Effluent Treatment Facilities	Effluent Treatment facilities installed at different units of RINL	-Do-	All existing and new units of the proposed expansion plan	-Do-	Environmental Cost	Concerned Plant Units/EnMD, RINL	Water management Dept
11. Work zone Air Quality	At all units of RINL	-Do-	-Do-	-Do-	-Do-	-Do-	-Do-
12. Work zone Noise levels	At all units of RINL	-Do-	-Do-	-Do-	-Do-	-Do-	-Do-
13. Atmospheric Pollution (AAQ)	Ambient Air Quality with respect to various pollutants shall be monitored as envisaged in the pollution-monitoring plan.	-Do-	As per specified AAQ monitoring programme	-Do-	-Do-	-Do-	-Do-
14. Water quality at RINL outfalls	Water quality at all the outfalls of RINL as per the wastewater discharge (in surface water) criteria of CPCB.	-Do-	As per specified waste water discharge monitoring programme	-Do-	-Do-	-Do-	-Do-
5. Ambient Noise	Noise pollution will be monitored.	-Do-	As per the noise pollution monitoring program	-Do-	-Do-	-Do-	-Do-

Environmental Issue/ Impacts	Mitigation Measure	Reference to Contract Documents	Approximate Location	Time Frame	Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
6.Ground Water Quality	Changes in ground water quality will be monitored in the up-gradient and down gradient of RINL slag bank will be monitored	-Do-	As per ground water monitoring programme	-Do-	-Do-	-Do-	-Do-
7. Soil quality	Changes in soil quality will be monitored		As per the soil quality monitoring programme	-Do-	-Do-		

Note: EMP = environmental management plan, EnMD = Environmental Management Department Unit formed at Plant level at RINL, SPM = suspended particulate matter, RPM = respirable particulate matter, SO2 = Sulphur di-oxide, NOx = nitrogen oxides, CO = carbon mono-oxide, HC = hydrocarbons, Pb = lead.

Table 6.1 : Part B: Environmental Monitoring Plan for the Performance Indicators

Environmental component	Project Stage	Parameters	Location	Frequency	Standards	Implement-ation	Supervision
Effluent Quality	Operation stage	All the parameters as specified by statutory agencies	At inlet and outlet of different effluent treatment plants	Once in each month per year.	-Do-	Concerned Plant Units/EnMD, RINL	EnMD, RINL
Work zone Air Quality	Operation stage	As per applicable statutory standards	All units of RINL	8 hr per shift continuous (to cover all shifts of operation in a year for each unit) per year during the operation at all plant units.	-Do-	-Do-	-Do-
Work zone Noise levels	Operation stage	As per OSHA work-zone noise norms.	All units of RINL	8 hr per shift continuous (to cover all shifts of operation in a year for each unit) per year during the operation at 20 plant units.	-Do-	-Do-	-Do-
Ambient Air Quality	Operation stage	PM, RPM, NOx, CO, HC, Pb, SO_2	Exisitng continous ambient monitring stations located all four directions of the plant	Once for 24 hr continuous, over the project period (once in a year except in monsoon) per year.	-Do-	EnMD and / or through approved monitoring agency	EnMD, RINL

Environmental component	Project Stage	Parameters	Location	Frequency	Standards	Implement-ation	Supervision
Waste water discharge quality	Operation stage	All the parameters for waste water discharge in surface water as specified by CPCB	All RINL plant outfalls	4 times a month per year during operation.	-Do-	-Do-	-Do-
Ambient Noise levels	Operation stage	As per National Ambient Noise Standard as per Environmental Protection Act, 1986 amended 2002		Once / year during the operation period.	-Do-	-Do-	-Do-
Ground Water Quality	Operation stage	As per IS 10500	locations	Once in a year during winters up to the plant operation.	-Do-	-Do-	-Do-
Soil	Operation stage	Monitoring of Pb, Cr, Cd and other heavy metals.		Once in a year during winters up to the plant operation.	-	-Do-	-Do-

Note: Cd -Cadmium; CO - Carbon Monoxide; Cr - Chromium; EnMD = Environmental Managment Department of RINL, HC - Hydrocarbon; IS - India Standard; NOx - Nitrogen Oxide; Pb - Plumbum, (lead); RPM - Respirable Particulate Matter; SO_2 - Sulfur Dioxide; SPM - Suspended Particulate Matter, RPM - Respirable Particulate Matter

6.2.4 Progress Monitoring and Reporting Arrangements

The rational for a reporting system is based on accountability to ensure that the measures proposed as part of the Environmental Monitoring Plan get implemented in the project. The monitoring and evaluation of the management measures are critical activities in implementation of the project. Monitoring involves periodic checking to ascertain whether activities are going according to the plans. It provides the necessary feedback for the project management to keep the programme on schedule. The rational for a reporting system is based on accountability to ensure that the measures proposed as part of Environmental Management Plan get implemented in the project.

A reporting system for environmental monitoring the monitoring programme is given in **Table 6.2.**

Table 6.2 : Reporting System for Environmental Monitoring Plan

S.N	Details	Indicators	Stage	Responsibility
A.	**Construction Stage: Environmental Condition Indicators and Monitoring Plan**			
1.	Dust suppression at construction site	Construction site	Construction	Contractor
2	The parameters to be monitored as per frequency, duration & locations of monitoring specified in the Environmental Monitoring Programme	Air quality	Construction	Contractor through approved monitoring agency
B.	**Operation Stage: Management & Operational Performance Indicators**			
1	Solid waste generation, utilization and dumping	As per CREP for Integrated Steel Plant	Operation	Concerned Plant Units / EnMD, RINL
2	Hazardous waste re-utilisation and dumping in designated pits	As per the notifications / guidelines specified by statutory authorities.	Operation	-Do-
3	Stack Emissions from Process & de-dusting stacks	All parameters as specified for stacks of different units of an Integrated Steel Plant by Statutory Authorities	Operation	EnMD, RINL / Approved Agency
4	Meteorology, Ambient air quality, Waste water discharge through plant outfalls and Noise levels.	All parameters as specified by Statutory Authorities	Operation	-Do-

6.2.5 Budgetary Provisions for Environmental Protection Measures

Total capital cost of the project was about Rs 9439.53 Crs. About Rs 559 Crores (6% of the capital cost) shall be spent against pollution control equipment. Annual cost of operation and maintenance of pollution control measures is estimated around Rs 15 Crores.

Since RINL will be getting necessary environmental monitoring carried out by in-house EnMD, capital expenditure towards environmental monitoring facilities and occupational health of personnel is not required.

6.3 UPDATING OF EMP

The directives from MOEF&CC and the regulations in force at any time shall govern the periodicity of monitoring. However it is suggested that the implementation of various measures recommended in the EMP be taken as EMPs in the ISO –14001 system to effectively implement the measures for continual improvement in environmental performance. OHSAS and SA-8000 shall also be implemented for the total plant.

7.0 ADDITIONAL STUDIES: RISK ASSESSMENT

7.1 GENERAL

Industrial activities, which produce, treat, store and handle hazardous substances, have a high hazard potential endangering the safety of man and environment at work place and outside. Recognizing the need to control and minimize the risks posed by such activities, the Ministry of Environment, Forests and Climate control have notified the "Manufacture Storage & Import of Hazardous Chemicals Rules" (MSIHC) in the year 1989 and subsequently modified, inserted and added different clauses in the said rule to make it more stringent. For effective implementation of the rule, Ministry of Environment, Forests and Climate Control (MoEFCC) has provided a set of guidelines. The guidelines, in addition to other aspects, set out the duties required to be performed by the occupier along with the procedure. The rule also lists out the industrial activities and chemicals, which are required to be considered as hazardous.

RINL is engaged the production of Steel from iron ore and other required raw materials. During the process of manufacture of steel and other associated materials hazardous gases are generated which are stored and used in the plant. In addition to this, some other hazardous substances, which are required as feed/fuel in the process or produced as a by-product, will also be stored/handled by RINL. The major substances handled / stored by RINL includes Coke Oven gas (primarily H_2 & CH_4), Blast furnace gas (primarily CO), LD Gas (primarily CO, N_2 & CO_2), Liquefied Petroleum Gas (LPG)/Propane, etc.

In view of this, RINL's existing and proposed activities are scrutinized in line of the above referred "Manufacture, storage and import of hazardous chemicals rules" and observations / findings are presented in this chapter. An elaborate and well-documented Disaster Management Plan covering all substances/gases handled by RINL for their existing plant covering all the chemicals / gases handled by RINL is already in place. The same shall be upgraded and extended to the units under the expansion programme of RINL.

The assessment has been made in a systematic manner covering the requirements of the above-mentioned rules. Accordingly subsequent sections have been divided as follows:

- *Process description*
- *Applicability of the rule*
- *Description of hazardous substances*
- *Hazard Identification*
- *Hazard Assessment (& hazard scenarios)*
- *Consequence analysis*
- *Brief description of the measures taken and*
- *On site emergency plan*

Accordingly next sections are elaborated.

7.2 PROCESS DESCRIPTION

RINL is producing steel products via BF- BOF Route of steel making. Iron ore lumps, sinters and coke (made from coking coal) and fluxes such as limestone, dolomite are the major raw materials. The major steps in the manufacturing process are as follows:

COKE MAKING - COAL CARBONISATION:
Coking coals are the coals which when heated in the absence of air, first melt, go in the plastic state, swell and re-solidify to produce a solid coherent mass called coke. When coking coal is heated in absence of air, a series of physical and chemical changes take place with the evolution of gases and vapors, and the solid residue left behind is called coke. Coke is used in Blast Furnace (BF) both as a reductant and as a source of thermal energy. It involves reduction of ore to liquid metal in the blast furnace and refining in convertor to form steel. The coke making process generates Coke Oven Gas (COG), which is a high calorific value fuel gas. This is cleaned and utilized as an energy source for different other units of the steel plant. COG has a risks of fire & explosion associated with its storage & handling due to its high energy value as well as flammable nature. The presence of Carbon Monoxide (CO) makes it toxic in nature too.

SINTERING:
Sintering is a technology for agglomeration of iron ore fines into useful Iron-bearing burden material for Blast Furnace. The raw materials used are Iron ore fines, coke breeze, Lime stone & dolomite fines and other metallurgical wastes. The proportioned raw materials are mixed and moistened in a mixing drum. The mix is loaded on sinter machine through a feeder onto a moving grate (pallet) and then the mix is rolled through segregation plate so that the coarse materials settle at the bottom and fines onto the top.

The top surface of the mix is ignited through stationary burners at 1200°C. As the pallet moves forward, air is sucked through a wind box situated under the grate. A high temperature combustion zone is created in the charge -bed due to combustion of solid fuel of the mix and regeneration of heat of incandescent sinter and outgoing gases. Due to forward movement of pallet, the sintering process travels vertically down.

Sinter is produced as a combined result of locally limited melting, grain boundary diffusion and recrystallization of iron oxides. On completion of the sintering process, finished sinter cake is crushed and cooled. The cooled sinter is screened and is dispatched to blast furnace.

HOT METAL PRODUCTION (BLAST FURNACE):
The iron making process via Blast furnace basically consists of the conversion of iron oxide to iron in liquid form. This requires reductant for reduction of iron oxide and heat for the above reduction reaction to take place and for melting the products of smelting. The primary source to fulfill both these requirements is carbon (in the form of coke).The blast furnace is a vertical counter-current heat exchanger as well as a chemical reactor in which burden material charged from the top descend downward and the gasses generated at the tuyere level ascend upward.

VISAKHAPATNAM STEEL PLANT
EIA/ EMP Studies for expansion of Integrated Steel Plant from 6.3 MTPA to 7.3 MTPA Liquid steel within the premises of Visakhapatnam Steel Plant

The top gas containing the flue dust is routed from the furnace top to the gas purifiers and then to the consumption zones. The hot air for combustion is injected through water-cooled tuyeres into the blast furnace. Hot metal is tapped through the tap hole, which is opened by power driven drills into a train of ladles kept below the runner of the cast house. Slag comes along with the metal and is skimmed off with the help of skimmer plate towards slag runner and is collected in slag thimbles. Raw material (ore, sinter, coke) are screened before being charged into the blast furnace through conveyors or skip. Air for combustion in the blast furnace is blown from turbo blowers, which are preheated in hot blast stoves to temperatures around 1300°C, which is then blown through tuyers into the blast furnace. Each blast furnace is equipped with two or more stoves, which operate alternatively. Preheating of air helps in reducing fuel consumption in the furnace.

Hot metal from blast furnaces is treated to remove undesired elements like sulphur, silicon or phosphorous before being transformed to steel. De-sulphurising agents are applied to reduce sulphur content of the metal. After this pre-treatment of hot metal produced in the blast furnace, it is sent to Basic oxygen Furnace (BOF) for steel making or to Pig casting machines(PCM) for pig iron casting in ladles.

The hot metal production generates Blast Furnace Gas (BFG), which is a relatively low calorific value fuel gas, but when mixed with COG in specific proportions, results in Mixed Gas (MG), which is also used by different consuming units within the steel plant. BFG and MG are also flammable gases with potential to cause fire & explosion risks. Additionally, BFG is also toxic in nature due to presence of CO in its composition.

STEEL PRODUCTION (BASIC OXYGEN FURNACE):
The Basic Oxygen Furnace (LD convertor) is a pear shaped vessel lined inside with refractory bricks. The vessel lining consists of tar bonded dolomite /magnesia carbon bricks or other refractories. The vessel can be rotated 360° on its axis. Oxygen is blown into the vessel with the help of water-cooled lance.

The 'heat' begins with the addition of scrap into the slightly tilted convertor, hot metal is then added after straightening the convertor, and Oxygen is blown into the bath through the lance. The necessary fluxes are added during blowing. Flux addition is done automatically and precisely through bunkers situated above the convertor. A sample is taken after blowing for 16-18 minutes and temperature is measured using a thermocouple. The steel is tapped by tilting the convertor to the tapping side and alloying elements are added via chutes while metal is being tapped. The convertor is tilted to the charging side in order to remove the floating slag.

During blowing operation, oxygen oxidizes iron into iron oxide and carbon into carbon monoxide. The iron oxide immediately transfers the oxygen to the tramp elements. The center of the reaction has temperatures of around 2000°-2500°C. The development of CO during refining process promotes agitation within the molten bath. The reaction of the tramp elements with the oxygen and the iron oxide developed in the center of reaction leads to formation of reactive slag. As blowing continues, there is a continuous decrease of carbon, phosphorous, manganese and silicon within the melt. Phosphorous is removed by inducing early slag formation by

adding powder lime with oxygen. The refining process is completed when the desired carbon content is attained. The steel produced in the basic oxygen furnace is sent to continuous casting or for ingot teeming.

The steel making process via LD/BOF Convertors also generates LD/BOF Gas, which is lower in calorific value when compared with COG or BFG but when mixed into Mixed Gas (MG) supplements the energy reserve of the steel plant. LD gas is also a flammable as well as toxic gas and has associated risks of fire & explosion as well as toxic poisoning.

CONTINUOUS CASTING:

During continuous casting, the liquid steel produced via LD/BOF unit, passes from the pouring ladle, with the exclusion of air, via a tundish with an adjustable discharge device into the short, water-cooled copper mould. The shape of the mould defines the shape of the steel. Before casting, the bottom of the mould is sealed with a so-called dummy bar. As soon as the bath reaches its intended steel level, the mould starts to oscillate vertically in order to prevent the strand adhering to its walls. The red-hot strand, solidified at the surface zones, is drawn from the mould, first with the aid of a dummy bar, and later by driving rolls. Because of its liquid core, the strand is carefully sprayed and cooled down with water. Rolls on all sides also support it until it has completely solidified. This prevents the still thin rim zone from disintegrating. Once it has completely solidified, mobile cutting torches or shears can divide the strand. Intensive cooling leads to a homogeneous solidification microstructure with favourable technological properties.

The different heating and/or cutting requires propane/LPG as fuel to be used in various in-plant consumer units.

From the above description, it can be noticed that the process of Iron & Steel manufacturing via BF-BOF route requires considerable thermal energy. This thermal energy is supplied through fuel gasses generated in the plant e.g. Coke oven gas (COG), Blast Furnace gas (BFG), BOF gas as well as LPG/Propane gas. If there is any shortfall of these generated gasses then fuel gas is also supplied from outside source also.

The present proposal of RINL for expansion will create additional energy requirements, which will be catered to by in-plant COG, BFG, BOFG and/or Mixed Gas. However, the in-plant generation of these fuel gasses alone will not be able to meet all the requirement of the existing plant with expansion units. Therefore, use of LPG/Propane has also been considered. In addition to these fuel gasses, a number of chemicals are being produced in the by-product plant of Coke Oven. Further Oxygen is also required as mentioned above. Therefore to run the plant, it is required to store and/or handle all these chemicals along with their distribution arrangement.

The existing RINL plant has two (2) LD gas holders within the SMS complex to meet its requirements. As part of the expansion programme, a Gas Mixing station (GMS) for mixing COG and BFG into Mixed gas (required for under-firing of coke ovens) and three (3) Mounded Propane Bullets of 75 T capacity each has also been envisaged.

The major hazardous materials to be stored, transported, handled and utilized within the facility have been summarized in **Table 7.1** below:

TABLE 7.1: LIST OF MAJOR HAZARDOUS SUBSTANCES TO BE STORED/HANDLED

Sn.	Hazardous substance handled/stored	Quantity handled/ stored	Type of vessel used for handling / storage	Nature of hazard associated
1.	Coke Oven gas[1] (major components being CH_4, H_2 and CO)	108 kg handled via in-plant piping network	In-plant Steel pipelines	Flammable gas
2.	Blast Furnace Gas[2]	591.6 kg handled via in-plant piping network	In-plant Steel pipelines	Flammable gas
3.	Mixed Gas[3]	231.2 kg handled via plant piping network	In-plant Steel pipelines	Flammable gas
4.	LD gas[4]	2 x 102.1 T = 204.2 Tonnes stored in 02 LD Gas holders	Stored in steel Cylindrical shaped gas holder (Wiggin's type) with Dry Rubber seal and handled via In-plant Steel pipelines	Flammable gas
5.	Propane[5]	3 x 75 T = 225 Tonnes stored in 03 mounded bullets	Horizontally placed steel Bullet with hemispherical ends laid within a trapezoidal mound of earth materials (i.e. Mounded Bullets* as per OISD-150).	Flammable pressurized liquid

Note: *[1]Coke Oven Gas density as 0.499 kg/m³ calculated at 25°C, 1 atm pressure conditions considering tentative gas mixture composition*
[2]Blast Furnace Gas density 1.145 kg/m³ as calculated at 25°C, 1 atm pressure conditions considering tentative gas mixture composition
[3]Mixed Gas density as 1.08 kg/m³ calculated at 25°C, 1 atm pressure conditions considering BF:CO gas ratio of 9:1
[4]LD Gas quantity of existing LD Gas holders and density considered as 1.37 kg/Nm³ as furnished by RINL.

7.3 APPLICABILITY OF THE RULE

As per MSIHC Rules, 1989 with subsequent amendments, the galvanization process is classified as an "industrial activity" storing/handling hazardous substances.

To decide whether the above mentioned industrial activities/substances are likely to come within the scope of the above mentioned "Manufacture Storage and Import of Hazardous Chemicals Rules, 1989", the threshold quantities mentioned in the rules are used for comparison, as given in **Table 7.2**.

TABLE 7.2: THRESHOLD QUANTITY & IDENTIFIED HAZARDOUS SUBSTANCES TO BE HANDLED AS PER MSIHC RULES, 1989

Sn	Hazardous substance handled/ stored	Maximum Quantity handled/ stored	Whether Included in The List of Hazardous & Toxic Chemicals	Type of vessel used for handling / storage	Lower Threshold Qty. (In Tonne) *[For rules 5,7 to 9 and 13 to 15]*	Upper Threshold Qty. (In Tonne) *[For rules 10 to 12]*	Remarks
1.	Coke Oven gas	**108 kg** handled	**Yes**, As per Sch. 3(i)	In-plant Steel pipelines	15	200	***Below the lower threshold limit.*** *Does not require additional However, consequence analysis carried out due to COG's high flammability potential*
2.	Blast Furnace Gas	**591.6 kg** handled	**Yes**, As per Sch. 3(i)	In-plant Steel pipelines	15	200	***Below the lower threshold limit.*** *Does not require additional However, consequence analysis carried out due to BFG's high flammability potential*
3.	Mixed Gas	**231.2 kg** handled	**Yes**, As per Sch. 3(i)	In-plant Steel pipelines	15	200	***Below the lower threshold limit.*** *Does not require additional However, consequence analysis carried out due to Mix.G's high flammability potential*
4.	LD gas	2 x 102.1 T = **204.2 Tonnes** stored in 02 LD Gas holders	**Yes**, As per Sch. 3(i)	Steel Cylindrical shaped gas holder (Wiggin's type) with Dry Rubber seal and handled via In-plant Steel pipelines	15	200	***Exceeds upper threshold limit.*** *Consequence analysis required to be carried out.*
5.	Propane	3 x 75 T = **225 Tonnes** stored in 03 mounded bullets	**Yes**, As per Sch. 3(i)	Horizontally placed steel Bullets with hemispherical ends laid within a trapezoidal mound of earth materials (i.e. Mounded Bullets* as per OISD-150).	15	200	***Exceeds upper threshold limit.*** *Consequence analysis required to be carried out.*

After comparison of the stored / handled and threshold quantities, it can be noticed that LD gas and propane exceed the upper threshold limits and come under the purview of MSIHC Rules, 1989 amended in 2000. However, Coke Oven gas, Blast furnace gas and Mixed gas are not exceeding the lower threshold quantity limits but are coming under the purview of MSIHC rules due to their hazardous nature. Accordingly only rule 17 i.e. preparation and maintenance of material safety data sheets are required for both the substances. Rule-7 i.e. notification of site requires submission of a written report containing among other information the followings:

- *Identification of major accident hazards*
- *The conditions or events which could be significant in bringing one about*

- *Brief descriptions of the measures taken*
- *Area likely to be affected by the major accident etc.*

However, owing to the hazardous nature of Coke oven gas, Blast furnace gas and Mixed gas, consequence analysis of the facility has been done, taking in consideration all hazardous substances identified at Table 7.2 above. MCAA (maximum credible accident analysis) approach ash been used to identify plausible worst case scenarios for hazard identification and risk assessment. As per Rule-17 of the MSIHC Rules-1989, the material safety data sheets for identified hazardous substances are provided at **Annexure 7.1**.

7.4 DESCRIPTION OF HAZARDOUS SUBSTANCES

The hazardous substances which are expected to be handled, are presented in **Table 7.2** above. The Material Safety data sheets of different hazardous substances identified in the table are presented in **Annexure 7.1**. The brief nature of identified hazardous substances is described in the following paragraphs.

Coke Oven Gas: It is a flammable gas which is proposed to be used as fuel in the plant and is primarily a mixture of Hydrogen (55-56%), Methane (27.3-27.8%) and Carbon monoxide (7.3-7.6%). Coke Oven gas will be generated from existing Coke Oven batteries as well as proposed new coke oven battery #6, which will be transported via the gas network using pipelines, directly to the consumer units of RINL. Since, the gas is not proposed to be stored within the RINL complex, the risks associated with gas leakage and explosion are very low. A regular inspection of pipelines and maintenance operations along with installation of pressure detection systems in the pipelines will ensure no occurrence of pipeline failure. The physical & chemical properties of Coke Oven gas are given below:

PHYSICAL PROPERTIES*		
Form	:	Gas
Colour	:	Colourless
Odour	:	Characteristic phenolic with a trace of hydrogen sulphide
Density	:	0.42 kg/m^3 at NTP
Molecular weight	:	~170 g/mol
Lower explosion limit (LEL)	:	4.0 %
Upper explosion limit (UEL)	:	30.0 %
Flash point	:	<60°C
Solubility in water	:	Slightly soluble in water
Toxicity	:	Acutely toxic if inhaled
Flammable nature	:	Extremely flammable

**Based on tentative data sourced from Material Safety Data Sheet of Clean Coke Oven Gas*

CHEMICAL COMPOSITION* (mol %)		
Carbon Dioxide (CO_2)	:	2.6 – 2.8
Carbon Monoxide (CO)	:	7.3 - 7.6
Hydrogen (H_2)	:	55 - 56
Methane (CH_4)	:	27.3 - 27.6
Nitrogen (N_2)	:	4.4 – 4.8
Oxygen (O_2)	:	0.4
Other higher hydrocarbons (C_nH_m)	:	2.1 – 2.2

Based on typical data for Clean Coke Oven Gas generated from Coke Oven plants of RINL's Visakhapatnam Steel Plant.

The toxic component of the Coke Oven gas is listed below:

Sn.	Chemical Component	Max quantity	Quantity in % by wt.
1.	Carbon Monoxide (CO)	7.8 % by mole	~1.20
2.	Ammonia (NH_3)	0.05 g/Nm^3	~0.012
3.	Hydrogen sulphide (H_2S)	0.85 g/Nm^3	~0.20
4.	Naphthalene	0.1 g/Nm^3	~0.024

The high concentration of hydrogen and methane in COG suggests that the gas can be ignited by a low ignition energy (e.g., static). Therefore, the probability of ignition of COG leaks is likely to be high relative to other flammable gases. COG is a corrosive gas due to the presence of hydrogen and sulphides. This has significant implications for the maintainability of COG systems, because COG pipework frequently develops small corrosion holes.

Blast Furnace Gas (BFG): BFG is a by-product of the iron making process and is used as a fuel gas. It is an odourless, colourless and toxic gas. Its toxic properties are due to the presence of carbon monoxide (CO) (typically 21-25% v/v) in the gas. In confined space, it can form explosive mixture.

BFG is a very low heating value fuel (CV=800-900 Kcal/Nm^3), containing inerts of approximately 56-58% nitrogen and 17-26% carbon monoxide. Therefore, the gas is only likely to support stable combustion at elevated temperature, or with a permanent pilot flame. BFG may be ignited by a high ignition source such as a permanent pilot flame. BFG may be ignited by a high ignition source such as a welding torch. However, the resulting combustion is slow.

BFG is not typically considered an explosion hazard for the following reasons:
- Very high ignition energies are required to initiate BFG combustion;
- High concentration of inerts in the gas; and
- Very low combustion energy (3.2 MJ/m^3).

LD Gas (LDG): Convertor gas or LD gas, typically has a high carbon monoxide content, low combustion speed and is very harmful. It has got a calorific value which varies in the range of 1600 to 2400 kcal/N Cum of the gas. It is the function of the air ratio. Lower is the air ratio higher is the calorific value, since nitrogen percentage of the gas reduces. Lower air ratio also means lower specific yield of the gas. Density of Convertor gas is 0.865 kg/Cum.

Convertor gas is highly poisonous and explosive and requires high degree of disciplined operation at the time of recovery .The gas is invisible and colourless. It cannot be detected by odor. It can readily form explosive mixtures with air, which are easily ignited by a static charge. Therefore, any leakage from flanges, valves and joints, may lead to severe explosion in the area resulting in fatal accident. Any ingress of external air or oxygen can also cause explosion in the system. So, supreme care is needed to avoid any kinds of leakage in the recovery, transportation as well as the utilization of the Convertor gas.

The physical & chemical properties of LD gas is given below:

PHYSICAL PROPERTIES*		
Form	:	Gas
Colour	:	Colourless
Odour	:	Not distinctive
Density	:	1.37 kg/Nm^3
Toxicity	:	Acutely toxic if inhaled
Flammable nature	:	Flammable gas

CHEMICAL COMPOSITION* (mol %)		
Carbon Dioxide (CO_2)	:	16.7
Carbon Monoxide (CO)	:	54.3
Hydrogen (H_2)	:	0.7
Nitrogen (N_2)	:	27.3
Oxygen (O_2)	:	1.0

Based on Data furnished by RINL for LD gas stored at 40°C

RINL's existing plant has two LD gas holders which can store upto 80,000 m^3 of LD gas. Both of these are situated within the existing SMS complex of RINL.

Mixed gas: Mixed gas is a homogenous mixture of Coke Oven Gas, Blast furnace gas and sometimes, LD gas. Its chemical and physical properties are similar to BF gas. The Mixed gas to be used by RINL for the proposed facility will be a 9:1 mixture of BFG and COG.

A new Gas mixing station is proposed to be installed near the existing Coke Oven Battery 5 of RINL, which is designed to handle a total capacity of 2,00,000 m^3/hr of mixed gas. Proposed new pipelines carrying Coke Oven gas as well as Blast furnace gas will be proportioned using control valves and mixed via conventional gas mixing (in-pipe mixing) method to generate Mixed gas of desired calorific value.

Propane: It is a primarily handled in liquefied form under pressurised conditions. It is a flammable hydrocarbon gas used as fuel for heating purposes as well as for cutting etc. in manufacturing processes. In liquefied form, it is a colourless and odourless liquid.

The physical properties of Propane (C3H8) are given below:

PHYSICAL PROPERTIES*		
Form	:	Gas, liquefied under pressure
Colour	:	Colourless
Odour	:	Odourless
Liquid density	:	0.54 kg/m^3
Molecular weight	:	44 g/mol
Lower explosion limit (LEL)	:	2.2 %
Upper explosion limit (UEL)	:	9.5 %
Flash point	:	-104°C
Solubility in water	:	Slightly soluble in water
Flammable nature	:	Highly flammable

Based on tentative data sourced from Material Safety Data Sheet of Propane

Propane is envisaged to be stored at RINL in (3 x 75T) mounded bullets with inlet, outlet and vapour balancing lines and associated pumps, compressors etc. The mounded bullet, as per design considerations mentioned in OISD-150(The Oil Industry Safety Directorate), eliminates chances of a BLEVE(Boiling Liquid Expanding Vapor Explosion) and reduces chances of fatal hazards at design stage itself. As for the pipes which form the part of inlet, outlet and vapour balancing lines, regular inspection of the pipelines and maintenance operations along with installation of pressure detection systems in the pipelines will ensure no occurrence of pipeline failure.

7.5 HAZARD IDENTIFICATION

Hazards associated with the identified hazardous chemicals based on NFPA (National Fire Protection Association) ratings as well as other parameters are presented in **Table 7.3**.

TABLE 7.3: TYPE OF HAZARDS ASSOCIATED WITH IDENTIFIED HAZARDOUS CHEMICALS

Name of Chemical		Type of Hazard	*NFPA Hazard Rating*			IDLH Value	Flash point (°C)	Flammability range (for gases)	Remarks
			Health	*Flammability*	*Reactivity*				
*Constituents of **COG/ BFG/ LDG/ Mixed Gas***	Hydrogen	1,6,9	*0*	*4*	*0*	-	-	LEL = 4% (<13%)	All gases transported directly through pipelines. *Release: Leak/rupture* *LD gas stored in Steel Gas holders. Release: Leak/ Rupture*
	Methane	1,6,9	*2*	*4*	*0*	-	-	LEL = 4.4% (<13%)	
	Carbon monoxide	1,3,9	*2*	*4*	*0*	1200 ppm	-	LEL = 12% (<13%)	
	Ammonia (NH3)	4,8	*3*	*1*	*0*	300 ppm	-	LEL = 16% UEL = 25%	
	Hydrogen sulphide (H_2S)	1,4,8	*4*	*4*	*0*	100 ppm	-	LEL = 4.3% UEL = 46%	
	Naphthalene	1,7,8	*2*	*2*	*0*	250 ppm	79°	LEL = 0.9% UEL = 5.9%	
Propane (C_3H_8)		1,3,9	*2*	*4*	*0*	2100 ppm	-104°	LEL = 2.2% UEL = 9.5%	Stored in mounded bullets. *Release: Leak/rupture*

Note: Type of Hazard **IDLH: Immediately Dangerous to Life or Health**

1 Flammable substance	*6 Gas or vapour not dangerous other than displacing air*
2 Oxidising substance, reacts with reducing agents	*7 Causes skin irritation or burns*
3 Emits a toxic gas or vapour	*8 Toxic substance*
4 Emits an irritating gas or vapour	*9 Explosive material under certain conditions*
5 Emits a narcotic gas or vapour	

NFPA Hazard Rating				
a) HEALTH				
1 - None	*2 - Minor*	*3 - Moderate, could cause temporary incapacitation or injury*	*4 - Severe, short exposure may cause serious injury*	*5 - Extreme, short exposure may cause death*
b) FLAMMABILITY				
1-None, Material does not burn	*2- Minor, material must be preheated to ignite*	*3- Moderate, moderate heating is required for ignition and volatile vapours are released*	*4- Severe, material ignites at normal temperature*	*5- Extreme, very flammable substance that readily forms explosive mixtures*
c) REACTIVITY				
1-None, stable when exposed to fire	*2-Minor, unstable at high temp. or press and may react with water*	*3-Moderate, unstable but does not explode, may form explosive mixture with water*	*4-Severe, Explodes if heated or water added*	*5-Extreme, readily explosives under normal condition*

From the above table it can be observed that Coke Oven gas, BF gas, LD gas, mixed gas and propane are the hazardous material of concern for the proposed project. Propane is proposed to be stored in mounded bullets, as per the design guidelines of OISD-150, which also confirms high levels of safety of mounded bullets, diminishing possibilities of BLEVE from the bullets.

The catastrophic potential of a hazardous substance depends on its flammability, toxicity and volatility. The ambient temperature vapour pressure of a substance is used as a measure of the ability to become air borne. Although COG, BFG and Mixed gas are not proposed to be stored in the plant and also, as per applicability of MSIHC Rules, 1989, there is no specific requirement for carrying out its consequence analysis, the fire hazards associated have been quantified owing to its toxic as well as high flammable nature. LD gas and propane being highly flammable and stored in significant quantities in the plant require consequence analysis to be carried out for them.

7.6 HAZARD ASSESSMENT

In the earlier section, type of hazard associated with different type of substances and the event of release of these substances is being identified. It has also been identified the category of hazard associated with different chemicals.

In any plan hazardous situation arises due to:

- *Failure in the monitoring of crucial process parameters e.g. pressure, temperature, flow quantity etc.*
- *Failure in the utilities e.g. cooling water*
- *Failure control elements e.g. pressure, temperature level, flow controllers etc.*
- *Failure of components such as pumps, compressor etc.*
- *Failure of safety systems, safety valves / relief valves, sprinkler systems, alarm etc.*
- *Mechanical failure of vessels or pipe work due to excessive stress, over pressure, corrosion etc.*
- *Wrong operation, failing to adhere to the safety norms etc.*

Such a situation is possible during the storage as well as handling of aforementioned hydrocarbon gases. It is unlikely that small leakage through pipes, gaskets, glands or any other means (user points) will create a hazardous situation unless allowed to be released for a long time as will be established in the subsequent sections. It is expected that during such small leakage preventive steps will be taken within a specified time span. Therefore a Preliminary Hazard Analysis (PHA) is carried out first for assessment of hazard. It is to note that the storage of Propane involves mounded storage bullets, which are designed to be intrinsically safe from the occurrence of a BLEVE condition. It is also to be noted that the storage of LD gas involves vertical storage tanks called Gas holders located at separate locations nearer to the existing SMS complex of RINL, considering the nature of risks involved in storage of LD gas. All the above gases shall be transported through steel pipelines constructed as per applicable safety standards.

Effects of the above Hazards:

The effect of accidents in these areas will be confined to the facilities only and can be controlled within the areas by the operating personnel themselves. At the extreme, it may require the resources of the whole facility to control the effects but these are not at all expected to spill over to the community. Primary Hazard Analysis is given in **Table 7.4**.

TABLE 7.4: PRELIMINARY HAZARD ANALYSIS

Sn.	Project component	Incident type	Failure Scenario	Causes of failure	Proposed preventive measures
1.	**Mounded Storage bullets**	Release of pressurized gas into the atmosphere, Formation of vapour cloud, fire, explosion	Failure in inlet, outlet or vapour balancing line or associated fittings, pump or pipe-work or operator error leading to impacts including chemical or fuel contamination	• Overfilling • Pressure increase in bullet • Rupture of hose • Gasket Failure • Leak at flanges • Wrong line-up • Non adherence to SOP for sampling • Instrumentation failure • Operator error • External fire • Corrosion	• Design of storage structures / tanks to relevant standards and legislations. • Design of pipelines (i.e. wall thickness and stress relief), well sites, Central Processing Facility and related infrastructure to relevant standards and legislation. • Installation of pressure monitoring systems. • Regular inspections and maintenance. • Housekeeping activities – site would be kept clean and tidy and fire hazards removed where practicable. • Availability of firefighting equipment. • Maintenance of fire breaks to slow the progress of bushfires. • Routine hazard reduction burns. • Fire-fighting equipment located in on-site vehicles and infrastructure (wherever appropriate). • Regular inspections and maintenance of firefighting equipment and storage areas, where required. • Operator induction and ongoing training. • Operational procedures. • Material safety data sheet (MSDS) register and MSDSs kept on-site at different locations in form of signage etc. • Hazard Signage. • Location of explosive storage shall be such that it has minimum interaction with people and property.
		Sabotage	Malicious act/sabotage resulting in off-site impacts.	• Inadequate protection of facilities. • Lapse in safety procedures due to Human error.	• Restriction of access to storage areas, including securing storage facilities. • Provision of adequate lighting around storage facilities. • Signage (i.e. unauthorized entry warning and information signs). • Police would be notified as soon as possible in case of a suspected breach.
2.	**Vertical Storage tanks (gas holders)**	Release from Leak / rupture	Failed tank or associated fittings, pump or pipework or operator error.	• Rupture of hose • Gasket Failure • Leak at flanges • Non adherence to SOP for sampling	• Design of storage structures / tanks to relevant standards and legislations. • Regular inspections and maintenance. • Operator induction and ongoing training.

Sn.	Project component	Incident type	Failure Scenario	Causes of failure	Proposed preventive measures
				• Instrumentation failure • Operator error • External fire • Corrosion	• Operational procedures. • Material safety data sheet (MSDS) register and MSDSs kept on-site at different locations in form of signage etc. • Hazard Signage.
			Failed vessel due to mechanical impact or corrosion	• Corrosion • Mechanical impact	
		Fire or Explosion	Poor maintenance, poor design, collision or human error leading to fire / explosion / fume related impacts.	Human/ Operator error in design and construction	• Design of storage structures / tanks to relevant standards and legislations. • Appropriate storage of all chemicals, fuel and dangerous substances in accordance with relevant Hazardous Chemical Rules, 2000 with subsequent amendments and associated legislations. • Housekeeping activities – site would be kept clean and tidy and fire hazards removed where practicable. • Availability of firefighting equipment, such as overhead water spray system, mounted on top of gas holders. • Regular inspections and maintenance of firefighting equipment and storage areas, where required. • Site policies, management plans and procedures. • Protection of storage facilities (e.g. bollards). • Operator induction and ongoing training. • Location of explosive storage should be such that it has minimum interaction with people and property.
		Sabotage	Malicious act/sabotage resulting in off-site impacts.	• Inadequate protection of facilities. • Lapse in safety procedures due to Human error.	• Restriction of access to storage areas, including securing storage facilities. • Provision of adequate lighting around storage facilities. • Signage (i.e. unauthorized entry warning and information signs). • Police would be notified as soon as possible in case of a suspected breach.
2.	**Gas Pipelines**	Release of flammable gas, Formation of vapour cloud, fire, explosion	Failure of pipeline, bursting of pipeline due to - Corrosion - Vibration - External loading - Operation error - Over pressure - Maintenance failure - Communication failure - Sabotage	• Pressure increase • Rupture of pipe • Leak in pipework • Instrumentation failure • Operator error • External fire • Corrosion	• Design of pipelines (i.e. wall thickness and stress relief), well sites, Central Processing Facility and related infrastructure to relevant standards and legislation. • Installation of pressure monitoring systems. • Conduct regular inspections, maintenance and testing of equipment. • Site policies, management plans and procedures. • Operator induction and ongoing training. • Maintenance of fire breaks to slow the progress of bushfires.

Sn.	Project component	Incident type	Failure Scenario	Causes of failure	Proposed preventive measures
					• Routine hazard reduction burns. • Fire-fighting equipment and spill kits located in on-site vehicles and infrastructure (where appropriate).
		Sabotage	Malicious act/sabotage resulting in off-site impacts.	• Inadequate protection of facilities. • Lapse in safety procedures due to Human error.	• Restriction of access to storage areas, including securing storage facilities. • Provision of adequate lighting around storage facilities. • Signage (i.e. unauthorized entry warning and information signs). • Police would be notified as soon as possible in case of a suspected breach.

7.6.1 Maximum Credible Accident Analysis (MCAA)

A Maximum Credible Accident (MCA) can be characterized, as an accident with a maximum damage potential, this is still believed to be probable. The selection of accident scenarios representative for a MCA-Analysis has been done on the basis of engineering judgement and expertise in the field of risk analysis studies, especially accident analysis.

In the proposed expansion programme of RINL, which is also identified as an "Industrial activity" handling hazardous substances as per MSIHC Rules, 1989 and subsequent amendments, hazardous substances may be released as a result of failures or catastrophes, causing possible damage to the surrounding area.

As mentioned above, the hazardous substances identified of posing major threats to the facility and people working at the facility are listed at **Table 7.2**.

MCA Analysis assists in identifying the potential major accidents arising due to flammable and/or toxic storages or handling facilities and estimate the maximum consequent effects on the surrounding environment in terms of damage distances of heat, radiation, toxic release, vapor cloud explosion etc. depending upon the effective hazardous attributes and the impact of the event, in the worst possible hazard situations.

The visualization of MCA scenarios has been done considering the chemical inventory being handled at the proposed plant, various loss of containment scenarios and subsequent accident scenarios and analysis of incident history of similar nature to establish credibility of the identified accident scenarios. Based on the above, the identified credible accident scenarios having maximum damage effects (worst case) were as follows:

i. For **LD gas Holders:**
   a. Release of LD gas due to rupture resulting in
      - Fireball
      - Flash fire
      - Vapour Cloud explosion
      - Toxic cloud dispersion

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ii. For **Gas Mixing Station/facility:**
   a. Release of COG from **COG inlet pipeline** due to
      - leak from hole (eq. size 100mm) of piping resulting in
        - Jet fire
        - Flash fire

      Note: *No Vapour Cloud explosion and Toxic cloud dispersion effects observed due to hole releases due to very low release rates of gas quantity from the holes. Thus, they have been excluded from the analysis.*

      - rupture of pipeline resulting in
        - Fireball
        - Flash fire
        - Vapour Cloud explosion
        - Toxic cloud dispersion

   b. Release of BF gas from **BF gas inlet** pipeline due to rupture resulting in
      - Fireball
      - Flash fire
      - Vapour Cloud explosion
      - Toxic cloud dispersion

      Note: *Due to low mass release rates of the gas, no significant hazard distances were observed due to release from holes of all sizes upto 20% of pipe dia. Thus, only full bore rupture considered for the analysis.*

   c. Release of Mixed gas from **Mixed gas outlet** pipeline due to rupture resulting in
      - Fireball
      - Flash fire
      - Vapour Cloud explosion
      - Toxic cloud dispersion

      Note: *Due to low mass release rates of the gas, no significant hazard distances were observed due to release from holes of all sizes upto 20% of pipe dia. Thus, only full bore rupture considered for the analysis.*

iii. For **Mounded bullet storage of Propane:**
   a. Release of Propane from Bullet's Liquid Inlet, Outlet Lines and/or Vapour Balancing Line connection points resulting in
      - Jetfire
      - Flash fire
      - Vapour Cloud explosion

7.7 CONSEQUENCE ANALYSIS

Subsequent to the accidental release of hazardous chemicals, the consequence depends on various factors e.g. type and inventory of released hazardous materials,

presence and location of an ignition source, meteorological conditions, etc. Consequence analysis for the selected accident scenarios has been carried to estimate the vulnerable zones.

7.7.1 Consequence Model/Software used

DNV's PHAST (Version 6.4) software, which is a consequence and risk assessment software for calculation of physical effects (fire, explosion, atmospheric dispersion) of the escape of hazardous materials has been used to perform the consequence calculations. The software allows detailed modeling and quantitative assessment of release of pure chemicals as well as mixtures from different scenarios.

7.7.2 Hazardous scenarios modeled

Consequence analysis quantifies vulnerable zone for a conceived incident and once the vulnerable zone is identified for an incident, measures can be proposed to eliminate damage to plant and potential injury to personnel. Consequence analysis for existing LD gas stored in gas holders, additional COG, BFG and Mixed Gas proposed to be handled via pipelines of new Gas mixing station and Propane envisaged to be stored in Mounded bullets at RINL has been carried out. The release scenarios selected and associated hazards based on MCA Analysis are listed below in **Table 7.5.**

TABLE 7.5: PROBABLE RELEASE & ACCIDENT SCENARIOS IDENTIFIED AS PER MCAA

Sn	Hazardous substance	Credible Release scenario	Credible identified accidents
1.	LD gas	Complete failure of Gas holder leading to catastrophic release of LD gas	Fireball, Flash fire, Vapour Cloud explosion, Toxic Cloud dispersion
2.	Propane	Complete failure of inlet-outlet and other lines connected to the bullets leading to release from connecting points.	Fireball, Flash fire, Vapour Cloud explosion
3.	Coke Oven Gas, BF Gas, Mixed gas	Leak from hole (100mm dia. hole) [for COG only]	Jet fire, Flash fire
		Full bore rupture of piping [for all gases]	Fireball, Flash fire, Vapour Cloud explosion, Toxic Cloud dispersion

7.7.3 Meteorological conditions CONSIDERED

Minimum wind speed of 1.0 m/s and stable as well as neutral atmospheric stability conditions have been assumed to model fire effects in a worst case scenario having low chance of dilution of flammable substance concentration in the atmosphere and a higher damage effect. An average Wind speed of 3.0 m/s based on annual climatological trend of wind speeds at Visakhapatnam as collected from IMD Atlas at Visakhapatnam with neutral atmospheric stability conditions has been assumed to predict maximum extent of dispersion of toxic components of the identified hazardous substances during a release.

7.7.4 Damage Criteria considered in the model

In order to apprehend the damage produced by various scenarios, it is appropriate to discuss the physiological/physical effects of thermal radiation intensities due to fire accidents and overpressure effects of explosions. The thermal radiation due to pool fire or jet fires usually results in burn on the human body. Furthermore, inanimate objects like equipment, piping, cable, etc. may also be affected and also need to be evaluated for damages. The effect of overpressure due to blast effect and the effect of thermal radiation due to fire on unprotected skin, as per Indian Standard **IS 15656 : 2006** ***HAZARD IDENTIFICATION AND RISK ANALYSIS — CODE OF PRACTICE*** is presented below in **Table 7.6(a) & (b),** respectively.

TABLE 7.6: (a) EFFECT OF DIFFERENT OVERPRESSURES ON HUMAN LIFE & PROPERTY

Overpressure (bar)	Type of Damage on structure	Type of Damage on Human life
0.02	Typical window glass breakage	-
0.14	Partial collapse of buildings	Personnel knocked down
0.21	Steel framed buildings get distorted and uprooted from their foundations	Ear drum rupture (beginning of serious injury to human life)

TABLE 7.6: (b) RELATION BETWEEN HEAT RADIATION INTENSITY, TIME AND EFFECT ON MAN

Heat Radiation Level (Kw/m^2)	Duration (Secs)	Effect on Humans	Effect on property
4 -6	20	Sufficient to cause pain to personnel	Impairment of escape routes
12.5	5-20	Extreme pain within 20s	Provides minimum energy required for piloted ignition of wood and melting of plastic
37.5	10	Immediate fatality (100% lethality)	Sufficient to cause severe damage to process equipment

The results of consequence analysis are summarised in the succeeding **Table 7.7** below.

TABLE 7.7: RESULTS OF CONSEQUENCE ANALYSIS

Plant Unit	Hazardous Substance Handled/ Stored	Failure size (mm)	Hazard effects	End Point Criteria	Hazard extent(m) Atmospheric Conditions		
					1.5F	1.5D	3D
1. GAS MIXING STATION							
i) COG Inlet Pipeline	COG	Hole (100mm)	Jet fire *[Release rate: 0.4 kg/s Flame length: 12.27 m*	4.0 kW/m²	*9*	-	*11*
				12.5 kW/m²	-	-	-
				37.5 kW/m²	-	-	-
			Flash Fire *[½ LFL conc: 23698.9 ppm]*	LFL	*5*	*5*	*4*
				½ LFL	*8*	*8*	*7*
		Rupture (FBR)	Fire Ball *[Max Fireball radius= 13.79m]*	4.0 kW/m²	*115*	*115*	*115*
				12.5 kW/m²	*66*	*66*	*66*
				37.5 kW/m²	*38*	*38*	*38*
			Flash Fire *[½ LFL conc: 23698.9]*	LFL	*14*	*12*	*13*
				½ LFL	*34*	*31*	*35*
			Vapour Cloud Explosion *[Distance of ignition: 10m]*	0.21 bar	*36*	*36*	*37*
				0.14 bar	*44*	*43*	*44*
				0.02 bar	*142*	*140*	*143*
			Toxic Dispersion *[Probability of fatality at distance of]*	0 m	*0.83*	*0.63*	*0.04*
				25 m	*0*	*0*	*0*
ii) BFG Inlet Pipeline	BFG	Rupture (FBR)	Fire Ball *[Max Fireball radius= 52.3m]*	4.0 kW/m²	*111*	*111*	*111*
				12.5 kW/m²	*51*	*51*	*51*
				37.5 kW/m²	-	-	-
			Flash Fire *[½ LFL conc: 162338 ppm]*	LFL	*65*	*14*	*23*
				½ LFL	*210*	*34*	*51*
			Vapour Cloud Explosion *[Distance of ignition: 10m]*	0.21 bar	*48*	*47*	*47*
				0.14 bar	*59*	*58*	*58*
				0.02 bar	*198*	*197*	*197*
			Toxic Dispersion *[Probability of fatality at distance of]*	0 m	*0.83*	*0.93*	*0.34*
				25 m	*0*	*0*	*0*
iii) Mixed gas Outlet Pipeline	Mix. G	Rupture (FBR)	Fire Ball *[Max Fireball radius= 38.25m]*	4.0 kW/m²	*99*	*99*	*99*
				12.5 kW/m²	*49*	*49*	*49*
				37.5 kW/m²	*9*	*9*	*9*
			Flash Fire *[½ LFL conc: 104424 ppm]*	LFL	*12*	*10*	*15*
				½ LFL	*43*	*26*	*51*
			Vapour Cloud Explosion	0.21 bar	*44*	*43*	*43*

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Plant Unit	Hazardous Substance Handled/ Stored	Failure size (mm)	Hazard effects	End Point Criteria	Hazard extent(m) Atmospheric Conditions		
					1.5F	1.5D	3D
			[Distance of ignition: 10m]	0.14 bar	*54*	*53*	*53*
				0.02 bar	*178*	*177*	*177*
			Toxic Dispersion *[Probability of fatality at distance of]*	0 m	*0.87*	*0.93*	*0.31*
				25 m	*0*	*0*	*0*
2. LD GAS HOLDERS	LD Gas	Rupture (FBR)	Fire Ball *[Max Fireball radius= 135m]*	4.0 kW/m²	*410*	*410*	*410*
				12.5 kW/m²	*219*	*219*	*219*
				37.5 kW/m²	*84*	*84*	*84*
			Flash Fire *[½ LFL conc: 110644 ppm]*	LFL	*127*	*76*	*120*
				½ LFL	*262*	*126*	*192*
			Vapour Cloud Explosion *[Distance of ignition: 10m]*	0.21 bar	*136*	*136*	*136*
				0.14 bar	*173*	*173*	*173*
				0.02 bar	*640*	*640*	*640*
			Toxic Dispersion *[Probability of fatality at distance of]*	0 m	*0.52*	*0.90*	*0.37*
				25 m	*0*	*0.01*	*0*
				50 m	*0*	*0*	*0*
3. MOUNDED PROPANE BULLET							
i) Connection point of Inlet/ outlet pipelines (80mm Ø)	Propane	Vessel hole (80mm)	Jet fire *[Release rate: 133 kg/s Flame length: 132 m]*	4.0 kW/m²	*131*	*131*	*154*
				12.5 kW/m²	-	-	*45*
				37.5 kW/m²	-	-	-
			Flash Fire *[½ LFL conc: 10000 ppm]*	LFL	*6*	*6*	*8*
				½ LFL	*23*	*21*	*22*
			Vapour Cloud Explosion *[Distance of ignition: 10m]*	0.21 bar	*44*	*45*	*42*
				0.14 bar	*54*	*55*	*51*
				0.02 bar	*179*	*184*	*169*
ii) Connection point of Vapour Balancing lines/ other pipelines (80mm Ø)	Propane	Vessel hole (50mm)	Jet fire *[Release rate: 52 kg/s Flame length: 88.25 m]*	4.0 kW/m²	*81*	*9*	*98*
				12.5 kW/m²	-	-	*22*
				37.5 kW/m²	-	-	-
			Flash Fire	LFL	*Not observed due to low mass flow release rate from hole*		
				½ LFL			
			Vapour Cloud Explosion *[Distance of ignition: 10m]*	0.21 bar	*33*	*33*	*30*
				0.14 bar	*39*	*39*	*35*
				0.02 bar	*123*	*123*	*108*

The above table makes evident that the majority of the hazardous consequence have highest hazard extents in the atmospheric stability class D. The worst case results for the different releases enumerated above have been observed in the atmospheric scenario similar to 3D. As observed from the table above, the worst case results are summarized in **Table 7.8** below. For assessing maximum damage from most credible scenarios, results have been shown for end point criteria corresponding to maximum observed damage due to a particular hazard effect.

TABLE 7.8: WORST CASE HAZARD EXTENTS FOR IDENTIFIED HAZARDOUS FACILITIES

Plant Unit	Failure size	Nature of hazard	Hazard effects	Worst case Hazard extent (m)
GAS MIXING STATION	Hole	*Fire & Explosion*	Jet fire	*11m @ 4.0 kW/m²*
			Flash Fire	*8m @ LFL*
	Rupture	*Fire & Explosion*	Fireball	*38m* @37.5 kW/m²
			Flash Fire	*65m* @LFL
			Vapour Cloud Explosion	*48m* @0.21 bar(g)
		Toxic effect	Toxic effect safe distance	*≥ 25m @ no probability of fatality*
LD GAS HOLDERS	Rupture	*Fire & Explosion*	Fireball	*84m* @37.5 kW/m²
			Flash Fire	*127m* @LFL
			Vapour Cloud Explosion	*136m* @0.21 bar(g)
		Toxic effect	Toxic effect safe distance	*≥ 50m @ no probability of fatality*
MOUNDED PROPANE BULLET	Vessel failure at pipe junctions	*Fire & Explosion*	Jetfire	*45m at 12.5 kW/m²*
			Flash Fire	*8m @ LFL*
			Vapour Cloud Explosion	*45m* @0.21 bar(g)

The worst case Hazard extents of all identified major hazardous units is shown in **Figures. 7.1(a) to 7.1(g).**

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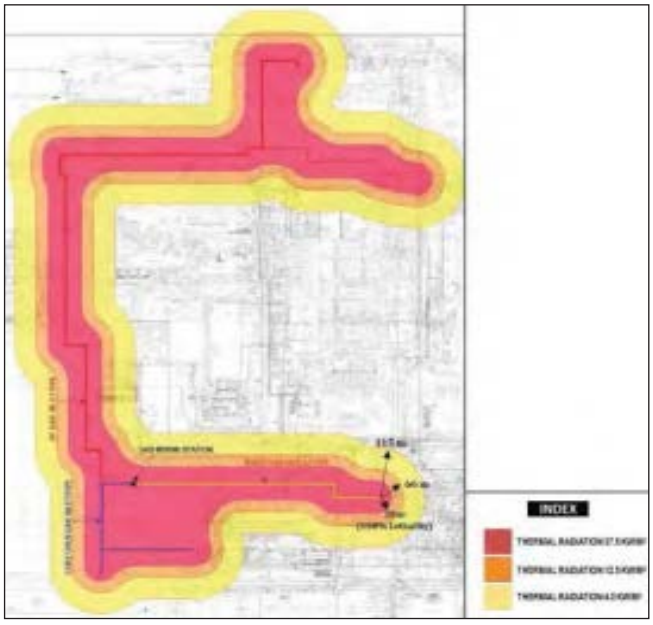
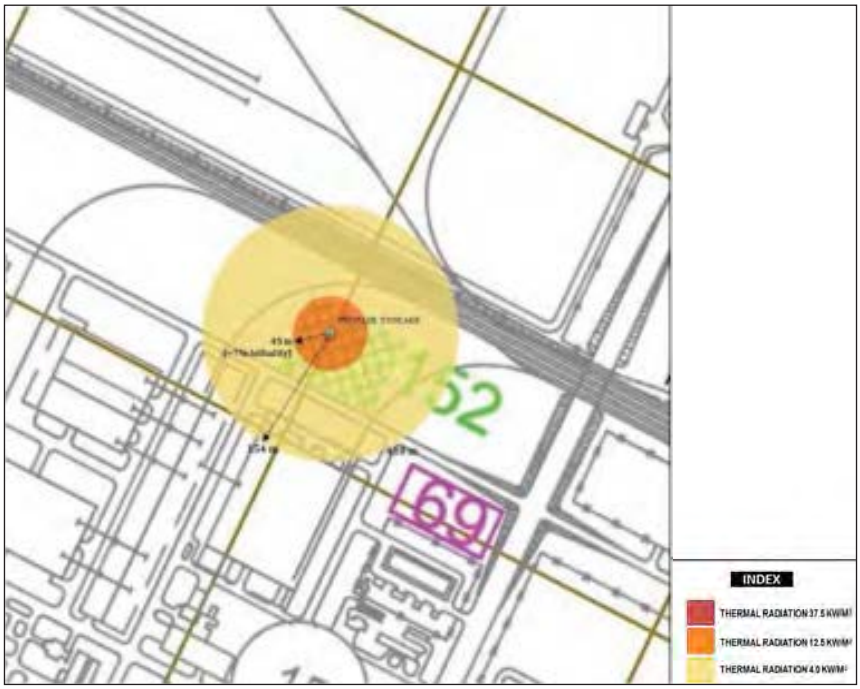
FIG 7.1: (a) HAZARD EXTENTS FOR THERMAL FIRE RADIATION EFFECTS



GAS MIXING STATION WITH ASSOCIATED PIPEWORK

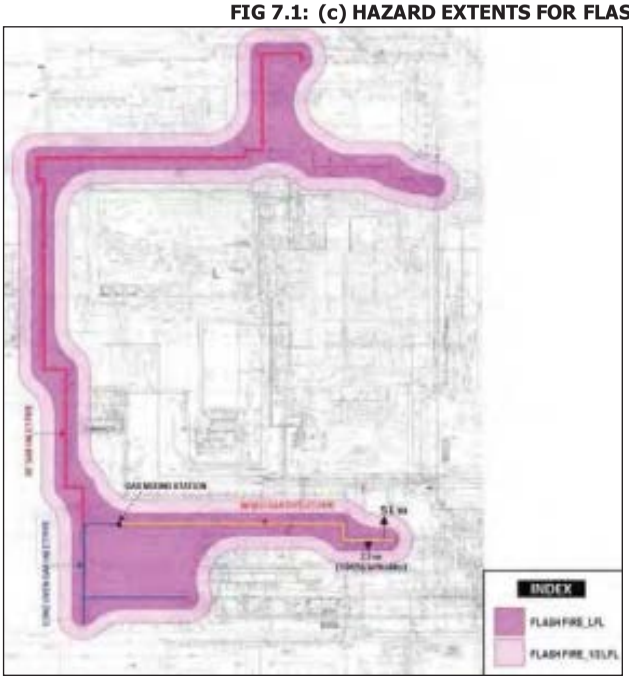
LD GAS HOLDERS

FIG 7.1: (b) HAZARD EXTENTS FOR THERMAL FIRE RADIATION EFFECTS

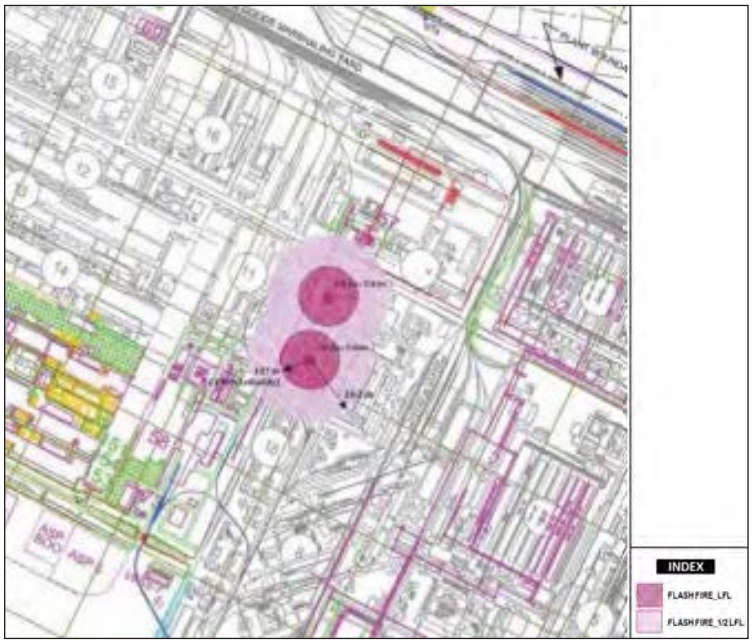


MOUNDED PROPANE BULLET

FIG 7.1: (c) HAZARD EXTENTS FOR FLASH FIRES IN IDENTIFIED HAZARDOUS FACILITIES

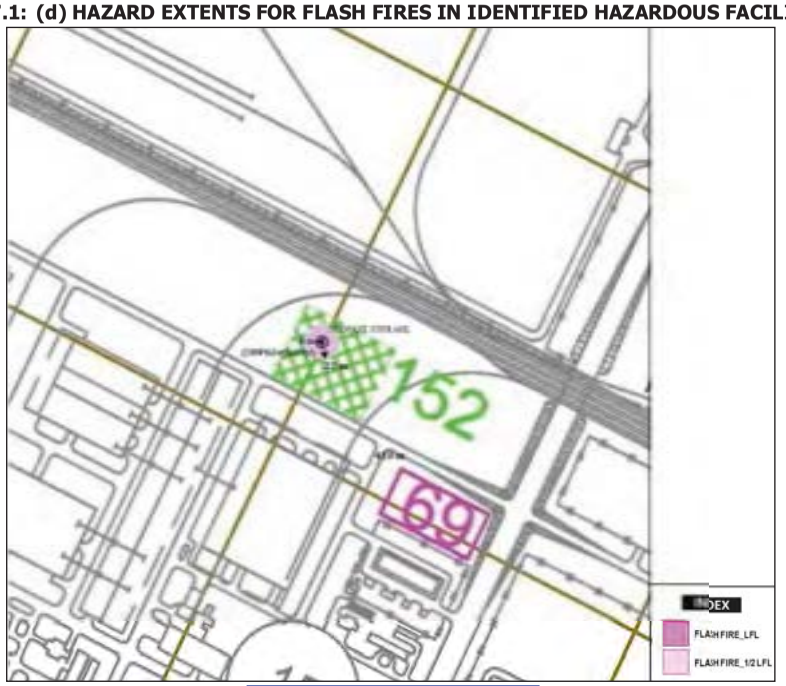


GAS MIXING STATION WITH ASSOCIATED PIPEWORK



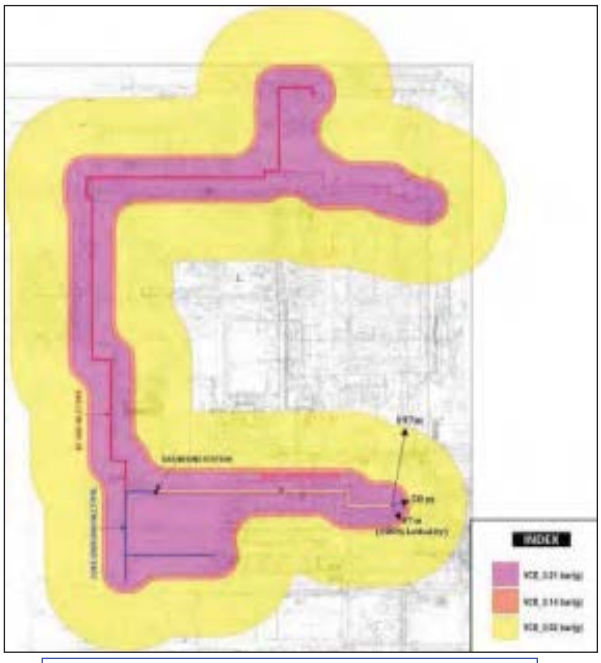
LD GAS HOLDERS

FIG 7.1: (d) HAZARD EXTENTS FOR FLASH FIRES IN IDENTIFIED HAZARDOUS FACILITIES

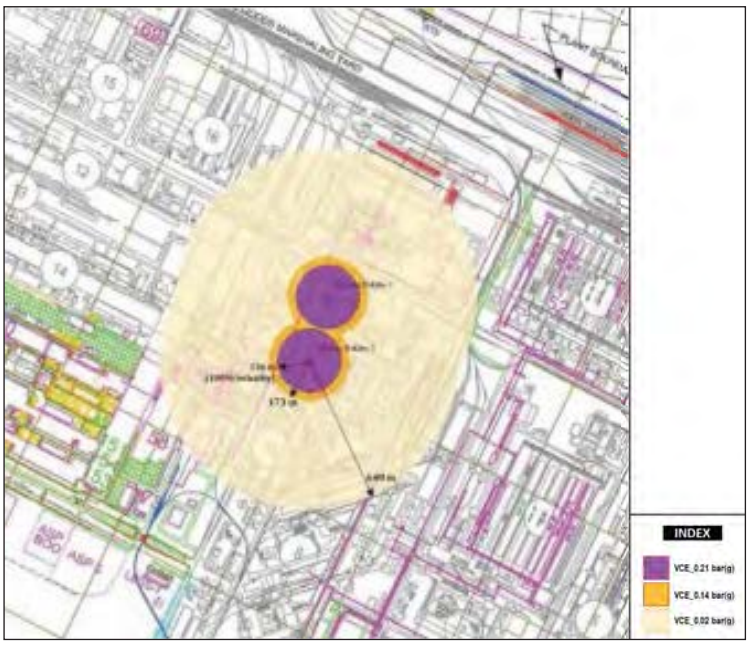


MOUNDED PROPANE BULLET

FIG 7.1: (e) HAZARD EXTENTS FOR VAPOUR CLOUD EXPLOSION EFFECTS IN IDENTIFIED HAZARDOUS FACILITIES

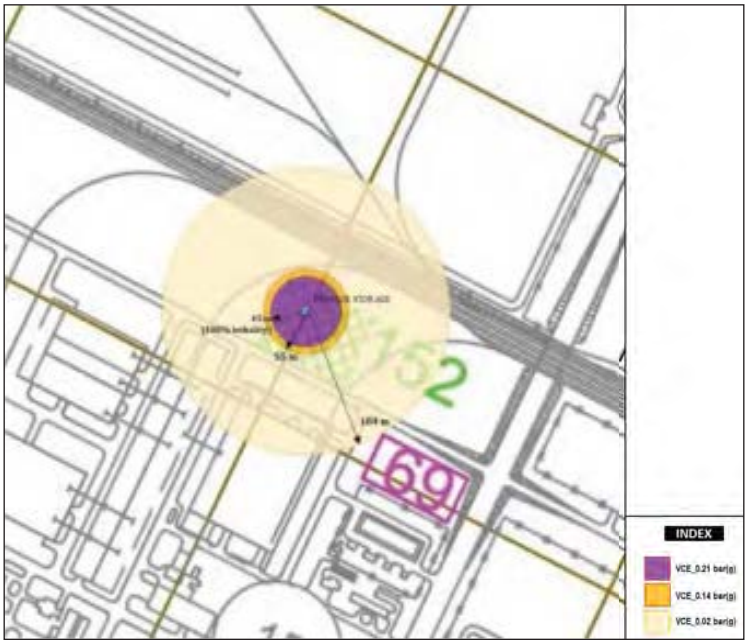


GAS MIXING STATION WITH ASSOCIATED PIPEWORK



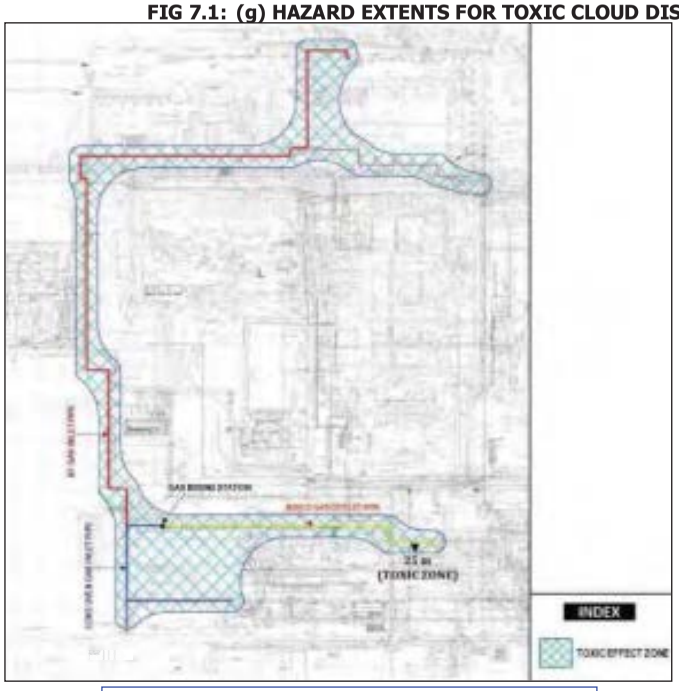
LD GAS HOLDERS

FIG 7.1: (f) HAZARD EXTENTS FOR VAPOUR CLOUD EXPLOSION EFFECTS IN IDENTIFIED HAZARDOUS FACILITIES



MOUNDED PROPANE BULLET

FIG 7.1: (g) HAZARD EXTENTS FOR TOXIC CLOUD DISPERSION EFFECTS IN IDENTIFIED HAZARDOUS FACILITIES

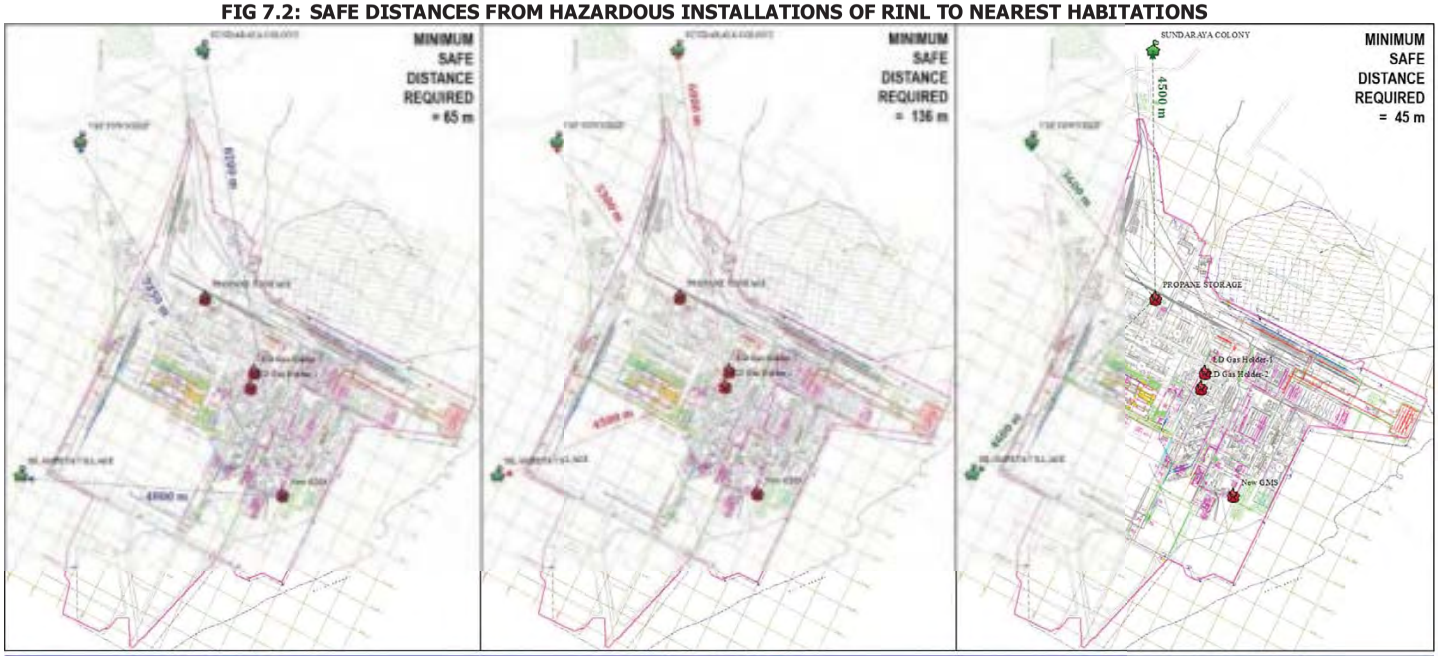


GAS MIXING STATION WITH ASSOCIATED PIPEWORK

LD GAS HOLDERS

The proximity of nearest habitations to **Identified Hazardous facilities** is shown in **Figure 7.2** below:

FIG 7.2: SAFE DISTANCES FROM HAZARDOUS INSTALLATIONS OF RINL TO NEAREST HABITATIONS



7.8 CONCLUSION ON MCA ANALYSIS

7.8.1 Gas Mixing Station

A maximum total of 2,00,000 m^3/hr of mixed gas is proposed to be prepared and handled by a new Gas mixing station envisaged at RINL's Coke Oven complex, wherein BF Gas and Coke Oven gas will be tapped from existing as well as future producing units and will be mixed in suitable proportions to produce Mixed gas of desired calorific value for use at the existing and new coke oven batteries. The results of MCA analysis indicates a maximum fire hazard distance for causing significant damage (@37.5 Kw/m^2 thermal radiation) extending up to **38 m** in the case of complete failure of the holder and catastrophic release of LD gas, subsequently being ignited during worst meteorological conditions resulting in a fireball. The hazard extent for flash fire extends till **65 m** (@ LFL concentration). Explosion effects having significant potential for damage (@0.21 bar(g) overpressure) is observed to be upto a distance of **48m**.

The toxic effect of BFG, COG as well as Mixed gas (attributed to presence of Carbon Monoxide in the gases) will be limited to **25m** from the gas holder, beyond which there will be no probability of fatality due to toxic effect in case of a release.

Overall, a minimum safe distance of **65 m** from the Gas mixing station will ensure no damage to personnel as well as property, outside the plant premises. As observed from the overall analysis, t*he hazard extents will be contained within the plant premises and will not extend beyond plant boundary into any nearby settlement in the area.*

7.8.2 LD Gas Holders

There are two (2) LD gas holders, each of 80,000 m3 capacity, located separately within the SMS complex of RINL's Visakhapatnam Steel Plant. The results of MCA analysis indicates a maximum fire hazard distance for causing significant damage (@37.5 Kw/m^2 thermal radiation) extending up to **84 m** in the case of complete failure of the holder and catastrophic release of LD gas, subsequently being ignited during worst meteorological conditions resulting in a fireball. Explosion effects having significant potential for damage (@0.21 bar(g) overpressure) is observed to be upto a distance of **136m**.

The toxic effect of LDG (attributed to 54.3% (mole %) of Carbon Monoxide in LDG) will be limited to **50m** from the gas holder, beyond which there will be no probability of fatality due to toxic effect in case of a release.

Overall, a minimum safe distance of **136 m** from the LD Gas holders will ensure no damage to personnel as well as property, outside the plant premises. As observed from the overall analysis, *the hazard extents will be contained within the plant premises and will not extend beyond plant boundary into any nearby settlement in the area.*

7.8.3 Mounded Propane Bullet

RINL has envisaged three (3) Mounded propane bullets, each of 75 Tonne capacity, located within the RINL's Visakhapatnam Steel Plant for heating and cutting purposes. The results of MCA analysis indicates a maximum fire hazard distance for causing significant damage (@12.5 Kw/m^2 thermal radiation) extending up to **45 m** in the case of complete failure of the pipeline connections on the bullets and release of propane, subsequently

being ignited during worst meteorological conditions resulting in a jetfire. Explosion effects having significant potential for damage (@0.21 bar(g) overpressure) is also observed to be upto a distance of **45 m**.

Overall, a minimum safe distance of **45 m** from the Mounded Propane bullets will ensure no damage to personnel as well as property, outside the plant premises. As observed from the overall analysis, *the hazard extents will be contained within the plant premises and will not extend beyond plant boundary into any nearby settlement in the area. Also, pressure-monitoring systems shall be installed to detect leaks or cracks in the pipeline. Fire-fighting facilities will also be installed to check any fire incident that may occur.*

7.9 HAZARDOUS EVENTS WITH GREATEST CONTRIBUTION TO FATALITY RISK

The hazardous event scenarios likely to make the significant contribution to the risk of potential fatalities are enlisted in **Table-7.9**. The risks to people at plant site are categorised as "On-site" risks while the risks to communities outside the plant premises is categorised as "Off-site" risks.

TABLE 7.9: HAZARDOUS EVENTS CONTRIBUTING TO RISK AND THEIR RISK RANKING

			(A)	(B)	C = A*B
Sn.	**Hazardous event**	**Consequence of significant damage**	**Consequence severity*** *(1=least severe; 5=most severe)*	**Likelihood*** *(1=least likely; 5=most likely)*	**RISK RANK**
1.	Onsite vehicle impact on personnel	Potential for single fatalities, onsite impact only	3	3	9
2.	Entrapment/struck by Machinery	Potential for single fatalities, onsite impact only	3	2	6
3.	Fall from heights	Potential for single fatalities, onsite impact only	1	3	3
4.	Electrocution	Potential for single fatalities, onsite impact only	2	3	6
5.	Gas Mixing Station fire & explosion as well as toxic dispersion	Potential for multiple fatalities, onsite impact only	4	1	4
6.	LD gas holder failure and fire & explosion as well as toxic dispersion	Potential for multiple fatalities, onsite impact only	5	1	5
7.	Mounded Propane Bullet's fire & explosion	Potential for multiple fatalities, onsite impact only	3	1	3

** based on Historical survey of similar facilities*

The above risk ranking indicates that although the most severe consequences will be due to rupture of LD Gas holders followed by Gas Mixing station and Mounded propane bullets, their chances of occurrences are low due to implementation of better safety features in the installations and constant monitoring of vessel/pipework integrity for regular repair and maintenance, and hence these facilities have **low levels of risk** in the facility.

7.10 SUMMARY & CONCLUSIONS OF RISK ASSESSMENT

The risk assessment and analysis for RINL's steel plant for most severe hazardous events is broadly summarised below:

- The nearest habitations in the vicinity of the RINL Plant are VSP's township at distance of **1500m** in NW, Islampeta village at distance of **450m** in SW and Sundaraya Colony at distance of **1140m** in the N, which are far away from the hazard distances observed for thermal effects *(maximum at 127m)* as well as toxic effects *(maximum at 50m)* due to failure of above identified hazardous facilities of RINL. Also, these facilities are located in the Northern and North-eastern part of the RINL steel plant away from each other to prevent multiple hazards, initiated due to fire in one facility and leading to a hazard in another facility, also known as domino effect. So, there will be no significant impact on the local community or damage to property / environment.
- The most severe damage effects due to the identified hazardous facilities will be limited to the plant premises and adequate safety controls as well as implementation of recommended control strategies in the design as well as operation stage will ensure effective management of the associated risks.

7.11 RECOMMENDED RISK REDUCTION & MITIGATIVE MEASURES

The following opportunities shall be considered as a potential means of reducing identified risks during the detailed design phase:

- *The zones identified from consequence modelling as affected areas due to thermal radiations greater than 12.5 kW/m2 shall be marked as "Heat Zones" and provisions for fire fighting will be made available close to these zones.*
- *It is also recommended to provide portable gas detectors within the site in order to facilitate manual gas leak monitoring and regular leakage checks. Constant monitoring of gas leak shall be ensured for immediate identification of leaks and subsequent implementation of action plan to prevent development of any hazardous situation.*
- *Further, all major units / equipment shall be provided with the following safety facilities:*
  - *Smoke / fire detection and alarm system*
  - *Water supply*
  - *Fire hydrant and nozzle installation*
  - *Foam system*
  - *Water fog and sprinkler system*
  - *Mobile fire-fighting equipment*
  - *First-aid appliances*
- *Personal Protective Equipment (PPE) shall be provided for additional protection to workers exposed to workplace hazards in conjunction with other facility controls and safety systems.*
- *Restricted access to these areas to have minimum casualties in an event of exposure.*
- *The onsite Emergency Plan will be integrated with the Visakhapatnam district's Offsite Emergency Plan for comprehensive management of emergencies in minimum response time and maximum rescue results in an event of a disaster /emergency. Co-ordination with nearby industries will also be maintained for creating unified Disaster management resource pool to be utilised in case of any disaster occurrence.*
- *The plant structures shall be designed for cyclone floods and seismic events to prevent structural collapse and integrity of weather (water) proofing for storage of dangerous goods.*

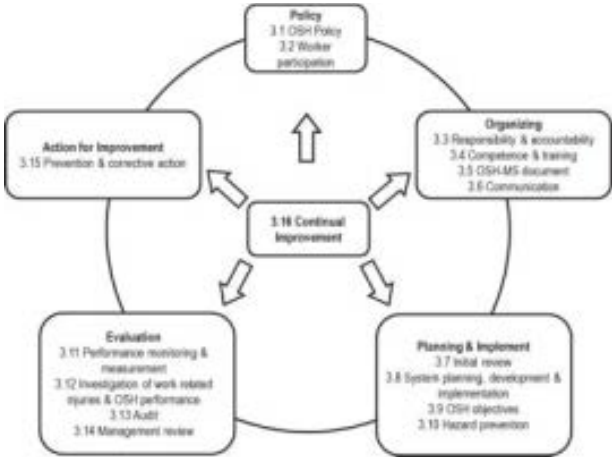
- *Isolate people from load carrying/mechanical handling systems, vehicle traffic and storage and stacking locations.*
- *Security of facility to prevent unauthorized access to plant, introduction of prohibited items and control of onsite traffic; and*
- *Development of emergency response management systems commensurate with site specific hazards and risks (fire, explosion, rescue and first aid).*
- *Regular safety audits shall be undertaken to ensure that hazards are clearly identified and risk-control measures are maintained within tolerable limits.*

7.12 OCCUPATIONAL HEALTH AND SAFETY

Some workplace hazards have the potential to cause so much injury or disease that specific regulations or codes of practice are warranted. As such, codes are not legally enforceable, but they can be used in courts as evidence that legal requirements have or have not been met.

All safety gears will be provided to workers and care will be taken by EMC that these are used properly by them. All safety norms will be followed as per **Figure 7.3** below.

FIG 7.3: OHS CYCLE IMPLEMENTATION AT RINL



7.12.1 Personal Protective Equipment (PPE)

General Provisions:

As a supplementary protection against exposure to hazardous conditions where the safety of workers cannot be ensured by other means, such as eliminating the hazard, controlling the risk at source or minimizing the risk, suitable and sufficient PPE, having regard to the type of work and risks, and in consultation with workers and their representatives, should

be used by the worker and provided and maintained by the employer, without cost to the workers.

- Items of PPE provided should comply with the relevant national standards and criteria approved or recognized by the competent authority.
- Those responsible for the management and operation of the personal protection programme should be trained in the selection of the proper equipment, in assuring that it is correctly fitted to the people who use it, in the nature of the hazards the equipment is intended to protect against, and provide adequate comfort, and in the consequences of poor performance or equipment failure.
- PPE should be selected considering the characteristics of the wearer and additional physiological load or other harmful effects caused by the PPE. It should be used, maintained, stored and replaced in accordance with the standards or guidance for each hazard identified at the facility and according to the information given by the manufacturer.
- PPE should be examined periodically to ensure that it is in good condition.
- Different PPE & their components should be compatible with each other when worn together.
- PPE should be ergonomically designed and, to the extent practicable, should not restrict the user's mobility or field of vision, hearing or other sensory functions.
- Employers should ensure that the workers who are required to wear PPE are fully informed of the requirements and of the reasons for them, and are given adequate training in the selection, wearing, maintenance and storage of this equipment.
- When workers have been informed accordingly, they should use the equipment provided throughout the time they may be exposed to the risk that requires the use of PPE for protection.
- The PPE should not be used for longer than the time indicated by the manufacturer.
- Workers should make proper use of the PPE provided, and maintain it in good condition, consistent with their training and be provided with the proper means for doing so.

7.12.2 Occupational Health – Proposal for Surveillance

The choice and the implementation of specific measures for preventing workplace injury and ill health in the work-force depends on the recognition of the principal hazards, and the anticipated injuries and diseases, ill health and incidents. Below are the most common causes of injury and illness:

- Slips, trips and falls on the same level; falls from height; unguarded machinery; falling objects;
- Engulfment; working in confined spaces; moving machinery, on-site transport, forklifts and cranes;
- Exposure to controlled and uncontrolled energy sources; exposure to mineral wools and fibres; inhalable agents (gases, vapours, dusts and fumes);
- Skin contact with chemicals (irritants acids, alkalis), solvents and sensitizers); contact with hot objects;
- Fire and explosion; extreme temperatures; radiation (non-ionizing, ionizing);
- Noise and vibration; electrical burns and electric shock;
- Manual handling and repetitive work; failures due to automation; ergonomics;
- Lack of OSH training; poor work organization;

- Inadequate accident prevention and inspection; inadequate emergency first- aid and rescue facilities; lack of medical facilities and social protection
- Dust may enter into the systemic circulation and thereby reach the essentially all the organs of body and affects the different tissues.
- Working near heavy noise generating equipment may cause hearing and blood pressure related diseases
- Continuous working and improper working position leading to pain & exhaustion.

7.12.3 Plan of evaluation of health of workers

- By pre designed format during pre-placement and periodical examinations.
- Proper schedule will be devised and followed with help of occupational health experts and doctors.
- Health effects of metals used and health hazard plans based on monthly correlation of these metal related diseases and people affected.

7.12.4 Schedule of medical check-up during operational phase

- Comprehensive Pre-employment medical checkup for all employees
- General checkup of all employees once every year.
- Medical examination will be done for all the employees after retirement and all those employees with more than 5 years of service leaving the company.
- After retirement, medical examination facility will be provided for a period of 5 years.
- Local hospitals and Govt. health monitoring system will be engaged.
- Dispensary and ESI facility will be provided to all workers as applicable
- All safety gears will be provided to workers and care will be taken by EMC that these are used properly by them. All safety norms will be followed.

7.13 OFFSITE & ONSITE DISASTER MANAGEMENT & EMERGENCY PLAN

In order to prevent occurrence of any disaster, the Disaster Management Plan (inclusive of the onsite emergency plan), DMP has been designed based on the range, scales and effects of "Major Generic Hazards" described in the Risk Assessment and prediction of their typical behavior. The DMP addresses the range of thermal and mechanical impacts of these major hazards so that potential harm to people onsite and off-site, plant and environment can be reduced to a practicable minimum. The scenarios of loss of containment are credible worst cases to which this DMP is linked. The project is in its formative stage and detail engineering is yet to be done, so the elements of the DMP are based on concepts.

Capabilities of DMP:

The emergency plan envisaged will be designed to intercept full range of hazards specific 'to power plant such as fire, explosion, major spill etc. In particular, the DMP will be designed and conducted to mitigate those losses of containment situations, which have potentials to escalate into major perils.

Another measure of the DMP's capability will be to combat small and large fires due to ignition, of flammable materials either from storage or from process streams and evacuate people from the affected areas speedily to safe locations to prevent irreversible injury.

Emergency medical aids to those who might be affected by incident heat radiation flux, shock wave overpressures and toxic exposure will be inherent in the basic capabilities

The most important capability of this DMP will be the required speed of response to intercept a developing emergency in good time so that disasters such as explosion, major fire etc. are never allowed to happen.

Disaster Control Philosophy:

The principal strategy of DMP is "Prevention" of identified major hazards. The "Identification" of the hazards will employ one or more of the techniques [e.g. Hazard and Operability Study (HAZOP), accident consequence analysis etc.]. Since these hazards can occur only in the event of loss of containment, one of the key objectives of technology selection, project engineering, construction, commissioning and operation is "Total and Consistent Quality Assurance". The Project Authority will be committed to this strategy right from the conceptual stage of the plant so that the objective of prevention can have ample opportunities to mature and be realized in practice.

The DMP or Emergency Preparedness Plan (EPP) will consist of:

- On-site Emergency Plan
- Off-site Emergency Plan

Disaster Management Plan preparation under the headlines of On-site Emergency Plan and Off-site Emergency Plan is in consonance with the guidelines laid by the Ministry of Environment and Forests and Climate Change (MOEF&CC & CC) which states that the "Occupier" of the facility is responsible for the development of the On- site Emergency Plan. The Off-site Emergency Plan should be developed by the Governments district emergency authorities/district collector.

7.13.1 On-Site Emergency Plan

Objectives

The objective of the On-site Emergency Plan should be to make maximum use of the combined resources of the plant and the outside services to

- Effect the rescue and treatment of casualties
- Safeguard other personnel in the premises
- Minimize damage to property and environment
- Initially contain and ultimately bring the incident under control
- Identify any dead
- Provide for the needs of relatives
- Provide authoritative information to the news media
- Secure the safe rehabilitation of affected areas
- Preserve relevant records and equipment for the subsequent enquiry into the cause and circumstances of emergency

Action Plan

The Action Plan should consist of:

- Identification of Key Personnel
- Defining Responsibilities of Key Personnel
- Designating Emergency Control Centres and Assembly Points
- Declaration of Emergency
- Sending All Clear Signal
- Defining actions to be taken by non-key personnel during emergency

Key Personnel

The actions necessary in an emergency will clearly depend upon the prevailing circumstances. Nevertheless, it is imperative that the required actions are initiated and directed by nominated people, each having specified responsibilities as part of co-ordinated plan. Such nominated personnel are known as Key Personnel. The Key Personnel are:

- Site Controller (SC)
- Incidental Controller (IC)
- Liaison and Communication Officer (LCO)
- Fire and Security Officer (FSO)
- Team Leaders (TL)

Site Controller (SC)

In the emergency situation, decisions have to be taken which may affect the whole or a substantial part of the plant and even places outside. Many of these decisions will be taken in collaboration with the other officers at the plant and the staff. It is essential that the authority to make decision be invested in one individual. In this plan, he is referred to as the 'Site Controller'. The Plant Manager (however called) or his nominated deputy will assume responsibility as SC.

Incident Controller (IC)

In the emergency situation, someone has to direct the operations in the plant area and co-ordinate the actions of outside emergency services at the scene of incident. The one who will shoulder this responsibility is known as 'Incident Controller' in this plan. A Senior Operations Officer or an officer of similar rank of the unit may be nominated to act as the IC.

Liaison and Communication Officer (LCO)

Operations Officer or any other officer of deputy rank will work as LCO and will be stationed at the main entrance during emergency to handle Police, Press and other enquiries. He will maintain communication with the IC

Fire and Safety officer (FSO)

The Fire and Safety Officer will be responsible for firefighting. On hearing the fire alarm he shall contact the fire station immediately and advise the security staff in the plant and cancel the alarm. He will also announce on PAS (public Address System) or convey through telephones or messengers to the SC, IC and LCO about the incident zone. He will open the

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gates nearest to the incident and stand by to direct the emergency services. He will also be responsible for isolation of equipment from the affected zone.

Team Leaders (TL)

A number of special activities may have to be carried out by specified personnel to control as well as minimize the damage and loss. For this purpose designated teams would be available. Each team will be headed by a Team Leader (TL). Following teams are suggested:

- Repair Team
- Fire Fighting Team
- Communication Team
- Security Team
- Safety Team
- Medical Team

Responsibilities of Key Personnel:

Site Controller (SC)

- On getting information about emergency, proceed to Main Control Centre
- Call in outside emergency services
- Take control of areas outside the plant, which are affected
- Maintain continuous communication, review situation and assess possible course of events
- Direct evacuation of nearby settlements, if necessary
- Ensure that casualties are getting enough help
- Arrange for additional medical help and inform relatives
- Liaison with Fire and Police Services and Provide advice on possible
- effects on outside areas
- Arrange for chronological recording of the emergency
- Where emergency is prolonged, arrange for relieving personnel, their catering needs etc.
- Inform higher officials in head office
- Ensure preservation of evidence
- Direct rehabilitation work on termination of emergency

Incident Controller (IC)

- On getting emergency information, proceed to Main Control Centre
- Activate emergency procedure such as calling in various teams
- Direct all operations within plant with following priorities:
  - Control and contain emergency
  - Secure safety of personnel
  - Minimise damage to plant, property and the environment
  - Minimise loss of material
- Direct rescue and repair activities
- Guide fire-fighting teams
- Arrange to search affected area and rescue trapped persons
- Arrange to evacuate non-essential personnel to safe area/assembly point
- Set up communications network and establish communication with SC

- Arrange for additional help/equipment to key personnel of various teams
- Consider need for preserving all records, information for subsequent enquiries

Liaison and Communications Officer

- To ensure that casualties receive adequate attention, arrange additional help if required and inform relatives
- To control traffic movements into the plant and ensure that alternative transport is available when need arises
- When emergency is prolonged, arrange for the relief of personnel and organize refreshments/catering facility
- Advise the Site Controller of the situation, recommending (if necessary) evacuation of staff from assembly points
- Recruit suitable staff to act as runners between the Incident Controller and himself if the telephone and other system of communication fail.
- Maintain contact with congregation points
- Maintain prior agreed inventory in the Control Room
- Maintain a log of the incident on tape
- In case of a prolonged emergency involving risk to outside areas by windblown materials - contact local meteorological office to receive early notification of changes in weather conditions

Fire and Safety Officer

- Announce over the PAS in which zone the incident has occurred and on the advice of the Shift Officer informs the staff to evacuate the assembly
- Inform the Shift Officer In-charge, if there is any large escape of products
- Call out in the following order:
  - Incident Controller or his nominated deputy
  - Maintenance Officer
  - Personnel and Administrative Officer
  - Departmental Head in whose area the incident occurred
  - Team Leaders (TL)

Emergency Control Centre

The Emergency Control Centre will be the focal point in case of an emergency from where the operations to handle the emergency are directed and coordinated. It will control site activities.

Emergency management measures in this case have been proposed to be carried from single control Centre designated as Main Control Centre (MCC). MCC is the place from which messages to outside agencies will be sent and mutual aids and other helps for the management of emergency will be arranged. It will be located in the safe area. It will be equipped with every facility for external and internal communication, with relevant data, personal protective equipment to assist hose manning the centre to enable them to co-ordinate emergency control activities. CC will be attended by SC.

Following facilities would be available in the MCC:

- P&T phones, mobile phones, intercoms, and wireless
- Fax and telex

- Emergency manuals
- Blown up area maps
- Internal telephone directories
- District telephone directories
- Emergency lights
- Wind direction and speed indicator
- Requisite sets of personal protective equipment such as gloves, gumboots and aprons

MCC will be furnished with call out list of key persons, fire, safety, first aid, medical, security, police and district administrative authorities. MCC will also contain safety data pertaining to all hazardous materials likely to cause emergency and well-defined procedures of firefighting, rescue operations, first aid etc.

Assembly Point

In an emergency, it will certainly be necessary to evacuate personnel from affected areas and as precautionary measure, to further evacuate non-essential workers, in the first instance, from areas likely to be affected, should the emergency escalate. The evacuation will be effected on getting necessary message from i.e. on evacuation, employees would be directed to a predetermined safe place called Assembly Point.

Location

Area opposite to service building will be the Assembly Point where all non-key personnel would assemble on getting direction over Public- Address System.

Outdoor assembly points, predetermined and pre-marked, will also be provided to accommodate evacuees from affected plant area(s). Roll call of personnel collected at these assembly points, indoor and outdoor will be carried out by roll call crew of safety team to account for any missing person(s) and to initiate search and rescue operations if necessary.

Declaration of Emergency

An emergency may arise in the plant due to major leakage of oil or major outbreak of fire/explosion. In case of major leak or major outbreak of fire the state of emergency has to be declared by the concerned by sounding Emergency Siren.

Upon manual or sensor detection of a major loss of containment of volatile hazardous substance, the DMP is activated by raising an audible and visual alarm through a network of geographically dispersed gas/Vapour and heat detectors and also "break glass" type fire alarm call points with telephone handsets to inform the Central Control Room.
A separate siren audible to a distance of 5 km range will be available for this purpose. The alarm is coded such that the nature of emergency can be distinguished as a leakage or major fire. The Control Centre and Assembly point will be located at an area of the minimum risk or vulnerability in the premises concerned, taking into account the wind direction, areas which might be affected by fire/explosion, leakage etc.

After cessation of emergency, FSO will communicate to IC. After verification of status, IC will communicate with SC and then announce the "All Clear" by instructing the Time Office to sound the "All Clear Signal".

Alarms would be followed by an announcement over Public Address System (PAS). In case of failure of alarm system, communication would be' by telephone operator who will make announcement in the complex through PAS. Walkie-talkie system is very useful for communication during emergency with predetermined codes of communication. If everything fails, a messenger could be used for sending the information.

Two 5.0 km, range variable pitch electric sirens (one in service and the other standby) will generate the main alarm for the entire site as well as for the district fire brigade. The alarm is coded such that the nature of emergency can be distinguished as a leakage or major fire. Fire and Gas alarm matrices are provided at the Central Control room, security gate, on-site fire station and main administrative office corridor to indicate location of the site of emergency and its nature.

Mutual Aid

Procedure

All factories may not be equipped with an exhaustive stock of equipment/materials required during an emergency. Further, there may be a need to augment supplies if an emergency is prolonged.

It would be ideal to pool all resources available in the and nearby outside agencies especially factories during an emergency, for which a formal Mutual Aid scheme should be made among industries in the region.

Essential Elements

Essential elements of this scheme are given below:

- Mutual aid must be a written document, signed by Location In-charge of all the industries concerned
- It should specify available quantity of materials/ equipment that can be spared (not that which is in stock)
- Mode of requisition during an emergency.
- It should authorize the shift-in-charge to quickly deploy available material/equipment without waiting for formalities like gate pass etc.
- It should spell out mode of payment/replacement of material given during an emergency
- It should specify key personnel who are authorized to requisition materials from other industries or who can send materials to other industries
- It should state clearly mode of receipt of materials at the affected unit without waiting for quantity/quality verification etc.
- Revision number and validity of agreement should be mentioned
- This may be updated from time to time based on experience gained operations will be represented in a graphic panel on the console and every operation will be depicted as operating sequences.
- All operating parameters will be displayed in digital format.
- Alarms will be provided for all parameters, when they exceed set values.

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- High-High/Low-Low alarms and trip functions will be provided to trip
- Pumps/compressors to bring the entire system to a safe shutdown.

Emergency Management Training

The Key Personnel would undergo special courses on disaster management. This may preferably be in-plant training. The Managers, Senior Officers and Staff would undergo a course on the use of personal protective equipment.
The Key Personnel belonging to various Teams would undergo special courses as per their expected nature of work at the time of emergency.

The plant management should conduct special courses to outside agencies like district fire services to make them familiar with the plant layout and other aspects, which will be helpful to them during an emergency.

Mock Drills

It is imperative that the procedures laid in this Plan are put to the test by conducting Mock Drills. To avoid any lethality, the emergency response time would be clocked below 2 minutes during the mock drill.

1st Step: Test the effectiveness of communication system
2nd Step: Test the speed of mobilization of the plant emergency teams
3rd Step: Test the effectiveness of search, rescue and treatment of casualties
4th Step: Test emergency isolation and shut down and remedial measures taken on the system
5th Step: Conduct a full rehearsal of all the actions to be taken during an emergency

The Disaster Management Plan would be periodically revised based on experiences gained from the mock drills.

Proposed Communication System

The instrument and control system will take care of the following operating philosophy of the plant:

- The project will be provided with a control system located in a central control room.
- The shift engineer will operate the plant from his console panel.
- All operations will be represented in a graphic panel on the console and every operation will be depicted as operating sequences.
- All operating parameters will be displayed in digital format.
- Alarms will be provided for all parameters, when they exceed set values.
- High-High/Low-Low alarms and trip functions will be provided to trip
- Pumps/compressors to bring the entire system to a safe shutdown.

Proposed Fire Fighting System

Elaborate firefighting system will be available for fighting fires in any corner of the plant. A comprehensive fire detection and protection system is envisaged for the project Area.

Other safety Measures

Considering that fire and explosion is the most likely hazard in such installations, the plant is being provided with systems to guard against such hazards. Salient among these are:

- A proper layout to prevent and minimize the effects of any hazardous situation
- Design of storage vessels and all components to codes and standards to withstand the rigorous duty
- Provision of operating systems to conduct the process through well-established safe operating procedures
- A control system, which monitors all, plant parameters and give alarms
- Control system, which has trip provisions to prevent hazard conditions escalating
- A gas detection system which will provide early warning of any leaks
- Provision of a fire protection system to control fire
- Provision of flame-proof lighting system in the fire prone areas

Proposed First Aid and Medical Facilities

The First Aid Medical Centre has been proposed. It will be fully equipped with emergency facilities. It will be open round the clock. A Medical attendant will always be available in the centre. Emergency cars will be available in all the shifts. Adequate number of first aid boxes will be kept at strategic locations. Required stock of first aid medicines will be maintained. Trained first aiders will be available in all departments.

Facilities to be kept in the Medical Room along with others will include: Oxygen Cylinders, Injection Corarnine, Glucose Saline, LV. Sets, Syringes, Injection Needles, Stretchers and medicines.

Proposed Emergency Power Supply

Strategic areas will be provided with emergency lights fed through stationed battery system. Portable emergency lamps will be also available at required points. A Diesel Driven Generator of adequate capacity will be available to keep the operations running in case of power failure.

7.13.2 Off Site Emergency Plan

Objective

If the effects of the accident or disaster inside the plant are felt outside its premises, it calls for an off-site emergency plan, which should be prepared and documented in advance in consultation with the District Authorities.

Key Personnel

The ultimate responsibility for the management of the off-site emergencies rests on the Collector / District Magistrate / Deputy Commissioner. He will be assisted by representatives from all concerned organizations, departments and services at the District level. This core group of officers would be called the District Crisis Management Group (CMG). The members of the group will include:

1. Collector/District Magistrate Deputy Commissioner

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2. Commissioner of Police
3. Municipal Commissioner, if municipalities are involved
4. Deputy Director, Health
5. Pollution Control Board Representative

An Operation Response Group (ORG) will then be constituted to implement the directives of the CMG. The various government departments, some or all of which will be concerned, depending on the nature of the emergency, could include:

- Police
- Health & Family Welfare
- Medical
- Revenue
- Fire Service
- Transport
- Electricity
- Animal Husbandry
- Agriculture
- Civil Defense
- PWD
- Civil Supplies
- Panchayats

The SC and IC, of the on-site emergency team, will also be responsible for communications with the CMG during the off-site emergency.

Education to Public

People living within the influence zone should be educated on the emergency in a suitable manner. This can be achieved only through the Local and District Authorities. However, the Project Authority can extend necessary information to the Authorities.

This preliminary plan will be up-dated and modified from time to time depending on the situation (expansion of the units, modifications, new hazards, etc.) but the role/work and objective will be the same.

7.13.3 Emergency Planning For Natural Disasters

Various scenarios that are anticipated to cause major emergencies are natural calamities like earthquake, flood, cyclone, tsunami etc. All these scenarios are as following:

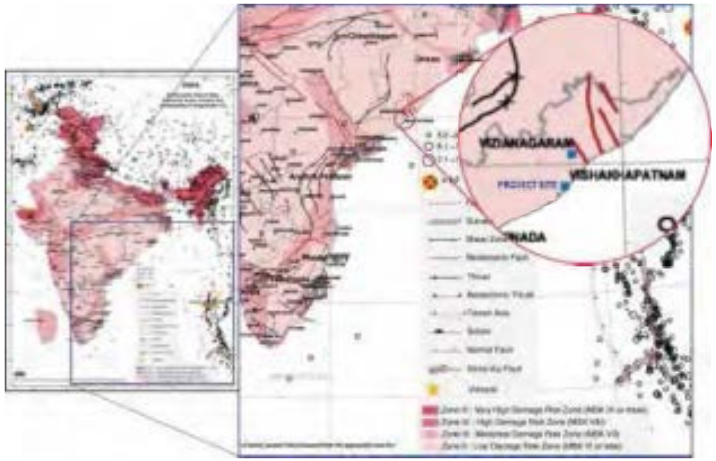
- *Earthquake*
- *Flood*
- *Cyclone*
- *Tsunami*

Earthquakes:

Andhra Pradesh is vulnerable to various kinds of natural disaster due to its locational setting viz. cyclones, floods, earthquakes and drought. The coastal region suffers repeated cyclones and floods. The 1977 cyclone and tidal wave, which resulted in great loss of life, attracted the attention of the central and state Governments of India and the international donor communities, as did those of 1979, 1990 and 1996. The floods in the Godavari and

Krishna Rivers caused havoc in the East and West Godavari and Krishna districts. Earthquakes in the recent past have occurred along and off the Andhra Pradesh coast and in regions in the Godavari river valley. Mild tremors have also hit the capital city of Hyderabad, for example in September 2000. The Earthquake vulnerability of Andhra Pradesh state as well as the proposed site is shown in **Fig. 7.4**.

FIG 7.4: EARTHQUAKE HAZARD MAP WITH ANDHRA PRADESH & PROPOSED SITE INDICATED



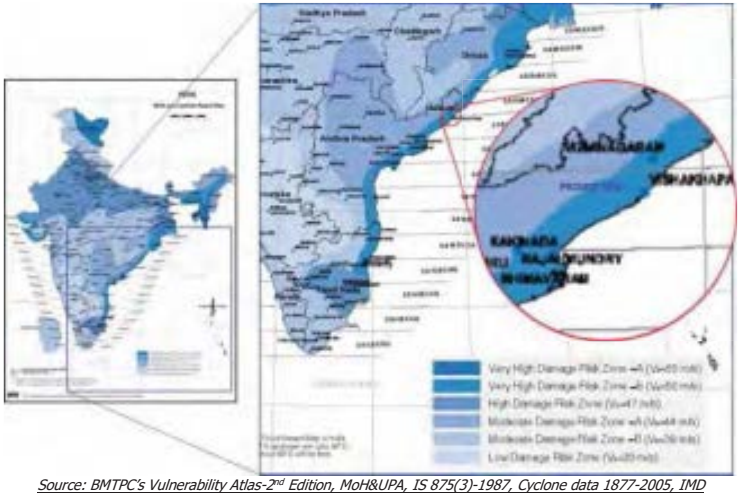
Source: BMTPC's Vulnerability Atlas-2nd Edition, MoH&UPA, Seismic Zone of India map IS:1893-2002

The above figure indicates that Andhra Pradesh has **Low to Moderate damage risk due to earthquake**. However, the proposed site has low damage risk due to earthquakes.

Cyclones

Cyclones are caused by atmospheric disturbances around a low-pressure area distinguished by swift and often destructive air circulation. Cyclones are usually accompanied by violent storms and bad weather. The air circulates inward in an anticlockwise direction in the Northern hemisphere and clockwise in the Southern hemisphere. Cyclones are classified as: (i) extra tropical cyclones (also called temperate cyclones); and (ii) tropical cyclones. Andhra Pradesh is exposed to cyclones, storm surges, floods and droughts. A moderate to severe intensity cyclone can be expected to make landfall every two to three years. About 44 percent of the state is vulnerable to tropical storms and related hazards as observed from **Fig. 7.5**.

FIG 7.5: WIND & CYCLONE HAZARD MAP WITH ANDHRA PRADESH & PROPOSED SITE INDICATED



Source: BMTPC's Vulnerability Atlas-2nd Edition, MoH&UPA, IS 875(3)-1987, Cyclone data 1877-2005, IMD

The above figure indicates that Andhra Pradesh has **Low to High damage risk due to cyclone**. However, the proposed site has very high damage risk due to cyclones.

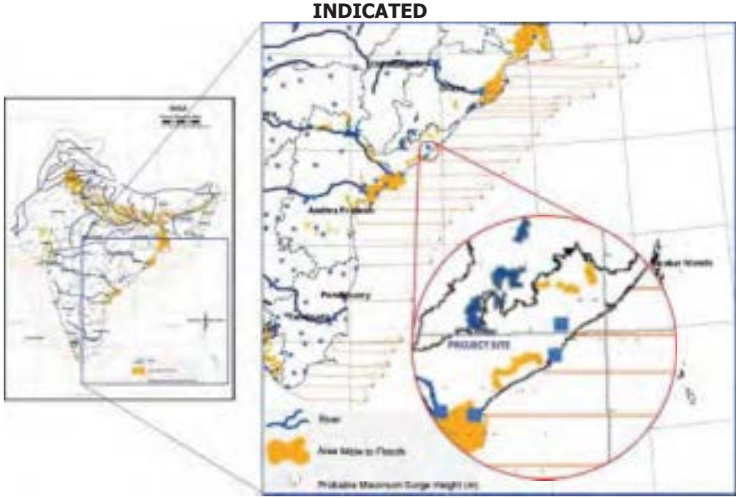
As per Report of 'Cyclone Hazard Prone Districts of India' by National Disaster Management Authority, Government of India, New Delhi, Thirteen coastal states and Union Territories (UTs) in the country are affected by tropical cyclones. Four states (Tamil Nadu, Andhra Pradesh, Orissa and West Bengal) and one UT (Puducherry) on the east coast and one state (Gujarat) on the west coast are more vulnerable to cyclone hazards. Vishakhapatnam district of Andhra Pradesh is classified in VH (Very High) zone and FLZ (Flood Zone) category in Vulnerable Districts for Cyclone Wind and Coastal/Inland Flooding area respectively. In India, the cyclones develop in the pre-monsoon (April to May) and post-monsoon seasons (October to December), but most of them tend to form in the month of November. Once the cyclones enter the mainland, they give way to heavy rains which often translate into floods, as it was the case with the damaging cyclone-induced floods in the Godavari delta, in August of 1986. Many drought prone areas adjacent to coastal districts in eastern maritime states are thus vulnerable to flash floods originated by the torrential rains induced by the cyclonic depression. In addition to cyclones and its related hazards, monsoon depressions over the north and central areas of the Bay of Bengal move until reaching north and central India, including portions of Andhra Pradesh, bringing heavy to very heavy rains and causing floods in the inland rivers between June and September.

Floods

A flood is an overflow of water that submerges land which is usually dry. The European Union (EU) Floods Directive defines a flood as a covering by water of land not normally covered by water. In the sense of "flowing water", the word may also be applied to the

inflow of the tide. Flooding may occur as an overflow of water from water bodies, such as a river, lake, or ocean, in which the water overtops or breaks levees, resulting in some of that water escaping its usual boundaries, or it may occur due to an accumulation of rainwater on saturated ground in an areal flood. These can also occur in rivers when the flow rate exceeds the capacity of the river channel, particularly at bends or meanders in the waterway. Some floods develop slowly, while others such as flash floods, can develop in just a few minutes and without visible signs of rain. Additionally, floods can be local, impacting a neighbourhood or community, or very large, affecting entire river basins. Andhra Pradesh's vulnerability to floods is depicted in **Fig. 7.6** below.

FIG 7.6: FLOOD HAZARD MAP WITH ANDHRA PRADESH & PROPOSED SITE INDICATED



Source: BMTPC's Vulnerability Atlas-2nd Edition, MoH&UPA, SOI maps, Flood Atlas, Task Force report, GOI

The map indicates that although Andhra Pradesh's coastal areas are vulnerable to floods, the **Project site is not liable to floods** and away from any flood-prone area.

Tsunami

A tsunami, also known as a seismic sea wave, is a series of waves in a water body caused by the displacement of a large volume of water, generally in an ocean or a lake. Earthquakes, volcanic eruptions and other explosions, landslides and other disturbances above or below water all have the potential to generate a tsunami. Unlike normal ocean waves which are generated by wind, or tides which are generated by the gravitational pull of the Moon and Sun, a tsunami is generated by the displacement of water. In context to Andhra Pradesh, the occurrence of Tsunami is a rare phenomenon particularly along the project region, still it is exposed to threat against the submarine tectonic movement of Indonesian and Indian plates. The occurrence of 26.12.04 Tsunami along the east coast of India had an impact of about 0.5 m run up between Visakhapatnam and Kakinada. A map

showing areas affected by the Tsunami that hit the Eastern and Southern coast of India in 2004 is depicted in **Fig. 7.7** below.

FIG 7.7: TSUNAMI AFFECTED AREA OF THE INDIAN EASTERN & SOUTHERN COAST OF 2004

The plan to manage a natural disaster for Andhra Pradesh has been comprehensively developed as per National Disaster Management Authority (NDMA) guidelines by the GVMC (Greater Visakhapatnam Municipal Corporation) published as City Disaster Management Plan, and the same shall be utilised as guideline for management of natural disasters for the project area also.

The action plan to be followed for disaster management of natural disasters is enumerated in the following section.

Preparedness Plan for Tsunami

The preparedness plan shall contain details about: i) warning that should be given ii) Protective measures to contain the effect of surging water level and iii) Other precautionary measures to be taken. The following measures are the key aspects with reference to the project region.

- ***Coordination with International and National Agencies*** *such as National Oceanic and Atmospheric Administration (NOAA), USA at the International level and National level organizations as Indian National Centre for Ocean Information Services (INCOIS), Hyderabad, National Disaster Management Authority (NDMA),*

New Delhi, Indian Meteorological Department (IMD), New Delhi and National Institute of Ocean Technology (NIOT), Chennai.

- ***Online monitoring system:*** *The industries at Visakhapatnam shall combined set up online monitoring system linking with NIOT/INCOIS/IMD by enrolling themselves as potential users. Live contact shall be kept with the organizations indicated above by transmitting the instant warning on occurrence of cyclone, Tsunami and storm surge. A vigilant team will be created and trained to understand the method of monitoring and the kind of emergency preparedness required.*

- ***Emergency Evacuation:*** *An evacuation plan describing the time span available before and during the Tsunami or storm surge event shall be developed keeping in mind the prime objective of bringing as many people as possible out of the reach of the wave's impact to safe or 'relatively safe' areas. However, when facing local threat, evacuation procedures most possibly will have the character of a 'runaway effort' and people should not expect to receive much institutional support.*

Mitigation Measures against Tsunami and Storm Surge

Although the impact of Tsunami and storm is disastrous, the impact can be minimized by adopting the key components of mitigation measures. The mitigation measures to be taken normally vary according to the local site conditions. Accordingly, in general case, the following mitigation measures are seen to be effective for the proposed project:

- ***Bio Shield*** *formed by planting a vegetation belt along coastlines would protect the region against coastal storms, cyclones and Tsunamis. The plantations could absorb the force of severe storms and Tsunamis.*
  Construction of Tsunami mound *constructed with beach sand or any inland native sediments/rocks. The mounds should be erected without felling trees if they exist in this region which will effectively help to dissipate the energy of Tsunami surge and protect the leeward side.*
- ***Construction of Tsunami/Cyclone Shelter*** *equipped with water supply, toilets, first aid centre, Generators, ration storing rooms and minimum cooking facility.*

The onsite-emergency plan integrated along with GVMC's Disaster Management plan for Visakhapatnam shall provide for all necessary steps and action plans required to combat all disasters/hazards that may affect RINL's Visakhapatnam Steel Plant.

7.14 Socio-Economic Environment

Vizag Steel Plant was founded in 1982, from nearly 45 years the plant is engaged in steel production. It is the largest single site plant in India. Now the plant is going for expansion of the plant the project activity may affect the surrounding population positively as well as negatively. Due to the expansion activity of the steel plant, proposed impacts on socio-economic environment were studied by the help of focus group discussion, household discussion and discussion with Gram Panchayat officials. Aspects during construction and operation are provided as **Table 7.10**.

TABLE 7.10:Aspects during Construction & Operation Phase

Aspect	During Construction phase	During Operation phase
Employment	Expansion of the project will contribute in employment generation in the form of skilled and semi-skilled. Work force will be taken from local areas only by local contractors.(	Regular job for skilled and semi-skilled workers.(Long term)
Migration of workers	During construction it may possible that workforce from nearer states migrate for employment. It will cause increase of migration of population.(short term)	In operation phase also migration trend may increase
Land acquisition and R&R	The plant is proposed to be built within existing premises, which is already under land use category. Hence there will be minimal change in the land use. other than those discussed during the construction	No additional impact on site land use is envisaged during the operation stage of the project.
Labour camp	All the works will be executed through contractors. During construction labour camps will be established by the contractors. It will be stipulated in the contracts to establish labour camps with amenities like drinking water supply, health & sanitation and medical facilities	Operational workers will stay in the existing Township of VSP, there will be no need of extra construction/residential area
Growth in local market	During construction, material for construction activities will be taken from local shops(short term impact)	Expansion of the plant will fulfil the steal demand in market, it will help for growth of the steel industry as well as national level market
Literacy	Construction phase will be short term therefore no impact on literacy	In industrial society literacy is an expediency. In view of the high skills, job differentiation, higher level of technical training is essential. Increased job opportunities in the steal plant will motivate the students for higher studies/vocational courses and it will improve literacy in the surrounding area
Health	During construction activities dust generation, noise may disturb the surrounding population	Air emission from the plant may cause to surrounding population at some extent (respiratory diseases, lung diseases)

Aspect	During Construction phase	During Operation phase
Transportation	During construction phase, loading-unloading of construction material etc. Will increase transportation activity near to plant site(short term impact)	In operation phase for loading-unloading plant products transportation activity will be increase (Long term impact)
Agriculture	The impact on the topsoil will be confined to the main plant area.There will be no impact on the agriculture farm or crops.	The air borne fugitive dust from the plant is likely to be deposited on the topsoil in the immediate vicinity of the plant boundary.(long term

7.14.1 Measures to improve on Socio economic conditions

The infrastructure facilities of the surrounding areas need development notably Medical, Sanitation and skill based education facilities in nearby villages. It is expected that the proposed project will catalyze the infrastructure development of the surroundings as it will attract investment of a considerable part of capital of the District.

Drinking water requirement, Promotion of Educational institutions, Medical facilities to the villagers (especially Senior Citizens and infants or pregnant ladies). Community centres, recreation facilities etc., will also be developed as part of social responsibility. The basic target would be the development of the local villages in the vicinity of the project. Hence, the scope for development of the local population economic status is envisaged.

7.14.2 Socio- economic impact matrix

The assessment of the impact of the general activities on the below parameters of socio-economic indices can be done by establishing a prediction of likely impacts matrix. Predication impacts, on socio-economic environment presented in **Table 7.11**

TABLE 7.11:Predication of Likely Impacts on Socio- Economic Environment

Parameter	Local	Regional	Direct	Indirect
Employment	+	+	+	+
Income	+	*	+	+
Transport	-	+	-	-
Education	+	+	+	+
Medical facilities	+	*	+	*
Communication	+	*	+	*
Availability of power	+	+	+	+
Sanitation	+	*	+	*
Housing	+	*	+	*
Health	-	*	-	*
Recreation	*	*	*	*
Agriculture	-	*	*	*
Cost of living	*	*	*	*
Business	+	+	+	+
Pollution	-	*	-	*

+=Positive Impact, -=Negative Impact, **=Insignificant

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From the proposed expansion activity directly impact will be on employment, health, business growth and environmental pollution.

7.14.3 Mitigation measures

After primary data collection and impact assessment its necessary to provide mitigation measures. In order to mitigate the adverse impact likely to arise in social, cultural and economic aspects in the surrounding region and the expansion of the project is expected to contribute towards enlistment of local people quality of life; certain line of action should be adopted are provided as **Table 7.12**.

TABLE 7.12: Impacts and Mitigation Measures

Impact	Mitigation measures
Migration	❖ Preference should be given to local population ❖ Identify skill gap and provide training to local youths
Health	❖ Health services through mobile dispensary in surrounding wards/villages in the study area ❖ Timely valued different awareness programs(sanitation and health) must be arranged by the project proponent based on the common health problems caused in the region that may help to reduce the lower status of the study area
Pollution	❖ Adequate air pollution, water and noise control measures will be undertaken in proposed project to conform to regulatory standards. ❖ The environmental management and emergency preparedness plans are proposed to ensure that the probability of undesired events and consequences are greatly reduced, and adequate mitigation is provided in case of an emergency
Transportation	❖ Appointment of trained drivers ❖ Proper sign, barriers near to plant site ❖ Decide speed limit of heavy vehicles
Soil	❖ However, the fugitive emissions are likely to be controlled to a great extent through proposed control measures like ESP, ventilation systems, and industrial road sweeping in all plant areas. Good green belt development has been envisaged to further arrest the fugitive emissions.

7.14.4 Employment Generation (Direct and Indirect) due to the Project

Direct Employment during Operation is 1600 and Indirect employment is for 3000 people. There will be influx of people.

7.14.5 Impact on Health

Adequate air pollution, water and noise control measures will be undertaken in proposed project to conform to regulatory standards. The environmental management and emergency preparedness plans are proposed to ensure that the probability of undesired events and consequences are greatly reduced, and adequate mitigation is provided in case of an emergency.

7.15 Public Consultation

The Public Consultation advertisement for Proposed Capacity Expansion from 6.3 MMTPA to 7.3 MMTPA by Revamping and Augmentation of Existing Facilities has been given in 8 editions of Eenadu & 2 editions of The Hindu dated 13.05.2017 and the same has been provided in **Annexure 7.2**. The public consultation was conducted on 15/06/2017 at Trishna Grounds, Sector -2, Ukkunagaram. Public views and comments along with action plan for the suggestions is incorporated in **Table 7.13**.

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TABLE 7.13: Public Hearing Action Plan

S. No	Issue	Proponent Response	Budget	Action Plan with Date
1	**Sri Ch Narasinga Rao, CPI(M) State Secretary, Visakhapatnam,** while welcoming the proposed expansion project, informed that • The communication about Public Hearing is not circulated properly resulted in less attendance of public. • He opined that the Plant would have own mines for which the Government would take steps to allot Captive mines to the Plant so that the production cost would be less and the industry could withstand by competing with the market.	• Advertisement given one month advance in 8 editions of Eenadu & 2 editions of The Hindu dated 13.05.2017. • RINL has participated for two Coal blocks i.e. one Thermal and one Coking Coal put up for e-auction in Tranche- III in July 2015 and also for one Thermal Coal put up for e-auction in Tranche-IV in November, 2015. • RINL has participated in the e-auction of one Iron ore block in Odisha put up for auction in December, 2015 and in two Iron Ore Blocks in Odisha put up for auction in March, 2017. • Identified Iron Ore Deposit in Andhra Pradesh to be operated through a Joint Venture between Rashtriya Ispat Nigam Ltd and Andhra Pradesh Mineral Development Corporation Ltd. Is in process. • Liaison with State and Central Governments for direct allotment of Coal & Iron ore blocks/mines. Consultants have been engaged for Coal and Iron Ore to advise RINL for future e-auctions. • The Major equipment requires the	-	-

S. No	Issue	Proponent Response	Budget	Action Plan with Date
	• He said that the proposed capital investment of Rs.9439.53 Cr for expanding the capacity of another 1.0 MMTPA is not reasonable, since it is public money, should be spent transparently. ` • He opined that the time limit of 5 years for completion of the expansion project is a lengthy process and suggested to complete the process in 3 years.	revamping which necessitate the setting up of standby equipment and also shut down periods shall be planned without affecting the annual production plans. • While revamping & modernisation of existing old equipment, additional 1MTPA production is envisaged. • Along with standby equipment, few additional infrastructures have been planned to optimise the plant efficiency along with balancing reservoir. • All the above actions which are part of planned revamping and modernisation have led to cost of Rs. 9439.55 crores and resulted in 1 MMTPA additional production. • The Major equipment requires the revamping which necessitate the setting up of standby equipment and also shut down periods shall be planned without affecting the annual production plans. • COB#5 complex (7M tall top charged recovery type battery) with a gross coke production capacity of about 0.84 mtpa is to be completed within a period of 29 months from order placement. Once the Coke oven battery#5 is commissioned, this battery will act initially as a replacement battery and rebuilding of Coke oven batteries shall be taken up one after the other keeping at least 4 numbers	Breakup for new equipment is as follows: • Installation of Convertor-3 & Caster-4– Rs.975 Crores. • Twin LF Rs.106 crores. • Rebar Mill – Rs.431 Crores. • Augmentation of Utilities – Rs.18.57 crores. • Standby facilities envisaged, • COB-5 – Rs.2857.66 Crores, • TB-5 –Rs.280 Crores. • KBR-2 – Rs.465.85 Crores, • Guard Pond – Rs.12.55 crores. Remaining expenditure will be spent for revamping of existing facilities. -	During Construction and Operation stage of the Expansion Project -

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S. No	Issue	Proponent Response	Budget	Action Plan with Date
	• He expressed doubt about the marketing opportunities for the steel produced even after expansion.	of batteries under operation at any point of time to take care of uninterrupted supply of coke to blast furnaces during rebuilding of the three old batteries. The above duration of rebuilding of each of these batteries shall be 31 months. Hence, the time limit of 5 years for completion of the expansion project is considered. The following efforts are being put by RINL to ensure marketability of enhanced volumes after expansion. • Demand assessment surveys are done on annual basis and based on the projections from different regions and availability of product mix from the mills, product wise demand is frozen. • Based on the demand assessment analysis customers are tied up through annual MOUs for supply of products in different market segments as per the policy/operating guidelines of sales in vogue. • Tied up with re-rollers for conversion of semis to cater to requirement of finished products in local markets. • Tied up with Indian Railways for supply of upto 1,00,000 forged wheels per annum. • Tied up with Power Grid Corporation India Ltd for supply of upto 1,20,000 tons of semis/finished products for transmission line towers.	-	Continuous

S. No	Issue	Proponent Response	Budget	Action Plan with Date
		• Engaging with OEMs for certification of RINL process/products to improve the share of high end value added steels. • Expansion of marketing network to capture markets in emerging consumption centres such as Vijayawada and North East Regions. • Rural dealership schemes has been improved and E-retailer schemes are being finalized. More thrust is given on exports.		
	• He expressed that the commitments given earlier at the time of establishment of the Plant were not fulfilled and not yet provided proper rehabilitation and sought preference to rehabilitants in recruitments during the expansion.	• Expansion of the project will contribute in employment generation in the form of skilled and semi skilled during Construction period. Work force will be taken from local areas only by local contractors (short term). During Operation Phase Regular job for skilled and semi skilled workers(Long term) Direct Employment during Operation is 1600 and Indirect employment is for 3000 people.	-	• During Construction and Operation stage of the Expansion Project
	• He requested to take necessary measures for environmental protection citing the example of the pollution issues at Chepalapalem village near the plant despite repeated representations to the management regarding loss of marine aquatic life due to discharge of treated effluents in to sea.	• Effluent is discharged into the sea after Mechanical, Biological & Chemical Treatment and after confirming to the discharge standards. Only 17%of treated waste water is discharged into the sea. In the proposed expansion COB-5 is provided with Mechanical, Biological & Chemical Treatment Plant of approx.70M^3/hr capacity. For SMS-2 existing WTP will be augmented with the provision of Scale pit & pump house, Secondary settling tank & pump	-	Synchronised with expansion

S. No	Issue	Proponent Response	Budget	Action Plan with Date
		house, Wastewater treatment plant (WWTP) and Sludge handling system. In BF-3 WTP similar to BF1 & BF2 being provided. Existing STP has sufficient capacity to treat additional sewage water generated during proposed augmentation.		
2	**Sri Ganga Rao, Visakhapatnam (Secretary, CPM),** While welcoming the proposed expansion project, informed that			
	• The EIA report was not properly explaining the details of proposed expansion project.	• Table 2 in EIA Report explains the Existing & Proposed expansion project in detail.	-	-
	• He informed that the management should explain how much land is proposed for development of green belt in the expansion from the existing land.	• Out of total acquired land of 8827 ha (21811.99 Acres), greenbelt has been developed in 1969 ha (4866 Acres) within the plant area. On the whole about 38% of the land is already afforested with the planting of 5.16 million trees. The proposed expansion is taking place inside the above area only. Budget spent so far for 52,00,000 plantations is Rs.3834 lakhs Area has been earmarked and allotted for green belt development.	Budget projection for 2017-18 to 2019-20 is Rs.13.50 crores.	Synchronised with expansion

S. No	Issue	Proponent Response	Budget	Action Plan with Date
	• He expressed that, the existing permitted water is 45 MGD for the existing production capacity of 6.3 MTPA and in that case, the sufficiency of water even after expansion is doubtful.	• VSP has MOU with Visakhapatnam Industrial Water Supply Company Limited for use of 45 MGD of water. For the existing plant the requirement of water is 30 MGD for Plant and 8MGD for township and others. For the proposed expansion the water requirement is 6MGD for plant and 1MGD for township and others. Hence the existing agreement meets the requirement of expansion also. The water requirement after proposed revamping and modification is well within the quantity allotted / agreed by VIWSCO	-	During Operation of the proposed Expansion
	• He opined that the Plant should produce captive electricity as it requires 1260 MW of power for existing and after expansion process.	• The additional power required for the proposed augmentation is 76 MW, which will be sourced from the APTRANCO.		During Operation of the proposed Expansion
	• He further opined that the employment opportunity should be preferred for the surround local educated people and R-card holders.	• Employment opportunities will be provided in accordance with the existing policies and guidelines.		During construction & Operation of the proposed Expansion
3	**Sri J. Ayodhaya Ramu, Kurmannapalem,** while welcoming the proposed expansion project, informed that			
	• The proposed capital investment of Rs.9439.53 Cr for expanding the capacity	• 1MTPA is being achieved by revamping and upgradation of existing facilities. Standby	Breakup for new equipment as follows:	During

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S. No	Issue	Proponent Response	Budget	Action Plan with Date
	of another 1.0 MMTPA not sounds reasonable, since it is public money, should be spent transparently.	units are being installed to facilitate revamping of the existing units. Hence cost of expansion with revamping and upgradation is high compared to expansion normally planned with new units.	• Installation of Convertor-3 & Caster-4 – Rs.975 Crores. • Twin LF Rs.106 crores. • Rebar Mill – Rs.431 Crores. • Augmentation of Utilities – Rs.18.57 crores. • Standby facilities envisaged • COB-5 – Rs.2857.66 Crores • TB-5 – Rs.280 Crores. • KBR-2 – Rs.465.85 Crores • Guard Pond – Rs.12.55 crores. • Remaining expenditure will be spent for revamping of existing facilities.	Construction
	• He opined that the time limit of 5 years for completion of the expansion project is a lengthy process and suggested to complete the process in 3 years.	• The Major equipment requires the revamping which necessitate the setting up of standby equipment and also shut down periods shall be planned without affecting the annual production plans. • COB#5 complex (7M tall top charged recovery type battery) with a gross coke production capacity of about 0.84 mtpa is to be completed within a period of 29 months from order placement. Once the Coke oven battery#5 is commissioned, this battery will act initially as a replacement battery and rebuilding of Coke oven batteries shall be taken up one after the other keeping at least 4 numbers of batteries under operation at any point of time to take care of uninterrupted supply of coke to blast furnaces during rebuilding of the three old batteries. The above duration of rebuilding of each of these batteries shall be 31 months. Hence, the time limit of 5 years for completion of the expansion project is considered.		
	• He opposed the issuing of expansion works to contractors on turnkey basis.	• Packaging philosophy in expansion has been well deliberated and finalised by Project Management Consultant duly considering the		

S. No	Issue	Proponent Response	Budget	Action Plan with Date
		technical requirements		
4	**Sri J. Muthyalu, Nadupuru,** While welcoming the proposed expansion project, informed that, • The management has not given proper publicity for the Public Hearing and opined that if the Public Hearing would have conducted in public place instead of township, the public would have attended in a large number. • He further expressed that, the Pedagantyada Mandal is affected due to pollution caused by the operations of Steel Plant in one side and M/s. Gangavaram Port on the other side.	• Advertisement given one month advance in 8 editions of Eenadu& 2 editions of The Hindu dated 13.05.2017. Public hearing is held in a open place facilitating free participation of public. • Vizag Steel Plant has adopted Best Available Technologies, for the Air Pollution, water pollution and Solid Waste Management. For the proposed expansion the following pollution control measures are planned. • Revamping of ESPs of Air Cleaning Plant and Gas Cleaning Plant of Sinter plant 1&2 • Revamping of ESPs of Blast furnace-1 &2 stock house & cast house fume extraction • Installation of dog houses in all 3 convertors of SMS-1, Convertor-3 • Installation of secondary ventilation and material handling systems with ESP/Bag filter • Revamping of ESPs of all 5 boilers • Mechanical, Biological & Chemical Treatment Plant Of Approx. 70m^3/Hr Capacity for coke oven battery-5	- • Expenditure involved for environmental improvements during 2004-2016 is Rs.1035.68 crores • Expenditure for pollution control from 6.3 MTPA to 7.3 MTPA is • Rs.559 Crores. • Annual expenditure for operation and maintenance of environmental • systems: Rs 300 Crores	- Synchronised with expansion

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S. No	Issue	Proponent Response	Budget	Action Plan with Date
		• Existing WTP to Be Augmented at SMS-2 • There would be additional generation of approx 1,700 TPD of solid waste during proposed augmentation • It is estimated that 100% of the granulated BF slag would be sold to the cement making industries for manufacturing of slag cement. • Other waste such as mill scale, sludges, dust etc would be 100% recycled into the sinter plant.		
	• He informed that that at the time of acquiring land for establishment of Steel Plant, R cards were given but there is no clarity that how many R card holders were compensated with R & R package and employment opportunity. • He urged to fulfill the earlier commitments given at the time of establishment and do justice to the rehabilitants.	• R&R Issues & Employment opportunities will be provided in accordance with the existing policies and guidelines. Out of 16000 R cards issued, agreements were entered with 5000 R card holders and the jobs were provided for 6300 R Card holders. Due to the Hon'ble Supreme Court of India's judgment issued in 1998, the employment opportunities are equally given to all the people by giving publicity through paper notification instead of providing jobs only to R Card holders. • As per the prevalent Act at the time of aquisition of land for RINL-VSP, the amount spent on compensation of the land acquired for VSP is Rs. 34.15 Crores so far. As regards R&R, the responsibility for Rehabilitation & Resettlement of Disaplaced Persons was the responsibility of Govt. of AP, which has implemented R&R scheme. However, as	- -	- Completed

S. No	Issue	Proponent Response	Budget	Action Plan with Date
		agreed in the High Level Committee meeting, RINL-VSP has paid 50% contribution amounting to 2.78 Crores towards R&R expenses.		
	• The industries in Visakhapatnam District were incurred heavy damage due to Hud-Hud Cyclone and obtained compensation from Government to some extent but the Steel Plant has not estimated & not disclosed the damage incurred due to Hud-Hud Cyclone for obtaining compensation.	• RINL have made claims for insurance for the damages occurred due to Hud- Hud cyclone and pursued and received Rs.140 crores.	-	Completed
	• Since the Visakhapatnam Steel plant has its own identity, it would have captive mines but the mines were not being allotted.	• RINL has participated for two Coal blocks i.e. one Thermal and one Coking Coal put up for e-auction in Tranche- III in July 2015 and also for one Thermal Coal put up for e-auction in Tranche-IV in November, 2015. • RINL has participated in the e-auction of one Iron ore block in Odisha put up for auction in December, 2015 and in two Iron Ore Blocks in Odisha put up for auction in March, 2017. • Identified Iron Ore Deposit in Andhra Pradesh to be operated through a Joint Venture between Rashtriya Ispat Nigam Ltd and Andhra Pradesh Mineral Development Corporation Ltd. Is in process. • Liaison with State and Central Governments for direct allotment of Coal & Iron ore blocks/mines.	-	Continuous

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EIA/ EMP Studies for expansion of Integrated Steel Plant from 6.3 MTPA to 7.3 MTPA Liquid steel within the premises of Visakhapatnam Steel Plant

S. No	Issue	Proponent Response	Budget	Action Plan with Date
		• Consultants have been engaged for Coal and Iron Ore to advise RINL for future e-auctions.		
5	**Sri N. Ramachandra Rao, INTUC Member, Pedagantyada,** While welcoming the proposed expansion project, informed that			
	• The Steel Plant was established in this area after scarification of many people by saying "Visakha Ukku Andhrula Hakku".	-	-	-
	• The Green Belt was planned to plant 1.0 lakh plants for 10 Lakh Tons production, but for the production of 6.3 Million Tons, plantation of 6.3 lakhs plants was not developed. He expressed that developing greenbelt within the Plant area and township not only serving the purpose but also would be developed in the surrounding areas viz., Gajuwaka, Pedagantyada, Aganampudi and Vadlapudi to control the pollution. He opined that, pollution would persist in the surroundings of any industry but the same would be controlled by developing good green belt and taking preventive measures.	• Out of total acquired land of 8827 ha (21811.99 Acres), greenbelt has been developed in 1969 ha (4866 Acres) within the plant area. On the whole about 38% of the land is afforested with the planting of 5.16 million trees. • Area has been earmarked, allotted and developed for green belt.	• Budget spent so far for 52,00,000 plantations is Rs.3834 lakhs. • Budget projection for 2017-18 to 2019-20 is Rs.13.50 crores	Continuous
	• He suggested that the management should not compromise with quality and take preventive measures to control accidents.	• HAZOP and QRA are carried out by RINL during planning phase and operations phase. Disaster Management Plan is in place.	Expenditure for HAZOP & ORA studies is Rs 23,99,976 (as done in 16-17)	Continuous

S. No	Issue	Proponent Response	Budget	Action Plan with Date
6	**Sri K. Mahesh, Kurmannapalem (Ukku Nirvasitula Nirudyogula Sangham)** While welcoming the proposed expansion project said that • The commitments given at the time of establishment of the Plant were not fulfilled and not yet provided proper rehabilitation and sought preference to them in recruitments during the expansion.	• R&R Issues &Employment opportunities will be provided in accordance with the existing policies and guidelines. Out of 16000 R cards issued, agreements were entered with 5000 R card holders and the jobs were provided for 6300 R Card holders. Due to the Hon'ble Supreme Court of India's judgment issued in 1998, the employment opportunities are equally given to all the people by giving publicity through paper notification instead of providing jobs only to R Card holders. • Expansion of the project will contribute in employment generation in the form of skilled and semi skilled during Construction period. Work force will be taken from local areas only by local contractors (short term). During Operation Phase Regular job for skilled and semi-skilled workers(Long term) Direct Employment during Operation is 1600 and Indirect employment is for 3000 people.	• As per the prevalent Act at the time of aquisition of land for RINL-VSP, the amount spent on compensation of the land acquired for VSP is Rs. 34.15 Crores so far. As regards R&R, the responsibility for Rehabilitation & Resettlement of Displaced Persons was the responsibility of Govt. of AP, which has implemented R&R scheme. However, as agreed in the High Level Committee meeting, RINL- VSP has paid 50% contribution amounting to 2.78 Crores towards R&R expenses.	During Construction and Operation stage of the Expansion Project
7	**Sri Venkata Rao, Dalita Porata Samithi** While welcoming the proposed expansion project opined that, • Public hearing shall also to be conducted at mining area to obtain the opinion of public as there is a proposal to allot the mines for the expansion project. • He urged to consider reservation	• Public Hearing was conducted by APPCB as per the guideline of MOEF&CC. • Reservation criteria is followed in RINL as	- -	Completed During

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S. No	Issue	Proponent Response	Budget	Action Plan with Date
	criteria in providing employment in the existing plant as well as after expansion also. • He requested to fulfill the commitments given to the rehabilitants and sought preference to them in recruitments during the expansion.	per the Govt. Guidelines. • R&R Issues &Employment opportunities will be provided in accordance with the existing policies and guidelines. Out of 16000 R cards issued, agreements were entered with 5000 R card holders and the jobs were provided for 6300 R Card holders. Due to the Hon'ble Supreme Court of India's judgment issued in 1998, the employment opportunities are equally given to all the people by giving publicity through paper notification instead of providing jobs only to R Card holders.	 As per the prevalent Act at the time of acquisition of land for RINL-VSP, the amount spent on compensation of the land acquired for VSP is Rs. 34.15 Crores so far. As regards R&R, the responsibility for Rehabilitation & Resettlement of Disaplaced Persons was the responsibility of Govt. of AP, which has implemented R&R scheme. However, as agreed in the High Level Committee meeting, RINL-VSP has paid 50% contribution amounting to 2.78 Crores towards R&R expenses.	Construction and Operation stage Completed
8	**Sri B. Pydi Raju, Secretary, INTUC, Visakhapatnam** While welcoming the proposed expansion project said that, • Development of ancillary industries in the surroundings would help in increasing employment opportunities. • He requested to implement minimum wages to the contract workers and do justice to the rehabilitants by fulfilling the earlier commitments. • He further said that the CSR funds are	- • Wages will be paid as per the existing guidelines. • CSR funds for the last 2 years is less due	- - • Budget spent for CSR Activities is	- Continuous Continuous

S. No	Issue	Proponent Response	Budget	Action Plan with Date
	to be allotted properly in the surrounding areas. • He urged to adopt Chepalapalem village which is affecting due to pollution.	to the losses incurred by the Plant. However, the plant is still carrying out skill development programmes, supplying water to the surrounding areas. • A RCC road and Bus Shelter at Chapelapalem, one of the peripheral villages of RINL-Visakhapatnam Steel plant, was built under RINL Corporate Social Responsibility (CSR) initiative.	more than Rs.138 crores. -	 Completed
9	**Sri G. Venkat Rao, Secretary, INTUC, Visakhapatnam,** While welcoming the proposed expansion project, said that • The proposed capital investment for expanding the capacity and the time period of 5 years for completion of the expansion project is to be re-estimated as allotment of funds throughout the period would obstruct the expansion.	• The Major equipment requires the revamping which necessitate the setting up of standby equipment and also shut down periods shall be planned without affecting the annual production plans. • COB#5 complex (7M tall top charged recovery type battery) with a gross coke production capacity of about 0.84 mtpa is to be completed within a period of 29 months from order placement. Once the Coke oven battery#5 is commissioned, this battery will act initially as a replacement battery and rebuilding of Coke oven batteries shall be taken up one after the other keeping at least 4 numbers of batteries under operation at any point of time to take care of uninterrupted supply of coke to blast	-	-

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S. No	Issue	Proponent Response	Budget	Action Plan with Date
		furnaces during rebuilding of the three old batteries. The above duration of rebuilding of each of these batteries shall be 31 months. Hence, the time limit of 5 years for completion of the expansion project is considered.		
	• He requested to provide permanent jobs to the rehabilitants and develop more greenbelt in and around the plant premises and township.	• Employment opportunities will be provided in accordance with the existing policies and guidelines. • Greenbelt development is taken as a continuous process. 5215100 of plants are already planted and plan is to plant 7,200,000 trees in the coming years. • Area has been earmarked, allotted and developed for green belt.	• Budget projection for 2017-18 to 2019-20 is Rs.13.50 crores • Budget spent sofar for 52,00,000 plantations is Rs.3834 lakhs.	Continuous
10	**Sri B. Satyanarayana, Aganampudi** while welcoming the proposed expansion project requested the management to • Implement CSR activities in the surrounding areas by providing skill development training to the local youth and women for better employment opportunities.	• CSR funds for the last 2 years is less due to the losses incurred by the Plant. However, the plant is still carrying out skill development programmes, supplying water to the surrounding areas.	Budget spent for CSR Activities is more than Rs.138 crores.	Continuous
11	**Sri M. Satyanarayana, Pedagantyada** While welcoming the proposed expansion project, said that • At the time of acquiring land for establishment of Steel Plant, R cards were given but employment opportunities are yet to be given for most of the R	• Out of 16000 R cards issued, agreements were entered with 5000 R card holders and the jobs were provided for 6300 R Card	As per the prevalent Act at the time of aquisition of land for RINL-VSP, the amount spent on compensation of the	Completed

S. No	Issue	Proponent Response	Budget	Action Plan with Date
	card holders and R & R package is yet to be completed. The rehabilitation problems are to be solved by conducting meetings in the surrounding villages. • The Pedagantyada area is suffering from pollution problems hence the Steel Plant management should develop greenbelt in the surrounding areas on par with the township.	holders. Due to the Hon'ble Supreme Court of India's judgment issued in 1998, the employment opportunities are equally given to all the people by giving publicity through paper notification instead of providing jobs only to R Card holders. • Project for plantation of 4,50,000 trees in a period of 5 years with a view to reduce pollution in the area of Greater Visakha Municipal Corporation (GVMC) Visakhapatnam has been taken up.	land acquired for VSP is Rs. 34.15 Crores so far. As regards R&R, the responsibility for Rehabilitation & Resettlement of Disaplaced Persons was the responsibility of Govt. of AP, which has implemented R&R scheme. However, as agreed in the High Level Committee meeting, RINL-VSP has paid 50% contribution amounting to 2.78 Crores towards R&R expenses. • Budget projection for 2017-18 to 2019-20 is Rs.13.50 crores • Budget spent so far for 52,00,000 plantations is Rs.3834 lakhs.	Continuous
12	**Sri K.V. Gowri Prasad, Aganampudi,** while welcoming the proposed expansion project, requested that • The Steel Plant is to be provided with permanent source of water supply as the production is affecting sometimes due to insufficient water supply.	• VSP has MOU with Visakhapatnam Industrial Water Supply Company Limited for use of 45 MGD of water and this meets the requirement of expansion also	-	Completed
13	**Sri P. Srinivasa Rao, Vadlapudi,** while welcoming the proposed expansion project, requested to • Fulfil the commitments given at the time of establishment of the Plant and provided proper rehabilitation.	• Out of 16000 R cards issued, agreements were entered with 5000 R card holders and the jobs were provided for 6300 R Card holders. Due to the Hon'ble Supreme Court of India's judgment issued in 1998, the employment opportunities are equally given to all the people by giving publicity through paper notification instead of	As per the prevalent Act at the time of aquisition of land for RINL-VSP, the amount spent on compensation of the land acquired for VSP is Rs. 34.15 Crores so far. As regards R&R, the responsibility for Rehabilitation & Resettlement of Disaplaced Persons was the responsibility of Govt. of AP, which	Completed

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S. No	Issue	Proponent Response	Budget	Action Plan with Date
		providing jobs only to R Card holders.	has implemented R&R scheme. However, as agreed in the High Level Committee meeting, RINL-VSP has paid 50% contribution amounting to 2.78 Crores towards R&R expenses.	
14	**Sri D. Suresh Babu, Ukkunagaram,** while welcoming the proposed expansion project, said that • Developing plantation par with the production capacity is appreciated due to which pollution level will be reduced. • He opined that pollution is not only due to the operations of Steel Plant but also due to the operations of Pharma industries located in Pharmacity which would be properly monitored and controlled. The fish catch is depleting thereby affecting the livelihood of fishermen due to the release of treated effluent into Sea water. • He requested to adopt reservations in contract employment also.	- • Water effluent is discharged into the sea after proper treatment. In the proposed expansion COB-5 is provided with Mechanical, Biological & Chemical Treatment Plant of approx.70M^3/hr capacity. For SMS-2 existing WTP will be augmented with the provision of Scale pit & pump house, Secondary settling tank & pump house, Wastewater treatment plant (WWTP) and Sludge handling system. In BF-3 WTP similar to BF1 & BF2 being provided. Existing STP has sufficient capacity to treat additional sewage water generated during proposed augmentation. • VSP is extending 50 % reservation to the displaced persons in Semi-Skilled and Un-skilled categories in the new vacancies arising while awarding the contracts or during operation of the contracts. Accordingly	- Expenditure for the water pollution Control Measures is around Rs.62 crores. -	- During Operation Phase of the proposed Expansion Continuous

S. No	Issue	Proponent Response	Budget	Action Plan with Date
		a suitable clause was incorporated in the contracts being awarded.		
15	**Smt Urmila, Duvvada** while welcoming the proposed expansion project said that • The Visakhapatnam Steel Plant management is implementing CSR activities properly by providing vocational training centers, adult education centers and skill development trainings to women etc.	• Management has assured to continue the CSR activities	-	Continuous
16	**Sri N. Rama Rao, Ukkunagaram,** while welcoming the proposed expansion project, said that • The Steel Plant is expected to expand up to 10 MMTPA. • He opined that though India has the capacity of producing 100% indigenous steel, producing 60% only and the balance 40% is being importing from foreign countries and hence urged to discourage the imported steel. • He said that no political interference would be involved in the expansion proposal and the expansion is proposed on importance basis, the funds allocated would not be misused.	- - -	- - -	- - -

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S. No	Issue	Proponent Response	Budget	Action Plan with Date
	• He further requested for preference would be given to the rehabilitants and women in the proposed expansion.	• Employment opportunities will be provided in accordance with the existing policies and guidelines		
17	**Sri Ch Musalayya, Appikonda** while welcoming the proposed expansion project, said that • The fish catch is depleted due to which the livelihood of fishermen is affected. • The Water Plant provided earlier was damaged during HudHud Cyclone time. • The village people are suffering due to lack of proper water facilities hence the Appikonda area shall be treated as rehabilitant area and arrange to shift the village to another places duly providing common amenities.	- • The water shed damaged during Hud-Hud cyclone in Chepalapalem village was repaired and made operational. • **Supply of Drinking water** – Safe drinking water has been supplied to four RH colonies & surrounding villages during the summer months when the wells and other natural water resources go dry and municipal water supply gets reduced. • Safe drinking water facility has been provided to 24 habitations in rural areas of Visakhapatnam District by setting up RO water plants.	- - -	- Completed -
18	**Sri Sunanda Reddy, Environmentalist,** while welcoming the proposed expansion project, suggested that • The Steel Plant management shall construct water sheds in their 22,000 acres land to collect and store the rain	• 2 large rain water harvesting ponds to capture and use about 3.3 MGD of water are constructed	Expenditure incurred for Installation is Rs.13.83 crores. -	Completed -

S. No	Issue	Proponent Response	Budget	Action Plan with Date
	water which may be used for plant requirements. • The plantation in the surroundings is good and it would be more beneficial if the management plants fruit baring, medicated value plants. • He requested the management to conduct skill development trainings to the surrounding local youth so as to improve their technical skills to get proper employment. • He opined that the Steel Plant should have captive mines and requested that all the required permissions may be granted to the expansion proposal.	- • Skill development trainings to the surrounding youth are taken as part of CSR Activities. -	- -	- -
19	**Sri Janardhan Reddy, Social worker** while welcoming the proposed expansion project, requested to • Fulfil the earlier commitments and do justice to the rehabilitants.	• R&R will be provided in accordance with the existing policies and guidelines.	• As per the prevalent Act at the time of aquisition of land for RINL-VSP, the amount spent on compensation of the land acquired for VSP is Rs. 34.15 Crores so far. As regards R&R, the responsibility for Rehabilitation & Resettlement of Displaced Persons was the responsibility of Govt. of AP, which has implemented R&R scheme. However, as agreed in the High Level Committee meeting, RINL- VSP has paid 50% contribution amounting to 2.78 Crores towards R&R expenses	Completed

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EIA/ EMP Studies for expansion of Integrated Steel Plant from 6.3 MTPA to 7.3 MTPA Liquid steel within the premises of Visakhapatnam Steel Plant

S. No	Issue	Proponent Response	Budget	Action Plan with Date
	• He requested that all the required permissions may be granted to the expansion proposal.			
20	**Sri P. Ramulu, Rehabilitant,** while addressing in the public hearing, expressed his grievance that • Though their land was acquired at the time of establishment of the plant, neither compensated nor provided any employment opportunity. He requested the management to provide employment immediately for livelihood.	• R&R Issues &Employment opportunities will be provided in accordance with the existing policies and guidelines.	-	-
21	**Sri Vijayakumar, Aganampudi** while welcoming the proposed expansion project, said that • Local people and rehabilitants would be preferred in jobs. • The green belt is to be developed in the surrounding nearby villages. • A village meeting is to be conducted in Aganampudi village and discussions would be held on the pollution issues.	• Employment opportunities will be provided in accordance with the existing policies and guidelines. • Project for plantation of 4,50,000 trees in a period of 5 years with a view to reduce pollution in the area of Greater Visakha Municipal Corporation (GVMC) Visakhapatnam has been taken up. -	- • Budget projection for 2017-18 to 2019-20 is Rs.13.50 crores • Budget spent sofar for 52,00,000 plantations is Rs.3834 lakhs. -	Continuous Continuous

S. No	Issue	Proponent Response	Budget	Action Plan with Date
	• The management would involve the local youth in CSR activities and green belt development.	• RINL involved around 300 Nos. local youth in vocational training/skill development programmes.	-	Continuous
22	**Smt Vijaya, Aganampudi,** while welcoming the proposed expansion project, said that • The Visakhapatnam Steel Plant management is implementing CSR activities properly by providing vocational training centers and skill development trainings to women etc. She requested to enhance the more funds for CSR activities and provide employment to the women.	• Vocational training is being imparted every year in trades like, tailoring, fabric painting, LMV driving, Welding, Beautician course etc. to the unemployed youth and women in the peripheral villages of Plant and Mines. The above programmes are being organized every year and has enabled beneficiaries to earn their livelihood	• Budget spent for CSR Activities is more than Rs.138 crores.	Continuous
23	**Sri Lakshmana, Srinagar Official Colony,** while welcoming the proposed expansion project, said that • The green belt is to be developed more. • The CSR activities are to be implemented properly in the surrounding areas for developing their livelihood. The local youth should be involved in the CSR programmes.	• Greenbelt development is taken as a continuous process. • RINL is carrying out skill development programmes, supplying water to the surrounding areas. RINL involved around 300 Nos. local youth in vocational training/skill development programmes.	• Budget projection for 2017-18 to 2019-20 is Rs.13.50 crores • Budget spent so far for 52,00,000 plantations is Rs.3834 lakhs. Budget spent for CSR Activities is more than Rs.138 crores.	Continuous Continuous

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EIA/ EMP Studies for expansion of Integrated Steel Plant from 6.3 MTPA to 7.3 MTPA Liquid steel within the premises of Visakhapatnam Steel Plant

S. No	Issue	Proponent Response	Budget	Action Plan with Date
24	**Sri Manthri Rajasekhar, Nadupuru** while welcoming the proposed expansion project, said that • The surrounding Yarada, Gajuwaka and Gangavaram areas are affected by pollution. Green belt would be developed in those areas on par with township to reduce the affect of pollution. Since the Visakhapatnam Steel Plant, Gangavaram Port and public are using the same road for conveyance, the sound & vehicular pollution, public nuisance and traffic issues are increasing day by day. The Yeleru reservoir water is getting polluted due to dumping of Pharma waste and Poultry waste which is to be prevented.	• Vizag Steel Plant has adopted Best Available Technologies, for the Air Pollution, water pollution and Solid Waste Management. For the proposed expansion the following pollution control measures are planned. ➢ Revamping of ESPs of Air Cleaning Plant and Gas Cleaning Plant of Sinter plant 1&2 ➢ Revamping of ESPs of Blast furnace-1 &2 stock house & cast house fume extraction ➢ Installation of dog houses in all 3 convertors of SMS-1, Convertor-3 ➢ Installation of secondary ventilation and material handling systems with ESP/Bag filter ➢ Revamping of ESPs of all 5 boilers ➢ Mechanical, Biological & Chemical Treatment Plant Of Approx.70m3/Hr Capacity for cokeoven battery-5 ➢ Existing WTP to Be Augmented at SMS-2 ➢ There would be additional generation of approx 1,700 TPD of solid waste during proposed augmentation	• Expenditure involved for environmental improvements during 2004-2016 is Rs.1035.68 crores • Expenditure for pollution control from 6.3 MTPA to 7.3 MTPA is Rs.559 Crores. • Annual expenditure for operation and maintenance of environmental systems: Rs300 Crores	During Construction and Operation stage of the Expansion Project

S. No	Issue	Proponent Response	Budget	Action Plan with Date
		➢ It is estimated that 100% of the granulated BF slag would be sold to the cement making industries for manufacturing of slag cement. ➢ Other waste such as mill scale, sludges, dust etc would be 100% recycled into the sinter plant. • Greenbelt development is taken as a continuous process. 5215100 of plants are already planted and plan is to plant 7,200,000 trees in the coming years		
	• The earlier commitments are to be fulfilled and the rehabilitants are to be justified by providing one time settlement.	• R&R Issues &Employment opportunities will be provided in accordance with the existing policies and guidelines.	• As per the prevalent Act at the time of acquisition of land for RINL-VSP, the amount spent on compensation of the land acquired for VSP is Rs. 34.15 Crores so far. As regards R&R, the responsibility for Rehabilitation & Resettlement of Disaplaced Persons was the responsibility of Govt. of AP, which has implemented R&R scheme. However, as agreed in the High Level Committee meeting, RINL- VSP has paid 50% contribution amounting to 2.78 Crores towards R&R expenses.	Completed
25	**Sri M. Dattathreya, Nadupuru** while welcoming the proposed expansion project, informed that • The ash is spreading in the township due to operation of thermal power plant	-	- As per the prevalent Act at the time of acquisition of land for RINL-VSP, the amount spent on compensation of the	-

S. No	Issue	Proponent Response	Budget	Action Plan with Date
	by NTPC. • The rehabilitants are to be justified.	• R&R Issues opportunities will be provided in accordance with the existing policies and guidelines.	land acquired for VSP is Rs. 34.15 Crores so far. As regards R&R, the responsibility for Rehabilitation & Resettlement of Disaplaced Persons was the responsibility of Govt. of AP, which has implemented R&R scheme. However, as agreed in the High Level Committee meeting, RINL-VSP has paid 50% contribution amounting to 2.78 Crores towards R&R expenses.	Completed
26	**Sri Mokkala Raju** while welcoming the proposed expansion project, informed that • The green belt is to be developed more in and around surroundings of the Plant to mitigate pollution issues.	Greenbelt development is taken as a continuous process. 5215100 of plants are already planted and plan is to plant 7,200,000 trees in the coming years.	Budget spent sofar for 52,00,000 plantations is Rs.3834 lakhs. Budget projection for 2017-18 to 2019-20 is Rs.13.50 crores	Continuous

8.0 PROJECT BENEFITS

8.1 INTRODUCTION

The development of industrial projects plays a key role in the economic growth of any country. Iron is the most important metal to the mankind, which is widely used for domestic, agricultural, industrial and defence purposes. Per capita iron / steel consumption is a major indicator of economic status of any country. The growth of the steel industry significantly contributes to economic growth as it generates employment both directly and also due to development of downstream industries. Peripheral development takes place and due to more influx of money through the area, overall importance of the area increases and overall the infrastructure improves. As the current project is a part of the presently ongoing expansion of RINL, it shall also contribute to the social, economic, infrastructural and community development by the overall Steel Plant in the surrounding area.

8.2 IMPROVEMENTS IN PHYSICAL INFRASTRUCTURE

From the very inception, RINL has been aware of and is concerned about the health and safety of not only its own employees and their families but also about the ecology and issues affecting society around RINL and its stakeholders. As a corporate citizen, it has always been the endeavor of RINL to take effective steps to tackle all these issues. The current project is also expected to yield a positive impact on the socio-economic environment. It shall help in sustainable development of this area including further development of physical infrastructure facilities. The following physical infrastructure facilities will further improve due to the current project-

- Road Transport Facilities
- Educational Facilities
- Water Supply and Sanitation
- Medical and Health Facilities
- Housing and Township Facilities
- Social Security Measures

8.3 IMPROVEMENTS IN SOCIAL INFRASTRUCTURE

RINL Steel Plant is committed to improvement of the social structure of the area. The current project was expected to generate employment opportunities, both direct and indirect, during construction as well operation stage of the project. Apart from employment opportunities, RINL has played a major role in development of various social amenities in and around the area including medical facilities, water supply and sanitation facilities, Schools etc.

8.3.1 Community Development Efforts of RINL

Steel plants by nature serve as the nuclei for development of small-scale industries in the areas around them. These small-scale units usually have input-output linkages with the steel plants. The demand for spares, assemblies and sub-assemblies by steel plants are generally met through the supply (of these items) from small-scale units located nearly. The small-scale units, in turn, get necessary steel products from the steel plant.

Several measures have been proposed in the environmental mitigation measures for mitigation of adverse environmental impacts. These shall be implemented as per proposal and monitored regularly to ensure compliance to environmental regulation and also to maintain a healthy environmental conditions around the steel works.

From the very inception RINL Steel Plant has been aware of and concerned about the health and safety of not only its own employees and their families but also about the ecology and issues affecting society around RINL.

The major areas where RINL Steel Plant has been taken up social responsibilities are

- Medical & Health Services
- Housing & Township facilities
- Social security measures
- Promotion Sports & Cultural activities
- Concern for society and Environment Protection
- Community development & cultural events in villages
- Health camps in surrounding areas.

8.4 EMPLOYMENT POTENTIAL

8.4.1 Skilled and Semi-skilled

Skilled and Semi-skilled employment potential in terms of indirect employment of RINL will be non-marginal and will usually remain widespread across a long region. Over the years RINL has caused generation of income and employment opportunities the ancillaries and service units which came in the vicinity of the steel plant, specifically, in mining, ancillary, transport and manufacturing sectors. Due to expansion of RINL, indirect employment is likely to grow further. The project is expected to generate substantial indirect employment in other sectors such as metal-based industries, chemical-based industries, small rolling units, scrap dealing units, service units etc. Overall assessment of the employment and income effects indicates that the project has strong positive direct as well as indirect impact on employment and income generation of the area.

8.4.2 Un-skilled

Unemployment for un-skilled workers is quite common in the study area. However, RINL has taken a major drive as CSR initiative to impart training for developing technical skills of the villagers for enhancing economic strength. The present expansion project has employment generation potential by way of recruiting local people directly for different activities of the project, specifically at the construction phase. It is expected that substantial portion of the investment in this project will trickle down to the local people in the form of employment and income.

8.4.3 Industrialization around RINL

Steel plants by nature serve as the nuclei for development of small scale industries in the areas around them. These small scale units usually have input-output linkages with the steel plants. The demand for spares, assemblies and sub-assemblies by steel plants are generally met through the supply (of these items) from small scale units located nearly. The small scale units, in turn, get necessary steel products from the steel plants. Over the years, similar type of small-scale industrialization has ready taken place in the vicinity of RINL. This brought mutual advantages with one acting as complementary to another. The advantages to steel plants as well as small scale units are listed below:

Advantages to RINL

- Assurance of a reliable source of supply of spares and consumables;
- Supply on short-delivery schedules enabling maintenance of lower inventory;
- Saving foreign exchange through import substitution;
- Lower freight element in comparison to materials supplied by firm located far away;

- Better service facilities etc.

Advantages to small scale units

- Availability of ready market;
- Availability of raw material source for steel/by-product consuming industries;
- Getting price preference over distant suppliers;
- Availability of facilities from government;
- Availability of infrastructure support from the steel plant etc.

Proper utilisation of these mutual advantages played a catalytic role in the development of the region around RINL.

The small scale industries that came in the vicinity of RINL can be grouped into major three categories -- spares, metal based and chemical based, besides the service units. These are complemented by the service units. The present project is likely to accelerate such industrialization through "Bubble Effects" in the study area. It is important to note that the small scale units are usually labour-intensive and high-priority industries from social point of view.

The proposed project is expected to serve as centre of significant small-scale industrial economy around it complemented by the services sector. This is expected to play a major role in the future economic and social development of this area.

8.5 OTHER TANGIBLE BENEFITS

The other tangible benefits will be in the form of hospital and schooling facilities as well as Community Development plan of RINL which will also help local population to enjoy the fruit of better facilities in nearby.

9.0 EMP- ORGANISATIONAL SET UP AND IMPLEMENTATION ARRANGEMENT

9.1 ORGANIZATION POLICY

The importance of environmental control has been recognized by RINL and it has taken necessary steps to identify and control pollution in the plant, respond to impacts on its own captive population and also in the peripheral areas. RINL has Integrated Corporate policy on environment including Quality, safety, health, & energy which is enclosed as **Annexure 9.1.**

RINL declared "Environment Management" as one of its thrust areas of operation. RINL management adopted a three pronged strategy to protect the environment. They are;

- Use of natural resources with concern to environment
- Comply with all legal and requirement applicable to environmental protection
- Support the purchase of safe, environmental friendly and energy efficient products as well as services and design for continual improvement

The above objective has been intended to be achieved through the following:

i) Improvement in the quality of raw materials.
ii) Modernisation of manufacturing operations in steel plant,
iii) Using automation & Computer control to have improvement on technology and on working condition,
iv) Pollution Monitoring and Control,
v) Modernisation of occupational health set up including regular medical monitoring of employees,
vi) A well developed safety management organization,
vii) Preparation of Emergency/Disaster Control plan and a properly trained group to meet the emergency situations,
viii) Green belt development inside the plant and township.
ix) Development of awareness in employees and public including student population towards environmental preservation,
x) R & D activities in regard to specific pollution problems.

RINL has given maximum importance for adopting latest technologies for keeping the pollution to minimum levels. RINL had already spent about Rs. 468 Cr at 3.5 MT stage, Rs. 1283 Cr at 6.3 MT stage and about Rs. 558 cr has kept for expansion from 6.3 MT to 7.3 Mt.

9.2 ORGANISATIONAL SET UP

Environmental monitoring and reporting has been designed to provide a close watch on the surrounding natural environment and provide early warnings of any adverse changes that may be related to some dimension of the plant's operations.

9.2.1 Administrative Setup

A separate Environment Management Department (En MD) was set up along with an Environmental Laboratory with latest monitoring instruments. The plant is certified for ISO 14001:2015 for implementing EMS in the organization.

EnMD also co-ordinates with process units & other departments like Occupational Health, Safety Management, Project Engineering, Horticulture, Social Welfare, CSR Dept., Water Supply Department etc. and also do the liaison work with external agencies like State & Central Pollution Control Boards.

EnMD is already functioning in the existing plant to look after all environmental aspects including operation and maintenance of pollution control systems, carry out day to day environmental monitoring / inspection requirements and maintain records. However, casual labourers etc. is employed for plantation, drain cleaning etc as and when required.

The EnMD carries out complete Air Monitoring, Noise Level Monitoring, Special monitoring on water and air, effluent, special surveys and Impact Assessment etc.

Simultaneously the RINL has taken into cognizance the importance of noise pollution at work sites, solid waste management, occupational health, safety management, green belt development, community welfare and peripheral development which are described in detail.

Presently, a senior officer of the rank of GM, is the head of the EnMD. AGM rank officers will look after monitoring, DSS systems DE systems of various units. In his day to day work, he is assisted by Environmental Engineers, Chemists and Laboratory Assistants. The GM reports to the GM I/c (Safety & Environment), who in turn reports to the Executive Director (Works). The Organisation Chart of the EnMD is given as **Fig. 9.1.** Environmental monitoring and reporting has been designed to provide a close watch on the surrounding natural environment and provide early warnings of any adverse changes that may be related to some dimension of the plant's operations. Any non compliance of norms/standards identified it will be reported immediately to higher ups. If any issues are raised it will be resolved EnMD level. If major revamping or additional procurement of instruments are to be done, it will be bring to the notice of the Management.

All compliance reports are being submitted to SPCB, RO of MOEFCC and also uploaded in the RINL web site periodically.

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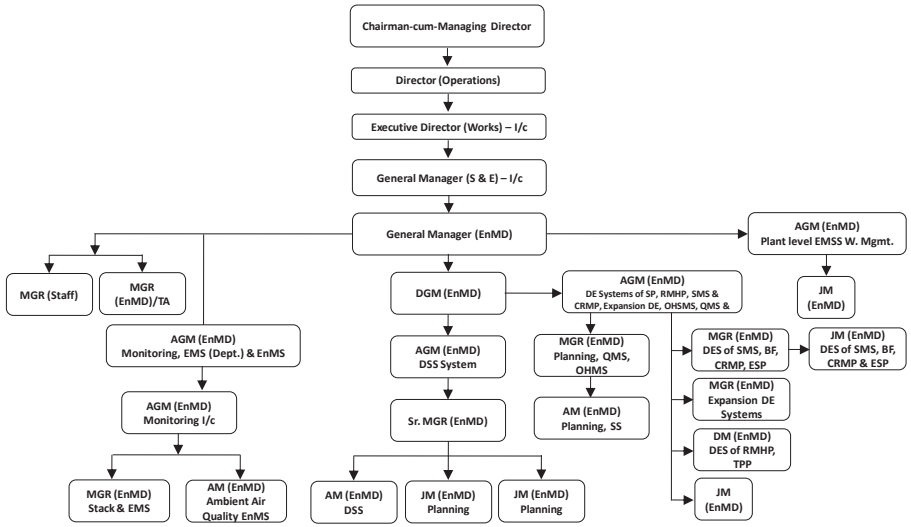
Fig. 9.1 : Organisation chart of Environmental Management Department, RINL



9.2.2 Manpower

EnMD is manned by 8 no. of skilled and trained personnel supported by another 9 no. of dedicated staff doing the monitoring, analysis & other functions. For development and maintenance of jobs like drainage, settling tanks etc. assistance from the projects civil engineering department are taken.

The resources of the plant's chemical laboratory have been augmented to carry out the regular environmental surveillance programme.

Various measures have been suggested in the chapter 4 for mitigation of impacts. These have to be implemented according to the suggestions and monitored regularly to prevent any lapse.

A large part of the sampling and measurement activity is concerned with long term monitoring aimed at providing an early warning of any undesirable changes or trends in the natural environment that could be associated with the plant's operation.

Third party environmental audits are carried out regularly as part of Environment Management System.

The units are taking all necessary steps to implement the measures suggested by Central Pollution Control Board (CPCB) in the Charter on Corporate Responsibility for Environmental Protection (CREP) for Integrated Iron and Steel Industry.

9.2.3 Laboratory Setup

RINL has a well-equipped environmental control laboratory inside the plant premises. All the personnel deployed in the laboratory have been given training to carry out necessary environmental monitoring as well analysis also. The equipment available for carrying out environmental monitoring are given below.

Available instruments/equipments (major):-

- UV-V is spectrophotometer
- Ion selective electrodes with EA-940 compatibility for DO, f-, No3-,pH
- BOD incubator-
- COD closed reflux system(digester)
- Filtration assembly(make Millipore)
- Flame photometer
- TOC analyzer
- Mercury analyzer
- AAS
- GC-MS
- Millipore water system for double distilled water with ultra purity
- Micro balance and analytical balances
- Laminar flow for micro-biological analysis
- Hot air ovens micro-biological analysis
- Incubators microbiological analysis
- Sterilizers(wet)
- Muffle furnace
- Refrigerator

Other instruments:

- Weather station
- RSPM analyzer -5 nos
- PM- 2.5 analyzers- 2 nos
- Sound level monitors – 2 nos
- Stack Monitoring kits -2nos

9.2.4 Meteorology

One automatic continuous weather meteorological stations were already set up. The following parameters are being recorded regularly:

- Wind speed and direction
- Rainfall
- Temperature and humidity
- Solar Radiation

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9.2.5 Emissions And Air Quality

Ambient air quality is being monitored regularly in accordance with CPCB / Andhra Pradesh Pollution Control Board (APPCB). Work zone air quality is being monitored as per directives of SPCB, AP to assess the levels of particulate matter, NO_x and SO_2.

Four nos continuous Ambient Air Quality monitoring stations have been installed covering all 4 directions. All major stacks are provided with on-line monitoring system. The emissions from all the stacks are being monitored once a month using the manually operated stack emissions monitoring equipment. However the frequency of monitoring may be increased if required in accordance with the stipulations of APPCB or other statutory authorities. Details of Air Monitoring is provided in **Table 9.1**.

Table 9.1 - Air Monitoring

Sl, No.	monitoring	Parameter	Frequency
1.	Ambient monitoring -4 no. of stations are installed near Main Gate, BC Gate, Pedagantyada and Appikonda	PM_{10} $PM_{2.5}$ SO_2 NO_X	Continuous
2.	Work zone air fugitive emission	NO_X PM_{10} $PM_{2.5}$ SO_2 * Pb, * CO, * NH_3	4/5 days per weak
3.	Ambient Noise	Noise level	Once in a week
4.	Stack gas source emission • All Major 36 stacks	PM, SO_2 & NO_X	Continuous online

** Only Quarterly*

9.2.6 Effluent Quality Monitoring

RINL has regular monitoring programme to check quality of the effluents discharge from the plant. RINL has also installed an online effluent quality monitoring system at ETP & DM plant. pH, Flow, TSS, BOD, COD, Temperature, Cyanide, Phenol will be checked regularly. Details of Effluent monitoring is provided in **Table 9.2.**

Table 9.2 - Effluent Monitoring

Sl, No.	Locations	Parameter	Frequency
1.	Effl. discharge from drains	pH, Flow, TSS, BOD, COD, Temperature, Cyanide, Phenol	Daily

The suggestions given in the EMP shall be implemented by the EnMD by following an implementation schedule.

Along with the performance and guarantee test of main plant equipment, performance and guarantee test of pollution control equipment will be made before taking over the expansion plant.

- A detailed maintenance schedule shall be drawn for all pollution control systems. The maintenance shall be done strictly as per schedule and guidelines furnished by plant manufacturer.
- Ground level concentration in ambient air, stack emission and work zone monitoring results shall be discussed in the EnMD and any variance from norms shall be reported to the Executive Director for immediate study and rectification action

9.2.7 Institutional Implementation Arrangement

RINL is responsible for implementation of all the mitigation and management measures suggested in Environmental Monitoring Programme. A separate department "Environmental Management Department" (EnMD) already exists in RINL to look after all environmental related matters of the plant.

For successful implementation of the environmental management plan other agencies of the State may also be involved by RINL if required (for regulatory requirement or technical support). The coordinating agencies, which may be involved for specific environmental related activities, are State Forest Department, State Pollution control Board & Inspector of factories at state level, and the Divisional Forest Officer and Regional Officer, State Pollution Control Board at District level.

Local NGOs will also be identified at the district and block level to provide help and advice for implementation of EMP especially on matters related to community development programme.

9.3 TRAINING FACILITIES

The present project is a part of ongoing expansion of RINL. Therefore, for the present project also including other proposed projects of RINL, additional training facilities will be developed for environmental control. Specialized courses at various Research/ Educational institutes will be organized. Training will cover the following fields:

- Awareness regarding Pollution Control and Environmental protection.
- Operation and maintenance of pollution control equipment.
- Afforestation / plantation and post care of plants.
- Field monitoring, maintenance and calibration of pollution monitoring instruments.
- Chemical analysis of various environmental parameters at laboratory.
- Repair of pollution monitoring instruments.
- Knowledge of norms, regulations and procedures.
- Occupational health and safety.
- Risk assessment and Disaster Management Plan.

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9.4 ENVIRONMENTAL MANAGEMENT PLAN FOR PROPOSED PROJECT DURING OPERATION PHASE

As this is a Brown field Integrated Steel Plant Project, Corporate Responsibility for Environment Protection (CREP) Guidelines are being followed presently during operation which are provided in **Table.9.3**.

Table 9.3: Status Report on Implementation of CREP Guidelines

Sl. No	Action point	Status/action taken	Remarks
1	To meet the parameters PLL, PLD & PLO as notified Under EPA by Dec'06	PLD, PLL & PLO in existing 3 batteries are well below the norms.	
2	To re-build at least 40% of Coke Oven Batteries by 2012	Battery-1 re-building for 30 months after Bat-5 commissioning	Batt-2: Cold repairs done in 2000. Battery-1: 17 nos of Hot full wall repairs completed by Aug'2013 Battery-3: Hot full wall repairs completed in total 68 No's of Heating walls by Apr'2015
3	Steel Melt Shop – Fugitive emissions to reduce 30% by Mar'04	Fugitive emissions reduced by 30% by installing Torpedo ladle fume extraction system in Dec'02. Since then it is maintained for controlling fugitive emissions.	Complied
4	Steel Melt Shop – Fugitive emissions to be reduced by 100%by Mar'08 including installation of secondary de- Dusting facilities	Installation of secondary de-dusting facilities is under progress	SMS-2: Installed & Commissioned SMS-1: 1 & 3 Converters Commissioned, 2nd Converter- Under progress
5	Direct injection of reducing agents by June, 2013	Pulverized Coal Injection in BF-1 commissioned on 18/03/15 & BF-2 is under implementation by Dec' 2016 Pulverized coal injection in BF-3 is commissioned on 02/11/2015	
6	Solid waste/ Hazardous waste management- SMS &BF slag utilization 70% by '04, 80% by '06 and 100% by '08 – CREP	QUANTITY(t)	

Item	2013-14	2014-15	2015-16	Jan'17	2016-17
BF slag generation	1374045	1405462	1424169	127623	1197615
BF slag utilisation	1576960*	1280178	1264809	98092	966823
SMS slag generation	454778	471246	507959	44475.79	436134.78
SMS slag utilisation	173896	166130	132894	8535	82747

Sl. No	Action point	Status/action taken	Remarks
		% of (BF& SMS) total slag utilisation: 95.74 | 77.07 | 72.34 | 61.96 | 64.24 ***-Excess qty. sold/recycled was from previous stock. 100% disposal of Hazardous wastes being done as per authorization of APPCB**	
7	Charge of tar sludge/ ETP sludge in coke oven by June'03	‣ Complied ‣ Charging being done regularly	
8	Inventorisation of hazardous wastes	‣ Complied ‣ Annual returns are being submitted inform-4 regularly-	
9	Water conservation & water pollution : reduce specific water consumption to 5 m3/tls	Complied. Sp. Water consumption of VSP is as given below. Parameter: Specific water consumption. (m3/tcs) — 13-14: 2.32; 14-15: 2.78; 15-16: 2.63; Jan'17: 2.70; 2016-17: 2.51	
10	To operate COBP effluent treatment plant efficiently to achieve the standards by July'04	Being maintained efficiently	Status to be maintained in future also
11	Installation of continuous stack monitoring equipment by Jun'05	On-line monitors for all stacks are already installed and in operation	Status to be maintained in future also
12	Setting up of 3 nos. on-line ambient air quality monitoring stations by Jun '05	Four stations (3 in the plant Premises & 1out side) are commissioned and working	Status to be maintained in future also
13	To operate existing pollution control eqpt. & keep proper records	Procedures and records for Status / availability of DE systems and pollution control facilities are established as per QMS and EMS. Emissions of DE systems are also monitored and records maintained as per EMS.	Status to be maintained in future also
14	To implement the recommendations of LCA Study • Battery1,2,3 repaired. In good health • Coke dry quenching, BF top gas recovery, LD gas recovery and 100% continuous casting.	‣ Complied ‣ Complied	Status to be maintained in future also

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Sl. No	Action point	Status/action taken	Remarks
	• Doghouse- SMS: • PCI in BF 1&2: • Sp. Water Consumption • Specific Energy consumption	‣ Planned along with replacement of existing converters ‣ Under implementation ‣ Complied. ‣ Complied.	
15	Energy recovery from BF top gas pressure	Gas Expansion Turbines- 2x12 MW in BF 1&2 are in operation. For new BF-3-1 x 14 MW TRT installed and commissioned on 11.06.2014.	Gets production- Nil TRT-5678 MWH
16	Use of tar free runners/ BF	‣ Tar free runners provided in BF-1during Cat-1 capital repairs ‣ BF-2 along with Cat-1 capital repairs ‣ BF 3 is with Tar free runners only	
17	De-dusting in Cast house	• Complied - Cast House Exhaust Station in all Blast Furnaces is in operation	
18	Suppression of fugitive emission using N_2	Cast house exhaust stations with ESPs are already provided to take care of cast house emissions hence, suppression with N_2 is not required/ applicable.	
19	Processing of waste containing flux & ferrous wastes through waste recycling plant	Lime briquette plant, skull breaker, magnetic separator, screens and facilities for LD slag recovery exist.	
20	To implement rain water harvesting measures	12 masonry check dams,1 Earthen check dam, Percolation pits and recharge wells 112 have been constructed so far.	1. 125 Rain water facilities are provided 2. Two Rain harvesting projects being implemented at an expenditure of Rs.1303 lakhs for saving of 3.3 MGD of water
21	Reduction of greenhouse gasses by: a. Reduction in power consumption	‣ Following initiatives taken for reduction of power consumption: ‣ Reducing field currents in DC motors in rolling mills (during	

Sl. No	Action point	Status/action taken	Remarks
		no rolling periods) • Use of vector drives in Raw Material Handling Plants • Use of VVF drives in DE Systems of Coke Ovens • Regular audit and fine tuning of equipment to reduce power consumption • Energy saving devices and energy efficient lighting systems implemented extensively in the plant • Transparent roof sheets provided in suitable areas to reduce load during day time	
	b. Use of by-products gases for power generation	Being used extensively in TPP,CCCD,CRMP,SP, SMS, BF &Mills.	
	Promotion of Energy Optimization Technology incl. energy audit	In-house energy audits are done.	
22	To set targets for Resource Conservation such as raw material, energy and water consumption	Internal targets are set towards resource conservation &monitored regularly to ensure the targets are met	
23	Up-gradation of the monitoring and analysis facilities for air and water pollutants. Also impart elaborate training to the manpower	• Monitoring facilities:4 Continuous Ambient Air Stations and 20 Continuous Stack Emission Monitoring Systems are installed. • Environment laboratory is now equipped to analyze all parameters related to physical characteristics, inorganic and organic elements, trace metals, micro-biological and Bio-Assay characteristics. • Training being imparted regularly.	
24	Power Plants should provide dry fly ash free of cost to the users	Work of dry fly ash handling, storage & delivery system for boilers 2,3,4&5 has been already awarded to M/s Indure at a cost of Rs 10.23 cr and it is expected to be commissioned by Mar'2016.	100% dry fly ash collection system at TPP shall be made ready by March'19.
25	Good housekeeping	Good housekeeping is being maintained all over the plant	

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Sl. No	Action point	Status/action taken	Remarks
		through EMS, QMS, OHSMS. As a proactive measure, VSP has also adopted the concept of "5S" to improve housekeeping. In each department a team has been formed for the implementation of "5S". All **74** departments have implemented 5S and have been certified for the same.	

10.0 SUMMARY AND CONCLUSION

Executive summary of the entire EIA study is being submitted as a separate report. However in this chapter the brief summary and conclusion of the study is being highlighted.

RINL had received EC expansion of Hot metal from 4.0 to 6.5 MTPA from Ministry of Environment, Forest and climate change (MoEFCC).

However, since then operating at high levels of capacity utilization RINL started revamping / capital repairs of the existing critical equipment of the plant. That was extremely essential, to ensure paramount safety and in addition would help in meeting the upgraded environmental norms specified vide MoEF notification vide GSR.277(E) dt 31st Mar'2012.

This modernization and revamping drive led to enhanced capacities by upto 1 MTPA. However, since revamping has resulted in producing additional 1 MT without prior EC as per EIA Notification 2006, it may be considered as a "Violation" of the provisions of the EIA Notification, 2006.

Latest state of art technology has been installed in the plant so as to reduce waste emissions during plant operation in comparison to the existing plant units and tend to achieve zero water discharge. The expansion of project site is within the plant boundary only. No additional land outside the plant premises is required.

Primary and secondary data were used to estimate the contribution of environmental emissions from the plant during the project construction phase and the environmental impacts of the project after expansion in operation phase in future. The potential environmental impacts were assessed in a comprehensive manner. All the potential environmental impacts associated with each individual activity in different phases (i.e. during design or pre-construction, construction and operation) of the Project were assessed.

During construction of the project, fugitive dust and noise had been generated. However the effect was not felt at nearby human habitations because of a combination of mitigation measures implemented by the project authorities, the intervening distance and attenuation by the steel plant's green belt and other buildings.

The existing plant units are revamped, pollution control equipments are upgraded and modern process technologies are adopted. Due to this quantum of emissions during operation of the plant will be low though plant's production capacity increased by 1Mt that of the existing plant.

The EIA report has thoroughly assessed all the potential environmental impacts associated with the project. The environmental impacts identified by the study are manageable. The implementation of environmental mitigation measures recommended in the report will bring the anticipated impacts to minimum. A separate Community and Natural Resource Augmentation Plan has been prepared as restitution for the damages which occurred in the nearby areas during construction of expansion of various units of the plant.

Site specific and practically suitable mitigation measures are recommended to mitigate the impacts. Further, a suitable monitoring plan has been designed and incorporated in the existing monitoring plan of ongoing expansion plan of RINL to monitor the effectiveness of envisaged mitigation measures during the operation phase.

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The introduction of state of art technology (including the technological mitigation measures) during the design shall reduce the environmental impacts related with the Project. The implementation and monitoring of effectiveness of the environmental mitigation measures during the operation phase will be assigned to the Environmental Management Department (EnMD) of RINL. EnMD, headed by GM level officer, periodically assess and monitor the implementation of mitigation measures, and will tackle the management bottle necks of implementation of mitigation measures and environmental monitoring programme

11.0 DAMAGE ASSESMENT, REMEDIATION PLAN AND NATURAL & COMMUNITY RESOURCE AUGMENTATION PLAN (NCRAP)

11.1 INTRODUCTION

The objective of Damage Assessment Report (DAR) and Natural & Community Resource Augmentation Plan (NCRAP) includes the study of effects which are caused by change in the environment due to an activity and to identify the corrective measures to compensate or restore or replace those resources such as Land, Biota, Air, Water and others in order to mitigate the adverse effects on such resources. The damage is assessed based on negative changes brought onto the various environmental aspects due to the construction of a proposed facility.

RINL's Visakhapatnam Steel Plant was granted environmental clearance for increase of Hot Metal production from 4.0 to 6.5 MTPA by Ministry of Environment, Forest and Climate Change (MoEFCC) vide their letter no.J-11011/196/2005-IA II (I) dated 11-08-2005. RINL had setup all the facilities envisaged in this expansion programme. However, since then, because of operating the units at high levels of capacity utilization on account of the continuous thrust on production of value added steel, it was deemed necessary that major revamps / capital repairs of the existing critical equipment of the plant should be taken up immediately. This was extremely essential, to ensure paramount safety and in addition would help in meeting the upgraded environmental norms notified by MoEFCC vide Gazette No. GSR.277(E) dtd. 31st March, 2012. Revamping of the furnaces producing hot metal and liquid steel was overdue and this needed to be done urgently.

Keeping in view of the above, RINL contemplated modernizing its facilities along with revamping. The modernization and revamping drive led to enhancement of capacities of some units. Concurrently, RINL had obtained Terms of reference (ToR) vide Letter. No. J-11011/196/2005-IA.II(I) dated 19th September 2016 from MoEFCC. Subsequently, public hearing was also conducted on 15.06.2017 at Trishna Grounds, Sector -2, Ukkunagaram and the final EIA-EMP report was submitted. The project was presented at the 28th meeting of EAC held during 5th to 7th Feb 2018 for environmental appraisal of Industry-I Sector projects. However, as per provisions of the EIA Notification, 2006 and amendments thereto, site activities pertaining to the modernization and revamping of various units had been carried out before grant of Environmental Clearance, and hence were in violation of the notification.

The present Damage Assessment, Remediation Plan and Natural & Community Resource Augmentation Plan (NCRAP) has been prepared to assess damage to natural resources as well as ecological damages caused due to the site activities pertaining to the modernization & revamping of RINL's Visakhapatnam Steel Plant.

The modernization, revamping and consequent expansion activities of RINL under scrutiny for violation of the EIA Notification, 2006 can be attributed primarily due to (a) proposed new units (COB5 & Rebar mill)and (b) expansion/revamping units (BF1&2, SP1 & SMS2) & construction of Kanithi Balancing Reservoir-2, Installation of LPG storage facility, Installation of Nitrogen Buffer vessel and construction of Guard Pond

As inferred from status check on these facilities by way of physical verification of progress of site activities already carried out for each unit, the following was construed-

- Of the new units proposed, COB 5, reservoir, turbo blower, LPG storage facility, Installation of Nitrogen Buffer Vessel, Installation of Twin Ladle Heating furnace in SMS

2 are under construction and are not under operation till date while the proposed Rebar mill is still in planning phase. This suggests that the only impacts concerned with these units pertain to construction phase only.

- The expansion units, viz. BFs 1 & 2, SP1 & SMS2 have been modernized and are under operation. However, despite revamping of these facilities, production has not exceeded the capacities as indicated in the existing EC. This suggests that most of the impacts of the expansion units occurred during the installation/modernization phase rather during their operation.

The above suggests that the modernization & revamping project of RINL is not expected to cause an adverse effect on the land, biota, air and water resources during the construction period. Also, no significant impacts are anticipated due to operation of the revamped units. Overall, it is observed that the revamping and modernization of existing units which included addition of newer, more efficient and environment friendly facilitating units within the existing RINL steel plant, has led to reduction in specific pollution loads as well as improved resource consumption, in-turn largely improving the plant efficiency as well as environmental affability.

The detailed discussion of the damages caused due to the project activities during construction as well as operation of the units is elaborated in the subsequent section. The overall impact of the project when all envisaged facilities are operating has been discussed in **Chapter-4** of the EIA-EMP report.

However, any industrial activity does pose potential for environmental consequences, which can either be avoided or minimized in terms of size, scope and duration. It is based on the recognition that minimizing the environmental impacts of an activity primarily entails managing the environmental consequence(s) of those activities by either avoiding them in the first place or by mitigating them to as low as reasonably practical.

To ameliorate the damages due to the construction activities as well as those that are anticipated due to the operation of facilities under RINL's expansion project that should entail scientific development of the local environment, a **Remediation plan** is necessary. Also, a **Natural & Community Resource Augmentation Plan (NCRAP)** is required to pay for the ecological damage as well as economic benefits derived at the cost of the environment and the local community. Both of these, with respect to RINL's expansion project have been elaborated in the subsequent sections.

11.2 PROJECT DEVELOPMENT

As elaborated in the preceding section, RINL's modernization-cum-expansion programme was the result of a technical assessment of the existing plant with respect to its operating life as well as safety in lieu of a long and continuous operation regime. The revamping/modernization as well as expansion units were contemplated to improve upon these aspects of the plant for sustainable and safe operations.

This modernization and revamping drive has led to enhancement of the plant's capacity by 1.0 MTPA of Crude steel. However, the activities pertaining to the same were carried out without obtaining prior Environmental Clearance, and hence has been considered as a case of violation of the provisions of EIA Notification, 2006 and subsequent amendments thereto.
As per MoEFCC's notification vide S.O. 804 (E) dated 14.03.2017 and subsequent notification/OMs viz. S.O. 1030(E) dtd. 08.03.2018 and OM dated 15.03.2018 for one time

opportunity for all such projects/activities under violation of the provisions of EIA Notification, 2006 for obtaining prior Environmental Clearance under EIA Notification, 2006, RINL had applied for seeking Terms of References (ToR) for the project in pursuance of the Ministry's Notification dated 14th March, 2017 due to violation of the EIA Notification, 2006 and subsequent Office Memorandum issued on 16/03/2018, vide their proposal no. IA/AP/IND/73713/2018 dated 29.03.2018 and was recommended ToR for undertaking detailed EIA and EMP study by the Expert Appraisal Committee (Violation Committee) in their 8th meeting held on 13th-14thJune, 2018 at MoEFCC, Delhi.

Based on the prescribed ToRs, EIA report was prepared including damage assessment and application for grant of EC was submitted. Subsequently, the proposal was appraised at the 13th meeting of EAC for proposals involving Violation of EIA notification 2006. After detailed deliberations, EAC asked RINL to submit additional details regarding the project. RINL was asked to carry out fresh baseline data for one month and to revise the Damage Assessment portion of the EIA report.

11.3 PROJECT CHRONOLOGY

The key events / highlights of the project pertaining to obtaining of environmental clearance for the project after its conceptualization, are mentioned hereunder in **Table 11.1**.

Table 11.1 : KEY EVENTS/HIGHLIGHTS OF THE PROJECT

Sn	Event/Activity	Date
1	Applied online to MoEFCC for EC amendment of 6.3 MTPA to 7.3 MTPA and hard copy sent through courier	05.02.2015
2	While pursuing the status with MoEFCC– VSP was advised to resubmit the application and application was resubmitted	20.12.2015
3	VSP approached MoEFCC for amendment of EC. MoEFCC advised VSP to apply afresh for TOR	28.01.2016
4	Applied online to MoEFCC enclosing Form-1 & pre-feasibility report	30.06.2016
5	Presentation given to MoEF&CC	28.07.2016
6	TOR issued by MoEFCC for conducting EIA	19.09.2016
7	Public Hearing conducted	15.06.2017
8	Applied online to MoEFCC enclosing final EIA report	27.07.2017
9	Online resubmission to MoEF&CC	09.01.2018
10	MoEF&CC: MoM recommended that VSP'S proposal attracts Violation of EIA notification, 2006.	08.02.2018
11	Applied to MoEFCC for appraisal by Violation Committee.	29.03.2018
12	Proposal included in the agenda for the meeting and TOR issued	14.06.2018
13	Meeting for Amendment of ToRs for using existing base line data.	28.06.2018
14	Applied to MoEFCC for grant of EC by Violation Committee.	28.08.2018
15	Meeting for grant of EC by Violation Committee.	18.09.2018

11.4 NEED OF THE STUDY

The specific Terms of Reference granted to the project, under the provisions of MoEFCC's notification vide S.O. 804 (E) dated 14.03.2017 regarding grant of Environment Clearance to projects in violation of the EIA Notification, 2006 and its subsequent amendments, recommended the following:

- Assessment of damage to be carried out with respect to air, water, land, ecology and other environmental attributes.
- A remediation plan and natural and community resource augmentation plan to be prepared corresponding to the ecological damage assessed and economic benefits

derived due to violation.

The EIA Report had been prepared in line with the above TOR and presented at the 13th EAC meeting. However, EAC sought additional information including one month's baseline environmental monitoring. EAC has asked to rework the damage assessment for the project considering the damages due to the new reservoir.

In accordance with the above, fresh baseline monitoring data was generated and assessment of damage due to the expansion of the plant was revised. The corresponding restitution and mitigation plan along with budget provisions are discussed in this chapter, in the subsequent sections.

11.5 ECONOMIC BENEFITS DERIVED

As discussed earlier, the expansion of the Integrated Steel Plant from 6.3 MTPA to 7.3 MTPA started with revamping and capital repair of existing BF1 followed by BF2. Subsequently, in order to match the increased Hot Metal Production capacity, expansion/ revamping/ modernization of existing facilities also started. The schedule of these plant developmental activities is given in **Table 11.2**.

Table 11.2 : Time Table of Plant Development

Sl. No.	Facility	Commencement	Completion
1	**BF1 Revamping**	October 2013	July 2014
2	**SMS2 Converter 3**	March 2013	Nov. 2016
3	**SMS2 Caster 4**	June 2014	Dec. 2017
4	**COB 5**	July 2015	Yet to finish
5	**BF2 Revamping**	May 2016	August 2017
6	**SP1 Revamping**	October 2016	31.07.2017
7	**SP2 Revamping**	Yet to start	
8	**New Rebar Mill**	Yet to start	
9	**KBR-2**	July 2016	By Oct. 2018
10	**Turbo Blower 5**	June 2014	Nov. 2017
11	**Guard Pond**	March 2018	February 2020

From the above table, it can be seen that the various expansion/modernization programs for different units started at different times. Some have already been completed while and some are still in progress. However, the actual production of hot metal and crude steel have continually increased and reached a maximum of about 5.13 MTPA hot metal and 4.97 MTPA Liquid steel in 2017-18 [approved capacities are at 6.5 MTPA of Hot Metal and 6.3 MTPA of Liquid steel].

11.5.1 Estimation based on production exceeding approved capacity

The two Blast furnaces were operating at near maximum capacity prior to expansion phase. For the capital repairs/expansion of capacity, the existing two blast furnaces were put under repair one after the other. However, although the blast furnaces were put under capital repair during the expansion period, the total production of hot metal from the entire plant has been increasing since 2012-13. This increase is mainly attributable to the simultaneous commissioning of a new blast furnace (BF3).

Therefore, after 2012-13, when the production from BF1 started declining due to ongoing

revamping activities, the production from BF2 was almost constant but the production from new BF3 started to increase gradually. Similarly, when BF1 revamping was completed and BF2 revamping started in 2016, the production from BF1 was normalized around 1.8 MTPA. The contribution from revamped BF1 and new BF3 reached to 1.8 MTPA each.

A significant increase in production was observed after 2016 when the BF1 was normalized after revamping with an output of around 2 MTPA and BF3 was also producing at near max capacity of 2.5 MTPA. And even though there was no output from BF2, the total hot metal production in 2016-17 was 4.4 MTPA. This was the first time when RINL breached the benchmark of 4 MTPA hot metal production and this was mainly due to the newly installed BF3 of 2.5 MTPA capacity.

In August 2017, when the revamping of BF2 was completed, the production from the unit gradually started increasing. The final output figures of all the blast furnaces were 2.0 MTPA, 0.6 MTPA and 2.5 MTPA for BF1, BF2 & BF3 respectively. Total output was 5.13 MTPA.

Therefore, from the above paragraphs, it can be inferred that the gradual increase in hot metal production from 2012-13 to 2017-18 is mainly attributable to newly installed BF3. Secondly, even after the revamping and capacity expansion of BF1 & BF2 from 2.0 MTPA to 2.5 MTPA, none of the units have given an output exceeding the approved limit of 2.0 MTPA.

In such an integrated steel plant where input is basically iron ore, the income from the operation is directly proportional to the hot metal production. And since, the hot metal production from the two revamped units has never exceeded the approved capacity, the economic benefits derived due to the project can be assumed to be nil.

11.5.2 Estimation based on proportionate increase in production capacity

To estimate the notional economic benefits derived due to the violation, the same can be calculated based on the increase in actual production in proportion to the increased production capacities. Again, since the income from an integrated steel plant is directly proportional to the quantity of hot metal produced, therefore it is assumed that prior to commissioning of BF1 after revamping, no economic benefit was obtained.

The estimation of economic benefits derived shall be done in two phases-
Phase 1: when only BF1 was commissioned after revamping from July 2014 till May 2016.
Phase 2: when both BF1 & BF2 were being operated after revamping from May 2016 till date.

In Phase 1, the total capacity of Hot metal production has increased from 6.5 MTPA to 7.0 MTPA. Therefore, 0.5 MTPA of the total 7.0 MTPA hot metal production capacity shall be considered for calculation. This means that 7.1 % of the total income from production and expenses thereof during the period shall be considered for cost estimation.

Similarly in Phase 2, the total capacity of Hot metal production has increased from 6.5 MTPA to 7.5 MTPA. Therefore, 1.0 MTPA of the total 7.5 MTPA hot metal production capacity shall be considered for calculation. This means that 11.4 % of the total income from production and expenses thereof during the period shall be considered for economic benefit estimation. The estimation of costs for different financial years is shown in **Table 11.3**.

Table 11.3 : Year-wise estimated benefits due to violation

Sl. No.	Particulars	2014-15	2015-16	2016-17	2017-18
1	Production Capacity (TPA)	6833333	7000000	7000000	7333333
2	Incremental Capacity (TPA)	333333	500000	500000	833333
3	Incremental Capacity as Percentage of Total Production Capacity	4.9 %	7.1 %	7.1 %	11.4 %
Income & Expenses for actual production and those attributable to Violation (Rs in Crores)					
1	Total Income	10,688.5	10,480.6	12,679.0	14,872.4
2	Total Expenses	10,590.5	12,268.6	14,369.5	16,242.8
3	**Net Profit/Loss**	**62.38**	**-1420.64**	**-1263.2**	**-1369.0**
4	Income corresponding to Violation	508.9	723.8	887.1	1659.9
5	Expenses corresponding to Violation • *Cost of materials consumed* • *Excise duty* • *Finance costs* • *Depreciation and amortization expense* • *Consumption of stores and spare parts* • *Power and fuel* • *Repairs and maintenance* • *Rent* • *Rates and taxes* • *Insurance* • *Handling and scrap recovery* • *Freight outward* • *Miscellaneous expenses*	463	656.7	893.7	1591.8
6	**Net Economic Benefit (4-5)**	**45.9**	**67.1**	**-6.7**	**68.1**

** Other incomes and expenses which are not relevant to the above calculations are not shown.*

From the above table it can be observed that out of the 4 years as per the Balance Sheet, RINL has incurred operational losses when economic benefits were being derived due to the violation. However, breakup of cost for proportionate income and expenses from the revamped units indicate a total profit of **Rs 174.5** Crores over 4 years period of plant operation.

11.6 DAMAGE ASSESSMENT

The environmental damages attributed to RINL's expansion-cum-modernization project can be primarily categorized into the following categories viz.

- Damage due to project location
- Damages caused during construction of units
- Damages caused during operation of units prior to getting EC

Accordingly, remedial measures have been identified based on the severity of the damage as well as the vulnerable agent (infrastructure, natural resource, community etc.) to which the damage was caused.

The detailed damage assessment due to the project activities and damage scoring for each component is elaborated in the subsequent sections.

11.7 DAMAGE DUE TO PROJECT LOCATION

Most of the additional units proposed for the expansion from 6.3 MTPA to 7.3 MTPA shall be/are being installed within the existing premises of the Steel Plant and adjacent to existing similar units' locations keeping in view that some infrastructure facilities of existing units can be shared with the new units. The sites of these new project units were vacant, unutilized plots within existing steel Plant which were used for temporary storage of scrapped material and scrap metal. The plots' only vegetation were common shrubs and grasses. Thus, location of the new units involve minimal disturbance to existing environment as no additional area was acquired outside the plant boundary. Only the new reservoir (KBR-2) is being set up outside the steel plant's premises but on land owned by the steel plant. Part of this land was covered with thickets of common trees and shrubs some of which are considered as "Invasive Species".

The revamping of existing units was carried out within the existing individual complexes of the units. The land of the existing plant units is already under industrial use.

Also, the land over which these new units/revamped units shall be/have been set up, were vacant areas which had been earmarked for such expansion units since inception of the plant. Overall, the project required no additional land and no significant disturbance was caused to the natural eco-system due to the site location of these units.

11.8 DAMAGE DUE TO CONSTRUCTION

11.8.1 Methodology For Assessment Of Damage During Construction Phase

As discussed earlier, some of the units of the proposed expansion plan have already been installed and construction of the rest are still in progress. The construction work of new Rebar Mill is yet to commence. Construction of the project may have had some impacts on land use, ground water, water quality, air quality, noise etc. of the study area. The impacts due to construction activities which were carried out for units which are already installed and others which are being installed are discussed here under.

The identified impacts due to activities associated with the construction of the facility have been studied in relation to the following areas:

- Land environment
- Ambient Air Environment
- Noise environment
- Water environment
- Ecological environment

The expansion of Integrated Steel Plant from 6.3 MTPA to 7.3 MTPA started with revamping and capital repair of existing BF1 followed by BF2. Subsequently, in order to match the increased Hot Metal Production capacity, expansion/ revamping/ modernization of supporting and downstream facilities also commenced. The time line for these plant developmental activities is given in **Table 11.4**.

Table 11.4 : Time Table of Plant Development

Sl. No.	Unit	2013				2014				2015				2016				2017				2018			
		Jan	April	July	Oct	Jan	April	July	Oct	Jan	April	July	Oct	Jan	April	July	Oct	Jan	April	July	Oct	Jan	April	July	Oct
1.	BF1 Revamping																								
2.	SMS2 Converter 3																								
3.	SMS2 Caster 4																								
4.	COB 5																								
5.	BF2 Revamping																								
6.	SP1 Revamping																								
7.	KBR 2																								
8.	Guard Pond																								

From the above chart, it is inferred that from 4th quarter of 2016 to 3rd quarter of 2017, 5 different construction activities were being undertaken simultaneously but all these activities were at various phases of development. Therefore, it order to estimate the maximum contribution of plant construction activities on ambient environment at any time, cumulative emissions during this period are considered.

To estimate the impacts of construction activities, following assumptions have been made:

- Since the projects are being developed over a significant land area, the site preparation activities are assumed to be carried out evenly during entire period of construction phase.
- The construction and demolition debris arising out of the construction activities are utilized within the area of RINL. No external dumping was done.
- Transport of construction material and equipments was carried out evenly during the entire construction phase.

a. Damage to Land Environment

Land use change is necessary and essential for economic development and social progress. Land use change, however, does not come without costs. Conversion of farmland and forests to urban/industrial use reduces the amount of land available for food, timber production and green cover. Soil erosion, salinization, desertification, and other soil degradations associated with intensive agriculture and deforestation reduce the quality of land resources and future agricultural productivity.

The construction activities did not involve any land acquisition as the proposed expansion was carried out within the existing land area under possession of RINL. Hence, there were no issues regarding Rehabilitation and Resettlement (R&R). All of construction activities are limited within the land in possession of RINL.

However, within the land owned by RINL, the actual land cover included green cover. Construction of new units may have resulted in destruction of green cover and change of land cover from plantation to industrial use. Therefore, in order to estimate the impacts on land due to expansion, the proportion of green cover diverted for industrial use have been estimated for individual units. Google earth satellite imagery of pre-construction and post-construction period were considered for the same.

b. Damage to Air Environment

As the project site is located within a well-developed industrial plant, not much leveling work was involved. However, during the construction phase, a lot of civil work was carried out. This led to generation of fugitive dust

Dust emissions from construction and other civil construction activities are a common problem. Fine particles (PM_{10}) from these sources is a significant cause of air pollution. Owing to their small size, PM_{10} can be carried from sites even in light winds and may therefore have an adverse effect on the local environment and on the health of local residents. Being an important indicator of Ambient Air quality, this factor has been considered for assessment of Degree of Damage.

Gaseous pollutants like NO_X were also contributed to ambient air due to operation of diesel powered machinery and vehicles associated with construction. Gaseous emissions from construction machinery and vehicles were minimized by enforcing strict emission monitoring system. The impacts were confined within the specific plant area where the project was taking place and were expected to be negligible outside the plant boundaries.

During the construction period, the impacts that are associated with air quality are:

- Deterioration of air quality due to dust emissions from construction activities (especially during dry season) like excavation, back filling and concreting, hauling and dumping of excavated material & construction spoils and movement of construction machinery & vehicles over unpaved surfaces..
- Generation of pollutants due to operation of heavy vehicles and movement of machinery and equipment for material handling, earth moving, laying of sands, metal, stones, asphalt, etc.

In order to study the maximum contribution of construction activities on air environment, the ground level concentrations of air pollutants from all the sources are predicted using Air dispersion modelling. The various sources of pollution for the construction activities have been considered for modeling for variable time periods, depending upon the duration of activity.

The damages caused due to increase of pollutants on the ambient air are estimated using AERMOD Air Quality Simulation model released by USEPA. The isopleths have been drawn over a 25 km X 25 km area with the location of the BF1 as the centre. The incremental concentrations have been estimated at every 500 m grid point.

c. Effects on Noise Levels

Noise is generated during construction due to operation of diesel powered excavators, trucks and cranes and handling of heavy metallic equipment. Noise was also generated due to use of explosives to break up some large boulders encountered during construction of the new reservoir. The maximum noise generated by the diesel powered machinery deployed for excavations was 85 dB(A) at ~1 m distance from the machinery.

For hemispherical sound wave propagation through homogeneous medium, one can estimate the noise levels at various locations due to different sources using a model based on the following principle-

$$L_{p2} = L_{p1} - 20\ \mathrm{Log}_{10}\ (r_2/r_1),$$

where L_{p1} and L_{p2} are the sound levels at points located at distance r1 and r2 from the source.

This indicates that noise level decreases by 6 dB(A) for doubling of the distance. Combined effect of all the sources (A,B,C,…. Etc.) can be determined at various locations by the following equation:

$$L_{ptotal} = 10\ \mathrm{Log}_{10}\ (10^{Lpa/10} + 10^{Lpb/10} + 10^{Lpc/10} \ldots\ldots\ldots\ldots),$$

Where L_{pa}, L_{pb} and L_{pc} are noise pressure levels at a point due to different sources.

From the above methodology, the incremental noise level at a particular location due to any distant sound source can be estimated.

d. Damage to Water Environment

The surface and ground water bodies may get affected due to construction activities as there is some interaction of site activities with the surface water bodies in the area. However, the impact on any water body cannot be attributable to any single activity. The impact or damage caused may be due to several industrial or anthropogenic activities occurring in the buffer zone over a period of time.

In order to study the damages on water environment, monitored ground water quality is analysed during pre-construction and post-construction stage. Additionally, impacts of surface water bodies due to diversion of natural streams is also studied.

e. Damage to Ecology

Biological impacts of the project were identified and quantified. The likely biological impacts of the project have been identified on the basis of project activities, their possible environmental aspects and consequent impacts. The impacts have been quantified wherever possible by use air pollution dispersion models, noise attenuation models. The Likely Impact Zone has been demarcated by superimposing the air pollution dispersion isopleths on suitable maps.

Details of activities performed for individual units and damages on ambient environment are discussed in following sections.

11.8.2 Damage Assessment

Based on the methodology explained in the preceding paragraphs, assessment of damage has been carried out with respect to various environmental attributes for each unit separately and later collectively for all the units. Following units have been considered-

1. Construction of new KBR 2
2. Construction of new Coke Oven Battery 5
3. Construction of new Guard ponds
4. Revamping of existing BF1 and BF2
5. Revamping of existing SP1
6. Expansion of SMS2 by installation of new converter 3 and caster 4.

Unit-wise damage assessment is carried out in the following paragraphs.

1. Construction of new Kanithi Balancing Reservoir 2

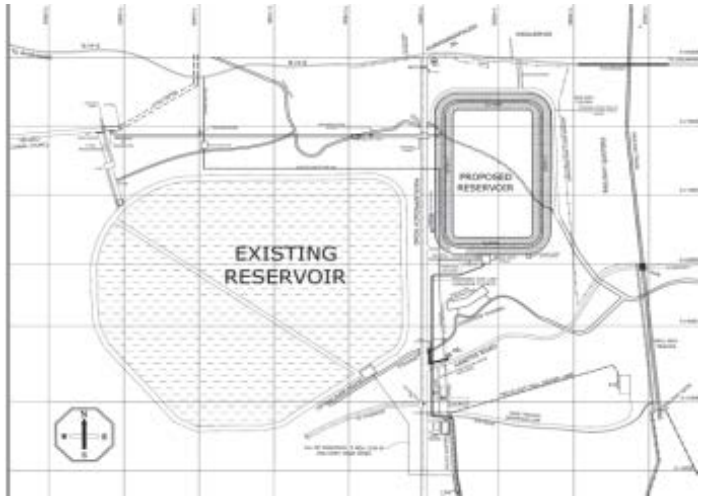
Present water requirement RINL is of around 38 MGD for the existing plant is met from Yeleswaram Reservoir and Godavari River through a 153 km long open canal. Water consumption is expected to go upto 45 MGD when the plant attains its rated capacity (7.3 MTPA steel).

With implementation of measures like Zero Liquid Discharge Schemes & Rain Water Harvesting, another 5 MGD of incremental demand can be met. Still there will be a significant gap in demand and supply of water at 7.3 MTPA stage.

To meet exigencies in case of canal flow disruption, Kanithi Balancing Reservoir (KBR) of 15 Million Cubic Metres (Mm^3) capacity was constructed near plant premises over 300 hectares area in the year 1989.

In order to facilitate inlet water canal maintenance with increased per day water consumption and to take care of the surges in water flow through canal, it is planned to increase in house water storage capacity by constructing an additional water storage reservoir of 12.32 Mm^3 capacity, opposite to the existing reservoir (KBR). Location of the proposed reservoir relative to the existing reservoir is shown in **Figure 11.1**.

Figure 11.1 : Location of the proposed reservoir relative to the existing reservoir



The new water reservoir is being constructed about 4 km north of the plant near NH-5. The new water reservoir is spread over ~80 ha and will be ~20 m deep.

The habitation closest to the proposed reservoir is about 200m away (Railway Colony which has about 200 dwellings) from the excavated site in the East and about 300 m in the North side.

The soil at reservoir site is comprises silty clay and silty gravel up to a maximum depth of 10 m. Thickness of the soil layer (overburden) varies from 2.4 m 10 m. No soil exists below 10 m depth. Water table is at shallow depth (1.2 m - 5.0 m). At proposed KBR site there were three nalas viz Northern, Central and Southern. KBR2 is located in between Central Nala and Southern Nala. However, during construction entry of Central Nala near KBR2 was diverted and temporarily made arrangement in the west side of the KBR2 and confluence with southern nala in the southern direction. Salient features of the construction of new KBR2are given in **Table 11.5.** Photographs of the site are given in **Figure 11.2-11.4.**

Table 11.5 : Salient features of the construction of reservoir

1.	Area, depth and dimension of bund wall, Quantity of material excavated	i) Area: 225acres ii) Depth : 13.53M below G.L iii) Bund wall:3.208KM iv) Excavation Quantity:45Lcum
2.	Ground water Depth in the reservoir area and Details of de-watering	i)Water table 4m below Ground level ii)20 dewatering pumps used
3.	Duration of excavation	21 months
4.	Method of Excavation	Excavators, Rippers, Rock breakers, Controlled Blasting
5.	Method and Location of material dumping	i) Transporting by Trucks ii) In the allotted land within VSP land boundary
6.	Details of modified drainage network of the area.	Re-routing drain passing through reservoir area.
7.	Details of Drilling and Blasting.	i) 7 nos. of drilling machines deployed ii) Controlled blasting. Approx qty 4 lakhs cum

Figure 11.2 : View New Water Reservoir Site on 23-07-18 from approx. 17°40'41.8"N, 83°10'05.0"E

Figure 11.3 : View New Water Reservoir Site on 23-07-18 from approx. 17°40'41.8"N, 83°10'05.0"E

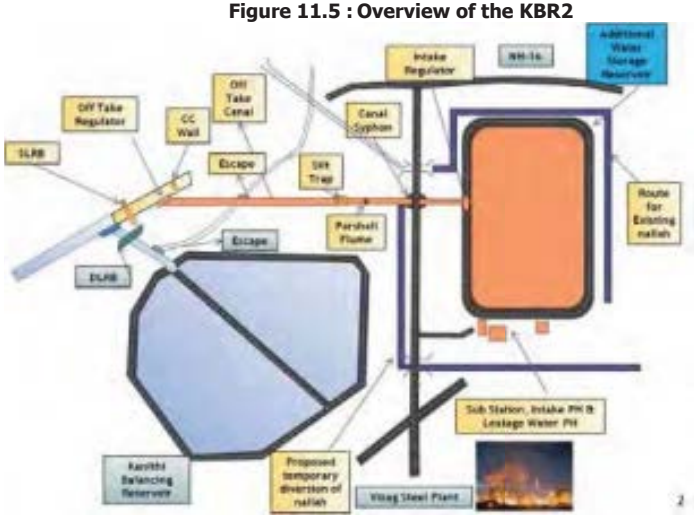
Figure 11.4 : View of New Reservoir Site on 29-10-18 Looking North from approx. 17°40'20"N, 83°10'16"E

Construction of the reservoir has involved the following activities:

1. Clearance of vegetation.
2. Diversion of natural stream passing through the site.
3. Excavation of soil & rocks.
4. Transport and dumping of excavated material
5. Discharge of seepage water
6. Construction of embankment by utilizing part of the excavated soil & rocks
7. Concrete lining of inner side of embankment
8. Construction of intake structure.

The water intake structure is being constructed on the southern side of the reservoir. This shall comprise of concrete structures to house electrically driven pumps with all necessary accessories. Construction of this intake structure shall involve fabrication and erection of steel reinforcements, construction of concrete structures, installation of electrical power supply system, installation of water pipelines and other accessories. The overview of the KBR2 is shown in **Figure 11.5**.

Figure 11.5 : Overview of the KBR2



Damage assessment:

The probable damages due to activities associated with the construction of the reservoir have been studied in relation to the following areas:

- Land environment
- Ambient Air Environment
- Noise environment
- Water environment
- Ecological environment

Damage to Land environment:

The site of the reservoir was an expanse of scrub land. The vegetation comprised of dense thickets of *Prosopis juliflora* with few *Acacia nilotica, Azadirachta indica* and *Borassus flabellifer*) and expanses of grassland as can be seen from the Google Earth Image of 26-01-2011 in **Figure 11.6-11.7**.

Figure 11.6 : Google Earth Image dated 26-01-2011 of New Reservoir Site. Existing Reservoir seen on left.

Figure 11.7 : Google Earth Image dated 13-04-2018 of New Reservoir Site. Existing Reservoir seen on left.

Approximately 4450000 m^3 of soil and rocks were excavated for creation of the reservoir. Excavation was carried out using mechanical shovels / excavators, which loaded the excavated muck on to tipper trucks. The tipper trucks then transported the material to designated dump sites. A few large boulders, too large to be excavated and broken up by the deployed shovels / excavators, were encountered. These were broken up into manageable sizes by blasting. Prior clearance had been obtained from the concerned authorities for using explosives for blasting rock.

The soil and rocks excavated from the reservoir site have been dumped externally at five locations:

1. Just beyond the north-eastern corner of the new reservoir (between latitudes 17°40'53.1" N & 17°41'04.5" N and longitudes 83°10'20.8" E & 83°10'33.3" E)
2. Just beyond the eastern side of the new reservoir site (between latitudes 17°40'26.5" N & 17°40'52.25" N and longitudes 83°10'30.5" E & 83°10'35.6" E).
3. Just beyond the south-eastern corner of the new reservoir (between latitudes 17°40'14.5" N & 17°40'26.1" N and longitudes 83°10'25.1" E & 83°10'36.2" E)

4. Just beyond the north-western corner of the existing reservoir, ~2.6 km due west of the new reservoir site (between latitudes 17°40′18.7″ N & 17°40′39.8″ N and longitudes 83°08′20.2″ E & 83°08′53.3″ E)
5. About 4.5 km due west of the new reservoir site (between latitudes 17°40′12.7″ N & 17°40′32.1″ N and longitudes 83°07′17.5″ E & 83°07′43.9″ E).

Top soil has been dumped separately as small dumps not more than 1 m high. ~90 ha area has been utilised for the reservoir and associated structures / facilities and 61.41 ha area has been utilised dumping material excavated from the reservoir. Dumped material spread over 25.91 ha area is being rehandled and being utilised for embankment construction i.e. 35.5 ha of dumps shall remain. The entire dump area shall be biologically reclaimed. Photograph of dump site is given imn **Figure 11.8** below.

Figure 11.8 : Excavated Material from New Reservoir Dumped Externally at approx. 17°40′25″N, 83°07′33"E

Measures considered for minimizing the damage:

- In order to preserve top soil, Top soil has been dumped separately as small dumps not more than 1 m high.
- Dumped material being rehandled and being utilised for embankment construction

Damage on Ambient air quality

As indicated above the new KBR 2 is being dug out near the existing KBR1 on the opposite site of the road. Since this is a fresh project, all the activities like, vegetation removal, ground levelling, drilling & blasting, civil construction work etc shall be involved.

Approximately 4450000 m^3 of soil and rocks were excavated for creation of the reservoir. Excavation was carried out using mechanical shovels / excavators, which loaded the excavated muck on to tipper trucks. The excavated material stored at different locations
The estimated quantity of material transported during construction phase is as follows--

- Total quantity of excavated material and transported – 6675000 T
- Total Concrete transported – 200 T

The project basically involves digging out soil, rocks and other debris from site and storing it in some other areas. Along with this, an embankment is also provided which is constructed of the same material being dug out and some other material.

The main source pollutant generate from the above activities is dust. The emissions are fugitive in nature. The fugitive emissions arising out of these activities have been estimated based on AP-42 considering the quantity of material excavated and handled.

The emissions of NOx during transport of excavated material are estimated based on CPCB guidelines. The estimated emissions for each activity are given in **Table 11.6** below.

Table 11.6 : Pollutant emissions during construction phase of KBR2

Sl. No.	Activity	Emission Factor	Emission Rate (g/sec)
Excavation /Construction activities			
1	Bulldozing	2.292 Kg/hr	0.064
2	Motor Grading	0.6 g/Km/Vehicle	0.014
3	Truck Loading with debris	0.0002 Kg/T	0.057
4	Truck Unloading	0.0002 Kg/T	0.057
5	Drilling and blasting of rocks	0.59 Kg/Hole	0.074
6	Wind erosion of exposed material	9.03E-07 g/s/m^2	0.027
Material Transport			
1	Truck transport of cement to site on paved roads		
	PM	17.8 g/Km/Vehicle	0.000000000871 g/s/m^2
	NOx	9.3 g/Km/Vehicle	0.000000000456 g/s/m^2
2	Truck transport of excavated material on unpaved roads		
	PM	5.8 g/Km/Vehicle	0.000003528695 g/s/m^2
	NOx	9.3 g/Km/Vehicle	0.000005702298 g/s/m^2

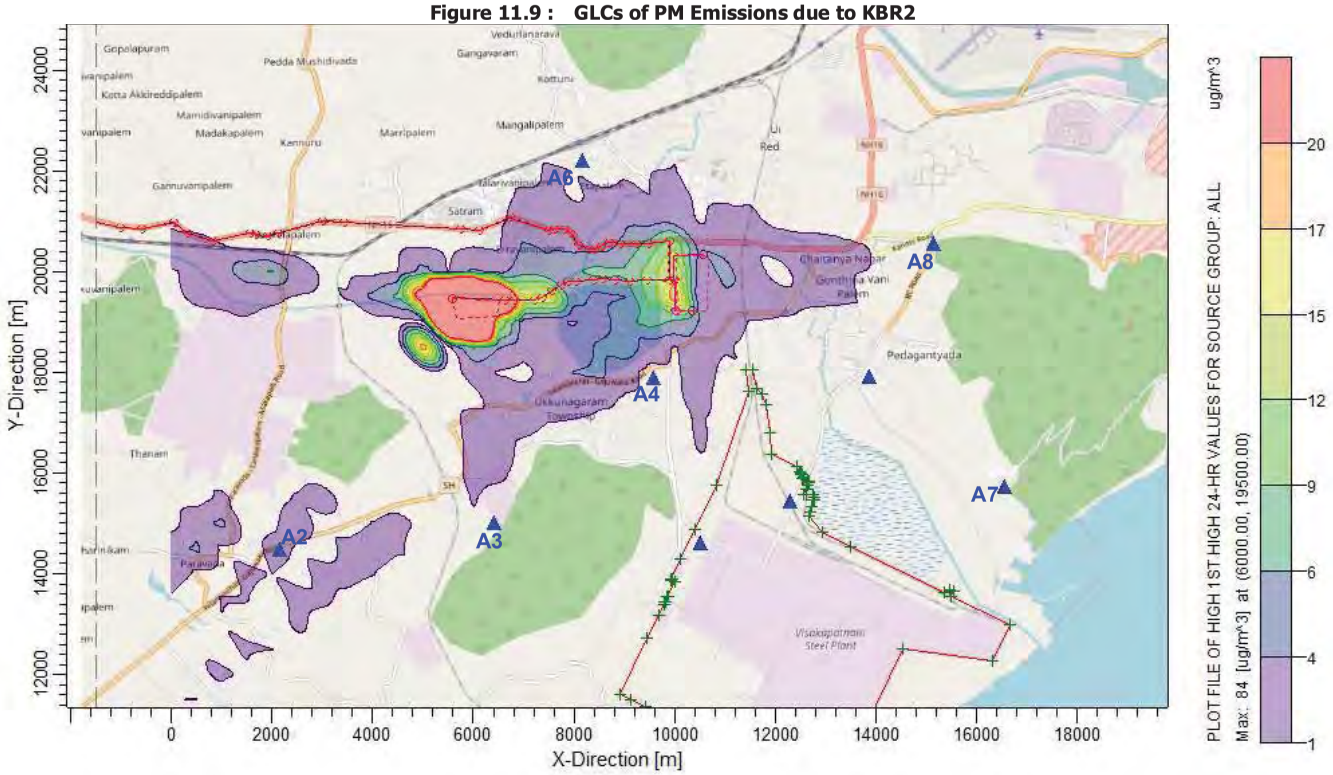
Based on the above estimated emission values, damage of ambient air quality which would have happened during construction activities of reservoir have been assessed. The assessment has been made by studying increase of ground level concentrations due to construction activities in buffer areas. The incremental concentrations due to the construction activities are given in **Table 11.7** below. The isopleths of PM_{10} and NO_X concentrations are also given in **Figure 11.9** and **Figure 11.10** respectively.

Table 11.7 : GLCs due to construction activities of KBR2

Station ID	PM	NOx
A1	0.026	0.232
A2	1.592	1.880
A3	0.380	0.078
A4	0.115	0.925
A5	0.000	0.000
A6	0.568	0.313
A7	0.109	0.163
A8	0.132	0.005

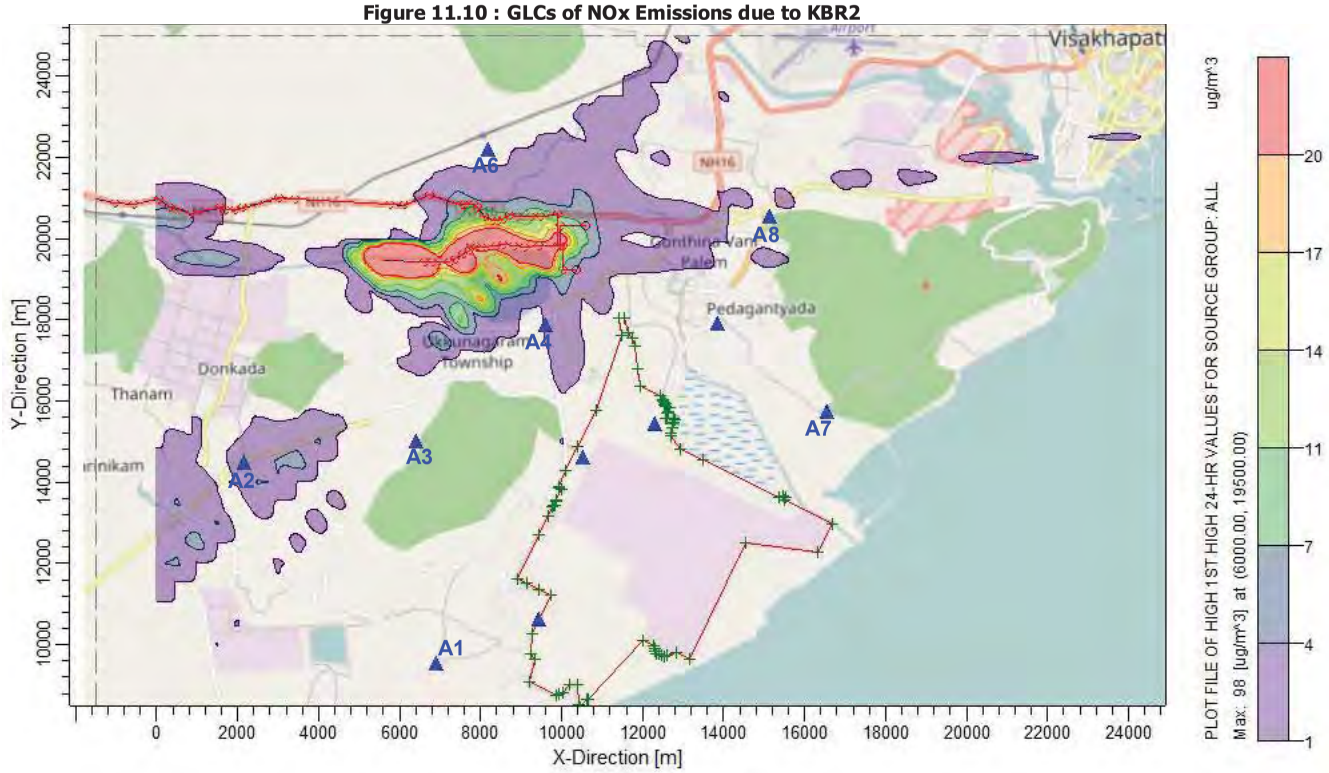
**** All values in µg/m^3.***

Figure 11.9 : GLCs of PM Emissions due to KBR2



VISAKHAPATNAM STEEL PLANT
EIA/ EMP Studies for expansion of Integrated Steel Plant from 6.3 MTPA to 7.3 MTPA Liquid steel within the premises of Visakhapatnam Steel Plant

Figure 11.10 : GLCs of NOx Emissions due to KBR2



Based on the above, following conclusions can be drawn:

- During excavation of the reservoir, the fugitive dust was generated due to various excavation activities, the maximum was near to the source and concentrations of PM emissions at nearest habitation i.e. Railway colony which is ~200m away from the site would have increased by about 4 µg/m^3 above the ambient concentrations. Similarly in the northern side beyond NH road the emissions were in the range of 4 to 7 µg/m^3.
- The PM_{10} at this location are in the range of 72 to 75 µg/m^3. The resultant concentrations at nearest inhabited areas during construction period would have been in the range of 76 to 82 µg/m^3 which are within the norms. Though there were minor increases in PM_{10} concentrations during excavation period of KBR2 which would have led to a minor damage to the environment.
- The NOx generated due to construction of KBR-2 were too low to have any measurable change in air quality at the nearest habitation.

Measures considered for minimizing the damage:

- Provided temporary enclosures to restrict the dust during excavation
- Regular water sprinkling on un paved roads
- Muffling was done by sand bags, wire mesh and blast mats to reduce fly rocks and spread of dust from blasting. The fragments were arrested within 15m of the blasting locations.

Damage to Water environment:

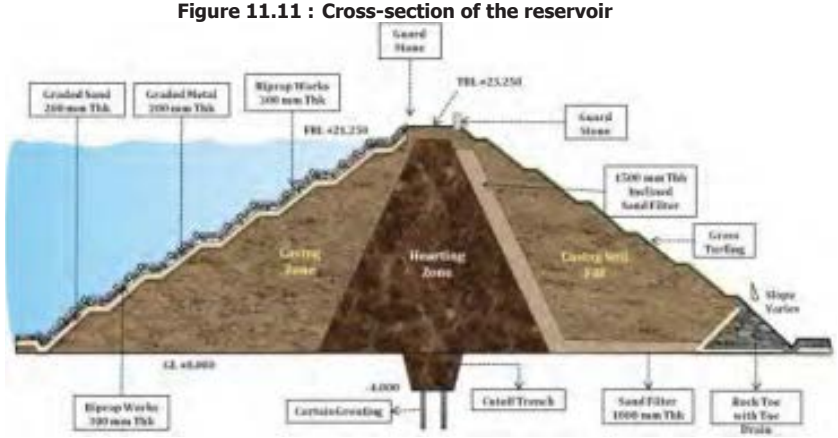
Three natural perennial streams flowed through the reservoir site area. One (called the Central Nala) entered the site somewhat in the middle of the western boundary of the reservoir site and flowed towards the south-east across the reservoir site. The second (called the Northern Nala) flows from the north slightly east of the eastern boundary of the reservoir site and flowed south-ward to join the Central Nala east of the south-eastern corner of the reservoir site. The third stream (called the Southern Nala) flows close to but outside the reservoir site. This stream flows from south-west to north-east in the southern part of the reservoir. After confluence with the Central Nala coming from the north-west across the reservoir site east of the south-east corner of the reservoir site, it turns towards the south-east.

During construction of the reservoir the drains were diverted. Prior to commencement of reservoir construction a diversion channel was constructed to divert the Central Nala along the proposed western and southern rim of the proposed reservoir area to the existing southern channel, thus maintaining the overall drainage pattern.

The new reservoir bottom is ~14 m below the original ground level. In the reservoir site, the ground water level is ~4 m below the original ground level. So water has to be discharged from the excavations. Due to this it would drained out the ground water in the surrounding areas.

RINL has constructed an artificial ground water recharging pond on the southern side of the reservoir site. Water seeping into the excavated reservoir water was pumped out into the ground-water recharging pit. The pits were grouted to avoid any further infiltration. The cross section of the reservoir is shown in **Figure 11.11.**

Figure 11.11 : Cross-section of the reservoir



Measures considered for minimizing the damage:

- In order to prevent infiltration of ground water during excavation and to avoid depletion of ground water levels in the surrounding areas, grouting was done.
- Diversion channel was constructed to divert the Central Nala along the proposed western and southern rim of the proposed reservoir area to the existing southern channel, thus maintaining the overall drainage pattern.

Effects on Ambient Noise Levels:

The maximum noise generated by the diesel powered machinery deployed for excavations was 85 dB(A) at ~1 m distance from the machinery. The distance between the nearest residential areas (Railway Colony near the north-eastern corner of the reservoir site) and machine deployment site was 150 m.

Thus without any attenuation by physical barriers, the 85 dB(A) will reduce to 41.5 dB(A) at a distance from the source. The Railway Colony is close to the nearby National Highway on which there is very heavy traffic round the clock. Consequently the day time noise levels in the Railway Colony is ~59 dB(A).

The noise levels at the Railway Colony would have had increased by only 0.08 dB(A) on account of machinery deployed for reservoir construction. In reality, the actual increase was less because of attenuation by the thick vegetation in the intervening area i.e. background noise levels at nearby residential areas were unaffected by deployment of diesel powered machinery at the reservoir site.

Measures considered for minimizing the damage:

- Excavation activities have limited only during day time.
- Temporary enclosures have arranged to further decrease of noise levels.
- Thick vegetation in the intervening area and boundary wall between the reservoir and railway colony further decreases the noise levels

Ground Vibrations & Fly Rock:

Prior to blasting, trial blasting studies were carried out by M/s Mineral on Ground, Hyderabad to determine the maximum amount of explosives which can be used per blast without damaging any nearby buildings. Before carrying out trial blasting, the distance to nearby structures was determined and the quantity of explosives was adjusted accordingly so that the structures were not affected (i.e. only "Controlled Blasting" was carried out).

The minimum distance between buildings and blasting sites is about 380 m. Directorate General of Mines Safety (DGMS), has stipulated that a Safety Zone of 300 m must be maintained between blasting sites and residential areas to avoid risks to human life & property due to fly rock from blasting. Thus the distance between blasting sites and residential areas was adequate.

Damage to Ecology:

As mentioned earlier, the project area comprises of dense scrub and grass lands and bulk of the vegetation comprises of *Prosopis juliflora* which is an invasive species

Sample survey of vegetation of the areas adjacent to the areas cleared for the new reservoir indicates that *Prosopis juliflora* constituted about 92 % of the trees, *Acacia nilotica* about 5% and the balance was mostly *Borassus flabellifer, Azadirachta indica, Ficus* spp. along with a few isolated miscellaneous species.

Due to the spreading nature of the canopy of *Prosopis juliflora*, the green cover of the area (except the grass lands) was almost total although the trees were about 5 – 6 m apart on an average as can be seen from the flowing photograph (**Figure 11.12- 11.14**) inside the dense vegetation adjacent to the area cleared for the reservoir.

Figure 11.12 : Dense Vegetation Adjacent to New Reservoir Site at approx. 17°40'39"N, 83°10'34.7"E

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Figure 11.13 : Dense Vegetation Adjacent to New Reservoir Site at approx. 17°40'12"N, 83°10'07"E

Figure 11.14 : Inside Dense Vegetation Adjacent to New Reservoir Site at approx. 17°40'12"N, 83°10'23"E

The damages on ecology due to reservoir construction are as follows:

1. Loss of green cover due to removal of vegetation
2. Loss of animals' habitat due to clearance of vegetation
3. Damage to vegetation due to deposition of fugitive dust on vegetation.

During clearance of the area for reservoir construction, a total of 23564 trees were felled of which 20982 were *Prosopis juliflora* of girth less than 30 cm. 2053 nos. of trees had girth between 30 cm & 60 cm, 521 trees had girth between 60 cm and 120 cm and 8 trees had girth >120 cm.

The area where the new reservoir is being constructed is surrounded by urban areas. The National Highway from Kolkata to Chennai via Cuttack, Bhubaneshwar, Visakhapatnam, Rajmundry and Vijaywada runs close to the site's northern boundary. There is very heavy traffic round the clock on this road. The size of the area, which is an isolated one, is too small to support any viable population large animals. The only animals found in the reservoir area were common small birds, reptiles (snakes & lizards) and small mammals (squirrels, rats & mice, mongooses etc.).

The excavation and dumping has involved operation of diesel powered heavy earth moving machinery (HEMMs) over unpaved surfaces. Excavation and dumping of soil & rocks have led to generation of fugitive dust and NOx (from diesel engines). The excavated soil and hard rock dumped adjacent to the new reservoir, have been / are being re-handled and used for construction of the reservoir's embankments. The embankment will extend for up to 12 m above the original ground level. The slope of the embankment on the inner side (i.e. inside the reservoir will be lined with concrete panels up to a depth of 4 m below the top of the embankment. The work involves handling of excavated soil & rocks and movement of diesel powered HEMMs over unpaved surfaces. This is leading to generation of fugitive dust and NOx.

Water sprinkling was / is being carried out on the unpaved roads to suppress fugitive dust (**Figure 11.15**). However, the excavations and the dumps remain a major source of fugitive dust.

Figure 11.15 : Water Sprinkling on Road Between New Reservoir Site and Dump Site

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The likely increase in airborne dust levels and NOx due to increased truck traffic has been estimated by mathematical modeling. The inputs for the mathematical modeling were (besides the increased vehicular movement) hourly meteorological data as monitored during Summer Season, 2018, emission factors suggested by Automotive Research Association of India, Pune after detailed field studies for Heavy Commercial Vehicles, Diesel Trucks manufactured after the year 2000. Emission factors for dust and NOx were considered to be 1.24 g/km and 9.3 g/km respectively.

The NOx was emitted over a wide area. Preliminary calculations have indicated that the quantity of NOx emitted over ~150 ha area was too less to have any measurable impact on the ambient air quality.

The maximum estimated ground level concentration of fugitive dust due to activities of the project was 84 µg/m^3 and occurred at the debris dumping location. It is to be noted that fugitive dust is generated at the ground level or few metres above the ground (in case of dumps). Fugitive dust does not travel very far unless there are very strong winds and most of the dust usually settles down within a few hundred metres of the source. The dust settling on the leaves of plants reduces the plants' photosynthetic activity and in extreme cases can also lead to the death of the leaves and apical buds. This is often seen adjacent to unpaved haul roads in mine areas. However, in the present project some dust deposition was observed on vegetation facing the dumps and the under-construction embankment, but fatal damage to vegetation by dust deposition was not observed, possibly due to effective dust suppression on unpaved roads.

Summary of Damages during Construction of KBR2

- A small portion of unutilized land which was already available with RINL was diverted for the project. The main vegetable of the land was some shrubs.
- Dust generation due to excavation and truck movement was major source of pollution. The same will cease to exist on completion on construction phase of the project.
- Some natural streams passing through the site were diverted.
- Major source of noise pollution was truck movement and blasting activities. The same will cease to exist on completion on construction phase of the project.
- The main vegetable of the land was some shrubs which was removed during construction phase.

Mitigation Measures

Measures considered during excavation and construction:

- Water is being sprinkled on unpaved roads to suppress fugitive dust.
- Garland drain and retaining wall will be constructed at the toe of the dumps to prevent wash off from the dump. The retaining walls shall be 1 m high and 0.5 m thick. The retaining walls will have weep holes leading to garland drain (0.5m X 0.5m). The garland drains will be routed through desilting ponds, before discharging to natural drainage channels.
- After utilization of the material, the dump sites and the other two dumps (whose material will not be utilised), shall be biologically reclaimed. This will be carried out as follows:

  - On completion of external dumping / reclamation of dump sites, top soil (which was excavated during the initial stage of reservoir construction and has been stored in

separate small dumps) will be scattered over the area. Water will be sprinkled over the topsoil.

- Grasses and the shrub *Ipomea carnea* will be planted on the soil to stabilize it.
- 0.5 m x 0.5 m x 0.65 m pits will be excavated at ~3 m intervals.
- These pits will be filled with a mixture of topsoil, compost / organic manure.
- About 0.6 m tall saplings of *Acacia nilotica, Azadirachta indica, Ficus bengalensis, Ficus religiosa,* and *Pongamia pinnata* will be planted in soil filled pits just after the commencement of monsoons. Seeds of *Phoenix sylvestris* will also be planted.

2. Construction of new Coke Oven Battery 5

The new Coke Oven Battery No.5 (COB-5) is being set up over an area of 100 acres within the existing steel plant adjacent to the existing Coke Oven Battery No.4. This site is located at a distance of ~275 m from the nearest boundary of the steel plant.

Construction of the new Coke Oven Battery has involved the following activities:

1. Clearance of land.
2. Digging of foundations
3. Transport and dumping of excavated material
4. Transport and handling of construction materials (steel, concrete, pre-fabricated equipment)
5. Construction of Coke Oven Battery involving construction of steel & concrete structures.

Damage to Land environment:

COB-5 is being set up within the premises of the existing steel plant adjacent to the existing COB-4. The land over which the COB-5 is being set up was partly a vacant area for dumping scrap refractory bricks (from the coke-ovens) and various metallic scrap such as unserviceable structural & pipes etc. and partly for storing thermal coal fuel for the steel plant's captive coal based thermal power plant. The same can be seen in the Google Earth Image of 21 March, 2014 (see **Figure 11.16**).

Figure 11.16 : Google Earth Image of 21st March, 2014 of Site of COB-5 inside Visakhapatnam Steel Plant (Pre-construction Phase)

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The site was cleared as can be seen in the Google Earth Images during March, 2014 to September, 2018 (see **Figures. 11.17-11.24**). The metallic scrap was recovered and used as melting scrap in the plant's Steel Melting Shop. The waste refractory bricks were used up for repair of roads inside the plant. Further storage of coal in the area earmarked for COB 5 was discontinued and the coal stored in this area was used up on a priority basis in the power plant.

Figure 11.17 : Google Earth Image of 19th Nov., 2014 of Site of COB-5 inside Visakhapatnam Steel Plant (Coal Stock in NW side of Site Partly Cleared)

Figure 11.18 : Google Earth Image of 3rd Feb., 2015 of Site of COB-5 inside Visakhapatnam (Coal Stock in NW part of Site Partly Cleared. Clearing of coal stock in SW part of site started)

Figure 11.19 : Google Earth Image of 3rd Nov., 2015 of Site of COB-5 inside Visakhapatnam Steel Plant (Coal Stock in SW part of Site Mostly Cleared. Coal stock in NW part of Partly Cleared. Civil Works at Site Started)

Figure 11.20 : Google Earth Image of 10th Jan., 2016 of Site of COB-5 inside Visakhapatnam Steel Plant (Coal Stock in SW part of Site Completely Cleared. Coal stock in NW part of Mostly Cleared. Civil Works at Site in Progress)

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Figure 11.21 : Google Earth Image of 15th Dec., 2016 of Site of COB-5 inside Visakhapatnam Steel Plant (Coal Stocks Almost Completely Cleared. Structural Erection Works at Site Started)

Figure 11.22 : Google Earth Image of 20th April, 2017 of Site of COB-5 inside Visakhapatnam Steel Plant (Coal Stocks Completely Cleared. Battery Erection Works at Site Started)

Figure 11.23 : Google Earth Image of 21st Dec., 2017 of Site of COB-5 inside Visakhapatnam Steel Plant (Battery Erection Works in Progress)

Figure 11.24 : Google Earth Image of 30th Sept., 2018 of Site of COB-5 inside Visakhapatnam Steel Plant (Coal Stocks Completely Cleared, Battery Erection Works in Progress)

As is clear from the above images, very little vegetation was present in the area earmarked for new COB5 prior to the construction phase. Some scrubby vegetation was present over a small area on the eastern side of the plot. Therefore, no impacts can be attributed to the change in land use due to construction of COB5.

Damage to Ambient air quality

The new coke oven battery 5 is being constructed from ground near the existing coke oven battery complex. Since this is a fresh project, all the activities like, vegetation removal, ground levelling, civil and structural construction work etc shall be involved.
The estimated quantity of material brought from outside the plant is as follows--

- Total Excavated material transported from site – 750000 T
- Total Structural material transported to site – 246500 T
- Total Refractory material transported to site – 60000 T

Based on the above, number of trucks per day has been estimated to be around 40 trucks per day. This number also includes the number of trucks used for transportation of plant equipment and materials. The fugitive emissions due to diesel combustion & road emissions and other construction activities have been calculated based on AP-42 and CPCB guidelines. The same is given in **Table 11.8** below.

Table 11.8 : Particulate matter emissions during construction phase of COB 5

Sl. No.	Activity	Emission Factor	Emission Rate (g/sec)
Demolition and Debris Removal			
1	Land Clearing	0.039 Kg/hr	0.002685
2	Truck Loading with debris	0.018 Kg/T	0.01252
3	Transport of debris on paved road	16.5 g/Km/Vehicle	0.001533
4	Truck Unloading	0.001 Kg/T	0.000696
5	Wind erosion of exposed material	0.85 T/Ha/Year	0.001348
Site Preparation			
1	Bulldozing	0.039 Kg/hr	0.002685
2	Top Soil Removal by Scrapper	0.029 Kg/T	0.020171
3	Scrapper in travel(Paved Road Around Plant)	16.5 g/Km/Vehicle	0.001533
4	Top Soil scrapper unloading	0.02 Kg/T	0.013911
5	Truck Loading with const. material	0.018 Kg/T	0.00626
6	Truck Unloading of construction material	0.001 Kg/T	0.000348
7	Compacting	0.039 Kg/hr	0.002685
8	Motor grading	600 g/Km/Vehicle	0.006944
General Construction			
1	Vehicular traffic within site	16.5 g/Km/Vehicle	0.004783
2	Fine Screening	0.001 Kg/T	0.0000289

Based on the above estimated emission values, GLCs have been estimated due to the construction activities in buffer area. The incremental concentrations due to the construction activities are given in **Table 11.9** below. The isopleths of PM_{10} and NO_X concentrations are also given in **Figure 11.25** and **Figure 11.26** respectively.

Table 11.9 : GLCs due to various COB5 construction activities

Station ID	PM	NOx
A1	0.101	0.663
A2	0.033	0.269
A4	0.161	1.147
A4	0.247	0.857
A5	0.074	0.726
A6	0.077	0.750
A7	0.081	0.298
A8	0.279	2.025

** All values in µg/m³.*

Figure 11.25 : GLCs of PM Emissions due to CO5

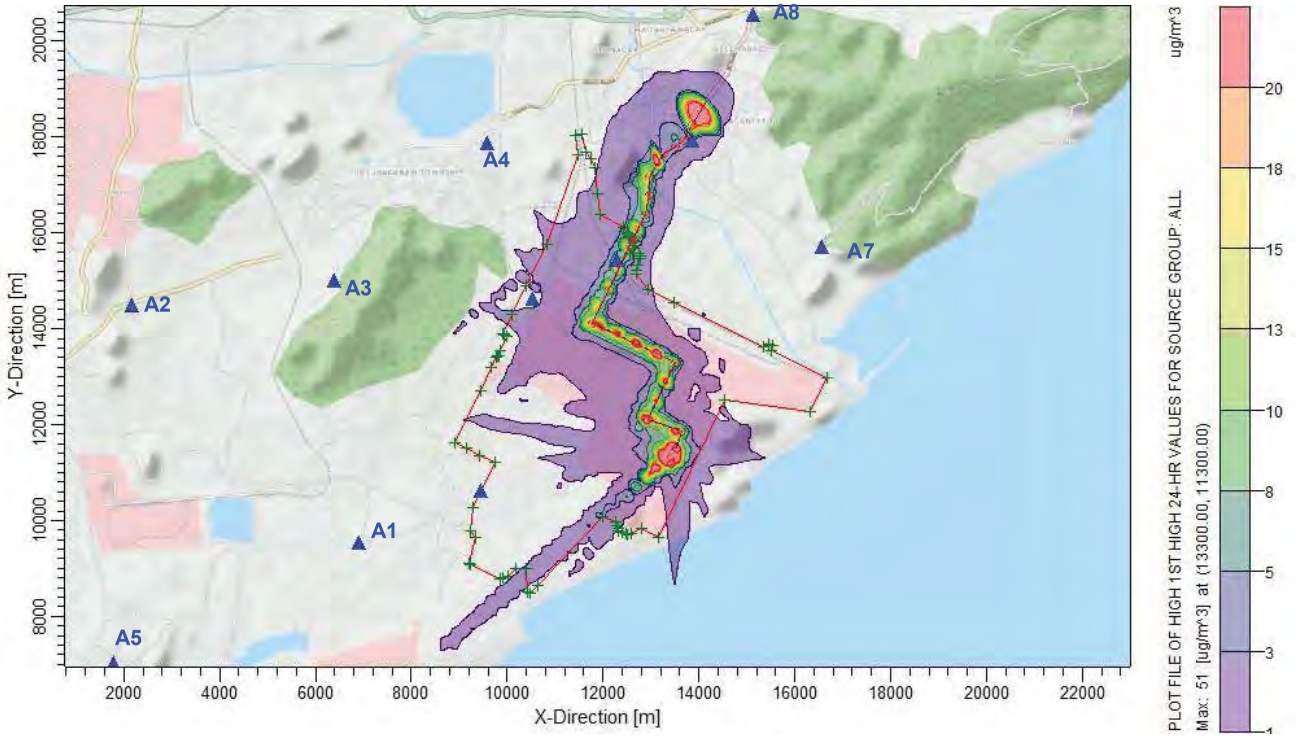
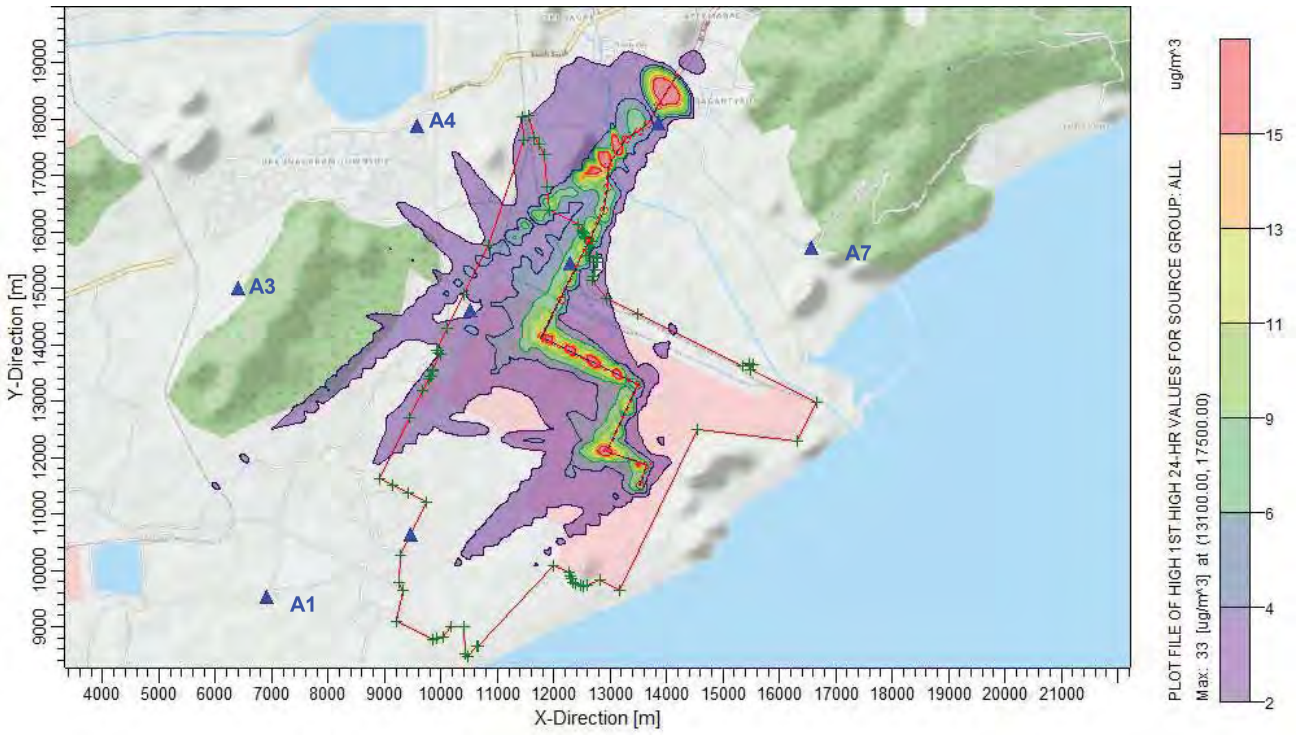


Figure 11.26 : GLCs of NOx Emissions due to CO5



From the above figures, it can be observed that the estimated values of maximum Ground level concentrations are concentrated in and around the construction site and transportation route. The maximum GLC values at A8 (Gajuwaka) is observed to be around 0.279 µg/m^3 and 2.025 µg/m^3 for PM and NOx respectively. Therefore, hardly any damage to ambient air quality can be attributed due to construction of new Coke Oven Battery 5.

Damage to Water environment:

During construction of the project, the water environment could have been affected by:

- Discharge of ground water from deep excavations
- Discharge of storm water laden with debris

During construction, excations were carried for foundations of various structures. Discussions with concerened RINL Officials and civil contractors revealed that water was encountered about 6 m below ground level during summer. Extensive grouting was carried out prior to excavations to limit inflow of ground-water. The water which seeped into the excavations was pumped out into the plant's storm water drainage system. The amount of water which seeped in was not much and contiunous pumping was not required. Since the construction of the foundations was completed over a few weeks, there were no permanent effects on ground water resources.

Most of the soil and debris excavated during the civil construction was used to construct the bund of the ash-pond being constructed inside the plant. Nevertheless, during monsoons, the storm water was contaminated by soil & debris excavated for the civil contruction. The storm water from the southern part of the plant area is routed through a lined channel leading to the sea near Apikonda Village.

Therefore, no significant damage can be attributed to construction of COB5 on water environment.

Effects on Ambient Noise Levels:

Noise is generated during construction due to operation of diesel powered excavators, trucks and cranes and handling of heavy metallic equipment. Based on similar fabrication yards elsewhere, the noise levels at a distance of 15 m from construction site was ~85 dB(A). Without any attenuation, this 85 dB(A) will reduce to 36 dB(A) at the nearest habitation i.e. Appikonda village, which is ~4.2 km from the project site. The net increase in noise level at the nearest habitation will only be about 0.1 dB(A) over and above the existing noise levels that too without any attenuation. In reality, the actual increase would have been much less due to attenuation by the Steel Plant's green belt and effects of sea breezes.

Therefore, no damage on ambient noise environment is anticipated.

Damage to Ecology:

Based on the residual vegetation at the COB Site and that of the adjacent vacant area, it can be concluded that the vegetation of the COB-5 site comprised of naturally growing small trees (*Acacia spp., Prosopis juliflora*), shrubs (*Lantana camara, Calotropis gigantea, Ricinus communis*), herbs such as *Mimosa pudica, Tridax procumbens* and grasses (see **Figure 11.27-11.29**).

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Figure 11.27 : Vegetation in Vacant Plot Adjacent to COB – 5 Comprising of Acacia spp., Prosopis juliflora, Lantana, Calotropis, Tridax procumbens and Grasses

Figure 11.28 : Ricinus communis growing in COB – 5 Site

Figure 11.29 : Tridax procumbens and Mimosa pudica growing in COB – 5 Site

Since the project site is located inside the plant adjacent to a major operating unit (COB-4), other than some common birds such as Common Crows (*Corvus splendens*), Jungle Crows (*Corvus marorhynchos*), Common Mynah (*Acridotheres tristis*), Pied Mynah (*Sturnus contra*), Cattle Egret (*Bubulcus ibis*), Red-wattled Lapwings (*Vannelus indicus*), Jungle Babblers (*Turdoides striata*), Spotted Munia (*Lonchura punctulata*) and reptiles such as Garden Lizards and Skinks were observed in the site . Also sveral species of insects including beetles, and grass-hoppers (notably *Poekilocerus pictus*) were observed to be present in vegetation.

The shrubby vegetation was cleared to make way for the new Coke Oven Battery. Since the area involved is very small, the effect on the overall greenery inside the existing steel plant will be hardly of any consequence.

No external injury / damage / lesions, which can be attributable to pollution was visible on the residual vegetation at project site and in the adjacent plot. The vegetation appreared to be healthy.

During construction some fugitive dust was generated due to clearing away of coal stocks (which had to be done anyway as the coal had to be used as boiler fuel) and civil works (site levelling, excavation of foundations etc.). The nearest human habitation (Appikonda Village) is about 4 km away (towards the south west). The intervening area is covered by the plant's green belt as well as other units of the plant. Since the dust from soil excavations is generated at ground level it is unlikely to spread far. The dust was partially suppressed by water sprinkling. It may also be noted that the area is very close to the sea shore and is characterised by strong breezes, which disperse fugitive dust.

The vegetation outside the plant boundaries (but within RINL's acquired area) was also surveyed to look for external damage / injuries which may be attributable to activities in the plant.

Summary of Damages during Construction of COB5

- No damage to land use change.
- Minor damages on ambient air quality.
- Minor damage to water environment.
- No damage to noise environment.
- Minor damages to ecological environment.

Mitigation Measures adopted

During construction, water sprinkling was carried out to suppress fugitive dust. Treated effluent from the VSP's ETP was utilised for this purpose. For removal of vegetation, it was ensured that "slash and burn" was not resorted to.

Once construction activities are completed, all the residual excavated soil & debris shall be collected and dumped in a low lying area in the plant. Water will be sprinkled on the dumped soil to suppress fugitive dust. Subsequently grass seeds will be scattered over the moist soil. Just before monsoons, seeds of common shrubs and trees growing inside the plant (*Calotropis gigantea, Ricinus communis, Leucaena leucophloea*) shall be scattered on the soil.

3. <u>Construction of new Guard Pond:</u>

4 new Guard Ponds are being constructed on the eastern side of the plant over a total area of ~4 ha. Treated effluents from the steel plant's ETP will flow by gravity into these ponds to settle out any residual suspended solids, before flowing out by gravity to the outfall. At any given time 3 of the ponds shall be in use. The 4th shall be emptied to excavate the settled sludge.

Construction of the Guard Pond has involved the following activities:

1. Clearance of vegetation.
2. Excavation of soil & rocks.
3. Transport and dumping of excavated material
4. Construction of embankment by utilising part of the excavated soil & rocks
5. Concrete lining of inner side of embankment

Damage to Land environment:

The site of the Guard Ponds was an expanse of unutilised area with dense vegetation inside the steel plan's premises. The vegetation comprised of dense thickets of *Leucaena leucophloea.* Google earth imageries of project site are given in **Figure 11.30-11.31**.

Figure 11.30 : Google Earth Image dated 07-08-2017 of Guard Pond Site.

Figure 11.31 : Google Earth Image dated 30-09-2018 of Guard Pond Site.

Approximately 38400 m^3 of soil and rocks were excavated for creation of the Guard Ponds. Excavation was carried out using mechanical shovels / excavators, which loaded the excavated muck on to tipper trucks. The tipper trucks then transported the material to designated dump site located adjacent to the project site on the north-eastern side. A few large boulders, too large to be excavated and broken up by the deployed shovels / excavators, were encountered. Part of the excavated debris is utilised for construction of the Guard Ponds' bunds.

~4 ha dense vegetation inside the premises of the existing steel plant has been converted to industrial use. Since the area involved is only ~0.16% of the plant area (~2550 ha), the change is of minor consequence.

Damage to Ambient air quality:

The new Guard Ponds are being dug near the existing Coke Oven ETP near Gangavaram. Since this is a fresh project, all the activities like, vegetation removal, ground levelling, civil construction work etc. are involved. The estimated quantity of material transported during construction phase is as follows--

- Total debris transported – 76800 T

Based on the above, number of trucks per day has been estimated to be around 40 trucks per day. The project basically involves digging out soil, rocks and other debris from site, temporarily storing it in some other areas and utilizing the same for embankment construction. The fugitive emissions arising out of these activities have been estimated based on AP-42 and CPCB guidelines. The same is given in **Table 11.10** below.

Table 11.10 : Pollutant emissions during construction phase of Guard Ponds

Sl. No.	Activity	Emission Factor	Emission Rate (g/sec)
Construction/Demolition activities			
1	Bulldozing	2.292 Kg/hr	0.064
2	Motor Grading	0.6 g/Km/Vehicle	0.003
3	Truck Loading with debris	0.0002 Kg/T	0.001
4	Truck Unloading	0.0002 Kg/T	0.001
5	Wind erosion of exposed material	9.02E-07 g/s/m^2	0.001
Material Transport			
1	Truck transport of excavated material on unpaved roads		
	PM	5.8 g/Km/Vehicle	0.000000071050 g/s/m^2
	NOx	9.3 g/Km/Vehicle	0.000000114815 g/s/m^2

Based on the above estimated emission values, GLCs have been estimated due to the construction activities in buffer area. The incremental concentrations due to the construction activities are given in **Table 11.11** below. The isopleths of PM_{10} and NO_X concentrations are also given in **Figure 11.32** and **Figure 11.33** respectively.

Table 11.11 : GLCs due to construction of new Guard Pond

Station ID	PM	NOx
A1	0.008	0.055
A2	0.003	0.029
A3	0.012	0.094
A4	0.012	0.072
A5	0.006	0.060
A6	0.004	0.028
A7	0.006	0.025
A8	0.023	0.168

** All values in µg/m^3.*

Figure 11.32 : GLCs of PM Emissions due to Guard Pond

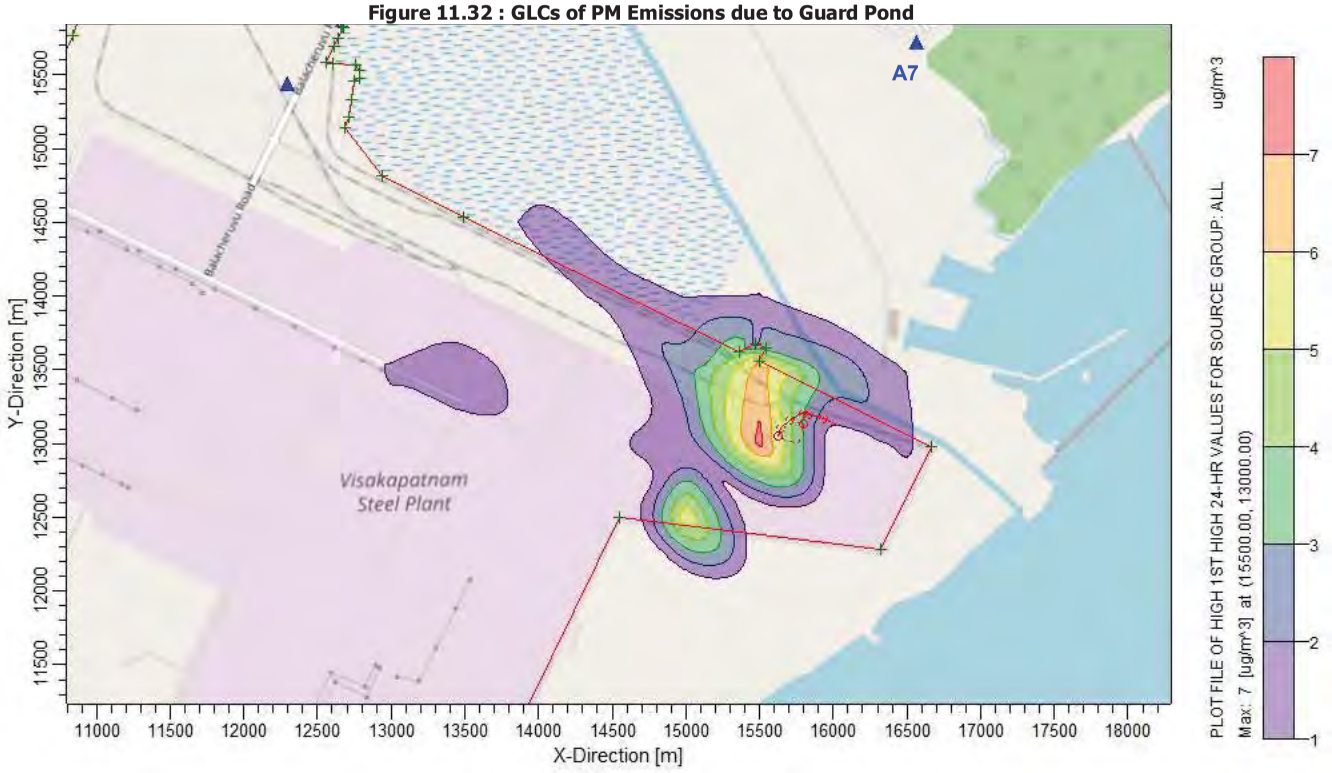
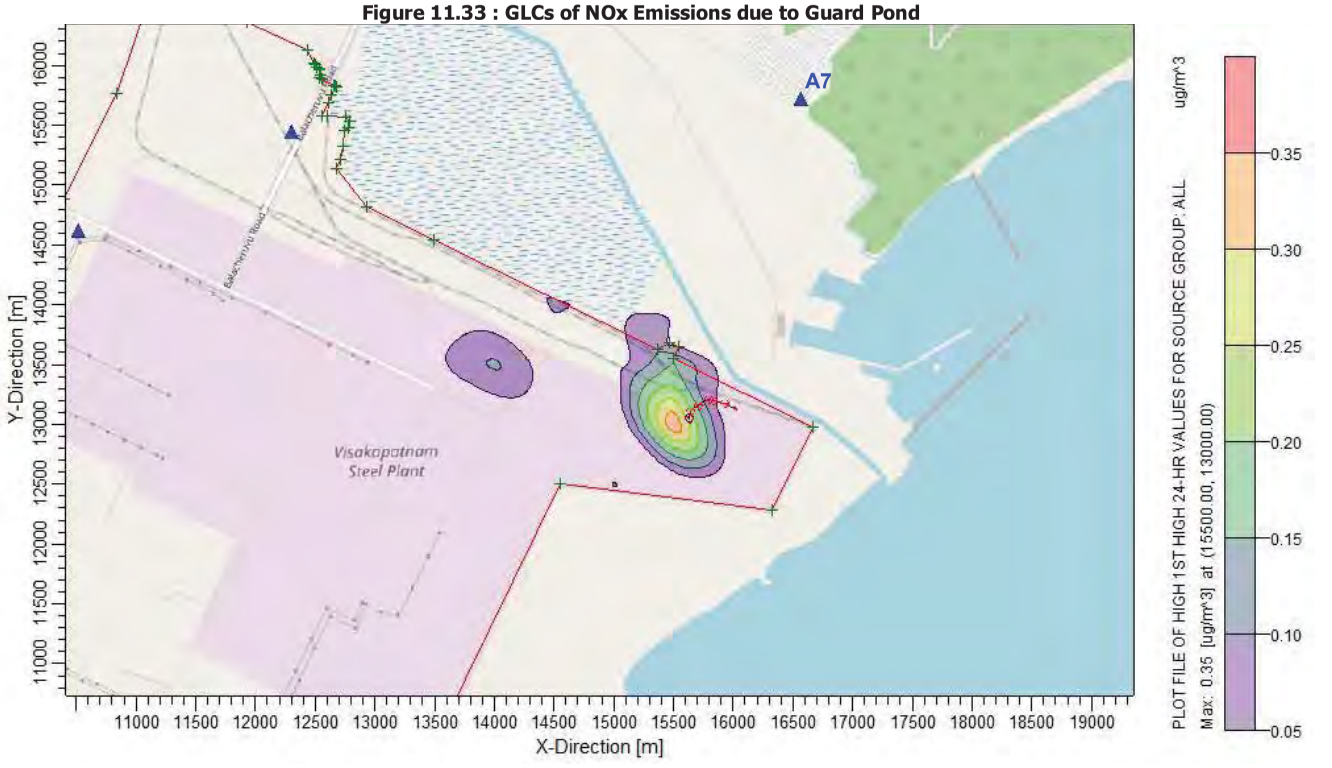


Figure 11.33 : GLCs of NOx Emissions due to Guard Pond



From the above figures, it can be observed that the estimated values of maximum Ground level concentrations are concentrated in and around the construction site. The maximum GLC values at nearest habitat i.e. A7 (Gangavaram) is observed to be around 0.005 µg/m^3 for PM. Therefore, no damage to ambient air quality can be attributed to construction of new Guard ponds.

Damage to Water environment:

The Guard Ponds' bottom is ~3 m below the original ground level. In the project site, the ground water level is ~5 m below the original ground level. So there was no seepage of ground water into the pits. Therefore, no significant damage to ground water resources can be attributed to construction of new Guard ponds.

Moreover, the Guard-Ponds will have impervious lining which is designed to prevent leaching of the Guard Ponds' contents into the ground water.

Effects on Ambient Noise Levels:

Since the residential areas are too far away to be affected by activities at the Guard Pond site, no damage on ambient noise levels is anticipated.

Damage to Ecology:

As mentioned earlier, the project area comprises of dense thickets of *Leucaena leucophloea*. The damages on ecology due to Guard Pond construction are as follows:

1. Loss of green cover due to removal of vegetation
2. Damage to vegetation due to deposition of fugitive dust on vegetation.

During clearance of the area for Guard Pond construction, approximately 9800 trees were felled, all of which were *Leucaena leucophloea* of girth less than 30 cm.

The area where the Guard Ponds are being constructed is located in a rather remote corner of the plant. Because of the dense vegetation the area is inhabited by large numbers of birds, all of them common species. The adjacent area outside is part of Gangavaram Port (in the north) and dense scrub on the sea coast (in the east).

The excavation and dumping has involved operation of diesel powered heavy earth moving machinery (HEMMs) over unpaved surfaces. Excavation and dumping of soil & rocks have led to generation of fugitive dust and NOx (from diesel engines). The excavated soil and hard rock dumped adjacent to the Guard Pond site, have been / are being re-handled and used for construction of the Guard Ponds' embankments. The slope of the embankment on the inner side (i.e. inside the guard ponds) and the guard ponds' bottom will be lined with PCC and HDPE sheets The work involves handling of excavated soil & rocks and movement of diesel powered HEMMs over unpaved surfaces. This is leading to generation of fugitive dust and NOx.

The maximum estimated ground level concentration of fugitive dust due to activities of the project was 7 µg/m^3 and occurred within the construction site. It is to be noted that fugitive dust is generated at the ground level or few metres above the ground (in case of dumps). Fugitive does not travel very far unless there are very strong winds and most of the dust usually settles down within a few hundred metres of the source. The dust settling

on the leaves of plants reduces the plants' photosynthetic activity and in extreme cases can also lead to the death of the leaves and apical buds. This is often seen adjacent to unpaved haul roads in mine areas.

In the present case, the work is localised over a very small area and inside the steel plant. Moreover the area is surrounded by dense thickets of *Leucaena leucophloea* on all sides, which has screened the fugitive dust. The dust settling on the leaves of the vegetation facing the project area have probably reduced the photosynthetic activity of the plants. However these effects are temporary. The construction activity is expected to be completed within 12 months. The leaves will be washed clean by the first spell of rains after completion of construction. The increase in NOx levels are too low to have any additional impact on the vegetation.

Summary of Damages during Construction of Guard Ponds

- No damage to land use change.
- No significant damage on ambient air quality.
- No damage to water environment.
- No damage to noise environment.
- Minor damages to ecological environment.

Mitigation Measures

Water sprinkling is being done on unpaved roads to suppress fugitive dust. The existing trees around the project site are mature and already bearing fruits / seeds. In all likelihood, seed from these trees will naturally revegetate the unutilised soil dump. Nevertheless, after utilisation of the material, the dump site, shall be biologically reclaimed.

This will be carried out as follows:

- On completion of dumping / reclamation of dump sites, topsoil (which was excavated during the initial stage of reservoir construction and has been stored in separate small dumps) will be scattered over the area. Water will be sprinkled over the topsoil.
- Grasses and the shrub *Ipomea carnea* will be planted on the soil to stabilise it.
- 0.5 m x 0.5 m x 0.65 m pits will be excavated at ~3 m intervals.
- These pits will be filled with a mixture of topsoil, compost / organic manure.
- About 0.6 m tall saplings of *Acacia nilotica, Azadirachta indica, Ficus bengalensis, Ficus religiosa,* and *Pongamia pinnata* will be planted in soil filled pits just after the commencement of monsoons.

4. <u>Revamping of Blast Furnaces 1 & 2:</u>

Existing Blast Furnaces (BFs) 1 & 2 have been revamped. Construction of the new BFs has involved the following activities:

- Shutting down of the furnaces.
- Partial dismantling of the outer shell of the furnaces
- Removal of the inner refractory lining of the furnaces
- Removal of the rest of the outer shell
- Reconstruction of the entire furnace and associated systems

The work involved metal cutting, handling of waste refractory bricks & metal, erection of refractories and metal structures.

Damage to Land environment:

Since the revamping of existing BFs 1 & 2 has taken place inside the existing Shop level, no additional land was diverted for industrial use. Hence, no green cover was destroyed. Therefore, revamping of the existing BFs has not changed Land Use in any way.

Damage to Ambient air quality:

Since the activity was for repair and modernization of existing blast furnaces, all the major construction activities were carried out within the existing BF complex. The emissions arising out of the construction activities were captured through space dedusting system of BF and clean air was exhausted to atmosphere. Therefore, no additional emissions were assumed to have occurred due to construction activities.

However, the materials required for the construction activities were transported to site through roads in trucks. This might have resulted in additional fugitive emissions. In order to predict the same, following information has been collected for each blast furnace-

- Total Concrete transported – 58322 T
- Total Structural material transported – 16118 T
- Total weight of Refractories transported – 3000 T

Based on the above, number of trucks per day has been estimated to be around 40 trucks per day. The fugitive emissions due to diesel combustion and road emissions have been calculated based on AP-42 and CPCB guidelines. The above estimates also include the transportation of machinery/equipment to site. The same is given below-

PM – 0.0045 g/s
NOx – 0.0024 g/s

Based on the above estimated emission values, GLCs have been estimated due to the revamping activities in buffer area. The incremental concentrations due to the revamping activities of BF1 & BF2 are given in **Table 11.12** below. The isopleths of PM_{10} and NO_x concentrations are also given in **Figure 11.34** and **Figure 11.35** respectively.

Based on the above, minor damage can be attributed due to revamping of BFs.

Table 11.12 : GLCs due to various BF1 and BF2 revamping activities

Station ID	PM	NOx
A1	0.008	0.055
A2	0.003	0.029
A3	0.012	0.094
A4	0.012	0.072
A5	0.006	0.060
A6	0.004	0.028
A7	0.006	0.025
A8	0.023	0.168

** All values in µg/m³.*

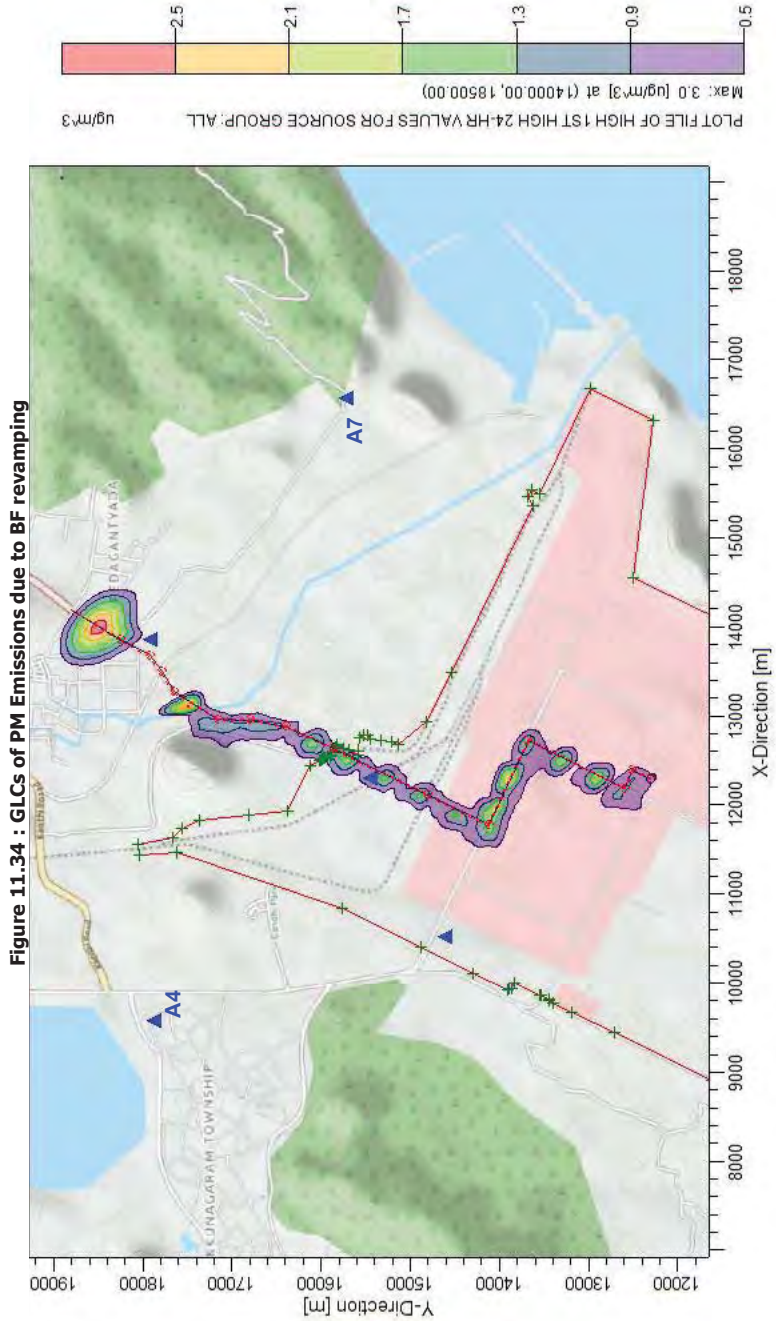


Figure 11.34 : GLCs of PM Emissions due to BF revamping

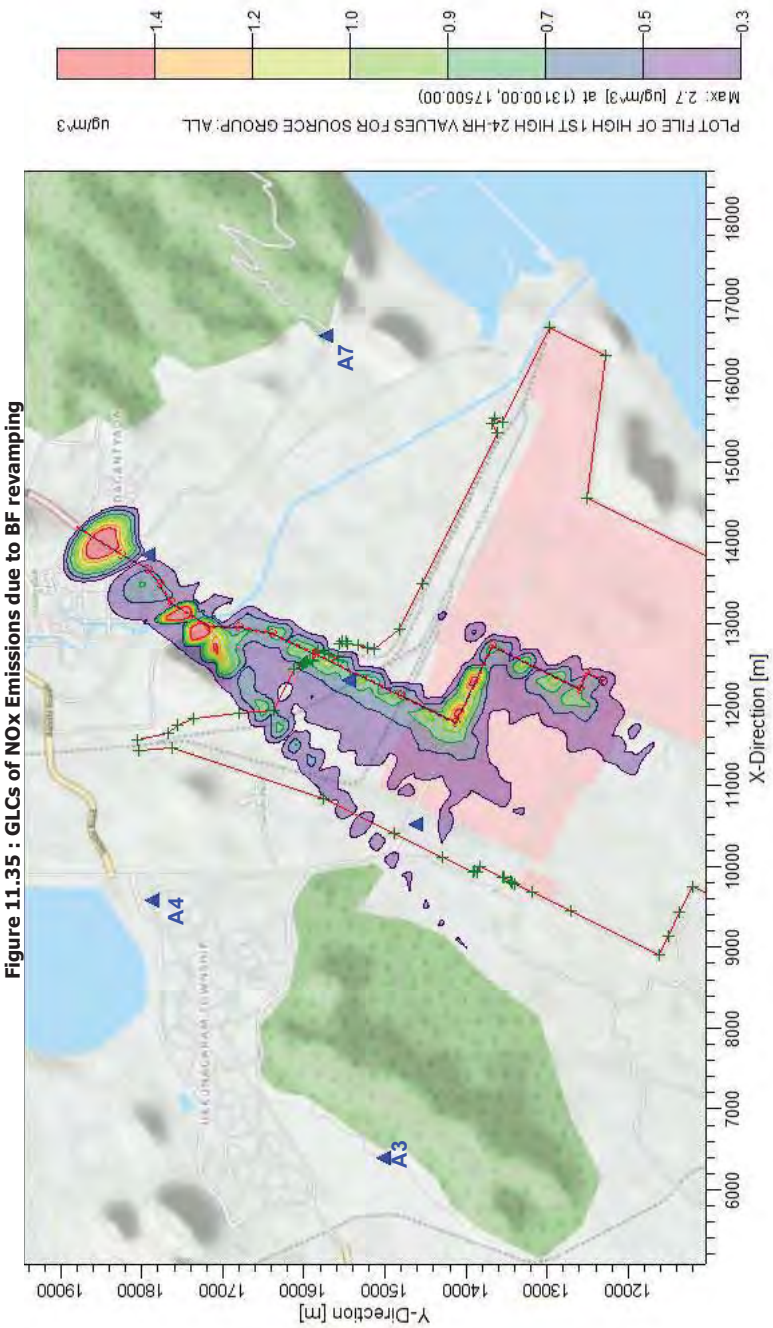


Figure 11.35 : GLCs of NOx Emissions due to BF revamping

From the above figures, it can be observed that the maximum Ground level concentrations are concentrated on the transportation route. The maximum GLC values at a distance of 100 m from source is observed to be less than 2 µg/m^3 and 1 µg/m^3 for PM and NOx respectively. The maximum GLC values at nearest habitation i.e. A8 (Gajuwaka) is observed to be around 0.315 µg/m^3 and 0.168 µg/m^3 respectively for PM and NOx. Therefore, no damage to ambient air quality can be attributed due to revamping of BF1 and BF2.

Damage to Water environment:

As discussed above, the revamping of BF1 and BF2 was carried out within the existing complex. The units are already having all infrastructure facilities including water supply, sanitation etc. The water requirement during the construction phase was met through the already existing water supply facilities. Thus no ground water was extracted for drinking purposes. Also, no effluents or surface runoffs were generated during the revamping process. Therefore, no significant modification in the water environment of the area occurred.

However, a comparative analysis was carried out for cumulative change in groundwater quality for the period before and after the construction activities. The same has been done in cumulative damage on Water environment section later in this chapter.

Effects on Ambient Noise Levels:

During the Blast Furnace revamping work, noise was generated by diesel powered material handling equipment and construction machinery, movement of diesel powered trucks, and metal fabrication. Based on similar fabrication yards elsewhere, the noise levels at a distance of 15 m from construction site was ~85 dB(A). Without any attenuation, this 85 dB(A) will reduce to ~43 dB(A) at the nearest plant boundary (~1.9 km away). The nearest habitation is Islampet Village is 3.8 km away. Without any attenuation, the 85 dB(A) will reduce to ~37 dB(A) at Islampet Village.

The day time noise levels at Islampet Village 67.7 dB(A) – 47.3 dB(A) {avg. 55 dB(A)}. The resultant noise levels due to revamping activities at BF complex would have been 67.7 dB(A) – 47.7 dB(A) {avg. 55.06 dB(A)} i.e. almost negligible.

It is to be noted that the BFs are surrounded by other units of the plant on all sides and there is thick green belt along the plant boundary which would have attenuated the noise generated at the BF complex. Thus the noise levels outside the plant would not have changed from activities associated with the revamping of the BFs.

Therefore, there was no change in ambient noise levels.

Damage to Ecology:

The BF revamping has not led to any change in land use. The changes in air quality have been localized to only along the roads inside the plant. The increase in noise levels too have been confined inside the plant premises. Thus there have been no lasting effects on the ecology of the area.

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Summary of Damages during Revamping of BF1 and BF2

- No damage to land use change.
- Minor damage on ambient air environment.
- No damage to water environment.
- No damage to noise environment.
- No damage to ecology.

Mitigation Measures adopted during Construction

During construction, water sprinkling was carried out to suppress fugitive dust generated from handling the waste refractory linings. Treated effluent from VSP's ETP was utilised for this purpose.

Transport of material, use of heavy diesel powered material handling machinery and use of noise metal fabrication machinery was carried out during day time only.

Workers deployed in noisy areas were issued necessary Personal Protective Equipment and their use was enforced.

5. Revamping of Sinter Plant1

The sinter plants have been revamped by replacement of some of the existing equipment by equipment of higher capacity and modification / augmentation of some of the existing equipment

Installation of the new convertor has involved the following activities-

- Replacement of pallets with increased width and modified sealing system.
- Modification of Sinter machine feeding & charging system.
- Replacement of Sinter machine drive & driven sprockets.
- Replacement of ignition furnace with energy efficient multi-slit burners.
- Enhancement of Sinter cooler and its blower fans.
- Removal of hot screen & drum cooler and extension of length of Sinter machine.
- Replacement of pelletizer drum with improved internals.
- Lime addition before pelletizing drums.
- Pneumatic conveying of electrostatic precipitator dust and granulation.
- Upgradation of flux crushing & screening system.
- Fuel grinding system with closed loop screening upgradation of conveying system.
- Replacement of primary mixing drum with better internals.
- Structural Health study and strengthening & repairs.
- Checking of existing foundation and strengthening for all structural members such as Sinter Machine, Sinter Screen building Sinter cooler, double roll crushers, Conveyor supporting structures etc.
- New LCSS & Compressor air building.
- Civil & Structural work for SM-1 bed length extension at Discharge end.
- Civil & Structural work for laying of New BFG, COG, Mixed Gas pipelines at GMS & Pneumatic Conveying system of Lime & ESP Dust.

The work involved dismantling and/or scrapping some of the existing equipment and assembly of new equipment (mostly metallic) along with auxiliaries.

Damage to Land environment:

The entire revamping work was carried out within the existing Sinter Plant of the existing steel plant. Hence no land was diverted (even within the plant).

Additionally, the construction and demolition debris arising out of the revamping activities was utilized within the plant boundary for levelling. Therefore, revamping of the existing SP has not changed Land Use in any way.

Damage to Ambient air quality

Again, since the activity was for repair and modernization of existing sinter plant, all the major construction activities were carried out inside the existing SP complex. The emissions arising out of the construction activities were sucked through space dedusting system of SP, filtered and the clean air was exhausted to atmosphere. Therefore, no additional emissions were assumed to have occurred due to construction activities.

However, the material required for the construction activities was transported to site through roads in trucks. This might have resulted in additional fugitive emissions. In order to predict the same, following information has been collected for the Sinter plant-

- Total Concrete transported – 2734 T
- Total Structural material transported – 5822 T

Based on the above, number of trucks per day has been estimated and fugitive emissions due to diesel combustion and road emissions have been calculated based on AP-42 and CPCB guidelines. The same is given below-

PM – 0.0007 g/s
NOx – 0.0004 g/s

Based on the above estimated emission values, GLCs have been estimated due to the revamping activities in buffer area. The incremental concentrations due to the revamping activities are given in **Table 11.13** below. The isopleths of PM_{10} and NO_X concentrations are also given in **Figure 11.36** and **Figure 11.37** respectively.

Based on the above, minor damage can be attributed due to revamping of SP1.

Table 11.13 : GLCs due to various SP1 revamping activities

Station ID	PM	NOx
A1	0.001	0.005
A2	0.000	0.002
A3	0.001	0.008
A4	0.001	0.006
A5	0.000	0.005
A6	0.000	0.002
A7	0.000	0.002
A8	0.002	0.014

** All values in µg/m³.*

Figure 11.36 : GLCs of PM Emissions due to SP1 revamping

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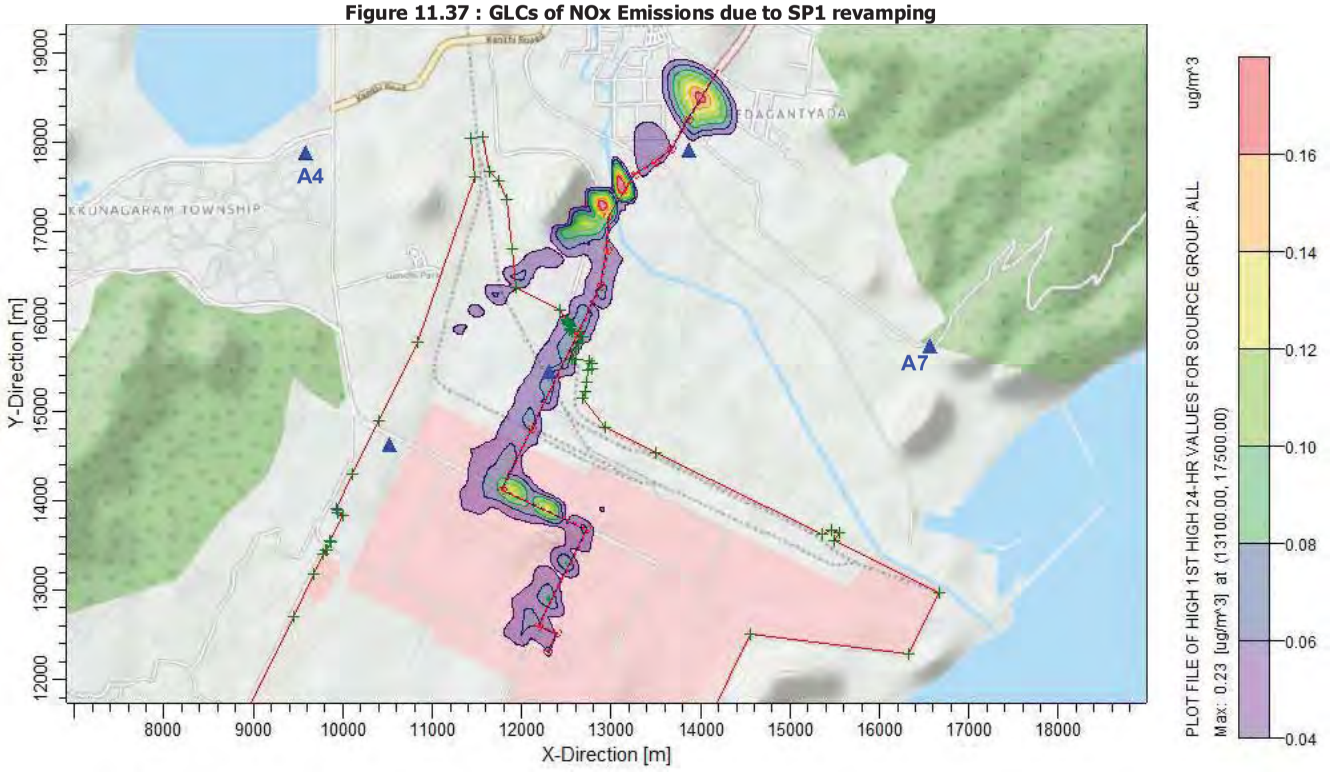
Figure 11.37 : GLCs of NOx Emissions due to SP1 revamping



From the above figures, it can be observed that the maximum Ground level concentrations are concentrated along the transportation route. The maximum GLC values at a distance of 100 m from source is observed to be less than 0.4 µg/m^3 and 0.2 µg/m^3 respectively for PM and NOx. The maximum GLC values at nearest habitation i.e. A8 (Gajuwaka) is observed to be around 0.024 µg/m^3 and 0.014 µg/m^3 respectively for PM and NOx. Therefore, no damage to ambient air quality can be attributed to revamping of SP1.

Damage to Water environment:

As discussed earlier, the revamping of SP1 was carried out within the existing complex. The unit is already having all infrastructure facilities including water supply, sanitation etc. The water requirement during the construction phase was met through the already existing water supply facilities. Thus no ground water was extracted for drinking purposes. Also, no effluents or surface runoff were generated during the revamping process. Therefore, no damage to the water environment of the area is anticipated.

Effects on Ambient Noise Levels:

During the SP revamping work, noise was generated by diesel powered material handling equipment and construction machinery, movement of diesel powered trucks, and metal fabrication. Most of the work was carried out inside an enclosed building. Based on similar fabrication works elsewhere, the noise levels inside the building during construction work was about 90 dB(A), whereas outside the building the noise level was ~75 dB(A). Without any attenuation, this 75 dB(A) will reduce to ~37.7 dB(A) at the nearest plant boundary (~1.1 km away).

The nearest habitation is Appikonda Village is 3.5 km away. Without any attenuation, the 75 dB(A) will reduce to ~27.6 dB(A) at Appikonda Village. The day time noise levels at Appikonda Village 55.2 dB(A) – 44 dB(A) {avg. 52.3 dB(A)}. The noise levels would have increased by only ~0.1 dB(A) maximum due to revamping activities at Sinter Plant complex without any attenuation by vegetation or man-made structures.

It is to be noted that there is thick green belt along the plant boundary which would have attenuated the noise generated at the Sinter Plant complex. Thus the noise levels outside the plant would not have changed from activities associated with the revamping of the Sinter Plant complex.

Thus there were no impacts on ambient noise levels due to revamping of SP1.

Damage to Ecology:

SP revamping has not led to any change in land use. The changes in air quality have been localized to only along the roads inside the plant. The increase in noise levels too have been confined inside the plant premises. Thus there have been no lasting effects on the ecology of the area.

Summary of Damages during Revamping of BF1 and BF2

- No damage to land use change.
- Minor damage on ambient air environment.
- No damage to water environment.

- No damage to noise environment.
- No damage to ecology.

Mitigation Measures adopted during Construction

During construction, all material transport was carried out during day-time only. Most fabrication work was carried out during daytime. All workers were provided with appropriate personal protective equipment, whose use was enforced.

6. <u>Expansion of SMS 2 by Installation of new Converter 3 & Caster 4</u>

A new 150 t convertor has been installed in SMS-2. The new convertor has been installed inside the existing building of SMS-2 which was constructed earlier with provision for additional convertor. Along with the convertor a new Continuous Casting Machine No. 4 (CCM#4) has also been installed.

Installation of the new convertor has involved the following activities-

- Installation of 150 t BOF Converter 3 along with all associated auxiliaries.
- Civil and structural work involving construction of 5-Strands Bloom cum round Continuous casting machine.
- Augmentation of water system
- Auxiliary power wiring, earthing, lighting, Yard and road lighting, etc.
- Augmentation of Utility i.e. LPG, Compressed Air, Oxygen, Nitrogen, Chilled Water generation systems etc. and their distribution systems
- Power distribution system including ventilation system
- Civil works package including piling works along with dismantling & relocation of existing facilities (wherever required) and also construction of roads & drainage network
- Structural works package including sheeting work and dismantling and relocation of existing building structure facilities (wherever required)
- Torpedo car track work along with augmentation of Telecommunication & signaling system

The work involved erection of metal structures, assembly of metallic equipment along with auxiliaries and construction of concrete chimney.

Damage to Land environment:

Since the installation of new Converter 3 and Caster 4 along with associated facilities was carried out inside the existing building, no additional land was diverted for industrial use. Hence, no green cover was destroyed.

Additionally, the construction and demolition debris arising out of the construction activities was utilized within the plant boundary for levelling. Therefore, there was no change in land use on account of installation of new converter in SMS2.

Damage on Ambient air quality

Since the project was for installation of a new converter within existing SMS Complex, all the major construction activities were carried out inside the complex. The emissions arising out of the construction activities was filtered through space dedusting system of SMS and

clean air was exhausted to atmosphere. Therefore, no additional emissions were assumed to have occurred due to construction activities.

However, the material required for the construction activities was transported to site through roads in trucks. This might have resulted in additional fugitive emissions. In order to predict the same, following information has been collected-

- Total Concrete transported – 750000 T
- Total Structural material transported – 179800 T
- Refractory – 900 T

Based on the above, number of trucks per day has been estimated to be around 27 trucks per day. The fugitive emissions due to diesel combustion and road emissions have been calculated based on AP-42 and CPCB guidelines. The above estimates also include the transportation of machinery/equipment to site. The same is given below-

PM – 0.0456 g/s
NOx – 0.0293 g/s

Based on the above estimated emission values, GLCs have been estimated due to the construction activities in buffer area. The incremental concentrations due to the construction activities are given in **Table 11.14** below. The isopleths of PM_{10} and NO_X concentrations are also given in **Figure 11.38** and **Figure 11.39** respectively.

Based on the above, minor damage can be attributed due to installation of new converter in SMS2.

Table 11.14 : GLCs due to various SMS2 expansion activities

Station ID	PM	NOx
A1	0.044	0.355
A2	0.014	0.116
A3	0.066	0.610
A4	0.062	0.465
A5	0.032	0.389
A6	0.021	0.179
A7	0.030	0.160
A8	0.122	1.084

** All values in µg/m³.*

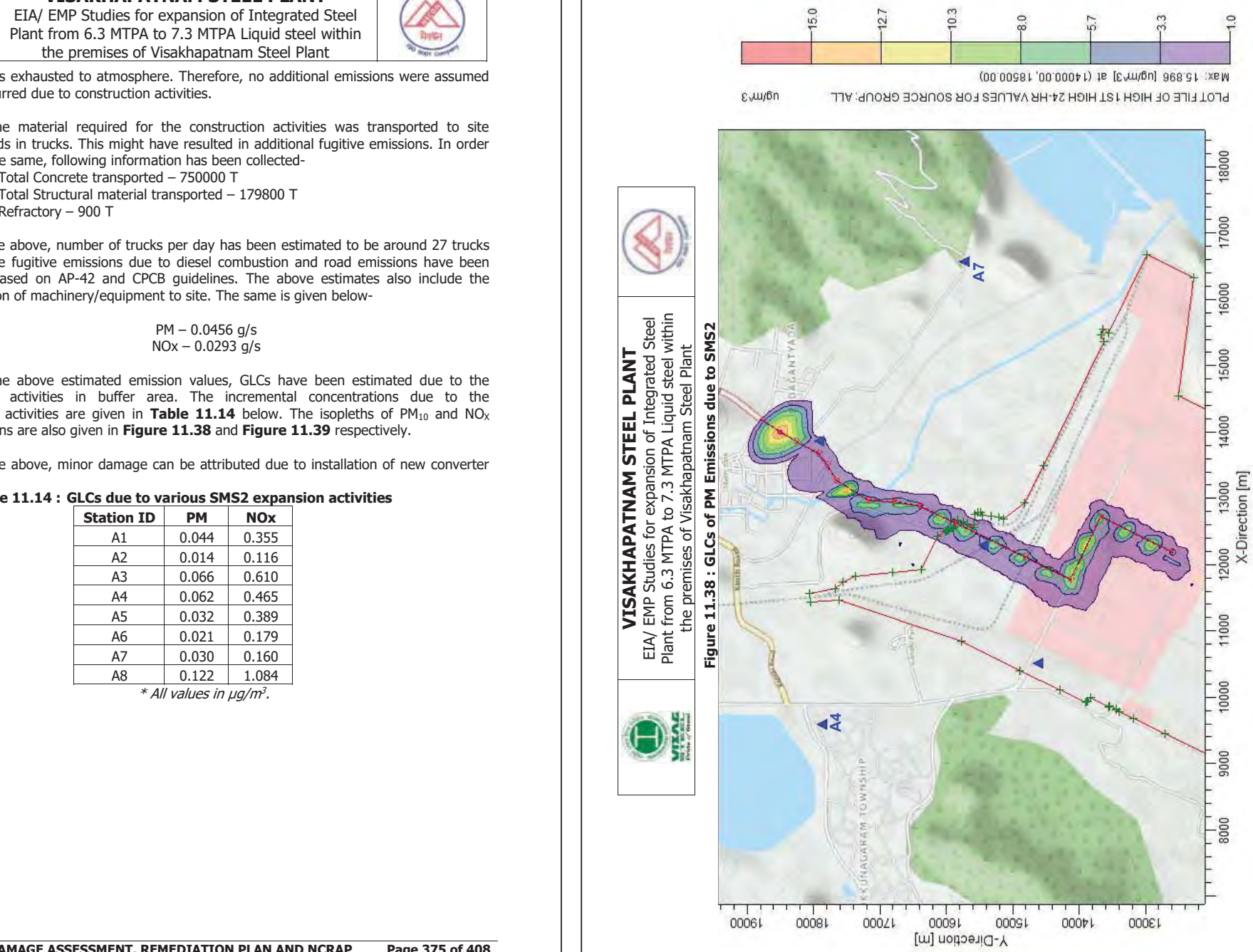


Figure 11.38 : GLCs of PM Emissions due to SMS2

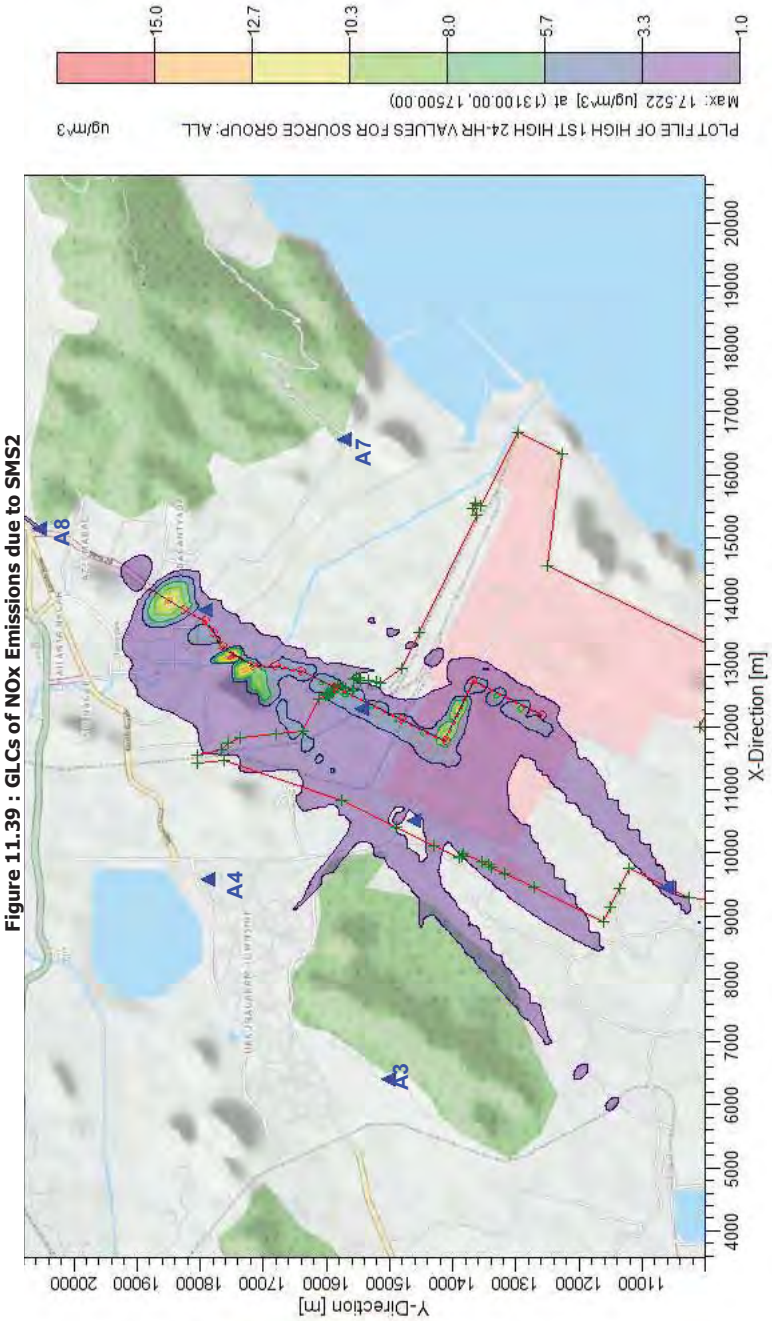


Figure 11.39 : GLCs of NOx Emissions due to SMS2

From the above figures, it can be observed that the maximum Ground level concentrations are concentrated on the transportation route. The maximum GLC values at a distance of 500 m from road is observed to be less than 6 µg/m^3 and 5 µg/m^3 respectively for PM and NOx. The maximum GLC values at nearest habitation i.e. A8 (Gajuwaka) is observed to be around 1.4 µg/m^3 and 1.1 µg/m^3 respectively for PM and NOx. Therefore, no damage can be attributed due to revamping of SMS2.

Damage to Water environment:

As discussed earlier, the installation of new Converter 3 and Caster 4 in existing SMS 2 was carried out within the existing complex. The unit is already having all infrastructure facilities including water supply, sanitation etc. The water requirement during the construction phase was met through the already existing water supply facilities. Thus no ground water was extracted for drinking purposes. Also, no additional effluents or surface runoffs were generated during the revamping process. Therefore, no significant modification in the water environment of the area occurred.

Effects on Ambient Noise Levels:

During the SMS revamping work, noise was generated by diesel powered material handling equipment and construction machinery, movement of diesel powered trucks, and metal fabrication. Most of the work (except the construction of the new chimney) was carried out inside an enclosed building. Based on similar fabrication works elsewhere, the noise levels inside the building during construction work was about 90 dB(A), whereas outside the building the noise level was ~77 dB(A). Without any attenuation, this 77 dB(A) will reduce to ~33.5 dB(A) at the nearest plant boundary (~2.2 km away).

The nearest habitation is Islampet Village is 3.6 km away. Without any attenuation, the 77 dB(A) will reduce to ~29.4 dB(A) at Islampet Village. The day time noise levels at Islampet Village 67.7 dB(A) – 47.3 dB(A) {avg. 55 dB(A)}. The resultant noise levels due to revamping activities at SMS complex would have remained unchanged.

It is to be noted that the SMS are surrounded by other units of the plant on all sides and there is thick green belt along the plant boundary which would have attenuated the noise generated at the BF complex. Thus the noise levels outside the plant would not have changed from activities associated with the revamping of the SMS.

No impact on ambient noise environment is anticipated.

Damage to Ecology:

Since the SMS revamping has not led to any change in land use. The changes in air quality have been localized to only along the roads inside the plant. The increase in noise levels too have been confined inside the plant premises. Thus there have been no lasting effects on the ecology of the area.

Summary of Damages during Revamping of BF1 and BF2

- No damage to land use change.
- Minor damage on ambient air environment.
- No damage to water environment.

- No damage to noise environment.
- No damage to ecology.

Mitigation Measures adopted during Construction

During construction, all material transport was carried out during day-time only. Most fabrication work was carried out during daytime. All workers were provided with appropriate personal protective equipment, whose use was enforced.

7. Cumulative Impacts

Damage to Land environment:

In the ongoing expansion of RINL from 6.3 MTPA to 7.3 MTPA, the majority of job was for revamping of existing old units. As a result of which, RINL got a chance to increase their production capacity from 6.5 MTPA of hot metal to 7.5 MTPA. Therefore, in order to sustain this production, other upstream and downstream facilities were modified or expanded.

All of the revamped units are already a part of the plant site which is classified under industrial use. The under construction COB 5 was also built over an expanse of land under industrial use. The area was earlier used for storage of Boiler coal. As observed from pre-construction phase satellite imagery, no major vegetation was present on the proposed site.

The new guard ponds are being constructed in an expanse of 4 ha of land which was an expanse of unutilized area with dense vegetation inside the steel plan's premises. The vegetation comprised of dense thickets of *Leucaena leucophloea.* The same was cleared for the construction of guard ponds.

The site of the reservoir was an expanse of scrub land. The vegetation comprised of dense thickets of *Prosopis juliflora* with few *Acacia nilotica, Azadirachta indica* and *Borassus flabellifer*) and expanses of grassland. Approximately 4450000 m^3 of soil and rocks were excavated for creation of the reservoir. The same was then transported to designated dump sites at five locations.

~90 ha area has been utilised for the reservoir and associated structures / facilities and 61.41 ha area has been utilised for dumping material excavated from the reservoir. Dumped material which was spread over 25.91 ha area is being rehandled and being utilised for embankment construction i.e. 35.5 ha of dumps shall remain. The entire dump area shall be biologically reclaimed.

In all around, 154 ha of total area which was earlier covered with vegetation shrubs was diverted for industrial use as a result of the ongoing expansion. And even though it has been planned to biologically reclaim all the dump sites and develop thick green belt over it, the quantum of shrubby land diverted for construction purposes i.e. 154 ha which is equivalent to ~6% of the green cover area (~2550 ha) shall be considered for damage assessment.

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Damage to Ambient air quality

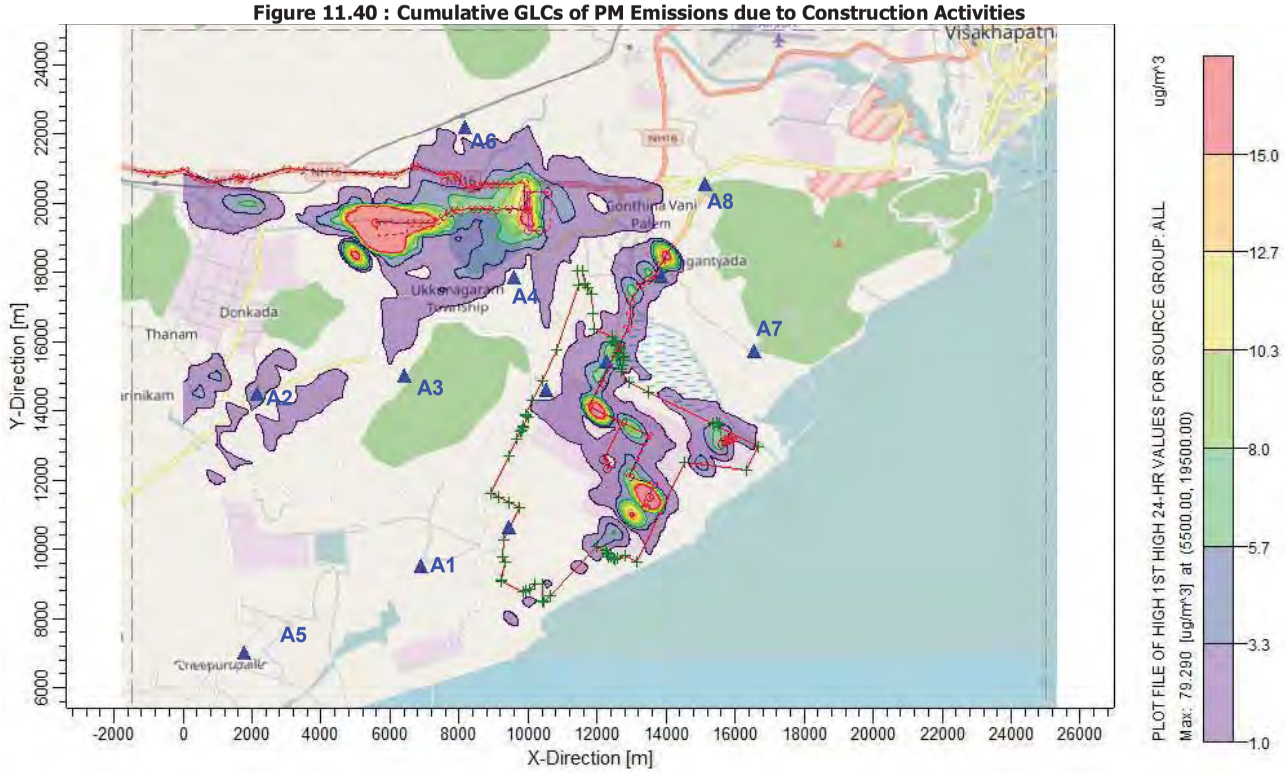
In order to anticipate the cumulative damages due to the overall construction activities for all the units, all the emissions from all construction activities are considered collectively for prediction of GLCs. The predicted maximum GLC values at individual AAQ monitoring locations are given in **Table 11.15** below. The Isopleths of PM & NOx for emissions due to each unit are presented in **Figure 11.40** and **Figure 11.41** respectively**.**

Table 11.15 : Cumulative value of GLCs due to all construction activities

Station ID	Background PM Conc. (Avg)	PM contribution due to plant construction activities	Background NOx Conc. (Avg)	NOx contribution due to plant construction activities
A1	90	0.155	23.7	0.796
A2	85	1.590	25.2	1.998
A3	84	0.384	17.2	0.093
A4	68	0.345	15.4	0.955
A5	84	0.133	25.6	0.689
A6	81	0.573	19.5	0.379
A7	98	0.203	29.7	0.403
A8	72	0.134	21.2	0.007

** All values in µg/m^3.*

Figure 11.40 : Cumulative GLCs of PM Emissions due to Construction Activities



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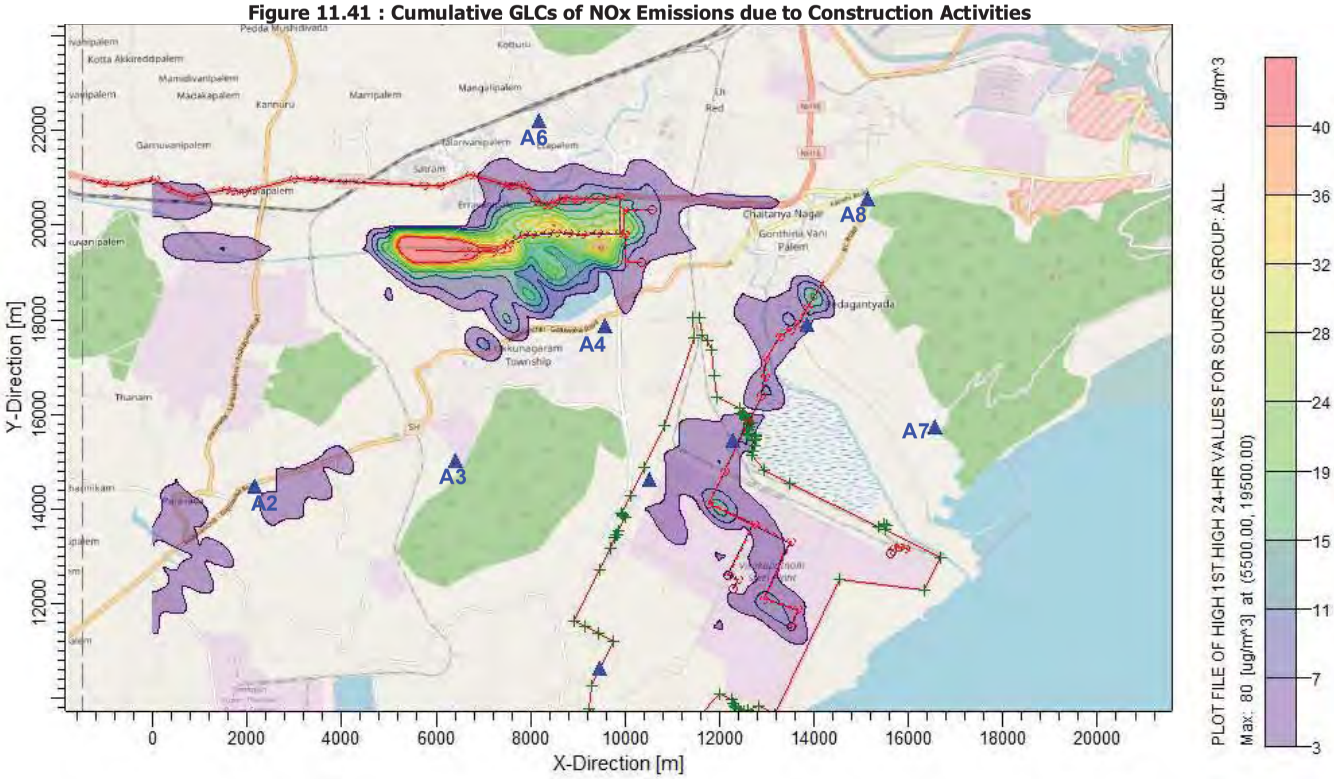
EIA/ EMP Studies for expansion of Integrated Steel Plant from 6.3 MTPA to 7.3 MTPA Liquid steel within the premises of Visakhapatnam Steel Plant

Figure 11.41 : Cumulative GLCs of NOx Emissions due to Construction Activities



From the above figures, it can be observed that the higher concentration values are observed in areas close to KBR2 construction site. The site used for storage of rocks and soil dug out of KBR2 has been anticipated to be the location of maximum PM and NOx concentrations.

The presence of thick vegetation near the waste storage site and all along the transportation route would have contributed to the reduction of fugitive dust emissions. The actual GLC value would have been much less than anticipated due to this.

The anticipated maximum GLC values at nearest AAQ location is estimated to be 1.6 µg/m^3 and 2.0 µg/m^3 for PM and NOx respectively. Therefore, no significant damages due to all the construction and revamping activities were observed. Additionally, the damage caused by the construction activities are temporary and will cease to exist after completion of construction phase.

Damage to Water environment:

Surface Water

As discussed earlier, except in KBR2 area, the surface water bodies are unaffected due to the construction activities as there is minimal interaction of site activities with the surface water bodies in the plant area. Also, the construction activities are being carried out within the plant premises, which is well away from any natural stream, river or lake. Thus, chances of storm water overflowing into the buffer area's surface water bodies is minimal.

In KBR2 area, three natural perennial streams flowed through the site area. Prior to commencement of reservoir construction, a diversion channel was constructed to temporarily divert the Central Nala along the proposed western and southern rim of the proposed reservoir area to the existing southern channel. After completion of KBR2, the stream shall be diverted along the northern periphery of the reservoir to meet the natural stream on west side. A lined channel has been constructed for the same. Therefore, the overall drainage pattern of the area shall not be disturbed.

Ground Water

The new reservoir bottom is ~14 m below the original ground level. In the reservoir site, the ground water level is ~4 m below the original ground level. So water was discharged from the excavations. It is to be noted that RINL has constructed an artificial ground water recharging pond on the southern side of the reservoir site. Water seeping into the excavated reservoir water was pumped out into the ground-water recharging pit.

In order to identify the impacts on ground water regime of the study area caused due to the plant construction phase activities, the ground water quality is compared for 2010 and 2016 utilizing published Ground water quality index. The average water quality with respect to selected parameters is given in **Table 11.16** below.

Table 11.16 : Average ground water quality before and after the construction phase

Selected Parameters of groundwater quality	*2010 (before construction)	**2016 (after construction)
pH	8.05	7.71
Total Dissolved Solids (mg/l)	729	1155
Fluoride (mg/l)	1.05	0.63

Selected Parameters of groundwater quality	*2010 (before construction)	**2016 (after construction)
Chloride (mg/l)	147	194
Sulphate (mg/l)	63	89
Nitrate (mg/l)	7	1

Note: ** Annual average of 38 locations in study area*
*** Annual average of 7 locations in study area*

Based on the above selected parameters and methodology developed by Surjeet Singh et. al. and published in their technical paper titled "Development of an **Overall Water Quality Index (OWQI)** for Surface Water in Indian Context, 2015" in the journal of *Current World Environment* as well as validation of equal applicability of these OWQI to groundwater as published by RP Singh et al. in their technical paper titled "Water level fluctuation as the sum of environmental and anthropogenic activities in southeast, Punjab (India), 2015" in the Journal of *Environmental and Analytical Toxicology*. The calculated WQIs is given in **Table 11.17** below. Corresponding class and status of water quality is provided in **Table 11.18.** Calculations of OWQI is attached as **Annexure 11.1.**

Table 11.17 : Calculated OWQI before and after the construction phase

Duration	OWQI	Associative grade of water quality
2010 (before construction)	86	Acceptable quality [2]
2016 (after construction)	65	Needs Treatment (Filtration & Disinfection) [3]

Table 11.18 : WQI and corresponding class and status of water quality

WQI Value	Status of Water	Grade of water quality (G_{wq})
0 - 24	Unsuitable for All Purposes	5
25 - 49	Special Treatment (Special Treatment)	4
50 - 74	Needs Treatment (Filtration & Disinfection)	3
75 - 94	Acceptable	2
95 - 100	Pristine Quality	1

References:
1. *Singh RP, Krishan G, Takshi KS (2015) Water level fluctuation as the sum of environmental and anthropogenic activities in southeast, Punjab (India). Journal of Environmental and Analytical Toxicology 5: 298.*
2. *Singh Surjeet, Ghosh, N.C., KrishanGopal, Galkate Ravi, Thomas T. and Jaiswal R.K. 2015. Development of an Overall Water Quality Index (OWQI) for Surface Water in Indian Context. Current World Environment. 10(3): 813- 822*

From the above tables it can be concluded that in comparison to the pre-construction period, the ground water quality of the study area has degraded by one grade, falling of Grade 2 to Grade 3.

Effects on Ambient Noise Levels:

It can be seen from **Table 11.4** (Time Table of Plant Development) in **Clause 11.8.1** of this Chapter, that at any given time, maximum 5 (five) programmes were under execution at the same time. Maximum activity took place during the 4th quarter of 2016 and the 1st 3 quarters of 2017. During the 4th Quarter of 2016, works on SMS2 Convertor 3, SMS2 Caster 4, COB5, SP1 Revamping and BF2 Revamping were in progress. During the 1st – 3rd quarters of 2017, works on SMS2 Caster 4, COB5, BF2 Revamping, SP1 Revamping and KBR 2 were in progress. It may be assumed that maximum noise too was generated during this one year period. The cumulative noise at three locations due to construction activities was estimated. The results are given in **Table 11.19**.

Table 11.19 : Cumulative noise due to construction activities

Location	Year and Quarter	Cumulative Noise from Construction Activities	Existing Noise	Resultant Noise
Steel Plant Township	4th Quarter, 2016	~33.9	61.7 – 48.0	~61.7 - ~48.2
	1st / 2nd / 3rd Quarter, 2017	~41.2		~61.7 - ~48.8
Village Appikonda	4th Quarter, 2016	~38.3	55.2 - 44	~55.3 - ~45
	1st / 2nd / 3rd Quarter, 2017	~38.3		~55.3 - ~45
Village Islampet	4th Quarter, 2016	~39.1	67.7 – 47.3	~67.7 - ~47.9
	1st / 2nd / 3rd Quarter, 2017	~38.7		~67.7 - ~47.9
All values in dB(A)				

From the above table it can be seen that revamping of existing units inside the plant, construction of the new coke-oven battery (COB5) and construction of the new reservoir have had only negligible effects on noise levels in nearby residential areas. The maximum increase in noise levels at the receptors was only ~1 dB(A) and that too without considering any attenuation by the plant's green belt, other vegetation and other buildings. The actual increase was in all likelihood much less than ~1 dB(A) due to attenuation by the plant's green belt, other vegetation and other buildings. Thus in all likelihood the construction activities would not have led to any measurable increase in ambient noise levels.

Damage to Human Health:

During a Health Survey of people of nearby areas, no cases of silicosis were reported. Some cases of respiratory diseases / disorders were reported. But the patients reported that they were suffering from these ailments even before commencement of construction began and their problems have not worsened after commencement of construction activities. Amongst healthy persons no complaints regarding distress due to airborne dust were reported. So it may be concluded that the construction activities have not affected the health of residents of nearby areas.

Damage to Ecology:

Overall, it can be said that revamping of existing units inside the plant and construction of the new coke-oven battery (COB5) have hardly affected the local ecology. Only very limited loss of green cover has occurred due to clearance of a few small common trees, shrubs and grasses. Since the area is located within the existing plant and adjacent to operating units of the plant, there were hardly any animals in the area except common invertebrates, birds and lizards.

However, in case of construction of the new reservoir loss of green cover is much more as about 23564 trees had to be felled. Fugitive dust generated due to excavation of soil, transport of soil over unpaved roads and dumping of soil. The fugitive dust settled on leaves of plants facing the working areas and probably reduced their photosynthetic activity. These effects were temporary only. The deposited dust was washed off by rain. The fugitive dust generation will come down once construction is completed and the exposed soil is revegetated by RINL as well as naturally.

Since the site of the new reservoir is surrounded by urban settlements and is adjacent to very busy National Highway, there were no large animals in the area. The fauna of the area comprised of only common birds, reptiles and small mammals. Most of these have been displaced and / or scared off by construction activities. However some of the birds and reptiles and small mammals are expected to repopulate the undisturbed vegetation along the reservoir boundaries as well as the revegetated areas.

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11.9 DAMAGES DURING OPERATION PRIOR TO GETTING EC

As discussed earlier, the expansion of Integrated Steel Plant from 6.3 MTPA to 7.3 MTPA started with the revamping and capital repair of existing BF1 followed by BF2. Later on, in order to support the increased Hot Metal Production capacity, expansion/ revamping/ modernization of existing facilities also got started.

11.9.1 Damages due to Proposed New Units (COB5 & Rebar Mill)

In order to anticipate the environmental impacts caused due to the operation of a new unit prior to getting EC, it is assumed that production which has occurred after commissioning and continued till date shall be considered for impacts estimation.

For the proposed expansion, the only two new process units which were proposed to be freshly installed are Coke Oven Battery 5 and Rebar Mill. COB 5 is still in construction phase and has not started operation till date while the proposed Rebar mill is still in planning phase.

Therefore, no environmental impacts are attributable to the proposed new units of the 7.3 MTPA expansion plan due to their operation. The only impacts associated with such units are the impacts due to ongoing construction activities which has already been discussed in previous section.

11.9.2 Damages due to Expanded/revamped Units (BFs 1 & 2, SP1 & SMS2)

(i) Damage to Land Environment

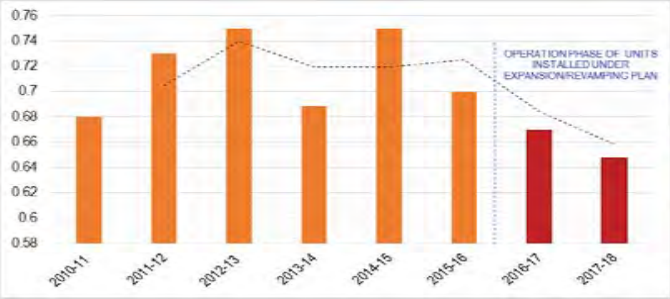
The operation of units under the expansion/revamping project of RINL has been installed within the premises of existing RINL steel plant. Hence, no land acquisition was required for the project and consequently, the existing land use of the area has remained unchanged.

The operation of these units will also generate solid wastes, some of which are hazardous while others are non-hazardous. Some of these wastes shall be reused / re-utilised. Additional solid wastes shall mainly be generated from:

- Coke Oven –Sludge, coke dust, etc
- Sinter Plant – return sinter & ESP Dust
- Blast Furnace – BF sludge, BF Slag, etc
- SMS – LD Slag, SMS Sludge, etc
- Rebar Mill – Mill Scales, scrap, etc

The specific solid waste generation statistics for the plant before and after operation of installed units under expansion/revamping projects of RINL is given in **Figure 11.42**.

Figure 11.42 : Specific waste generation trend over 2010-2018



As evident from the above trend variation of specific waste generation, it is easily deduced that the operation of the units installed under expansion/revamping plan of RINL did not lead to additional generation of solid waste, which might have consequently led to increase in load on the existing land resources for waste management as well as risk of contamination of soil. The decreasing trend indicates increased waste recycling, reuses as well as optimized raw material utilization leading to lesser generation of waste and efficient resource management.

Mitigative Measures Undertaken

As per the existing procedures, all of the wastes generated from the revamped units are reused / re-utilised within the plant. Additionally, other wastes generated during operation / maintenance / annual maintenance of other units / shops etc., like Flue dust from BF, BF/BOF Gas Cleaning Plant sludge, Waste Refractories, iron & steel scrap etc are also utilized appropriately within the plant.

It can be noticed that except some sludge generated from Coke Oven and By Product area, all other wastes are non-hazardous. All the solid wastes are utilized as such in the plant in Sinter Plant/BOF. BF/BOF Slag is sold to cement manufacturers or used for road construction. All hazardous waste were handed over to authorized dealers for disposal as per statutory norms.

(ii) Ambient Air Quality

For the units, which have undergone expansion/revamping, only the proportionate increase in pollution load with respect to increase in production capacity of individual unit shall be considered for damage assessment. For example, since the production capacity of Blast Furnaces 1 & 2 has increased from 2 MTPA to 2.5 MTPA each, 20% of the total expanded capacity (i.e. 0.5 MTPA of 2.5 MTPA capacity) is considered under violation. Therefore, 20 % of the actual pollution load is attributable to violation. The same is estimated to have been caused for the duration since the unit is in operation. The time table for these plant operation activities after revamping is given in **Table 11.20.**

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Table 11.20 : Time Table of Unit operation after revamping

Sl. No.	Unit	Oct 2014	2015				2016				2017				2018			
			Jan	April	July	Oct	Jan	April	July	Oct	Jan	April	July	Oct	Jan	April	July	Oct
1.	BF1 Revamping																	
2.	BF2 Revamping																	
3.	SMS2 Converter 3																	
4.	SMS2 Caster 4																	
5.	SP1 Revamping																	

A graph showing pollution loads of revamped units is prepared based on the monitored values of stack emissions from respective units. Trend of pollution loads when the units are running at full loads at 6.3 MTPA are also plotted onto the same graph. As the units resumed their operations after revamping, a portion of their total emissions is accountable to the violation phase. The trend of the same is also plotted. The graphs are shown in **Figure 11.43- 11.46**.

Figure 11.43 : Graph showing trend of emissions from Blast Furnaces

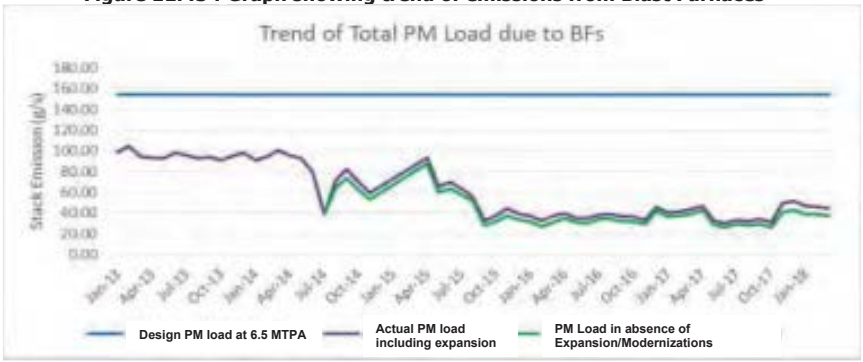


Figure 11.44 : Graph showing trend of emissions from SMSs

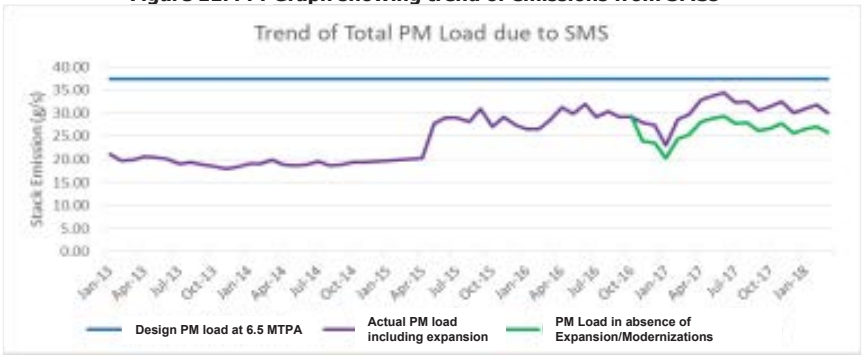


Figure 11.45 : Graph showing trend of emissions from Sinter Plants

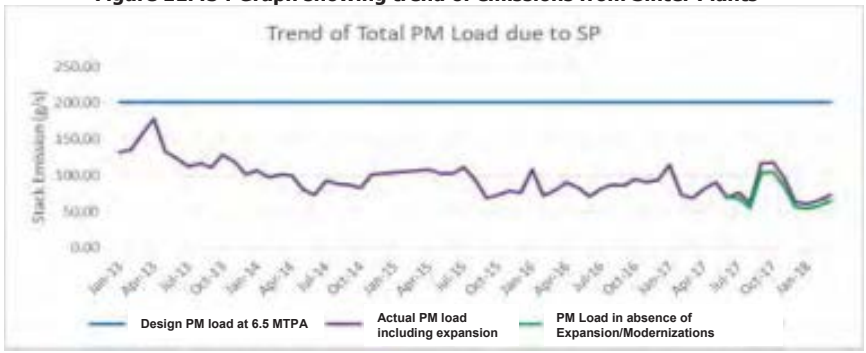
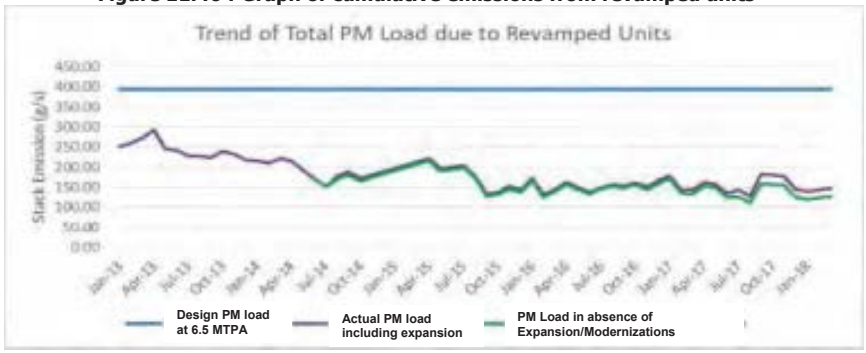


Figure 11.46 : Graph of cumulative emissions from revamped units



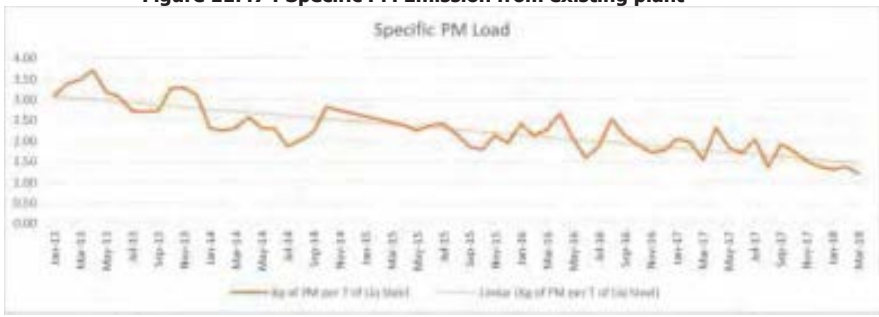
From the above graphs, it can be concluded that even though RINL is gradually increasing the gross hot metal production, the pollution load from the revamped units remained almost constant. And never have the total pollution loads from the units have exceeded the maximum permissible limits at full loads as per EC. However, as a portion of the total load is assumed to have contributed to violation, the maximum PM load attributable to violation is estimated around 23.38 g/s in Nov 2017. At that time, the cumulative pollution loads from the revamped units were 177.39 g/s.

Additional, it can also be observed from the graph that in view of the latest environmental norms, RINL has continually upgraded the pollution control equipment / systems of the existing plant, thereby continually decreasing the emitted pollution load. This has resulted in a reduction in specific pollution loads. This can be attributed to the enhancements in pollution control devices which have been done as part of the revamping activities.

Overall Integrated Steel Plant

In order to access the impacts of ongoing developments in plant units on ambient environment, a graph of total specific pollution loads from all units of VSP is prepared. The same is given in **Figure 11.47**.

Figure 11.47 : Specific PM Emission from existing plant



From the graph, a downward trend is observed in specific emission load from overall plant units. Therefore, an overall positive impact is observed on ambient air due to the ongoing revamping/modernization activities.

Mitigation Measures Undertaken

In order to mitigate various impacts of air pollution during the operation phase, the following measures are implemented in the installed new as well as expansion/revamping units as given in **Table 11.21.**

Table 11.21 : Air Pollution Control Measures in installed Plant Units

Sl. No.	Unit	Details of APC	Design Limit
1.	Raw Material Handling System	• Covered conveyors • DFDS • DE system for material transfer points	• DE stack outlet <50 mg/Nm^3
2.	Sinter Plant	• Process Flue gas cleaning • Stock House dedusting • Sinter cooler DE system	• Stack dust level < 50 mg/Nm^3
3.	Coke Ovens	• Charging & Pushing emissions control • CDQ • Waste heat recovery	• DE stack outlet <50 mg/Nm^3
4.	Blast Furnace	• Cast House Dedusting • Stock House dedusting	• Stack dust level < 50 mg/Nm^3
5.	Steel Melting Shops	• Secondary emission control	• Stack dust level < 50 mg/Nm^3
6.	CRMP Kilns	• Process Flue gas cleaning	• Stack dust level < 50 mg/Nm^3
7.	CPP Boilers	• Process Flue gas cleaning	• Stack dust level < 50 mg/Nm^3

(iii) Effect on Ambient Noise Levels

During construction work, lot of noise was generated at the construction site due to operation of diesel powered construction and material handling machinery, metal fabrication and erection of metallic structures and equipment. However, the noise generated at the construction sites have hardly affected the noise levels at nearby receptors (refer **Table 11.19**). Noise generation due to construction have now ceased. Noise generation by the revamped equipment is not more than the original equipment. Hence ambient noise levels have remained unchanged from what they were prior to the revamping works been taken up.

Mitigative Measures Undertaken

Various measures have been undertaken to reduce noise pollution include reduction of noise at source, provision of acoustic lagging for the equipment and suction side silencers, vibration isolators, selection of low noise equipment, isolation of noisy equipment from working personnel. In some areas, working personnel have been provided with personal protective equipment (PPE) such as ear muffs/ ear plugs and also the duration of exposure of the personnel will be limited as per the norms. The following measures are undertaken:

Technological Measures

- Plugging leakages in high-pressure gas/air pipelines.
- Reducing vibration of high speed rotating machines by regular monitoring of vibration and taking necessary steps.
- Regular lubrication of machinery as per the manufacturers' guidelines
- Design of absorber system for the shift office and pulpit operator's cabin.
- Noise absorber systems in pump houses.
- Noise level at 1m from equipment is limited to 85 dB (A).
- The fans and ductwork are designed for minimum vibration.
- All the equipment in different units are designed/operated in such a way that the noise level does not exceed 85 dB (A).

Management Measures

In a manufacturing plant, with a variety of noise producing equipment, it is not practicable to take technological control measures at all the places. In such cases the following administrative measures are taken:

- High noise zone are marked as "High Noise Zone".
- Workers exposed to noise level are provided with PPE like earmuffs and are advised to use them regularly, while at work.
- Duty hours of workers exposed to noisy work places are regulated to reduce overall noise exposure levels.
- All workers are regularly checked medically for any noise related health problem and if detected, they are provided with alternative duty.
- Periodical monitoring of work zone noise and outside plant premises.

Over and above, all these adopted measures, trees and shrubs belts of substantial density & width have been developed within the surrounding the plant premises to further attenuate the sound levels reaching the receptors within and outside the plant premises.

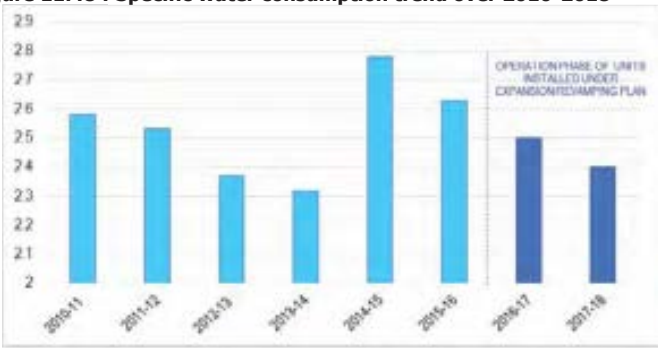
(iv) Effects on Water Resources and Waste Water Management

Total make-up water requirement for the existing steel plant at 6.3 MTPA stage is about 1,36,350 m^3/day (30 MGD) and for township and others it is at 36,360 m^3/day (8 MGD).The water is sourced from existing Yeleru Reservoir. RINL has been accorded permission for withdrawal of 45 MGD from Visakhapatnam Industrial Water Supply Company Limited (VIWSCO). Kanithi Balancing Reservoir has been constructed for storage of raw water.

As indicated in chapter 2, waste water generated in various units of the steel plant are pretreated and recycled within the plant itself. Rejects are discharged into two outfalls and led to waste water treatment / RO plants. From there, the waste water is further recycled and reused within the plant. Only a small portion (200 m^3/hr) of Coke oven and RO plant rejects are discharged into the sea after treatment to meet effluent discharge standards.

The existing water requirement is inclusive of the requirements of the units installed under expansion/revamping units and is less than the quantity of for which RINL has already been accorded permission (45 MGD). Thus, the operational phase does not require any additional water and hence has no negative impact on the existing water regime of the area. The same is evident from the specific water consumption of the plant also, as shown in **Figure. 11.48** below.

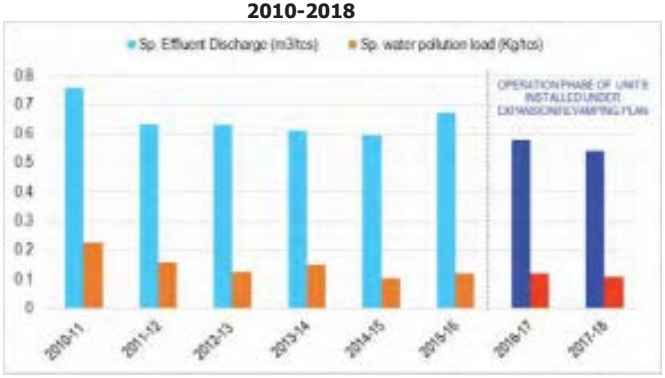
Figure 11.48 : Specific water consumption trend over 2010-2018



The above trend indicates a clear improvement in water utilization by the expansion/revamping project, indicating optimized water consumption and minimal negative impact on the existing water regime due to water use for plant purposes.

Another aspect of environmental damage of the water resources is the effluent discharge by the plant. To quantify the impact due to effluent discharge, the specific effluent discharge and the specific water pollution load for the period before installation of the new units under expansion/revamping project of RINL was done with existing data of the same. The same is shown in **Figure 11.49.**

Figure 11.49 : Specific effluent discharge and specific water pollution load trend over 2010-2018



As evident from the above trend variation of specific effluent discharge and specific water pollution load, it is easily deduced that the operation of the units installed under expansion/revamping plan of RINL did not lead to excessive generation of effluent as well as any increase in water pollution load on the existing water resources. The reducing trend indicates an improvement of plant's recycling, reuses and treatment systems for optimized water consumption and efficient water resource management.

Mitigative Measures Undertaken

Following schemes have been implemented in the existing steel plant for maximum waste water recycling-

- Existing Coke ovens have been provided with separate ETP involving Mechanical, Biological & Chemical treatment of coke oven effluents. The treated waste water is recycled to the maximum possible extent in the plant; the unutilized treated effluent is discharged into the sea.
- Clarification and recycling of DCW from gas cleaning plant of BF and SMS
- Oil skimming and filtration of mills waste water followed by clarification.
- Utilization of CT Blow Down in slag granulation, dust separation and ash handling.

(v) Damage to Ecology

The revamped units do not utilise any ground water. The effluents generated at the revamped units are utilised for industrial purposes within the plant itself. Thus resumption of operations at the revamped units have not affected the water environment either.

Revamping of existing pollution control systems to meet the latest norms / standards have been part of the whole revamping exercise. So although production has increased, quantum of air pollutants has actually decreased. Thus there may have been some improvement in air quality in and around the steel plant. Ecological impacts of the revamping works were confined to the project areas and their immediate vicinity only. The revamping works have not affected the air quality in and around the plant. Air quality may have profound effects on ecology. Since resumption of operations have not affected the air quality, in all likelihood ecology has also not been affected.

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Since air quality, noise levels and water quality have not been affected by resumption of operations at the revamped units, there have been no impacts on human health either.

11.10 BUDGET FOR ENVIRONMENT RESTITUTION AND PROTECTION

RINL's Visakhapatnam Steel Plant (VSP) has always aimed at improving the lives of people living around the steel plant by way of its dedicated Corporate Social Responsibility (CSR) plan and activities therein. Despite RINL-VSP's poor financial performance in the last few years, it has not turned away from its commitment to improving the lives of communities living in the area, and has continually contributed its resources for improvement of the lives of people living in the peripheral areas.

As part of RINL-VSP's commitment to offset even the most insignificant damage that has been caused due to its activities under its expansion/revamping project, a detailed budget of Rs. 200 lakhs has been dedicatedly allocated for the restitution and remediation of the damages identified to the environment as well as the community in the peripheral areas.

The detailed Remedial Measures and Natural & Community Resource Augmentation Plan – Budgetary Allocation is given in **Table 11.22** below:

Table 11.22 : Ecological Damage Assessment and Remediation Plan

Sl. No.	Environmental Attribute	Activity	Issues	Related Damages	Measures already been taken	Remediation plan	Estimated cost
1	Air environment	**I. Construction of new units/facilities:** KBR2 1. Site clearance 2. Excavation activities 3. Transport of excavated material 4. Controlled Blasting to break up occasional large boulders 5. Handling of excavated soil, rocks & debris COB5 1. Site clearance 2. Transport of construction material 3. Construction activity Guard pond 1. Site clearance 2. Excavation & handling of soil **II. Revamping of existing units and operation (BF1&2, SP2&2, SMS1&2)** Revamping stage: 1. Construction activity	1. Fugitive dust emissions due to ground clearing and leveling activities at all new sites 2. Fugitive dust emissions during excavation and handling of soil & debris at KBR2. 3. Emissions due to fuel combustion by diesel powered HEMMs & construction equipment 4. Fugitive emissions from paved/unpaved roads due to vehicular movement. 5. Fugitive emissions from external soil dumps. 1. Emissions due to fuel combustion by vehicles 2. Fugitive dust emission from paved/unpaved roads due to vehicular movement 3. Emissions during Process and during combustion through stacks 4. Fugitive emissions from	1. Deterioration of air quality due to increase in dust concentration leading to respiratory problems. 2. Deposition of particulates on buildings, roads etc. leading to damage to property as well as disturbance to the aesthetics of the area. 3. Air pollutant deposition as well as gaseous emissions from vehicles and heavy machinery can cause damage to leaves of local flora. 4. Increase in air pollutant concentrations in the ambient air due to emissions releasing in the atmosphere through stacks	1. To prevent dispersion of fugitive emissions during excavation activity near reservoir, around the reservoir site especially residential area side covered with GI sheets 2. To prevent Depletion of ground water during excavation Grout curtains were made. 3. Ground water was pumped to nearby rain water harvesting ponds. 4. Regular water sprinkling done to suppress fugitive dust. 5. Covered vehicles to transport raw material, debris etc, 6. Allowed PUC certified vehicles 7. Up gradation pollution control equipment in BF, SP and SMS to meet the standards 8. Dust suppression and dust extraction system at all material transferring points,	1. Plantation near reservoir area 2. Plantation beyond plant boundary 3. Water sprinkling on the roads 4. Health Check-ups through Medical camps 5. Infrastructure support to public health centers /Govt. Hospitals	1200 plants @ Rs 250/plant with 2 years Maint. = Rs **3.0 lakhs** 1200 plants @ Rs 250/plant with 2 years maint. = Rs **3.0 lakhs** 5000L – 5 trips/day x Rs 800 @ 4 times in a month for one year= **Rs 2.0 lakhs** One camp/ qtr. Rs 2.5 L X 4 **= Rs 10 lakhs** Wheel chairs - 25nos @ Rs 15000 Stretchers- 25nos @ Rs5000 Beds -100nos @ Rs5000

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Sl. No.	Environmental Attribute	Activity	Issues	Related Damages	Measures already been taken	Remediation plan	Estimated cost
		2. transportation of construction material and debris 3. Transportation of equipment/machinery Operation stage: 1. Combustion of fossil fuels 2. Conveying raw material 3. Movement of tucks for material movement	the shops 5. Emissions due to fuel combustion by vehicles 6. Fugitive dust emission from roads due to vehicular movement			6. Erection of enclosures around the project site during construction(2 lakhs)	**Total Rs10 lakhs** for 5 PHCs 400 Sqm (ie., 80 RM of 5 M height) @ 500 per Sqm by using inhouse material **Rs.2 Lakhs** **Total = 30 lakhs**
2	Noise levels	**I. Construction of new units/facilities:** (KBR2, COB5, & Guard pond) 1. Vehicular movement 2. Excavation activity 3. Construction activity **II. Revamping of existing units and operation (BF1&2, SP2&2, SMS1&2)** Revamping stage: 1. Revamping activities of existing facilities 2. Vehicle movement	1. Generation of noise due to tucks for transportation of excavated material & machinery 2. Generation of noise due to blasting, using machinery for excavation of soil 3. High noise generation during material handling, metal fabrication & Equipment erection 1. Noise generation during Site preparation activities including debris removal etc., using heavy machinery 2. Noise generation due to Vehicular movement for transportation of	Increase in ambient noise levels in habitation areas may lead to disruption of sleep cycles in people, hearing losses as well as annoyance to patients and children. Increased noise and vibrations may scare away animals in nearby areas	1. Avoided excavation during night time 2. Control blasting was done at KBR2. The maximum allowable peak particle velocity is fixed at 10mm/s which is the safest limit of the structural damage as per DGMS guidelines. 3. Acoustic enclosures for High noise equipment the noise levels will be limited to 85 dB(A) in the working area. 4. Where ever it is not to cover the equipment, personal protective systems are provided to the working personnel. 5. Reducing vibration of high speed rotating machines by regular monitoring of vibration and taking necessary steps	1. Plantation near habitations (covered in sl 1) 2. Cochlear Implantation for poor children with hearing impairment	Five surgeries for implantation of cochlear for 5 children @ Rs 8.0 L = **Rs 40.0 lakhs**. **Total = 40 lakhs**

Sl. No.	Environmental Attribute	Activity	Issues	Related Damages	Measures already been taken	Remediation plan	Estimated cost
		Operation stage: 1. Operation of equipment such as compressors, blowers ID fans etc . Vehicle movement	construction material & labour during construction 3. High noise generation during operation of plant machinery				
3	Water environment	**I. Construction of new units/facilities: (KBR2, COB5, & Guard pond)** 1. Storm water run offs during construction 2. Interference of Ground water table **II. Revamping of existing units and operation (BF1&2, SP2&2, SMS1&2)** 1. Storm water run offs during construction 2. Use of fresh water for plant operations	1. Increase in Suspended Solids in storm water run offs during monsoon season 2. Obstruction of groundwater percolation due to ground water cementing 3. Percolation of contaminated groundwater 1. Generation of effluent from different unit of the plan 2. Use of water from community resources for plant purposes	1. Increase in suspended solids in the nearby surface water bodies 2. Reduction in ground water recharging due to paving, 3. increasing run off factor 4. Contamination of ground water 5. Obstruction of natural drains and consequent disruption of drainage pattern 1. Increase in pollutant load, leading to contamination of community water resources in the area 2. Decrease in water availability due to exhaustion of community water resources	1. Catch pits are provided to arrest suspended solids 2. To prevent Depletion of ground water during excavation Grout curtains were made. 3. Ground water was pumped to nearby rain water harvesting ponds 4. Natural drains were diverted 5. complete recirculating cooling system for the equipment cooling after proper treatment 6. Treated effluent discharged from the plant will be utilised for dust suppression. 7. RINL has developed two nos. of rain water harvesting ponds from which about 5.48 Mil cum water can be recovered per year. 8. Garland drain and retaining wall will be constructed at the toe of the dumps to prevent wash off from the dump	1. Rain water harvesting in communities. 2. Recharge pits 3. Construction of Check dams 4. Supply of Drinking Water(15 lakhs)	3mt X4mt rain water conservations pits @Rs 50,000 X 12 **=6 Lakhs** @Rs 50,000 X 6= **Rs 3.0 Lakhs** Each dam @2.0 Lakhs X3 = **6 Lakhs** 15 trips /day @825 X4 months =**Rs 15 Lakhs** **Total = 30 lakhs**

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Sl. No.	Environmental Attribute	Activity	Issues	Related Damages	Measures already been taken	Remediation plan	Estimated cost
4	Land environment	**I. Construction of new units/facilities: (KBR2, COB5, & Guard pond)** 1. Location of facilities 2. Inflow of people **II. Revamping of existing units and operation (BF1&2, SP2&2, SMS1&2)** 1. Solid wastes generation 2. Handling of chemicals/raw materials	1. Change of land use 2. Green cover 3. Stress on common property resources 1. Storage of solid wastes 2. Spillages of chemicals/raw materials	1. Land used for industrial purpose 2. Degradation of green cover 3. Loss of top soil 4. Increase in demand of land near project site for housing of construction labour. 5. Change in land use of the area due to increase in habitation of construction workers, converting vacant areas to settlements and loss of access to existing land uses such as roads etc. 6. Creation of new land uses such as roads etc. for catering to infrastructural needs of labour 1. Increase in land requirement for disposal of solid wastes generated 2. Change in land use of the area 3. destruction of existing land use such as existing access routes etc.	1. Facilities are proposed in already acquired land for industrial use. 2. Locations are not having any important plant species 3. Necessary infrastructure facilities for labour already in place. 4. Top soil is preserved for biological reclamation of the over burden dumps 5. Maximum utilization of solid wastes 6. Standard SOPs in place for Handling of hazardous chemicals 7. Major raw material transported through covered conveyers.	1. Providing greenbelt resistant native species within the proposed plant units in place of shrubs 2. Biological reclamation of un used excavated soil	60,000 plants x @Rs 100= **Rs 6 Lakhs** Out of 35.50 Ha, 12 Ha land reclaimed for three years @ 11110 per year by broad casting seeds **Rs.4 Lakhs** **Total = 10 lakhs**
5	Ecological	**I. Construction of new**	1. Loss of Green cover	1. Loss of green cover	1. Facilities are coming up in	1. Distribution of free	8000 plants

Sl. No.	Environmental Attribute	Activity	Issues	Related Damages	Measures already been taken	Remediation plan	Estimated cost
	Environment	**units/facilities: (KBR2, COB5, & Guard pond)** 1. Site clearance 2. Excavation activities 3. Transport of excavated material 4. Blasting 5. Dumping of un used soil	2. Air Pollution from construction activity 3. Surface and ground water contamination	leads to increase the pollution 2. potential of the area 2. Clearance of vegetation due to site clearance / preparation leads to 3. generation of fugitive dust, noise, ground vibrations (due to blasting of rocks) 4. dewatering due to excavations 5. Generation of fugitive dust and noise due to movement of heavy vehicles as well as construction activities 6. Emission of particulate matter & gases (NOx, CO) from engines 7. Loss of animals' habitat 8. Damage to vegetation due to dust deposition. 9. Scaring away of fauna 10. Damage to nearby buildings / structures. 11. Increased siltation in receiving water body. 12. Damage to vegetation and human health due to	the already acquired land of RINL and kept for future industrial activity. 2. Proposed areas comprises of dense scrub and grass lands and bulk of the vegetation comprises of *Prosopis juliflora* and comes under low risk category as per environment, forest, science &technology Department, Govt of AP. 3. Catch pits are provided to arrest suspended solids. 4. To prevent Depletion of ground water during excavation Grout curtains were made. 5. Ground water was pumped to nearby rain water harvesting ponds Natural drains were strategically diverted 6. Barricades were provided to restrict the spread of fugitive emissions to nearby residential areas. 7. Top soil was preserved for bio-reclamation of unused soil dumps.	saplings to peripheral villagers preferably native plants 2. Participating in Green Visakha project 3. Release of algae eating and larvae eating fish into water bodies	x@ Rs 100=**8 lakhs** 15,000 block plantation @Rs 200 =**Rs 30 Lakhs** Rs.1 lakh per year for 2 years **=Rs.2 Lakhs** **Total = 40 Lakhs**

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Sl. No.	Environmental Attribute	Activity	Issues	Related Damages	Measures already been taken	Remediation plan	Estimated cost
		II. Revamping of existing units and operation (BF1&2, SP2&2, SMS1&2) 1. Revamping of existing units 2. Process emissions during operation	1. Generation of fugitive dust due to vehicular movement for transport of machinery and construction material. 2. Emission of particulate matter, gases (NOx, SO_2, CO, H_2, CH_4, NH_3, C_2H_6, C_6H_6, Phenols, H_2S etc.) 3. Generation & release of waste water	air emissions from engines as well as dust. 1. Damage to vegetation due to exposure to process emissions: Project site located inside integrated steel plant far from any major ecosystem. 2. Damage to human health due to exposure to process emissions and heat 3. Disturbance to fauna Contamination of receiving water body & surrounding habitats due to discharge of treated effluents: Increased incidence of diseases spread by insects which breed in water	1. Part of treated effluents utilized for industrial purposes in plant. Balance discharged after quality checks. 2. Increased biodiversity due to large surface water body: This is a beneficial impact 3. 5297688 number of trees planted in around by RINL 4. RINL has developed two nos of rain water harvesting ponds from which about 5.48 Mm^3 water can be recovered per year.		
6	Socio-economic Condition	**I. Construction of new units/facilities: (KBR2, COB5, & Guard pond)** 1. Construction activities	1. Emissions (both fugitive and other emissions) due to site activities including domestic activities such as firewood burning for cooking and heating purposes during cold weather conditions, construction activities as well as vehicular	1. Increase of migration of population(short term) leading to 2. increased stress on local infrastructure due to the influx of construction labour 3. Health issues to inhabitants as well as construction workers because of decrease	1. Secure facilities including labour camps with basic facilities like changing rooms, toilets established by the contractors during the construction phase. 2. Adequate provision for potable water supply facilities and sanitation facilities. 3. Arrangement of first aid kits	1. Providing community toilets in nearby villages/communities 2. Providing financial assistance for maintenance of	Two Nos of Porta cabin toilets (4 male & 4 female) @ 10.0 Lakhs each =**Rs 20 Lakhs** Skill dev. programmes for 300

Sl. No.	Environmental Attribute	Activity	Issues	Related Damages	Measures already been taken	Remediation plan	Estimated cost
			movement during construction phase . 2. Influx of construction labour (short-term migration) 3. Creation of new infrastructure for construction workers (short term)	in air quality due to emissions. 4. Sanitation and hygiene issues in area because of large number of people working/residing during construction activities.	at construction sites. Medical assistance from Primary Health Centre in case of medical exigencies also ensured. 4. Provision for Safety equipment (PPE) at site for construction workers and strict monitoring of adherence of safety protocols for construction activities ensured. 5. Supervision of labour activity within the plant works.	toilets in schools 3. Providing facilities / support for education and skill development of local youth.	beneficiaries@ Rs 5000 =**Rs 15.0 lakhs** Digital class rooms @ 1.50 lakhs each X10=**Rs 15.0 lakhs**
		II. Revamping of existing units and operation (BF1&2, SP2&2, SMS1&2) 1. Revamping activities 2. Project operations •Process emissions and fugitive emissions in the air environment •Creation of employment opportunities •Development of indirect employment opportunities	1. Fugitive emissions during revamping of existing units due to vehicular movement and construction activities 2. Increased labour movement and vehicular movement for construction material inside plant area	1. Increased labour movement inside plant area leading to safety issues. 2. Increase in employment generation both direct as well as indirect			**Total = 50 Lakhs**
Grand Total (A)							**200 Lakhs**

Total budget allocated for Natural & Community Resource Augmentation Plan for the next three years i.e. 2018-19, 2019-20 & 2020-21 is **Rs 720 lakhs.**

Natural & Community Resources Augmentation Plan

The remediation plan concentrated on site activity and presented measures related to mitigation / control of pollution during construction. The impact of the construction activity related to transport of materials, employment, and resource consumption have a bearing on the surrounding areas. Hence it is proposed to prepare 'Natural & Community Resources Augmentation Plan' to compensate the impacts. Breakup of cost of activities to be carried out for Natural & Community Resource Augmentation is given in **Table 11.23** below.

Table 11.23 : Breakup of activities to be carried out for Natural & Community Resource Augmentation Plan

Natural Resources Augmentation Plan

Sl. No.	Activity	Year wise implementation Plan & Budgetary Provision during Operation Phase (Rs in lakhs)			Total Budgetary Provision (Rs.in lakhs)
		2018-19	2019-20	2020-21	
1	Raising and maintenance of block/Avenue plantation at various places in GVMC area @Rs 250 X 30,000 nos in three years.	15.00	30.00	30.00	**75.00**
2	Providing drinking water through gravity in tribal villages by conservation of water @Rs 5.0 lakhs /villages. Total 10 villages will be provided drinking water in 3 years.	10.00	20.00	20.00	**50.00**
3	Installation of rainwater harvesting systems in common/public buildings /school buildings @Rs 100000/- building avg. total 45 buildings	5.00	20.00	20.00	**45.00**
4	Development of greenery/plantation /park in the surrounding areas of KB Reservoir	4.00	24.00	24.00	**52.00**
5	Improving of solid waste management systems like provision of Bins, waste management vehicles, machinery, compost machines etc. (@one compost m/c-10 lakhs+20lakhs- one vehicle for garbage collection + 25 bins @10,000 each)	5.00	25.00	25.00	**55.00**

Sl. No.	Activity	Year wise implementation Plan & Budgetary Provision during Operation Phase (Rs in lakhs)			Total Budgetary Provision (Rs.in lakhs)
		2018-19	2019-20	2020-21	
6	Installation of solar street lights/solar power systems etc, in communities	1.00	5.00	5.00	**11.00**
	Total	**40.00**	**124.00**	**124.00**	**288.00**

Community Resources Augmentation Plan

Sl. No.	Activity	Year-wise implementation Plan & Budgetary Provision during Operation Phase (Rs in lakhs)			Total Budgetary Provision (Rs. In lakhs))
		2018-19	2019-20	2020-21	
1	Providing free education to BPL children (around 500 Nos) from surrounding the Plant & Mines Rs @ 20,000/year/child	25.00	100.00	100.00	**225.00**
2	Creation of educational infrastructure in schools like additional class rooms, duel desk benches lab equipment's, sports equipment in surrounding areas the plant & mines for promoting education.	5.00	25.00	25.00	**55.00**
3	Support to Persons with disabilities by providing assistive devices like ,wheel chairs, artificial limbs, hearing aids ,vision aids etc	5.00	10.00	10.00	**25.00**
4	Providing sanitation facilities ,like installation of RO plants, construction toilets, construction of hand wash stations in schools /public places	5.00	16.00	16.00	**37.00**
5	Providing Medical infrastructure like Ambulances, X ray m/cs , equipment to Govt hospitals /PHCs/cancer hospital etc.	10.00	20.00	20.00	**50.00**
6	Empowering unemployed through skill development programmes like LMV tailoring, welding, solar mechanic, mobile repair, plumbing, home Nurse, beautician courses etc @ Rs 7500/head benefiting 460 persons in three years.	10.0	15.00	15.00	**40.00**
	Total	**60.00**	**186.00**	**186.00**	**432.00**

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Total Budgetary Provision made towards the implementation of Natural & Community Augmentation Plan (Rs in lakhs)

Year	2018-19	2019-20	2020-21	Total
Natural Resources Augmentation Plan	40.00	124.00	124.00	288.00
Community Resources Augmentation Plan	60.00	186.00	186.00	432.00
Total Budgetary Provision	**100.00**	**310.00**	**310.00**	**720.00**

Summary of budgetary allocation with respect to Remediation and Natural & Community Resource Augmentation Plan for the present study is provided in **Table 11.24** below.

Table 11.24 : Budgetary allocation with respect to Remediation and Natural & Community Resource Augmentation Plan for the present study

Sl. No	Description	Estimated cost (Lakhs)
1	Estimated cost of damage/remediation with respect to ecological aspects	**200**
2	Natural & Community Resource Augmentation Plan for three years	**720**
3	Total Budget allotted	**920**

RINL will deposit a bank guarantee equivalent to the above mentioned amount of **Rs 920 lakhs** towards remediation plan and natural & community resource augmentation plan.

11.11 CONCLUSIONS

From the above discussion, it can be safely assumed that the contribution of construction as well as operation activities of RINL's expansion/revamping project are **marginal in nature** and are mostly limited to the existing plant complex.

Also, as the plant has never been able to produce even at 6.3 MTPA capacity, which is its rated capacity as per existing Environmental Clearance granted, it has **not been able to derive any actual economic benefit** out of the expansion.

Over the 4 years of plant operation during expansion period, an overall loss is observed by RINL. However, breakup of cost for proportionate income and expenses from the revamped units indicate a cumulative profit of **Rs 174.5** Crores in 4 years period of plant operation.

RINL-VSP aims to compensate for whatever minimal damages identified due to project, by way of a **dedicated Natural & Community resource augmentation plan with an earmarked budget** for implementation of the same. RINL will spend **Rs 920 lakhs** towards remediation plan and natural & community resource augmentation plan for restitution of damages caused due to violation.

12.0 DISCLOSURE OF CONSULTANTS FOR EIA REPORT

12.1 INTRODUCTION

The "*EIA/EMP report for expansion of Integrated Steel Plant from 6.3 MTPA to 7.3 MTPA liquid steel within the premises of Vizag Steel Plant*" has been prepared by MECON Limited, a Public Sector undertaking under the Ministry of Steel Government of India. MECON Limited is accredited by QCI/NABET for preparing EIA/EMP reports in 16 major sectors, including Metallurgical industries (ferrous & nonferrous) – both primary and secondary vide their certificate no. Certificate no: NABET/EIA/1619/RA0068. This certificate was valid up to 2nd October, 2019. MECON has been renewed for 15 sectors as well as the EIA sector for Nuclear industries has been added to the existing accredited list of sectors as communicated by NABET.

MECON's Environmental Engineering Division is a multi-disciplinary group of engineers, specialists and scientists whose services are backed up by a sophisticated Environmental Engineering Laboratory recognised by Ministry of Environment, Forests and Climate Control and several State Pollution Control Boards. There are specialists in the field of hydrogeology, geology, ecology, forestry, agricultural statistics, microbiology, soil sciences, biotechnology, audit & socio–economics and engineers from different disciplines. MECON has been preparing regularly EIA / EMP reports for different projects besides, rendering services for rehabilitation action plan for affected people, inspection and audit including environmental audit, etc. The details of sectors accorded to MECON under QCI-NABET scheme for accreditation of EIA consultant organization is given in **Table 12.1**

Table 12.1 : Details of Sectors Accorded To MECON under the QCI-NABET Scheme for Accreditation of EIA Consultant Organization

Sn.	Sector No.		Name of Sector	Cat.
	As per MoEFCC Notification	As per NABET Scheme		
1.	1 (a) (i)	1	Mining of minerals including Opencast / Underground mining	A
2.	1 (b)	2	Offshore and onshore oil and gas exploration, development & production	A
3.	1 (c)	3	River valley, hydel, drainage and Irrigation projects	A
4.	1 (d)	4	Thermal Power Plants	A
5.	1(e)	5	Nuclear power projects and processing of nuclear fuel	
6.	2 (a)	6	Coal washeries	A
7.	2 (b)	7	Mineral beneficiation including pelletization	A
8.	3 (a)	8	Metallurgical industries (ferrous & nonferrous) – both primary and secondary	A
9.	6 (a)	27	Oil & gas transportation pipeline (crude and refinery / petrochemical products), passing through national parks / sanctuaries / coral reefs / ecologically sensitive areas including LNG terminal	A
10.	6 (b)	28	Isolated storage & handling of hazardous chemicals (as per threshold planning quantity indicated in column 3	B

Sn.	Sector No.		Name of Sector	Cat.
	As per MoEFCC Notification	As per NABET Scheme		
			of schedule 2 & 3 of MSHIHC Rules 1998 amended 2000	
11.	7 (b)	30	All ship breaking yards including ship breaking units	A
12.	7 (c)	31	Industrial estates / parks / complexes / areas export processing Zones (EPZs), Special Economic Zones (SEZs), Biotech Parks, Leather Complexes	A
13.	7 (e)	33	Ports, harbours, jetties, marine terminals, break waters and dredging	A
14.	7 (f)	34	Highways, railways, transport terminals, mass rapid transport systems	A
15.	8 (b)	39	Township and Area development projects	A

Copy of certificate of accreditation by NABET/QCI including re-accreditation is attached as part of the EIA/EMP report. MECON has also been accredited for functional areas. Details of the Functional Area Experts of MECON working in Environmental area are given in **Table 12.2.**

Table 12.2 : Brief Description of the Functional Area Experts of MECON

Sn.	Functional area code	Functional Area Approved
1	AP	Air Pollution Prevention, Monitoring & Control
2	WP	Water Pollution Prevention, Control & Prediction of Impacts
3	SHW	Solid Waste and Hazardous Waste Management
4	SE	Socio-Economics
5	EB	Ecology and Biodiversity
6	HG	Hydrology, Ground Water & Water Conservation
7	GEO	Geology
8	SC	Soil Conservation
9	AQ	Meteorology, Air Quality Modeling & prediction
10	NV	Noise & Vibration
11	LU	Land Use
12	RH	Risk Assessment & hazard Management

All EIA coordinators and Functional area experts are in-house experts of MECON.

12.2 PROFILE OF EIA/EMP CONSULTANT

MECON Limited - a Government of India Enterprise Mini Ratna company under Ministry of Steel (established in 1959), is a premier multi-disciplinary consultancy organisation in the country. MECON's corporate Office is at Ranchi and has branches at Bengaluru, New Delhi, Bhubaneshwar, Kolkata, Burnpur, Vishakhapatnam, Bhilai, Durgapur, Rourkela, Bokaro, Mumbai etc. and also has its establishment at Lagos, Nigeria etc. MECON has till date completed ~5000 consultancy and EPC assignments covering wide range of field and services. The company is registered with International financial Institutions like World Bank (WB), Asian Development Bank (ADB), EBRD, ADB, UNIDO etc. MECON is the first engineering and consulting organization in the country to be accredited with ISO 9001 (now ISO 9001: 2000) by RWTUV of Germany. There are about 36 specialized disciplines

to cater to the various technical needs of the industries and infrastructural development. MECON's services include the whole range of work relating to setting up of industrial projects in the field of Environment, power, metallurgy and mining, ferrous and non-ferrous, chemicals/petrochemical and allied engineering complexes including specialized fields, such as, Defence Projects, mints/currency note presses. Services for Environmental engineering are provided to industries through MECON's Environmental Engineering Division.

MECON entered the business of Environmental Consultancy during the mid-1980s i.e. at the inception of this field in India. MECON also set up its own environmental engineering laboratory to undertake micro-meteorological, air quality, water quality, noise levels, soil quality and soil quality monitoring. By the time the EIA Notification came into force, MECON had already prepared a number of Environmental Impact Assessment and Environmental Management Plan (EIA/EMP) reports for various industries covering Integrated Steel Plants, Thermal Power Plants, Cement Plants, nuclear fuel processing complexes, open-cast / underground Mines (Uranium, Coal, Iron, Manganese, copper) etc. MECON is also called upon to perform the task of being a consultant-adviser to the Government of India and foreign governments on the technical front.

With this unique back up from independent specialized sections, MECON's consultancy services in the field of Environmental Engineering & Management includes but not limited to Project Specific EIA/EMP study, Regional EIA Study, ISO:14000 Consultancy, Environmental Audit, Ground water contamination study, Preparation of industry specific norms for CPCB, ETP/STP/Tailing disposal (FR/DPR/DE/Turnkey execution), Socio-Economic study, Rehabilitation & Resettlement study, Environmental Baseline data generation, Environmentally compatible land use zoning, Air Pollution (Dust Suppression & Dust Extraction Systems) /Water Management, Ecological study (Terrestrial & Aquatic/Marine), Effluent Treatment Plant, Sewage Treatment Plant and Rainwater Harvesting. The Environmental Engineering section of MECON has provided services for more than 350 numbers of projects.

Total manpower strength of MECON is more than 1200. MECON's Environmental Engineering Section is a multi-disciplinary group of about 25 engineers, specialists and scientists whose services are backed up by a sophisticated Environmental Engineering Laboratory.

MECON's Environmental Engineering Section is well equipped with various computerized predictive tools required for carrying out environmental studies and participates regularly in inter laboratory quality assessment exercise conducted by CPCB. **Table 12.3** lists the software models in use for Environmental studies.

Table 12.3 : List of Computer Models for Environmental Studies

Developed in-house	
	Multisource Dispersion Model based on Gaussian Model
	Screening Model to determine Max. GLC at most unfavorable meteorological condition
	Determination of Atmospheric stability
	Noise Propagation Model
	Subsidence Model (Coal)
	Coastal Zone Dispersion Model
	Model for preparation of Wind Rose
Procured	
	USEPA approved models
	Industrial Source Complex Short Term (ISCST)
	AEROMOD for Air Quality prediction
	Industrial Point Source Complex Long Term (ISCLT)
	Multiple Point Source Model With Terrain Adjustments (MPTER)
	Fugitive Dust Model (FDM)
	Qual 2E River Model
	CALINE – 3 (Highway Model)
	Complex Terrain Dispersion Model (CTDM PLUS)
	Groundwater Modeling System (GMS)
	Surface Water Modeling System (SMS)
	Watershed Modeling System (WMS)
	Green Belt Model
	PHAST Model for Risk Assessment

Environmental division has a sophisticated environmental engineering laboratory equipped with modern state of the art apparatus/instruments for carrying out physico-chemical and biological analysis of environmental parameters. Environmental Engineering laboratory of MECON is certified with BS OSHAS: 18001: 2007 with Occupational Health and safety management.

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ANNEXURES

Annexure 1.1

No. J-11011/196/2005 – IA II (I)
Government of India
Ministry of Environment & Forests
E-mail: plahujara@yahoo.com

Paryavaran Bhawan,
C.G.O. Complex, Lodi Road,
New Delhi – 110 003
Dated the August 11, 2005

To

The Managing Director
M/s Rashtriya Ispat Nigam Limited
Visakhapatnam Steel plant
6th Floor, Prakashdeep Building
7, Tolstoy Marg, New Delhi-110001

Sub. Expansion of Hot metal (Steel Plant) from 4.0 to 6.5 million tonne per annum (MTPA) at Vishakapatnam, Andhra Pradesh by M/s Rashtriya Ispat Nigam Limited.

Sir,

This has reference to your letter no. EnMD/87/546 dated 20th May, 2005, along with application, EIA /EMP reports and related project documents and subsequent communications/clarifications furnished by you vide your letters dated 1st June, 2005 and 10th June, 2005 for environmental clearance on the above mentioned project. The Ministry of Environment and Forests has examined your application. It is noted that expansion proposal involves increase in the hot metal production from 4.0 Million Tons per Annum(MTPA) to 6.5 MTPA, liquid steel production from 3.5 to 6.3 MTPA, saleable steel from 3.11 to 6.12 MMTPA, coal chemicals from 0.18 MTPA to 0.23 MTPA and power generation from 286 MW to 394MW.

It is noted that company is in possession of 4827 ha. of land area. The expansion will be carried out within the existing plant premises for which 407 ha. of area is required. No additional land will be required. The project does not involve diversion of forest land and displacement of people. Additional water requirement of 13 MGD would be met from the Yeleru Reservoir for which the company has entered into bulk supply agreement with Visakha Industrial Water Supply Company and Government of Andhra Pradesh. It is noted that the specific water consumption for steel making is 4m3/tonne of the product by collection of treated waste water, leakage water recycling and reuse. Solid waste would be generated in the form of Blast furnace slag (6700TPD), steel melting shop slag (2700TPD), gas cleaning sludge (144TPD), dust extraction system dust (1200 TPD), mill scale(428TPD) and used refractory bricks (100TPD). Thus, total solid waste generation would be 11692 TPD. Besides, 2053 TPD of boiler ash will be generated of which 1453 TPD will be stored in the ash pond and 600 TPD would be the dry ash. To meet the coke requirement, 3 coke oven batteries are being operated and 4th coke oven battery is under construction, which will operate as an additional battery from January, 2007 onwards. Also pulverized coal injection will be implemented in all three blast furnaces. Public hearing of the project was held on 26.03.2005. The Andhra Pradesh Pollution Control Board has granted NOC on 19.05.2005. Total cost of the project is Rs. 8211 crores.

2.0 The Ministry of Environment and Forests hereby accords environmental clearance to the above project under the provisions of EIA Notification dated 27th January, 1994 as amended subsequently subject to strict compliance of the following Specific and General conditions:

A SPECIFIC CONDITIONS

i. The gaseous emissions from various process units shall conform to the load/mass based standards notified by this Ministry on 19th May, 1993 and standards prescribed from time to time. The state Board may specify more stringent standards for the relevant parameters keeping in view the nature of the industry and its size and location. At no time the emission level shall go beyond the prescribed standards. In the event of failure of any pollution control system adopted by the unit, the respective unit shall not be restarted until the control measures are rectified to achieve the desired efficiency.

As reflected in the EIA/Environmental Management Plan report, the company shall undertake water conservation measures by adopting closed loop water recirculation system, recycling of direct contaminating cooling water through cooling tower, use of cooling tower blow down and slag granulation and dust suppression. The wastewater from gas cleaning plant, rolling mill, power plant, cooling tower blow down shall be treated in wastewater treatment plants. The coke oven effluent shall not release 2880m3/d. Existing effluent treatment plant shall be upgraded to treat the coke oven effluent and treated effluent shall comply with the prescribed standards. The company shall make efforts to maximize the reuse of the treated effluent. The surplus treated waste water shall be stored in the holding pond for use in the lean period. The overflow shall be discharged through a marine outfall into the sea. The discharge point shall be decided in consultation with the National Institute of Oceanography, Goa. Further, a marine ecological study shall be carried out to study the impact of discharge of excess treated waste water on the marine water quality. The domestic wastewater after treatment in STP shall be used for mixing mill and steel melt shop for cooling purpose.

iii. In plant control measures for checking fugitive emissions from storage/ raw materials handling shall be provided. Further specific measures like provision of dust extraction and dust suppression system for raw material handling, water sprinkling system at the stock yards shall be provided. The company shall provide dry fogging system for crushing and screening plant, material and transfer points etc. Data on fugitive emissions shall be regularly monitored and records maintained.

iv. The company shall strictly comply with the standards notified under the Environment (Protection) Act, 1986 vide GSR.631(E) dated 31st October 1997 to control the fugitive VOC emissions from the doors, lids and offtakes of the coke oven batteries.

v. The company shall provide dust suppression system by bag filters and ESP to control the particulate emissions within 50mg/Nm3. Cast house fume extraction system shall be based on ESP/bag filters. The company shall install low NOx burners to control the NOx emissions.

vi. As per the solid waste management plan submitted to the Ministry, the company shall enhance efforts for reuse of solid wastes. The BF slag shall be sold to the cement industries. The slag from the steel melting shop shall be partly reused and partly dumped within the plant premises. The sludge, dust extraction dust, mill scales and used refractory bricks shall be 100% recycled. The dry fly ash shall be utilized for brick making and ash from the pond will be used for land reclamation. The hazardous wastes generated in the tar sludge, benzol muck, MBL sludge shall be charged along with coal into the coke oven batteries. The spent oil shall be sold to the authorized reprocessors.

v The company shall develop green belt in 34 ha. of the plant area in addition to the 3490 ha. of plant area already afforested. Selection of plant species is as per the Central Pollution Control Board guidelines.

vi The company shall undertake rainwater harvesting measures to recharge the ground water.

ix Occupational Health Surveillance of the workers should be done on a regular basis and records maintained as per the Factories Act.

x Recommendations made in the Charter on Corporate Responsibility for Environment Protection shall be implemented.

B GENERAL CONDITIONS:

i The project authorities must strictly adhere to the stipulations made by the Andhra Pradesh Pollution Control Board and the State Government.

ii No further expansion or modifications in the plant shall be carried out without prior approval of the Ministry of Environment and Forests.

iv At least four ambient air quality monitoring stations shall be established in the downwind direction as well as where maximum ground level concentrations of SPM, SO2 and NOx are anticipated in consultation with the State Pollution Control Board. Data on ambient air quality and stack emission should be regularly submitted to this Ministry including its Regional Office at Bangalore and the State Pollution Control Board/Central Pollution Control Board once in six months.

v. Industrial waste water shall be properly collected, treated so as to confirm to the standards prescribed under GSR 422 (E) dated 19th May, 1993 and 31st December, 1993 or as amended from time to time. The treated wastewater should be utilized to make up, plantation etc.

v The overall noise levels in and around the plant area shall be kept well within the standards (85 dBA) by providing noise control measures including acoustic hoods, silencers, enclosures etc. on all sources of noise generation. The ambient noise levels should conform to the standards prescribed under Environment (Protection) Act, 1986 Rules, 1989 viz. 75 dBA (daytime) and 70 dBA (nighttime).

vi The project proponent shall also comply with all the environmental protection measures and safeguards recommended in the Environmental Impact Assessment Notification 1994 / Environmental Management Plan report. Further, the company must undertake socio-economic development activities in the surrounding villages like community development programmes, educational programmes, drinking water supply and health care etc.

vii The project authorities will provide requisite funds both recurring and non-recurring to implement the conditions stipulated by the Ministry of Environment and Forests as well as the State Government along with the implementation schedule for all the conditions stipulated herein. The funds so provided shall not be diverted for any other purposes.

v The Regional Office of this Ministry at Bangalore/Central Pollution Control Board/State Pollution Control Board will monitor the stipulated conditions. A six monthly compliance report and the monitored data along with statistical interpretation should be submitted to them regularly.

ix The Project Proponent shall inform the public that the project has been accorded environmental clearance by the Ministry and copies of the clearance letter are available with the State Pollution Control Board/ Committee and may also be seen at Website of the Ministry of Environment and Forests at http://envfor.nic.in. This should be advertised within seven days from the date of issue of the clearance letter, in at least two local newspapers that are widely circulated in the region of which one shall be in the vernacular language of the locality concerned and a copy of the same should be forwarded to the Regional office.

x The Project Authorities shall inform the Regional Office as well as the Ministry the date of financial closure and final approval of the project by the concerned authorities and the date of commencing the land development work.

xi The MoEF may revoke or suspend the clearance, if the implementation of any of the above conditions is not satisfactory.

xii The Ministry reserves the right to stipulate additional conditions if found necessary. The company in a time bound manner will implement these conditions.

xiii The above conditions will be enforced inter-alia under the provisions of the Water (Prevention & Control of Pollution) Act, 1974, the Air (Prevention & Control of Pollution) Act, 1981, the Environment (Protection) Act, 1986 and the Public Liability Act, 1991 along with their amendments and rules.

(Dr. P. L. Ahujarai)
Director

Copy to :-

1. The Secretary, State Dept. of Environment, Government of Andhra Pradesh, Mantralaya, Hyderabad.
2. The Chairman, Central Pollution Control Board, Parivesh Bhawan, CBD-cum-Office Complex, East Arjun Nagar, Delhi-110032.
3. The Chairman, Andhra Pradesh State Pollution Control Board, 2nd Floor, APIIDA Complex, Malkaram, S.R. Nagar, Hyderabad- 500 038.
4. The Chief Conservator of Forests (Central), Regional Office (SZ), Kendriya Sadan, IVth Floor, E&F Wing, 17th Main Road, Koramangala, Bangalore- 560034.
5. JS(CC-II), Ministry of Environment and Forests, Paryavaran Bhawan, CGO Complex, New Delhi - 110003.
6. Monitoring Cell, Ministry of Environment and Forests, Paryavaran Bhawan, CGO Complex, New Delhi - 110003.
7. Guard file.
8. Record file.
9. Monitoring Cell.

(Dr. P. L. Ahujarai)
Director

Annexure 1.2

ANDHRA PRADESH POLLUTION CONTROL BOARD
Paryavarana Bhavan, A-III, Industrial Estate,
Sanathnagar, Hyderabad-500 018
Phone : 040-23887500, Website: www.appcb.ap.nic.in

RED CATEGORY
RENEWAL OF CONSENT & AUTHORISATION ORDER
BY REGISTERED POST WITH ACKNOWLEDGEMENT DUE

Consent Order No : APPCB/VSP/VSP/108/CFO/HO/2015- **Date:27.04.2015**

(Consent Order for Existing/New or altered discharge of sewage and/or trade effluents/outlet under Section 25/26 of the Water (Prevention & Control of Pollution) Act, 1974 and amendments thereof, Operation of the plant under section 21 of the Air (Prevention & Control of Pollution) Act 1981 and amendments thereof and Renewal of Authorisation under Rule 5 of the Hazardous Wastes (Management, Handling & Transboundary, Movement) Rules, 2008 & Amendments thereof.

CONSENT is hereby granted under section 25/26 of the Water (Prevention & Control of Pollution) Act, 1974, under section 21 of Air (Prevention & Control of Pollution) Act 1981 and Authorisation under the provisions of HW (MH & TM) Rules, 2008 (hereinafter referred to as 'the Acts', 'the Rules') and the rules and orders made thereunder to.

M/s. Rashtriya Ispat Nigam Ltd.,
(Visakhapatnam Steel Plant),
Kurmanapalem,
Visakhapatnam – 530 031
E mail: rinlenmd@sify.com
(Hereinafter referred to as 'the Applicant') authorizing to operate the industrial plant to discharge the effluents from the outlets and the quantity of emissions per hour from the chimneys as detailed below:

i) Out lets for discharge of effluents:

Outlet No.	Outlet Description	Max Daily Discharge KLD	Point of Disposal
1.	TPP – DM Plant Effluents after Treatment	4800	Into Sea at Appikonda / recycle into Plant.
2.	Trade Effluents from the Plant after Treatment	9600	Into Sea at Gangavaram.
3.	Domestic Effluents from Town Ship after Treatment at Ultra Filtration plant	7200	For recycling in the Plant for cooling purpose after ultra filteration

ii) Emissions from chimneys:

Chimney No.	Description of Chimney	Quantity of Emissions at peak flow in Nm^3/hr
1.	Attached to BF – I Burden Handling System	22,25,000
2.	Attached to BF – I Cast House Exhaust Station	9,72,000
3.	Attached to BF – II Burden Handling System	22,25,000
4.	Attached to BF – II Cast House Exhaust Station	9,72,000
5.	Attached to Sinter Plant Air Cleaning Plant	26,22,000
6.	Attached to Sinter Plant Gas Cleaning Plant	36,00,000
7.	Attached to Rolling Mills (LMMM) W.B. Furnace	1,96,248
8.	Attached to Rolling Mills (LMMM)RH Holding Furnace	7,893
9.	Attached to WRM Walking Beam Furnace – I	1,20,709
10.	Attached to MMSM Walking Beam Furnace – II	1,41,576
11.	Attached to Thermal Power Plant Boiler – I & II	10,00,000
12.	Attached to Thermal Power Plant Boiler – III & IV	10,00,000
13.	Attached to Thermal Power Plant Boiler – V	5,00,000
14.	Attached to CRMP Flux Kiln - I & II	4,16,000
15.	Attached to CRMP Flux Kiln - III & IV	4,16,000
16.	Attached to CRMP Flux Kiln- V	2,08,000
17.	Attached to SMS Centralized Ventilation System	5,90,000
18.	Attached to Coke Oven Battery No. I	2,16,090
19.	Attached to Coke Oven Battery No. II	2,16,090
20.	Attached to Coke Oven Battery No. III	2,16,090
21.	Attached to Coke Oven Battery No. IV	2,16,090
22.	Attached to 2 x 250 KVA D.G. Sets	--
23.	Attached to 4 x 625 KVA D.G. Sets	--
24.	Attached to 1 x 1000 KVA D.G. Set	--
25.	Sinter Plant – 3 (waste gas)	1181530
26.	Sinter Plant – 3 (De-dusting)	732000
27.	Blast Furnace-3 (Cast House de-dusting)	1340000
28.	Blast Furnace-3 (Stock House dedusting)	470000
29.	SMS – 2 (material handling de-dusting system)	207500
30.	SMS – 2 (Secondary emission control system)	1630000
31.	SMS – 2 LFRH-1	106900
32.	SMS – 2 LFRH-2	106900
33.	Calcining & Refractory Material Plant- stack#1	85000
34.	Calcining & Refractory Material Plant- stack#2	85000
35.	Wire Rod Mill – 2 Walking beam furnace (fuel – by product gasses)	79600
36.	Thermal Power Plant & Blower House Boiler #6	587880
37.	Structural Mill Walking beam furnace – fuel (by product gasses)	85000
38.	Special bar mill Walking beam furnace (fuel – by product gasses)	85800

iii) HAZARDOUS WASTE AUTHORISATION (FORM – II) [See Rule 5 (4)]:

M/s. Rashtriya Ispat Nigam Ltd., (Visakhapatnam Steel Plant), Kurmanpalem, Visakhapatnam District., is hereby granted an authorization to operate a facility for collection, reception, storage, treatment, transport and disposal of Hazardous Wastes namely:

- **HAZARDOUS WASTES WITH RECYCLING OPTION:**

S.No	Name of the Hazardous Waste	Streams	Quantity	Method of Disposal
1.	ETP Sludge (MBC & ETP)	34.3 of Schedule – I	250 – 300 TPA.	Shall be used as alternate fuel in coke oven batteries.
2.	Used oil / Waste lubricating oil / vaccum oil / transformer oil / waste grease.	5.1 of Schedule - I	320 TPA.	Shall be used for internal consumption after reclamation. Partly sold to the authorised agencies.
3.	Tank bottom sludge of tar and oil storage tanks.	13.5 of Schedule - I	500 TPA.	Shall be stored within the premises and be used as alternate fuel in coke oven batteries.
4.	Tar Sludge from tar decanters	13.4 of Schedule - I	2800 TPA.	
5.	Acid tar from Ammonium sulphate plant (ASP)	13.2 of Schedule - I	200 TPA.	
6.	Benzol sludge from	13.3 of Schedule - I	480 TPA.	

	decanters of benzol distillation plant			
7.	Containers and containers liners of hazardous wastes & chemicals	33.3 of Schedule - I	50 TPA.	After detoxification, it shall be disposed to the outside agencies.

- **HAZARDOUS WASTES WITH DISPOSAL OPTION:**

S.No	Name of the Hazardous Waste	Streams	Quantity	Method of Disposal
1.	Oil soaked cotton waste	5.2 of Schedule - I	40 TPA	To TSDF, Parawada, Visakhapatnam for incineration / Authorised cement plants for co-processing.
2.	Spent resin from ion exchangers of DM Plant	34.2 of Schedule – I	5.0 TPA	To TSDF, Parawada, Visakhapatnam for secured land filling.
3.	Reactor catalyst	B-5 of Schedule – II	5 TPA	
4.	Asbestos waste	15.1 of Schedule – I	10 TPA	

This consent order is valid for manufacture of the following products with quantities indicated only:

S.No.	Products	Quantity
1.	Pig Iron	3,65,000 TPA
2.	Saleable Steel	57,20,000 TPA
3.	Coke Products	2,41,000 TPA
4.	Generation of Power	384 MW

This order is subject to the provisions of 'the Acts' and the Rules' and orders made there under and further subject to the terms and conditions incorporated in the schedule A, B & C enclosed to this order.

This combined order of consent & Hazardous Waste Authorisation shall be valid for a period ending with the **30th day of April, 2019.**

Sd/-
MEMBER SECRETARY

To
M/s. Rashtirya Ispat Nigam Ltd.,
(Visakhapatnam Steel Plant),
Kurmanapalem,
Visakhapatnam – 530 031
Copy to:

1. The JCEE, Zonal Office, **Visakhapatnam for information and with a direction to review the progress on PERT chart of action plan submitted by the industry once in three months by the Zonal Office-Visakhapatnam and report compliance to Board Office.**
2. The JCEE (Cess), APPCB, **Hyderabad** for information.
3. The SEE, Task Force – **Visakhapatnam** for information and for necessary action.

4. The Environmental Engineer, Regional Office, **Visakhapatnam** for information and necessary action

//T.C.F.B.O//

O/c

JOINT CHIEF ENVIRONMENTAL ENGINEER
UNIT HEAD - IV

SCHEDULE–A

1. The applicant shall make applications **through online** for renewal of Consent (under Water and Air Acts) and Authorisation under HWM Rules **at least 120 days before the date of expiry of this order**, along with prescribed fee under Water and Air Acts for obtaining Consent & HW Authorisation of the Board along with detailed compliance to the conditions stipulated in the CFO and HWA.
2. Any person aggrieved by an order made by the State Board under Section 25, Section 26, Section 27 of Water Act, 1974 or Section 21 of Air Act, 1981 may within thirty days from the date on which the order is communicated to him, prefer an appeal as per Andhra Pradesh Water Rules, 1976 and Air Rules 1982, to such authority (hereinafter referred to as the Appellate Authority) constituted under Section 28 of the Water(Prevention and Control of Pollution) Act, 1974 and Section 31 of the Air(Prevention and Control of Pollution) Act, 1981.
3. All other conditions stipulated in the Schedule – A of the earlier combined CFO & HWA order No: **APPCB/VSP/108/2007–2537** dated **05.03.2007** remains same. The industry shall ensure consistent compliance of each condition of Schedule-A.
4. The industry may explore the possibility of tapping the solar energy for their energy requirements.

SCHEDULE - B

1. The effluent discharged shall comply with the tolerance limits mentioned below:

Outlet	Parameter No.	Limiting Standards
1	pH	6.00 – 9.00
	Phenols	1.00 mg/l
	Ammonical Nitrogen	50.00 mg/l
	Suspended Solids	100.00 mg/l
	Oil and Grease	10.00 mg/l
	Copper (Total)	1.00 mg/l
	Iron (Total)	1.00 mg/l
	Iron	1.00 mg/l
	Temperature:- not more than 5 °C higher than the intake	
2	pH	6.00 – 9.00
	Suspended Solids	100.00 mg/l
	Phenols	1.00 mg/l
	Ammonical Nitrogen as N	50.00 mg/l
	Cyanide as CN	0.20 mg/l
	Oil and Grease	10.00 mg/l
	COD	250.00 mg/l
	BOD	30.00 mg/l

2. The water consumption shall not exceed the quantities mentioned below:

S.No	Purpose	Quantity
1.	Process	4,693 KLD
2.	Cooling & Boiler Feed	1,38,971 KLD
3.	Domestic (Plant & Township)	40,800 KLD
	Total	**1,84,464 KLD**

The industry shall maintain separate meters with necessary pipe-line for assessing the quantity of water used for each purpose.

3. The industry shall file the water cess returns in Form-I as required under section (5) of Water (Prevention and Control of Pollution) Cess Act, 1977 on or before the 5th of every

calendar month, showing the quantity of water consumed in the previous month along with water meter readings. The industry shall remit water cess as per the assessment orders as and when issued by Board.

4. The emissions shall not contain constituents in excess of the prescribed limits mentioned below:

Chimney No.	Parameter	Emission Standards
1 to 17	Particulate matter	50 mg/Nm^3
18 to 21	Particulate matter	50 mg/Nm^3
	Carbon Monoxide	3 Kg / Tonne of coke produced
25 to 37	Particulate matter	50 mg/Nm^3

5. The industry shall comply with emission limits for DG sets upto 800 KW as per the Notification G.S.R.520 (E), dated 01.07.2003 under the Environment (Protection) Amendment Rules, 2003 and G.S.R.448(E), dated 12.07.2004 under the Environment (Protection) Second Amendment Rules, 2004. In case of DG sets more than 800 KW shall comply with emission limits as per the Notification G.S.R.489 (E), dated 09.07.2002 at serial no.96, under the Environment (Protection) Act, 1986.

6. The industry shall comply with ambient air quality standards of PM10(Particulate Matter size less than 10μm) - 100 μg/ m3; PM2.5(Particulate Matter size less than 2.5 μm) - 60 μg/ m3; SO2 - 80 μg/ m3; NOx - 80 μg/m3, NH3 – 400 μg/m3 outside the factory premises at the periphery of the industry.

   Standards for other parameters as mentioned in the National Ambient Air Quality Standards CPCB Notification No.B-29016/20/90/PCI-I, dated 18.11.2009 shall be complied. Following standards prescribed for noise shall be complied.

   Noise Levels: Day time (6 AM to 10 PM) - 75 dB (A)
   Night time (10 PM to 6 AM) - 70 dB (A).

7. The industry shall not increase the capacity beyond the permitted capacity mentioned in this order.
8. **The industry shall ensure validity of the ISO-14001 certification during the validity of CFO.**
9. **The industry shall furnish revised PERT chart reducing the time lines to maximum extent as the present time lines are extraordinarily high.**
10. **The industry shall submit action plan for utilization of fly ash.**
11. **All the stacks shall be connected to APPCB website before 30.06.2015.**
12. **Online effluent monitoring system shall be provided before 30.06.2015 as per CPCB directions.**
13. **The industry shall lift asbestos waste of 200 Tons to TSDF duly following manifest system.**
14. **The industry shall furnish action plan in two months for construction of 4 guard ponds each of two days hydraulic load capacity of treated effluents.**
15. **The industry shall achieve plantation targets as prescribed under Green Visakha programme.**
16. **The industry shall submit within two months revised PERT chart with revised time frames for completion of the each activity at the earliest for the following:**
    a. **Upgradation and stabilization of MBC Plant to meet discharge standards in respect of COD, Phenols, Cyanides, Suspended Solids, etc.**
    b. **Upgradation of APC to meet emission standards in all the stacks.**
    c. **Revamping of SMS Plants to control dust emissions.**
    d. **Rectification of secondary de-dusting systems.**
    e. **Achieving AAQ standards.**
    f. **Achieving Zero Liquid Discharge.**

    g. **Conducting online Bioassay monitoring in Guard ponds.**
    h. **Compliance to Fly Ash Notification stipulations.**
    i. **Construction of Dry Flys Ash collection system.**
    j. **Concreting internal roads.**

   The industry shall submit monthly progress report on the progress of various activities mentioned above.

17. The industry shall comply with the effluent and emission standards specified in the G.S.R.No. 277 (E), dated 31.03.2012 applicable to Integrated Iron and Steel industries.
18. The industry shall maintain four CAAQM Stations as per the specifications of CPCB for online monitoring of Particulate Matter, SO_2, Hydro carbons & NOx with networking facility to Head Office, APPCB.
19. The industry shall maintain data sheet logging facility for each continuous online stack monitoring station. All individual stations shall be connected to a suitable common facility with data logging so that it is accessible at one location. The industry shall submit the on-line stack monitoring data to the R.O, Visakhapatnam on monthly basis.
20. The industry shall maintain good house keeping in the premises. The industry shall ensure regular watering of roads and work area to control fugitive dust emissions in the Plant premises.
21. The industry shall carryout Bio-Assay tests in "online bio-assay testing facility" by providing 4 guard ponds each of two days hydraulic load capacity so as to receive the treated effluents in guard ponds before disposal. Only three guard ponds shall be operational at a time and one will be kept empty as reserve to store the effluents in case effluents fail in bio monitoring. The guard pond shall have appropriate lining and leak-proof construction specified for this purpose. The industry shall submit Bio-Assay test reports and impact on the marine life to the Regional Office, Visakhapatnam on monthly basis.
22. The industry shall implement conditions in clearance of A.P. State Coastal Zone Management Authority (APSCZMA) dated 12.02.2014.
23. The industry shall take action on the recommendations made by the NIO in the Marine Environmental Impact Assessment report.
24. The industry shall not discharge any ash slurry effluent into Appikonda creek, which finally joins Sea.
25. The industry shall maintain digital display at the Main Gate for displaying the CAAQM and stack analyzers results.
26. The industry shall not shutdown ETP & MBC without prior intimation to A.P. Pollution Control Board.
27. There shall not be any fugitive emissions from the stock yards of raw materials. The industry shall operate MDSS system to control fugitive emissions.
28. The industry shall operate used oil reclamation unit with environmentally sound practices.
29. The industry shall conserve water resources by adopting various recycle options.
30. The industry shall maintain good green belt towards North – East direction of Gajuwaka to minimize the pollution impacts as per the earlier directions issued.
31. The industry shall provide internal concrete roads with Bitumen top to minimize fugitive emissions and submit report in three months.
32. The industry shall preserve water resources by adopting various recycle options.
33. The industry shall comply with the conditions stipulated in the CFE order No. APPCB/VSP/108/HO/2005/317, Dated 09.05.2005.
34. The industry shall comply with Task Force directions dated 18.05.2011 and other directions issued by the Board from time to time.
35. The industry shall maintain records in FORM – 13 as per Hazardous waste (Management, Handling & Transboundary) Rules, 2008.

36. The industry shall meet the National Ambient Air Quality standards as CPCB Notification dated 18.11.2009.
37. The industry shall comply with Battery (Management & Handling) Rules, 1998.
38. The industry shall comply with Noise (Pollution & Regulation) Rules, 2000.
39. The applicant shall submit Environment statement in Form V before 30th September every year as per Rule No.14 of E (P) Rules, 1986 & amendments thereof.
40. The conditions are without prejudice to the rights and contentions of this Board in any Hon'ble Court of Law.

SCHEDULE-C

[see rule 5(4)]

[CONDITIONS OF AUTHORISATION FOR OCCUPIER OR OPERATOR HANDLING HAZARDOUS WASTES]

1. The industry shall give top priority for waste minimization and cleaner production practices.
2. The industry shall not store hazardous waste for more than 90 days as per the Hazardous Wastes (Management, Handling and Transboundary Movement) Rules, 2008 and amendments thereof.
3. The industry shall store Used / Waste Oil and Used Lead Acid Batteries in a secured way in their premises till its disposal.
4. The industry shall not dispose Waste oils to the traders and the same shall be disposed to the authorized Reprocessors/ Recyclers.
5. The industry shall dispose Used Lead Acid Batteries to the manufacturers / dealers on buyback basis.
6. The industry shall take necessary practical steps for prevention of oil spillages and carry over of oil from the premises.
7. The industry shall maintain 6 copy manifest system for transportation of waste generated and a copy shall be submitted to Board Office and concerned Regional Office.
8. The industry shall maintain good house keeping & maintain proper records for Hazardous Wastes stated in Authorisation.
9. The industry shall maintain proper records for Hazardous Wastes stated in Authorisation in FORM-3 i.e., quantity of incinerable waste, land disposal waste, recyclable waste etc., and file annual returns in Form- 4 as per Rule 22(2) of the Hazardous Wastes (Management, Handling & Transboundary Movement) Rules, 2008 and amendments thereof.
10. The industry shall submit the condition wise compliance report of the conditions stipulated in Schedule B & C of this Order on half yearly basis to Board Office, Hyderabad and concerned Regional Office.
11. The industry shall dispose of e-waste to the authorised recyclers only.
12. The industry shall conform to the co-processing guidelines of CPCB in sending wastes to co-processing for cement plants.
13. The industry shall implement Fly Ash Notification and amendments thereof.

Sd/-
MEMBER SECRETARY

To
M/s. Rashtriya Ispat Nigam Ltd.,
(Visakhapatnam Steel Plant),
Kurmanapalem,
Visakhapatnam – 530 031

//T.C.F.B.O//

JOINT CHIEF ENVIRONMENTAL ENGINEER
UNIT HEAD - IV

Annexure 1.3

F. No. IA-J-11011/196/2005-IA-II(I)
Government of India
Ministry of Environment, Forest and Climate Change
(Impact Assessment Division)

Indira Paryavaran Bhawan
Jor Bagh Road, Aliganj,
New Delhi - 110003
E-mail: sharath.kr@gov.in
Tel: 011-24695319

Dated: 2nd August, 2018

To

The Managing Director,
M/s Rashtriya Ispat Nigam Ltd.,
Visakhapatnam Steel Plant,
Visakhapatnam - 530031

Subject: Capacity Expansion of Vishakhapatnam Steel Plant from 6.3 MTPA to 7.3 MTPA by revamping and augmentation of existing facilities by M/s Rashtriya Ispat Nigam Ltd located at Gajuwaka, Vishakhapatnam, Andhra Pradesh– Environmental Clearance reg.

Sir,

M/s Rashtriya Ispat Nigam Ltd has reference to your online application vide proposal no. **IA/AP/IND/56868/2016** dated **9th January 2018** along with the copies of EIA/EMP seeking Environmental Clearance under the provisions of the EIA Notification, 2006 for the above mentioned proposed project. The proposed project activity is listed at S. No. 3(a) Metallurgical industries (ferrous & non-ferrous) under Category "A" of EIA Notification, 2006 and the proposal is appraised at Central level.

2.0 The Capacity Expansion of Visakhapatnam Steel Plant from 6.3 MTPA to 7.3 MTPA by revamping and Augmentation of existing facilities of M/s Rashtriya Ispat Nigam Limited located in Village Gajuwaka Tehsil Visakhapatnam District Visakhapatnam State Andhra Pradesh was initially received in the Ministry on 30th June 2016 for obtaining Terms of Reference (ToR) as per EIA Notification, 2006. The project was appraised by the Expert Appraisal Committee (Industry) [EAC(I)] during its 8thmeeting held during 27th to 29th July, 2016 and prescribed ToRs to the projectfor undertaking detailed EIA study for obtaining environmental clearance. Accordingly, the Ministry of Environment, Forest and Climate Change had prescribed ToRs to the project on 19th September 2016 vide Lr. No. J-11011/196/2005-IA.II(I).

3.0 The project of M/s Rashtriya Ispat Nigam Limited located in Village Gajuwaka Tehsil Visakhapatnam District Visakhapatnam, Andhra Pradesh State is for setting up of a new Modification for production of 7.3 MTPA of Steel production enhancement of production of 1MTPA from 6.3 to 7.3

million tonnes per annum (million TPA). The existing project was accorded environmental clearance vide lr.no. F.No.J-11011/196/2005-IA.II(I) dated 11-8-2005. The Status of compliance of earlier EC was obtained from Regional Office, Chennai vide Lr. No. EP/12.1/354/AP/2052 dated 21-12-2017. There are no non-compliances reported by Regional officer except for the modernization activity undertaken by VSP/RINL which is compulsory in view of aging of the existing plant, ensure the safety during operation and cleaner environment. The proposed capacity for different products for new site area as below:

Sl. No.	Production Unit	Facilities at 6.3 MTPA stage, MT	Production at 6.3 MTPA stage, MT	Facilities at 7.3 MTPA stage, MT	Production at 7.3 MTPA stage, MT
1	Coke Ovens and By-products Recovery Plant (COBP) of capacity 0.8 MTPA each	COB-1 COB-2 COB-3 COB-4	0.695 0.695 0.695 0.695	COB-1 COB-2 COB-3 COB-4 COB-5	0.775 0.775 0.775 0.775 0.8
2	Sinter Plant	SP-1 SP-2 SP-3	2.85 2.85 3.25	SP-1 SP-2 SP-3	3.64 3.64 3.25
3	Blast Furnace	BF-1 BF-2 BF-3	2.0 2.0 2.5	BF-1 BF-2 BF-3	2.5 2.5 2.5
4	Lime/dolo Plant	Kiln#1-5 Kiln#6&7	0.425 0.365	Kiln#1-5 Kiln#6&7	0.425 0.365
5	LD Shop	SMS-1 SMS-2	3.5 2.8	SMS-1 SMS-2	3.5 3.8
6		Wire Rod Mill	1.65	Wire Rod Mill	1.81
		Special Bar Mill	1.65	Special Bar Mill	1.78
		Structural Mill	1.75	Structural Mill	1.93
		Rebar	-	Rebar	0.6
				Rounds for FWP	0.08
		Semis (Bloom/ Rounds/ Billets)	0.66	Semis (Bloom/ Rounds/ Billets)	0.58
		Coal Based Waste Gas Gas Based Nedo Sinter cooler	315 MW 69 MW 120 MW 20.6 MW	Coal Based Waste Gas Gas Based Nedo Sinter cooler	315 MW 69 MW 120 MW 20.6 MW

7	Captive Power	Coal Based Waste Gas Gas Based Nedo Sinter cooler	315 MW 69 MW 120 MW 20.6 MW	Coal Based Waste Gas Gas Based Nedo Sinter cooler	315 MW 69 MW 120 MW 20.6 MW

4.0 The proposed expansion is planned in the existing project site of 3240 ha. No forestland involved. The entire land has been acquired for the project. There is no River passes through the project area. It has been reported that no water body exists around the project and modification/diversion in the existing natural drainage pattern at any stage has not been proposed.

5.0 The topography of the area is flat and reported to lies between 17°34'29" to 17 ° 38'49" N Latitude and 83 ° 09'23" to 83 ° 14'12" E Longitude in Survey of India topo sheet No. 65 O/2, at an elevation of 10 m AMSL. The ground water table reported to ranges between 5-10mgbl below the land surface during the post-monsoon season and 2-5mbgl below the land surface during the pre-monsoon season. Based on the hydro-geological study, it has been reported that the radius of influence of pumped out water will be 1m. Further, the stage of groundwater development is reported to be 100% and 100% in core and buffer zone respectively and thereby these are designated as critically exploited.

6.0 No National Park/Wildlife Sanctuary/Biosphere Reserve/Tiger Reserve/Elephant Reserve etc. are reported to be located in the core and buffer zone of the project. The area also does not report to form corridor for Schedule-I fauna. The authenticated list of flora and fauna in the study area is incorporated in EIA.

7.0 For the proposed capacity augmentation from 6.3 MTPA to 7.3 MTPA liquid steel, it is estimated that nearly 3.533 MTPA additional minerals would be required namely iron ore in the form of fines, Sized Iron Ore& Pellets, limestone & dolomite, Quartzite. 1.2 MTPA Coal/ PCI coal as fuel is required. No additional land is required.

8.0 The targeted production capacity of the Vizag Steel Plant is 7.3 MTPA. The ore for the plant would be procured from (linkages Rail). The ore transportation will be done through Rail.

9.0 The water requirement of the project is estimated as 4,545.m3 /day which will be obtained from the existing Yeleru Reservoir. The permission for drawl of groundwater / surface water is obtained from VIWSCO videagenda item no. 43/7 of 43rd meeting of the BOD held on 24/12/2009.

10.0 The power requirement of the project is estimated as 76 MW, out of which 76 MW will be obtained from the APTRANSCO.

11.0 Baseline Environmental Studies were conducted during post monsoon season 2016 i.e., from October to December 2016. Ambient air quality monitoring has been carried out at 8 locations during 17-10-2016 to 7-1-2017 and the data submitted indicated that PM_{10} (43.8 $\mu g/m^3$ to 85.0 $\mu g/m^3$), $PM_{2.5}$ (20.2 to 58.1$\mu g/m^3$), SO2 (11.6 to 17.5 $\mu g/m^3$) and NOx (14.1 to 18.5 $\mu g/m^3$). The results of the modelling study indicate that the maximum increase of GLC for the proposed implementation of 7.3 MTPA expansion is 16.6 $\mu g/m^3$ with respect to the PM10, 23.2 $\mu g/m^3$ with respect to the SO_2 9.3 $\mu g/m^3$ with respect to the NOx, which is less than the predicted GLCs due to operation of 6.3 MTPA. This is due to proposed up-gradation of pollution control equipment, and also reduction in volumetric flows.

12.0 Ground water quality has been monitored in 7 locations in the study area and analysed. pH: 7.35 to 8.10, Total Hardness: 360 to 520 mg/l, Chlorides: 130 to 250 mg/l, Fluoride: 0.4 to 0.8 mg/l. Heavy metals are within the limits. Surface water samples were analysed from 4 locations. pH: 7.21 to 8.06; DO: 5.6 to 6.2 mg/l and BOD: 1.0 to 1.3 mg/l.

13.0 Noise levels are in the range of 52.0 to 72.9 dB(A) for daytime and 42.2 to 66.2 dB(A) for night time.

14.0 No R&R is involved.

15.0 The solid waste generated at 6.3 MTPA stage will be approx 11,700 TPD which includes granulated BF slag, SMS slag, mill scales, sludges, ESP/Bag filter dust etc. In addition, about 2000 TPD of coal ash will be generated at 6.3 MTPA stage. There would be additional generation of approx 1,700 TPD of solid waste for 7.3 MTPA stage. It is estimated that 100% of the granulated BF slag would be sold to the cement making industries for manufacturing of slag cement. Other waste such as mill scale, sludges, dust etc. would be 100% recycled into the sinter plant. 60% of the SMS slag would also be used within the steel plant and the balance would be stored for further processing for secondary use.

16.0 It has been reported that the Consent for Establishment (CFE) has been obtained from the Andhra Pradesh State Pollution Control Board vide order no APPCB/VSP/108/HO/2005/317 dated 09.05. 2005. Consent for Operation has been obtained from Andhra Pradesh State Pollution Control Board vide order dt.27-04-2015 and the same is valid till February 2019.

17.0 The Public hearing of the project was held on 15th June 2017 at Trishna Grounds, Sector -2, Ukkunagaram under the chairmanship of District Collector and District Magistrate Visakhapatnam for production of 7.3 MTPA of Capacity Expansion Steel Plant / setting up of Capacity Expansion Steel Plant. The issues raised during public hearing inter alia include estimation of project cost, effluent discharge, development of

greenbelt, water requirement, pollution, safety of industry, utilization of CSR funds, R&R package, etc.

18.0 The capital cost of the project is Rs 9439.53 Crores and the capital cost for environmental protection measures is proposed as Rs. 558.99 crore. The annual recurring cost towards the environmental protection measures is proposed as Rs 33700 Lakhs. The employment generation from the proposed project/expansion is Direct Employment during Operation is 1600 and indirect employment is for 3000 people. An amount of Rs. 778.0 Lakhs has been earmarked for 2017-18 towards enterprise social commitment/corporate environment responsibility.

19.0 Out of total acquired land of 8827 ha (21811.99 Acres), greenbelt has been done in 1969 ha (4866 Acres) within the plant area. On the whole about 38% of the land is afforested with the planting of 5.16 million trees.

20.0 There is no litigation pending against the project and/or land in which the project is proposed to be set up.

21.0 The proposal was considered by the Expert Appraisal Committee (Industry-I) during its 28th meeting held on 5th - 7th February 2018. The PP has made detailed presentation on the proposal. The committee observed that the project proponent has already started the proposed modernization and revamping activities since 2013 and the status of implementation of various packages, as reported by Regional Officer, Chennai as follows:

Package	Front hand over date/ Contractual Start Date	Actual Completion date / Likely completion date	Status as on November 2017
BF-1 Revamping	25/10/2013	21/07/2014	Commissioned and running at 90% capacity
BF-2 Revamping	5/5/2016	1/08/2017	Commissioned and running at 60% capacity
Sinter Plant-1 Revamping	31/10/2016	31/07/2017	Commissioned and running at 70% capacity
Kanthi Balancing Reservoir -2	19/07/2016	Likely to complete by July 2018	15% of construction work completed
3rd Converted	March 2013	Completed in November 2016	100% completed
4th Caster	June 2014	Likely to be completed	80% completed
TB-5	June 2014	November 2017	95% completed
Sinter Plant-2 Revamping			Not yet started

22.0 After detailed deliberations, the Committee recommended that since the project proponent has already implemented the expansion project / activity without prior Environmental Clearance attracts the violation under EIA Notification 2006.

23.0 In view of above, the proposal was considered by the EAC (Violation) meeting held during 13th -14th June 2018 and further considered in the meeting held during 27th -28th July 2018. The EAC, after detailed deliberations on the proposal in terms of the provisions of the MoEF&CC Notification dated 14th March, 2017, confirmed the case to be of violation of the EIA Notification, 2006 and recommended for issuing the Term of Reference for undertaking EIA and preparation of Environment Management Plan (EMP) as follows:

1) The State Government/SPCB to take action against the project proponent under the provisions of section 19 of the Environment (Protection) Act, 1986, and further no consent to operate for expansion project to be issued till the project is granted EC for the expansion.
2) The project proponent shall be required to submit a bank guarantee equivalent to the amount of remediation plan and natural and community resource augmentation plan with the SPCB prior to the grant of EC. The quantum shall be recommended by the EAC and finalized by the regulatory authority. The bank guarantee shall be released after successful implementation of the EMP, followed by recommendations of the EAC and approval of the regulatory authority.
3) Assessment of ecological damage with respect to air, water, land and other environmental attributes. The collection and analysis of data shall be done by an environmental laboratory duly notified under the Environment (Protection) Act, 1986, or an environmental laboratory accredited by NABL, or a laboratory of a Council of Scientific and Industrial Research (CSIR) institution working in the field of environment.
4) Preparation of EMP comprising remediation plan and natural and community resource augmentation plan corresponding to the ecological damage assessed and economic benefits derived due to violation.
5) The remediation plan and the natural and community resource augmentation plan to be prepared as an independent chapter in the EIA report by the accredited consultants.
6) Since Public Hearing (PH) has been conducted on dated 19.07.2017 covering all the issues, committee felt that one time PH as per the order of Hon'ble High Court of Madras has already taken care and hence repeat PH is not required.
7) EIA/EMP may be prepared by using existing base line data generated.
8) EIA/EMP should cover the validation of current practices also predict cumulative Impact covering total production capacity for each component of environment.
9) Selection of technology and adaption of clean technology for both production & environment be addressed in EIA/EMP report.
10) Fund allocation for Corporate Environment Responsibility (CER) shall be made as per Ministry's O.M. No. 22-65/2017-IA.III dated 1st May, 2018 for various activities therein. The details of fund allocation and activities for CER shall be incorporated in EIA/EMP report.

24.0 In view of above, the Ministry has considered the recommendations of in EAC (violation) and hereby prescribed the specific ToRs as recommended by EAC (violation) above, in addition to the standard ToR, for undertaking detailed EIA-EMP study in addition to the generic ToR enclosed at Annexure I read with additional ToRs at Annexure-2.

25.0 The undersigned is directed to inform that the Ministry of Environment, Forest and Climate Change (MoEF&CC) after accepting the recommendation of the EAC (violation), hereby decided to accord ToRs for the above project.

26.0 It is requested that the draft EIA Report may be prepared in accordance with the above mentioned specific ToRs and enclosed generic ToRs and additional ToRs and thereafter further necessary action may be taken for obtaining Environment Clearance in accordance with the procedure prescribed under the EIA Notification, 2006 as amended.

27.0 The ToRs are valid for a period of three years from today i.e., 02.08.2018 and will expire on 01.08.2021. However, this period could be further extended by a maximum period of one year provided an application is made by the project proponent at least three months before the expiry of the validity period, together with updated Form-I, based on proper justification.

(Sharath Kumar Pallerla)
Scientist 'F'/Director

Copy to: -

1. The PrincipalSecretary to Government, Department of Environment, Forest and Science & Technology, Govt. of Andhra Pradesh, Secretariat Office: 4th Block, Ground Floor,Room No:187 Phone: 0863-2444438 Email:splcs_efst@ap.gov.in
2. The Chairman, Central Pollution Control Board, Parivesh Bhawan, CBD-cum-Office Complex, East Arjun Nagar, Delhi-110032.
3. The Additional Principal Chief Conservator of Forests (C), Ministry of Environment, Forest and Climate Change, Regional Office (SEZ), Ist and IInd Floor, Handloom Export Promotion Council, 34, Cathedral Garden Road, Nungambakkam, Chennai – 600034.
4. The Chairman, Andhra Pradesh State Pollution Control Board, Paryavaran Bhawan, A-3 Industrial Estate, Sanath Nagar, Hyderabad - 500 018.
5. The District Collector, VizianagaramDistrict, State of Andhra Pradesh.
6. Guard File/**Record File/Monitoring File**.
7. MoEF&CC Website

(Sharath Kumar Pallerla)
Scientist 'F'/Director

ANNEXURE –I

GENERIC TERMS OF REFERENCE (ToR) IN RESPECT OF INDUSTRY SECTOR

1. **Executive Summary**
2. **Introduction**
   - i. Details of the EIA Consultant including NABET accreditation
   - ii. Information about the project proponent
   - iii. Importance and benefits of the project
3. **Project Description**
   - i. Cost of project and time of completion.
   - ii. Products with capacities for the proposed project.
   - iii. If expansion project, details of existing products with capacities and whether adequate land is available for expansion, reference of earlier EC if any.
   - iv. List of raw materials required and their source along with mode of transportation.
   - v. Other chemicals and materials required with quantities and storage capacities
   - vi. Details of Emission, effluents, hazardous waste generation and their management.
   - vii. Requirement of water, power, with source of supply, status of approval, water balance diagram, man-power requirement (regular and contract)
   - viii. The project proponent shall furnish the requisite documents from the competent authority in support of drawl of ground water and surface water and supply of electricity.
   - ix. Process description along with major equipments and machineries, process flow sheet (Quantative) from raw material to products to be provided
   - x. Hazard identification and details of proposed safety systems.
   - xi. Expansion/modernization proposals:
     a. Copy of all the Environmental Clearance(s) including Amendments thereto obtained for the project from MoEF&CC/SEIAA shall be attached as an Annexure. A certified copy of the latest Monitoring Report of the Regional Office of the Ministry of Environment, Forest and Climate Cahnge as per circular dated 30th May, 2012 on the status of compliance of conditions stipulated in all the existing environmental clearances including Amendments shall be provided. In addition, status of compliance of Consent to Operate for the ongoing /existing operation of the project from SPCB/PCC shall be attached with the EIA-EMP report.
     b. In case the existing project has not obtained environmental clearance, reasons for not taking EC under the provisions of the EIA Notification 1994 and/or EIA Notification 2006 shall be provided. Copies of Consent to Establish/No Objection Certificate and Consent to Operate (in case of units operating prior to EIA Notification 2006, CTE and CTO of FY 2005-2006) obtained from the SPCB shall be submitted. Further, compliance report to the conditions of consents from the SPCB shall be submitted.
4. **Site Details**
   - i. Location of the project site covering village, Taluka/Tehsil, District and State, Justification for selecting the site, whether other sites were considered.
   - ii. A toposheet of the study area of radius of 10km and site location on 1:50,000/1:25,000 scale on an A3/A2 sheet. (including all eco-sensitive areas and environmentally sensitive places)
   - iii. Co-ordinates (lat-long) of all four corners of the site.

iv. Google map-Earth downloaded of the project site.
v. Layout maps indicating existing unit as well as proposed unit indicating storage area, plant area, greenbelt area, utilities etc. If located within an Industrial area/Estate/Complex, layout of Industrial Area indicating location of unit within the Industrial area/Estate.
vi. Photographs of the proposed and existing (if applicable) plant site. If existing, show photographs of plantation/greenbelt, in particular.
vii. Landuse break-up of total land of the project site (identified and acquired), government/private - agricultural, forest, wasteland, water bodies, settlements, etc shall be included. (not required for industrial area)
viii. A list of major industries with name and type within study area (10km radius) shall be incorporated. Land use details of the study area
ix. Geological features and Geo-hydrological status of the study area shall be included.
x. Details of Drainage of the project upto 5km radius of study area. If the site is within 1 km radius of any major river, peak and lean season river discharge as well as flood occurrence frequency based on peak rainfall data of the past 30 years. Details of Flood Level of the project site and maximum Flood Level of the river shall also be provided. (mega green field projects)
xi. Status of acquisition of land. If acquisition is not complete, stage of the acquisition process and expected time of complete possession of the land.
xii. R&R details in respect of land in line with state Government policy

5. Forest and wildlife related issues (if applicable):

i. Permission and approval for the use of forest land (forestry clearance), if any, and recommendations of the State Forest Department. (if applicable).
ii. Land use map based on High resolution satellite imagery (GPS) of the proposed site delineating the forestland (*in case of projects involving forest land more than 40 ha*).
iii. Status of Application submitted for obtaining the stage I forestry clearance along with latest status shall be submitted.
iv. The projects to be located within 10 km of the National Parks, Sanctuaries, Biosphere Reserves, Migratory Corridors of Wild Animals, the project proponent shall submit the map duly authenticated by Chief Wildlife Warden showing these features vis-à-vis the project location and the recommendations or comments of the Chief Wildlife Warden thereon.
v. Wildlife Conservation Plan duly authenticated by the Chief Wildlife Warden of the State Government for conservation of Schedule I fauna, if any exists in the study area.
vi. Copy of application submitted for clearance under the Wildlife (Protection) Act, 1972, to the Standing Committee of the National Board for Wildlife

6. Environmental Status

i. Determination of atmospheric inversion level at the project site and site-specific micro-meteorological data using temperature, relative humidity, hourly wind speed and direction and rainfall.
ii. AAQ data (except monsoon) at 8 locations for PM_{10}, $PM_{2.5}$, SO_2, NO_x, CO and other parameters relevant to the project shall be collected. The monitoring stations shall be based CPCB guidelines and consider the pre-dominant wind direction, population zone and sensitive receptors including reserved forests.
iii. Raw data of all AAQ measurement for 12 weeks of all stations as per frequency given in the NAQQM Notification of Nov. 2009 along with – min., max., average and 98% values for each of the AAQ parameters from

data of all AAQ stations should be provided as an annexure to the EIA Report.
iv. Surface water quality of nearby River (60 m upstream and downstream) and other surface drains at eight locations as per CPCB/MoEF&CC guidelines.
v. Whether the site falls near to polluted stretch of river identified by the CPCB/MoEF&CC.
vi. Ground water monitoring at minimum at 8 locations shall be included.
vii. Noise levels monitoring at 8 locations within the study area.
viii. Soil Characteristic as per CPCB guidelines.
ix. Traffic study of the area, type of vehicles, frequency of vehicles for transportation of materials, additional traffic due to proposed project, parking arrangement etc.
x. Detailed description of flora and fauna (terrestrial and aquatic) existing in the study area shall be given with special reference to rare, endemic and endangered species. If Schedule-I fauna are found within the study area, a Wildlife Conservation Plan shall be prepared and furnished.
xi. Socio-economic status of the study area.

7. Impact Assessment and Environment Management Plan

i. Assessment of ground level concentration of pollutants from the stack emission based on site-specific meteorological features. In case the project is located on a hilly terrain, the AQIP Modelling shall be done using inputs of the specific terrain characteristics for determining the potential impacts of the project on the AAQ. Cumulative impact of all sources of emissions (including transportation) on the AAQ of the area shall be well assessed. Details of the model used and the input data used for modelling shall also be provided. The air quality contours shall be plotted on a location map showing the location of project site, habitation nearby, sensitive receptors, if any.
ii. Water Quality modelling – in case, if the effluent is proposed to be discharged in to the local drain, then Water Quality Modelling study should be conducted for the drain water taking into consideration the upstream and downstream quality of water of the drain.
iii. Impact of the transport of the raw materials and end products on the surrounding environment shall be assessed and provided. In this regard, options for transport of raw materials and finished products and wastes (large quantities) by rail or rail-cum road transport or conveyor-cum-rail transport shall be examined.
iv. A note on treatment of wastewater from different plant operations, extent recycled and reused for different purposes shall be included. Complete scheme of effluent treatment. Characteristics of untreated and treated effluent to meet the prescribed standards of discharge under E(P) Rules.
v. Details of stack emission and action plan for control of emissions to meet standards.
vi. Measures for fugitive emission control
vii. Details of hazardous waste generation and their storage, utilization and disposal. Copies of MOU regarding utilization of solid and hazardous waste shall also be included. EMP shall include the concept of waste-minimization, recycle/reuse/recover techniques, Energy conservation, and natural resource conservation.
viii. Proper utilization of fly ash shall be ensured as per Fly Ash Notification, 2009. A detailed plan of action shall be provided.
ix. Action plan for the green belt development plan in 33 % area i.e. land with not less than 1,500 trees per ha. Giving details of species, width of plantation, planning schedule etc. shall be included. The green belt shall

be around the project boundary and a scheme for greening of the roads used for the project shall also be incorporated.

x. Action plan for rainwater harvesting measures at plant site shall be submitted to harvest rainwater from the roof tops and storm water drains to recharge the ground water and also to use for the various activities at the project site to conserve fresh water and reduce the water requirement from other sources.

xi. Total capital cost and recurring cost/annum for environmental pollution control measures shall be included.

xii. Action plan for post-project environmental monitoring shall be submitted.

xiii. Onsite and Offsite Disaster (natural and Man-made) Preparedness and Emergency Management Plan including Risk Assessment and damage control. Disaster management plan should be linked with District Disaster Management Plan.

8. Occupational health

i. Details of existing Occupational & Safety Hazards. What are the exposure levels of above mentioned hazards and whether they are within Permissible Exposure level (PEL). If these are not within PEL, what measures the company has adopted to keep them within PEL so that health of the workers can be preserved,

ii. Details of exposure specific health status evaluation of worker. If the workers' health is being evaluated by pre-designed format, chest x rays, Audiometry, Spirometry, Vision testing (Far & Near vision, colour vision and any other ocular defect) ECG, during pre-placement and periodical examinations give the details of the same. Details regarding last month analyzed data of abovementioned parameters as per age, sex, duration of exposure and department wise.

iii. Annual report of heath status of workers with special reference to Occupational Health and Safety.

iv. Plan and fund allocation to ensure the occupational health & safety of all contract and casual workers.

9. Corporate Environment Policy

i. Does the company have a well laid down Environment Policy approved by its Board of Directors? If so, it may be detailed in the EIA report.

ii. Does the Environment Policy prescribe for standard operating process / procedures to bring into focus any infringement / deviation / violation of the environmental or forest norms / conditions? If so, it may be detailed in the EIA.

iii. What is the hierarchical system or Administrative order of the company to deal with the environmental issues and for ensuring compliance with the environmental clearance conditions? Details of this system may be given.

iv. Does the company have system of reporting of non-compliances / violations of environmental norms to the Board of Directors of the company and / or shareholders or stakeholders at large? This reporting mechanism shall be detailed in the EIA report

10. Details regarding infrastructure facilities such as sanitation, fuel, restroom etc. to be provided to the labour force during construction as well as to the casual workers including truck drivers during operation phase.

11. Enterprise Social Commitment (ESC)

i. To address the Public Hearing issues, 2.5% of the total project cost of (Rs. .....crores), amounting to Rs. .....crores, shall be earmarked by

the project proponent, towards Enterprise Social Commitment (ESC). Distinct ESC projects shall be carved out based on the local public hearing issues. Project estimate shall be prepared based on PWD schedule of rates for each distinct Item and schedule for time bound action plan shall be prepared. These ESC projects as indicated by the project proponent shall be implemented along with the main project. Implementation of such program shall be ensured by constituting a Committee comprising of the project proponent, representatives of village Panchayat & District Administration. Action taken report in this regard shall be submitted to the Ministry's Regional Office. No free distribution/donations and or free camps shall be included in the above ESC budget

12. Any litigation pending against the project and/or any direction/order passed by any Court of Law against the project, if so, details thereof shall also be included. Has the unit received any notice under the Section 5 of Environment (Protection) Act, 1986 or relevant Sections of Air and Water Acts? If so, details thereof and compliance/ATR to the notice(s) and present status of the case.

13. A tabular chart with index for point wise compliance of above ToRs.

14. The ToRs prescribed shall be valid for a period of three years for submission of the EIA-EMP reports along with Public Hearing Proceedings (wherever stipulated).

<u>The following general points shall be noted:</u>

i. All documents shall be properly indexed, page numbered.

ii. Period/date of data collection shall be clearly indicated.

iii. Authenticated English translation of all material in Regional languages shall be provided.

iv. The letter/application for environmental clearance shall quote the MOEF&CC file No. and also attach a copy of the letter.

v. The copy of the letter received from the Ministry shall be also attached as an annexure to the final EIA-EMP Report.

vi. The index of the final EIA-EMP report must indicate the specific chapter and page no. of the EIA-EMP Report

vii. While preparing the EIA report, the instructions for the proponents and instructions for the consultants issued by MOEF&CC vide O.M. No. J-11013/41/2006-IA.II (I) dated 4th August, 2009, which are available on the website of this Ministry shall also be followed.

viii. The consultants involved in the preparation of EIA-EMP report after accreditation with Quality Council of India (QCI)/National Accreditation Board of Education and Training (NABET) would need to include a certificate in this regard in the EIA-EMP reports prepared by them and data provided by other organization/Laboratories including their status of approvals etc. Name of the Consultant and the Accreditation details shall be posted on the EIA-EMP Report as well as on the cover of the Hard Copy of the Presentation material for EC presentation.

ix. ToRs' prescribed by the Expert Appraisal Committee (Industry) shall be considered for preparation of EIA-EMP report for the project in addition to all the relevant information as per the 'Generic Structure of EIA' given in Appendix III and IIIA in the EIA Notification, 2006. Where the documents provided are in a language other than English, an English translation shall be provided. The draft EIA-EMP report shall be submitted to the State Pollution Control Board of the concerned State for conduct of Public Hearing. The SPCB shall conduct the

Public Hearing/public consultation, district-wise, as per the provisions of EIA notification, 2006. The Public Hearing shall be chaired by an Officer not below the rank of Additional District Magistrate. The issues raised in the Public Hearing and during the consultation process and the commitments made by the project proponent on the same shall be included separately in EIA-EMP Report in a separate chapter and summarised in a tabular chart with financial budget (capital and revenue) along with time-schedule of implementation for complying with the commitments made. The final EIA report shall be submitted to the Ministry for obtaining environmental clearance.

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ANNEXURE-2

ADDITIONAL TORs

1. Manganese ore/coal linkage documents along with the status of environmental clearance of Manganese ore and coal mines
2. Quantum of production of coal and iron ore from coal &Manganese ore mines and the projects they cater to. Mode of transportation to the plant and its impact
3. Recent land-use map based on satellite imagery. High-resolution satellite image data having 1m-5m spatial resolution like quickbird, Ikonos, IRS P-6 pan sharpened etc. for the 10 Km radius area from proposed site. The same shall be used for land used/land-cover mapping of the area.
4. PM(PM_{10} and $P_{2.5}$) present in the ambient air must be analysed for source analysis – natural dust/RSPM generated from plant operations (trace elements) of PM_{10} to be carried over.
5. All stock piles will have to be on top of a stable liner to avoid leaching of materials to ground water.
6. Plan for the implementation of the recommendations made for the steel plants in the CREP guidelines.
7. Plan for slag utilization
8. Plan for utilization of energy in off gases (coke oven, blast furnace)
9. System of coke quenching adopted with justification.
10. Trace metals Mercury, arsenic and fluoride emissions in the raw material.
11. Trace metals in waste material especially slag.
12. Trace metals in water

Executive Summary

Executive summary of the report in about 8-10 pages incorporating the following:

i. Project name and location (Village, Dist, State, Industrial Estate (if applicable)
ii. Products and capacities. If expansion proposal then existing products with capacities and reference to earlier EC.
iii. Requirement of land, raw material, water, power, fuel, with source of supply (Quantitative)
iv. Process description in brief, specifically indicating the gaseous emission, liquid effluent and solid and hazardous wastes.
v. Measures for mitigating the impact on the environment and mode of discharge or disposal.
vi. Capital cost of the project, estimated time of completion
vii. Site selected for the project – Nature of land – Agricultural (single/double crop), barren, Govt/private land, status of is acquisition, nearby (in 2-3 km.) water body, population, with in 10km other industries, forest, eco-sensitive zones, accessibility, (note – in case of industrial estate this information may not be necessary)
viii. Baseline environmental data – air quality, surface and ground water quality, soil characteristic, flora and fauna, socio-economic condition of the nearby population
ix. Identification of hazards in handling, processing and storage of hazardous material and safety system provided to mitigate the risk.
x. Likely impact of the project on air, water, land, flora-fauna and nearby population
xi. Emergency preparedness plan in case of natural or in plant emergencies
xii. Issues raised during public hearing (if applicable) and response given
xiii. CSR plan with proposed expenditure.
xiv. Occupational Health Measures
xv. Post project monitoring plan

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Annexure 1.4

Minutes of 13th meeting of Expert Appraisal Committee for the proposal involving violation of EIA Notification, 2006 to be held on 18th-20thSeptember 2018 at Conference Hall (Narmada), Ground Floor,JalWing, Ministry of Environment, Forest and Climate Change, Indira ParyavaranBhawan, Jor Bagh Road, New Delhi - 110 003

Day 1: Tuesday, 18th September, 2018

Time: 10:00 AM

13.1. Opening remarks of the Chairman

13.2. Confirmation of the minutes of the 12th meeting held on 28th -29th August, 2018 at Indira Paryavaran Bhawan, Jor Bagh Road, New Delhi

13.3. Consideration of proposals

S.No.	Proposals
13.3.1	**Capacity expansion of Vishakhapatnam Steel Plant from 6.3 MTPA to 7.3 MTPA by revamping and augmentation of existing facilities located at Gajuwaka, Vishakhapatnam, Andhra Pradesh by M/s Rashtriya Ispat Nigam Ltd. - Environmental Clearance** **[IA/AP/IND/73713/2018 dated 28.08.2018] [F. No. 23-132/2018-IA.III (V)]**
13.3.1.1	**M/s Rashtriya Ispat Nigam Ltd.** has made online application vide proposal no. **IA/AP/IND/73713/2018 dated 28.08.2018** seeking Term of References for the above mentioned proposed project. The proposed project activity is covered under category A of item **3(a) 'Metallurgical industries (Ferrous & Non-Ferrous)'** of the Schedule to the EIA Notification 2006.
13.3.1.2	**Details of the project as per the submission of project proponent:** **1.** Present proposal is for capacity expansion of Visakhapatnam Steel Plant from 6.3 MTPA to 7.3 MTPA by Revamping and Augmentation of existing facilities by Rashtriya Ispat Nigam Limited at Village Gajuwaka, Tehsil Visakhapatnam, District Visakhapatnam. **2.** The said project /activity is covered under category 'A' of item **3(a) 'Metallurgical industries (Ferrous & Non-Ferrous)'** of the Schedule to the EIA Notification 2006. **3.** Details of earlier appraisal by EAC/ SEAC; observation and compliance: EAC meeting was held on 05/02/2018. EAC stated that since the project proponent had already implemented the expansion project / activity without prior environmental clearance, the proposal attracts the provisions under violation of the EIA Notification 2006. Fresh Application was submitted for grant of TOR and EAC meeting was held on 13th -14th June 2018 & 27-28th June 2018. The EAC, after detailed deliberations on the proposal in terms of the provisions of the MoEF&CC Notification dated 14th March, 2017, confirmed the case to be of violation of the EIA Notification, 2006 and recommended TORs for carrying out EIA/EMP

	Study comprising remediation plan and natural and community resource augmentation plan corresponding to the ecological damage assessed and economic benefits derived due to violation. **4.** The Terms of Reference (ToR) have been prescribed for carrying out EIA/EMP studies for proposed Capacity expansion of Visakhapatnam Steel Plant from 6.3 MTPA TO 7.3 MTPA by Revamping And Augmentation of existing facilities by Rashtriya Ispat Nigam Limited vide MoEFCC letter no F. No. IA-J-11011/196/2005-IA-II(I) dated 02/08/2018. **5.** Public Hearing was held on 15/06/2017 at Trishna Grounds, Ukkunagaram, Visakhapatnam in the presence of Honorable Collector & District Magistrate, Visakhapatnam. During Public Hearing, project proponent presented the details of the project and informed that the expansion is being carried out in the existing vacant land available in the plant premises and latest technology proposed in the expansion project to reduce the pollution level within specified standards. Members of public actively participated and expressed their views and suggestions in the environmental point of view about the proposed project. Project proponent informed about the proposed activities, utilization of CSR funds and afforestation carried out in and around areas. **6.** The total land area in possession with the company is 8827 ha. No additional land will be required for the expansion project. **7.** At 6.3 MTPA stage, the plant water requirement is 29 MGD and for township and others it is estimated at 9 MGD for 6.3 MTPA stage. The additional water required for the proposed augmentation is estimated to be 7 MGD. The water will be sourced from existing Yeleru Reservoir. RINL has accorded permission for withdrawal of 45 MGD from Visakhapatnam Industrial Water Supply Company Limited (VIWSCO). **8.** Existing Waste water treatment plant consisting of bowl rake classifier / spiral classifier, thickener, thickener under flow pumps sludge dewatering units etc shall be installed. MBC technology based ETP have been installed for existing coke ovens. A major portion of the treated waste water is being recycled within the plant. A small part (200 m^3/hr) of the treated effluent is being discharged to sea, maintaining the statutory norms. Necessary permission for the same has been accorded. No untreated waste water is being disposed off. The same shall continue after the proposed expansion. **9.** About 12,000 t of Municipal solid wastes are generated from the plant and township. Garbage collected on daily basis from all sources and transported to SWM facility. 'Bio-degradable' wastes are Converted into compost. 'Non Bio-degradable wastes are disposed to relevant parties. Other Solid wastes generated from the plant operations: The solid waste generated at 6.3 MTPA stage is approximately 25460 TPD which includes granulated BF slag, SMS slag, mill scales, sludge's, ESP/Bag filter dust, fly ash etc. There would be additional generation of approximately 3740 TPD of solid waste after the proposed expansion. 100% of the granulated BF slag would be sold to the cement making industries for manufacturing of slag cement. Other waste such as mill scale, sludge's, dust etc. would be 100% recycled into the sinter plant. 60% of the SMS slag would also be used within the steel plant and the balance would be stored for further processing for secondary use. Tar sludge/solid sludge generated in by-product plant will be transported to coal yard for mixing with coal. **10.** The power requirement for operating the steel plant including township at 6.3 MTPA stage was 470 MW. The additional power required for the proposed augmentation is 76 MW. The present maximum power generation capacity of RINL is about 523.6 MW. This include 131.5 MW power generation from coal based boilers and balance from gas based boilers and waste heat recovery. After present ongoing expansion, additional 14 MW of power shall be generated from CO5 CDQ waste heat recovery and 5 MW shall be obtained from Solar power

plant. Power requirement will be met from the in house TPP and waste heat recovery and additional power as per requirement will be sourced from AP Transco grid.

11. Proposed energy saving measures: Following initiatives taken for reduction of power consumption:

Coke Oven Battery

- Coke Dry Quenching Plant sensible heat recovery with steam generation 52 TPH at 40 KSCA, 440 deg C and total power generation in combination 39 MW.
- Exhauster VVVF drive for better control of gas suction and energy conservation.
- Stage Combustion / Recirculation of Flue Gas for Energy Conservation and NOx control

Sinter Plant

- Sinter Cooler Sensible Heat Recovery –Power Generation 20.6 MW from Sinter Machine 1&2.
- Sinter Cooler Sensible Heat Recovery implemented in SP-3 (400 Sqm) for generation of process heat and preheating of combustion air by sensible heat recovery from sinter cooler.
- High-Efficiency Multi slit Burner in Ignition Furnace eliminates “NO FLAME” areas and supplies minimum heat input for ignition, therefore saving energy.
- The hot cooler off-air is re-circulated to the sinter machine as part of energy conservation measures.
- Addition instant calcined lime facility for binding and utilizing heat of reaction for moisture control in sinter raw feed.
- Specific energy consumption reduced from 0.57 Gcal/T of sinter to 0.55 Gcal/T of sinter.

Blast Furnace

- PCI injection up to 150 kg/thm to reduce coke rate
- TRT power generation utilizing potential energy of BF Top Gas for all BFs
- Sensible heat recovery from Stove exhaust flue gas is installed
- Specific energy consumption of BF reduced from 3.39 Gcal/THM to 3.12 Gcal/THM.

SMS

- Integration of casting and rolling
- SMS- GCP – ID Fan VVVF Drives Control installed for all Convertor
- Gas Holder installation for BOF fuel gas recovery
- Walking Beam Cooling bay for round and billet transfer

Rolling Mills

- Integration of casting and rolling
- Hot charging facility of billets to Reheating furnace to reduce gaseous fuel energy consumption
- Recuperator for sensible heat recovery from furnace flue gas and combustion air preheating for energy conservation.
- Installation of regenerative digitized control energy efficient burner in WRM Refractory insulation for energy conservation.
- VVVF drive control of combustion air fan for precision control, optimize resources and energy conservation.

Other Measures

- Regular audit and fine tuning of equipment to reduce power consumption

- Energy saving devices and energy efficient lighting systems implemented extensively in the plant.
- Transparent roof sheets provided in suitable areas to reduce load during day time.
- Power Generation by utilizing by product gases generated in steel making which otherwise would have been let to atmosphere.

12. 2 large rain water harvesting ponds are constructed to capture 3.3 MGD water. Expenditure incurred for Installation is Rs.13.83 crores. One large reservoir of RwH pond exists and the other one is under completion stage.

13. Parking facilities are envisaged in all the new major facilities.

14. Investment/Cost of the project: Rs 9439.53 Crores.

15. Benefits of the project: Increase in productivity

I. Enhancement of Safety conditions
II. Reduction of pollution
III. No additional land requirement
IV. Power, water & raw materials sourcing through existing sources
V. No additional logistic arrangements required.

16. Employment potential: The proposed plant will require skilled and semi-skilled personnel during construction and operational phase. Many people in and around neighboring villages will get opportunity for employment during construction and operational phase based on suitability.

The total direct man power requirement for O&M of the plant during operation period is estimated to be 1600 persons. Further, more than 3000 personnel will be indirectly employed.

17. National Park/ Wild Life Sanctuary in 10km radius area: Nil

18. Eco-Sensitive Zone in10 km radius area: Nil

19. Details of Forest land involved, if any: No forest land is involved.

20. Appraisal by State Coastal Zone Management Authority (SCZMA): CRZ clearance not required

21. If any court case pending for violation of the environmental laws (supported by an undertaking): NO.

22. Ground water withdrawal approval from CGWA: No Ground water drawal envisaged. RINL has been accorded permission for with drawl of 45 MGD from Visakhapatnam Industrial Water Supply Company Limited (VIWSCO).

23. Undertaking to the effect that no activity has since been taken up: Construction activities for modernization / expansion were started. However, the actual production from the steel plant has not exceeded the Approved Limit of 6.3 MTPA Liquid Steel production as per EC.

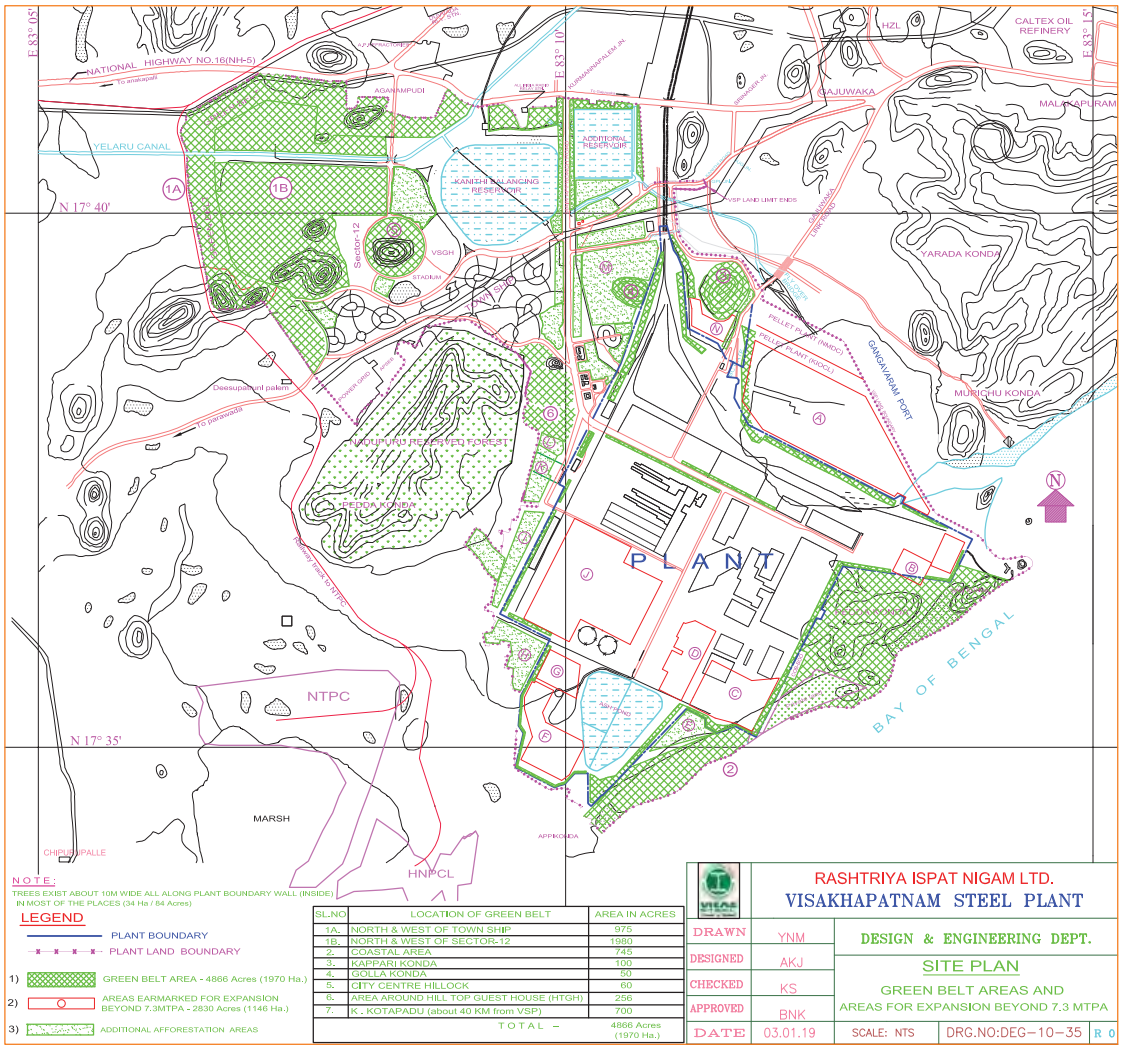
Already the case was referred to violation committee and the violation has been dealt by MoEF&CC as per the S.O. 804 (E) dt. 14/03/2017. In accordance with the prescribed Terms of Reference by Violation Committee, the EIA/ EMP Report has been prepared in compliance with the TOR issued by MoEF&CC and hereby submitted for the consideration of MOEF&CC.

24. Details of earlier EC, if any and compliance thereof: The plant has received Environmental clearance for expansion of Hot metal from 4.0 to 6.5 MTPA by Ministry of Environment, Forest and climate change (MoEFCC) vide their letter no.J-11011/196/2005-IA II (I) dated 11-08-2005. The said EC was for increase in hot metal production from 4.0 to 6.5 MTPA, liquid steel production from 3.5 to 6.3 MTPA, saleable steel from 3.17 to 5.72 MTPA, coal chemicals from 0.18 to 0.23 MTPA and power generation from 235 MW to 384 MW.

13.3.1.3	Observations and recommendations of committee: Technical presentation was made by the project proponent and accredited consultant Meckon. In the instant proposal, the repeat Public Hearing (PH) was not required as PH was conducted in the year 2017 for the proposed expansion project from 6.3 to 7.3 MTPA for liquid steel. Blast furnace Refractory thickness has been reduced while revamping and hence volume has been increased subsequently increasing the production capacity. The EAC **deferred** the proposal because of following short fall while appraising the project: 1. The quantity of excavated material handled for creating a reservoir was not considered while calculating the emission of particles during excavation and transportation. Resultant potential impact on health, vegetation, ecology and related remediation measures that could have been taken for preventing this impact, should have been considered as the major parameter for damage assessment in the EIA/EMP report. 2. Air quality in the core zone was not monitored and correlation of emission from the plant area therefore could not be correlated properly for possible impact on the receptor in the buffer zone in the downwind direction. Project proponent had been asked to collect one month fresh data as the base line data used was mostly secondary collected in the year 2016 and was not updated for validity the current environment parameters. 3. Waste water discharge points in the sea was studied by NIO that report has also to be presented along with terrestrial impact in the revised documents. Revalidation of the point of discharge for any potential impact should be carried out, if there is an increase in the quantity of discharge and change in composition of waste water. 4. In the land use area, the green belt that was prescribed in the EC of 6.3 MTPA has to be properly demonstrated giving composition of the planted width of the green belt and height of the green belt. Since purpose of the green belt is attenuation of point and non-points source pollution, monitoring on both the side of green belt is tom be done to understand the utility of impact of green belt. 5. Remediation plan was poorly drawn and needs to be revised by incorporating damage due to excavation of reservoir, transportation, impact on nearby habitat as mentioned in the report. Air quality changes due to emission from coke oven, two sintered plant (SP 1 & SP2), and Blast furnace (BF1 & BF2). 6. No objection certification from CGWA/concerned state authority for ground water handling to be submitted. 7. Proof of action taken by the State Government/SPCB against the project proponent under the provisions of section 19 of the Environment (Protection) Act. 8. Submission of revised CER as per Ministry's OM dated 01st may, 2018 and also including works taken up under CER for the year 2018-2019. 9. ESP proper functioning has to be properly brought out to study its effectiveness. 10. Waste water from coke oven to be studied for phenols/VOCs. 11. In air quality, particles be analyzed for associated phenols/VOCs and heavy metals to study the health status. 12. Closure of Noncompliance reported by the regional office of the Ministry.

	13. Statement from PP that commissioning had been done within validity of EC. 14. NOC from concerned department for cutting of trees during the construction phase to be submitted. 15. Base line health study within 5km radius of the project. 16. Revised EIA report along with compliance of ToR conditions with proper cross reference and page numbers to be submitted. 17. A table mentioning the plants constructed or revamped shall be included in a tabular form involving an investment of about 6435 crores without prior EC. 18. The damage assessment shall be calculated for each construction and revamping activity as deliberated in the meeting and then cumulative effect to be mentioned. 19. The benefit accrued due to violation should be brought out properly on financial considerations.
13.3.2	**Expansion of existing hospital project at Kadapra Village, Pathanamthitta, Kerala by M/s St. Gregorios International Cancer Care Centre - Environmental Clearance** **[IA/KL/NCP/70240/2017 dated 25.08.2018] [F. No. 23-65/2018-IA.III]**
13.3.2.1	**M/s St. Gregorios International Cancer Care Centre** has made online application vide proposal no. **[IA/KL/NCP/70240/2017 dated 25.08.2018] [F. No. 23-65/2018-IA.III]** seeking Term of References for the above mentioned proposed project. The Project activity covered under item of Schedule of Category 8(a) of EIA Notification, 2006..
13.3.2.2	**Details of the project as per the submission of project proponent:** The project is for Environmental Clearance for expansion of the existing hospital by M/s St. Gregorios International Cancer Care Centre at Sy. No. 286/2, 286/3, 286/16, village Kadapra, Thiruvalla Taluk, Pathanamthita District, Kerala. The project obtained all other statutory permissions like Building Permit, Fire Approval, Consent to Establish & Consent to Operate from various statutory bodies. The cumulative built-up area is for 38,123.48 sq. m. and which is more than 20,000 sq. m and hence the project has not taken prior Environmental Clearance before the commencement of construction and hence violated the provisions of EIA Notification, 2006 and EP Act, 1986. The construction was commenced on 01/09/2009 and the construction work is completed. The building is partially occupied and in operation phase. The existing built-up area (Pre 2006) was 8,745.48 sq. m. and the built-up area of the construction carried out post 2006 is 29,378 sq. m. The application for ToR was submitted as per the provisions of Notification dt. 14/03/2017 on 20/05/2017. The project was appraised by the EAC (Violation) in its 4th Meeting held on 19-21, February, 2018 at Item No. 4.5.7. The EAC after detailed deliberations recommended to MoEF&CC for grant of ToR. The Ministry accepted the recommendations of EAC and issued ToR vide Letter dt. 19/04/2018.

Annexure 2.1



NOTE:
TREES EXIST ABOUT 10M WIDE ALL ALONG PLANT BOUNDARY WALL (INSIDE) IN MOST OF THE PLACES (34 Ha / 84 Acres)

LEGEND

PLANT BOUNDARY

PLANT LAND BOUNDARY

1) GREEN BELT AREA - 4866 Acres (1970 Ha.)

2) AREAS EARMARKED FOR EXPANSION BEYOND 7.3MTPA - 2830 Acres (1146 Ha.)

3) ADDITIONAL AFFORESTATION AREAS

SL.NO	LOCATION OF GREEN BELT	AREA IN ACRES
1A.	NORTH & WEST OF TOWN SHIP	975
1B.	NORTH & WEST OF SECTOR-12	1980
2.	COASTAL AREA	745
3.	KAPPARI KONDA	100
4.	GOLLA KONDA	50
5.	CITY CENTRE HILLOCK	60
6.	AREA AROUND HILL TOP GUEST HOUSE (HTGH)	256
7.	K. KOTAPADU (about 40 KM from VSP)	700
	TOTAL –	4866 Acres (1970 Ha.)

RASHTRIYA ISPAT NIGAM LTD.
VISAKHAPATNAM STEEL PLANT

DRAWN	YNM	DESIGN & ENGINEERING DEPT.
DESIGNED	AKJ	SITE PLAN
CHECKED	KS	GREEN BELT AREAS AND AREAS FOR EXPANSION BEYOND 7.3 MTPA
APPROVED	BNK	
DATE	03.01.19	SCALE: NTS — DRG.NO:DEG–10–35 — R 0

CERTIFIED COPY OF MINUTES OF AGENDA ITEM NO. 43/7 OF 43RD MEETING OF THE BOARD OF DIRECTORS HELD ON 24TH DECEMBER 2009 AT HYDERABAD.

AGENDA ITEM NO.43/7 — ADDITIONAL RAW WATER REQUIREMENT BEYOND 127 MLD FOR VSP

. RINL vide its letter No. GM(W)/284/D-54 Dated 28th October 2008 address to VIWSCO informed that keeping the completion schedule of erection and commissioning of expansion units in view and further continuous operation of the same the total water requirement for VSP is as below:

From April 2009 – May 2010 - 150 MLD to 163 MLD
June 2010 – Dec 2010 - 163 MLD to 204 MLD
Dec 2010 onwards - 204 MLD

2. Further RINL vide its letter No. VSP/D(O)/T-34/D-071 dated 24-04-2009 addressed to Secretary, Irrigation, GoAP, Hyderabad notified following additional requirement pursuant to provisions of Clause-5.1 (C) of the BWSA

From June 2010 – Dec 2010 - 163 MLD to 204 MLD
Dec 2010 onward - 204 MLD

3. RINL vide its letter No. W(K)/D(O)/T-34/D-102 dated 13th July 2009 forwarded a draft supplementary Agreement to BWSA for requirement of additional water beyond 127 MLD from June 2010.

4. In various recently held meetings RINL had been insisting for written commitment from VIWSCO for supply of additional quantities required by them as projected in the Cash Flow statement for rehabilitation. Quantities projected by them are 28 MGD, 40 MGD and 45 MGD for 2009-10, 2010-2011 and 2011-12 and thereafter respectively. The above quantities work out approximately to127 MLD, 182 MLD and 205 MLD respectively.

5. The provisions in Bulk Water Supply Agreement with RINL with regard to supply period, quantities during respective supply periods, procedure for demanding additional quantities, interest, rates, special rates, prevailing water supply position, feasibility to supply the required quantities subject to availability, necessity to increase the rate etc., were submitted to the Board for its consideration and decision.

6. After some discussions the Board decided to issue letter to RINL confirming supply as scheduled below:

SNo	year	Quantity	
		MGD	MLD
1	2009-10	28	127
2	2010-11	30	136
3	2011-12	32	145
4	2012-13	35	159
5	2013-14	40	182
6	2014-15	45	205

subject to availability of required water in Godavari River and Yeleru Reservoir and subject to enhanced rate which will be negotiated and settled mutually. The Board authorized CMD to issue the letter accordingly.

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for Visakhapatnam Industrial Water Supply Co. Ltd.

DIRECTOR

Annexure 2.3

6.3 MTPA EXPANSION - PLANT FUEL BALANCE

GENERATION	
	Gas Generation
	Nm3/hr
1.CO & CCP (CO Gas)	**155,950**
2. BF1 (BF Gas)	**387,143**
3. BF2 (BF Gas)	**387,143**
4. BF3 (BF Gas)	**476,190**
5. SMS 1 (LD Gas)	**36,458**
6. SMS 2 (LD Gas)	**29,167**

Generation in NM3/h		155950	1250476	65625
		CO gas	BF gas	LD gas
		Ncum/hr	Ncum/hr	Ncum/hr
CONSUMPTION				
1. Coke Plant 1		15475		
2. Coke Plant 2		16259		
3. Coke Plant 3		4518	71353	
4. Coke Plant 4		5470	86383	
5. SP1 + SP2		4921	4633	
6. SP3		1878	1768	
7 . BF1		4013	143380	
8 . BF2		4013	143380	
9 . BF3		4572	183681	
10 . SMS 1		3612		
11. SMS 2		6013		
12. CRMP		300		
12.a. CRMP (New)		6673	10179	
13. Billet mill		24882	16839	22003
14. Bar Mill		449	304	397
15. WRM		6547	4431	5578
		0	0	0
16. MMSM		10154	6872	7981
17. WRM(New)		3850	601	8700
18. SPL. BRM (New)		3336	601	8700
19. LSM (new)		5011	785	11368
20. Aux shop and others		5000		
21 Line losses		312	37514	
Total Gas con for process		**137257**	**712703**	**64726**
Gas Available for boilers		**18693**	**537773**	**899**
CPP 2			400000	
CPP1(Including Boiler 6)		18693	137773	

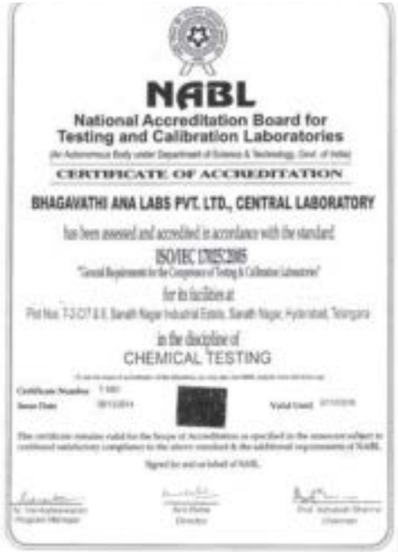
7.3 MTPA EXPANSION - PLANT FUEL BALANCE

GENERATION	
	Gas Generation
	Nm3/hr
1.CO & CCP (CO Gas)	1,97,231
2. BF1 (BF Gas)	4,83,929
3. BF2 (BF Gas)	4,83,929
4. BF3 (BF Gas)	4,76,190
5. SMS 1 (LD Gas)	41,667
6. SMS 2 (LD Gas)	34,375

Generation in NM3/h		1,97,231	14,44,048	76,042
		CO gas	BF gas	LD gas
		Ncum/hr	Ncum/hr	Ncum/hr
CONSUMPTION				
1. Coke Plant 1		15,475		
2. Coke Plant 2		16,259		
3. Coke Plant 3		4,609	71,262	
4. Coke Plant 4		5,580	86,273	
5. Coke Plant 5		5,580	86,273	
5. SP1 + SP2		739	11,425	
6. SP3		1,880	1,597	
7 . BF1		5,244	1,78,996	
8 . BF2		5,244	1,78,996	
9 . BF3		4,806	1,83,447	
10 . SMS 1		4,128		
11. SMS 2		7,087		
12. CRMP		300		
12.a. CRMP (New)		6,686	10,166	
13. Billet mill		22,863	5,433	31,657
14. Bar Mill		412	98	571
15. WRM		6,016	1,430	8,026
16. MMSM		9,330	2,217	11,483
17. WRM-II		2,942	1,134	5,665
18. SBM		2,942	1,134	5,665
19. STM		3,845	1,482	7,402
20.Rebar Mill		2,354	907	4,532
20. Aux shop and others		5,000		
21 Line losses		394	43,321	
Total Gas con for process		1,39,715	8,65,594	70,468
Gas Available for boilers		57,515	5,78,454	5,573
CPP 2			4,00,000	
CPP1(Including Boiler 6)		57,515	1,78,454	

Annexure 3.1

NABL CERTIFICATE



NABL

National Accreditation Board for Testing and Calibration Laboratories

CERTIFICATE OF ACCREDITATION

BHAGAVATHI ANA LABS PVT. LTD., CENTRAL LABORATORY

has been assessed and accredited in accordance with the standard

ISO/IEC 17025:2005

"General Requirements for the Competence of Testing & Calibration Laboratories"

for its facilities at

Plot Nos. T-2 C/T & 8, Sanath Nagar Industrial Estate, Sanath Nagar, Hyderabad, Telangana

in the discipline of

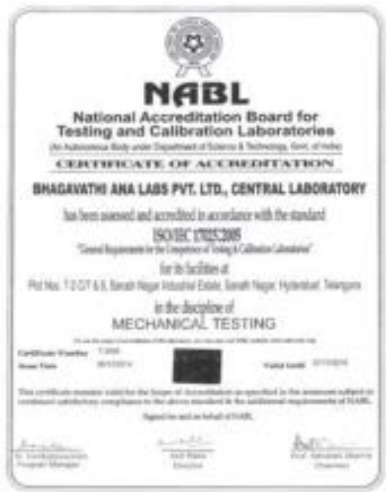
CHEMICAL TESTING

Certificate Number

Issue Date

Valid Until

Signed for and on behalf of NABL



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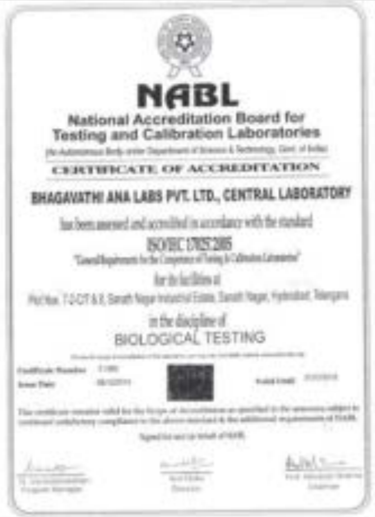

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in the discipline of

BIOLOGICAL TESTING

F.No. 11-121/2010-IA.III
Government of India
Ministry of Environment & Forests,
(IA Division)

Paryavaran Bhawan,
CGO Complex, Lodhi Road,
New Delhi – 110 003.

Dated: February 12, 2014

To
M/s Rashtriya Ispat Nigam Ltd.,
Visakhapatnam Steel Plant,
Visakhapatnam – 530 001

Contact Person Details:
Shri R V Ragghavulu,
Dy. General Manager, D&E (WS),
Phone: 0891-2518389
Email: ravuri@vizagsteel.com

Subject: CRZ Clearance for laying of the pipeline for marine discharge of treated effluents and installation of mobile container sea water reverse osmosis units for desalination of sea water, Visakhapatnam, Andhra Pradesh by M/s Rashtriya Ispat Nigam Ltd. – Reg.

This has reference to the letter No. 5660/CZMA/2010, dated 28.09.2010 of Special Chief Secretary, E.F.S & T. Department, Govt. of Andhra Pradesh and your subsequent letter dated 18.12.2013 seeking prior CRZ Clearance for the above project under the Coastal Regulation Zone Notification, 2011. The proposal has been appraised as per prescribed procedure in the light of provisions under the CRZ Notification, 2011 on the basis of the mandatory documents enclosed with the application viz., the Questionnaire, EIA, EMP and the additional clarifications furnished in response to the observations of the Expert Appraisal Committee constituted by the competent authority in its meetings held on 17th – 18th October, 2011, 16th -17th August, 2012 and 20th – 23rd November, 2013.

2. It is inter-alia noted that the proposal is for laying of pipeline for marine discharge of treated effluents and installation of mobile container seawater reverse osmosis units for the Visakhapatnam Steel Plant. The total effluent proposed to be discharged into marine environment is about 14,1400 cum/day. The industry proposed to lay a subterranean and submarine pipeline for the discharge of treated effluents into the sea near Gangavaram within the project premises. The width of the inter tidal zone varied between 130 and 175 meters at this stretch and is covered with sand/beach and interspersed with low elevated sand dunes. The NIO Visakhapatnam, after considering the prevailing physico-chemical and bathymetry data of the study area, recommended the discharge point at 20 m water depth i.e. at 17° 35' 39" N latitude and 83° 13' 50" E longitude which is 1.12 km from the Land Fall Point (LFP). They assessed that the fluid dilution can be enhanced with a jet velocity of 2 m/s at a depth of 20

m. The dilution can be enhanced 198 times by using a 6 port diffuser of 0.11 m diameter with a jet velocity of 2.5 m/s at a depth of 20 m. It has been recommended that the jet velocity of 2.0 m/s is essential to avoid bio fouling and the accumulation of the particulate matter inside the pipeline. The industry intends to establish Mobile Container Seawater Reverse Osmosis (MCSRO) Units to treat sea water in mobile RO units as make up water to the plant for 3 months which will be extendable 6 months to tide over the water crisis period. It is proposed to draw seawater through an open channel of 2M x 1M size and lagoon size of 100 M x 200 M along with stand trap sumps. The lagoon will be provided with 3 mm PVC sheets to avoid any seepage loss. The water from the lagoon will be pumped to MRO units through mobile pre-treatment units. The water will be drawn through the pipeline for discharge of treated effluents by installing pumps on the beach on a temporary basis. The treated seawater with TDS less than 400 ppm will be pumped to make-up water pressurized net work, which is at a distance of 3.5 km. The TDS of the RO reject will be 74,000 ppm approximately. It involves digging an open channel from the sea to the lagoon and another to discharge rejects from the RO units. The total quantum of drawal of seawater is 3750 cum/hour. The NIO carried out studies to firm up the intake and outfall locations and also the impact on account of the discharge of high-density plant rejects. The temperature of the seawater varies between 26.8° C to 27.9° C. Salinity range is 32.92 to 34.04 psu in the study area. Seawater density varies between 1021 and 1022 kg/cum in the water column. The temperature and salinity vary with the season, the density generally varies between 1015 - 1025 kg/cum on the annual scale. No ecologically sensitive areas such as mangroves or national parks are present in the vicinity of the proposed landfall point or along the route of the pipeline. The estimated cost of the pipeline project is Rs. 6 crores.

3. The National Institute of Oceanography (NIO), Visakhapatnam, an authorized agency carried out the demarcation of LTL, HTL and CRZ area, including firming up of outfall point. The NIO carried out field studies to generate baseline and site-specific data and also suggested suitable disposal point to facilitate quick dispersal of treated effluents. The Andhra Pradesh Coastal Zone Management Authority has recommended the project vide letter No. 5660/CZMA/2010, dated 28.09.2010.

4. The proposal was examined by the EAC in its 106th meeting held in October, 2011. The Committee deferred the proposal noting that the proposal involves construction of a lagoon to store sea water for the proposed desalination plant, which is not permissible in CRZ area, and because the proponent was not ready with details of dispersion model studies for presentation and discussion etc.

5. The matter was again considered in the 115th EAC meeting. Regarding lagoon, it was clarified by the proponent that the available low lying area will be used providing bottom lining and there will not be any new construction of lagoon. Further, Project Proponent claimed that it was an associated facility for desalination which is permissible under CRZ Notification, 2011. Also Project Proponent informed that the desalination is purely a temporary use for 3-5 months for 2-3 years. Since the notification permitted facilities

for Desalination in CRZ area and it requires storage of sea water, the Committee decided to consider the project.

However, in the same meeting the Committee noted that the rejects from Desalination were to be discharged on the shore itself which was not acceptable. It wanted the Proponent to discharge the rejects into the sea through a pipeline and submit the details.

In respect of discharge from the desalination plant, the Project Proponent informed that it is proposed to discharge the mobile RO rejects into the sea through proposed discharge pipeline. Arrangements like no-return valve, tapping point at LFP for feeding mobile RO reject shall be made.

6. The Expert Appraisal Committee, after due consideration of the relevant documents submitted by the project proponent and additional clarifications furnished in response to its observations, have recommended for the issue of CRZ Clearance for the project. Accordingly, the Ministry hereby accords necessary CRZ Clearance for the above project as per the provisions of CRZ Notification, 2011 and its subsequent amendments. As the arrangement is temporary for a period of two years the Committee recommended the proposal for CRZ clearance only for one year for the RO plan subject to strict compliance of the terms and conditions as follows:

7. Specific Conditions:

(i) The intake and outfall shall be buried pipelines and no open channel/cutting is permissible in CRZ areas. The pipelines shall be buried 2 m below the ground level/sea bed.

(ii) The marine outfall shall be at least 1.12 km from the shore line. The effluents shall be discharged through multiple ports at the outfall for proper thermal and salinity dispersion.

(iii) The disposal shall meet State Pollution Control Board norms.

(iv) The outlet quality as well as the sea water near the outfall shall be monitored especially for temperature and salinity regularly. A report in this regard shall be submitted to Regional Officer, MoEF along with six monthly monitoring report.

(v) RO rejects from the mobile RO unit should be discharged into the sea through proposed discharge pipeline.

(vi) Arrangements like no-return valve, tapping point at LFP for feeding mobile RO reject shall be made.

(vii) All the conditions stipulated by Andhra Pradesh Coastal Zone Management Authority vide their letter No. 5660/CZMA/2010, dated 28.09.2010 shall be strictly complied with.

(viii) All the recommendations of EIA and Disaster Management Plan shall be strictly complied with.

(ix) Under Corporate Social Responsibilities (CSR), sufficient budgetary provision shall be made for health improvement, education, water and electricity supply etc. in and around the project.

8. General Conditions:

(i) The construction of the structures should be undertaken as per the plans approved by the concerned local authorities/local administration, meticulously conforming to the existing local and Central rules and regulations including the provisions of Coastal Regulation Zone Notification, 2011 and the approved Coastal Zone Management Plan of Andhra Pradesh.

(ii) In the event of any change in the project profile a fresh reference shall be made to the Ministry of Environment and Forests.

(iii) This Ministry reserves the right to revoke this clearance, if any, of the conditions stipulated are not complied with to the satisfaction of this Ministry.

(iv) This Ministry or any other competent authority may stipulate any additional conditions subsequently, if deemed necessary, for environmental protection, which shall be complied with.

(v) Full support should be extended to the officers of this Ministry's Regional Office at Bangalore and the offices of the Central and Andhra Pradesh State Pollution Control Board by the project proponents during their inspection for monitoring purposes, by furnishing full details and action plans including the action taken reports in respect of mitigative measures and other environmental protection activities.

9. These stipulations would be enforced among others under the provisions of water (Prevention and Control of Pollution) Act, 1974 the Air (Prevention and Control of Pollution) Act 1981, the Environment (Protection) Act, 1986, the Public Liability (Insurance) Act, 1991 and Municipal Solid Wastes (Management and Handling) Rules, 2000 including the amendments and rules made thereafter.

10. All other statutory clearances such as the approvals for storage of diesel from Chief Controller of Explosives, Fire Department and Civil Aviation Department from height point of view, Forest Conservation Act, 1980 and Wildlife (Protection) Act, 1972 etc. shall be obtained, as applicable by project proponents from the respective competent authorities.

11. The project proponent should advertise in at least two local Newspapers widely circulated in the region, one of which shall be in the vernacular language informing that the project has been accorded CRZ Clearance and copies of clearance letters are available with the Tamil Nadu State Pollution Control Board and may also be seen on the website of the

Ministry of Environment and Forests at http://www.envfor.nic.in. The advertisement should be made within 10 days from the date of receipt of the Clearance letter and a copy of the same should be forwarded to the Regional office of this Ministry at Bangalore.

12. This Clearance is subject to final order of the Hon'ble Supreme Court of India in the matter of Goa Foundation Vs. Union of India in Writ Petition (Civil) No.460 of 2004 as may be applicable to this project.

13. Any appeal against this environmental clearance shall lie with the National Green Tribunal, if preferred, within a period of 30 days as prescribed under Section 16 of the National Green Tribunal Act, 2010.

14. A copy of the clearance letter shall be sent by the proponent to concerned Panchayat, Zilla Parisad/Municipal Corporation, Urban Local Body and the Local NGO, if any, from whom suggestions/ representations, if any, were received while processing the proposal. The clearance letter shall also be put on the website of the company by the proponent.

15. The proponent shall upload the status of compliance of the stipulated EC conditions, including results of monitored data on their website and shall update the same periodically. It shall simultaneously be sent to the Regional Office of MoEF, the respective Zonal Office of CPCB and the SPCB. The criteria pollutant levels namely; SPM, RSPM, SO_2, NOx (ambient levels as well as stack emissions) or critical sectoral parameters, indicated for the project shall be monitored and displayed at a convenient location near the main gate of the company in the public domain.

16. The project proponent shall also submit six monthly reports on the status of compliance of the stipulated EC conditions including results of monitored data (both in hard copies as well as by e-mail) to the respective Regional Office of MoEF, the respective Zonal Office of CPCB and the SPCB.

17. The environmental statement for each financial year ending 31st March in Form-V as is mandated to be submitted by the project proponent to the concerned State Pollution Control Board as prescribed under the Environment (Protection) Rules, 1986, as amended subsequently, shall also be put on the website of the company along with the status of compliance of EC conditions and shall also be sent to the respective Regional Offices of MoEF by e-mail.

(Lalit Kapur)
Director (IA-III)

Copy to:

1. Chairman, Andhra Pradesh Coastal Zone Management Authority and Special Chief Secretary to Government, E.F.S & T. Department Government of Andhra, Pradesh Secretariat, Hyderabad- 500 002
2. The Chairman, CPCB, Parivesh Bhawan, CBD-cum-Office Complex, East Arjun Nagar, Delhi – 32.

3. The Chairman, Andhra Pradesh Pollution Control Board, Paryarana Bhawan, A-III, Industrial Area, Sanathnagar, Hyderbabad - 500 018, Andhra Pradesh.
4. The CCF, Regional Office, Ministry of Environment & Forests(SZ), Kendriya Sadan, IVth floor, E&F wings, 17th Main Road, Koramangala II Block, Bangalore – 560 034.
5. Guard File.
6. Monitoring Cell.

(Lalit Kapur)
Director (IA-III)

AMBIENT AIR QUALITY

A1- DEVADA

S.No.	Month	Week	Day	PM10 µg/m³	PM2.5 µg/m³	SO_2 µg/m³	NO_2 µg/m³	Benzene (C_6H_6) (µg/m³)	BaP(ng/m³)	CO (mg/m³)	HYDROCARBON METHANE (PPM)	VOC (µg/m³)	HYDRO CARBON NON METHANE (PPM)
1	OCTOBER'2016	I st	17.10.2016	54.4	28.4	12.4	17.6	1.18	0.18	0.54	1.45	28.6	0.18
2			18.10.2016	53.6	26.1	13.1	15.8	1.23	0.16	0.61	1.62	24.6	0.21
3		II nd	24.10.2016	54.1	25.4	12.8	16.3	1.34	0.23	0.71	2.21	23.4	0.23
4			25.10.2016	55.3	23.8	11.8	19.6	2.36	0.24	0.75	2.36	22.9	0.22
5		III rd	31.10.2016	45.2	30.0	14.2	18.1	2.89	0.19	0.56	3.21	27.4	0.19
6			01.11.2016	43.8	25.8	13.8	16.4	2.29	0.21	0.54	1.85	25.8	0.16
7	NOVEMBER'2016	IV th	07.11.2016	56.4	22.3	12.2	21.3	2.25	0.25	0.58	1.96	26.1	0.22
8			08.11.2016	52.8	24.7	14.5	24.1	2.21	0.18	0.62	2.21	23.9	0.21
9		I st	14.11.2016	51.7	24.7	12.3	20.4	1.36	0.21	0.61	1.47	24.7	0.18
10			15.11.2016	50.8	26.8	14.2	19.6	1.35	0..31	0.47	1.54	23.8	0.19
11		II nd	21.11.2016	48.6	25.1	13.0	21.1	2.14	0.19	0.43	1.39	26.1	0.22
12			22.11.2016	52.7	24.6	12.4	17.8	2.32	0.23	0.41	1.24	25.8	0.24
13		III rd	28.11.2016	56.3	23.7	13.1	22.2	3.12	0.32	0.52	1.23	31.8	0.21
14			29.11.2016	54.7	22.2	12.8	18.4	2.18	0.24	0.47	1.31	32.6	0.19
15		IV th	05.12.2016	58.1	21.7	12.6	17.1	2.23	0.27	0.61	1.41	35.8	0.23
16	DECEMBER'2016		06.12.2016	55.3	26.8	11.8	18.2	1.36	0.22	0.54	1.28	29.4	0.24
17		I st	12.12.2016	52.7	28.1	12.1	17.4	2.34	0.19	0.52	1.26	23.8	0.22
18			13.12.2016	51.4	27.6	13.1	18.1	1.39	0.21	0.51	1.23	31.4	0.21
19		II nd	19.12.2016	50.8	24.3	11.6	21.0	2.25	0.24	0.47	1.96	28.5	0.26
20			20.12.2016	50.1	23.1	12.1	20.8	2.24	0.32	0.63	1.84	26.9	0.21
21		III rd	26.12.2016	52.3	22.4	14.1	22.1	2.28	0.27	0.47	1.56	27.4	0.23
22			27.12.2016	58.4	21.7	12.8	18.9	1.28	0.21	0.41	1.74	23.6	0.24
23		IV th	02.01.2017	52.7	23.6	13.1	17.4	2.14	0.23	0.42	1.63	28.4	0.18
24			03.01.2017	51.4	22.7	12.4	18.1	1.29	0..31	0.5	1.54	26.8	0.21
	Min			**43.8**	**21.7**	**11.6**	**15.8**	**1.18**	**0.16**	**0.41**	**1.23**	**22.90**	**0.16**
	Max			**58.4**	**30.0**	**14.5**	**24.1**	**3.12**	**0.32**	**0.75**	**3.21**	**35.80**	**0.26**
	10th percentile			**49.1**	**22.2**	**11.9**	**16.6**	**1.28**	**0.18**	**0.42**	**1.25**	**23.66**	**0.18**
	30th percentile			**50.8**	**22.6**	**12.2**	**17.4**	**1.35**	**0.19**	**0.47**	**1.30**	**23.86**	**0.19**
	50th percentile			**52.7**	**24.7**	**12.8**	**18.3**	**2.20**	**0.23**	**0.53**	**1.55**	**26.45**	**0.21**
	95th percentile			**57.8**	**28.4**	**14.2**	**22.2**	**2.81**	**0.32**	**0.70**	**2.34**	**32.48**	**0.24**
	98th percentile			**58.3**	**29.3**	**14.4**	**23.2**	**3.01**	**0.32**	**0.73**	**2.82**	**34.33**	**0.25**
	AVERAGE			**52.7**	**24.8**	**12.8**	**19.1**	**1.96**	**0.23**	**0.54**	**1.69**	**27.06**	**0.21**

AMBIENT AIR QUALITY

A2-GORALAVANIPALEM

S.No.	Month	Week	Day	PM10 µg/m³	PM2.5 µg/m³	SO_2 µg/m³	NO_2 µg/m³	Benzene (C_6H_6) (µg/m³)	BaP(ng/m³)	CO (mg/m³)	HYDROCARBON METHANE (PPM)	VOC (µg/m³)	HYDRO CARBON NON METHANE (PPM)
1	OCTOBER'2016	I st	17.10.2016	55.3	28.7	13.2	17.4	1.17	0.17	0.55	1.48	23.6	0.17
2			18.10.2016	50.4	30.2	14.0	24.5	1.22	0.15	0.6	1.64	24.1	0.21
3		II nd	24.10.2016	53.6	21.3	15.2	23.6	1.36	0.22	0.51	2.23	32.2	0.24
4			25.10.2016	61.2	20.2	13.8	24.1	2.31	0.21	0.5	2.41	25.6	0.22
5		III rd	31.10.2016	60.4	24.3	15.0	23.6	2.89	0.23	0.6	2.96	22.3	0.19
6			01.11.2016	54.7	25.6	14.6	19.4	2.29	0.19	0.65	1.78	24.1	0.19
7		IV th	07.11.2016	52.8	23.4	15.1	23.2	2.25	0.23	0.71	1.95	29.6	0.21
8	NOVEMBER'2016		08.11.2016	45.9	25.7	13.8	18.7	2.21	0.21	0.62	2.23	31.1	0.23
1		I st	14.11.2016	50.4	27.6	14.2	18.2	1.36	0.26	0.61	1.42	28.4	0.18
2			15.11.2016	51.3	28.4	15.6	22.4	1.35	0.24	0.55	1.55	21.3	0.21
3		II nd	21.11.2016	50.7	26.2	14.5	18.9	2.14	0.21	0.47	1.32	23.8	0.22
4			22.11.2016	52.6	27.1	15.8	19.4	2.32	0.25	0.61	1.21	21.4	0.26
5		III rd	28.11.2016	53.4	22.7	14.2	22.8	3.12	0.31	0.63	1.26	29.6	0.24
6			29.11.2016	52.4	23.6	14.6	20.4	2.18	0.24	0.55	1.34	28.5	0.25
7		IV th	05.12.2016	53.6	22.8	14.8	19.6	2.23	0.26	0.62	1.22	27.1	0.23
8	DECEMBER'2016		06.12.2016	54.4	23.4	15.7	21.3	1.36	0.21	0.74	1.24	23.6	0.28
1		I st	12.12.2016	52.3	25.9	16.8	20.4	2.34	0.23	0.63	1.23	31.2	0.23
2			13.12.2016	51.7	24.2	17.5	21.3	1.39	0.25	0.54	1.52	23.6	0.21
3		II nd	19.12.2016	50.8	22.3	16.5	20.2	2.25	0.27	0.53	1.63	33.5	0.26
4			20.12.2016	55.6	28.4	16.4	18.3	2.24	0.26	0.61	1.48	29.6	0.41
5		III rd	26.12.2016	52.8	28.1	15.8	21.2	2.28	0.22	0.55	1.61	25.4	0.38
6			27.12.2016	56.3	20.9	17.2	20.6	1.28	0.23	0.56	1.33	26.3	0.41
7		IV th	02.01.2017	52.4	24.3	16.4	21.4	2.14	0.24	0.48	1.41	28.4	0.26
8			03.01.2017	51.7	23.6	13.5	20.8	1.29	0.26	0.56	1.32	31.7	0.23
	Min			**45.9**	**20.2**	**13.2**	**17.4**	**1.2**	**0.2**	**0.5**	**1.2**	**21.3**	**0.2**
	Max			**61.2**	**30.2**	**17.5**	**24.5**	**3.1**	**0.3**	**0.7**	**3.0**	**33.5**	**0.4**
	10th percentile			**50.5**	**21.6**	**13.8**	**18.4**	**1.3**	**0.2**	**0.5**	**1.2**	**22.7**	**0.2**
	30th percentile			**51.7**	**23.4**	**14.5**	**19.6**	**1.4**	**0.2**	**0.6**	**1.3**	**24.1**	**0.2**
	50th percentile			**52.7**	**24.3**	**15.1**	**20.7**	**2.2**	**0.2**	**0.6**	**1.5**	**26.7**	**0.2**
	90th percentile			**56.1**	**28.4**	**16.7**	**23.6**	**2.3**	**0.3**	**0.6**	**2.2**	**31.6**	**0.4**
	95th percentile			**60.8**	**29.5**	**17.4**	**24.3**	**3.0**	**0.3**	**0.7**	**2.7**	**32.9**	**0.4**
	98th percentile			**60.0**	**28.4**	**17.2**	**24.1**	**2.8**	**0.3**	**0.7**	**2.4**	**32.2**	**0.4**
	AVERAGE			**53.1**	**24.8**	**15.3**	**21.1**	**2.0**	**0.2**	**0.6**	**1.6**	**27.1**	**0.3**

AMBIENT AIR QUALITY

A3 - BHAVANI NAGAR NEAR NADUPURI

S.No.	Month	Week	Day	PM10 µg/m^3	PM2.5 µg/m^3	SO2 (µg/m3)	NOX (µg/m3)	Benzene (C6H6) (µg/m3)	BaP(ng/m3)	Co (mg/m3)	HYDROCARBON METHANE (PPM)	VOC (µg/m3)	HYDRO CARBON NON METHANE (PPM)
1	OCTOBER'2016	Ist	19.10.2016	56.3	23.4	14.1	17.8	3.12	0.25	0.58	1.96	32.1	0.22
2			20.10.2016	61.2	21.9	13.8	16.7	2.18	0.18	0.62	2.21	29.2	0.21
3		IInd	26.10.2016	58.3	20.4	12.9	16.3	2.23	0.21	0.61	1.47	32.1	0.18
4			27.10.2016	55.1	23.6	14.8	18.1	1.36	0..31	0.47	1.54	23.6	0.19
5		IIIrd	02.11.2016	52.3	22.7	13.8	17.3	2.34	0.19	0.43	1.39	33.2	0.22
6			03.11.2016	54.7	23.1	15.1	20.4	1.39	0.23	0.41	1.24	28.9	0.24
7		IVth	09.11.2016	53.6	20.9	14.0	21.6	1.22	0.17	0.55	1.48	23.6	0.17
8			10.11.2016	54.7	21.8	13.2	22.3	1.21	0.15	0.6	1.64	24.1	0.21
1	NOVEMBER'2016	Ist	16.11.2016	55.8	22.9	14.7	24.1	1.34	0.22	0.51	2.23	32.2	0.24
2			17.11.2016	59.1	28.4	15.0	25.6	2.36	0.21	0.5	2.41	25.6	0.22
3		IInd	23.11.2016	54.2	26.9	13.8	23.2	2.89	0.23	0.6	2.96	22.3	0.19
4			24.11.2016	51.8	28.0	14.1	21.4	3.21	0.19	0.65	1.78	24.1	0.19
5		IIIrd	30.11.2016	50.4	28.5	13.6	20.8	4.11	0.23	0.71	1.95	29.6	0.21
			01.12.2016	49.8	29.3	14.2	21.6	1.23	0.21	0.62	2.23	31.1	0.23
7		IVth	07.12.2016	48.7	24.7	15.1	16.9	1.24	0.26	0.61	1.42	28.4	0.18
8			08.12.2016	45.6	28.4	14.0	17.8	1.35	0.24	0.55	1.55	21.3	0.21
1	DECEMBER'2016	Ist	14.12.2016	51.4	26.8	13.8	24.2	2.36	0.21	0.47	1.32	23.8	0.22
2			15.12.2016	50.4	29.1	12.7	21.8	3.34	0.25	0.61	1.21	21.4	0.26
3		IInd	21.12.2016	53.8	24.7	13.1	23.8	4.12	0.31	0.63	1.26	29.6	0.24
4			22.12.2016	54.9	23.6	12.8	22.4	3.11	0.24	0.55	1.34	28.5	0.25
5		IIIrd	28.12.2016	60.1	28.4	13.6	21.8	2.23	0.26	0.62	1.22	27.1	0.23
6			29.12.2016	58.9	26.8	14.1	23.6	1.36	0.21	0.74	1.24	23.6	0.28
7		IVth	04.01.2017	55.4	24.2	12.6	22.4	2.21	0.23	0.63	1.23	31.2	0.23
8			05.01.2017	50.4	26.3	14.1	21.8	2.23	0.25	0.54	1.52	23.6	0.21
	Min			**45.6**	**20.4**	**12.6**	**16.3**	**1.2**	**0.2**	**0.4**	**1.2**	**21.3**	**0.2**
	Max			**61.2**	**29.3**	**15.1**	**25.6**	**4.1**	**0.3**	**0.7**	**3.0**	**33.2**	**0.3**
	10th percentile			**50.0**	**21.8**	**12.8**	**17.0**	**1.2**	**0.2**	**0.5**	**1.2**	**22.7**	**0.2**
	30th percentile			**51.8**	**23.4**	**13.6**	**20.2**	**1.4**	**0.2**	**0.5**	**1.3**	**23.8**	**0.2**
	50th percentile			**54.5**	**24.7**	**13.9**	**21.7**	**2.2**	**0.2**	**0.6**	**1.5**	**27.8**	**0.2**
	90th percentile			**59.0**	**28.5**	**14.9**	**24.0**	**3.3**	**0.3**	**0.6**	**2.2**	**32.1**	**0.2**
	95th percentile			**60.0**	**29.0**	**15.1**	**24.2**	**4.0**	**0.3**	**0.7**	**2.4**	**32.2**	**0.3**
	98th percentile			**60.7**	**29.2**	**15.1**	**25.0**	**4.1**	**0.3**	**0.7**	**2.7**	**32.8**	**0.3**
	AVERAGE			**53.9**	**25.3**	**13.9**	**21.1**	**2.2**	**0.2**	**0.6**	**1.6**	**26.9**	**0.2**

AMBIENT AIR QUALITY

A4- VSP QUARTERS

S.No.	Month	Week	Day	PM10 µg/m^3	PM2.5 µg/m^3	SO2	NOX	Benzene (C6H6) (µg/m3)	BaP(ng/m3)	Co (mg/m3)	HYDROCARBON METHANE (PPM)	VOC (µg/m3)	HYDRO CARBON NON METHANE (PPM)
1	OCTOBER'2016	Ist	19.10.2016	54.7	24.7	14.1	18.2	2.28	**0.26**	**0.56**	**1.94**	**22.1**	0.26
2			20.10.2016	55.8	28.4	13.8	19.3	1.96	**0.23**	**0.78**	**1.85**	**22.3**	0.24
3		IInd	26.10.2016	59.1	26.8	14.0	17.8	1.85	**0.19**	**0.96**	**2.21**	**22.4**	0.25
4			27.10.2016	54.2	29.1	13.8	16.3	1.96	**0.21**	**1.1**	**2.54**	**30.1**	0.23
5		IIIrd	02.11.2016	51.8	24.7	14.1	15.2	2.22	**0.26**	**1**	**2.61**	**29.6**	0.28
6			03.11.2016	50.4	23.6	14.8	14.8	2.24	**0.32**	**9.6**	**2.84**	**32.1**	0.31
7		IVth	09.11.2016	55.3	28.4	16.1	16.9	2.74	**0.41**	**0.78**	**2.63**	**23.6**	0.21
8			10.11.2016	50.4	26.8	15.2	17.4	3.11	**0.39**	**0.59**	**2.47**	**29.6**	0.22
1	NOVEMBER'2016	Ist	16.11.2016	53.6	24.2	13.5	16.3	2.29	**0.35**	**1.1**	**1.96**	**32.1**	0.35
2			17.11.2016	61.2	26.3	14.1	15.8	3.04	**0.42**	**0.88**	**1.56**	32	0.28
3		IInd	23.11.2016	60.4	21.9	12.8	17.1	3.95	**0.41**	**0.63**	**2.21**	29.2	0.29
4			24.11.2016	54.7	20.4	13.1	19.0	2.78	**0.36**	**1**	**1.98**	32.1	0.22
5		IIIrd	30.11.2016	52.8	23.6	12.4	15.8	2.91	**0.4**	**0.96**	**1.85**	23.6	0.31
\			01.12.2016	45.9	22.7	12.9	16.1	3.12	**0.32**	**0.74**	**1.91**	33.2	0.28
7		IVth	07.12.2016	50.4	23.1	12.3	15.7	2.84	**0.29**	**0.51**	**1.82**	28.9	0.21
8			08.12.2016	51.3	20.9	14.5	16.3	2.23	**0.31**	**0.58**	**1.63**	23.6	0.24
1	DECEMBER'2016	Ist	14.12.2016	50.7	21.8	13.2	17.0	2.21	**0.28**	**1.1**	**1.47**	24.1	0.58
2			15.12.2016	52.6	22.9	14.1	16.2	2.26	**0.22**	**1**	**1.96**	32.2	0.24
3		IInd	21.12.2016	53.4	28.4	13.6	15.9	3.17	**0.26**	**0.63**	**1.84**	25.6	0.54
4			22.12.2016	52.4	26.9	12.8	17.4	2.56	**0.35**	**0.74**	**1.89**	22.3	0.21
5		IIIrd	28.12.2016	53.6	22.3	13.1	16.7	3.54	**0.21**	**0.81**	**1.63**	24.1	0.23
6			29.12.2016	54.4	23.6	12.9	18.1	2.56	**0.25**	**0.56**	**1.47**	29.6	0.18
7		IVth	04.01.2017	56.3	24.1	13.0	17.6	3.11	**0.23**	**0.87**	**1.85**	**32.1**	0.21
8			05.01.2017	54.8	25.6	14.1	18.1	3.54	**0.24**	**0.69**	**1.74**	**29.8**	0.22
	Min			**45.9**	**20.4**	**12.3**	**14.8**	**1.85**	**0.19**	**0.51**	**1.47**	**22.10**	**0.18**
	Max			**61.2**	**29.1**	**16.1**	**19.3**	**3.95**	**0.42**	**9.60**	**2.84**	**33.20**	**0.58**
	10th percentile			**50.4**	**21.8**	**12.8**	**15.7**	**2.04**	**0.21**	**0.57**	**1.58**	**22.33**	**0.21**
	30th percentile			**52.3**	**23.1**	**13.1**	**16.2**	**2.26**	**0.25**	**0.68**	**1.84**	**24.05**	**0.22**
	50th percentile			**53.6**	**24.2**	**13.7**	**16.8**	**2.65**	**0.29**	**0.80**	**1.90**	**29.40**	**0.24**
	90th percentile			**58.3**	**28.4**	**14.7**	**18.2**	**3.43**	**0.41**	**1.10**	**2.59**	**32.10**	**0.34**
	95th percentile			**60.2**	**28.4**	**15.1**	**18.9**	**3.54**	**0.41**	**1.10**	**2.63**	**32.19**	**0.51**
	98th percentile			**60.8**	**28.8**	**15.7**	**19.2**	**3.77**	**0.42**	**5.86**	**2.75**	**32.76**	**0.56**
	AVERAGE			**53.7**	**24.6**	**13.7**	**16.8**	**2.70**	**0.30**	**1.20**	**2.00**	**28.01**	**0.28**

AMBIENT AIR QUALITY

A-5 CHIPURAPALLI

S.No.	Month	Week	Day	PM10 µg/m^3	PM2.5 µg/m^3	SO2	NOX	Benzene (C6H6) (µg/m3)	BaP(ng/m3)	Co (mg/m3)	HYDROCARBON METHANE (PPM)	VOC (µg/m3)	HYDRO CARBON NON METHANE (PPM)
1	OCTOBER'2016	Ist	19.10.2016	58.9	28.9	13.8	16.1	3.12	0.25	0.58	1.96	31.2	0.22
2			20.10.2016	57.4	31.2	16.1	19.8	2.18	0.18	0.62	2.21	29.2	0.21
3		IInd	26.10.2016	56.8	28.4	14.8	18.4	2.23	0.21	0.61	1.47	36.5	0.18
4			27.10.2016	49.8	22.7	14.1	17.3	1.36	0..31	0.47	1.54	32.5	0.19
5		IIIrd	02.11.2016	55.2	31.1	16.0	23.4	2.34	0.19	0.43	1.39	33.1	0.22
6			03.11.2016	60.1	32.8	12.9	17.8	1.39	0.23	0.41	1.24	28.9	0.24
7		IVth	09.11.2016	55.8	29.4	13.6	16.8	1.22	0.17	0.55	1.48	23.5	0.17
8			10.11.2016	48.6	22.3	14.0	18.4	1.21	0.15	0.6	1.64	24.5	0.21
1	NOVEMBER'2016	Ist	16.11.2016	52.6	21.3	13.2	16.9	1.34	0.22	0.51	2.23	28.1	0.24
2			17.11.2016	58.4	28.5	12.8	17.4	2.36	0.21	0.5	2.41	26.1	0.22
3		IInd	23.11.2016	55.9	22.3	13.1	15.8	2.89	0.23	0.6	2.96	22.3	0.19
4			24.11.2016	54.7	24.1	12.6	16.9	3.21	0.19	0.65	1.78	24.1	0.19
5		IIIrd	30.11.2016	56.3	23.6	13.2	20.3	4.11	0.23	0.71	1.95	25.3	0.21
6			01.12.2016	55.2	24.5	15.0	18.4	1.23	0.21	0.62	2.23	32.1	0.23
7		IVth	07.12.2016	54.1	26.5	14..8	20.3	1.24	0.26	0.61	1.42	28.4	0.18
8			08.12.2016	53.8	24.8	15.6	19.4	1.35	0.24	0.55	1.55	21.3	0.21
1	DECEMBER'2016	Ist	14.12.2016	55.7	26.9	13.7	17.4	1.85	**0.19**	**0.96**	**2.21**	**24**	0.25
2			15.12.2016	56.9	24.7	12.4	18.1	1.96	**0.21**	**1.1**	**2.54**	**31**	0.23
3		IInd	21.12.2016	58.1	30.6	13.6	14.5	2.22	**0.26**	**1**	**2.61**	**29.6**	0.28
4			22.12.2016	56.8	28.1	14.1	18.6	2.24	**0.32**	**9.6**	**2.84**	**32.1**	0.31
5		IIIrd	28.12.2016	59.1	27.9	13.8	20.4	2.74	**0.41**	**0.78**	**2.63**	**22.3**	0.21
6			29.12.2016	60.1	31.6	12.7	24.5	3.11	**0.39**	**0.59**	**2.47**	**29.6**	0.22
7		IVth	04.01.2017	58.7	32.8	16.1	22.3	2.29	**0.35**	**1.1**	**1.96**	**32.1**	0.35
8			05.01.2017	61.1	28.9	15.8	21.0	2.31	**0.41**	**1.2**	**1.87**	**28.5**	**0.41**
	Min			**48.6**	**21.3**	**12.4**	**14.5**	**1.21**	**0.15**	**0.41**	**1.24**	**21.30**	**0.17**
	Max			**61.1**	**32.8**	**16.1**	**24.5**	**4.11**	**0.41**	**9.60**	**2.96**	**36.50**	**0.41**
	10th percentile			**53.0**	**22.4**	**12.7**	**16.3**	**1.23**	**0.18**	**0.48**	**1.44**	**22.66**	**0.18**
	30th percentile			**55.2**	**24.7**	**13.2**	**17.4**	**1.39**	**0.21**	**0.58**	**1.63**	**25.22**	**0.21**
	50th percentile			**56.6**	**28.0**	**13.8**	**18.4**	**2.23**	**0.23**	**0.61**	**1.96**	**28.70**	**0.22**
	90th percentile			**59.8**	**31.5**	**16.0**	**21.9**	**3.12**	**0.38**	**1.10**	**2.62**	**32.38**	**0.30**
	95th percentile			**60.1**	**32.6**	**16.1**	**23.2**	**3.20**	**0.41**	**1.19**	**2.81**	**33.01**	**0.34**
	98th percentile			**60.7**	**32.8**	**16.1**	**24.0**	**3.71**	**0.41**	**5.90**	**2.91**	**35.00**	**0.38**
	AVERAGE			**56.1**	**27.2**	**14.1**	**18.9**	**2.10**	**0.25**	**1.08**	**2.03**	**28.05**	**0.23**

AMBIENT AIR QUALITY

A-6 DUVVADA

S.No.	Month	Week	Day	PM10 µg/m^3	PM2.5 µg/m^3	SO2	NOX	Benzene (C6H6) (µg/m3)	BaP(ng/m3)	Co (mg/m3)	HYDROCARBON METHANE (PPM)	VOC (µg/m3)	HYDRO CARBON NON METHANE (PPM)
1	OCTOBER'2016	Ist	21.10.2016	68.5	31.1	13.2	16.8	2.89	0.33	**1.2**	**1.51**	**25.6**	**0.17**
2			22.10.2016	71.4	35.4	15.4	17.4	3.14	0.28	**1.3**	**1.23**	**31.2**	**0.41**
3		IInd	28..10.2016	80.4	42.8	13.6	15.8	2.69	0.31	**1.4**	**1.27**	**26.3**	**0.18**
4			29.10.2016	68.9	41.8	14.1	18.1	3.01	0.26	**1.6**	**1.31**	**28.4**	**0.22**
5		IIIrd	04.11.2016	80.0	42.3	12.8	15.3	2.98	0.24	**1.1**	**1.42**	**29.1**	**0.23**
6			05.11.2016	82.3	43.1	14.1	18.4	3.85	0.19	**1.3**	**1.28**	**27.8**	**0.39**
7		IVth	11.11.2016	79.6	40.8	12.8	16.7	2.47	0.23	**1.2**	**1.35**	**26.4**	**0.41**
8			12.11.2016	80.1	42.8	16.1	21.3	3.26	0.21	**1.4**	**1.42**	**28.9**	**0.41**
1	NOVEMBER'2016	Ist	18.11.2016	74.6	42.0	17.0	19.5	4.11	0.18	**1.3**	**1.41**	**35.6**	**0.27**
2			19.11.2016	73.9	40.1	16.5	22.3	3.62	0.22	**1.1**	**1.25**	**40.1**	**0.61**
3		IInd	25.11.2016	74.4	43.5	14.8	20.4	3.15	0.23	**1.3**	**1.47**	**32.8**	**0.45**
4			26.11.2016	80.1	41.0	16.1	14.7	3.01	0.31	**1.6**	**1.56**	**38.6**	**0.23**
5		IIIrd	02.12.2016	82.6	40.9	15.4	20.1	2.36	0.25	**1.2**	**1.82**	**41.2**	**0.18**
6			03.12.2016	79.1	41.5	16.2	19.8	1.28	0.23	**1.1**	**1.36**	**32.6**	**0.24**
7		IVth	09.12.2016	69.1	44.0	14.8	21.6	1.34	0.19	**1.61**	**1.47**	**27.6**	**0.32**
8			10.12.2016	68.5	43.8	13.6	20.3	1.96	0.21	**1.5**	**1.22**	**28.9**	**0.41**
1	DECEMBER'2016	Ist	16.12.2016	66.8	42.1	12.5	21.4	2.01	0.26	**0.5**	**1.33**	**31.4**	**0.38**
2			17.12.2016	71.0	42.8	14.1	22.8	2.26	0.31	**1.3**	**1.41**	**32.6**	**0.32**
3		IInd	23.12.2016	70.4	43.1	13.6	21.7	3.41	0.25	**0.56**	**1.21**	**42.1**	**0.41**
4			24.12.2016	81.4	42.6	14.2	22.3	3.11	0.41	**0**	**1.47**	**31.5**	**0.23**
5		IIIrd	30.12.2016	75.6	36.5	14.9	18.7	3.11	0.45	**1.2**	**1.23**	**27.8**	**0.21**
6			31.12.2016	72.4	33.4	15.1	16.9	2.29	0.51	**1.3**	**1.14**	**26.9**	**0.22**
7		IVth	06.01.2017	65.8	32.6	13.8	20.3	2.18	0.42	**1.4**	**1.41**	**25.8**	**0.25**
8			07.01.2017	64.3	35.4	12.6	18.6	2.16	0.36	**1.2**	**1.5**	**23.6**	**0.41**
	Min			**65.8**	**31.1**	**12.5**	**14.7**	**1.28**	**0.18**	**0.00**	**1.14**	**25.60**	**0.17**
	Max			**82.6**	**44.0**	**17.0**	**22.8**	**4.11**	**0.51**	**1.61**	**1.82**	**42.10**	**0.61**
	10th percentile			**68.5**	**33.8**	**12.9**	**16.0**	**1.97**	**0.19**	**0.67**	**1.22**	**26.32**	**0.19**
	30th percentile			**70.8**	**40.9**	**13.7**	**17.8**	**2.33**	**0.23**	**1.20**	**1.28**	**27.80**	**0.23**
	50th percentile			**74.4**	**42.0**	**14.2**	**19.8**	**2.98**	**0.25**	**1.30**	**1.36**	**29.10**	**0.27**
	90th percentile			**81.2**	**43.4**	**16.2**	**22.2**	**3.58**	**0.42**	**1.58**	**1.50**	**39.80**	**0.41**
	95th percentile			**82.2**	**43.8**	**16.5**	**22.3**	**3.83**	**0.45**	**1.60**	**1.56**	**41.09**	**0.45**
	98th percentile			**82.5**	**43.9**	**16.8**	**22.6**	**3.99**	**0.48**	**1.61**	**1.70**	**41.69**	**0.54**
	AVERAGE			**74.2**	**40.2**	**14.5**	**19.2**	**2.74**	**0.29**	**1.19**	**1.38**	**30.95**	**0.31**

AMBIENT AIR QUALITY

A7-GANGAVARAM PORT ADJACENT

S.No.	Month	Week	Day	PM10 µg/m^3	PM2.5 µg/m^3	SO2	NOX	Benzene (C6H6) (µg/m3)	BaP(ng/m3)	Co (mg/m3)	HYDROCARBON METHANE (PPM)	VOC (µg/m3)	HYDRO CARBON NON METHANE (PPM)
1	OCTOBER'2016	I st	21.10.2016	74.1	35.1	13.1	18.1	2.81	**0.21**	**1.23**	**1.42**	**31.2**	0.25
2			22.10.2016	65.2	36.8	13.4	21.3	3.01	**0.26**	**1.14**	**1.28**	**28.9**	0.41
3		II nd	28..10.2016	64.3	38.0	14.1	20.4	2.65	**0.32**	**1.15**	**1.35**	**24.6**	0.36
4			29.10.2016	70.1	40.0	15.6	22.3	2.74	**0.41**	**1.2**	**1.42**	**26.3**	0.32
5		III rd	04.11.2016	68.4	39.0	13.7	23.5	3.11	**0.45**	**1.3**	**1.41**	**24.7**	0.41
6			05.11.2016	70.0	41.0	14.1	24.1	3.06	**0.61**	**1.4**	**1.25**	**32.6**	0.45
7		IV th	11.11.2016	78.9	35.6	13.6	23.6	2.98	**0.54**	**1.11**	**1.47**	**38.1**	0.41
8			12.11.2016	75.6	35.2	14.0	24.1	2.74	**0.52**	**1.15**	**1.56**	**29.8**	0.32
1	NOVEMBER'2016	I st	18.11.2016	80.1	30.1	13.1	28.1	3.11	**0.47**	**1.61**	**1.82**	**32.4**	0.36
2			19.11.2016	83.9	38.9	12.8	16.1	2.56	**0.61**	**1.18**	**1.36**	**31.8**	0.19
3		II nd	25.11.2016	79.1	35.4	13.1	19.6	3.22	**0.23**	**1.19**	**1.47**	**33.6**	0.51
4			26.11.2016	83.6	30.4	14.0	18.9	2.56	**0.41**	**1.17**	**1.22**	**34.5**	0.45
5		III rd	02.12.2016	76.3	28.4	12.8	20.3	3.11	**0.25**	**1.21**	**1.33**	**28.7**	0.36
6			03.12.2016	75.2	26.1	13.6	21.4	2.96	**0.36**	**0.96**	**1.4**	**26.1**	0.41
7		IV th	09.12.2016	78.0	28.3	14.1	20.2	2.36	**0.41**	**1.1**	**1.32**	**25.8**	0.33
8			10.12.2016	81.5	31.2	12.8	18.6	2.41	**0.23**	**1.2**	**1.38**	**26.3**	0.39
1	DECEMBER'2016	I st	16.12.2016	84.1	30.8	13.1	17.4	2.56	**0.31**	**1**	**1.41**	**35.6**	0.41
2			17.12.2016	80.0	36.4	12.9	18.3	2.33	**0.41**	**1.2**	**1.58**	**37.4**	0.36
3		II nd	23.12.2016	69.8	33.4	13.6	21.1	2.14	**0.52**	**1.3**	**1.61**	**35.8**	0.41
4			24.12.2016	65.7	32.6	14.1	18.6	2.56	**0.41**	**1.1**	**1.82**	**36.2**	0.52
5		III rd	30.12.2016	71.4	31.4	15.0	22.0	2.45	**0.36**	**1.2**	**1.65**	**39.1**	0.39
6			31.12.2016	78.4	33.8	13.8	21.4	1.26	**0.41**	**1.3**	**1.47**	**34.6**	0.41
7		IV th	06.01.2017	74.3	32.1	14.2	18.9	2.96	**0.51**	**1.4**	**1.21**	**33.8**	0.51
8			07.01.2017	69.8	33.4	16.0	16.3	3.11	**0.36**	**1.1**	**1.23**	**31.4**	0.45
	Min			**64.3**	**26.1**	**12.8**	**16.1**	**1.26**	**0.21**	**0.96**	**1.21**	**24.60**	**0.19**
	Max			**84.1**	**41.0**	**15.6**	**28.1**	**3.22**	**0.61**	**1.61**	**1.82**	**39.10**	**0.52**
	10th percentile			**66.2**	**28.7**	**12.8**	**18.1**	**2.34**	**0.23**	**1.10**	**1.26**	**25.86**	**0.32**
	30th percentile			**70.9**	**31.3**	**13.1**	**18.9**	**2.56**	**0.34**	**1.15**	**1.36**	**28.82**	**0.36**
	50th percentile			**75.6**	**33.8**	**13.6**	**20.4**	**2.74**	**0.41**	**1.20**	**1.41**	**32.40**	**0.41**
	90th percentile			**83.2**	**39.0**	**14.2**	**24.0**	**3.11**	**0.54**	**1.38**	**1.64**	**37.16**	**0.50**
	95th percentile			**83.9**	**39.9**	**14.9**	**24.1**	**3.11**	**0.60**	**1.40**	**1.80**	**38.03**	**0.51**
	98 th percentile			**84.0**	**40.5**	**15.8**	**26.3**	**3.17**	**0.61**	**1.51**	**1.82**	**38.64**	**0.52**
	AVERAGE			**74.9**	**33.9**	**13.8**	**20.6**	**2.70**	**0.40**	**1.20**	**1.44**	**31.64**	**0.39**

AMBIENT AIR QUALITY

A8- GAJUWAKA

S.No.	Month	Week	Day	PM10 µg/m^3	PM2.5 µg/m^3	SO2	NOX	Benzene (C6H6) (µg/m3)	BaP(ng/m3)	Co (mg/m3)	HYDROCARBON METHANE (PPM)	VOC (µg/m3)	HYDRO CARBON NON METHANE (PPM)
1	OCTOBER'2016	I st	21.10.2016	81.5	41.5	13.1	18.1	3.15	0.26	1.2	1.35	32.1	0.19
2			22.10.2016	80.4	42.6	15.4	20.6	3.41	0.41	1.1	1.62	25.8	0.51
3		II nd	28..10.2016	78.9	42.8	16.0	18.9	2.98	0.39	1.13	1.54	31.1	0.45
4			29.10.2016	78.9	41.8	14.1	21.4	2.16	0.41	1.15	1.41	28.9	0.36
5		III rd	04.11.2016	74.5	36.8	12.5	20.8	2.31	0.33	1.5	1.32	32.4	0.41
6			05.11.2016	81.6	41.5	14.1	21.7	2.41	0.28	1.4	1.41	36.1	0.33
7		IV th	11.11.2016	83.9	40.7	12.5	20.8	2.35	0.29	1.1	1.51	41.2	0.39
8			12.11.2016	81.4	41.3	13.1	25.4	2.41	0.41	1.2	1.47	28.7	0.41
1	NOVEMBER'2016	I st	18.11.2016	80.3	45.6	15.0	23.6	2.63	0.33	1.3	1.52	33.6	0.36
2			19.11.2016	83.1	42.8	14.2	21.4	3.14	0.41	1.14	1.41	34.5	0.41
3		II nd	25.11.2016	82.4	45.4	14.6	25.8	3.36	0.55	1.3	1.63	41.2	0.52
4			26.11.2016	75.4	44.6	12.3	20.4	3.41	0.53	1.4	1.14	40.8	0.39
5		III rd	02.12.2016	78.6	42.3	15.0	22.3	3.25	0.41	1.1	1.45	41.6	0.41
6			03.12.2016	82.2	45.0	13.5	21.4	3.61	0.56	1	1.36	40.1	0.51
7		IV th	09.12.2016	79.4	42.8	14.1	22.5	3.25	0.47	1.2	1.47	38.9	0.45
8			10.12.2016	80.1	38.9	12.9	26.1	3.63	0.45	1.6	1.31	33.4	0.46
1	DECEMBER'2016	I st	16.12.2016	79.8	34.7	13.1	24.8	3.85	0.51	1.1	1.52	35.2	0.55
2			17.12.2016	80.4	41.1	14.2	23.6	2.96	0.48	1.1	1.54	36.7	0.61
3		II nd	23.12.2016	81.6	40.8	13.0	24.0	2.74	0.41	1.2	1.56	28.9	0.47
4			24.12.2016	82.3	42.3	14.1	23.4	2.85	0.46	1.3	1.47	27.4	0.52
5		III rd	30.12.2016	81.4	41.5	15.0	22.8	2.63	0.36	1.1	1.61	30.6	0.61
6			31.12.2016	82.6	42.3	12.9	24.6	2.74	0.41	1.2	1.63	31.4	0.47
7		IV th	06.01.2017	81.4	40.7	13.4	28.1	2.56	0.52	1.3	1.47	33.5	0.36
8			07.01.2017	78.9	41.2	14..8	31.6	2.74	0.47	1.1	1.52	34.1	0.47
	Min			**74.5**	**34.7**	**12.3**	**18.1**	**2.16**	**0.26**	**1.00**	**1.14**	**25.80**	**0.19**
	Max			**83.9**	**45.6**	**16.0**	**28.1**	**3.85**	**0.56**	**1.60**	**1.63**	**41.60**	**0.61**
	10th percentile			**78.7**	**39.3**	**12.6**	**20.4**	**2.36**	**0.30**	**1.10**	**1.33**	**28.74**	**0.36**
	30th percentile			**80.0**	**41.2**	**13.1**	**21.4**	**2.63**	**0.40**	**1.12**	**1.41**	**31.28**	**0.40**
	50th percentile			**81.4**	**41.8**	**14.1**	**22.5**	**2.96**	**0.41**	**1.20**	**1.47**	**33.50**	**0.45**
	90th percentile			**82.6**	**44.9**	**15.0**	**25.7**	**3.57**	**0.53**	**1.40**	**1.62**	**41.12**	**0.54**
	95th percentile			**83.1**	**45.4**	**15.4**	**26.1**	**3.63**	**0.55**	**1.49**	**1.63**	**41.20**	**0.60**
	98 th percentile			**83.5**	**45.5**	**15.7**	**30.0**	**3.75**	**0.56**	**1.55**	**1.63**	**41.42**	**0.61**
	AVERAGE			**80.5**	**41.7**	**13.8**	**23.1**	**2.94**	**0.42**	**1.22**	**1.47**	**34.09**	**0.44**

Annexure 3.4

1.0 Ambient Air Quality Monitoring Results

Station wise detailed monitoring data are furnished in **Tables 1.1** to **1.12**.The summarized results of ambient air quality monitoring (covering PM_{10}, $PM_{2.5}$, NOx, SO_2, CO, NH_3, O_3, Pb, As, Ni, Benzene and BaP are given in **Table 1.13.**

Table 1.1 : Detailed Ambient Air Quality Results For Near Coke Oven Plant (WZAAQ1), POST MONSOON 2018

S.No.	Date of Sampling	PM_{10} ($\mu g/m^3$)	$PM_{2.5}$ ($\mu g/m^3$)	NO_X ($\mu g/m^3$)	SO_2 ($\mu g/m^3$)
1	15/10/2018	140	82	48.2	51.9
2	18/10/2018	138	82	35.2	52.1
3	21/10/2018	144	85	41.7	40.5
4	26/10/2018	161	95	42.2	56.0
5	31/10/2018	122	72	26.5	42.8
6	3/11/2018	110	65	29.6	38.1
7	6/11/2018	109	64	31.6	52.8
8	9/11/2018	96	57	38.0	47.3

Table 1.2 : Detailed Ambient Air Quality Results For CPP 2 Near Appikonda Gate (WZAAQ2), POST MONSOON 2018

S.No.	Date of Sampling	PM_{10} ($\mu g/m^3$)	$PM_{2.5}$ ($\mu g/m^3$)	NO_X ($\mu g/m^3$)	SO_2 ($\mu g/m^3$)
1	15/10/2018	85	39	20.3	10.5
2	18/10/2018	78	30	25.2	9.6
3	21/10/2018	69	26	21.2	8.9
4	26/10/2018	99	54	23.7	16.6
5	31/10/2018	91	45	21.8	12.6
6	3/11/2018	96	58	21.5	13.5
7	6/11/2018	87	43	26.7	10.4
8	9/11/2018	75	31	22.3	12.3

Table 1.3 : Detailed Ambient Air Quality Results For Near Ash Pond (WZAAQ3), POST MONSOON 2018

S.No.	Date of Sampling	PM_{10} ($\mu g/m^3$)	$PM_{2.5}$ ($\mu g/m^3$)	NO_X ($\mu g/m^3$)	SO_2 ($\mu g/m^3$)
1	15/10/2018	190	85	37.2	25.7
2	18/10/2018	231	104	39.9	30.5
3	21/10/2018	164	74	34.3	29.5
4	26/10/2018	132	60	30.4	26.0
5	31/10/2018	119	53	29.6	22.0
6	3/11/2018	216	97	36.4	30.0
7	6/11/2018	262	118	32.5	27.1
8	9/11/2018	164	74	26.6	21.2

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Table 1.4 : Detailed Ambient Air Quality Results For Central Laboratory (WZAAQ4), POST MONSOON 2018

S.No.	Date of Sampling	PM_{10} ($\mu g/m^3$)	$PM_{2.5}$ ($\mu g/m^3$)	NO_X ($\mu g/m^3$)	SO_2 ($\mu g/m^3$)
1	15/10/2018	79	34	28.2	18.6
2	18/10/2018	80	38	20.9	17.4
3	21/10/2018	83	42	27.2	16.2
4	26/10/2018	89	50	31.7	15.7
5	31/10/2018	73	31	25.4	11.2
6	3/11/2018	88	47	26.9	15.7
7	6/11/2018	85	46	21.0	17.6
8	9/11/2018	81	40	15.1	13.8

Table 1.5 : Detailed Ambient Air Quality Results For Devada (A1), POST MONSOON 2018

S.No.	Date of Sampling	PM_{10} ($\mu g/m^3$)	$PM_{2.5}$ ($\mu g/m^3$)	NO_X ($\mu g/m^3$)	SO_2 ($\mu g/m^3$)
1	15/10/2018	92	52	22.7	13.2
2	18/10/2018	91	48	18.6	16.0
3	21/10/2018	90	47	25.8	12.7
4	26/10/2018	96	47	20.3	12.8
5	31/10/2018	95	51	27.3	13.1
6	3/11/2018	91	43	21.6	14.4
7	6/11/2018	87	41	29.3	13.3
8	9/11/2018	79	35	23.8	14.2

Table 1.6 : Detailed Ambient Air Quality Results For Gorlavaripalem (A2), POST MONSOON 2018

S.No.	Date of Sampling	PM_{10} ($\mu g/m^3$)	$PM_{2.5}$ ($\mu g/m^3$)	NO_X ($\mu g/m^3$)	SO_2 ($\mu g/m^3$)
1	13/10/2018	81	41	27.3	19.3
2	19/10/2018	90	48	28.9	19.3
3	25/10/2018	82	40	26.8	21.7
4	28/10/2018	89	50	24.0	21.1
5	1/11/2018	73	40	25.0	22.7
6	4/11/2018	88	52	22.3	19.7
7	7/11/2018	89	50	23.7	22.3
8	9/11/2018	86	45	23.7	20.1

Table 1.7 : Detailed Ambient Air Quality Results For Bhavaninagar (A3), POST MONSOON 2018

S.No.	Date of Sampling	PM_{10} ($\mu g/m^3$)	$PM_{2.5}$ ($\mu g/m^3$)	NO_X ($\mu g/m^3$)	SO_2 ($\mu g/m^3$)
1	15/10/2018	69	33	17.8	11.8
2	18/10/2018	79	45	13.1	13.2
3	21/10/2018	94	52	18.7	10.7
4	26/10/2018	90	51	16.2	13.4
5	31/10/2018	89	43	15.5	10.3

S.No.	Date of Sampling	PM_{10} ($\mu g/m^3$)	$PM_{2.5}$ ($\mu g/m^3$)	NO_X ($\mu g/m^3$)	SO_2 ($\mu g/m^3$)
6	3/11/2018	81	36	18.2	11.0
7	6/11/2018	87	45	20.7	10.5
8	9/11/2018	82	38	17.1	10.8

Table 1.8 : Detailed Ambient Air Quality Results For Sector 3, VSP Quarters (A4), POST MONSOON 2018

S.No.	Date of Sampling	PM_{10} ($\mu g/m^3$)	$PM_{2.5}$ ($\mu g/m^3$)	NO_X ($\mu g/m^3$)	SO_2 ($\mu g/m^3$)
1	15/10/2018	68	26	15.6	11.5
2	18/10/2018	70	31	14.7	10.9
3	21/10/2018	74	35	13.2	13.2
4	26/10/2018	71	42	10.3	13.8
5	31/10/2018	63	30	15.9	10.7
6	3/11/2018	75	39	19.2	12.6
7	6/11/2018	63	29	20.1	13.2
8	9/11/2018	57	25	14.2	8.4

Table 1.9 : Detailed Ambient Air Quality Results For Cheepurapalli (A5), POST MONSOON 2018

S.No.	Date of Sampling	PM_{10} ($\mu g/m^3$)	$PM_{2.5}$ ($\mu g/m^3$)	NO_X ($\mu g/m^3$)	SO_2 ($\mu g/m^3$)
1	13/10/2018	89	40	28.8	14.4
2	19/10/2018	90	47	25.8	16.1
3	25/10/2018	82	36	25.7	15.1
4	28/10/2018	90	49	25.4	13.2
5	1/11/2018	86	45	22.5	13.2
6	4/11/2018	78	38	26.4	16.0
7	7/11/2018	74	41	26.8	12.7
8	9/11/2018	81	44	23.5	12.8

Table 1.10 : Detailed Ambient Air Quality Results For Duvvada (A6), POST MONSOON 2018

S.No.	Date of Sampling	PM_{10} ($\mu g/m^3$)	$PM_{2.5}$ ($\mu g/m^3$)	NO_X ($\mu g/m^3$)	SO_2 ($\mu g/m^3$)
1	15/10/2018	85	41	22.6	13.8
2	18/10/2018	84	44	20.2	11.7
3	21/10/2018	82	38	19.7	12.8
4	26/10/2018	79	36	17.3	13.2
5	31/10/2018	82	39	23.4	17.1
6	3/11/2018	72	29	18.7	10.5
7	6/11/2018	75	34	15.6	8.6
8	9/11/2018	89	47	18.3	11.5

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Table 1.11 : Detailed Ambient Air Quality Results For Gangavaram (A7), POST MONSOON 2018

S.No.	Date of Sampling	PM_{10} ($\mu g/m^3$)	$PM_{2.5}$ ($\mu g/m^3$)	NO_X ($\mu g/m^3$)	SO_2 ($\mu g/m^3$)
1	15/10/2018	87	38	27.1	18.6
2	18/10/2018	89	41	30.8	15.3
3	21/10/2018	95	44	36.1	14.2
4	26/10/2018	119	54	41.3	23.1
5	31/10/2018	89	38	33.6	23.8
6	3/11/2018	87	45	22.3	15.6
7	6/11/2018	110	57	20.6	11.8
8	9/11/2018	98	43	25.4	17.7

Table 1.12 : Detailed Ambient Air Quality Results For Gajuwaka (A8), POST MONSOON 2018

S.No.	Date of Sampling	PM_{10} ($\mu g/m^3$)	$PM_{2.5}$ ($\mu g/m^3$)	NO_X ($\mu g/m^3$)	SO_2 ($\mu g/m^3$)
1	13/10/2018	80	49	26.1	18.1
2	19/10/2018	59	32	19.4	9.4
3	25/10/2018	61	34	20.2	10.6
4	28/10/2018	70	40	19.5	11.7
5	1/11/2018	72	41	21.3	15.0
6	4/11/2018	69	32	19.1	9.8
7	7/11/2018	82	39	24.6	16.4
8	9/11/2018	82	43	19.6	9.8

Table 1.13 : Summarized Results of one month AAQ Monitoring Inside the Plant during Post Monsoon Season

Parameter	Detection Limit of Instrument used	Statistical data	WZAAQ1	WZAAQ 2	WZAAQ 3	WZAAQ 4	A1	A2	A3	A4	A5	A6	A7	A8	NAAQS
PM_{10} ($\mu g/m^3$)	*5 $\mu g/m^3$*	**Mean**	128	85	185	82	90	85	84	68	84	81	98	72	*100*
		Min	96	69	119	73	79	73	69	57	74	72	87	59	
		Max	161	99	262	89	96	90	94	75	90	89	119	82	
$PM_{2.5}$ ($\mu g/m^3$)	*5 $\mu g/m^3$*	**Mean**	75	41	83	41	46	46	43	32	43	39	46	39	*60*
		Min	57	26	53	31	35	40	33	25	36	29	38	32	
		Max	95	58	118	50	52	52	52	42	49	47	57	49	
SO_2 ($\mu g/m^3$)	*4 $\mu g/m^3$*	**Mean**	47.7	11.8	26.5	15.8	13.7	20.8	11.5	11.8	14.2	12.4	17.5	12.6	*80*
		Min	38.1	8.9	21.2	11.2	12.7	19.3	10.3	8.4	12.7	8.6	11.8	9.4	
		Max	56.0	16.6	30.5	18.6	16.0	22.7	13.4	13.8	16.1	17.1	23.8	18.1	
NOx ($\mu g/m^3$)	*10 $\mu g/m^3$*	**Mean**	36.6	22.8	33.4	24.5	23.7	25.2	17.2	15.4	25.6	19.5	29.7	21.2	*80*
		Min	26.5	20.3	26.6	15.1	18.6	22.3	13.1	10.3	22.5	15.6	20.6	19.1	
		Max	48.2	26.7	39.9	31.7	29.3	28.9	20.7	20.1	28.8	23.4	41.3	26.1	
CO (mg/m^3)	*0.057 mg/m^3*	**Mean**	2.175	1.263	2.209	1.579	1.224	0.88	1.472	0.887	0.83	1.719	1.546	0.64	*2.0*
		Min	1.875	1.125	1.906	1.283	1.010	0.10	1.364	0.729	0.15	1.511	1.279	0.15	
		Max	2.581	1.384	2.541	1.871	1.543	2.69	1.575	1.105	2.57	1.928	1.975	1.32	
Ozone ($\mu g/m^3$)	*2.0 $\mu g/m^3$*	**Mean**	82	35	73	37	66	52	45	29	56	41	63	39	*100*
		Min	75	33	65	34	61	43	43	25	46	38	58	30	
		Max	89	39	80	41	71	60	47	34	65	44	67	49	
NH_3 ($\mu g/m^3$)	*4.2 $\mu g/m^3$*	**Mean**	177	48	73	64	62	41	57	26	63	59	71	68	*400*
		Min	149	37	67	56	55	37	52	20	58	51	68	65	
		Max	224	58	80	70	68	46	63	33	69	72	77	73	
Pb ($\mu g/m^3$)	*0.0006 $\mu g/m^3$*	**Mean**	0.1331	0.0117	0.1325	0.0292	0.0290	0.028	0.0414	0.0035	0.004	0.0460	0.0904	<0.0006	*1.0*
		Min	0.0860	0.0066	0.0846	0.0108	0.0234	0.013	0.0206	<0.0006	0.002	0.0160	0.0167	<0.0006	
		Max	0.1907	0.0185	0.1607	0.0569	0.0357	0.047	0.0608	0.0035	0.006	0.1059	0.1492	<0.0006	

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EIA/ EMP Studies for expansion of Integrated Steel Plant from 6.3 MTPA to 7.3 MTPA Liquid steel within the premises of Visakhapatnam Steel Plant

Parameter	Detection Limit of Instrument used	Statistical data	WZAAQ1	WZAAQ 2	WZAAQ 3	WZAAQ 4	A1	A2	A3	A4	A5	A6	A7	A8	NAAQS
As (ng/m^3)	*1.8 ng/m^3*	**Mean**	3.1	<1.8	3.5	<1.8	<1.8	2.3	<1.8	<1.8	2.8	<1.8	<1.8	2.0	*6.0*
		Min	2.0	<1.8	2. 6	<1.8	<1.8	<1.8	<1.8	<1.8	2.7	<1.8	<1.8	<1.8	
		Max	4.2	<1.8	4.7	<1.8	<1.8	2.6	<1.8	<1.8	3.0	<1.8	<1.8	2.0	
Ni (ng/m^3)	*0.6 ng/m^3*	**Mean**	12.3	4.2	16.0	3.5	14.5	3.8	13.6	<0.61	8.4	10.3	16.7	0.8	*20*
		Min	3.7	2.7	<0.61	0.9	12.1	1.7	8.6	<0.61	4.4	7.6	12.3	<0.61	
		Max	21.3	7.3	55.5	7.1	16.2	5.4	18.8	<0.61	10.8	12.5	22.7	1.0	
Benzene ($\mu g/m^3$)	*2.08 $\mu g/m^3$*	**Avg**	7.36	<2.08	4.48	2.82	2.56	3.82	<2.08	<2.08	2.77	2.51	4.86	2.72	5
BaP (ng/m^3)	*0.21 ng/m^3*	**Avg**	1.16	<0.21	0.52	0.36	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	<0.21	1

2.0 Summary of Results of Air Quality Status Inside and Outside the Plant

Inside the Plant (Core Zone)

AAQ was monitored at 4 stations in the four directions continuously for one month during the monitoring season. In absence of core zone ambient air quality standards, the values have been compared with NAAQS, 2009. The values of PM_{10} and $PM_{2.5}$ at WZAAQ2 and WZAAQ4 station is found within the limits when compared with National Ambient Air Quality Standards (NAAQS), 2009 of Central Pollution Control Board (CPCB).

The PM_{10} and $PM_{2.5}$ values are high in WZAAQ1 (near Coke Oven plants) in the East direction and WZAAQ3 (near Ash pond) in the South direction. High concentrations of pollutants are recorded at these locations. The high concentrations PM_{10} and $PM_{2.5}$ at WZAAQ1 can be attribute to the construction activities of new coke oven and activities nearby waste dumps. However, these are below norm when compared to work zone standards for dust specified in Indian Factories Act.

The WZAAQ1 (near Coke Oven plants) is also showing relatively high concentrations of ammonia , benzene and Benzo(a) pyrene concentrations compared to the other locations as the monitoring station is located in the downwind direction to ammonium sulphate and by product recovery plant. Whereas, the values in WAAQ3 (Near ash pond) is showing a downward trend for the above parameters. The values are further decreased in ambient air location A3 which is further south and beyond the plant premises.

Further, high Ni concentrations have observed in WZAAQ 1&3. However, WZAAQ2 & 4 the values are much below the norms. The presence of Ni in coal ash particles has been reported and naturally also available in soil (Journal of Industrial pollution Control (2008).

The high concentrations PM_{10} and $PM_{2.5}$ at WZAAQ3 can be attributed to the ash handling activities at the ash pond area and plying of trucks nearby. It is to be noted that the sea is less than a km away. Sand and salt spray blowing in from the sea coast cannot be ruled out the high PM levels. PM_{10} and $PM_{2.5}$ values are within the norms in remaining locations.

The values of SO_2, NOx and other parameters are within the limits at all locations within the core zone.

Outside the Plant (Buffer Zone)

AAQ was monitored at eight AAQ stations continuously for one month during the monitoring season. The results indicate that air quality is within norms for all the monitoring locations for all parameters as prescribed by NAAQS, 2009. However, values of PM_{10} and $PM_{2.5}$ are relatively high at A1 and A7. It can be attributed to material handling areas of port including coal at Gangavaram Port as well as higher vehicular movement. The high results of PM_{10} at A1 may be attributed due to higher vehicular movement in residential area, industrial activities and activities near ash pond.

VISAKHAPATNAM STEEL PLANT
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Ni values are found high in A7. Ni values are also relatively high at A1, A3 and A6 though the values are within norms. Higher values of Ni in ambient air have also been reported in studies in Vishakhapatnam area in literature (Ref. Atmospheric Pollution Research 7 (2016) 725-733). The possible reason is mainly due to anthropogenic activities.

Further, A5 station has reported values of As though within norms. The concentration of As might be due to proximity of thermal power plant in the vicinity of this monitoring station.

Annexure 3.5

Population Data

Sr. No	Mandal	Code	Name	Type	Total Household	Total Population	Total Male	Total Female	0-6 Child	SC population	ST Population	Total Literate	Total Illiterate
1	Paravada	586160	Thanam	Rural	1023	4526	2122	2404	440	188	9	2608	1918
2	Paravada	586164	Paravada	Rural	2057	8203	4166	4037	788	280	57	5412	2791
3	Paravada	586162	Pentaseema Bonangi	Rural	168	644	323	321	74	105	7	373	271
4	Paravada	586163	Payakarao Bonangi	Rural	274	998	496	502	113	0	0	552	446
5	Paravada	586167	Swayambuvaram	Rural	275	1023	523	500	102	20	0	560	463
6	Paravada	586169	Cheepurupalle (West)	Rural	2289	8573	4416	4157	887	644	90	5962	2611
7	Paravada	586170	Cheepurupalle (East)	Rural	2155	9317	4619	4698	1048	155	8	4488	4829
8	Paravada	586166	Ravada	Rural	1011	3789	1941	1848	389	105	0	2240	1549
9	Paravada	586168	Kalapaka	Rural	484	1722	867	855	180	102	21	973	749
10	Paravada	586161	Edulapaka Bonangi	Rural	715	2835	1434	1401	301	73	4	1822	1013
11	Paravada	586153	Thadi	Rural	1086	3980	1982	1998	452	131	5	2312	1668
12	Paravada	586160	Thanam	Rural	1023	4526	2122	2404	440	188	9	2608	1918
13	Pedagantyada	802947	GVMC (Part) Ward No.-0050	Urban	5371	22221	11317	10904	2428	441	383	13325	8896
14	Pedagantyada	802947	GVMC (Part) Ward No.-0051	Urban	5519	21725	11087	10638	2065	1548	80	14675	7050
15	Pedagantyada	802947	GVMC (Part) Ward No.-0052	Urban	4379	17422	8994	8428	1533	992	254	12907	4515
16	Pedagantyada	802947	GVMC (Part) Ward No.-0055	Urban	3622	14021	7291	6730	1439	270	316	8575	5446
17	Pedagantyada	802947	GVMC (Part) Ward No.-0061	Urban	860	3428	1786	1642	329	92	0	2724	704
18	Pedagantyada	802947	GVMC (Part) Ward No.-0062	Urban	4274	16474	8322	8152	1726	522	93	10900	5574
19	Gajuwaka	802947	GVMC (Part) Ward No.-0045	Urban	757	3125	1640	1485	301	20	7	1901	1224
20	Gajuwaka	802947	GVMC (Part) Ward No.-0046	Urban	66	185	99	86	10	2	0	174	11
21	Gajuwaka	802947	GVMC (Part) Ward No.-0050	Urban	2528	10387	5387	5000	1178	428	97	7111	3276
22	Gajuwaka	802947	GVMC (Part) Ward No.-0052	Urban	1596	6334	3261	3073	624	163	367	3975	2359
23	Gajuwaka	802947	GVMC (Part) Ward No.-0053	Urban	5500	21749	11055	10694	2323	1439	746	15651	6098

Sr. No	Mandal	Code	Name	Type	Total Household	Total Population	Total Male	Total Female	0-6 Child	SC population	ST Population	Total Literate	Total Illiterate
24	Gajuwaka	802947	GVMC (Part) Ward No.-0054	Urban	3819	15095	7634	7461	735	2598	1101	13792	1303
25	Gajuwaka	802947	GVMC (Part) Ward No.-0056	Urban	4616	18063	9065	8998	1897	881	142	12035	6028
26	Gajuwaka	802947	GVMC (Part) Ward No.-0057	Urban	2405	9325	4712	4613	1089	590	44	6229	3096
27	Gajuwaka	802947	GVMC (Part) Ward No.-0058	Urban	5398	20965	10623	10342	2118	1872	230	16010	4955
28	Gajuwaka	802947	GVMC (Part) Ward No.-0059	Urban	4393	17335	8751	8584	1705	1372	389	13094	4241
29	Gajuwaka	802947	GVMC (Part) Ward No.-0060	Urban	6930	26775	13749	13026	2755	1438	246	19669	7106
30	Gajuwaka	802947	GVMC (Part) Ward No.-0061	Urban	7012	27580	14095	13485	2740	1202	463	20825	6755
31	Gajuwaka	802947	GVMC (Part) Ward No.-0062	Urban	1731	7062	3602	3460	805	532	16	4805	2257
32	Gajuwaka	802947	GVMC (Part) Ward No.-0063	Urban	5406	21449	10988	10461	2162	965	81	16364	5085
33	Gajuwaka	802947	GVMC (Part) Ward No.-0064	Urban	6410	24575	12483	12092	2586	1122	77	17501	7074
34	Gajuwaka	802947	GVMC (Part) Ward No.-0065	Urban	5221	20419	10433	9986	1970	1701	92	15711	4708
35	Anakapalle	586172	Jagannadhapuram	Rural	215	787	398	389	102	17	0	315	472
36	Anakapalle	586183	Seethanagaram	Rural	1299	4834	2406	2428	546	288	2	2662	2172
Total					**101887**	**401471**	**204189**	**197282**	**40380**	**22486**	**5436**	**280840**	**120631**

Employment Rate

Sr. No	Mandal	Code	Name	Total Workers	Main Workers	Marginal Workers	Non Workers	Cultivators	Agricultural Workers	Household industry Workers	Other Workers
1	Paravada	586160	Thanam	1819	1494	325	2707	244	460	43	747
2	Paravada	586164	Paravada	3326	3050	276	4877	623	871	78	1478
3	Paravada	586162	Pentaseema Bonangi	234	230	4	410	22	119	5	84
4	Paravada	586163	Payakarao Bonangi	352	322	30	646	31	59	10	222
5	Paravada	586167	Swayambuvaram	471	354	117	552	33	110	28	183
6	Paravada	586169	Cheepurupalle (West)	3373	2997	376	5200	324	307	67	2299
7	Paravada	586170	Cheepurupalle (East)	4136	3310	826	5181	392	257	58	2603
8	Paravada	586166	Ravada	1785	1052	733	2004	154	197	54	647

Sr. No	Mandal	Code	Name	Total Workers	Main Workers	Marginal Workers	Non Workers	Cultivators	Agricultural Workers	Household industry Workers	Other Workers
9	Paravada	586168	Kalapaka	619	345	274	1103	28	37	9	271
10	Paravada	586161	Edulapaka Bonangi	1214	849	365	1621	84	60	7	698
11	Paravada	586153	Thadi	1436	1161	275	2544	73	185	31	872
12	Paravada	586160	Thanam	1819	1494	325	2707	244	460	43	747
13	Pedagantyada	802947	GVMC (Part) Ward No.-0050	7691	6219	1472	14530	32	44	216	5927
14	Pedagantyada	802947	GVMC (Part) Ward No.-0051	7415	6119	1296	14310	31	57	105	5926
15	Pedagantyada	802947	GVMC (Part) Ward No.-0052	5877	4371	1506	11545	24	67	83	4197
16	Pedagantyada	802947	GVMC (Part) Ward No.-0055	4910	4006	904	9111	26	360	38	3582
17	Pedagantyada	802947	GVMC (Part) Ward No.-0061	1144	828	316	2284	9	8	6	805
18	Pedagantyada	802947	GVMC (Part) Ward No.-0062	5533	3461	2072	10941	43	38	39	3341
19	Gajuwaka	802947	GVMC (Part) Ward No.-0045	1108	1093	15	2017	30	184	15	864
20	Gajuwaka	802947	GVMC (Part) Ward No.-0046	79	79	0	106	0	0	0	79
21	Gajuwaka	802947	GVMC (Part) Ward No.-0050	3805	3312	493	6582	46	31	78	3157
22	Gajuwaka	802947	GVMC (Part) Ward No.-0052	2277	1642	635	4057	8	19	13	1602
23	Gajuwaka	802947	GVMC (Part) Ward No.-0053	7418	5593	1825	14331	56	124	139	5274
24	Gajuwaka	802947	GVMC (Part) Ward No.-0054	4947	4203	744	10148	27	35	30	4111
25	Gajuwaka	802947	GVMC (Part) Ward No.-0056	6609	4701	1908	11454	25	163	101	4412
26	Gajuwaka	802947	GVMC (Part) Ward No.-0057	3441	3055	386	5884	199	63	29	2764
27	Gajuwaka	802947	GVMC (Part) Ward No.-0058	7370	6068	1302	13595	22	71	65	5910
28	Gajuwaka	802947	GVMC (Part) Ward No.-0059	5722	5118	604	11613	14	36	59	5009
29	Gajuwaka	802947	GVMC (Part) Ward No.-0060	9451	7855	1596	17324	60	82	232	7481
30	Gajuwaka	802947	GVMC (Part) Ward No.-0061	9484	7611	1873	18096	65	318	433	6795
31	Gajuwaka	802947	GVMC (Part) Ward No.-0062	2392	2211	181	4670	15	8	19	2169
32	Gajuwaka	802947	GVMC (Part) Ward No.-0063	7444	5985	1459	14005	44	79	316	5546
33	Gajuwaka	802947	GVMC (Part) Ward No.-0064	8800	7239	1561	15775	56	26	96	7061
34	Gajuwaka	802947	GVMC (Part) Ward No.-0065	7308	5100	2208	13111	51	71	131	4847
35	Anakapalle	586172	Jagannadhapuram	422	422	0	365	168	245	2	7
36	Anakapalle	586183	Seethanagaram	2372	1557	815	2462	427	495	35	600
Total				**143603**	**114506**	**29097**	**257868**	**3730**	**5746**	**2713**	**102317**

Annexure 3.6

भारतसरकार
GOVERNMENT OF INDIA
पर्यावरण ,वनएवंजलवायुपरिवर्तनमंत्रालय
MINISTRY OF ENVIRONMENT, FORESTS & CLIMATE CHANGE
Regional Office (South Eastern Zone),
1st & 2nd floor, HEPC Building, No.34, Cathedral Garden Road,
Nungambakkam, Chennai - 600034

F.No. EP/12.1/354/AP/2052
21.12.2017

To
The Executive Director,
Rashtriya Ispat Nigam Limited,
Visakhapatnam Steel Plant,
Administrative Building,
Visakhapatnam – 530 031.

Subject: a. Visakhapatnam Steel Project – Environmental Clearance – Regarding.
b. Expansion of Hot metal (Steel Plant) from 4.0 to 6.5 million tonne per annum (MTPA) at Vishakapatnam, Andhra Pradesh by M/s. Rashtriya Ispat Nigam Limited.

Reference: 1. Letter No. J-11011/1/87-IA, Dated: 04.01.1988.
No. J-11011/196/2005-IA II (I), Dated: 11.08.2005.
2. Your letter dated. 26.08.2017.

Sir/Madam,

With reference to the above mentioned subject, please find enclosed herewith a certified copy of the compliance report. This has been approved by the Addl.PCCF(C) vide diary no. 1821 dated: 14.12.2017.

Yours faithfully,

(Dr.C.Kaliyaperumal)
Director (S)

Encl: As above.

Dr. C. KALIYAPERUMAL, M.E., PhD.
Director (S)
Government of India
Ministry of Environment, Forests & Climate Change
Regional Office (South Eastern Zone)
HEPC Building, No.34, Cathedral Garden Road,
Nungambakkam, Chennai-600 034

Certified copy of the Compliance Report

Subject: Visakhapatnam Steel Project – Environmental Clearance – Regarding.

Reference: No. J-11011/1/87-IA, Dated: 04.01.1988.

Present Status of the project: As informed by the Project Authority (PA) this Environmental Clearance (EC) is for 3 million tones of liquid steel/4 million tones of hot metal. The PA has achieved the quantity in the year 2000. The PA manufacturing the steel and the unit is running.

Date of Monitoring: 07.11.2017.

S.No.		Conditions	Compliance
i.	a)	Environmental Management Plan (EMP) must be prepared which among others, should contain results of air and water quality monitoring to be done in the project area.	Complied Environment management plan was prepared along with the results of air and water quality monitoring and submitted. Further air & water quality are being monitored regularly and results of the same are being submitted along with six monthly compliance reports.
	b)	Continuous monitoring of air and water quality must be initiated immediately. Water to be monitored must include both marine and inland waters	Complied As informed by the PA the continuous monitoring of air was started in the year 1992 in all three shifts daily. Similarly water quality was started monitoring on daily basis (in land water) and on monthly basis (marine water) by the PA.
	c)	Minimum three ambient air monitoring stations must be installed.	Complied Three numbers of continuous ambient air quality monitoring stations were set up and they were monitoring.
	d)	An air monitoring station in the Zoological park in the north east must be set up.	Complied An ambient air monitoring station (Repairable dust sampler) is installed in the zoo park area and monitoring is being done regularly.
	e)	Two monitoring stations one for air and other for water must be set up at Kondakarla lake towards the south of Visakhapatnam	Complied Two monitoring stations one for air and other for water has been set up at Kondakarla lake towards the south of Visakhapatnam.
ii.		The project authorities (VSP) must	Complied

	consider using low sulphur gas / oil. If such use is not possible appropriate flue gas de-sulphurisation devices must be installed at relevant units.	In their power plant earlier proposal was to utilize low sulphur Gas/oil. They used LSHS along with boiler coal for a short time and then discontinued due to some reason. Instead they started using boiler coal which is containing low sulphur (0.17%). Flue gas de-sulphurisation plant has not been installed.
iii.	VSP authorities must recycle effluents to the extent possible. In any case, the treated effluent must be used for irrigation of afforested area.	Refer below The effluent is treated in the ETP and the treated effluent is used for dust suppression at raw material handling plant after meeting the standards. Township sewage water is treated and being used as makeup water in Rolling mills & SMS after treatment in Ultra-filtration plant since Dec'2005onwards.
iv.	VSP authorities must divert the storm water towards the south side away from the creek (which is on the northern side)	Refer below This condition was dropped by MoEF vide letter no. J-11014/75/90-1A .II(i) Dated 20.07.2000
v.	VSP authorities must relocate sludge / debris dump, the ash pond, the labourer and staff colony shown in the south west corner away from the sea shore. Revised plan in this regard must be submitted to this Ministry for approval.	Complied VSP authorities relocated sludge / debris dump, the ash pond, the labourer and staff colony shown in the south west corner away from the sea shore. Revised plan in this regard was submitted to this Ministry for approval on 30.07.88.
vi.	Present and future linkages for coal must be established and reported to the Ministry.	Complied The coal linkage for VSP is as follows: 1. Steam coal is from collieries of Talcher & 1b Valley of M/s Mahanadi Coal Fields 2. Coking coal is imported from Australia, New Zealand and USA etc., through Gangavaram Port limited. 3. Medium coking coal is from washeries -Rajarappa, Swang and Kathara of M/s Central Coal fields and the same were report to the Ministry.

vii.	a)	VSP authorities must provide a green belt of 3600 ha.	Refer below a) As informed 3600 ha. is brought under green belt development .
	b)	The above green belt will include 500 metres wide green belt on the boundary of the acquired land.	b) The above green belt includes 500 metres wide green belt on the boundary of the acquired land also.
	c)	Out of total green belt, 1970 hectares must be declared as reserve forest under the control of VSP and covered by the Forest conservation act, 1980. The balance 1630 hectares must not be used for any other purpose excepting for further expansion of the plant.	c) Out of total green belt, 1970 hectares has not been declared as reserve forest instead 283.4 ha. has been given to Gangavaram Port as directed by Government of Andhra Pradesh. Balance 1630 ha. is earmarked for afforeststation. Out of this 1630 ha. 880 ha. was used for expansion of 4 to 6.5 tons hot metal per annum. *The detail of land use plan is enclosed separately.(Annexure – I)*
	d)	2809 hectares of salt lands must be afforested with appropriate floral species. This area will be regarded as permanent reserve forest under the control of VSP and will be governed by the Forest (Conservation) Act, 1980.	d) 2809 ha. of salt land has not been afforested. As informed by the PA, the land details were already taken up with the Ministry for clarification.

This has the approval of the Addl.PCCF(C) vide diary no.1821 dt: 14.12.2017.

(Dr.C.Kaliyaperumal)
Director (S)

Dr. C. KALIYAPERUMAL, M.E., PhD
Director (S)
Government of India
Ministry of Environment, Forests & Climate Change
Regional Office (South Eastern Zone)
HEPC Building, No.34, Cathedral Garden Road,
Nungambakkam, Chennai-600 034.

Certified copy of the Compliance Report

Subject: Expansion of Hot metal (Steel Plant) from 4.0 to 6.5 million tonne per annum (MTPA) at Vishakapatnam, Andhra Pradesh by M/s. Rashtriya Ispat Nigam Limited.

Reference: No. J-11011/196/2005-IA II (I), Dated: 11.08.2005.

Present Status of the project: The Project Authority (PA) manufacturing 4.5 million tons per annum of hot metal and generating 248.1 MW power.

The PA now going for an expansion from 6.5 to 7.5 MTPA (Hot metal) and for this they have approached the Ministry in the year 2015 to get an amendment. The chronological events carried out by the PA with the Ministry is attached herewith for information (Annexure – I). As informed by the PA during the discussion, the Ministry directed the PA to submit an application for getting TOR and for that the PA also submitted their application to the Ministry and TOR was issued on 19.09.2016. By this time, the PA started their construction activities for their modernization / expansion from 2013 onwards without obtaining EC. Blast furnace - I was started in October 2013, Blast Furnace –II was started in May, 2016, Sinter Plant - I was started in October 2016, Converter – III was started in March, 2013, Converter – IV was started in June, 2014, Turbo Blower – V was started in June 2014 and Reservoir was started in July 2016. All these expansion activities were started without obtaining prior Environmental Clearance. The status of the expansion details is given in Annexure – II.

Date of Monitoring: 07.11.2017

A. Specific Conditions:

S.No.	Conditions	Compliance
i.	The gaseous emissions from various process units shall confirm to the load/mass based standards notified by this Ministry on 19th May, 1993 ad standards prescribed from time to time. The state Board may specify more stringent standards for the relevant parameters keeping in view the nature of the industry and its size and location. At no time the emission level shall go beyond the prescribed standards. In the event of failure of any pollution control system adopted by the unit, the respective unit shall not be restarted until the control measures are rectified to achieve the desired efficiency.	Refer below Load based norms was stipulated only for Coke oven plant by APPCB. As per their norms for CO in Coke oven batteries is 3 Kg/tone of coke produced. The PA informed that the load based norm is between 2.2 and 2.5 Kg/tone of coke produced. As informed that at no time the emission level has gone beyond the prescribed standards and assured that in the event of failure of any pollution control system adopted by the unit, the respective unit would not be restarted until the control measures are rectified to achieve the desired efficiency.
ii.	a) As reflected in the EIA/Environmental Management Plan report, the company shall undertake water conservation measures by adopting closed loop water recirculation system, recycling of direct contaminating cooling water through cooling tower, use of cooling tower blow down and slag granulation and dust suppression.	The Company is undertaking water conservation measures by adopting closed loop water recirculation system, recycling of direct contaminating cooling water through cooling tower, use of cooling tower blow downs and slag granulation and dust suppression.
	b) The waste water from gas clearing plant, rolling mill, power plant, cooling tower blow down shall be treated in waste water treatment plants.	The waste water from the gas cleaning plant, cooling tower blow downs are treated in waste water treatment plants.
	c) The coke oven effluent shall not increase 2880m3/ Existing effluent treatment plan shall be upgraded to treat the coke oven effluent and treated effluent shall comply with the prescribed standards.	Complied The coke oven effluent generation is about 2000 m^3/day. As informed that the existing effluent treatment plant was upgraded to treat the coke oven effluent and treated effluent is complying with the prescribed standards. The PA monitoring on daily basis in addition to the APPCB monthly monitoring. Now the PA has installed online effluent monitoring system and it would be commissioned in the month of December 2017.
	d) The Company shall make efforts to maximize the reuse of the treated effluent. The surplus treated waste water shall be stored in the holding pond for use in the lean period.	Complied. The PA has informed that efforts are made to maximize reuse of treated effluent. About 90 m^3/hr of treated effluent which was earlier let out into the sea is now reused for dust suppression activities at Raw Material Handling Plant. There is no surplus treated waste water now.
	e) The overflow shall be discharged through a marine outfall into the sea. The discharge point shall be decided in consultation with the National Institute of Oceanography, Goa.	Complied. Since there is no surplus treated waste water storage, no over flow at present. The marine outfall discharge point was finalized in consultation with NIO, Goa.
	f) Further a marine ecological study shall be carried out to study the impact of discharge of excess treated waste water on the marine water quality.	Complied. The PA has informed that National Institute of Oceanography, Goa has carried out the study on "Monitoring of chemical & biological parameters

			in the marine environment off Appikonda and toxicological studies of the treated effluent of Visakhapatnam Steel Plant" in the year 2010, wherein it was mentioned that there is no impact of discharge of treated waste water on marine ecology.
	g)	The domestic waste water after treatment in STP shall be used for rolling mill and steel melt shop for cooling purpose.	Complied. The PA has informed that township sewage is treated with effluent and the treated water is being reused in Steel Melting Shop & Rolling Mills after ultra filtration.
iii.	a)	In plant control measures for checking fugitive emissions from spillage / raw materials handing shall be provided.	Complied. The PA monitoring the fugitive emissions on monthly basis which is highly in adequate.
	b)	Further specific measures provisions of dust extraction and dust suppression system from raw material handling, water sprinkling system at the stock yards shall be provided.	Complied. The PA has informed dust extraction and dry Fog type dust suppression systems are provided in raw material handling systems. Also it was informed that a water sprinkling system is provided in the stock yards.
	c)	The company shall provide dry fogging system for crushing and screening plant, material and transfer points etc.	Complied. The PA has informed that dry fog type systems are provided for crushing and screening plant, material and transfer points etc.
	d)	Data on fugitive emissions shall be regularly monitored and records maintained.	Complied. The PA has informed that fugitive emission data is being maintained.
iv.		The company shall strictly comply with the standards notified under the Environment (Protection) Act, 1986 vide GSR 631 (E) dated 31st October, 1997 to control the fugitive emissions, VOC from the doors, lids and off takes of the coke oven batteries.	Complied. The PA has informed that Fugitive emissions and VOC emissions from the doors, lids and offtakes of the coke oven batteries are monitored regularly as per the notified standards and are below the norms.
v.	a)	The company shall provide dust suppression systems by bag filters and ESP to control the particulate emissions within 50mg/m3	Complied. The PA has informed that dust suppression systems such as bag filters and ESP are provided to control the particulate emissions to

			within 50mg/m3.
	b)	Cast house extraction system shall be based on ESP / bag filters.	Complied. The PA has informed that Cast house extraction system is based on ESP.
	c)	The company shall use low NOx burners to control the NOx emissions.	Complied. The PA has informed that Low Nox burners are provided wherever it is required.
vi.	a)	As per the solid waste management plan submitted to the Ministry, the company shall enhance efforts for reuse of solid wastes. The BF slag shall be sold to cement industries.	Complied. The PA has informed that efforts are being made to enhance reuse of solid wastes (slag, coal dust) and that BF slag is being sold regularly to cement industries for manufacturing slag cement. Coal dust is recycled in sinter plant.
	b)	The slag from the steel melting shop shall be partly reused and partly dumped within the plant premises.	Complied. The PA has informed that the slag from steel melting shop is partly being recycled at Sinter Plant and partly dumped within the plant premises. It is also being used for making roads, as railway ballast and filling of low lying areas.
	c)	The sludge, dust extraction dust, mill scales and used refractory bricks shall be 100% recycled.	Complied. The PA has informed that most of sludge, dust extraction dust, mill scales are being recycled at Sinter Plant and for making refractory bricks. 100% of the solid waste is reused.
	d)	The dry fly ash shall be utilized for brick making and ash from the pond will be used for land reclamation.	Refer below. The PA has informed that tendering has been done for setting up of brick making unit in PA's land and pond ash is being used for land reclamation works.
	e)	The hazardous wastes generated in the tar sludge, benzol muck, MBC sludge shall be charged alongwith coal into the coke oven batteries.	Complied. The PA has informed that the hazardous wastes such as tar sludge, benzol muck, Mechanical Biological Chemical treatment plants sludge are being charged alongwith coal into the coke oven batteries.
	f)	The spent oil shall be sold to the	Complied. The PA has informed that spent oil is

		authorized re-processors.	being collected, reclaimed and reused in their plant. Further only non-reclaimable waste oil is collected, stored and disposed to authorised re-processors.
vii.		The company shall develop green belt in 34 ha. of the plant area in addition to the 3425 ha. of plant area already afforested. Selection of plant species is as per the Central Pollution Control Board guidelines.	Refer below The PA has informed that the balance area of 34 Hectares in green belt will be taken up after the land dispute is resolved by the State government. Plantation is done as per CPCB guidelines and details of species are provided at Annexure-III.
viii.		The company shall undertake rainwater harvesting measures to recharge the ground water.	Complied. The PA has informed that 12 masonry check dams, 3 Earthen check dam, 112 Percolation pits and recharging wells have been constructed for rainwater harvesting measures to recharge the ground water.
ix.		Occupational Health Surveillance (OHS) of the workers should be done on a regular basis and records maintained as per the Factories Act.	Complied. The PA has informed that a full fledged OHS is functioning since 1992 onwards. Periodical medical examinations are carried out regularly and records are maintained.
x.		Recommendations made in the Charter on Corporate Responsibility for Environment Protection (CREP) shall be implemented.	Refer below The details of implementation of CREP recommendation provided by the PA are enclosed herewith as Annexure - IV.
B. General Conditions:			
S.No.		**Conditions**	**Compliance**
i.		The project authorities must strictly adhere to the stipulations made by the APPCB and State Government	Complied The PA has informed that all the stipulations made by the APPCB and State Government are being implemented.
ii.		No further expansion or modifications in the plant shall be carried out without prior approval of the MoEF.	Refer below The details are given in the present status of the project.
iii.		At least four ambient air quality monitoring stations shall be established in the downward direction as well as where	Complied. The PA has informed 3 Continuous Ambient Air Quality Monitoring

		maximum ground level concentration of SPM, SO2 and NOx are anticipated in consultation with the State Pollution Control Board. Data on ambient air quality and stack emission should be regularly submitted to this Ministry including its Regional Office at Bangalore and the State Pollution Control Board / Central Pollution Control Board once in six months.	Stations (CAAQMS) have been established within plant premises and fourth station is installed at Pedagantyada village in the downwind direction of factory. The locations of the monitoring stations were decided in consultation APPCB. The real time data are transmitted to APPCB and CPCB.
iv.		Industrial waste water shall be properly collected, treated so as to conform to the standards prescribed under GSR 422(E) dated 19th May 1993 and 31st December, 1993 or as amended from time to time. The treated wastewater should be utilized for makeup plantation etc.	Refer below The industrial waste water is treated with sewage generated from their colony and office. The treated sewage is reused to some extend and also disposed into the marine environment. The treated sewage is not used for green belt development.
v.	a)	The overall noise levels in and around the plant area shall be kept well within the standards (85 dBA) by providing noise control measures including acoustic hoods, silencers, enclosures etc., on all sources of noise generation.	Complied. The PA has informed that adequate noise control measures such as acoustic hoods, silencers, enclosures are provided at all sources of noise generation. The noise levels were monitored and as informed the levels within the limit.
	b)	The ambient noise levels should conform to the standards prescribed under Environment (Protection) Act. 1986 Rules, 1989 viz., 75 dBA (daytime) and 70 dBA (nighttime).	Complied. The PA has informed that monitoring of noise levels during day and night times are being carried out regularly and the results are within the limit.
vi.	a)	The project proponent shall also comply with all the environmental protection measures and safeguards recommended in the Environmental Impact Assessment Notification, 1994 / Environmental Management Plan report.	Refer below Though the PA informed that the Environment Protection Measures and safeguards recommended in the Environmental Impact Assessment Notification, 1994 / Environmental Management Plan report are implemented, the fugitive dust levels control measures are highly inadequate.
	b)	Further, the company must undertake socio-economic development activities in the surrounding villages like community development programmes, educational programmes, drinking water supply and	Refer below The PA informed that under CSR, many activities were carried out in and around the villages and a copy of the report provided is herewith

		health care etc.	enclosed as Annexure –V.
vii.		The project authorities will provide requisite funds both recurring and non-recurring to implement the conditions stipulated by the Ministry of Environment & Forests as well as the State Government along with the implementation schedule for all the conditions stipulated herein. The funds so provided shall not be diverted for any other purposes.	Complied. The PA has informed that an amount of Rs 1503.67 cr. and Rs. 337 Cr. was incurred for non-recurring and recurring expenditure annually for environmental management activities.
viii.		The Regional Office of this Ministry at Bangalore / Central Pollution Control Board / State Pollution Control Board will monitor the stipulated conditions. A six monthly compliance report and the monitored data along with statistical interpretation should be submitted to them regularly.	Complied. The PA submitting six monthly compliance reports and the monitored data to MoEF& CC, RO, APPCB and CPCB regularly.
ix.		The project proponent shall inform the public that the project has been accorded environmental clearance by the Ministry and copies of the clearance letter are available with the State Pollution Control Board / Committee and may also be seen at Website of the MoEF at http//envfor.nic.in. This should be advertised within seven days from the date of issue of the clearance letter, at least in two local newspapers that are widely circulated in the region of which one shall be in the vernacular language of the locality concerned and a copy of the same should be forwarded to the Regional Office.	Refer below No details made available.
x.	a)	The Project Authorities shall inform the Regional Office as well as the Ministry, the date of the financial closure	Refer below No details made available.
	b)	Final approval of the project by the concerned authorities and the date of commencing the land development work.	Refer below The PA has not submitted final approval of the project by the concerned authorities and the date of commencing the land development work to the Ministry and also RO.
3		The Ministry may revoke or suspend the clearance, if implementation of any of the above conditions is not satisfactory.	Refer below Refer the Present status of the project and General conditions number. vi.

4	The Ministry reserves the right to stipulate additional conditions if found necessary. The Company in time bound manner will implement these conditions.	Agreed to Comply.
5	The above conditions will be enforced, inter-alia under the provisions of the Water (Prevention & Control of Pollution) Act, 1974, the Air (Prevention & Control of Pollution) Act, 1981, the Environment (Protection) Act, 1986 and the Public (Insurance) Liability Act, 1991 along with their amendments and rules.	Refer below CFO validity is upto Feb, 2019 and the Public (Insurance) Liability Act, validity is upto March, 2018.

This has the approval of the Addl.PCCF(C) vide diary no.1821 dt: 14.12.2017.

(Dr.C.Kaliyaperumal)
Director (S)

Dr. C. KALIYAPERUMAL, M.E., PhD
Director (S)
Government of India
Ministry of Environment, Forests & Climate Change
Regional Office (South Eastern Zone)
HEPC Building, No.34, Cathedral Garden Road,
Nungambakkam, Chennai-600 034.

Annexure - I

LAND

Acres /Ha

- Total Acquired Land : 19703/7977
- Plant area : 7859/3181.8
- Township : 4875/1973.7
- Auxiliaries : 2103/851.4
- Afforestation : 8892/3600
  (In Plant+ Township+ Auxiliaries areas)
- Area allotted for green belt : 4866/1970
- Area afforested in the green belt : 4448.5/1801
- Area of green belt given to Gangavaram Port ltd : 333.5/135
- Balance land to be afforested in the green belt area : 84 */34
- Area afforested other than green belt : 4026/1630
  (*Land under dispute & taken up with state govt for resolving the issue. Aforestation to be done after the issued is resolved)

Annexure - IA

Chronology of Events

I.No.	Event	Date
1	Applied online to MOEF for amendment of 6.3 MTPA to 7.3 MTPA and hard copy sent through courier	05.02.2015
2	VSP could not attend meetings as they could not track the website information	11.02.2015 & 27.03.2015
3	MOEF acknowledged the proposal and asked for submission of hard copy	13.04.2015
4	Hard Copy resubmitted to MOEF	16.04.2015
5	While pursuing the status with MOEF, it is understood that the file was not traceable in MOEF newly shifted office in Delhi and RINL was advised to resubmit the application and application was resubmitted	20.12.2015
6	Summary project report submitted to MOEF	23.01.2016
7	MOEF meeting attended by Dastur Co and VSP officials Sri T.T.Reddy & Sri P.B.C.Rao	28.01.2016
8	MOEF rejected the proposal for amendment and asked for fresh submission for TOR	28.01.2016
9	Brief of proceedings of 28-1-16 meeting of MOEF submitted by Sri T.T.Reddy & Sri P.B.C.Rao	03.02.2016
10	Open tender issued for consultancy	12.03.2016
11	M/s Bhagavathi Analabs is engaged as consultant	06.05.2016
12	Applied online to MOEF enclosing Form-1 & pre feasibility report	30.06.2016
13	Presentation given to MOEF	28.07.2016
14	TOR issued	19.09.2016
15	TOR Hard copy received at VSP	22.10.2016
15	Base line study conducted	October to December'2016
16	Draft EIA report submitted for VSP review by Bhagavati Ana Labs	Feb'2017
17	Draft EIA report made ready	April'2017
18	Draft EIA report submitted to APPCB for public hearing	08.05.2017
19	Public Hearing conducted	15.06.2017
20	Applied online to MOEF enclosing final EIA report	27.07.2017
21	MOEF sought essential details (certified compliance report of 6.3 MTPA environmental clearance)	04.08.2017
22	Compliance report submitted to Chennai RO / hard copy submitted through courier on	26.08.2017/ 05.09.2017
23	Inspection carried out by RO, MOEF	07.11.2017

Annexure -III

STATUS OF VARIOUS PACKAGES AS ON NOVEMBER-2017

Package	Front hand over date / Contractual Start Date	Actual Completion date / Likely completion date	Status as on November-2017
BF-1 Revamping	25/10/2013	31/07/2014	Commissioned and running at 90% capacity
BF-2 Revamping	5/5/2016	21/08/2017	Commissioned and running at 60% capacity
Sinter Plant-I Revamping	31/10/2016	31/07/2017	Commissioned and running at 70% capacity
Kanithi Balancing Reservoir-2	19/07/2016	Likely to be completed in July – 2018	15 % of construction work completed.

Package	Front hand over date / Contractual Start Date	Actual Completion date / Likely completion date	Status as on November-2017
3rd Converter	March – 2013	Completed in Nov-2016	100 % completed
4th Caster	June- 2014	Likely to be completed in December – 2017	80 % completed
TB-5	June-2014	November – 2017	95% completed
Sinter Plant-2 Revamping			Not yet started

Annexure - IV

II: Status of Charter on Corporate Responsibility for Environmental Protection(CREP) of detail below:

Status Report on Corporate Responsibility for Environment Protection (CREP)

Sl. No	Action point	Status/action taken	Remarks
1	To meet the parameters PLL, PLD & PLO as notified under EPA by Dec'06	PLD, PLL & PLO in existing 3 batteries are well below the norms.	
2	To re-build at least 40% of Coke Oven Batteries by 2012	Battery-1 re-building for 30 months from AUG'2016 after Bat-5 commissioning in June'2016	Bat-2: Cold repairs done in 2000 Battery-1 17 nos of Hot full wall repairs completed by Aug'2013 Battery-3 Hot full wall repairs completed in total 68 No's of Heating walls by Apr'2015
3	Steel Melt Shop – Fugitive emissions to reduce 30% by Mar'04	Fugitive emissions reduced by 50% by installing Torpedo ladle fume extraction system in Dec'02. Since then it is maintained for controlling fugitive emissions.	Completed
4	Steel Melt Shop – Fugitive emissions to be reduced by 100% by Mar'08 including installation of secondary de-dusting facilities	Installation of secondary de dusting facilities is under progress	SMS-2: Installed & Commissioned SMS-1: 1,2 &3 Converters Commissioned
5	Direct injection of reducing agents by June, 2013	Pulverized Coal injection in BF-1 commissioned on 18/03/15 & BF-2 is under implementation – by Dec'2016 Pulverized coal injection in BF-3 is commissioned on 02/12/2015	
6	Solid waste / Hazardous waste management: SMS & BF slag utilization 70% by '04, 80% by '06 and 100% by '08 – CREP		

Item	QUANTITY (t) 2014-15	2015-16	2016-17	Sep'17	2017-18
BF slag generation	1405462	1424169	1434882	122929	737533
BF slag utilisation	1260178	1264809	1230617	105928*	1248981
SMS slag generation	471246	507959	527819.786	47073	286556

Sl. No	Action point	Status/action taken						Remarks
		SMS slag utilisation	166130	132894	97048	11037	50220	
		% of (BF & SMS) total slag utilisation	77.07	72.34	67.14	121.74*	126.86	
		*- Excess qty. sold recycled was from previous stock.						
		100% disposal of Hazardous wastes being done as per authorization of APPCB						
7	Charge of tar sludge / ETP sludge in coke oven by June'03	• Complied • Charging being done regularly						
8	Inventorization of hazardous wastes	• Complied • Annual returns are being submitted in form-4 regularly.						
9	Water conservation & water pollution : reduce specific water consumption to 5 m3/tls	Complied. Sp. water consumption of VSP is as given below.						
		Parameter	**14-15**	**15-16**	**16-17**	**Sep'17**	**2017-18**	
		Specific water consumption. (m3/tcs)	2.78	2.63	2.50	2.47	2.51	
10	To operate COBP effluent treatment plant efficiently to achieve the standards by July'04	Being maintained efficiently						Status to be maintained in future also
11	Installation of continuous stack monitoring equipment by Jun'05	On-line monitors for all stacks are already installed and in operation						Status to be maintained in future also
12	Setting up of 3 nos. on-line ambient air quality monitoring stations by Jun '05	Four stations (3 in the plant premises & 1 outside) are commissioned and working						Status to be maintained in future also
13	To operate existing pollution control eqpt & keep proper records	Procedures and records for status / availability of DE systems and pollution control facilities are established as per QMS and EMS. Emissions of DE systems are also monitored and records maintained as per EMS.						Status to be maintained in future also
14	To implement the recommendations of LCA Study • Battery 1, 2, 3 repaired. In good health • Coke dry quenching, BF top gas recovery, LD gas recovery and 100% continuous casting.	• Complied • Complied						Status to be maintained in future also

Sl. No	Action point	Status/action taken	Remarks
	• Dog house- SMS • PCI in BF 1&2 • Sp. Water Consumption • Specific Energy consumption	• Planned along with replacement of existing converters • Under implementation • Complied • Complied	
15	Energy recovery from BF top gas pressure	Gas Expansion Turbines - 2x12 MW in BF 1 &2 are in operation. For new BF-3 - 1 x 14 MW TRT installed and commissioned on 11.06.2014.	Gets production- 859 MWh TRT-4531 MWh
16	Use of tar free runners / BF	• Tar free runners provided in BF-1 during Cat-1 capital repairs • BF-2 along with Cat-1 capital repairs • BF 3 is with Tar free runners only	
17	De-dusting in cast house	• Complied - Cast House Exhaust Station in all Blast Furnaces is in operation	
18	Suppression of fugitive emission using N_2	Cast house exhaust stations with ESPs are already provided to take care of cast house emissions hence, suppression with N_2 is not required / applicable.	
19	Processing of waste containing flux & ferrous wastes through waste recycling plant	Lime briquette plant, skull breaker, magnetic separator, screens and facilities for LD slag recovery exist.	
20	To implement rain water harvesting measures	12 masonry check dams, 1 Earthen check dam, Percolation pits and recharge wells 112 have been constructed so far.	1. 125 Rain water facilities are provided 2. Two Rain harvesting projects being implemented at an expenditure of Rs. 1303 lakhs for saving of 3.3 MGD of water
21	Reduction of green house gases by: a. Reduction in power consumption	Following initiatives taken for reduction of power consumption: • Reducing field currents in DC motors in rolling mills (during no rolling periods) • Use of vector drives in Raw Material Handling Plants • Use of VVF drives in DE Systems of Coke Ovens • Regular audit and fine tuning of equipment to reduce power consumption • Energy saving devices and energy efficient lighting systems implemented extensively in the plant • Transparent roof sheets provided in suitable areas to reduce load during day time	
	b. Use of by-products gases for power generation	Being used extensively in TPP, CCCD, CRMP, SP, SMS, BF& Mills.	
	c. Promotion of Energy Optimization Technology	In-house energy audits are done.	

Sl. No	Action point	Status/action taken	Remarks
	incl.energyaudit		
22	To set targets for Resource Conservation such as raw material, energy and water consumption	Internal targets are set towards resource conservation & monitored regularly to ensure the targets are met	
23	Up-gradation of the monitoring and analysis facilities for air and water pollutants. Also impart elaborate training to the manpower	1. Monitoring facilities: 4 Continuous Ambient Air Stations and 20 Continuous Stack Emission Monitoring Systems are installed. 2. Environment laboratory is now equipped to analyse all parameters related to physical characteristics, inorganic and organic elements, trace metals, microbiological and Bio-Assay characteristics. 3. Training being imparted regularly.	
24	Power Plants should provide dry fly ash free of cost to the users		Work is under progress
25	Good housekeeping	Good housekeeping is being maintained all over the plant thro' EMS, QMS, OHSMS. As a proactive measure, VSP has also adopted the concept of "5-S" to improve housekeeping. In each department a team has been formed for the implementation of "5S". All 74 departments have implemented 5S and have been certified for the same.	

Plantation status in Visakhapatnam Steel Plant as on 31.05.2017

A)	Erstwhile Afforestation Department – 36,97,792	
	a. Total plants planted – 35,22,000 b. Survived - 17,49,591 c. Regenerated - 21,13,209 d. No of trees harvested by AF Department – 1,65,000 **e. Total number of trees available when AF Department of formed – 36,97,792**	
B)	Planted by Agro Forestry:	
	2005-2006	86000
	2006-2007	0
	2007-2008	449400
	2008-2009	46000
	2009-2010	209700
	2010-2011	144000
	2011-2012	16076
	2012-2013	121150
	2013-2014	177000
	2014-2015	130374
	2015-2016	112000
	2016-17	25400
	Total	**1517100**
C)	**Grand Total (A+B)**	**5214892**

*127000 plants planted under Green Visakha within VSP Area.

D. Cost incurred by Agro Forestry

Net amount spent during 2005-2006 to 2013-14 = 3507 Lakhs

Amount spend during 2014-15 to 2016-17 = 327 Lakhs

Total expenditure – 3635 Lakhs

E. Stipulation of Mos for 3.3 million ton :

a. Green Belt Area – 1970 Ha
b. Afforestation Area – 1630 Ha

F. Stipulation for 6.3 million Ton :

a. Green Belt Area – 1970 Ha
b. Afforestation Area – 750 Ha

G. species wise plantation Details

Sl.No.	Species	Number of Plants Planted	Remarks
1	Casurina	2453257	To effectively combat TUSNAMI attacks and to act as Wind barriers during Cyclones, as the Plant is located in close proximity to Sea.
2	AA Formis	534088	To contain Air Pollution and for Carbon Sequestration.
3	Eucalyptus	947475	
4	Miscellaneous	655374	
5	Mango	29441	
6	Coconut	8318	
7	Cashew	46888	
8	Guava	5561	
9	Salvadora	12000	
10	Neem	44314	
11	Babul	31362	
12	Teak	1814	
13	Plmyrah	50000	Naturally grown
14	Pongamiea	140000	
15	Jatropha	255000	To Produce Bio-Diesel
	TOTAL	5214892	

THE NEW INDIA ASSURANCE CO. LTD.
(Wholly owned by the Govt. of India)

POLICY SCHEDULE FOR PUBLIC LIABILITY (Act Only) INSURANCE

Insured's Name	:	M/S. RASHTRIYA ISPAT NIGAM LIMITED			
Insured's Details			Issuing Office Details		
Customer ID	:	P005009341	Office Code	:	VIZAG DO-III TIED DO 620300 (620300)
Address	:	VISAKHAPATNAM STEEL PLANT VISAKHAPATNAM ANDHRA PRADESH, 530040	Address	:	D.NO.49-01-09, IIND FLOOR, DALI RAJU SUPER MARKET, AKKAYYAPALEM MAIN ROAD,VISHAKAPATNAM - 530 016 530016
Phone No	:		Phone No	:	08912517737 / 08912591977
E-mail/Fax	:	/	E-mail/Fax	:	na.620300@newindia.co.in / 08912517781
PAN No	:		S.Tax Regn. No	:	AAACN4165CST176

Policy Details					
Policy Number	:	620300361633000000002	Business Source Code		
Period of Insurance	:	From: 01/04/2016 12:00:01 AM To: 31/03/2017 11:59:59 PM	Dev.Off. level/Broker/Corp. Agent	:	DIRECT BUSINESS NA NA (1D3937283)
Date of Proposal	:	01-Apr-16	Agent/Bancassurance	:	
Prev. Policy no.	:	620300361533000000003	Phone No	:	NA / NA
Client Type	:	Corporate	E-mail/Fax	:	/

Premium(`)	ERF Premium(`)	Service Tax(`)	Total (`)	Total (` in words)	Receipt No. & Date
28128	28129	4079	60336	RUPEES SIXTY THOUSAND THREE HUNDRED THIRTY-SIX ONLY	620300B1160000000270 - 29/04/16

Details of Risks Covered Under Policy:

Risk Covered	Jurisdiction	Territory	AOC	AOY/Total Sum Insured	Turnover	Deductibles
						India
Public Liability Act Only	NA	NA	50000000	150000000	14022180000	0

Extensions under the Policy

Name of the Extension	Sub Limit of the Extension	Deductibles of the Extension

Special Conditions	NA AS PER PUBLIC LIABILITY ACT 1.ANNUAL TURNOVER IS RS.14022180000.00 2.Manufacturing of Steel & related by products. AS PER ANNEXURE-II OF THE TEN DER.
Special Exclusions	NA
Special Excess/Deductible	0

Retroactive Dates	Date
Policy Retroactive Date	01/12/2005

The policy shall be subject to the rules framed under the Public Liability Act 1991 and subsequent amendments from time to time.

The Policy shall be subject to PUBLIC LIABILITY (Act Only) INSURANCE Policy clauses attached herewith.

Clauses	Description

THE NEW INDIA ASSURANCE CO. LTD.
(Wholly owned by the Govt. of India)

In witness whereof the undersigned being duly authorised by the Insurers and on behalf of the Insurers has (have) hereunder set his (their) hand(s) on this 29th day of April 2016.

For and on behalf of
The New India Assurance Company Limited

Duly Constituted Attorney(s)

Stamp Duty under the Policy is : ₹

Mudrank _____ Dt _____ consolidated Stamp Fees Paid by Pay Order Number _____ vide receipt

IRDA Registration Number: 190

Annexure 7.1

Material Safety Data Sheet Page 1 of 6
Material/Trade Name: CLEAN COKE OVEN GAS

1 – Identification of Substance/Mixture and of the Company/Undertaking

Material/Trade Name : Clean Coke Oven Gas
Material type : Clean gas emerging from the by-products plant. Benzene has been scrubbed and much of the heavier organic materials have been removed. Low levels of benzene and coal tar

2 – Hazards Identification

Classification of the substance or mixture

According to Regulation (EC) No.1272/2008

Flammable gas (Category 1)	H220	Extremely flammable gas
Carcinogen (Category 1A)	H350	May cause cancer
Mutagen (Category 1B)	H340	May cause genetic defects
Reproductive Toxicity (Category 1A)	H360D	May damage the unborn child
Acute Toxicity (Category 3)	H331	Toxic if inhaled
Specific Target Organ Toxicity – Repeated Exposure (Category 1)	H372i	Causes damage to organs through prolonged or repeated exposure through inhalation

According to European Directive 67/548/EEC as amended

F+; Extremely Flammable
T; Toxic

R12	Extremely flammable
R45	May cause cancer
R46	May cause heritable genetic damage
R61	May cause harm to the unborn child
R23	Toxic by inhalation
R48/23	Toxic: danger of serious damage to health by prolonged exposure through inhalation

3 – Composition/Information on Ingredients

CAS No.	EC No.	Index No.	Classification	Concentration
Hydrogen				
1333-74-0	215-605-7	001-001-00-9	Flam gas 1: H220 F+; R12	61-66%
Methane				
74-82-8	200-812-7	601-001-00-4	Flam gas 1: H220 F+; R12	24-28%
Carbon Monoxide				
630-08-0	211-128-3	006-001-00-2	Flam gas 1; Repr. 1A; Acute Tox. 3; STOT RE 1 H220, H360D, H331, H372i F+; R12, Repr. Cat.1; R61, T; R23-R48/23	5.5-8%
Nitrogen				
7727-37-9	231-783-9	[-]	[-]	1-7%
Carbon Dioxide				
124-38-9	204-696-9	[-]	[-]	1-3.5%
Ethylene				
74-85-1	200-815-3	601-010-00-3	Flam gas 1; STOT SE 3: H220, H336 F+; R12, R67	1.9-2.3%
Hydrogen sulphide				
7783-06-4	231-977-3	016-001-00-4	Flam gas 1; Acute Tox.2; Aquatic Acute 1 H220, H330, H400 F+; R12, T+; R26, N: R50	<0.6%
Hydrogen Cyanide				
74-90-8	200-821-6	006-006-00-X	Flam. Liq.1; Acute Tox. 2; Aquatic Acute 1; Aquatic Chronic 1 H224, H330, H400, H410 F+; R12, T+; R26, N; R50/53	0.04-0.14%
Coal Tar (Note H Applies)				
65996-89-6	266-024-0	648-082-00-2	Carc. Cat.1; Aquatic Acute 2: H350, H411 Carc. Cat.1; R45, N; R51/53	1-1.5%
Benzene				
71-43-2	200-753-7	601-020-00-8	Flam. Liq.2; Carc. 1A; Muta. 1B; STOT RE 1; Asp. Tox. 1; Eye Irrit. 2; Skin Irrit. 2 H225, H350, H340, H372, H304, H319, H315 F; R11, Carc. Cat.1; R45, Muta. Cat. 2; R46, T; R48/23/24/25, Xn; R65, Xi; R36/38	0-0.6%

Clean Coke Oven Gas may be assigned the product identifier of **Fuel gasses, coke-oven** (CAS No. 65996-81-8). This is defined as the gas evolved from the high temperature (greater than 700°C) destructive distillation of coal after the removal of high temperature coal tar, coke oven light oil, and ammonia liquor. Composed primarily of hydrogen and methane and may contain ammonia, hydrogen sulphide, and low molecular weight hydrocarbons. The hazards associated with this material have been classified on the basis of the individual components present within this particular Coke Oven gas product stream. For the full text of the H-Statements & R Phrases mentioned in this Section, see Section 16. Refer to Section 16 for information concerning the applicability of EC/1272/2008 Annex VI Part 1 section 1.1.3.1 Note H. Note U does not apply to the clean coke oven gas as it is not placed on the market as a gas under pressure.

4 - First-aid Measures

Inhalation:
Remove to fresh air and rest. If recovery is not rapid call for prompt medical attention. Show this safety data sheet to medical personnel. If breathing has stopped, start artificial respiration using oxygen and a suitable mechanical device such as a bag and mask. If pulse and heart have stopped, start external heart massage. OBTAIN MEDICAL ATTENTION. Treatment for acute exposure to hydrogen sulphide and hydrogen cyanide includes immediate inhalation of amyl nitrite, injections of sodium nitrite, inhalation of pure oxygen, administration of bronchodilators to overcome eventual bronchospasm, and in some cases hyperbaric oxygen therapy.

Eyes
If exposure to gases and vapours causes transient irritation irrigate with water for at least 15 minutes. Take care not to wash contamination from one eye to another. If irritation persists, obtain medical attention.

Skin
Not considered requisite as exposure will have minimal effects on skin. If irritation does develop however, obtain medical advice.

Ingestion
Not considered requisite due to reasonable inability to swallow significant quantities of gas.

5 - Fire-fighting Measures

Suitable Extinguishers
Stop flow of escaping gas. Do not attempt to extinguish flames while gas is still escaping. Allow gas to burn if flow cannot be shut off safely. Apply water from a safe distance to cool surfaces, surrounding equipment and structures. Areas exposed to direct flame contact should be cooled with large quantities of water (500 gallons water per minute flame impingement exposure) to prevent weakening of structural integrity.

Unsuitable Extinguishers
Untrained personnel should not attempt to fight fire – shut off gas flow if it is safe to do so and evacuate the area immediately.

Hazardous Decomposition
Highly dependent on combustion conditions. A complex mixture of airborne solids, liquids, and gases including water vapour, carbon monoxide, carbon dioxide, sulphur oxides and unidentified organic compounds will be evolved when this material undergoes combustion.

Special Procedures/information for firefighters
Do not extinguish. Stop flow of gas and allow fire to burn out. If flames are accidentally extinguished, explosive reignition may occur. Eliminate ignition sources. Keep people away. Isolate fire area and deny unnecessary entry. Immediately withdraw all personnel from area in case of rising sound from venting safety device or discoloration of the surrounding equipment. For unignited vapour clouds, use water spray to knock down and control dispersion of vapours. Use water spray to cool fire-exposed containers and fire-affected zone until fire is out and danger of reignition has passed. For fires involving this material, do not enter any enclosed or confined fire space without proper protective equipment, including self-contained breathing apparatus.

Evacuate the area – inexperienced persons should not attempt to tackle fire

6 - Accidental Release Measures

Personal Protection and Precautions
Use suitable personal protective equipment (refer to Section 8 for details) and restrict access to all other personnel. Avoid breathing gas and eliminate all sources of ignition. Do not enter confined spaces or poorly ventilated areas without portable gas detectors/alarms or self contained breathing apparatus.

Environmental Precautions
Stop the source of any leaks if safe to do so. Do not let any residual condensate from the clean coke oven gas enter drains or watercourses. Where feasible and appropriate, remove contaminated soil. Place contaminated materials in disposable containers and dispose of in a manner consistent with applicable regulations.

Containment, Cleaning up and Disposal Considerations
Any equipment used when dealing with leakage must be grounded. Use clean non-sparking tools. Use water spray to reduce vapours or divert vapour cloud drift. Do not direct water at spill or source of leak. Isolate area until gas has dispersed.

7 - Handling and Storage

Handling
This material presents an extreme fire hazard. Gas/vapour clouds can be ignited by remote ignition sources. Most components of clean coke oven gas are lighter than air and may ignite distant ignition sources that may cause an explosive flashback. Clean coke oven gas produces an atmosphere immediately dangerous to life and health.

Storage
Gas handling systems must be designed to appropriate standards for an extremely flammable, toxic gas. Ensure integrity of any pressurised equipment in accordance with 97/23/EC or equivalent. Electrostatic charge which may accumulate can create hazardous conditions when handling this material; ensure bonding and grounding of equipment. Ensure the use of hydrogen sulphide gas, carbon monoxide and hydrogen cyanide detectors and alarms within surrounding infrastructure.

8 - Exposure Controls/Personal Protection

Occupational Exposure Limit:
35 mg/m^3 8hrTWA, 232 mg/m^3 15min STEL WEL Carbon monoxide
7 mg/m^3 8hrTWA, 14 mg/m^3 15minSTEL WEL Hydrogen sulphide
9150mg/m^3 8hrTWA 27400mg/m^3 15minSTEL WEL Carbon dioxide
11 mg/m^3 15minSTEL WEL Hydrogen cyanide (Sk)
3.25mg/m^3 8hrTWA WEL Benzene (Sk)

Biological Monitoring Guidance Value:

Carbon Monoxide	30 ppm Carbon Monoxide in end tidal breath (post shift)
Polycyclic aromatic Hydrocarbons (PAHs)	4µmol 1-Hydroxypyrene/mol Creatine in urine (post shift)

Exposure Controls/Personal Protection for personnel when breaking containment, working in by-products plant or during accidental release

PPE: Flame resistant coveralls to EN 11612 AB1C1 (change daily for regular exposure & always after significant liquor contamination).
Nitrile dipped cotton gloves.
Foundry boots compliant with EN 20349 HI, HRO, SRC Fe.
Safety glasses to standard EN 166.

RPE: Dependent upon gas test from power and energy dept.
Either EN405 / EN14387 with A1 filter or breathing apparatus (airline fed or SCBA).

9 - Physical & Chemical Properties

Appearance	: Colourless gas containing low level residual particulate/vapour phases	**Autoflammability**	: 550°C
		Explosive properties	: LEL 4.0%, UEL 30%
		Oxidising properties	: None
Odour	: Characteristic phenolic with a trace of hydrogen sulphide	**Vapour pressure**	: n/e
		Relative density	: 0.30
pH	: n/e	**Solubility**	: Slightly soluble in water
Boiling point/range	: <-226°C	**Partition Coefficient**	: n/e
Melting point/range	: n/e	**Vapour Density**	: less than air
Flash point	: n/e	**Viscosity**	: n/e
Flammability	: EXTREMELY FLAMMABLE	**Evaporation rate**	: n/e

(n/e = not established)

10 - Stability and Reactivity

Chemical Stability
Stable at normal temperatures and under recommended storage conditions. Small quantities of coal tar and benzene content may possibly be deposited from the airborne phase.

Conditions to Avoid
Sources of ignition.

Materials to Avoid
Oxidising agents.

Hazardous Decomposition Products
Hazardous decomposition products formed under fire conditions are highly dependent on combustion conditions include a mixture of airborne liquids, and gases including carbon monoxide, carbon dioxide, sulphur oxides and other organic compounds.

11 - Toxicological Information

Acute toxicity
Acutely toxic if inhaled

Skin corrosion/irritation
Not a skin irritant

Serious eye damage/eye irritation
Will not cause eye irritation

Carcinogenicity
IARC Group 1 carcinogen: Known to be carcinogenic to humans.

Germ cell mutagenicity
Category 2 Mutagen: Strong presumption that human exposure to the substance may result in the development of heritable genetic damage

Reproductive toxicity
Category 1A Developmental toxicity. Known to cause developmental impairment in humans.

Respiratory or skin sensitisation
Not expected to be a skin sensitiser

Specific target organ toxicity - single exposure
No data available

Specific target organ toxicity - repeated exposure
Danger of serious damage to health by prolonged exposure

Potential health effects
Inhalation Initial inhalation may cause drowsiness, dizziness & depression of the CNS system. May cause rapid loss of consciousness which may be fatal if victim is not in receipt of immediate medical attention. Asphyxiation by oxygen displacement is possible but unlikely to occur as the acute lethal effects of inhalation will take place first.
Ingestion Not applicable
Skin/Eyes Unlikely to cause eye or skin irritation.

Chronic effects May cause cancer, genetic defects, reproductive toxicity and serious damage to the central nervous system and other metabolic functions. Chronic exposure in conjunction with poor industrial hygiene may cause the formation of coal tar warts which are cancerous growths caused by skin contact with coal tar and may be either benign or malignant. Coal Tar Erythema, a coal tar mediated photosensitivity reaction may also occur following chronic exposure.

Signs and Symptoms of Exposure
Initial coughing, shortness of breath and wheezing followed by dizziness, drowsiness and unconsciousness which if not treated immediately may be rapidly fatal.

Exposure to hydrogen sulphide
Acute exposure to low levels of hydrogen sulphide (300ppm) may result in eye irritation, a sore throat and cough, nausea, shortness of breath, and build up of fluid in the lungs. Long-term, low-level exposure (<10ppm) may result in fatigue, loss of appetite, headaches, irritability, poor memory, and dizziness. Exposure to higher levels of hydrogen sulphide will rapidly lead to unconsciousness and death if immediate remedial measures are not undertaken.

Exposure to carbon monoxide
Acute exposure to low levels of carbon monoxide (50ppm and higher) include increasingly severe lightheadedness, confusion, headaches, vertigo, and flu-like effects; larger exposures can lead to significant toxicity of the central nervous system and heart. Acute exposure may lead to severe delayed neurological manifestations including difficulty with higher intellectual functions, short-term memory loss, dementia, amnesia, psychosis, irritability, a strange gait, speech disturbances, Parkinson's disease-like syndromes, cortical blindness, and a depressed mood. Exposure to higher levels of carbon monoxide will rapidly lead to unconsciousness (800ppm and higher) and death if immediate remedial measures are not undertaken.

Exposure to hydrogen cyanide
At lower doses, loss of consciousness may be preceded by general weakness, giddiness, headaches, vertigo, confusion, and perceived difficulty in breathing. At the first stages of unconsciousness, breathing is often sufficient or even rapid, although the state of the victim progresses towards a deep coma, sometimes accompanied by pulmonary edema, and finally cardiac arrest. Skin color goes pink from cyanide-hemoglobin complexes. A fatal dose for humans can be as low as 1.5 mg/kg body weight

12 - Ecological Information

Toxicity
Not expected to be particularly hazardous to aquatic life

Mobility in soil
Coal tar and will have low mobility

PBT and vPvB assessment/ Persistence and degradability
No data available

Bioaccumulative potential
Will not bioaccumulate

Other adverse effects
No data available

13 -Disposal Considerations

Product
Material is classified as hazardous waste under the Hazardous Waste Regulations 2005. Contact a licensed professional waste disposal service to dispose of this material.
Contaminated packaging - Not applicable.

14 -Transport Information

Not normally transported other than by pipeline
UN/SI Number: 1953 **Hazard Class:** 2.3 **Subsidiary Hazard Class:** 2.1
Transport Name: COMPRESSED GAS, TOXIC, FLAMMABLE, nos (Clean Coke Oven Gas)

15 - Regulatory Information

Label Elements

As a non-isolated or stored intermediate, labelling under the Chemicals (Hazard Information and Packaging for Supply) Regulations 2009 (as amended) is not required. Labelling of pipework shall be in accordance with Regulation 12(5) of the Control of Substances Hazardous to Health Regulations 2002 (as amended).

Health & Safety at Work etc. Act 1974
Control of Substances Hazardous to Health Regulations 2002 (as amended)
Chemicals (Hazard Information and Packaging for Supply) Regulations 2009 (as amended)
Classification, Labelling and Packaging of Substances and Mixtures Regulations 2008 (as amended)
EH40/2005 Workplace Exposure Limits (as amended)
Environmental Protection Act 1990
Hazardous Waste Regulations 2005

16 - Other Information

Text of H-code(s) and R-phrase(s) mentioned in Section 3

H220	Extremely flammable gas
H224	Extremely flammable liquid and vapour
H225	Highly flammable liquid and vapour
H304	May be fatal if swallowed and enters airways
H315	Causes skin irritation
H319	Causes serious eye irritation
H330	Fatal if inhaled
H331	Toxic if inhaled
H335	May cause respiratory irritation
H336	May cause drowsiness or dizziness
H340	May cause genetic defects
H350	May cause cancer
H360D	May damage the unborn child
H372	Causes damage to organs through prolonged or repeated exposure
H372i	Causes damage to organs through prolonged or repeated exposure through inhalation
H373sk	May cause damage to organs through prolonged or repeated exposure in contact with skin
H373sw	May cause damage to organs through prolonged or repeated exposure if swallowed
H400	Very toxic to aquatic life
H411	Toxic to aquatic life with long lasting effects
H412	Harmful to aquatic life with long lasting effects
R12	Extremely flammable
R23	Toxic by inhalation
R26	Very toxic by inhalation
R36/38	Irritating to eyes and skin
R36/37/38	Irritating to eyes, respiratory system and skin
R45	May cause cancer
R46	May cause heritable genetic damage
R48/21/22	Harmful: danger of serious damage to health by prolonged exposure in contact with skin and if swallowed
R48/23	Toxic: danger of serious damage to health by prolonged exposure through inhalation
R48/23/24/25	Toxic: danger of serious damage to health by prolonged exposure through inhalation, in contact with skin and if swallowed
R50	Very toxic to aquatic organisms
R50/53	Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment
R51/53	Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment
R52/53	Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment
R61	May cause harm to the unborn child
R65	Harmful: may cause lung damage if swallowed
R67	Vapours may cause drowsiness and dizziness

In accordance with EC/1278/2008 Annex VI Section Part 1 Section 1.1.3.1 Note H The coal tar component has been classified as being toxic to aquatic organisms with long lasting effects.

1 – Identification of Substance/Mixture and of the Company/Undertaking

Material/Trade Name : Blast Furnace Gas
Material type : Scrubbed gas emerging from the blast furnace

2 – Hazards Identification

Classification of the substance or mixture

According to Regulation (EC) No.1272/2008

Flammable gas (Category 1)	H220	Extremely flammable gas
Reproductive Toxicity (Category 1A)	H360D	May damage the unborn child
Acute Toxicity (Category 3)	H331	Toxic if inhaled
Specific Target Organ Toxicity – Repeated Exposure (Category 1)	H372i	Causes damage to organs through prolonged or repeated exposure through inhalation

According to European Directive 67/548/EEC as amended

F+; Extremely Flammable
T; Toxic

R12	Extremely flammable
R61	May cause harm to the unborn child
R23	Toxic by inhalation
R48/23	Toxic: danger of serious damage to health by prolonged exposure through inhalation

3 – Composition/Information on Ingredients

CAS No.	EC No.	Index No.	Classification	Concentration
Hydrogen				
1333-74-0	215-605-7	001-001-00-9	Flam gas 1: H220 F+; R12	2-6% (typical)
Carbon Monoxide				
630-08-0	211-128-3	006-001-00-2	Flam gas 1; Repr. 1A; Acute Tox. 3; STOT RE 1 H220, H360D, H331, H372i F+; R12, Repr. Cat.1; R61, T; R23-R48/23	20-22% (typical)
Nitrogen				
7727-37-9	231-783-9	[-]	[-]	50-55% (typical)
Carbon Dioxide				
124-38-9	204-696-9	[-]	[-]	20-22% (typical)

Blast Furnace Gas may be assigned the product identifier of **Flue gases, ferrous metal, blast furnace** (CAS No. 65996-68-1). This is defined as the off gas from the blast furnaces. Composed primarily of carbon monoxide, carbon dioxide, nitrogen, and hydrogen. The hazards associated with this material have been classified on the basis of the individual components present within this particular Blast Furnace Gas product stream. For the full text of the H-Statements & R Phrases mentioned in this Section, see Section 16. Note U (EC/1272/2008 Annex VI Part 1 section 1.1.3.1) does not apply to the blast furnace gas as it is not placed on the market as a gas under pressure.

4 - First-aid Measures

Inhalation:
Remove to fresh air and rest. If recovery is not rapid call for prompt medical attention. Show this safety data sheet to medical personnel. If breathing has stopped, start artificial respiration using oxygen and a suitable mechanical device such as a bag and mask. If pulse and heart have stopped, start external heart massage. OBTAIN MEDICAL ATTENTION. Treatment for acute exposure inhalation of pure oxygen, administration of bronchodilators to overcome eventual bronchospasm, and in some cases hyperbaric oxygen therapy.
Eyes
If exposure to gases and vapours causes transient irritation irrigate with water for at least 15 minutes. Take care not to wash contamination from one eye to another. If irritation persists, obtain medical attention.
Skin
Not considered requisite as exposure will have minimal effects on skin. If irritation does develop however, obtain medical advice.
Ingestion
Not considered requisite due to reasonable inability to swallow significant quantities of gas.

5 - Fire-fighting Measures

Suitable Extinguishers
Stop flow of escaping gas. Do not attempt to extinguish flames while gas is still escaping. Allow gas to burn if flow cannot be shut off safely. Apply water from a safe distance to cool surfaces, surrounding equipment and structures. Areas exposed to direct flame contact should be cooled with large quantities of water (500 gallons water per minute flame impingement exposure) to prevent weakening of structural integrity.
Unsuitable Extinguishers
Untrained personnel should not attempt to fight fire – shut off gas flow if it is safe to do so and evacuate the area immediately. Do not use water near molten metal or molten metal handling areas
Hazardous Decomposition
Highly dependent on combustion conditions. A mixture of components including water vapour and carbon dioxide and possibly other unidentified compounds will be evolved when this material undergoes combustion.
Special Procedures/information for firefighters
Do not extinguish. Stop flow of gas and allow fire to burn out. If flames are accidentally extinguished, explosive reignition may occur. Eliminate ignition sources. Keep people away. Isolate fire area and deny unnecessary entry. Immediately withdraw all personnel from area in case of rising sound from venting safety device or discoloration of the surrounding equipment. For unignited vapour clouds, use water spray to knock down and control dispersion of vapours. Use water spray to cool fire-exposed containers and fire-affected zone until fire is out and danger of reignition has passed. For fires involving this material, do not enter any enclosed or confined fire space without proper protective equipment, including self-contained breathing apparatus.

Evacuate the area – inexperienced persons should not attempt to tackle fire

6 - Accidental Release Measures

Personal Protection and Precautions
Use suitable personal protective equipment (refer to Section 8 for details) and restrict access to all other personnel. Avoid breathing gas and eliminate all sources of ignition. Do not enter confined spaces or poorly ventilated areas without portable gas detectors/alarms or self contained breathing apparatus.

Environmental Precautions
Stop the source of any leaks if safe to do so.

Containment, Cleaning up and Disposal Considerations
Any equipment used when dealing with leakage must be grounded. Use clean non-sparking tools. Use water spray to reduce vapours or divert vapour cloud drift. Do not direct water at spill or source of leak. Isolate area until gas has dispersed.

7 - Handling and Storage

Handling

This material presents an extreme fire hazard. Gas clouds can be ignited by remote ignition sources. Most components of blast furnace gas are lighter than air and may ignite distant ignition sources that may cause an explosive flashback. Blast furnace gas produces an atmosphere immediately dangerous to life and health.

Storage

Gas handling and storage systems must be designed to appropriate standards for an extremely flammable, toxic gas. Ensure integrity of any pressurised equipment in accordance with 97/23/EC or equivalent. Electrostatic charge which may accumulate can create hazardous conditions when handling this material; ensure bonding and grounding of equipment. Ensure the use of carbon monoxide detectors and alarms within surrounding infrastructure.

8 - Exposure Controls/Personal Protection

Occupational Exposure Limit: 35 mg/m^3 8hrTWA, 232 mg/m^3 15min STEL WEL Carbon monoxide
9150mg/m^3 8hrTWA 27400mg/m^3 15minSTEL WEL Carbon dioxide

Biological Monitoring Guidance Value: Carbon Monoxide 30 ppm Carbon Monoxide in end tidal breath (post shift)

Respiratory Protection

Use in well ventilated areas. Use mechanical ventilation if possible. The use of suitable carbon monoxide gas detectors and alarm systems set to trigger at 50ppm, especially in confined spaces and poorly ventilated areas is essential. Where entry to areas above 50ppm carbon monoxide is necessary wear an approved positive pressure air-supplying respirator.

Hand Protection

Wear heavy duty gloves to provide mechanical protection when working with pressure systems.

Eye Protection/Skin Protection

Wear suitable overalls/clothes and eye protection such as safety glasses to standard BS EN 166 if contact with significant quantities of gas is likely.

9 - Physical & Chemical Properties

Appearance	: Colourless gas	**Oxidising properties**	: None
Odour	: None	**Vapour pressure**	: n/e
pH	: n/e	**Relative density**	: n/e
Boiling point/range	: <-78°C	**Solubility**	: Slightly soluble in water
Melting point/range	: n/e	**Partition Coefficient**	: n/e
Flash point	: n/e	**Vapour Density**	: similar to air
Flammability	: EXTREMELY FLAMMABLE	**Viscosity**	: n/e
Autoflammability	: >650°C	**Evaporation rate**	: n/e
Explosive properties	: LEL 32%, UEL 70%		

(n/e = not established)

10 - Stability and Reactivity

Chemical Stability

Stable at normal temperatures and under recommended storage conditions.

Conditions to Avoid
Sources of ignition.

Materials to Avoid
Oxidising agents.

Hazardous Decomposition Products

Highly dependent on combustion conditions. A mixture of components including water vapour and carbon dioxide and possibly other unidentified compounds will be evolved when this material undergoes combustion.

11 - Toxicological Information

Acute toxicity
Acutely toxic if inhaled

Skin corrosion/irritation
Not a skin irritant

Serious eye damage/eye irritation
Will not cause eye irritation

Carcinogenicity
Not identified as probable, possible or confirmed human carcinogen by IARC

Germ cell mutagenicity
Not identified as probable, possible or confirmed human mutagen

Reproductive toxicity
Category 1A developmental toxicity. Known to cause developmental impairment in humans.

Respiratory or skin sensitisation
Not expected to be a skin sensitiser

Specific target organ toxicity - single exposure
No data available

Specific target organ toxicity - repeated exposure
Danger of serious damage to health by prolonged exposure by inhalation

Potential health effects

Inhalation Initial inhalation may cause drowsiness, dizziness & depression of the CNS system. May cause rapid loss of consciousness which may be fatal if victim is not in receipt of immediate medical attention. Asphyxiation by oxygen displacement is possible but unlikely to occur as the acute lethal effects of inhalation will take place first.
Ingestion Not applicable
Skin/Eyes Unlikely to cause eye or skin irritation.

Chronic effects May cause reproductive toxicity and serious damage to the central nervous system and other metabolic functions.

Signs and Symptoms of Exposure
Initial dizziness, drowsiness and unconsciousness which if not treated immediately may be rapidly fatal.

Exposure to carbon monoxide

Acute exposure to low levels of carbon monoxide (50ppm and higher) include increasingly severe lightheadedness, confusion, headaches, vertigo, and flu-like effects; larger exposures can lead to significant toxicity of the central nervous system and heart. Acute exposure may lead to severe delayed neurological manifestations including difficulty with higher intellectual functions, short-term memory loss, dementia, amnesia, psychosis, irritability, a strange gait, speech disturbances, Parkinson's disease-like syndromes, cortical blindness, and a depressed mood

12 - Ecological Information

Toxicity
Will not be hazardous to aquatic life

Persistence and degradability
No data available

Mobility in soil
No data available

PBT and vPvB assessment
No data available

Bioaccumulative potential
Will not bioaccumulate

Other adverse effects
No data available

13 -Disposal Considerations

Product

Material is classified as hazardous waste under the Hazardous Waste Regulations 2005. Contact a licensed professional waste disposal service to dispose of this material.

Contaminated packaging - Not applicable.

14 -Transport Information

Not normally transported other than by pipeline
UN/SI Number: 1953 **Hazard Class:** 2.3 **Subsidiary Hazard Class:** 2.1
Transport Name: COMPRESSED GAS, TOXIC, FLAMMABLE, nos (Blast Furnace Gas)

15 - Regulatory Information

Label Elements

As a non-marketed product, labelling under the Chemicals (Hazard Information and Packaging for Supply) Regulations 2009 (as amended) is not required. Labelling of pipework and gas storage systems shall be in accordance with Regulation 12(5) of the Control of Substances Hazardous to Health Regulations 2002 (as amended).

Health & Safety at Work etc. Act 1974
Control of Substances Hazardous to Health Regulations 2002 (as amended)
Chemicals (Hazard Information and Packaging for Supply) Regulations 2009 (as amended)
Classification, Labelling and Packaging of Substances and Mixtures Regulations 2008 (as amended)
EH40/2005 Workplace Exposure Limits (as amended)
Environmental Protection Act 1990
Hazardous Waste Regulations 2005

16 - Other Information

Text of H-code(s) and R-phrase(s) mentioned in Section 3

H220	Extremely flammable gas	R12	Extremely flammable
H330	Fatal if inhaled	R61	May cause harm to the unborn child
H331	Toxic if inhaled	R23	Toxic by inhalation
H360D	May damage the unborn child	R48/23	Toxic: danger of serious damage to health by prolonged exposure through inhalation
H372i	Causes damage to organs through prolonged or repeated exposure through inhalation		

SECTION: 1. Product and company identification

1.1. Product identifier

Product form	:	Substance
Name	:	Carbon monoxide (Major component of LD Gas)
CAS No	:	630-08-0
Formula	:	CO

1.2. Relevant identified uses of the substance or mixture and uses advised against

Use of the substance/mixture	:	Industrial use. Use as directed.

SECTION 2: Hazard identification

2.1. Classification of the substance or mixture

GHS-US classification

Flam. Gas 1	H220
Compressed gas	H280
Acute Tox. 3 (Inhalation:gas)	H331
Repr. 1A	H360
STOT RE 1	H372

2.2. Label elements

GHS-US labeling

Hazard pictograms (GHS-US) :

GHS02 GHS04 GHS06 GHS08

Signal word (GHS-US) : DANGER

Hazard statements (GHS-US) :
H220 - **EXTREMELY FLAMMABLE GAS**
H280 - CONTAINS GAS UNDER PRESSURE; MAY EXPLODE IF HEATED
H331 - TOXIC IF INHALED
H360 - MAY DAMAGE FERTILITY OR THE UNBORN CHILD
H372 - CAUSES DAMAGE TO ORGANS (CENTRAL NERVOUS SYSTEM) THROUGH PROLONGED OR REPEATED EXPOSURE
CGA-HG04 - MAY FORM EXPLOSIVE MIXTURES WITH AIR
CGA-HG10 - ASPHYXIATING EVEN WITH ADEQUATE OXYGEN

Precautionary statements (GHS-US) :
P202 - Do not handle until all safety precautions have been read and understood
P210 - Keep away from Heat, Open flames, Sparks, Hot surfaces. - No smoking
P260 - Do not breathe gas
P271+P403 - Use and store only outdoors or in a well-ventilated place
P280 - Wear protective clothing, protective gloves, eye protection, face protection
P377 - Leaking gas fire: Do not extinguish, unless leak can be stopped safely

P381 - Eliminate all ignition sources if safe to do so
P405 - Store locked up
P501 - Dispose of contents/container in accordance with container Supplier/owner instructions
CGA-PG05 - Use a back flow preventive device in the piping
CGA-PG12 - Do not open valve until connected to equipment prepared for use
CGA-PG06 - Close valve after each use and when empty
CGA-PG02 - Protect from sunlight when ambient temperature exceeds 52°C (125°F)

2.3. Other hazards

Other hazards not contributing to the classification : Chemical asphyxiant. Exposure to low concentrations for extended periods may result in dizziness or unconsciousness, and may lead to death.

2.4. Unknown acute toxicity (GHS US)

No data available

SECTION 3: Composition/Information on ingredients

3.1. Substance

Name	Product identifier	%
Carbon monoxide (Main constituent)	(CAS No) 630-08-0	100

3.2. Mixture

Not applicable

SECTION 4: First aid measures

4.1. Description of first aid measures

First-aid measures after inhalation : Remove to fresh air and keep at rest in a position comfortable for breathing. If not breathing, give artificial respiration. If breathing is difficult, trained personnel should give oxygen. Call a physician.

First-aid measures after skin contact : Wash with plenty of soap and water. If skin irritation occurs: Get medical advice/attention.

First-aid measures after eye contact : Immediately flush eyes thoroughly with water for at least 15 minutes. Hold the eyelids open and away from the eyeballs to ensure that all surfaces are flushed thoroughly. Contact an ophthalmologist immediately.. If eye irritation persists: Get immediate medical attention.

First-aid measures after ingestion : Not expected to be a primary route of exposure.

4.2. Most important symptoms and effects, both acute and delayed

Symptoms/injuries : Effects are due to lack of oxygen. Moderate concentrations may cause headache, drowsiness, dizziness, excitation, excess salivation, vomiting, and unconsciousness. Prolonged exposure to low concentrations of carbon monoxide can kill.

4.3. Indication of any immediate medical attention and special treatment needed

No additional information available

SECTION 5: Firefighting measures

5.1. Extinguishing media

Suitable extinguishing media : Carbon dioxide, Dry chemical, Water spray or fog.

5.2. Special hazards arising from the substance or mixture

Fire hazard : **EXTREMELY FLAMMABLE GAS**. Carbon monoxide cannot be detected by odor. May form explosive mixtures with air. Toxic, flammable gas may spread. Before entering area, especially a confined area, check atmosphere with an appropriate gas-specific device. Reduce gas with fog or fine water spray. Shut off source of gas flow if safe to do so. Ventilate area or move container to a well-ventilated area.

Explosion hazard : **EXTREMELY FLAMMABLE GAS**. Forms explosive mixtures with air and oxidizing agents.

Reactivity : No reactivity hazard other than the effects described in sub-sections below.

5.3. Advice for firefighters

Firefighting instructions : Evacuate all personnel from the danger area. Use self-contained breathing apparatus (SCBA) and protective clothing. Immediately cool containers with water from maximum distance. Stop flow of gas if safe to do so, while continuing cooling water spray. Remove ignition sources if safe to do so. Remove containers from area of fire if safe to do so. On-site fire brigades must comply with OSHA 29 CFR 1910.156 and applicable standards under 29 CFR 1910 Subpart L—Fire Protection.

Protection during firefighting : Compressed gas: asphyxiant. Suffocation hazard by lack of oxygen.

Special protective equipment for fire fighters : Standard protective clothing and equipment (Self Contained Breathing Apparatus) for fire fighters.

Specific methods : If venting or leaking gas catches fire, do not extinguish flames. Flammable vapors may spread from leak, creating an explosive reignition hazard. Vapors can be ignited by pilot lights, other flames, smoking, sparks, heaters, electrical equipment, static discharge, or other ignition sources at locations distant from product handling point. Explosive atmospheres may linger. Before entering an area, especially a confined area, check the atmosphere with an appropriate device.

Other information : Containers are equipped with a pressure relief device. (Exceptions may exist where authorized by DOT.).

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

General measures : Cannot be detected by odor. **DANGER: Flammable, liquefied gas.** FORMS EXPLOSIVE MIXTURES WITH AIR. Immediately evacuate all personnel from danger area. Use self-contained breathing apparatus where needed. Remove all sources of ignition if safe to do so. Reduce vapors with fog or fine water spray, taking care not to spread liquid with water. Shut off flow if safe to do so. Ventilate area or move container to a well-ventilated area. Flammable vapors may spread from leak and could explode if reignited by sparks or flames. Explosive atmospheres may linger. Before entering area, especially confined areas, check atmosphere with an appropriate device.

6.1.1. For non-emergency personnel

No additional information available

6.1.2. For emergency responders

No additional information available

6.2. Environmental precautions

Prevent waste from contaminating the surrounding environment. Prevent soil and water pollution. Dispose of contents/container in accordance with local/regional/national/international regulations. Contact supplier for any special requirements.

6.3. Methods and material for containment and cleaning up

No additional information available

6.4. Reference to other sections

See also sections 8 and 13.

SECTION 7: Handling and storage

7.1. Precautions for safe handling

Precautions for safe handling : Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking. Use only non-sparking tools. Use only explosion-proof equipment

Use in a closed system

Avoid using pure nickel. Corrosion of pure nickel in carbon monoxide atmospheres exceeds 50 mil/yr (1.27 mm/yr) at room temperature

Wear leather safety gloves and safety shoes when handling cylinders. Protect cylinders from physical damage; do not drag, roll, slide or drop. While moving cylinder, always keep in place removable valve cover. Never attempt to lift a cylinder by its cap; the cap is intended solely to protect the valve. When moving cylinders, even for short distances, use a cart (trolley, hand truck, etc.) designed to transport cylinders. Never insert an object (e.g, wrench, screwdriver, pry bar) into cap openings; doing so may damage the valve and cause a leak. Use an adjustable strap wrench to remove over-tight or rusted caps. Slowly open the valve. If the valve is hard to open, discontinue use and contact your supplier. Close the container valve after each use; keep closed even when empty. Never apply flame or localized heat directly to any part of the container. High temperatures may damage the container and could cause the pressure relief device to fail prematurely, venting the container contents. For other precautions in using this product, see section 16.

7.2. Conditions for safe storage, including any incompatibilities

Storage conditions : Store only where temperature will not exceed 125°F (52°C). Post "No Smoking/No Open Flames" signs in storage and use areas. There must be no sources of ignition. Separate packages and protect against potential fire and/or explosion damage following appropriate codes and requirements (e.g, NFPA 30, NFPA 55, NFPA 70, and/or NFPA 221 in the U.S.) or according to requirements determined by the Authority Having Jurisdiction (AHJ). Always secure containers upright to keep them from falling or being knocked over. Install valve protection cap, if provided, firmly in place by hand when the container is not in use. Store full and empty containers separately. Use a first-in, first-out inventory system to prevent storing full containers for long periods. For other precautions in using this product, see section 16

OTHER PRECAUTIONS FOR HANDLING, STORAGE, AND USE: When handling product under pressure, use piping and equipment adequately designed to withstand the pressures to be encountered. Never work on a pressurized system. Use a back flow preventive device in the piping. Gases can cause rapid suffocation because of oxygen deficiency; store and use with adequate ventilation. If a leak occurs, close the container valve and blow down the system in a safe and environmentally correct manner in compliance with all international, federal/national, state/provincial, and local laws; then repair the leak. Never place a container where it may become part of an electrical circuit.

7.3. Specific end use(s)

None.

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

Carbon monoxide (630-08-0)		
ACGIH	ACGIH TLV-TWA (ppm)	25 ppm
USA OSHA	OSHA PEL (TWA) (mg/m³)	55 mg/m³
USA OSHA	OSHA PEL (TWA) (ppm)	50 ppm
USA IDLH	US IDLH (ppm)	1200 ppm

8.2. Exposure controls

Appropriate engineering controls : Use an explosion-proof local exhaust system with sufficient flow velocity to maintain an adequate supply of air in the worker's breathing zone. Mechanical/General measures: Use in a closed system.

Hand protection : Wear working gloves when handling gas containers.

Eye protection : Wear safety glasses with side shields.

Skin and body protection : Wear metatarsal shoes and work gloves for cylinder handling, and protective clothing where needed. Wear appropriate chemical gloves during cylinder changeout or wherever contact with product is possible. Select per OSHA 29 CFR 1910.132, 1910.136, and 1910.138.

Respiratory protection : When workplace conditions warrant respirator use, follow a respiratory protection program that meets OSHA 29 CFR 1910.134, ANSI Z88.2, or MSHA 30 CFR 72.710 (where applicable). Use an air-supplied or air-purifying cartridge if the action level is exceeded. Ensure that the respirator has the appropriate protection factor for the exposure level. If cartridge type respirators are used, the cartridge must be appropriate for the chemical exposure. For emergencies or instances with unknown exposure levels, use a self-contained breathing apparatus (SCBA).

Environmental exposure controls : Refer to local regulations for restriction of emissions to the atmosphere.

Other information : Consider the use of flame resistant anti-static safety clothing.

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

Physical state : Gas

Appearance : Colorless, odorless gas.

Molecular mass : 28 g/mol

Color : Colorless

Odor : Odorless.

Odor threshold : No data available

pH : Not applicable.

Relative evaporation rate (butyl acetate=1) : No data available

Relative evaporation rate (ether=1) : Not applicable.

Melting point : -205.1 °C

Freezing point : No data available

Boiling point : -191.5 °C

Flash point : Not applicable.

Critical temperature : -139.8 °C

Auto-ignition temperature : 605 °C

Decomposition temperature : 400 °C

Flammability (solid, gas) : 12.5 - 74 vol %

Vapor pressure : Not applicable.

Critical pressure : 3499 kPa

Relative vapor density at 20 °C : No data available

Relative density : No data available

Density : 1.2501 kg/m³ (at 0 °C)

Relative gas density : 1

Solubility : Water: 41 g/l (at 20 °C)

Log Pow : 1.78

Log Kow : Not applicable.

Viscosity, kinematic : Not applicable.

Viscosity, dynamic : Not applicable.

Explosive properties : Not applicable.

Oxidizing properties : None.

Explosion limits : No data available

9.2. Other information

Gas group : Compressed gas

Additional information : None

SECTION 10: Stability and reactivity

10.1. Reactivity

No reactivity hazard other than the effects described in sub-sections below.

10.2. Chemical stability

Stable under normal conditions.

10.3. Possibility of hazardous reactions

May occur. Can form explosive mixture with air. Oxidizing agents.

10.4. Conditions to avoid

Keep away from heat/sparks/open flames/hot surfaces. – No smoking.

10.5. Incompatible materials

Oxidizing agents, Oxygen, Flammables, Metal oxides, halogenated fluorides, metals in the presence of moisture and/or sulfur compounds.

10.6. Hazardous decomposition products

Carbon monoxide will decompose above 752°F (400°C) to form carbon dioxide and carbon.

SECTION 11: Toxicological information

11.1. Information on toxicological effects

Acute toxicity : Inhalation:gas: TOXIC IF INHALED.

Carbon monoxide (\f)630-08-0	
LC50 inhalation rat (ppm)	1880 ppm/4h
ATE US (gases)	1880.000 ppmV/4h

Skin corrosion/irritation : Not classified

pH: Not applicable.

Serious eye damage/irritation : Not classified

pH: Not applicable.

Respiratory or skin sensitization : Not classified

Germ cell mutagenicity : Not classified

Carcinogenicity : Not classified

Reproductive toxicity : MAY DAMAGE FERTILITY OR THE UNBORN CHILD.

Specific target organ toxicity (single exposure) : Not classified

Specific target organ toxicity (repeated exposure) : CAUSES DAMAGE TO ORGANS (CENTRAL NERVOUS SYSTEM) THROUGH PROLONGED OR REPEATED EXPOSURE.

Aspiration hazard : Not classified

SECTION 12: Ecological information

12.1. Toxicity

Ecology - general : Classification criteria are not met. No ecological damage caused by this product.

12.2. Persistence and degradability

Carbon monoxide (630-08-0)	
Persistence and degradability	Will not undergo hydrolysis. Not readily biodegradable. Not applicable for inorganic gases.

12.3. Bioaccumulative potential

Carbon monoxide (630-08-0)	
Log Pow	1.78
Log Kow	Not applicable.
Bioaccumulative potential	Not expected to bioaccumulate due to the low log Kow (log Kow < 4). Refer to section 9.

12.4. Mobility in soil

Carbon monoxide (630-08-0)	
Mobility in soil	No data available.
Ecology - soil	Because of its high volatility, the product is unlikely to cause ground or water pollution.

12.5. Other adverse effects

Effect on ozone layer : None

Global warming potential [CO2=1] : 1.9

SECTION 13: Disposal considerations

13.1. Waste treatment methods

Waste disposal recommendations : Do not attempt to dispose of residual or unused quantities. Return container to supplier.

SECTION 14: Transport information

In accordance with DOT

Transport document description : UN1016 Carbon monoxide, compressed, 2.3

UN-No.(DOT) : UN1016

Proper Shipping Name (DOT) : Carbon monoxide, compressed

Class (DOT) : 2.3 - Class 2.3 - Poisonous gas 49 CFR 173.115

Hazard labels (DOT) : Poison Gas
2.3 - Poison gas
2.1 - Flammable gas

DOT Special Provisions (49 CFR 172.102) : 4 - This material is poisonous by inhalation (see 171.8 of this subchapter) in Hazard Zone D (see 173.116(a) of this subchapter), and must be described as an inhalation hazard under the provisions of this subchapter

Additional information

Emergency Response Guide (ERG) Number : 119 (UN1016);168 (NA9202)

Other information : No supplementary information available.

Special transport precautions : Avoid transport on vehicles where the load space is not separated from the driver's compartment. Ensure vehicle driver is aware of the potential hazards of the load and knows what to do in the event of an accident or an emergency. Before transporting product containers: - Ensure there is adequate ventilation. - Ensure that containers are firmly secured. - Ensure cylinder valve is closed and not leaking. - Ensure valve outlet cap nut or plug (where provided) is correctly fitted. - Ensure valve protection device (where provided) is correctly fitted.

Transport by sea

UN-No. (IMDG) : 1016

Proper Shipping Name (IMDG) : CARBON MONOXIDE, COMPRESSED

Class (IMDG) : 2 - Gases

MFAG-No : 119

Air transport

UN-No. (IATA) : 1016

Proper Shipping Name (IATA) : Carbon monoxide, compressed

Class (IATA) : 2

Civil Aeronautics Law : Gases under pressure/Gases toxic under pressure

SECTION 15: Regulatory information

15.1. US Federal regulations

Carbon monoxide (630-08-0)	
Listed on the United States TSCA (Toxic Substances Control Act) inventory	
SARA Section 311/312 Hazard Classes	Immediate (acute) health hazard Delayed (chronic) health hazard Sudden release of pressure hazard Fire hazard

All components of this product are listed on the Toxic Substances Control Act (TSCA) inventory.

This product or mixture does not contain a toxic chemical or chemicals in excess of the applicable de minimis concentration as specified in 40 CFR §372.38(a) subject to the reporting requirements of section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR Part 372.

15.2. International regulations

CANADA

Carbon monoxide (630-08-0)
Listed on the Canadian DSL (Domestic Substances List)

EU-Regulations

Carbon monoxide (630-08-0)
Listed on the EEC inventory EINECS (European Inventory of Existing Commercial Chemical Substances)

15.2.2. National regulations

Carbon monoxide (630-08-0)
Listed on the AICS (Australian Inventory of Chemical Substances) Listed on IECSC (Inventory of Existing Chemical Substances Produced or Imported in China) Listed on the Japanese ENCS (Existing & New Chemical Substances) inventory Listed on the Korean ECL (Existing Chemicals List) Listed on NZIoC (New Zealand Inventory of Chemicals) Listed on PICCS (Philippines Inventory of Chemicals and Chemical Substances) Listed on the Canadian IDL (Ingredient Disclosure List) Listed on INSQ (Mexican National Inventory of Chemical Substances)

15.3. US State regulations

Carbon monoxide(630-08-0)	
U.S. - California - Proposition 65 - Carcinogens List	No
U.S. - California - Proposition 65 - Developmental Toxicity	Yes
U.S. - California - Proposition 65 - Reproductive Toxicity - Female	No
U.S. - California - Proposition 65 - Reproductive Toxicity - Male	No
State or local regulations	U.S. - Massachusetts - Right To Know List U.S. - New Jersey - Right to Know Hazardous Substance List U.S. - Pennsylvania - RTK (Right to Know) - Environmental Hazard List U.S. - Pennsylvania - RTK (Right to Know) List

California Proposition 65 - This product contains, or may contain, trace quantities of a substance(s) known to the state of California to cause cancer, developmental and/or reproductive harm

SECTION 16: Other information

Other information : Prior to using any plastics, confirm their compatibility with this chemical

When you mix two or more chemicals, you can create additional, unexpected hazards. Obtain and evaluate the safety information for each component before you produce the mixture. Consult an industrial hygienist or other trained person when you evaluate the end product. Before using any plastics, confirm their compatibility with this product

Praxair asks users of this product to study this SDS and become aware of the product hazards and safety information. To promote safe use of this product, a user should (1) notify employees, agents, and contractors of the information in this SDS and of any other known product hazards and safety information, (2) furnish this information to each purchaser of the product, and (3) ask each purchaser to notify its employees and customers of the product hazards and safety information

The opinions expressed herein are those of qualified experts within Praxair, Inc. We believe that the information contained herein is current as of the date of this Safety Data Sheet. Since the use of this information and the conditions of use are not within the control of Praxair, Inc, it is the user's obligation to determine the conditions of safe use of the product

Praxair SDSs are furnished on sale or delivery by Praxair or the independent distributors and suppliers who package and sell our products. To obtain current SDSs for these products, contact your Praxair sales representative, local distributor, or supplier, or download from www.praxair.com. If you have questions regarding Praxair SDSs, would like the document number and date of the latest SDS, or would like the names of the Praxair suppliers in your area, phone or write the Praxair Call Center (Phone: 1-800-PRAXAIR/1-800-772-9247; Address: Praxair Call Center, Praxair, Inc, P.O. Box 44, Tonawanda, NY 14151-0044)

NFPA health hazard : 3 - Short exposure could cause serious temporary or residual injury even though prompt medical attention was given.

NFPA fire hazard : 4 - Will rapidly or completely vaporize at normal pressure and temperature, or is readily dispersed in air and will burn readily.

NFPA reactivity : 0 - Normally stable, even under fire exposure conditions, and are not reactive with water.

HMIS III Rating

Health : 1 Slight Hazard - Irritation or minor reversible injury possible

Flammability : 4 Severe Hazard

Physical : 3 Serious Hazard

SDS US (GHS HazCom 2012) - Praxair

This information is based on our current knowledge and is intended to describe the product for the purposes of health, safety and environmental requirements only. It should not therefore be construed as guaranteeing any specific property of the product.

MATERIAL SAFETY DATA SHEET

1. CHEMICAL IDENTITY		
CHEMICAL NAME : Propane		
CHEMICAL CLASSIFICATION: Dimethyl methane, propyl hydride		
SYNONYMES : Dimethyl methane, LP-Gas, Liquefied petroleum gas (LPG)		
TRADE NAME: Propane		
FORMULA: C_3H_8	C.A.S. NO. 74-98-6	
U.N. NO: 1978	HAZCHEM CODE: 2WE	
REGULATED IDENTIFICATION : NA		
SHIPPING NAME CODES / LABLE : Propane		
HAZARDOUS WASTE I.D. NO. : NA		
HAZARDOUS INGREDIENTS :	C.A.S. No. :	
1. Propane	74-98-6	

2. PHYSICAL AND CHEMICAL DATA		
BOILING POINT (°C): -42	PHYSICL STATE: Gas	APPEARANCE: Colorless
MELTING / FREEZING POINT(°C): -186	VAPOUR PRESSURE @ 35 °C mm/Hg 6840mmHg@20deg C	Odor: Odorless compressed liquid gas.
VAPOUR DENSITY (AIR= 1): 1.6	SOLUBILITY IN H_2O @ 30 °C :65-ml/100mlwater at 35DgC	
SPECIFIC GRAVITY (H2O=1): 0.5	PH: NA	

3. FIRE AND EXPLOSION HAZARD DATA		
FLAMMABILITY: Flammable liquid gas under pressure.	LEL : 2.2 %	UEL : 9.5 %
TDG FLAMMABILITY: NA	FLASH POINT (°C): -156	AUTO IGNITION TEMP(°C): 470
EXPLOSION	EXPLOSION	HAZARDOUS

MSDS: PROPANE

SENSITIVITY TO IMPACT: NA	SENSITIVITY TO STATIC ELECTRICITY: NA	COMBUSTION PRODUCTS: None known.
HAZARDOUS POLIMERISATION : Will not occur	EXPLOSIVE MATERIAL: Explosive mixture with air	CORROSSIVE MATERIAL: NA
FLAMMABLE MATERIAL: NA	OXIDISER : NA	OTHERS: NA
PYROPHORIC : No	ORGANIC PEROXIDE: NA	

4. REACTIVITY DATA
CHEMICAL STABILITY : Stable
INCOMPATABILITY WITH OTHER MATERIAL: Oxidizers.
REACTIVITY:
HAZARDOUS REACTION PRODUCTS : None in particular.

5. HEALTH HAZARD DATA		
ROUTES OF ENTRY:		
EFFECTS OF EXPOSURE / SYMPTOMS:		
EMERGENCY TREATMENT: Flush eyes and skin with plenty of water and get medical aid.		
TLV (ACGIH) : PPM mg/m3	STEL : none PPM mg/m3	
PERMISSIBLE EXPOSURE LIMITS LD 50: none PPM mg/m3	ODOUR THRESHOLD LD50 : none PPM mg/m3	

NFPA HAZARD RATING	HELATH: 1	FLAMABILITY : Flammable	STABILITY: Stable	SPECIAL: NA

6. PREVENTIVE MEASURES
PERSONAL PROTECTIVE EQUIPMENTS: Provide self-contained breathing apparatus.
HANDLING AND STORAGE PRECAUTION: Keep in a cool dry , well- ventilated

area, away from heat, flame or oxidizers.	
7. EMERGENCY AND FIRST- AID MESURES	
FIRE	FIRE EXTINGUISHING MEDIA: Stop flow gas foam , carbon dioxide, dry chemical powder.
	SPECIAL PROCEDURE: Stop the flow of gas and keep the containers cool by spraying water if exposed to heat or flame.
	UNUSUAL HAZARDS: Flash back along vapor trail may occur.
EXPOSURE	FIRST AID MEASURES: **Eye** : Flush eye with plenty of water for at least 30 minutes **Skin:** Get medical aid , Flush skin with plenty of water for at least 30 minutes **Ingestion**: If swallowed get medical aid. **Inhalation**: Remove from exposure and move to fresh air immediately
	ANTIDOTES / DOSAGES: NA
SPILLS	STEPS TO BE TAKEN: Shut off leaks if without risk. Warm everybody that air mixture is explosive.
	WASTE DISPOSAL METHOD: Allow the gas to burn under control.

Annexure 7.2

PROCEEDINGS OF ENVIRONMENTAL PUBLIC HEARING

HELD ON

15.06.2017

AT

Trishna Ground, Sector 2, Ukkunagaram, Gajuwaka Visakhapatnam

Contents:

ANDHRA PRADESH POLLUTION CONTROL BOARD
REGIONAL OFFICE, VISAKHAPATNAM

R. LAKSHMI NARAYANA
ENVIRONMENTAL ENGINEER

Main Road, Madhavadhara Vuda Colony,
Visakhapatnam – 530 018
Ph: 0891 – 2755356

Lr. No. 3601/PCB/RO-VSP/2017 - 937 Date: 18 /07/2017

To

The Director,
Ministry of Environment & Forests,
Govt. of India, (I.A Division),
Indira Paryavaran Bhavan,
Aliganj, Jorbagh Road,
New Delhi - 110003

Sir,

Sub: APPCB, RO, VSP M/s. Rashtriya Ispat Nigam Limited,- Capacity Expansion of Visakhapatnam Steel Plant from 6.3 MMTPA to 7.3 MMTPA by revamping and augmentation of existing facilities at Gajuwaka, Visakhapatnam Dist. Andhra Pradesh. – Environmental Public Hearing conducted on 15.06.2017 – Communication of Minutes – Reg.

Ref: 1. Environmental Public Hearing conducted on 15.06.2017.
2. Minutes approved by the Collector & District Magistrate on 11.07.2017

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It is submitted that that M/s. Rashtriya Ispat Nigam Limited has proposed for Capacity Expansion of Visakhapatnam Steel Plant from 6.3 MMTPA to 7.3 MMTPA by revamping and augmentation of existing facilities at Gajuwaka, Visakhapatnam Dist. Andhra Pradesh and with a capital investment of Rs.9439.53 Cr

In accordance with the EIA Notification No.S.O.1533, dated 14.09.2006 and its amendments thereof of the Ministry of Environment & Forests and Climate Change, Government of India, this office conducted the Environmental Public Hearing on 15.06.2017 within the premises of M/s. Visakhapatnam Steell Plant i.e., at Trishna Grounds, Sector – 2, Ukkunagaram, M/s. Rashtriya Ispat Nigam Ltd.,, (Visakhapatnam Steel Plant), Gajuwaka, Visakhapatnam under the Chairmanship of the Collector & District Magistrate, Visakhapatnam.

In this regard, the minutes of the Environmental Public Hearing in English & Telugu are herewith submitted along with the following enclosures:

a. Audio & Video CD of the Public Hearing proceedings.
b. The attendance of all those who were present at the venue of the Public Hearing.
c. Copy of Written objection submitted by the Public.

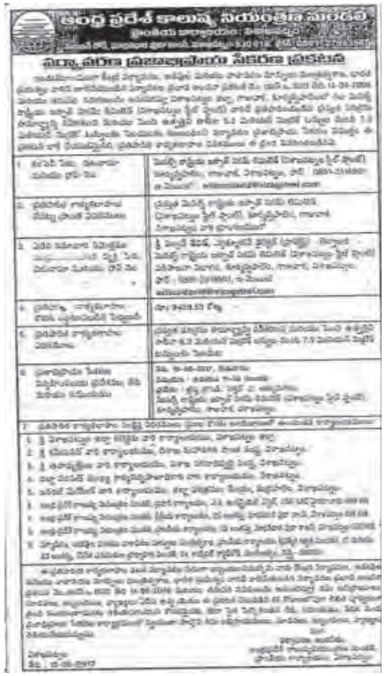
Submitted for kind information and further necessary action.

Yours faithfully,

ENVIRONMENTAL ENGINEER

Encl: a/a

1. Copy submitted to the Director, Ministry of Environment & Forests, Govt. of India, Regional Office (SEZ), I[st] and II[nd] Floor, Handloom Export Promotion Council, 34, Cathedral Garden Road, Nungambakkam, Chennai – 34 for kind information.
2. Copy submitted to the Joint Chief Environmental Engineer, UH - III, A.P. Pollution Control Board, Board Office, Hyderabad for information and necessary action.
3. Copy to M/s. Rashtriya Ispat Nigam Limited, (Visakhapatnam Steel Plant), Kurmannapalem, Gajuwaka, , Visakhapatnam - 530031



MINUTES OF THE ENVIRONMENTAL PUBLIC HEARING HELD ON 15.06.2017 AT 11:00 AM FOR THE PROPOSED CAPACITY EXPANSION FROM 6.3 MMTPA TO 7.3 MMTPA BY REVAMPING AND AUGMENTATION OF EXISTING FACILITIES OF M/S. RASHTRIYA ISPAT NIGAM LIMITED (VISAKHAPATNAM STEEL PLANT) AT KURMANNAPALEM, GAJUWAKA, VISAKHAPATNAM DIST. ANDHRA PRADESH.

PANEL MEMBERS PRESENT

1.	Sri Praveen Kumar, IAS Collector & District Magistrate, Visakhapatnam	Chairman
2.	Sri R. Lakshmi Narayana Environmental Engineer A.P. Pollution Control Board	Member

At the outset, the Environmental Engineer, Regional Office, Andhra Pradesh Pollution Control Board, welcomed the gathering and explained the features of the Ministry of Environment and Forests, Government of India, EIA Notification dated 14/09/2006. According to EIA Notification, Environmental Public hearing is mandatory for getting Environmental Clearance from Ministry of Environment, Forests & Climate Change, Government of India.

He informed that the Environmental Public Hearing is being conducted in connection with the proposed capacity expansion of M/s. Rashtriya Ispat Nigam Limited (Visakhapatnam Steel Plant) from 6.3 MMTPA to 7.3 MMTPA by revamping and augmentation of existing facilities at Kurmannapalem, Gajuwaka, Visakhapatnam Dist., Andhra Pradesh with a capital investment of Rs.9439.53 Cr.

He informed that in accordance with the EIA Notification No.S.O.1533 dated 14.09.2006 and its amendments thereof of the Ministry of Environment, Forests, & Climate Change, Government of India, for setting up of the new industrial establishments or expansion of the

existing industrial establishments, Environmental Public hearing is to be conducted in the proposed establishment site for getting Environmental Clearance from Ministry of Environment & Forests, Govt. of India.

He further informed that Environmental public hearing is being conducted under the chairmanship of the Collector & District Magistrate and assisted by A.P. Pollution Control Board officials.

A.P. Pollution Control Board issued a Paper Notification for conduct of Environmental Public Hearing on 15.06.2017 inviting concerns of the local affected people and the people having a plausible stake in the environmental aspects of the proposed activity. The Notification was appeared in the newspapers of "Eenadu" Telugu daily news paper & "The Hindu" English daily News paper on 13.05.2017.

The Environment Impact Assessment (EIA) reports and Executive Summaries in Telugu and English were displayed at the Office of the Collector & District Magistrate, Visakhapatnam, Office of the Commissioner, Greater Visakhapatnam Municipal Corporation, Visakhapatnam, Office of the Vice Chairman, Visakhapatnam Urban Development Authority, Visakhapatnam, Office of the Chief Executive Officer, Zilla Parishad, Visakhapatnam, Office of the General Manager, District Industries Centre, Visakhapatnam, as mentioned in the Public Hearing notification.

He informed that no written representations either favouring or against the expansion proposal were received till the date of Public Hearing. He requested the Collector & District Magistrate & chairman of Public Hearing to preside over the public hearing to conduct further proceedings.

The Collector & District Magistrate, Visakhapatnam as Chairman of the Public hearing welcomed the representatives of Public, Press Representatives, Govt. Officials and the project proponents who have attended for the Environmental Public Hearing.

He informed that the Public Hearing is being conducted for the proposed capacity expansion of M/s. Rashtriya Ispat Nigam Limited (Visakhapatnam Steel Plant) from 6.3 MMTPA to 7.3 MMTPA by revamping and augmentation of existing facilities at Kurmannapalem, Gajuwaka, Visakhapatnam Dist., Andhra Pradesh with a capital investment of Rs.9439.53 Cr.

He informed that the public can express their views, suggestions, opinions so that the same will be recorded and forwarded to MOEF&CC for taking further decision. He also informed that the Expert Committee of the MoEF would consider the public views while taking decision on the issue of Clearance. He requested the public to extend the co-operation for conducting the public hearing smoothly. He further requested the Environmental Engineer, to continue the proceedings of Public Hearing.

The Environmental Engineer, requested the project proponent to explain the salient features of the expansion proposal with specific reference to the impacts on environment and its management with pollution control measures.

Accordingly, Sri G.V. Rao, Dy. General Manager (Design & Engineering) of M/S. RINL (Visakhapatnam Steel Plant), while welcoming the Collector and District Magistrate, Public representatives, Press Representatives, Govt. Officials and public who have attended for the Environmental Public Hearing, informed the following:

1. M/s Visakhapatnam Steel Plant is the first shore-based integrated steel plant in India established by M/s. Rashtriya Ispat Nigam Limited (RINL), Visakhapatnam, a Navratna Public Sector Enterprise under Ministry of Steel, Government of India and operating with present capacity of 6.3 MMTPA.
2. It is proposed for augmentation and increase in production capacity from 6.3 MMTPA TO 7.3 MMTPA.
3. The proposed capital investment for augmentation and expansion is Rs.9439.53 Cr. The time limit for completion of the project is 5 years.
4. The proposed capacity augmentation would be carried out in an extent of 352 Acres of the existing vacant land available.
5. Facilities proposed in the augmentation and expansion.
   i. Augmentation of existing Coke Oven Battery systems (4No.s) and installation of 1 more Coke Oven Battery system in phased manner to achieve production capacity up to 0.8 MMTPA.
   ii. Revamping of Sinter Plant 1&2 to achieve the production capacity from 2.85 MMTPA capacity to 3.64 MMTPA
   iii. Revamping of Blast furnaces 1&2 to achieve hot metal production capacity up to1 MMTPA
   iv. Revamping of SMS Plants 1&2 to achieve liquid steel production capacity up to1 MMTPA
   v. Installation of Twin Laddle Heating furnace in SMS-2 Plant.
   vi. Revamping and Modernization of Continuous Casting Department
   vii. Revamping and up-gradation of Walking beam type reheating Furnaces of the Light and Medium Merchant Mill (LMMM)
   viii. Revamping & Up-gradation of Electrostatic Precipitators of Two Boilers in Thermal Power Plant (TPP)
6. About 3.80 MMTPA additional minerals viz., Iron ore in the form of fines, Sized Iron Ore & Pellets, Lime Stone, Dolomite and Quartzite would be required and about 1.3 MTPA Coal/PCI coal is required.
7. The present permitted water withdrawal is 45 MGD from Yeleru Reservoir through Visakhapatnam Industrial Water Supply Company Limited (VIWSCO). Out of that 38 MGD of water is being utilized i.e., 30 MGD for Plant operations and 8 MGD is for Township. The balance 7 MGD of water is proposed to use in the augmentation and expansion i.e., 6 MGD is for plant operations and 1 MGD is for Township and others. Hence the permitted 45 MGD would be sufficient even after expansion and augmentation.

8. The power requirement for operating the steel plant including township is 470 MW in which 384 MW is met from captive power generation and 86 MW is drawn from APTRANSCO. The additional power required for the proposed expansion is 76 MW, which will be supplied by APTRANSCO.

9. The solid waste generated is proposed to dispose to the cement industries. Other waste such as mill scale etc., would be recycled into the sinter plant.

10. The wastewater will be recycled and reused within the plant to the maximum extent and the balance treated effluent would be discharged in to sea.

11. Out of total acquired land of 8827 Ha, greenbelt has been developed in 2720 Ha in and around the plant and township.

12. About 1600 no. of jobs would be provided on skilled and semi skilled basis.

13. Proposed to install latest technology equipment to meet the emissions standard of 50 mg/Nm^3.

14. The CSR activities were implemented during 2015 - 2016 with an investment of Rs.9.24 Cr and 2% of average net profit funds are being allotted to carryout CSR activities.

Sri Shyam Sundar, General Manager, M/s. Bhagavathi Ann Labs(Hyderabad), the Technical Consultant of the project proponent, informed the following:

1. The baseline data i.e., ambient air quality, surface and ground water quality, noise and soil quality within 10 Km radius of the proposed project during the period from October to December, 2016 were collected and the parameters were analyzed. As per the results, the environmental parameters of Air, Water and Soil are within the prescribed CPCB limits.

2. The latest technology proposed in the expansion project would reduce the pollution levels within specified standards.

3. The EIA report was prepared based on the environmental study carried out in and around the surroundings of the project for a period of 3 months.

The Environmental Engineer requested the public to express their opinions, suggestions and objections freely in the environment point of view about the proposed project.

Public Views:

1. Sri Ch Narasinga Rao, CPI(M) State Secretary, Visakhapatnam, while welcoming the proposed expansion project, informed that the communication about Public Hearing is not circulated properly resulted in less attendance of public. He opined that the Plant would have own mines for which the Government would take steps to allot Captive mines to the Plant so that the production cost would be less and the industry could withstand by competing with the market. He said that the proposed capital investment of Rs.9439.53 Cr for expanding the capacity of another 1.0 MMTPA is not reasonable, since it is public money, should be spent transparently. He opined that the time limit of 5 years for completion of the expansion project is a lengthy process and suggested to complete the process in 3 years. He expressed doubt about the marketing opportunities for the steel produced even after expansion. He expressed that the commitments given earlier at the time of establishment of the Plant were not fulfilled and not yet provided proper rehabilitation and sought preference to rehabilitants in recruitments during the expansion. He requested to take necessary measures for environmental protection citing the example of the pollution issues at Chepalapalem village near the plant despite repeated representations to the management regarding loss of marine aquatic life due to discharge of treated effluents in to sea.

2. Sri Ganga Rao, Visakhapatnam (Secretary, CPM), while welcoming the proposed expansion project, informed that the EIA report was not properly explaining the details of proposed expansion project. He informed that the management should explain how much land is proposed for development of green belt in the expansion from the existing land. He expressed that, the existing permitted water is 45 MGD for the existing production capacity of 6.3 MTPA and in that case, the sufficiency of water even after expansion is doubtful. He opined that the Plant should produce captive electricity as it requires 1260 MW of power for existing and after expansion process. He further opined that the employment opportunity should be preferred for the surround local educated people and R-card holders.

3. Sri J. Ayodhaya Ramu, Kurmannapalem, while welcoming the proposed expansion project, informed that that the proposed capital investment of Rs.9439.53 Cr for expanding the capacity of another 1.0 MMTPA not sounds reasonable, since it is public money, should be spent transparently. He opined that the time limit of 5 years for completion of the expansion project is a lengthy process and suggested to complete the process in 3 years. He opposed the issuing of expansion works to contractors on turnkey basis.

4. Sri J. Muthyalu, Nadupuru, while welcoming the proposed expansion project, informed that, the management has not given proper publicity for the Public Hearing and opined that if the Public Hearing would have conducted in public place instead of township, the public would have attended in a large number. He further expressed that, the Pedagantyada Mandal is affected due to pollution caused by the operations of Steel Plant in one side and M/s. Gangavaram Port on the other side. He informed that that at the time of acquiring land for

establishment of Steel Plant, R cards were given but there is no clarity that how many R card holders were compensated with R & R package and employment opportunity. The industries in Visakhapatnam District were incurred heavy damage due to Hud-Hud Cyclone and obtained compensation from Government to some extent but the Steel Plant has not estimated & not disclosed the damage incurred due to Hud-Hud Cyclone for obtaining compensation. Since the Visakhapatnam Steel plant has its own identity, it would have captive mines but the mines were not being allotted. He urged to fulfill the earlier commitments given at the time of establishment and do justice to the rehabilitants.

5. Sri N. Ramachandra Rao, INTUC Member, Pedagantyada, while welcoming the proposed expansion project, informed that the Steel Plant was established in this area after scarification of many people by saying "Visakha Ukku Andhrula Hakku". The Green Belt was planned to plant 1.0 lakh plants for 10 Lak Tons production, but for the production of 6.3 Million Tons, plantation of 6.3 lakhs plants was not developed. He expressed that developing greenbelt within the Plant area and township not only serving the purpose but also would be developed in the surrounding areas viz., Gajuwaka, Pedagantyada, Agnampudi and Vadlapudi to control the pollution. He opined that, pollution would persist in the surroundings of any industry but the same would be controlled by developing good green belt and taking preventive measures. He suggested that the management should not compromise with quality and take preventive measures to control accidents.

6. Sri K. Mahesh, Kurmannapalem (Ukku Nirvasitula Nirudyogula Sangham) while welcoming the proposed expansion project said that the commitments given at the time of establishment of the Plant were not

fulfilled and not yet provided proper rehabilitation and sought preference to them in recruitments during the expansion.

7. Sri Venkata Rao, Dalita Porata Samithi while welcoming the proposed expansion project opined that, public hearing shall also to be conducted at mining area to obtain the opinion of public as there is a proposal to allot the mines for the expansion project. He urged to consider reservation criteria in providing employment in the existing plant as well as after expansion also. He requested to fullfill the commitments given to the rehabilitants and sought preference to them in recruitments during the expansion.

8. Sri B. Pydi Raju, Secretary, INTUC, Visakhapatnam while welcoming the proposed expansion project said that, development of ancillary industries in the surroundings would help in increasing employment opportunities. He requested to implement minimum wages to the contract workers and do justice to the rehabilitants by fulfilling the earlier commitments. He further said that the CSR funds are to be allotted properly in the surrounding areas. He urged to adopt Chepalupalem village which is affecting due to pollution.

9. Sri G. Venkat Rao, Secretary, INTUC, Visakhapatnam, while welcoming the proposed expansion project, said that the proposed capital investment for expanding the capacity and the time period of 5 years for completion of the expansion project is to be re-estimated as allotment of funds throughout the period would obstruct the expansion. He requested to provide permanent jobs to the rehabilitants and develop more greenbelt in and around the plant premises and township.

10. Sri B. Satyanarayana, Aganampudi while welcoming the proposed expansion project requested the management to implement CSR

activities in the surrounding areas by providing skill development training to the local youth andl women for better employment opportunities.

11. Sri M. Satyanarayana, Pedagantyada while welcoming the proposed expansion project, said that at the time of acquiring land for establishment of Steel Plant, R cards were given but employment opportunities are yet to be given for most of the R-card holders and R & R package is yet to be completed. The rehabilitation problems are to be solved by conducting meetings in the surrounding villages. The Pedagantyada area is suffering from pollution problems hence the Steel Plant management should develop greenbelt in the surrounding areas on par with the township.

12. Sri K.V. Gowri Prasad, Aganampudi, while welcoming the proposed expansion project, requested that the Steel Plant is to be provided with permanent source of water supply as the production is affecting sometimes due to insufficient water supply.

13. Sri P. Srinivasa Rao, Vadlapudi, while welcoming the proposed expansion project, requested to fulfill the commitments given at the time of establishment of the Plant and provided proper rehabilitation.

14. Sri D. Suresh Babu, Ukkunagaram, while welcoming the proposed expansion project, said that developing plantation par with the production capacity is appreciated due to which pollution level will be reduced. He opined that pollution is not only due to the operations of Steel Plant but also due to the operations of Pharma industries located in Pharmacity which would be properly monitored and controlled. The fish catch is depleting thereby affecting the livelihood of fishermen due to the release of treated effluent into Sea water. He requested to adopt reservations in contract employment also.

15. Smt Urmila, Duvvada while welcoming the proposed expansion project said that the Visakhapatnam Steel Plant management is implementing CSR activities properly by providing vocational training centers, adult education centers and skill development trainings to women etc.

16. Sri N. Rama Rao, Ukkunagaram, while welcoming the proposed expansion project, said that the Steel Plant is expected to expand up to 10 MMTPA. He opined that though India has the capacity of producing 100% indigenous steel, producing 60% only and the balance 40% is being importing from foreign countries and hence urged to discourage the imported steel. He said that no political interference would be involved in the expansion proposall and the expansion is proposed on importance basis, the funds allocated would not be misused. He further requested for preference would be given to the rehabilitants and women in the proposed expansion.

17. Sri Ch Musalayya, Appikonda while welcoming the proposed expansion project, said that the fish catch is depleted due to which the livelihood of fishermen is affected. The Water Plant provided earlier was damaged during Hud Hud Cyclone time. The village people are suffering due to lack of proper water facilities hence the Appikoda area shall be treated as rehabilitant area and arrange to shift the village to another places duly providing common amenities.

18. Sri Sunanda Reddy, Environmentalist, while welcoming the proposed expansion project, suggested that the Steel Plant management shall construct water sheds in their 22,000 acres land to collect and store the rain water which may be used for plant requirements. The plantation in the surroundings is good and it would be more beneficial if the management plants fruit baring, medicated value plants. He requested

the management to conduct skill development trainings to the surrounding local youth so as to improve their technical skills to get proper employment. He opined that the Steel Plant should have captive mines and requested that all the required permissions may be granted to the expansion proposal.

19. Sri Janardhan Reddy, Social worker while welcoming the proposed expansion project, requested to fulfill the earlier commitments and do justice to the rehabilitants. He requested that all the required permissions may be granted to the expansion proposal.

20. Sri P. Ramulu, Rehabilitant, while addressing in the public hearing, expressed his grievance that though their land was acquired at the time of establishment of the plant, neither compensated nor provided any employment opportunity. He requested the management to provide employment immediately for livelihood.

21. Sri Vijayakumar, Aganampudi while welcoming the proposed expansion project, said that local people and rehabilitants would be preferred in jobs. The green belt is to be developed in the surrounding nearby villages. A village meeting is to be conducted in Agnampudi village and discussions would be held on the pollution issues. The management would involve the local youth in CSR activities and green belt development.

22. Smt Vijaya,Agnampudi, while welcoming the proposed expansion project, said that the Visakhapatnam Steel Plant management is implementing CSR activities properly by providing vocational training centers and skill development trainings to women etc. She requested to enhance the more funds for CSR activities and provide employment to the women.

23. Sri Lakshmana, Srinagar Official Colony, while welcoming the proposed expansion project, said that the green belt is to be developed more. The CSR activities are to be implemented properly in the surrounding areas for developing their livelihood. The local youth should be involved in the CSR programmes.

24. Sri Manthri Rajasekhar, Nadupuru while welcoming the proposed expansion project, said that the surrounding Yarada, Gajuwaka and Gangavaram areas are affected by pollution. Green belt would be developed in those areas on par with township to reduce the affect of pollution. Since the Visakhapatnam Steel Plant, Gangavaram Port and public are using the same road for conveyance, the sound & vehicular pollution, public nuisance and traffic issues are increasing day by day. The Yeleru reservoir water is getting polluted due to dumping of Pharma waste and Poultry waste which is to be prevented. The earlier commitments are to be fulfilled and the rehabilitants are to be justified by providing one time settlement.

25. Sri M.Dattathreya, Nadupuru while welcoming the proposed expansion project, informed that the ash is spreading in the township due to operation of thermal power plant by NTPC. The rehabilitants are to be justified.

26. Sri Mokkala Raju while welcoming the proposed expansion project, informed that the green belt is to be developed more in and around surroundings of the Plant to mitigate pollution issues.

The Environmental Engineer requested the project proponent to clarify the apprehensions, opinions, views, objections and advises raised by the public in the meeting.

Sri P.V. Rao, General Manager, Visakhapatnam Steel Plant, while clarifying the public views, informed the following:

a. Providing employment is depends on the sanctioned jobs.
b. Out of 16000 R cards issued, agreements were entered with 5000 R card holders and the jobs were provided for 6300 R Card holders.
c. Due to the Hon'ble Supreme Court of India's judgment issued in 1998, the employment opportunities are equally given to all the people by giving publicity through paper notification instead of providing jobs only to R Card holders.

Sri Gandhi, CSR Department, Visakhapatnam Steel Plant informed that the allotment of CSR funds for the last 2 years is less due to the losses incurred by the Plant. However, the plant is still carrying out skill development programmes, supplying water to the surrounding areas. The water shed damaged during Hud-Hud cyclone in Chepadapalem village would be repaired immediately.

The Environmental Engineer requested the Chairman of Public Hearing Committee, to conclude the Public Hearing proceedings. He informed that 13 no. of representations were received at the venue of public hearing and all are welcoming the proposed project.

The Chairman of the Public Hearing, while concluding the Public Hearing, informed the following:

i. The project proponent explained the technical aspects and affects of the proposed projects on the surrounding environment.
ii. All the opinions, views were recorded and the same would be forwarded to MOEF&CC.
iii. Many people discussed about the rehabilitation & R - Cards issues, green belt, fishermen, employment opportunities. Apart from environmental issues, the other local issues would be dealt separately.
iv. The role of Public Hearing committee is to conduct and record the proceedings of the public hearing and would forward the same to the Expert Committee of MOEF&CC.

v. As per the DPR, the Expert Committee would review and focus on the water source, wastewater & solid waste disposal, noise pollution, air pollution limits technically including the public views while taking the decision on the issuel of clearance.

He concluded the public hearing meeting by thanking the people for their active participation and cooperation.

The Collector & District Magistrate,
Visakhapatnam

Environmental Engineer
APPCB, HO,
Visakhapatnam

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విశాఖపట్నం జిల్లా, గాజువాక, కూర్మన్నపాలెం లో గల మెసర్స్ రాష్ట్రీయ ఇస్పాత్ నిగమ్ లిమిటెడ్ (విశాఖపట్నం స్టీల్ ప్లాంట్) వారిచే ప్రతిపాదించబడిన ప్రస్తుత పరిశ్రమ సామర్థ్యాన్ని నవీకరించి మరియు పెంచి ఉత్పత్తిని సాలీనా 6.3 మిలియన్ మెట్రిక్ టన్నులనుండి 7.3 మిలియన్ మెట్రిక్ టన్నులకు పెంచుటకు సంబంధించి పరిశ్రమ ఆవరణలో తేదీ 15.06.2017 న ఉదయం 11.00 గం.లకు నిర్వహించిన పర్యావరణ ప్రజాభిప్రాయ సేకరణ సదస్సులో పాందుపరుచిన వివరములు (మినిట్స్).

ప్యానెల్ సభ్యులు:

1.	శ్రీ ప్రవీణ్ కుమార్, ఐ.ఎ.ఎస్ కలెక్టర్ మరియు జిల్లా మెజిస్ట్రేట్, విశాఖపట్నం జిల్లా	అధ్యక్షులు
2.	శ్రీ ఆర్. లక్ష్మీ నారాయణ, పర్యావరణ ఇంజనీరు, ఆంధ్ర ప్రదేశ్ కాలుష్య నియంత్రణ మండలి, ప్రాంతీయ కార్యాలయము, విశాఖపట్నం జిల్లా	సభ్యులు

సభ ప్రారంభించిన పర్యావరణ ఇంజనీరుగారు ప్రజా సమస్యలకు విచ్చేసిన వారిందరకు స్వాగతం పలుకుతూ పర్యావరణ ప్రజాభిప్రాయ సదస్సునకు సంబంధించిన కేంద్ర పర్యావరణ, అడవుల మరియు వాతావరణ మార్పులు మంత్రిత్వ శాఖ, భారత ప్రభుత్వం వారిచే జారీచేయబడిన పర్యావరణ ప్రభావ అంచనా నోటిఫికేషన్ ఎస్.ఓ. 1533 తేదీ 14.09.2006 మరియు తదుపరి సవరణల సమాచారాన్ని వివరించారు. తరువాత ప్రజాభిప్రాయ సేకరణ సదస్సును సంబంధించి ప్రాజెక్టు స్థాపనకు గల ముఖ్య ఉద్దేశ్యమును సభ్యులకు తెలియపరిచినారు.

మెసర్స్ రాష్ట్రీయ ఇస్పాత్ నిగమ్ లిమిటెడ్ (విశాఖపట్నం స్టీల్ ప్లాంట్)వారు సుమారు రూ.9439.53 కోట్ల ప్రతిపాదిత వ్యయంతో ప్రస్తుత పరిశ్రమ సామర్థ్యాన్ని నవీకరించి మరియు పెంచి ఉత్పత్తిని సాలీనా 6.3 మిలియన్ మెట్రిక్ టన్నులనుండి 7.3 మిలియన్ మెట్రిక్ టన్నులకు పెంచుటకు ప్రతిపాదించి ఆంధ్ర ప్రదేశ్ కాలుష్య నియంత్రణ మండలి వారిని పర్యావరణ ప్రజాభిప్రాయ సేకరణ సదస్సు నిర్వహించవలసినదిగా అభ్యర్థించినారు.

ఈ ప్రక్రియలో భాగంగా కేంద్ర పర్యావరణ, అడవుల మరియు వాతావరణ మార్పులు మంత్రిత్వ శాఖ, భారత ప్రభుత్వం వారి అనుమతి మంజూరు కొరకు ప్రజాభిప్రాయ సదస్సును నిర్వహించాలి. ఈ పర్యావరణ ప్రజాభిప్రాయ సదస్సుకు కలక్టర్ మరియు జిల్లా మెజిస్ట్రేట్ గారు అధ్యక్షత వహించి రాష్ట్ర కాలుష్య నియంత్రణ మండలి వారి సహకారంతో నిర్వహించుచున్నారు.

పర్యావరణ ప్రభావిత అంచనా ప్రకటన ప్రజాభిప్రాయ సేకరణ సదస్సునకై ప్రకటనను 30 రోజుల కాల వ్యవధి ఉండే విధముగా సభ్య కార్యదర్శి, ఆంధ్ర ప్రదేశ్ కాలుష్య నియంత్రణ మండలి వారి ఆదేశానుసారము తేదీ 15.06.2017 న ప్రజాభిప్రాయ సేకరణ సదస్సు నిర్వహించుటకు సంబంధించిన ప్రొజెక్టు వివరములతో

తేదీ 13.05.2017 నాడు ప్రముఖ దిన పత్రికలైన "ఈనాడు" (తెలుగు) మరియు "ది హిందూ" (ఇంగ్లీషు) దినపత్రికలలో ప్రజాభిప్రాయ సేకరణ సదస్సుకు సంబంధించి ప్రజల అభిప్రాయములను, సలహాలను, సూచనలను మరియు అభ్యంతరములను స్వీకరించుటకు ప్రకటన ఇవ్వబడినది.

ప్రాజెక్టుకు సంబంధించిన పర్యావరణ ప్రభావ అంచనా నివేదిక మరియు కార్యనిర్వాహక సారాంశములను తెలుగు, ఇంగ్లీషు భాషలలో తేదీ 13.05.2017 నాటి పత్రికా ప్రకటనలో తెలిపిన విధముగా శ్రీ విశాఖపట్నం జిల్లా కలెక్టరు వారి కార్యాలయము, విశాఖపట్నం జిల్లా, ముఖ్య కార్య నిర్వహణాధికారి వారి కార్యాలయము, జిల్లా పరిషత్, గ్రేటర్ విశాఖపట్నం మున్సిపల్ కార్పోరేషన్ వారి కార్యాలయము, వైస్ చైర్మన్, విశాఖ నగరాభివృద్ధి సంస్థ, జనరల్ మేనేజర్ వారి కార్యాలయము, జిల్లా పరిశ్రమల కేంద్రం, విశాఖపట్నం వారి కార్యాలయాలలోనూ ప్రజల పరిశీలనకై ఉంచడమైనది.

పర్యావరణ సదస్సునకు విచ్చేసిన పరిసర ప్రాంత ప్రజలు, పర్యావరణం విషయంలో తమతమ సూచనలు, సలహాలు, అభ్యంతరాలు మరియు అభిప్రాయములు తెలియజేసినట్లయితే, ఆయా విషయాలన్నీ క్రోడీకరించి కేంద్ర పర్యావరణ, అడవులు మరియు వాతావరణ మార్పులు మంత్రిత్వ శాఖ, భారత ప్రభుత్వం వారికి పంపించుట జరుగునని తెలియచేసినారు.

మెసర్స్ రాష్ట్రీయ ఇస్పాత్ నిగమ్ లిమిటెడ్ (విశాఖపట్నం స్టీల్ ప్లాంట్)వారు వారి ప్రతిపాదనకు సంబంధించి ఏ విధమైన వ్రాతపూర్వక వినతి పత్రములు అందలేదని తెలియపరచి, తదుపరి కార్యక్రమమును నిర్వహించవలసినదిగా అధ్యక్షులవారైన కలెక్టరు మరియు జిల్లా మెజిస్ట్రేట్ వారిని కోరడమైనది.

పర్యావరణ ప్రజాభిప్రాయ సేకరణ సదస్సు అధ్యక్షులు అయిన కలెక్టర్ మరియు జిల్లా మెజిస్ట్రేట్ వారు సదస్సుకు విచ్చేసిన ప్రజలకు, ప్రజా ప్రతినిధులకు, పత్రికా ప్రతినిధులకు, అధికారులకు మరియు యాజమాన్యం వారికి స్వాగతం పలుకుతూ, కేంద్ర పర్యావరణ, అడవుల మరియు వాతావరణ మార్పులు మంత్రిత్వ శాఖ, భారత ప్రభుత్వం వారిచే జారీచేయబడిన పర్యావరణ ప్రభావ అంచనా ప్రకటన నెం. యస్. ఒ. 1533 తేదీ 14.09.2006 మరియు తదుపరి సవరణల ప్రకారము ఒక క్రొత్త పరిశ్రమ స్థాపనకు లేదా ఉన్న పరిశ్రమ విస్తరణకు సంబంధించి పర్యావరణ అనుమతులను పొందుటకు గాను సంబంధిత ప్రతిపాదిత స్థలములో ప్రజాభిప్రాయ సేకరణ జరుపవలసి వుంటుందని తెలిపారు.

ఈరోజు జరుపబడుచున్న ప్రజాభిప్రాయ సేకరణ సదస్సు మెసర్స్ రాష్ట్రీయ ఇస్పాత్ నిగమ్ లిమిటెడ్ (విశాఖపట్నం స్టీల్ ప్లాంట్) వారు సుమారు రూ.9439.53 కోట్ల ప్రతిపాదిత వ్యయంతో ప్రస్తుత పరిశ్రమ సామర్థ్యాన్ని నవీకరించి మరియు పెంచి ఉత్పత్తిని సాలీనా 6.3 మిలియన్ మెట్రిక్ టన్నులనుండి 7.3 మిలియన్ మెట్రిక్ టన్నులకు పెంచు ప్రతిపాదనకు సంబంధించి నిర్వహింపబడుచున్నదని, ప్రజాభిప్రాయ సేకరణ కేవలము ప్రజల అభిప్రాయాలు సేకరించి నమోదు చేయుడానికి మాత్రమే నిర్వహింపబడుచున్నదనియూ, పరిశ్రమ ప్రతిపాదనకై కావలసిన అనుమతులు మంజూరు చేయుడమా, వద్దా అనే విషయం నిపుణుల కమిటీ వారి సిఫారసులపై ఆధారపడి వుంటుందని అన్నారు.

ప్రజలు సామరస్యంగా తమ అభిప్రాయాలను, సలహాలను, సూచనలను, చెప్పిన విషయాలనే మళ్ళీ మళ్ళీ చెప్పకుండా, ప్రశాంతంగా, క్లుప్తంగా వ్యక్తపరచి, ప్రజాభిప్రాయ సేకరణకు సహకరించినట్లయితే సదరు అభిప్రాయాలను, సలహాలనూ, సూచనలూ నమోదు చేసుకొని, క్రోడీకరించి కేంద్ర పర్యావరణ, అడవులు మరియు వాతావరణ మార్పులు మంత్రిత్వ శాఖ, భారత ప్రభుత్వం వారికి నివేదించడం జరుగుతుందని తెలిపారు. తదుపరి కార్యక్రమమును నిర్వహించవలసినదిగా పర్యావరణ ఇంజనీరు వారిని కోరారు.

పర్యావరణ ఇంజనీరు వారు ప్రాజెక్టు ప్రతినిధులను ప్రతిపాదిత ప్రాజక్టు నకు సంబంధించిన అంశములను ప్రజలకు సవివరముగా విశదీకరించవలసినదిగా విజ్ఞప్తి చేసారు.

పర్యావరణ ఇంజనీరు వారి విజ్ఞప్తి మేరకు శ్రీ జి వి. రావు, డిప్యూటీ జనరల్ మేనేజర్ (డిజైన్ మరియు ఇంజనీరింగ్), మెసర్స్ రాష్ట్రీయ ఇస్పాత్ నిగమ్ లిమిటెడ్ (విశాఖపట్నం స్టీల్ ప్లాంట్) ప్రజాభిప్రాయ సేకరణ సదస్సుకు విచ్చేసిన సభాధ్యక్షులవారికి, పర్యావరణ ఇంజనీరు వారికి, ప్రజలకు, పత్రికా ప్రతినిధులకు, ప్రభుత్వ అధికారులకు స్వాగతం పలుకుతూ, క్రింది వివరములను ప్రజలకు విశదీకరించినారు:

1. మెసర్స్ విశాఖపట్నం స్టీల్ ప్లాంట్, భారతదేశంలోనే మొట్టమొదటి తీరప్రాంత ఆధారిత సమగ్ర ఇనుము మరియు ఉక్కు కర్మాగారం. భారత ప్రభుత్వ ఉక్కు మంత్రిత్వ శాఖ ఆధ్వర్యంలో నవరత్న స్థాయిలోగల మెసర్స్ రాష్ట్రీయ ఇస్పాత్ నిగమ్ లిమిటెడ్ ద్వారా ఆంధ్రప్రదేశ్ రాష్ట్రం, విశాఖపట్నంలో స్థాపించబడినది. దీని ప్రస్తుత ఉత్పత్తి సామర్థ్యం సాలీనా 6.3 మిలియన్ మెట్రిక్ టన్నులు.
2. ప్రస్తుత పరిశ్రమ సామర్థ్యాన్ని నవీకరించి మరియు పెంచి ఉత్పత్తిని సాలీనా 6.3 మిలియన్ మెట్రిక్ టన్నులనుండి 7.3 మిలియన్ మెట్రిక్ టన్నులకు పెంచుటకు ప్రతిపాదించినారు.
3. ప్రస్తుత పరిశ్రమ సామర్థ్య పెంపుదల, నవీకరణ మరియు ఉత్పత్తి పెంపుదలకై సుమారు రూ.9439.53 కోట్లను కేటాయించి, 5 సం.ల వ్యవధిలో పూర్తి చేయుటకు ప్రతిపాదించినారు.
4. పరిశ్రమ సామర్థ్య పెంపుదల, నవీకరణ మరియు ఉత్పత్తి పెంపుదల ప్రతిపాదనకై ప్రస్తుత పరిశ్రమ పరిధిలోగల స్థలములో 362 ఎకరములను కేటాయించినారు.
5. పరిశ్రమ సామర్థ్య పెంపుదల, నవీకరణ మరియు ఉత్పత్తి పెంపుదల ప్రక్రియలో క్రింది సౌకర్యములను ఏర్పాటు చేయుటకు ప్రతిపాదించినారు:
   1. ప్రస్తుతం వాడుకలో వున్న నాలుగు (4) కోక్ ఒవెన్ బ్యాటరీలను ఆధునీకరించి, సామర్థ్యం పెంచి, అదనంగా మరియొక (1) కోక్ ఒవెన్ బ్యాటరీని ఏర్పాటు చేయుటద్వారా సాలీనా 8.0 మిలియన్ మెట్రిక్ టన్నుల ఉత్పత్తి సామర్థ్యాన్ని సాధించుట.
   2. సింటర్ ప్లాంట్ 1 మరియు 2 లను పునర్వ్యవస్థీకరించుట ద్వారా సాలీనా 2.85 మిలియన్ మెట్రిక్ టన్నుల నుండి 3.64 మిలియన్ మెట్రిక్ టన్నుల ఉత్పత్తి సామర్థ్యాన్ని సాధించుట.

iii. బ్లాస్ట్ ఫర్నేస్ 1 మరియు 2 లను పునర్వ్యవస్థీకరించుట ద్వారా సాలీనా 1.0 మిలియన్ మెట్రిక్ టన్నుల హాట్ మెటల్ ఉత్పత్తి సామర్థ్యాన్ని సాధించుట.

iv. ఎస్.ఎమ్.ఎస్ 1 మరియు 2 ప్లాంట్లను పునర్వ్యవస్థీకరించుట ద్వారా సాలీనా 1.0 మిలియన్ మెట్రిక్ టన్నుల ట్రకరూప స్టీల్ ఉత్పత్తి సామర్థ్యాన్ని సాధించుట.

v. ఎస్.ఎమ్.ఎస్ 2 ప్లాంట్ లో ట్విన్ లేడిల్ హీటింగ్ సర్వీస్ ను ఏర్పాటు చేయుట.

vi. నిరంతర కేస్టింగ్ విభాగమును పునర్వ్యవస్థీకరించి ఆధునీకరించుట.

vii. లైట్ మరియు మీడియమ్ సుర్చెంట్ మిల్ (ఎల్.ఎమ్.ఎమ్.ఎమ్) లో గల ఛాకింగ్ బీమ్ ఫంటి రీ-హీటింగ్ ఫర్నేసును పునర్వ్యవస్థీకరించి సామర్థ్యమును పెంచుట.

viii. థర్మల్ పవర్ ప్లాంట్ లో గల రెండు బాయిలర్ల ఎలక్ట్రోస్టాటిక్ ప్రసిపిటేటర్లను పునర్వ్యవస్థీకరించి సామర్థ్యమును పెంచుట.

6. ప్రస్తుత పలత్రయ సామర్థ్యాన్ని సవీకరించి మరియు పెంచిన తరువాత అదనంగా సుమారు 3.00 మిలియన్ మెట్రిక్ టన్నుల ఇనుపరజను, క్రమపట్టిక ఆకారము గల ఇనుప ఖనిజము, పెల్లెట్లు, సున్నపు రాయి, డోలమైట్, క్వార్టజైట్ మరియు 1.3 మిలియన్ టన్నుల బొగ్గు అవసరమవుతాయి.

7. ప్రస్తుతం విశాఖపట్నం స్టీల్ ప్లాంట్ కు రోజుకు 45 మిలియన్ గాలన్ల నీటి వినియోగమునకై అనుమతి ఉన్నది. ఈ నీరు ఏలేరు రిజర్వాయరు నుండి విశాఖపట్నం పారిశ్రామిక నీటి సరఫరా సంస్థ ద్వారా సరఫరా చేయబడుచున్నది. అనుమతించిన నీటితో రోజుకు 38 మిలియన్ గాలన్ల నీరు మాత్రమే అనగా రోజుకు 30 మిలియన్ గాలన్ల నీరు పారిశ్రామిక అవసరాలకు మరియు రోజుకు 8 మిలియన్ గాలన్ల నీరు టౌన్ షిప్ అవసరాలకు వినియోగించబడుచున్నది. మిగిలిన రోజువారీ 7 మిలియన్ గాలన్ల నీటిని ప్రతిపాదిత పరిశ్రమ సామర్థ్య పెంపుదల, సవీకరణ మరియు ఉత్పత్తి పెంపుదల ప్రక్రియ అనంతరం రోజుకు 6 మిలియన్ గాలన్ల నీటిని పారిశ్రామిక అవసరాలకు గానూ మరియు రోజుకు 1 మిలియన్ గాలన్ల నీరు టౌన్ షిప్ అవసరాలకు వినియోగించబడును. అందువలన అనుమతింపబడిన రోజుకు 45 మిలియన్ గాలన్ల నీరు ప్రతిపాదిత విస్తరణ తరువాత కూడా సరిపోతుంది.

8. ప్రస్తుతం విశాఖపట్నం స్టీల్ ప్లాంట్ నడుపుటకు మరియు టౌన్‌షిప్ అవసరాలకు 470 మెగా వాట్ల విద్యుత్ అవసరము. అందులో 384 మెగావాట్లు స్వంత విద్యుత్ ఉత్పత్తి కేంద్రము ద్వారా మిగిలిన 86 మెగావాట్ల విద్యుత్ ఎ.పి.ట్రాన్స్కో ద్వారా సరఫరా చేయబడుచున్నది. పరిశ్రమ సామర్థ్య పెంపుదల, సవీకరణ మరియు ఉత్పత్తి పెంపుదల ప్రక్రియ అనంతరం అనుమతియ్యే 76 మెగావాట్ల విద్యుత్ ఎ.పి.ట్రాన్స్కో ద్వారా సరఫరా చేయబడుతుంది.

9. పరిశ్రమ ద్వారా ఉత్పన్నమయ్యే ఘన వ్యర్థాలను సిమెంట్ పరిశ్రమలకు సరఫరా చేయుటకు. మిగ్ స్లాగ్ వంటి మిగిలిన ఘన వ్యర్థాలను సెంటర్ ఎంట్ లో పునర్వినియోగించటానికి ప్రతిపాదించబడినది.

10. పారిశ్రామిక వినియోగానంతరం బయటవయ్యే వ్యర్థజలాలను శుద్ధికరించి, పారిశ్రామిక మరియు టౌన్-షిప్ అవసరాలకు సరిపడా వినియోగించుకుని మిగులు జలాలు సముద్రములోనికి విడుదల చేయబడును.

11. ప్రస్తుత 8827 హెక్టార్ల స్థలములో 2720 హెక్టార్లలో పరిశ్ర మరియు టౌన్-షిప్ పరిసరాలలో పచ్చదనం అభివృద్ధి చేయబడును.

12. ప్రస్తుత విస్తరణలో ప్రత్యక్ష మరియు నైపుణ్యం ఆధారంగా 1600 ఉద్యోగములు కల్పించబడును.

13. ఉద్గారాల పరిమితి 50 mg/Nm^3 లోబడి ఉంచటానికై ఆధునిక సాంకేతిక పరికరాలను వినియోగించబడును.

14. పారిశ్రామిక సామాజిక బాధ్యతగా సం. 2015-2016 గానూ రూ.9.24 కోట్లను పరిసర గ్రామాలలలో పలు అభివృద్ధి కార్యక్రమాలకై ఖర్చు చేయడమైనది మరియు లాభాలలో 2శాతం నిధులను పారిశ్రామిక సామాజిక బాధ్యత అభివృద్ధి కార్యక్రమాలకై కేటాయించడమైనది

ప్రతిపాదిత ప్రాజక్టు సంబంధిత సలహాదారు శ్రీ శ్యామ్ సుందర్, జనరల్ మేనేజర్, మెసర్స్ భారతి ఎనాటెక్స్, హైదరాబాద్, ప్రతిపాదిత ప్రాజక్టుకు సంభందించి క్రింది వివరములను వివరీకరించినారు.

1. ప్రతిపాదిత సంస్థను స్థలమునుండి 10 కిలోమీటర్ల వ్యాసార్ధములో 2016 అక్టోబరు నుండి డిసంబరు వరకు ఉపరితల వాయువు, భూగర్భ మరియు ఉపరితల నీటి నాణ్యత, ధ్వని, భూసార పరీక్షలు నిర్వహించి పరిమాణములను పరిశీలించగా అవి అన్నియును నిర్దిత ప్రమాణములకు లోబడే వున్నవి.

2. ప్రతిపాదిత విస్తరణ వలన ఉత్పన్నమయ్యే ఉద్గారాలను పరిమితిలో ఉంచటానికై ఆధునిక సాంకేతిక పరికరాలను వినియోగించబడును.

3. పరిసర ప్రాంతాలలో మూడు నెలలపాటు సమగ్ర అధ్యయనము జరిపి పర్యావరణ ప్రభావ అంచనా నివేదికను తయారు చేయడమైనది.

అనంతరం, పర్యావరణ ఇంజనీరువారు ప్రజాభిప్రాయ సేకరణ సదస్సుకు హాజరైన ప్రజలనుద్దేశించి ప్రతిపాదిత ప్రాజెక్టు వలన పర్యావరణం విషయంలో తమతమ సూచనలు, సలహాలు, అభ్యంతరాలు మరియు అభిప్రాయములు నిర్భయంగానుగా తెలియచేయాలని విజ్ఞప్తిచేసారు.

ప్రజల అభిప్రాయాలు:

1. శ్రీ సి.హెచ్. వల్లింగరావు, సి.పి.ఐ (ఎమ్), రాష్ట్ర కార్యదర్శి, విశాఖపట్నం, ప్రతిపాదిత విస్తరణను స్వాగతిస్తూ, ప్రజాభిప్రాయ సేకరణకు సంబంధించి విస్తృత ప్రచారాన్ని చేయకపోవటం వలన ప్రజలు హాజరు తక్కువగానుందని అన్నారు. స్టీల్ ప్లాంటు కు స్వంత గనులు వుండాలని, ప్రభుత్వముపరు దీనిపై దృష్టి పెట్టలని, స్వంత గనులు వుండటం వలన ఉత్పత్తి వ్యయం తగ్గే మార్కెట్ లో వున్న ఎవటీని తట్టుకోగలదని

అభిప్రాయపడ్డారు. 1.0 మిలియన్ మెట్రిక్ టన్నుల వార్షిక ఉక్కు ఉత్పత్తికై రు.9439.53 కోట్ల ప్రతిపాదిత వ్యయంచేయడం సమంజసంగా లేదని, ప్రజల ధనాన్ని వ్యయం చేస్తున్నందువల్ల, పొదుపుగా ఖర్చు చేయాలనీ, విస్తరణకై ప్రతిపాదించిన 5 సం. సమయం చాలా ఎక్కువని అందువల్ల 3 సం.లలో పూర్తిచేయడానికి ప్రయత్నించాలని సూచించారు. విస్తరణ అనంతరం, ఉత్పత్తి చేసే స్టీల్ ను మార్కెట్ చేయగలమా అన్న సందేహాన్ని వ్యక్తపరచారు. గతంలో ఇచ్చిన హామీలను నెరవేర్చలేదని, ఇంకా చాలామంది నిర్వాసితులకు న్యాయం చేయాలని, అందువల్ల విస్తరణలో నిర్వాసితులకు ఉద్యోగ కల్పనలో ప్రాధాన్యత ఇవ్వాలని అన్నారు. పరిశ్రమకు సమీపంలోగల చేసలపాలెం గ్రామాన్ని ఖాళీచేయిస్తూ, పరిశ్రమనుండే సముద్రములోనికి విడుదల కాబడుతున్న వ్యర్థజలాలువల్ల మత్స్య సంపద తరిగిపోతోందని, కాలుష్య నియంత్రణకై చర్యలు చేపట్టాలని యాజమాన్యమువారికి పలుమార్లు వినతిపత్రాలు ఇచ్చినప్పటికీ, నియంత్రణ చర్యలు చేపట్టలేదని అన్నారు.

2. శ్రీ గంగారావు, సి.పి.ఎమ్, కార్యదర్శి, విశాఖపట్నం, ప్రతిపాదిత విస్తరణను స్వాగతిస్తూ, ప్రతిపాదిత విస్తరణకై తయారుచేయిన పర్యావరణ ప్రభావాల అంచనా నివేదికలో ప్రస్తుత విస్తరణలో హరితహారాన్ని ఎన్ని ఎకరాలలో అభివృద్ధి చేయడానికి ప్రతిపాదించారో తెలియపరచలేదని అన్నారు. ప్రస్తుత ఉత్పత్తి సామర్థ్యం 6.3 మిలియన్ మెట్రిక్ టన్నులకుగానూ రోజుకు 45 మిలియన్ గాలన్ల నీరు అవసరమైతే, విస్తరణ అనంతరం (7.3 మిలియన్ మెట్రిక్ టన్నులకు) అదే 45 మిలియన్ గాలన్ల నీరు ఏవిధంగా సరిపోతుందన్న అనుమానాన్ని వ్యక్తపరచారు. విస్తరణ అనంతరం అవసరమయ్యే 1260 మెగావాట్ల విద్యుత్ ను స్టీల్ ప్లాంట్ స్వంతంగా ఉత్పత్తి చేసుకోవాలని అభిప్రాయపడ్డారు. ఉద్యోగాల కల్పనలో స్థానిక నిరుద్యోగులకు మరియు ఆర్ కార్డ్ కలిగినవారికి ప్రాధాన్యత ఇవ్వాలని అన్నారు.

3. శ్రీ అయోధ్య రాము, కూర్మన్నపాలెం, ప్రతిపాదిత విస్తరణను స్వాగతిస్తూ, 1.0 మిలియన్ మెట్రిక్ టన్నుల అదనపు ఉత్పత్తికై రు.9439.53 కోట్లు వ్యయంచేయడం సమంజసంగా లేదని, ప్రజల ధనాన్ని వ్యయం చేస్తున్నందువల్ల, పొదుపుగా ఖర్చు చేయాలనీ, విస్తరణకై ప్రతిపాదించిన 5 సం. సమయం చాలా ఎక్కువని అందువల్ల 3 సం.లలో పూర్తిచేయడానికి ప్రయత్నించాలని సూచించారు. విస్తరణ పనులను కాంట్రాక్టర్లకు ఇవ్వడాన్ని వ్యతిరేకిస్తున్నానని అన్నారు.

4. శ్రీ వి. ముత్యాలు, నడుపూరు, ప్రతిపాదిత విస్తరణను స్వాగతిస్తూ, ప్రజాభిప్రాయ సేకరణకు సంబంధించి యాజమాన్యము వారు విస్తృత ప్రచారాన్ని చేయలేదని. ప్రజాభిప్రాయ సేకరణకు టౌన్ షిప్పులో కాకుండా సామాజిక ప్రాంతాలలో పెట్టివుంటే ప్రజలు అధిక సంఖ్యలో హాజరైవుండేవారని అభిప్రాయపడ్డారు. ఒక ప్రక్క స్టీల్ ప్లాంట్ మరోప్రక్క గంగవరం పోర్టు కార్యకలాపాలవల్ల పెదగంట్యాడ ప్రాంతం కాలుష్యమవుతున్నదని అన్నారు. స్టీల్ ప్లాంట్ ప్రారంభదశలో పరిసర ప్రాంతాలలోగల భూములను సేకరించి వారికి ఆర్. కార్డులు మంజూరు చేసారనీ, కాని అందులో ఎంత మందికి ఉద్యోగ, ఉపాధి కల్పన జరిగిందో ఎంతమంది నిర్వాసితులకు నష్టపరిహారం ఇచ్చారు అన్న వివరంలో స్పష్టతలేదని అన్నారు. హుద్-హుద్ తుఫాను వలన సంభవించిన పరిశ్రమలు ప్రభుత్వం నుండి కొంతమేరకు నష్టపరిహారాన్ని పొందాయి కానీ, విశాఖపట్నం స్టీల్

స్థాపనే మాత్రం ఎంత నష్టం జరిగిందన్న విషయాన్ని లెక్కకట్టలేదు మరియు ప్రభుత్వానికి నష్టపరిహారానికై దరఖాస్తు చేయలేదని అన్నారు. ఎంతో గుర్తింపు వున్న విశాఖపట్నం స్టీల్ ప్లాంట్ కు స్వంత గనులులేవు మరియు గనులను కేటాయించటంలేదని అంటూ, గతంలో ఇచ్చిన హామీలను నెరవెర్చి నిర్వాసితులకు న్యాయం చెయ్యాలని అన్నారు.

5. శ్రీ ఎన్. రామచంద్ర రావు, ఐ.ఎన్.టి.యు.సి సభ్యులు, పెదగంట్యాడ, ప్రతిపాదిత విస్తరణను స్వాగతిస్తూ, ఈ ప్రాంతంలో విశాఖపట్నం స్టీల్ ప్లాంట్ స్థాపించడానికి "విశాఖ చుక్కు – ఆంధ్రుల పుక్కు" అన్న నినాదంతో ఎందరో త్యాగాలు చేసారని అన్నారు. 10 లక్షల టన్నుల ఉత్పత్తికి 1.0 లక్ష మొక్కలు అని ప్రణాళిక వేసారు కానీ 6.3 మిలియన్ మెట్రిక్ టన్నుల ఉత్పత్తికి 6.30 లక్షల మొక్కల పెంపకం జరగలేదని అన్నారు. కేవలం పరిశ్రమ పరిసరాలలో మరియు టౌన్‌షిప్ ప్రాంతంలో హరితహారం అభివృద్ధి చేస్తే సరిపోదని, పరిసర గ్రామాలైన, గాజువాక, పెదగంట్యాడ అగనంపూడి మధురవాడ నక్కపూడి ప్రాంతాలలో హరితహారం అభివృద్ధి చేయటం ద్వారా కాలుష్య నియంత్రణ జరగాలని అభిప్రాయపడ్డారు. ఏ విధమైన పరిశ్రమ పరిసర ప్రాంతాలలోనైనా కాలుష్యానికి అనకూలం వుంటుంది కానీ హరితహారం అభివృద్ధి చేసి నియంత్రణ చర్యలు చేపట్టటం ద్వారా కాలుష్యం కొంతవరకు తగ్గించవచ్చునని అన్నారు. పరిశ్రమవారు ఉత్పత్తి సామర్థ్యతలో రాజీ పడకుండా, ప్రమాదాల నివారణకు తగు చర్యలు తీసుకోవాలని సూచించారు.

6. శ్రీ కె. మహేష్, కూర్మన్నపాలెం (ఉక్కు నిర్వాసిత నిరుద్యోగుల సంఘం), ప్రతిపాదిత విస్తరణను స్వాగతిస్తూ, స్టీల్ ప్లాంట్ ప్రారంభదశలో పరిసర ప్రాంతాలలోగల భూములను సేకరించే సమయంలో ఇచ్చిన హామీలను నెరవేర్చనందున, నిస్తరణలో నిర్వాసితులకు ఉద్యోగ కల్పనలో ప్రాధాన్యత కల్పించి న్యాయం చేయాలని అన్నారు.

7. శ్రీ వెంకట రావు, ఉక్కు పోరాట సమితి, ప్రతిపాదిత విస్తరణను స్వాగతిస్తూ, ప్రతిపాదిత విస్తరణకై విశాఖపట్నం స్టీల్ ప్లాంట్ వారికి గనులు కేటాయించే అవకాశం వున్నందువల్ల, అక్కడ ప్రజాభిప్రాయ సేకరణ జరిపి వారి అభిప్రాయాలను కూడా పరిగణలోనికి తీసుకోవాలనీ, ప్రస్తుతం మరియు విస్తరణ అనంతరం ఉద్యోగ కల్పనలో రిజర్వేషన్ ప్రకారం ప్రాధాన్యత ఇవ్వాలని, గతంలో ఇచ్చిన హామీలను నెరవేర్చి, విస్తరణానంతరం ఉద్యోగ కల్పనలో నిర్వాసితులకు ప్రాధాన్యత ఇచ్చి న్యాయం చెయ్యాలని అన్నారు.

8. శ్రీ బి. పైడిరాజు, ఐ.ఎన్.టి.యు.సి సభ్యులు, విశాఖపట్నం, ప్రతిపాదిత విస్తరణను స్వాగతిస్తూ, స్టీల్ ప్లాంట్ పరిసరాలలో అనుబంధ పరిశ్రమల స్థాపన వలన ఉద్యోగ, ఉపాధి అవకాశాలు పెరుగుతాయని, కాంట్రాక్ట్ ఉద్యోగులకు కనీస వేతనాలు అమలు పరచాలని, గతంలో ఇచ్చిన హామీలను నెరవేర్చి, విస్తరణానంతర ఉద్యోగ కల్పనలో నిర్వాసితులకు ప్రాధాన్యత ఇచ్చి న్యాయం చేయాలని, పారిశ్రామిక సామాజిక బాధ్యతలో భాగంగా కేటాయించే నిధులలో సముచిత్వత పాటించి అన్ని పరిసర ప్రాంతాలకు ఒకే విధంగా కేటాయించాలని, కాలుష్యబారిన పడిన చేసలపాలం గ్రామాన్ని దత్తత తీసుకోవాలని అన్నారు.

9. శ్రీ బి. వెంకటరావు, వి.ఎస్.టి.యు.సి సభ్యులు, విశాఖపట్నం. ప్రతిపాదిత విస్తరణను స్వాగతిస్తూ, విస్తరణలో కేటాయించిన నిధులు మరియు సమయం చాలా ఎక్కువని, కేటాయించిన నిధులను 5 సం. ల కాలంపాటు అందుబాటులో ఉంచడంలో అటంకాలు కలగవచ్చునని అభిప్రాయపడ్డారు. నిర్వాసితులకు శాశ్వత ఉద్యోగాలు కల్పించాలని, పరిశ్రమ పరిసర ప్రాంతాలలో మరియు టౌన్‌షిప్ ప్రాంతంలో పారిశుధ్యం అభివృద్ధి చెయ్యాలని అన్నారు.

10. శ్రీ బి. సత్యనారాయణ, అగనంపూడి, ప్రతిపాదిత విస్తరణను స్వాగతిస్తూ, వారిశ్రామిక సామాజిక బాధ్యతలో కేటాయించే నిధులతో ఉక్కు యాజమాన్యమువారు పరిసర ప్రాంతాలలో గల నిరుద్యోగులకు, స్త్రీలకు వృత్తినైపుణ్య శిక్షణాశిబిరాలను నెలకొల్పి వారి ఉద్యోగ ఉపాధి అవకాశాలు మెరుగుపడేలా చర్యలు చేపట్టాలని అభిప్రాయపడ్డారు.

11. శ్రీ ఎమ్. సత్యనారాయణ, పెదగంట్యాడ, ప్రతిపాదిత విస్తరణను స్వాగతిస్తూ, స్టీల్ ప్లాంట్ ప్రారంభదశలో పరిసర ప్రాంతాలలోగల భూములను సేకరించి వారికి ఆర్. కార్డులు మంజూరు చేసారనీ, కాని అందులో ఇంకా చాలామందికి ఉద్యోగ, ఉపాధి కల్పన జరగలేదని, నిర్వాసితులకు సష్టపరిహారం ఇవ్వలేదని అన్నారు. ఒక ప్రత్యేక సమావేశము/సదస్సు ఏర్పాటుచేసి నిర్వాసితుల సమస్యలు నివారించాలని అన్నారు. పెదగంట్యాడ ప్రాంతం కాలుష్యబారిన పడుతున్నందువలన, స్టీల్ ప్లాంట్ యాజమాన్యముహారు టౌన్‌షిప్ తో సమానంగా పరిసర నివాసప్రాంతాలలో కూడా హరితహారాన్ని అభివృద్ధి చెయ్యాలని అన్నారు.

12. శ్రీ వెచ్. గౌరీ ప్రసాద్, అగనంపూడి, ప్రతిపాదిత విస్తరణను స్వాగతిస్తూ, నిరంతర నీటి సరఫరా సదుపాయంలేక కొన్ని సమయాలలో ఉత్పత్తిపై ప్రభావం చూపుతోందని, అందువల్ల స్టీల్ ప్లాంట్ కు శాశ్వత నిరంతర నీటి సరఫరా సదుపాయం కల్పించాలని విజ్ఞప్తి చేసారు.

13. శ్రీ పి. శ్రీనివాసరావు, వడ్లపూడి, ప్రతిపాదిత విస్తరణను స్వాగతిస్తూ, స్టీల్ ప్లాంటి ప్రారంభదశలో ఇచ్చిన హామీలను నిరవేర్చి, విస్తరణానంతరం ఉద్యోగ కల్పనలో నిర్వాసితులకు ప్రాధాన్యత ఇచ్చి న్యాయం చేయాలని అన్నారు.

14. శ్రీ డి. సురేష్ బాబు, ఉక్కు నగరం, ప్రతిపాదిత విస్తరణను స్వాగతిస్తూ, ఉత్పత్తి సామర్థ్యంతో సమానంగా హరితహారాన్ని అభివృద్ధి చెయ్యడం వలన కాలుష్యం ప్రభావం తగ్గుతుందని, ఇది స్వాగతించవలసిన విషయం అన్నారు. కేవలం స్టీల్ ప్లాంట్ కార్మికులపైవల్లనే కాకుండా ఫ్యాక్టరీలోగల నిషిద్ధ పరిశ్రమలవలన కూడా కాలుష్యం వ్యాప్తి చెందుతోందని అందువల్ల దీనిని పర్యవేక్షించి నియంత్రించవలసిన అవసరం వుందని అభిప్రాయపడ్డారు. సముద్రములోనికి శుద్ధీకరించబడిన వ్యర్థజలాల విడుదల వలన మత్స్య సంపద తగ్గిపోయి, మత్స్యకారుల జీవనోపాధి దెబ్బతింటోందని అంటూ, కాంట్రాక్ట కార్మికుల ఉపాధిలో కూడా రిజర్వేషన్ విధానాన్ని అమలుచెయ్యాలని అన్నారు.

15 శ్రీమతి చిన్నిక, ప్రతిపాదిత విస్తరణను స్వాగతిస్తూ, సామాజిక సామాజిక బాధ్యతలో కేటాయించే నిధులతో ఉక్కు యాజమాన్యముహారు పరిసర ప్రాంతాలలో వృత్తినైపుణ్య శిక్షణాశిబిరాలను

నెలకొల్పుతున్నారని, నయోజన విద్యను ప్రోత్సహిస్తూ, వారి ఉద్యోగ ఉపాధి అవకాశాలు పెరిగేలా చర్యలు చేపడుతున్నారని అన్నారు.

16. శ్రీ ఎన్. గామారావు, ఉక్కునగరం, ప్రతిపాదిత విస్తరణను స్వాగతిస్తూ, విశాఖపట్నం స్టీల్ ప్లాంట్ 10 మిలియన్ మెట్రిక్ టన్నుల ఉత్పత్తి సామర్థ్యాన్ని, చేరుకోవాలని ఆకాంక్షించారు. భారతదేశం 100 శాతం స్వదేశీ స్టీల్ ను తయారుచేసే సాముర్థ్యం కలిగినప్పటికీ, 60 శాతం ఉత్పత్తి మాత్రమే జరుగుతోందని, మిగిలిన 40 శాతం విదేశాలనుండి దిగుమతి చేసుకుంటున్నామని అందువల్ల స్వదేశీ స్టీలును ప్రోత్సహించి విదేశాలనుండి దిగుమతి చేసుకునే విధానాన్ని తగ్గించాలని అభిప్రాయపడ్డారు. ప్రస్తుత విస్తరణలో రాజకీయ ప్రమేయం ఉండకూడదని, విస్తరణ ప్రక్రియ ఎంతో ప్రాముఖ్యమైనది కావున నిధుల దుర్వినియోగం జరగరాదని అంటూ, నిర్వాసితులకు, స్త్రీలకు ప్రతిపాదిత విస్తరణానంతరం ఉద్యోగ కల్పనలో ప్రాధాన్యత కల్పించాలని అన్నారు.

17. శ్రీ సి.హెచ్. ముసలయ్య, అప్పికొండ, ప్రతిపాదిత విస్తరణను స్వాగతిస్తూ, సుమ్య సంపద తరిగిపోవడంవల్ల, సుస్థిరాగాల జీవనోపాధి కోల్పోయి నష్టపోతున్నారని, గతంలో ధర్నాటు చేసిన సామాజిక నీటి ట్యాంకర్ హుడ్-హుడ్ తుఫాను కారణంగా దెబ్బతినడం వలన గ్రామ ప్రజలు త్రాగునీటి సదుపాయము లేక ఇబ్బందులు పడుతున్నారని, అందువల్ల అప్పికొండ గ్రామాన్ని ఉక్కు నిర్వాసిత గ్రామంగా పరిగణించి వేరేచోటికి తరలించి నిత్యావసర సదుపాయాలు కల్పించాలని అన్నారు.

18. శ్రీ మురందా రెడ్డి, పర్యావరణవేత్త, ప్రతిపాదిత విస్తరణను స్వాగతిస్తూ, ఉక్కు యాజమాన్యమువారు తమ 22,000 ఎకరాల స్థలములో నీటిని నిలువ చేసే వ్యవస్థలను ఏర్పాటుచేసి, వర్షపు నీటిని నిలువచేసి పరిశ్రమ అవసరాలకు వినియోగించుకోవచ్చునని, పరిశ్రమ పరిసరాలలో హరితహారాన్ని బాగా అభివృద్ధి చేసారనీ, వాటికి తోడుగా పండ్ల చెట్లను, ఔషధ మొక్కలను పెంచినట్లయితే ఇంకా ఉపయోగకరంగా వుంటుందని సూచించారు. వృత్తి నైపుణ్య శిక్షణా శిబిరాలను నిర్వహించి యువతకు తమ వృత్తిలో నైపుణ్యత సాధించే విధంగా తోడ్పాటును ఉక్కు యాజమాన్యానికి విజ్ఞప్తి చేసారు. విశాఖ స్టీల్ ప్లాంటు కు సొంత గనులను కేటాయించి, ప్రతిపాదిత విస్తరణకు సంబంధించిన అన్ని అనుమతులనూ మంజూరు చేయవలసిందిగా ప్రభుత్వానికి విజ్ఞప్తి చేసారు.

19. శ్రీ జనార్దన రెడ్డి, సామాజిక కార్యకర్త, ప్రతిపాదిత విస్తరణను స్వాగతిస్తూ, స్టీల్ ప్లాంట్ ప్రారంభదశలో ఇచ్చిన హామీలను నెరవేర్చి, విస్తరణానంతర ఉద్యోగ కల్పనలో నిర్వాసితులకు ప్రాధాన్యత ఇచ్చి న్యాయం చెయ్యాలని ప్రతిపాదిత విస్తరణకు సంబంధించిన అన్ని అనుమతులనూ మంజూరు చెయ్యాలని ప్రభుత్వానికి విజ్ఞప్తి చేసారు.

20. శ్రీ పి. రాములు, ఉక్కు నిర్వాసితులు, నూట్లుడుతూ, స్టీల్ ప్లాంట్ ప్రారంభదశలో తమ భూములను సేకరించి ఉద్యోగ, పునరావాస కల్పనలో న్యాయం చేయలేదని, ఇప్పటికైనా పునరావాసాన్ని, ఉద్యోగాన్ని కల్పించి న్యాయం చేయవలసినదిగా విజ్ఞప్తి చేసారు.

21. శ్రీ విజయకుమార్, అగనంపూడి, ప్రతిపాదిత విస్తరణను స్వాగతిస్తూ, విస్తరణానంతరం ఉద్యోగ కల్పనలో నిర్వాసితులకు, స్థానికులకు ప్రాధాన్యత ఇవ్వాలనీ, హరితహారాన్ని పరిసర గ్రామాలలో కూడా అభివృద్ధి చేయాలనీ, గ్రామ సభలను ఏర్పాటుచేసి కాలుష్య సమస్యలపై గ్రామస్థులతో చర్చించాలనీ, పారిశ్రామిక సామాజిక బాధ్యత ద్వారా చేపట్టే కార్యక్రమాలలోనూ, హరితహార అభివృద్ధిలోనూ స్థానిక యువకులకు అవకాశం కల్పించాలని విజ్ఞప్తి చేసారు.

22. శ్రీమతి విజయ, అగనంపూడి, ప్రతిపాదిత విస్తరణను స్వాగతిస్తూ, ఉక్కు యాజమాన్యమువారు పారిశ్రామిక సామాజిక బాధ్యతలో భాగంగా కేటాయించే నిధులతో పరిసర ప్రాంతాలలో స్త్రీలకు వృత్తినైపుణ్య శిక్షణాశిబిరాలను నెలకొల్పి, పలు అభివృద్ధి కార్యక్రమాలు నిర్వహిస్తున్నారని, నిధుల కేటాయింపు శాతాన్ని పెంచి మరిన్ని ఉపాధి అవకాశ పథకాలను అభివృద్ధి చేయ్యాలని అన్నారు.

23. శ్రీ లక్ష్మణ, శ్రీ నగర్ అఫీషియల్ కాలనీ, ప్రతిపాదిత విస్తరణను స్వాగతిస్తూ, హరితహారాన్ని మరింతగా అభివృద్ధిచెయ్యాలని అభిప్రాయపడ్డారు. పరిసర గ్రామాలలో పారిశ్రామిక సామాజిక బాధ్యత ద్వారా చేపట్టే కార్యక్రమాలు సక్రమంగా జరిగేలా చర్యలు తీసుకొని, గ్రామస్థులకు సామాజిక జీవన స్థితి పెరిగేలా సహకరించాలని, పారిశ్రామిక సామాజిక బాధ్యత ద్వారా చేపట్టే కార్యక్రమాలలో స్థానిక యువకులకు అవకాశం కల్పించాలని విజ్ఞప్తి చేసారు.

24. శ్రీ మంత్రి రాజశేఖర్, వడ్లపూడి, ప్రతిపాదిత విస్తరణను స్వాగతిస్తూ, పరిసర యారాడ, గాజువాక మరియు గంగవరం ప్రాంతాలలో కాలుష్యం పెరుగుతోందని, టౌన్‌షిప్ మాదిరిగా ఆయా ప్రాంతాలలో కూడా హరితహారాన్ని అభివృద్ధి చేసి కాలుష్య తీవ్రతను నియంత్రించాలని అన్నారు. విశాఖపట్నం స్టీల్ ప్లాంట్, గంగవరం పోర్టు మరియు స్థానికులు తమ అవసరాలకు ఒకే రోడ్డును వాడటం వలన, ధ్వని, వాహన కాలుష్యం పెరిగి, నిరంతర ట్రాఫిక్ సమస్యలు పెరిగి సామాజిక సమస్యగా మారిందని అన్నారు. ఔషధ పరిశ్రమల వ్యర్థాలు, ఇతర పరిశ్రమల వ్యర్థాల కలయిక వలన మేఘాద్రి రిజర్వాయరు లోని నీరు కలుషితమవుతున్నదని దానిని అరికట్టవలసిన అవసరం వుందని అన్నారు. స్టీల్ ప్లాంట్ ప్రారంభదశలో ఇచ్చిన హామీలను నెరవేర్చి, విస్తరణానంతర ఉద్యోగ కల్పనలో నిర్వాసితులకు ప్రాధాన్యత ఇచ్చి న్యాయం చెయ్యాలని, ఉక్కు నిర్వాసితులకు ఏకమొత్త పరిహారం కల్పించే విధంగా చర్యలు తీసుకోవాలని అన్నారు.

25. శ్రీ ఎమ్. దత్తాత్రేయ, వడ్లపూడి, ప్రతిపాదిత విస్తరణను స్వాగతిస్తూ, ఎన్.టి.పి.సి కార్యకలాపాల వల్ల విడుదలయ్యే బూడిద ఎగిరి పరిసర గ్రామాలలోనూ మరియు విశాఖపట్నం స్టీల్ ప్లాంట్ టౌన్ షిప్ ప్రాంతాలలోనూ వ్యాపిస్తున్నదని అంటూ విస్తరణానంతర ఉద్యోగ కల్పనలో నిర్వాసితులకు ప్రాధాన్యత ఇచ్చి న్యాయం చెయ్యాలని అన్నారు.

26. శ్రీ మొక్కల రాజు, ప్రతిపాదిత విస్తరణను స్వాగతిస్తూ, కాలుష్య నియంత్రణకై విశాఖపట్నం స్టీల్ ప్లాంట్ టౌన్‌షిప్ ప్రాంతంలో మాదిరిగా పరిసర ప్రాంతాలలో కూడా హరితహారాన్ని మరింతగా అభివృద్ధి చెయ్యాలని అన్నారు

ప్రజల అభిప్రాయాలు, సందేహాలు, సలహాలు, సూచనల అనంతరం, పర్యావరణ ఇంజనీరు వారు మాట్లాడుతూ సభ్యులు లేవనెత్తిన అంశాలపై వివరణ ఇవ్వవలసినదిగా రాష్ట్రీయ ఇస్పాత్ నిగమ్ లిమిటెడ్ (విశాఖపట్నం స్టీల్ ప్లాంట్) ప్రతినిధులకు విజ్ఞప్తి చేసారు.

పర్యావరణ ఇంజనీరు వారి సూచన మేరకు శ్రీ పి.వి. రావు, జనరల్ మేనేజర్, రాష్ట్రీయ ఇస్పాత్ నిగమ్ లిమిటెడ్ (విశాఖపట్నం స్టీల్ ప్లాంట్) వారు క్రింది వివరణ ఇచ్చారు:

1. ప్రతిపాదిత విస్తరణ అనంతరం మంజూరు అయిన సంఖ్యను బట్టి ఉద్యోగాల కల్పన ఆధారపడి వుంటుందని అన్నారు.
2. పరిశ్రమ స్థాపన సమయములో భూసేకరణానంతరం ఇచ్చిన 16000 ఆర్ కార్డ్ లలో, 5000 ఆర్ కార్డ్ పొందిన వారితో ఒప్పందాలు జరిగినవి మరియు 6300 ఆర్ కార్డ్ పొందిన వారికి ఉద్యోగాల కల్పన కూడా జరిగినది చెప్పారు.
3. ఉద్యోగ కల్పన విషయంలో వివరణ ఇస్తూ, పత్రికా ప్రకటన ద్వారా తెలియపరచి కేవలము ఆర్ కార్డ్ పొందినవారికే కాకుండా అర్హత వున్నవారందరికీ సమాన అవకాశాలు కల్పించాలని గౌరవ సుప్రీమ్ కోర్టువారు సం. 1998 లో ఉత్తర్వులు ఇచ్చియున్నారని తెలియ పరచారు.

శ్రీ గాంధీ, పారిశ్రామిక సామాజిక బాధ్యత విభాగం, రాష్ట్రీయ ఇస్పాత్ నిగమ్ లిమిటెడ్ (విశాఖపట్నం స్టీల్ ప్లాంట్) వారు మాట్లాడుతూ, గత రెండు (2) సంవత్సరాలుగా పరిశ్రమ నష్టాలలో వున్నందువలన పారిశ్రామిక సామాజిక బాధ్యతగా కేటాయించే నిధుల శాతం కొంతమేరకు తగ్గినప్పటికీ పరిశ్రమ యాజమాన్యము వారు పరిసర ప్రాంతాలలో నైపుణ్య పెంపు శిక్షణ శిబిరాల నిర్వహణ, నీటి సరఫరా సదుపాయాలు, అమలు చేసారని అంటూ, హుద్‌హుద్ తుఫాను సమయములో, చేపలపాలెం గ్రామములో దెబ్బతిన్న సామాజిక నీటి ట్యాంకు ను వెంటనే పునరుద్ధరిస్తామని తెలిపారు.

అనంతరం పర్యావరణ ఇంజనీరు వారు ప్రజాభిప్రాయ సేకరణ కార్యక్రమాలను ముగించవలసినదిగా అధ్యక్షులవారైన కలెక్టర్ మరియు జిల్లా మెజిస్ట్రేట్ వారిని కోరడమైనది.

సభా వేదిక వద్ద ప్రతిపాదిత ప్రాజెక్టునకు సంబంధించి 13 వ్రాతపూర్వక వినతి పత్రములు అందినవి. మరియు అవి అన్నియూ ప్రతిపాదనకు అనుకూలంగానూ వచ్చినవి.

పర్యావరణ ప్రజాభిప్రాయ సేకరణ సదస్సు అధ్యక్షులు అయిన కలెక్టర్ మరియు జిల్లా మెజిస్ట్రేట్, గారు మాట్లాడుతూ కొన్ని అంశాలపై క్రింది వివరణలను ఇచ్చారు.

i. ప్రతిపాదిత ప్రాజెక్ట్ యజమానులు, ప్రాజెక్ట్ కు సంబంధించిన సాంకేతిక విషయములను, పరిసర వాతావరణంపై ప్రభావాన్ని వివరించారు.

II అందరి అభిప్రాయాలు, సలహాలు, సూచనలు నమోదు చేయబడ్డాయి. వాటిని క్రోడీకరించి యథాతథంగా కేంద్ర పర్యావరణ, అడవులు మరియు వాతావరణ మార్పులు మంత్రిత్వ శాఖ, భారత ప్రభుత్వం వారి పంపించటం జరుగుతుంది.

III. చాలామంది ఆర్ కార్డుల కొరకు, నిర్వాసితులకు ఉద్యోగ, ఉపాధి కల్పన, పరిహారం, మత్స్యకారుల ఇబ్బందులు, మరియు ఇతర స్థానిక ఇబ్బందులను తెలియచేసారు. పర్యావరణ సంబంధిత విషయాలు మినహా, ఇతర అంశాలపై ప్రత్యేకంగా వేరే వేదికపై చర్చించి చర్యలు తీసుకోబడతాయి.

IV కేంద్ర పర్యావరణ, అడవులు మరియు వాతావరణ మార్పులు మంత్రిత్వ శాఖ, భారత ప్రభుత్వం వారి నిపుణుల కమిటీ, ప్రతిపాదిత ప్రాజక్టువారి సమగ్ర ప్రాజక్ట్ నివేదిక (డి.పి.ఆర్) వివరాలను నిశితంగా పరిశీలించి, నీటి లభ్యత, వినియోగము, వ్యర్థజలముల, ఘన వ్యర్థముల సంగ్రహణ, వినియోగము, తగ్గింపు, శబ్ద, గాలి కాలుష్యము మొదలైన వాటిపై సాంకేతికంగా పరిశీలించి, ప్రజాభిప్రాయ సేకరణలో ప్రజల అభిప్రాయాలను కూడా పరిగణనలోనికి తీసుకొని ఒక అవగాహనకు వచ్చి ప్రతిపాదిత ప్రాజక్టుకు అనుమతులు ఇవ్వాలా వద్దా అనే నిర్ణయం తీసుకుంటారని వివరిస్తూ ఈ సదస్సు ఇంతటితో ముగిసిందని ప్రకటించడమైనది.

కలెక్టర్ మరియు జిల్లా మెజిస్ట్రేట్,
4/8 విశాఖపట్నం

పర్యావరణ ఇంజనీర్,
ఆంధ్రప్రదేశ్ కాలుష్య నియంత్రణ మండలి,
ప్రాంతీయ కార్యాలయం, విశాఖపట్నం

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Sl.No.	Name of the person	Place	Signature
1	[illegible]	[illegible]	[illegible]
2	M. SAI RAM	[illegible]	[illegible]
3.	U. SRINIVAS	Madhuvada	[illegible]
4.	K. pavan	Aganampudi	[illegible]
5.	N.J.G. APPARAO	Kurmannapalem	[illegible]
6.	M. RAMARAO	Kurmannapalem	[illegible]
7	Sk. yasin	Kurmannapalem	[illegible]
8	A. Govindarao	Rajeevnagar	[illegible]
9	P. Sivaramakrishna	R.P. Peta	[illegible]
10	E.V. [illegible]	Tunganapuvalasa	[illegible]
11	M. [illegible] kumar	Pedagantyada	[illegible]
12	P. Srinivas	Pedagantyada	[illegible]
13	D. Appala naidu	Ukkunagaram	[illegible]
14	SHIVA KUMAR.M	SRI NAGAR	[illegible]
15	V. [illegible]	Ukku Nagaram	[illegible]

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Sl.No.	Name of the person	Place	Signature
31	R. URMILA DEVI	Duvvada-II	R. Urmila devi
32	K. Somaratnam	Samathanagar	K. Somaratnam
33	P.V. Ramana murthy	Tina Colony	[illegible]
34	KARTHIK VARMA D	Ukkunagaram	[illegible]
35	K. Brijendra Nath	Vizag, Gopalapatnam	K. [illegible]
36	I. APPALA RAJU	Agamanpudi colony RHC-1	I Appala Raju
37	K. SAI RAO	SECTOR-5 UKKUNAGARAM	K. [illegible]
38	M.S. Srinivasa Rao	SMS Dept. Steel Plant	M.S. Rao
39	RAJANA GIRISH	Anakapalli	[illegible]
40	K. DHARMA RAO	VIZAG, Reddy Kancharapalem	[illegible]
41	D. [illegible]	PEDANADUPURU	[illegible]
42	S. Koteswara Rao	Balacheruvu	[illegible]
43	V. Shyam	Simhachalam, VSP	V. Shyam
44	M. Srinivasulu	Shalanagar, VSP	[illegible]
45	P. APPALAREDDY	P. Appala Reddy (Dmd)	[illegible]

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Sl.No.	Name of the person	Place	Signature
46	B. YELLAJI RAO	VADLAPUDI	[illegible]
47	P. JAYA RAJU	-do-	[illegible]
48	U. Ramakrishna	-do-	U. Ramakrishna
49	Y. Nageswara Rao	Gajuwaka	[illegible]
50	G. K. KUMAR	Agamampudi	[illegible]
51	R. Satyanarayana	Appikonda	[illegible]
52	V. RAMESH	UKKUNAGARAM	V Ramesh
53	T. RAMESH	UKKUNAGARAM	[illegible]
54	S. Bhushan Rao	UKKUNAGARAM	S. Bhushan Rao
55	G. Sasibhushana Rao	UKKUNAGARAM	G. Sasi
56	Rajesh Kumar. N	Ukkunagaram	[illegible]
57	D. Simhachalam	UKKUNAGARAM	D. Simhachalam
58	U. Rama Swamy		[illegible]

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Sl.No.	Name of the person	Place	Signature
46	B. YELLAJI RAO	VADLAPUDI	[illegible]
47	P. JAYA RAJU	— do —	[illegible]
48	U. Ramakrishna	— do —	[illegible]
49	Y. Nageswara Rao	Gajuwaka	[illegible]
50	G. K. KUMAR	Aganampudi	[illegible]
51	R. Satyanarayana	Appikonda	[illegible]
52	V. RAMESH	UKKUNAGARAM	[illegible]
53	T. RAMESH	UKKUNAGARAM	[illegible]
54	S. Bhushan Rao	UKKUNAGARAM	[illegible]
55	G. Sasibhushana Rao	UKKUNAGARAM	[illegible]
56	Rajesh Kumar. N	Ukkunagaram	[illegible]
57	D. Simhachalam	UKKUNAGARAM	[illegible]
58	U. [illegible]		[illegible]

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Sl.No.	Name of the person	Place	Signature
59	R. Srikanth	Anakapalli	[illegible]
60	K. Siva Ganesh Kumar	Pedagantyada	[illegible]
61	D. MURALI	Visakhapatnam	[illegible]
62	P. Lakshmi [illegible]	Poorna Market	[illegible]
63	P. Bhaskar [illegible]	Anakapalli	[illegible]
64	N. Arun Kumar	Lingarajupalem	[illegible]
65	K. Vasantha Kumar	Madhuravada	[illegible]
66	G. [illegible] Kumar	PEDA NARAVA	[illegible]
67	K. [illegible]	Gajuwaka	[illegible]
68	M. RAMSET	ANAKAPALLI	[illegible]
69	Ch. Sai Kumar	GAJUWAKA	[illegible]
70	D Sai Kumar	Gopalapatnam	[illegible]
71	M. Laxman	Kakinada	[illegible]
72	Geddam. Anilkumar	Kurmannapalem near Duvvada.	[illegible]
73	Reji Wilson (To witness proceedings out of academic interest)	Ukkunagaram	Reji Wilson

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Sl.No.	Name of the person	Place	Signature
74	G. Srinivasa Rao	Ukkunagaram	[signature]
75	R. Venu	Kurmannapalem	[signature]
76	D.V.S. Kumar	Vizag	[signature]
77	P. Ramesh	Gajuwaka	[signature]
78	P. LAXMANA	GAJUWAKA (SRINAGAR)	[signature]
79	Y. Dhana Laxmi	Y. Adarsh nagar	[signature]
80	Ajith Kumar T.S.	Ukkunagaram	[signature]
81	P. S. Sukumar	Madhavadhara	[signature]
82	V. Krishna Rao	Vizag	[signature]
83	K. Premkumar	Ukkunagaram	[signature]
84	VVRV Prasada Raju	Kurmannapalem	[signature]
85	P. Srinivasa Reddy	Ukkunagaram	[signature]
86	M. N. REDDY	UKKunagaram	[signature]
87	KALESHABABA	Ukkunagaram	[signature]
88	G. Poornananda Sam	Agnampudi	[signature]

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Sl.No.	Name of the person	Place	Signature
89	KVN PRASADA RAO	UKKUNAGARAM	[signature]
90	N Rajkumar	UKKUNAGARAM	[signature]
91	B. Appa Rao	Ukkunagaram	[signature]
92	YELAMANCHILI RAJESH	Nammivaddi	[signature]
93	G.N. Swamy	UKKUNAGARAM	[signature]
94	V V Gupta	Ukkunagaram	[signature]
95	CH. P. Rao	Kurmannapalem	[signature]
96	P. Rama Lakshmana Rao	Ukkunagaram	[signature]
97	Krishna Kumar	Ukkunagaram	[signature]
98	T V L Narasimham	KANITHI ROAD	[signature]
99	P. Gangadhara Rao	Ukkunagaram	[signature]
100	M. NAGA RAJU	Ukkunagaram	[signature]
101	P. Eswar	Aganampudi	[signature]
102	K. G. [illegible]	"	[signature]
103	Manoranjan Mishra	Maddilapalem	[signature]

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Sl.No.	Name of the person	Place	Signature
104	K. M. Sai Kishore	Kurmannapalem	[signature]
105	P. K. Rath	Steel plant	[signature]
106	S. P. KRISHNAN	AGANAMPUDI	[signature]
107	K. SRINIVASARAO	UKKUNAGARAM	[signature]
108	Verma Sree Ramamurthy	UKKUNAGARAM	[signature]
109	J. SRINIVASU.	SAMIWADA	[signature]
110	K. Sreedevi	Ukkunagaram	[signature]
111	A. Nirmala	Ukkunagaram	[signature]
112	M. VASAVI MRUDULA	Ukkunagaram	[signature]
113	A. Syamala	Aganampudi	[signature]
114	S. Lalitha devi	Aganampudi	[signature]
115	S. GOVINDA RAO	Aganampudi	[signature]
116	P. S. N. MURTHY	Ukkunagaram	[signature]
117	PSVN Gopal (PRESIDENT)	Gangavaram	[signature]
118	[Telugu handwriting]	[Telugu handwriting]	[signature]

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Sl.No.	Name of the person	Place	Signature
119	A V R K Rao	Kurmannapalem	[signature]
120	Abhay Dhurde	Sector 8 Steel plant	[signature]
121	B. SREE HARI	Sector - II Steel plant	[signature]
122	Jagadish RRNV	Gajuwaka	[signature]
123	P. K. Das	Sector-9, Ukkunagaram	[signature]
124	T V S [illegible]	Steel Plant	[signature]
125	K. Mahesh	Gangavaram	[signature]
126	K. Ranga Reddy	Steel plant	[signature]
127	K. Murali Krishna	Steel Plant	[signature]
128	V.V. Murali Krishna.	Steel Plant	[signature]
129	T. Vamsi	Gajuwaka	[signature]
130	G. Somanna	Desapatrunipalem	[signature]
131	N. MISHRA	Steel plant	[signature]
132	T. Rama Krishna	Steel Plant	[signature]
133	K. Sanjeeva Rao	Kurmannapalem Gajuwaka	[signature]

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Sl.No.	Name of the person	Place	Signature
134	V. VIKAS KUMAR	7989832772	Vikas
135	K. Lakshmana Rao	9440662819	[signature]
136	K. Nani Ramakrishna	DAE/VSP 8008270679	[signature]
137	M. MOHAN RAO	Design & Engg. [illegible]	[signature]
138	S. Naidu	9908	[signature]
139	[illegible]	—	[signature]
140	VIKASH KUMAR	Trainee hostel	[signature]
141	K. Dayananda	Food-7	[signature]
142	CHIMMITI AppaRao	T.A	[signature]
143	R Vanama Raju	Sriidrampalem	[signature]
144	HIMANSHU	HOSTEL TRAINEE	[signature]
145	Diponkar Dey	—	[signature]
146	PANKAJ KUMAR	TRAINEE HOSTEL	Pankaj kumar
147	HARENDRA KUMAR	"	[signature]
148	R Naga lakshmi	Sect 81-3	R.N.L.

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Sl.No.	Name of the person	Place	Signature
149	Snigdha Meher	Visakhapatnam 8330930805	[signature]
150	Supriya Sahu	Visakhapatnam 8330930807	[signature]
151	R.K. Sharma	Trainee hostel-3 VSP RINL 8054059085	[signature]
152	SUDHANSHU SHEKHAR NAYAK	VISAKHAPATNAM 9643318197	Sudhanshu
153	ASHISH KUMAR	Trainees Hostel-3 RINL 7033501418	Ashish Kumar
154	VAIBHAV TRIPATHI	Trainees Hostel-3 7980595730	[signature]
155	V. Rama Krishna Rao	9492785700	[signature]
156	[illegible] TNTUC [illegible]	9908022555	[signature]
157	[illegible] TNTUC [illegible]	9492534050	[signature]
158	V.K.R. Sankar	Visakhapatnam 8500667902	[signature]
159	S Narasimha Rao	Visakhapatnam 9908523521	[signature]
160	Rupa Dhar	Visakhapatnam 9031140285	[signature]
161	Praveen M	Srinagar/VSP 8309492605	[signature]
162	Ch. Chandraiah	Muralinagar 9502776745	[signature]

Attendance of the Environmental Public Hearing of

M/s. Rashtriya Ispat Nigam Limited,- Capacity Expansion of Visakhapatnam Steel Plant from 6.3 MMTPA to 7.3 MMTPA by revamping and augmentation of existing facilities at Gajuwaka, Visakhapatnam Dist. on 15.06.2017

Sl.No.	Name of the person	Place	Signature
163	Yellati Srinivasa Rao	Nellimukka Pedagantyada Visakhapatnam	[signature]
164	B Venkata Rao	D.H.P.S Visakhapatnam	[signature]
165	B. N. Kiniyan	Mdc Narasingapuram Vizag	[signature]
166	Kishore Chinna	Ukkunagaram Vizag	[signature]
167	Bhaktavatsalam	Pragathinagar Aganampudi	[signature]

Attendance of the Environmental Public Hearing of

M/s. Rashtriya Ispat Nigam Limited,- Capacity Expansion of Visakhapatnam Steel Plant from 6.3 MMTPA to 7.3 MMTPA by revamping and augmentation of existing facilities at Gajuwaka, Visakhapatnam Dist. on 15.06.2017

Sl.No.	Name of the person	Place	Signature
168	Y. Gurunadha Rao	9490403918	[signature]
169	S. Sammani Chr	7730098887	[signature]
170	D. Sathi Reddy	9703337293	[signature]
171	G. NAGARAJU	9441516841	[signature]
172	N. SRINIVASA RAO	9908760321	[signature]
173	J. NAGESWARARAO	9866164570	J. Nageswara
174	KAMAL BASHA	9701348144	[signature]
175	G. V. RAO	8919873632	[signature]
176	T. Ganesh	7382295893	[signature]
177	V. VIJAYA BHASKAR	9963228585	[signature]
178	CH. ARJUN RAO	9885392396	Ch. Arjun Rao
179	S. Lathadevi	9963778766	S. Latha
180	S. Musalaiah	9704993884	[signature]
181	P. T. V. Swaroop	9985344910	[signature]
182	[illegible]	9963408320	

VISAKHA STEEL EMPLOYEE'S CONGRESS

Regd. No. D-1085/89 Affn. No. 10839/2000

(Affiliated to I.N.T.U.C.)

(Recognised)

To

The Environmental Engineer,

AP PCB,

VISAKHAPATNAM.

Date : 14-6-2017

Respected Sir,

Sub : Public hearing on expansion on Visakhapatnam Steel Plant from 6.3 to 7.3 MTPA

On behalf of Visakha Steel Employees Congress (INTUC), Recognized Union, we appealed that the capacity enhancement of Visakhapatnam Steel Plant frm 6.3 to 7.3 MTPA of liquid steel be agreed upon, since it is perceived that this shall improve the financials of the company, which is important even for the economy of the Government of Andhra Pradesh. And also we felt that capacity enhancement shall lead to more direct and indirect employment at Visakhapatnam. Through this expansion, lot of employment opportunities for local people will be created. All the villages around the plant will be getting boost in income through the investment made by the Visakhapatnam Steel Plant. The nearby Villages / Rehabilitation Colonies shall be developed by utilizing RINL / VSP CSR funds.

Thanking You Sir.

With regards,

Yours Sincerely,

(RAJASEKHAR MANTRI)

General Secretary

Regd. Office Address D.No. 7-55, Nadpur, Pedagantyada, R.H. Colony, Visakhapatnam - 530 044. Ph. No. 0891-2516061, Cell : 9885611679

Union Office Shramik Bhavan, Near C I S.F Barracks, Main Approach Road, Visakhapatnam Steel Plant, Visakhapatnam - 530 031. Mob : 25577, 65901 P&T : 0891-2744988. Fax : 0891 2571734

TELUGUNADU STEEL EMPLOYEES COUNCIL

(Regd. No. D-1912/2002)

Affiliated to TNTUC

VISAKHAPATNAM STEEL PLANT

Ref :

Date : 15.06.2017

To

The District Collector & District Magistrate, Visakhapatnam

Respected Sir,

Sub: Public hearing on Expansion of Visakhapatnam Steel Plant from 6.3 to 7.3 MTPA.

It is appealed that the capacity enhancement of Visakhapatnam Steel Plant from 6.3 to 7.3 MTPA of liquid steel shall be agreed upon, since it is felt that capacity enhancement shall generate more direct and indirect employment to the people of Visakhapatnam and Andhra Pradesh State. Through this expansion, lot of employment opportunities for local people will be created. Local small scale industries will also get benefitted. The surrounding villages shall be developed using RINL-VSP CSR funds.

Thanking you

(Bailreddy Satyanarayana)

Official Spokes Person

Office : Qtr. 85B, Sector-I, Ukkunagaram, Visakhapatnam Steel Plant, Visakhapatnam - 530 032.

Union Office Phone No.: 0891-287660, Cell : 9346295559, 9652000028, 9346193666, 9346436204

Cell : 9866825467

Cell : 98483 95024

HIND MAZDOOR STEEL EMPLOYEES UNION

(Affiliated to **HMS**) (Regd. No. 32/2011)

#14-36-11/2/1, K.L. Rao Nagar, Opp. Saibaba Temple, Dayal Nagar,
B.C. Road, Pedagantyada, Visakhapatnam - 530 044.
VIZAG STEEL PLANT

HMS

Hon'ble President :
Nayani Narasimha Reddy
Home & Labour Minister (T)

President
Dommiti Appa Rao

General Secretary
G. Ganapathi Reddy

Ref. No. _____ *Date:* 15-06-17

To
The District Collector & District Magistrate,
Visakhapatnam

Respected Sir,

Sub: Public hearing on Expansion of Visakhapatnam Steel Plant from 6.3 to 7.3 MTPA.

We have come to know from newspapers that Visakhapatnam Steel Plant is adding to its capacity by carrying out upgradation of the existing facilities and small additions, It is requested that this capacity addition be allowed , since this will result in improving the bottom line of the company. This in turn will encourage the company to spend more funds on CSR activities. It is seen that CSR activities in RINL-VSP are helping it's local communities to a large extent. Hence, more of CSR activities can be expected in the future. The general economy of the small villages will increase due to employment in expansion units .

Thanking you.

(G Ganapathi Reddy)
General Secretary

B.M.S.

[illegible]

To
Environmental Engineer,
AP Pollution Control Board,
Visakhapatnam

Respected Sir,

Sub: Public hearing on Expansion of Visakhapatnam Steel Plant from 6.3 to 7.3 MTPA..

It has come to our notice that Visakhapatnam Steel Plant is expanding its capacity from 6.3 to 7.3 MTPA. We welcome this capacity expansion. Since, during this expansion, it is learnt that about Rs.9000 crores will be spent and in this process number of unskilled workers will be engaged. This is necessary for engaging the large no of unemployed and unskilled workers in and around Visakhapatnam. CSR funds shall be spent for development nearby surrounding villages..

Thanking you.

(S Radha Krishnan)
General Secretary

VISAKHA STEEL EMPLOYEE'S CONGRESS

Regd. No. D-1085/89 Affn. No. 10839/2000

(Affiliated to I.N.T.U.C.)
(Recognised)

To Date : 14-6-2017

The District Collector

&

District Magistrate

VISAKHAPATNAM.

Respected Sir,

Sub : Public hearing on expansion on Visakhapatnam Steel Plant from 6.3 to 7.3 MTPA

On behalf of Visakha Steel Employees Congress (INTUC), Recognized Union, we appealed that the capacity enhancement of Visakhapatnam Steel Plant frm 6.3 to 7.3 MTPA of liquid steel be agreed upon; since it is perceived that this shall improve the financials of the company, which is important even for the economy of the Government of Andhra Pradesh. And also we felt that capacity enhancement shall lead to more direct and indirect employment at Visakhapatnam. Through this expansion, lot of employment opportunities for local people will be created. All the villages around the plant will be getting boost in income through the investment made by the Visakhapatnam Steel Plant. The nearby Villages / Rehabilitation Colonies shall be developed by utilizing RINL / VSP CSR funds.

Thanking You Sir

With regards,

Yours Sincerely,

(RAJASEKHAR MANTRI)
General Secretary

Regd. Office Address : D.No. 7-55, Nadpar, Pedagantyada, R.H. Colony, Visakhapatnam 530 044.
Ph. No. 0891-2516061, Cell : 09866136789

Union Office : Shramik Bhavan, Near C.I.S.F Barracks, Main Approach Road, Visakhapatnam Steel Plant, Visakhapatnam 530 031. Mox : 25577, 86901, P&T : 0891-2744988, Fax : 0891-2571734

Cell : 9866825467 Cell : 9848395024

HIND MAZDOOR STEEL EMPLOYEES UNION

(Affiliated to **HMS**) (Regd. No. 32/2011)

#14-36-11/2/1, K.L. Rao Nagar, Opp. Saibaba Temple, Dayal Nagar, B.C. Road, Pedagantyada, Visakhapatnam - 530 044.
VIZAG STEEL PLANT

HMS

Hon'ble President :	*President :*	*General Secretary*
Nayani Narasimha Reddy	*Dommiti Appa Rao*	*G. Ganapathi Reddy*
Home & Labour Minister (T)		

Ref. No. : *Date :* 15 - 6 - 2017

To
Environmental Engineer,
AP Pollution Control Board,
Visakhapatnam

Respected Sir,

Sub: Public hearing on Expansion of Visakhapatnam Steel Plant from 6.3 to 7.3 MTPA.

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Thanking you.

15/6/17

(G Ganapathi Reddy)
General Secretary

TELUGUNADU STEEL EMPLOYEES COUNCIL

(Regd. No. D-1912/2002)
Affiliated to TNTUC
VISAKHAPATNAM STEEL PLANT

Ref : *Date :* 15.04.2013

To
Environmental Engineer,
AP Pollution Control Board,
Visakhapatnam

Respected Sir,

Sub: Public hearing on Expansion of Visakhapatnam Steel Plant from 6.3 to 7.3 MTPA.

It is appealed that the capacity enhancement of Visakhapatnam Steel Plant from 6.3 to 7.3 MTPA of liquid steel shall be agreed upon, since it is felt that capacity enhancement shall generate more direct and indirect employment to the people of Visakhapatnam and Andhra Pradesh State. Through this expansion, lot of employment opportunities for local people will be created. Local small scale industries will also get benefitted. The surrounding villages shall be developed using RINL-VSP CSR funds.

Thanking you.

(Balireddy Satyanarayana)
Official Spokes Person

Office : Qtr. 85B, Sector-I, Ukkunagaram, Visakhapatnam Steel Plant, Visakhapatnam - 530 032.
Union Office Phone No. : 0891-287660, Cell : 9346295559, 9652000028, 9346193666, 9346436204

B.M.S.
RASHTRIYA ISPAT MAZDOOR SANGH

WORK IS WORSHIP

(Regd. No. 1343/93)
(Affiliated to B.M.S. & ABIM.MS), VISAKHAPATNAM STEEL PLANT

Hon'ble President	General Secretary	President
S. HARISH VARMA	S. RADHA KRISHNAN	KOMMINENI SRINIVASA RAO
Cell : 9440036226	Cell : 9440003097	Cell : 9848481282

To
The District Collector & District Magistrate,
Visakhapatnam

Respected Sir,

Sub: Public hearing on Expansion of Visakhapatnam Steel Plant from 6.3 to 7.3 MTPA.

It has come to our notice that Visakhapattnam Steel Plant is expanding its capacity from 6.3 to 7.3 MTPA. We welcome this capacity expansion. Since, during this expansion, it is learnt that about Rs.9000 crores will be spent and in this process number of unskilled workers will be engaged. This is necessary for engaging the large no of unemployed and unskilled workers in and around Visakhapatnam. CSR funds shall be spent for development nearby surrounding villages.

Thanking you.

(S Radha Krishnan)
General Secretary

Correspondence Address : D.No. 3-1-71/6, F-3, Pavan Sai Residency, Kurmannapalem, Aganampudi (P.O.), Visakhapatnam - 530 053 E-mail : [illegible]@gmail.com

STEEL PLANT EMPLOYEES UNION, VISAKHAPATNAM

(Affiliated to CITU & SWFI)

Sector-2, Ukkunagaram, Visakhapatnam - 530032

Ref. No.

[illegible]

[illegible]

[illegible]

Visakhapatnam Steel Plant 6.3 MT [illegible] 7.3 MT [illegible]

[illegible]

113

Cell : 9908022555

VISAKHA UKKU SRAMIKA SANGAM

Affiliated to TNTUC :: Regd. No. D/1113/90

VISAKHAPATNAM STEEL PLANT, VISAKHAPATNAM (A.P.)

BODDU PAIDIRAJU

VSP 1st AP State Sramasakthi Awardee

General Secretary : TNTUC

To Date : 15-06-17

The Environmental Engineer, AP-PCB, Visakhapatnam [illegible]

[illegible] 6.3-MT [illegible] 7.3 MT [illegible] Rs 10,000/- [illegible]

[illegible] CSR Founds [illegible] plant [illegible] Rs 10,000/- [illegible]

[illegible] CSR Founds [illegible]

Visakhapatnam Steel plant [illegible] Steel plant Employee [illegible] Employees [illegible] CSR Founds [illegible]

"[illegible]"

[illegible]

1. BODDU PAIDI RAJU - General Secretary

2. KATHI MUTYALU - Organizing President

3. GUMMALA NARASIMHARAO - Working President

D.No. 22-42-8, Viyyapuvanipalem, Pedagantyada, RH Colony, Gajuwaka, Visakhapatnam - 530 044 (A.P.)

Cell : 9908022555

Visakha Ukku Sramika Sangham
Affiliated to TNTUC : : Regd No. D/1113/90
Viskhapatnam steel Plant, Visakhapatnam (A.P.)
Boddu Paidiraju
VSP 1st AP State Sramasakthi Awardee
General Secretary : TNTUC

Date ; 15.06.2017

To,
Respected Visakhaptnam District Collector and District Magistrate Visakhapatnam,

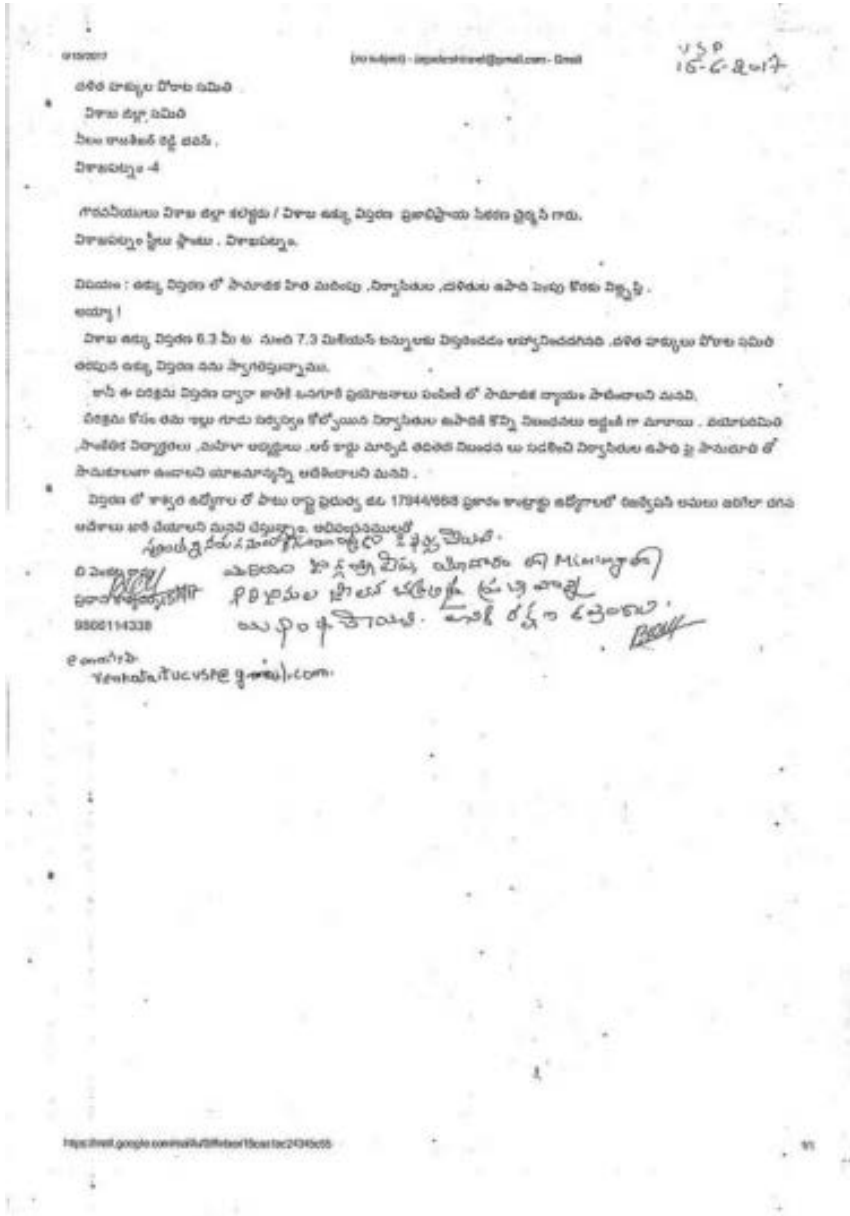
We are welcoming the expansion of Visakhapatnam Steel Plant from 6.3 MTPA to 7.3 MTPA . The amount being invested in this project is Rs. 10,000/- Crores. Due this there will be increased employment to the locals. In the surrounding areas ancillary small scale industries will be developed. So the livelihood of people will increase and the standard of living will also increase. With the help of CSR Funds, do many improvements in the surrounding villages. Due to the Investment of Rs. 10,000/- Crores in the plant expansion there will be many jobs and increased business opportunities to the people. Due to this the per capita income of the locals will increase. With the CSR Funds adopt the local villages and develop them.

Visakhapatnam Steel Plant expansion should provide more employment opportunities. We request you to replace the existing vacancies created due to retired employees and expired employees with the R Project Affected People (PAP) of Visakhapatnam Steel Plant. With the CSR Funds please develop our villages. With this expansion we expect some good will happen to our surrounding villages.

Yours Sincerely

Boddu Paidiraju (General Secretary)
Kathi Muthyalu (Organising President)
Gummala Narasingha Rao (Working President)

D.No. 22-42-8, Viyyapuvanipalem, Pedagantyada, RH Colony, Gajuwaka, Visakhapatnam – 530 044 (A.P)



6/5/2017 (no subject) – jagadeshtravel@gmail.com - Gmail

VSP
15-6-2017

Dalitha Hakkula Porata Samithi
Visakha jilla samithi
Neelam Rajasekhar Reddy Bhavan
Visakhapatnam – 4

Respected District Collector / Visakhapatnam Steel Plant Expansion Public Hearing Chairman,
Visakhapatnam Steel Plant, Visakhapatnam

Subject : Visakhatanam Steel Plant Expansion Summary of social Welfare, Request for increasing employment for Dalith's and Project Affected People (PAP).

Sir!

Welcoming the Expansion of Visakhapatnam Steel Plant from 6.3 MTPA to 7.3 MTPA by Dalitha Hakkula Porata Samithi.

This industry expansion which leads to national benefit must be distributed with social justice to all. Project Affected People (PAP) who lost everything for this industry are facing problems due to some rules like age, technical education, gender, R Card Transfer, etc. Please facilitate and help the Project Affected People (PAP) to get employment and also direct the management of Visakhapatnam Steel plant to be kind hearted in this regard.

In this expansion, provide permanent employment and as per State Government GO 17944/6618, reservation is to be provided in Contract Employment also. The same is to be conveyed to the Management of VSP.

Iron Ore Mines should be allotted. Need Based assessment should be conducted for the protection of the Schedule tribes living near Jaggayapeta and Yadharam Mines.

B Venkata Rao
Principal Secretary
9866114338
Email id: venkataitucusp@gmail.com

Cell : 9908022555

VISAKHA UKKU CONTRACT LABOUR UNION

Affiliated to TNTUC :: Regd. No. D/1664/97
VISAKHAPATNAM STEEL PLANT, VISAKHAPATNAM (A.P.)

BODDU PAIDIRAJU
VSP 1st AP State Sramasakthi Awardee
President :: TNTUC

DATE: 15.06.2017.

[illegible]

BODDU · SIVA RAJESH · PRESIDENT
CH · SOMESH VICE president
B · BANGU NAIDU · ORGANIZING secretary
R · V · S · S · RAJU · office Bearer
H · [illegible] office Bearer
V · NARASIMHA[illegible] office Bearer

D.No. 22-42-8, Viyyapuvanipalem, Pedagantyada, RH Colony, Gajuwaka, Visakhapatnam - 530 044 (A.P.)

Cell : 9908022555

Visakha Ukku Contract Labour Union
Affiliated to TNTUC : : Regd No. D/1664/97
Viskhapatnam Steel Plant, Visakhapatnam (A.P.)
Boddu Paidiraju
VSP 1st AP State Sramasakthi Awardee
General Secretary : TNTUC

Date ; 15.06.2017

To,

Respected District Collector and District Magistrate, Visakhapatnam.

Sir,

We are welcoming the expansion of Visakhapatnam Steel Plant from 6.3 MTPA to 7.3 MTPA . The amount being invested in this project is Rs. 10,000/- Crores. Due this there will be increased employment to the locals. In the surrounding areas ancillary small scale industries will be developed. So the livelihood of people will increase and the standard of living will also increase. With the help of CSR Funds, do many improvements in the surrounding villages. Due to the Investment of Rs. 10,000/- Crores in the plant expansion there will be many jobs and increased business opportunities to the people. Due to this the per capita income of the locals will increase. With the CSR Funds adopt the local villages and develop them.

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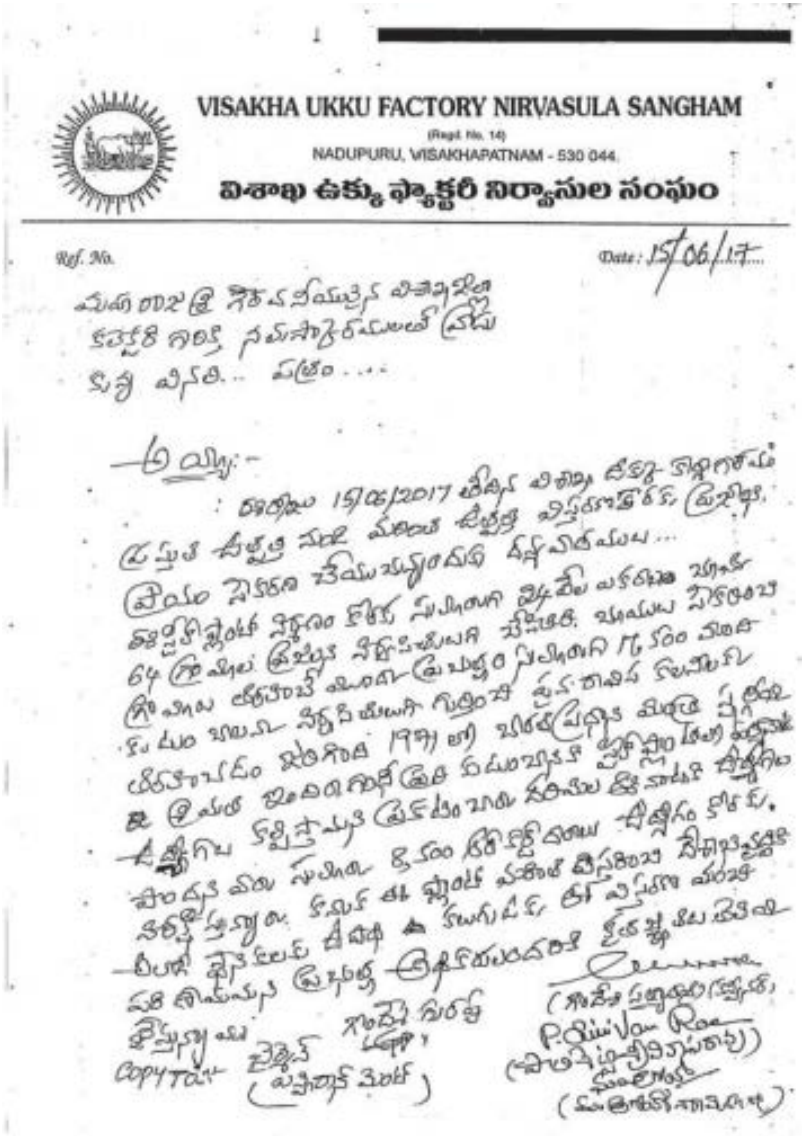
Thanking You,

Yours Sincerely

Boddu Siva Rajesh (President)
CH Somulu (Vice President)
B Gangu Naidu (Organising Secretary)
RVSS Raju (Office Bearer)
M Pyda Rao (Office Bearer)
V Narsimha (Office Bearer)

D.No. 22-42-8, Viyyapuvanipalem, Pedagantyada, RH Colony, Gajuwaka, Visakhapatnam – 530 044 (A.P)



VISAKHA UKKU FACTORY NIRVASULA SANGHAM
(Regd. No. 14)
NADUPURU, VISAKHAPATNAM - 530 044.
విశాఖ ఉక్కు ఫ్యాక్టరీ నిర్వాసుల సంఘం

Ref. No.

Date: 15/06/17

Visakha Ukku Factory Nirvasula Sangham
(Regd No.14)
Nadupuru, Visakhapatnam-530044
Visakha Ukku Factory Nirvasula Sangham

Ref No.

Date: 15/06/2017

Honourable Visakhapatnam District Collector,
Our humble request are…….

Sir

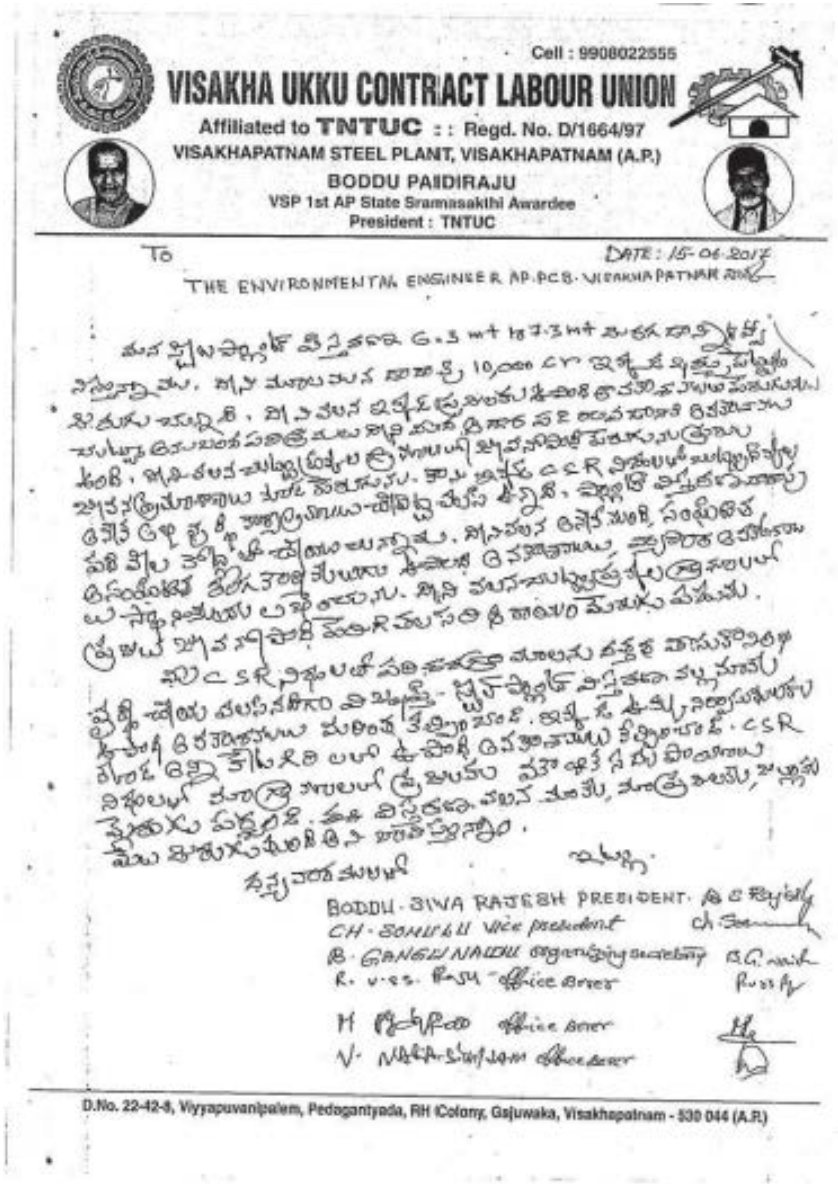
On this day we thank you for conducting the public hearing for the proposed expansion of Visakhapatnam Steel Plant.

For the construction of this Visakhapatnam Steel Plant 24000Acres of land from 64 villages has been taken and are resettled.

During R&R approximately 17500 families were sent to resettlement colonies. In 1971 then prime Minister Smt. Indira Gandhi promised to give permanent jobs to all Project Affected People (PAP) in Visakhapatnam Steel Plant, but even now 8500 R-card holders are still waiting for employment. So the plant should further expand and help in development of country by providing employment to Locals. This expansion is a positive sign. I thank all the government officials .

Gondesi Surya Rao (Convenor)
P Srinivasa Rao
M Narayana Rao
Gondesi Gurappa

Copy to : Chairman (Environment)



Cell : 9908022555

VISAKHA UKKU CONTRACT LABOUR UNION

Affiliated to TNTUC :: Regd. No. D/1664/97

VISAKHAPATNAM STEEL PLANT, VISAKHAPATNAM (A.P.)

BODDU PAIDIRAJU

VSP 1st AP State Sramasakthi Awardee

President : TNTUC

To

DATE : 15-06-2017

THE ENVIRONMENTAL ENGINEER AP.PCB. VISAKHAPATNAM

BODDU. SIVA RAJESH PRESIDENT.

CH. SOMIRAJU Vice president

B. GANGU NAIDU organising secretary

R. V.S.S. RAJU Office Bearer

H Office Bearer

V. Office Bearer

D.No. 22-42-8, Vijayapuvanipalem, Pedagantyada, RH Colony, Gajuwaka, Visakhapatnam - 530 044 (A.P.)

Cell : 9908022555
Visakha Ukku Contract Labour Union
Affiliated to TNTUC : : Regd No. D/1664/97
Viskhapatnam Steel Plant, Visakhapatnam (A.P.)
Boddu Paidiraju
VSP 1st AP State Sramasakthi Awardee
General Secretary : TNTUC

Date ; 15.06.2017

To,

The Environment Engineer APPCB, Visakhapatnam.

Sir,

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Yours Sincerely

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B Gangu Naidu (Organising Secretary)
RVSS Raju (Office Bearer)
M Pyda Rao (Office Bearer)
V Narsimha (Office Bearer)

D.No. 22-42-8, Viyyapuvanipalem, Pedagantyada, RH Colony, Gajuwaka, Visakhapatnam – 530 044 (A.P)

పోరాడుదాం! సాధించుకుందాం!!

ఉక్కు నిర్వాసిత నిరుద్యోగ సంక్షేమ సంఘం

అధ్యక్షులు :
కార్యదర్శి :
రిజిష్టర్ నెం: 1518/2003
☎ 2581496
Ph. No: 9866325622

ఆర్.ఐ.డి.యు ఆఫీసు, సెక్టార్-2, ఉక్కునగరం, విశాఖపట్నం - 530 032.

Ref: ....
Date: 15/06/2017

గౌరవనీయులైన,
జిల్లా కలెక్టర్ గారికి,
విశాఖపట్నం -44.

విషయము: స్టీల్‌ప్లాంట్ నిర్వాసితులకు, ఉపాధి కల్పించాలని, డూప్లికేట్ ఆర్‌కార్డులను బదిలీ సమస్యను పరిష్కారం చేయాలని

అయ్యా!

స్టీల్ ప్లాంట్ నిర్మాణం కోసం సర్వంత్యాగం చేసిన ఇళ్ళు, భూములు కోల్పోయిన నిర్వాసితులకు ఉద్యోగాలు ఇస్తామని కేంద్ర ప్రభుత్వం హామీ ఇచ్చింది. అందుకు అనుగుణంగా 16,500 మందికి ఆర్‌కార్డులు ఇచ్చారు. సుమారు 35 సంవత్సరాలు గడిచినప్పటికీ 6,300 మంది మాత్రమే శాశ్వత ఉపాధి కల్పించారు. మిగిలిన వారికి ఉపాధి కల్పించలేదు. తక్షణమే ఉపాధి కల్పించాలి.

2007లో విడుదలైన జీవో నెం. 35 ప్రకారం తమ ఆర్‌కార్డులను తమ వారసులకు బదిలీ చేసుకునేందుకు దరఖాస్తు చేసుకోగా అందులో 13,80 ఆర్‌కార్డులు డూప్లికేట్ పేరుతో పక్కన పెట్టారు. ఇందులో 104 మంది నిర్వాసితుల ఆర్‌కార్డును [illegible] ఆర్‌కార్డు తమ వారసులకు బదిలీ చేయమని ప్రకటించింది. కాని అధికారులు ఇంతవరకు అమలు చేయలేదు. కావున ఈ సమస్యను పరిష్కారం చేసి నిర్వాసితులకు న్యాయం చేస్తారని కోరుతున్నాము.

ఇట్లు,
K. Mallesh

Ukku Nirvasithula Nirudhyoga Sankshema Sangham
Registration No: 1512/2003
Phone No : 9666325622, 2581496
CITU Office, Sector-2, Ukkunagaram, Visakhapatnam – 530032

Ref:

15/06/2017

Respected,
District Collector,
Visakhapatnam – 44

Subject : Employment for Visakhapatnam Steel Plant Project Affected People (PAP), Doubtful R-Card Holders issue to be resolved.

For the construction of steel plant people had lost all their belongings like house, land etc. The Congress Government promised to give employment for the Project Affected People (PAP). In accordance with that 16550 R-Cards were issued. In the past 35 years 6700 people were given permanent employment rest are not provided with any jobs. So these people are to be given immediate employment.

As per the GO No: 37 given in the year 2007, The R-Cards can be transferred to their descendants. On applying for the same 1380 R-Cards were considered as Doubtful and were kept aside. In this 104 R-Card holders approached the High Court and got the Judgment that their R-Cards must be transferred on the names of their descendants but the officers of Visakhapatnam Steel Plant are not obeying this. So please resolve this problem and do justice to the Project Affected People (PAP) of Visakhapatnam Steel Plant.

Yours

K. Malesh

ఆంధ్రప్రదేశ్ మత్స్యకారులు, మత్స్యకార్మిక సంఘం
(గ్రేటర్ విశాఖ నగర కమిటీ (రి.నెం : 722/03)
అడ్రస్ : 26-6-8, యల్లమ్మతోట, జగదాంబ, విశాఖ-20, ఫోన్ నెం : 9666325622

తేది : 15-06-2017

గౌరవనీయులైన జిల్లా కలెక్టర్ గారికి,
విశాఖపట్నం.
ఆర్యా!

విషయం : అప్పికొండ గ్రామస్థులకి ఉక్కు నిర్వాసితులుగా గుర్తించాలి.
వారి జీవనోపాధిని కాపాడాలి.

స్టీల్‌ప్లాంట్ నుండి వెలువడే వ్యర్థ పదార్థాలు మరియు విషపు జలాలను బయటకు వదలడానికి స్టీల్‌ప్లాంట్ యాజమాన్యం వారు స్టీల్‌ప్లాంట్ నుండి అప్పికొండ సముద్రంలోనికి కాలువ నిర్మించారు. కాలువ ద్వారా స్టీల్‌ప్లాంట్ నుండి వచ్చిన విషపు జలాలను సముద్రంలోనికి విడిచి పెట్టడం ద్వారా సముద్రపు నీళ్ళు విషపు నీళ్లుగా మారడం వలన చేపలు చనిపోతున్నాయి. ఈ విషపు ప్రభావం 3, 4 నెలలు సముద్రపు నీళ్లలో ఉండటం వలన అప్పికొండ గ్రామస్థులు చేపల వేటకు వెళ్లకుండా తమ వృత్తిని కోల్పోతున్నారు. దాంతో వారి యొక్క కుటుంబాలు జీవనం అగమ్యగోచరంగా మారింది.

స్టీల్‌ప్లాంట్ నుండి వచ్చే విషపుజలాలు వల్ల అప్పికొండ గ్రామంలో ఉండే భూగర్భ జలాలు కాలుష్యం అవుతున్నాయి. స్టీల్‌ప్లాంట్ నుండి బూడిద (యాష్) కూడా ఎక్కువగా గ్రామాల్లోకి రావడం వలన అనారోగ్యాలకు గురవుతున్నారు.

జీవనోపాధి కోల్పోయి అనారోగ్యాలకు గురవుతున్న అప్పికొండ గ్రామంను సురక్షిత ప్రాంతానికి తరలించి, గ్రామస్థులను నిర్వాసితులుగా గుర్తించి తగిన చర్యలు తీసుకోవాలని కోరుచున్నాము.

ఇట్లు
భవదీయుడు
K. Malesh
(కె.మహేష్)
కార్యదర్శి

Andhra Pradesh Mathsyakarulu, Mathsyakarmika Sangham
Greater Visakha Nagara Comitee (Registration No : 722/03)
Address : 28-6-8, Yellamma Thota, Jagadhamba, Visakha -20 Phone No: 9666325622

Date: 15-06-2017

Respected District Collector,
Visakhapatnam.

Sir

Subject : Appikonda villagers to be considered as Project Affected People (PAP) of Visakhapatnam Steel Plant and to provide livelihood.

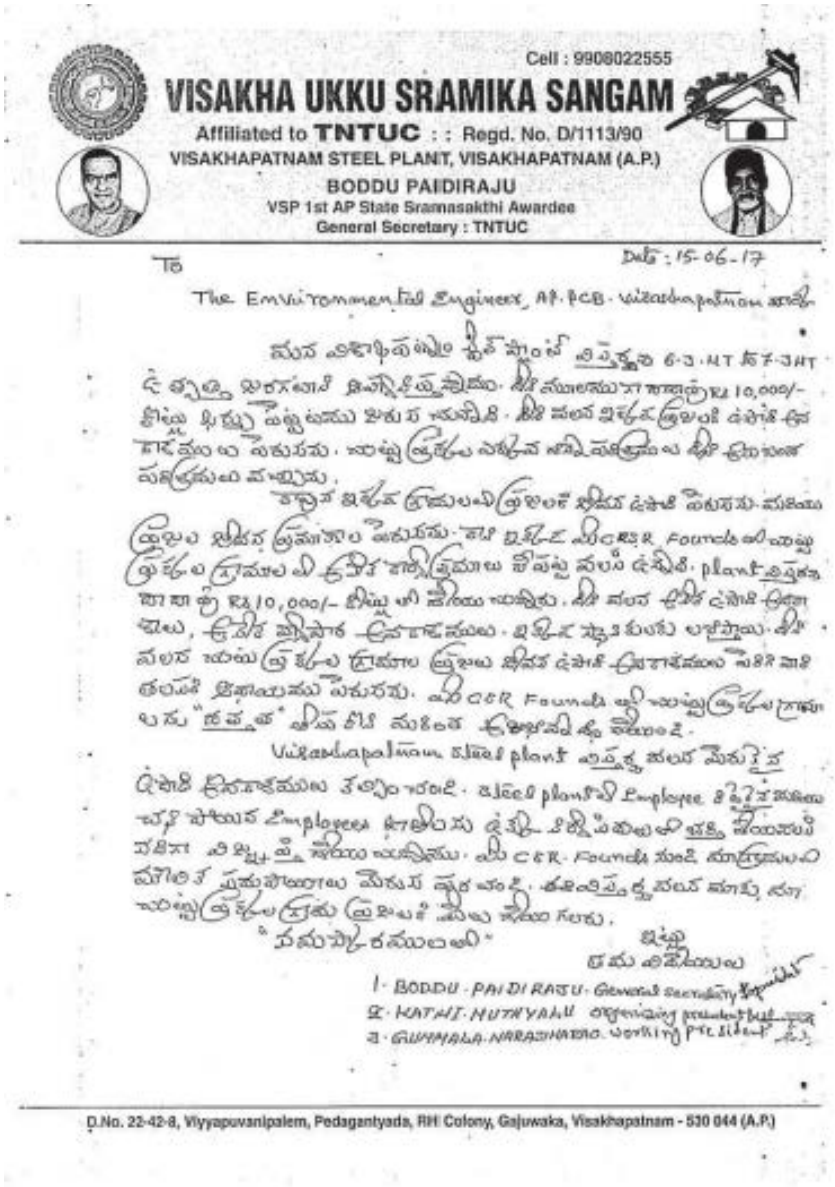
The solid waste and toxic waters of steel plant are released into the sea with the help of a drain constructed by Visakhapatnam steel plant near Appikonda. Due to the release of these toxic waters the marine water is polluting thus leading to the increased mortality of fish. As this water remains for 3-4 months the villagers of Appikonda are unable to go into the sea for catching fish thus losing their livelihood. There is no clarity on the livelihood opportunities of the villagers.

The toxic waters released from steel plant is polluting the ground water of Appikonda village. The ash released from steel plant is dispersed in the village thus causing ill health to the villagers.

As the villagers are losing livelihood and suffering from ill health, so this village is to be resettled to other location and the villagers are to be considered as Project Affected People (PAP) of Visakhapatnam Steel Plant.

Yours Sincerely

K. Mahesh (Secretary)
S Musalayya (Town Committee Member)



Cell : 9908022555

Visakha Ukku Sramika Sangham
Affiliated to TNTUC : : Regd No. D/1113/90
Viskhapatnam steel Plant, Visakhapatnam (A.P.)
Boddu Paidiraju
VSP 1st AP State Sramasakthi Awardee
General Secretary : TNTUC

Date ; 15.06.2017

To,
The Environment Engineer APPCB, Visakhapatnam.

We are welcoming the expansion of Visakhapatnam Steel Plant from 6.3 MTPA to 7.3 MTPA . The amount being invested in this project is Rs. 10,000/- Crores. Due this there will be increased employment to the locals. In the surrounding areas ancillary small scale industries will be developed. So the livelihood of people will increase and the standard of living will also increase. With the help of CSR Funds, do many improvements in the surrounding villages. Due to the Investment of Rs. 10,000/- Crores in the plant expansion there will be many jobs and increased business opportunities to the people. Due to this the per capita income of the locals will increase. With the CSR Funds adopt the local villages and develop them.

Visakhapatnam Steel Plant expansion should provide more employment opportunities. We request you to replace the existing vacancies created due to retired employees and expired employees with the R Project Affected People (PAP) of Visakhapatnam Steel Plant. With the CSR Funds please develop our villages. With this expansion we expect some good will happen to our surrounding villages.

Yours Sincerely

Boddu Paidiraju (General Secretary)
Kathi Muthyalu (Organising President)
Gummala Narasingha Rao (Working President)

D.No. 22-42-8, Viyyapuvanipalem, Pedagantyada, RH Colony, Gajuwaka, Visakhapatnam – 530 044 (A.P)

భారత ప్రజాతంత్ర యువజన సమాఖ్య (డి.వై.ఎఫ్.ఐ)
గ్రేటర్ విశాఖ నగర కమిటీ
అడ్రస్ : 38-31-3/1, దుర్గానగర్ జంక్షన్, కంచరపాలెం, విశాఖ-8, ఫోన్ నెం : 9490098796

తేది : 15-06-2017

ఆంధ్రప్రదేశ్ మత్స్యకారులు, మత్స్యకార్మిక సంఘం
గ్రేటర్ విశాఖ నగర కమిటీ (రి.నెం : 722/03)
అడ్రస్ : 28-6-8, యల్లమ్మతోట, జగదాంబ, విశాఖ-20, ఫోన్ నెం : 9000325622

తేది : 15-06-2017

గౌరవనీయులైన జిల్లా కలెక్టర్ గారికి,
విశాఖపట్నం.
అయ్యా,

విషయం : అప్పికొండ గ్రామస్థులకి [illegible] నిర్వాసితులుగా గుర్తించాలి,
వారి జీవనోపాధిని కాపాడాలి.

స్టీల్‌ప్లాంట్ నుండి వెలువడే వ్యర్థ పదార్థాలు మరియు విషపు జలాలను బయటకు వదలడానికి స్టీల్‌ప్లాంట్ యాజమాన్యం వారు స్టీల్‌ప్లాంట్ నుండి అప్పికొండ సముద్రంలోనికి కాలువ నిర్మించారు. కాలువ ద్వారా స్టీల్‌ప్లాంట్ నుండి వచ్చిన విషపు జలాలను సముద్రంలోనికి విడిచి పెట్టడం ద్వారా సముద్రపు నీళ్లు విషపు నీళ్లుగా మారడం వలన చేపలు చనిపోతున్నాయి. ఈ విషపు ప్రభావం 3, 4 నెలలు సముద్రపు నీళ్లలో ఉండటం వలన అప్పికొండ గ్రామస్థులు చేపలు వేటకు వెళ్లకుండా తమ వృత్తిని కోల్పోతున్నారు. దాంతో వారి యొక్క కుటుంబాలు జీవనం అగమ్యగోచరంగా మారింది.

స్టీల్‌ప్లాంట్ నుండి వచ్చే విషపు జలాలు వల్ల అప్పికొండ గ్రామంలో ఉండే భూగర్భ జలాలు కాలుష్యం అవుతున్నాయి. స్టీల్‌ప్లాంట్ నుండి కాలుష్యం (ధూళి) కూడా ఎక్కువగా గ్రామాల్లోకి రావడం వలన అనారోగ్యాలకు గురవుతున్నారు. [illegible]

జీవనోపాధి కోల్పోయి అనారోగ్యాలకు గురవుతున్న అప్పికొండ గ్రామమును సురక్షిత ప్రాంతానికి తరలించి, గ్రామస్థులను నిర్వాసితులుగా గుర్తించి తగిన చర్యలు తీసుకోవాలని కోరుతున్నాము.

ఇట్లు
అధ్యక్షుడు
K. Mahesh
(కె.మహేష్)
కార్యదర్శి

[illegible signatures]

Bharatha Prajathanthra Yuvajana Samikya (DYFI)
Greater Visakha Nagara Comitee
Address : 36-91-3/1, Urvasi Junction, Kancherapalem, Visakha -8 Phone No: 9490098796

Andhra Pradesh Mathsyakarulu, Mathsyakarmika Sangham
Greater Visakha Nagara Comitee (Registration No : 722/03)
Address : 28-6-8, Yellamma Thota, Jagadhamba, Visakha -20 Phone No: 9666325622

Date: 15-06-2017

Respected District Collector,
Visakhapatnam.

Sir

Subject : Appikonda villagers to be considered as Project Affected People (PAP) of Visakhapatnam Steel Plant and to provide livelihood.

The solid waste and toxic waters of steel plant are released into the sea with the help of a drain constructed by Visakhapatnam steel plant near Appikonda. Due to the release of these toxic waters the marine water is polluting thus leading to the increased mortality of fish. As this water remains for 3-4 months the villagers of Appikonda are unable to go into the sea for catching fish thus losing their livelihood. There is no clarity on the livelihood opportunities of the villagers.

The toxic waters released from steel plant is polluting the ground water of Appikonda village. The ash released from steel plant is dispersed in the village thus causing ill health to the villagers.

As the villagers are losing livelihood and suffering from ill health, so this village is to be resettled to other location and the villagers are to be considered as Project Affected People (PAP) of Visakhapatnam Steel Plant.

Yours Sincerely

K. Mahesh (Secretary)
S Musalayya (Town Committee Member)

Annexure 9.1

RASHTRIYA ISPAT NIGAM LIMITED
VISAKHAPATNAM STEEL PLANT
VISAKHAPATNAM – 530031

QUALITY, SAFETY, HEALTH, ENVIRONMENT & ENERGY (QSHE) POLICY

We, at Visakhapatnam Steel Plant within the defined scope and boundaries, are committed –

- to meet the needs and expectations of customers, stakeholders and other interested parties;
- to prevent incidents of injury and ill health of persons at workplace;
- to optimally utilize the various forms of energy; and
- to minimize the impact of steelmaking operations on climate change & environmental pollution.

To accomplish above, we will

- Supply quality goods and services to customers' delight.
- Document, implement, maintain & periodically review the QSHE management systems including the policy, objectives and targets and continually improve the effectiveness and performance of QSHE MS.
- Use natural resources/energy efficiently and effectively with concern for environment.
- Harness renewable and alternative energy sources to comply with national policies & energy security.
- Comply with all relevant legal and other requirements applicable to products, activities, services and processes in respect of Quality, Safety, Occupational Health, Environment & Energy aspects.
- Support the purchase of safe, environment friendly and energy efficient products as well as services and design for continual improvement.
- Encourage involvement & participation of employees in innovative and developmental activities.
- Continuously improve the level of consciousness related to Quality, Safety, Occupational Health, Environment, Energy and organizational requirements amongst employees and contract workers by imparting education, training and awareness.
- Ensure to make the policy available to public and communicate to all concerned for making them aware of their individual obligations towards QSHE MS.

(P Madhusudan)
Chairman-cum-Managing Director

Date: 15.05.2015

ANNEXURE-11.1 - CALCULATION OF OWQI

1. METHODOLOGY OF CALCULATION OF OWQI

Calculation of **OWQI (Overall Water Quality Index)**, as developed by Singh Surjeet et.al and published in the journal titled ***"Development of an Overall Water Quality Index (OWQI) for Surface Water in Indian Context."*** **in 2015** is constructed based on a **Sub-Index Function (Y)** and corresponding **weightage factor** for each of the water quality parameters under IS-10500 (1991).

The methodology adopted for construction of the OWQI, as elaborated in the above referred paper is mentioned in subsequent paragraphs.

- **Sub-Index Function (Y):** Sub-indices functions are basically the equations that transform the concentration ranges into the index score through mathematical equations. These scores are then further converted to a common scale based on their relative importance to impact the quality of water. These sub-indices function are developed based on the water quality standards and their concentrations to meet in particular range. For this purpose, mathematical expressions were fitted for each parameter to obtain the sub-index equations as given in **Table 1**. In this index, the corresponding variation between the range of parameter and index is kept uniform to provide more accurate value of indices.

- **Assignment of Parameter Weights (W):** Due emphasis have been given to decide the weight of each parameter. These weights have been decided based on the judgment of the authors and the experience gained from the literature. The parameter which greatly impacts the quality of water have been given higher weight and vice-versa. The weightages for the parameters relevant to this study are indicated in **Table-1**.

TABLE 1 SUB-INDEX FUNCTION (Y) & SIGNIFICANCE WEIGHT TO WATER QUALITY PARAMETERS FOR COMPUTING OWQI

Class	Sub-Index function (Y) calculation**	Weightage Factor (W)**	Standards (IS-10500) (1991)
pH	**Range of Parameter** / **Sub-Index Function** 0 – 5 : Y=100 6 – 10 : Y=-4*X+115 11 – 25 : Y=-1.667*X+91.67 26 – 250 : Y=-0.111*X+52.78 > 250 : Y=-0.1*X+50 ***Here X=Value of corresponding parameter***	1	6.5-8.5

Class	Sub-Index function (Y) calculation**	Weightage Factor (W)**	Standards (IS-10500) (1991)
Total Dissolved Solids (mg/l)	**Range of Parameter** / **Sub-Index Function** 0 – 500 : Y=100 501 – 1000 : Y=-0.2*X+195 1001 – 1500 : Y=-0.0278*X+91.67 1501 – 3000 : Y=-0.0167*X+75 > 3000 : Y=-0.0083*X+50 ***Here X=Value of corresponding parameter***	3	500-2000
Fluoride (mg/l)	**Range of Parameter** / **Sub-Index Function** 0.7 – 1.2 : Y=100 1.6 – 2.0 : Y=-260.8*LN(X)+205.38 < 0.7 & >2.0 : Y=0 ***Here X=Value of corresponding parameter***	3	1.5-2.0*
Chloride (mg/l)	**Range of Parameter** / **Sub-Index Function** 200 and below : Y=100 201 – 250 : Y=-0.4*X+175 251 – 600 : Y=-0.0714*X+92.86 > 800 : Y=-0.125*X+125 ***Here X=Value of corresponding parameter***	1	250-1000
Sulphate (mg/l)	**Range of Parameter** / **Sub-Index Function** 0 – 25 : Y=100 26 -150 : Y=-0.16*X+99 151 – 250 : Y=-0.25*X+112.5 251 – 400 : Y=-0.1667*X+91.67 401 – 1000 : Y=-0.0156*X+31.25 ***Here X=Value of corresponding parameter***	2	25-1000

Class	Sub-Index function (Y) calculation**		Weightage Factor (W)**	Standards (IS-10500) (1991)
Nitrate (mg/l)	**Range of Parameter**	**Sub-Index Function**	3	10-100
	10 and below	Y=-0.5*X+100		
	11 – 20	Y=-2*X+115		
	21 – 50	Y=-0.8333*X+91.67		
	51-100	Y=-0.5*X+75		
	> 100	Y=-0.25*X+50		
	Here X=Value of corresponding parameter			
****Source:** ***Singh Surjeet, Ghosh, N.C., Krishan Gopal, Galkate Ravi, Thomas T. and Jaiswal R.K. 2015. Development of an Overall Water Quality Index (OWQI) for Surface Water in Indian Context. Current World Environment. 10(3): 813- 822***				
**Applicable standard for Flouride in 2010 considered for uniformity in calculation and comparison*				

- **Aggregation of sub-indices – Overall Water Quality Index (OWQI):** In order to gauge the influence of each individual parameter on a common single scale, the score generated by each parameter was averaged-out. The following weighted average aggregation function is used for this purpose.

$$OWQI = \sum_{j=1}^{n} Wi \times Yi$$

where Wi = weight of the i^{th} water quality parameter
Yi = sub-index value of the i^{th} parameter

Based on the status of water quality, the index value range from 0 to 100 and is classified into five categories: heavily polluted (0-24), poor (25-49), fair (50-74), good (75-94) and excellent (95-100). The status of water corresponding to different OWQI values is presented in Table 5. If the index goes down, then it indicates that some of the water quality parameters are being affected due to any particular reason and suitable measures are needed to further improve the quality of water. Thus this index may be used as a guiding rule in management of quality of surface water resources. The OWQI values and corresponding status of water quality is given in **Table-2** below.

TABLE 2. WQI AND CORRESPONDING CLASS AND STATUS OF WATER QUALITY (PARAMETER-WISE)

Class	WQI Value	Status of Water
Heavily Polluted	0 - 24	Unsuitable for All Purposes
Poor	25 - 49	Special Treatment (Special Treatment)
Fair	50 - 74	Needs Treatment (Filtration & Disinfection)
Good	75 - 94	Acceptable
Excellent	95 - 100	Pristine Quality
Source: ***Water quality index (WQI), the methods reported by Singh et al. [[1]Singh RP, Krishan G, Takshi KS (2015) Water level fluctuation as the sum of environmental and anthropogenic activities in southeast, Punjab (India). Journal of Environmental and Analytical Toxicology 5: 298.]***		

2. CALCULATION OF OWQI FOR THE STUDY AREA

The water quality as measured during 2010 (before revamping) and 2016 (during revamping) at different locations within the study area were collected from RINL and the mean values were used to compare the representative status of water quality during both the periods. The data used has been summarized in **Table-3** below:

TABLE-3 GROUNDWATER QUALITY DATA FOR 2016

Sn	Location	pH Value	Total dissolved solids, mg/l	Chloride (as Cl),mg/l	Sulphate (as SO4), mg/l	Nitrate (as NO3), mg/l	Fluoride (as F), mg/l
1	Dasaripeta (GW1)	7.9	1189	130	92	0.9	0.5
2	Parwada (GW2)	7.6	1241	210	90	0.6	0.6
3	Golla Konda Quarter (GW3)	7.35	1280	185	83	1.2	0.4
4	Turakalapalem (GW4)	7.6	1082	154	96	1.3	0.8
5	Gajuwaka (GW5)	7.35	1080	190	90	0.5	0.6
6	Gangavaram (GW6)	8.1	1020	250	75	0.5	0.8
7	Yarada (GW7)	8.05	1196	238	96	1.5	0.7
	Mean Values	**7.71**	**1155**	**194**	**89**	**0.9**	**0.6**
	Requirement (Desirable limits)	*6.5 to 8.5*	*500*	*250*	*1*	*45*	*200*
	Permissible limits in the absence of alternate source	*No Relaxation*	*2000*	*1000*	*1.5*	*No Relaxation*	*400*
Source: *Monitoring data collected during Oct. 2016 – Dec. 2016 by accredited Lab & furnished by RINL for 7 locations within 10 km area*							

TABLE-3 WATER QUALITY DATA FOR 2010

Sn	Location	pH Value	Total dissolved solids, mg/l	Chloride (as Cl),mg/l	Sulphate (as SO4), mg/l	Nitrate (as NO3), mg/l	Fluoride (as F), mg/l
V1	Inside ED works office	8.04	189	20	17	0.65	0.25
V2	Agro Foresty Dept.	7.88	890	160	60	5.9	0.98
V3	pump house 1	8.09	456	30	20	2.16	1.9
V4	main gate (right side) at PH-2	8.13	616	30	40	2.66	1.92
V5	near chlorination room at PH-2	8.1	629	70	30	3.31	1.48
V6	Back side of cooling tower 16A	7.21	344	60	95	18.79	0.7
V7	TPD zone new pumphouse-4	7.83	1338	360	283	6.12	1.34
V8	Inside central school	7.76	199	20	24	0.81	0.23
V9	Inside VDA School	8.07	538	60	48	3.38	1.26
V10	Inside Admin Building (nursery)	8.05	1242	380	115	1.94	0.88
V11	100mts from above point	8.02	1152	330	101	2.27	0.91
V12	Swarnajayanthi park	8.4	1293	330	95	16.65	1.61
V13	Inside Nehru park	8.08	730	70	57	13.77	1.42
V14	ADB behind pump house 2	7.92	331	5	20	3.15	0.97
V15	Smrityanjali park	8.16	426	60	38	4.28	0.67
V16	Hostel III near bus stop	7.95	329	30	28	5.2	0.46
V17	Near telugu thalli statue	8.22	1197	270	97	1.87	1.51
V18	Sector II shopping complex	7.87	717	130	61	4.84	0.7
V19	Ukku club sect V	8.11	459	40	42	3.24	0.97
V20	Ambedkar park sect VI	7.99	678	90	59	0.56	0.73
V21	Umesh chandra DO Building	7.75	277	20	40	3.06	0.35
V22	Ap chowdaryDirector proj.	7.97	422	50	50	7.65	0.58
V23	CMD Building	7.99	312	40	35	0	0.3
V24	Director Personal	8.15	666	110	55	2.63	0.7
V25	Chief vigilence officer	7.99	678	130	41	0.23	0.57
V26	Director finance	7.92	460	40	40	20.81	0.73

Sn	Location	pH Value	Total dissolved solids, mg/l	Chloride (as Cl),mg/l	Sulphate (as SO4), mg/l	Nitrate (as NO3), mg/l	Fluoride (as F), mg/l
V27	Gurajada kalkshetrm	8.04	992	210	80	10.51	1.04
V28	Andhra kyari kala kshetram	8.33	851	80	70	15.3	1.23
V29	Indira Gandhi park	8.29	992	200	77	0.18	0.66
V30	AC Plant dug well	8.17	640	80	70	8.93	1.11
V31	Sports complex near Indoor stadium	8.28	723	60	60	0.25	1.38
V32	Controlled shed sect 10	8.46	653	50	62	9.79	1.07
V33	CISF opp Dog kellel	8.27	543	80	36	8.93	0.91
V34	vishaka vimala vidyalayam	8.17	3398	1610	150	25.65	0.67
V35	pump house 28	8.15	450	40	57	0.32	0.84
V36	18 MLD water treatment plant	8.11	653	100	72	0.88	0.98
V37	Back side of 18 MLD plant	8.29	387	40	24	1.69	4.13
V38	opposite to pump house 2	7.57	845	100	45	30.85	1.87
Mean Values		**8.05**	**729**	**147**	**63**	**7**	**1.05**
Requirement (Desirable limits)		6.5 to 8.5	500	250	1	45	200
Permissible limits in the absence of alternate source		No Relaxation	2000	1000	1.5	No Relaxation	400
Source: *Monitoring data collected by & furnished by RINL for 38 locations within study area*							

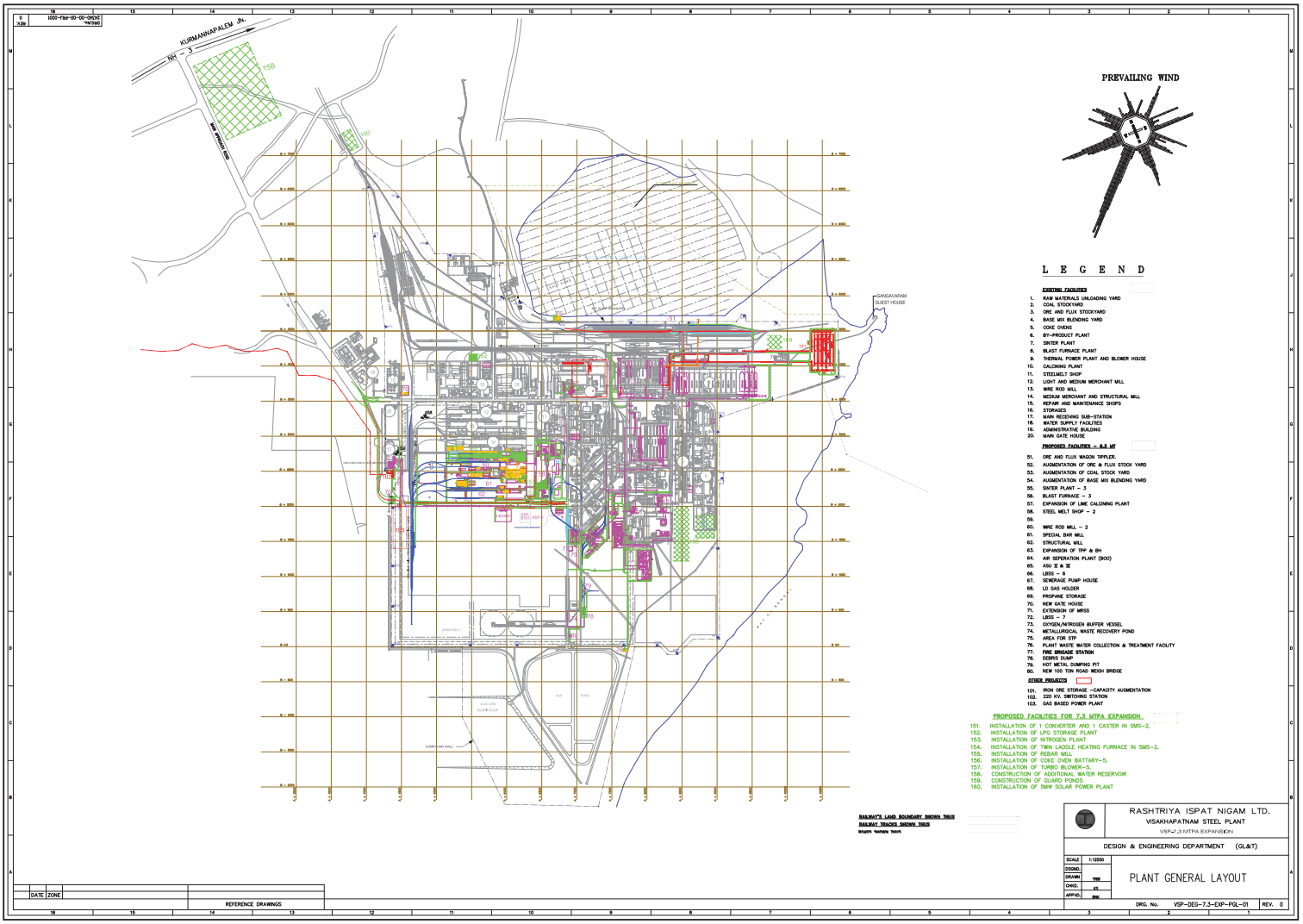
The OWQI was calculated for both periods (before and during revamping) and the same was used to assess damage due to the project. The same has been presented in **Table-4** below.

TABLE-4 OWQI CALCULATION FOR THE PROJECT

Parameter	2010		2016		Weight Factor (W)
	Value of parameter	Sub-index function (Y)	Value of parameter	Sub-index function (Y)	
pH	7.71	**100**	8.05	**100**	**1**
Total Dissolved Solids (mg/l)	1155	**60**	729	**49**	**3**
Fluoride (mg/l)	0.6	**0**	1.05	**100**	**3**
Chloride (mg/l)	194	**100**	147	**100**	**1**

Parameter	2010		2016		Weight Factor (W)
	Value of parameter	Sub-index function (Y)	Value of parameter	Sub-index function (Y)	
Sulphate (mg/l)	89	**85**	63	**89**	**2**
Nitrate (mg/l)	0.9	**100**	7	**97**	**3**
Calculated OWQI	**65**		**86**		

DRAWINGS



REFERENCE

10 km study area

RINL-VSP plant

REFERENCE

GOOGLE EARTH IMAGERY

SCALE

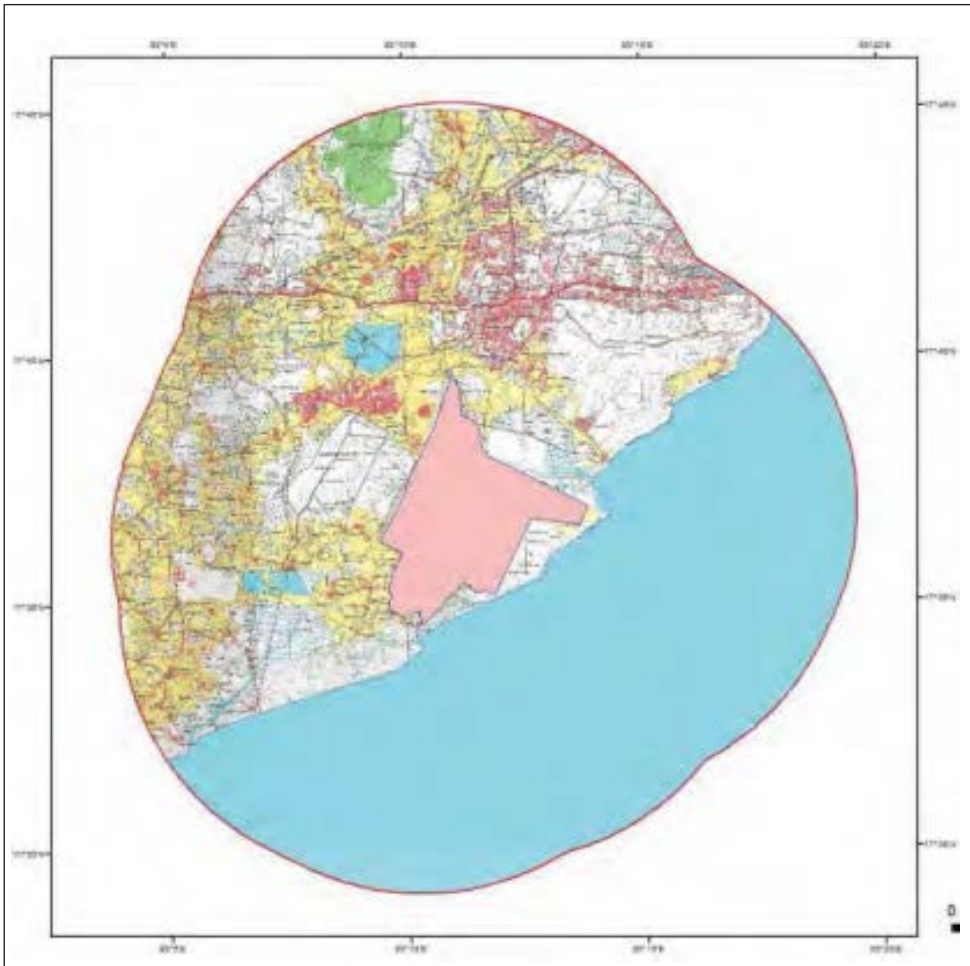
0 1 2 4 6 8 10 Km

VISAKHAPATNAM STEEL PLANT (VSP)

मेकॉन लिमिटेड
MECON LIMITED

SECTION	ENV. ENGG.	EXPANSION OF INTEGRATED STEEL PLANT FROM 6.3 MTPA TO 7.3 MTPA LIQUID STEEL WITHIN THE PREMISES OF VIZAG STEEL PLANT
LOCATION	RANCHI	
DESIGNED		
DRAWN		GOOGLE EARTH IMAGE OF THE STUDY AREA
CHECKED & VERIFIED		
APPROVED	SIG:	SCALE : AS SHOWN / SHEET 1/1 / REV 0
	DATE:	DRG NO : MEC/11/S2/Q7H4/01

REFERENCES: • 7 2 3 2 6 + ((7 1 2 6 (5 (



REFERENCE

RINL-VSP plant
Bay of Bengal
10 km study area

REFERENCE TOPOSHEETS

SCALE

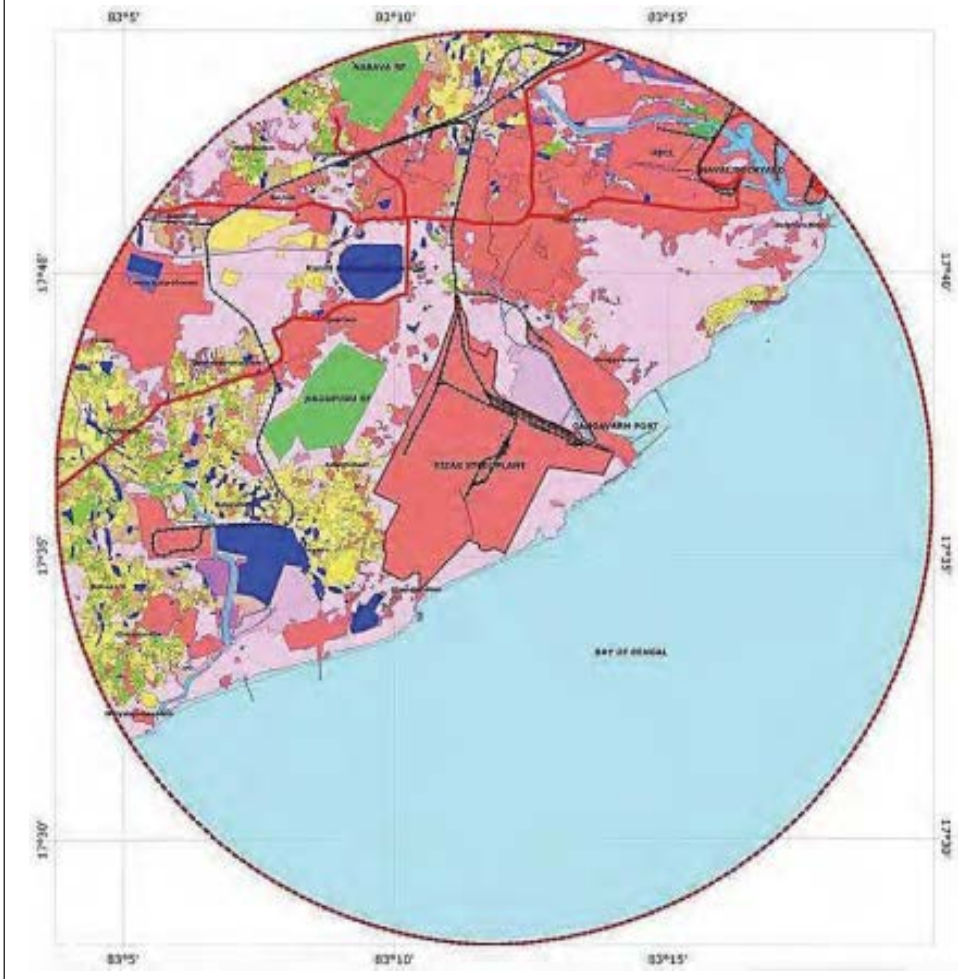
0 1 2 4 6 8 10 Km

VISAKHAPATNAM STEEL PLANT (VSP)

मेकॉन लिमिटेड
MECON LIMITED

SECTION / ENV. ENGG.	EXPANSION OF INTEGRATED STEEL PLANT FROM 6.3 MTPA TO 7.3 MTPA LIQUID STEEL WITHIN THE PREMISES OF VIZAG STEEL PLANT	
LOCATION / RANCHI		
DESIGNED		
DRAWN		
CHECKED & VERIFIED	PHYSIOGRAPHY OF THE STUDY AREA	
APPROVED / SIG.	SCALE : AS SHOWN	SHEET / REV
DATE	DRG NO : MEC/11/S2/Q7H4/02	1/1 / 0

REFERENCES: • 7 2 3 2 6 + ((7 1 2 6 (5 (5



REFERENCE

State/National Highway
Railway Line
Built-up Land
Industrial/Institutional Land
Layout/New Development
Dense/Open Forest
Degraded Scrub Land
Forest (Gen)
Mangroves
Plantation
Irrigated/Double Crop
Other Agriculture Land
Fallow Land
Land with/without Scrub
Stony/rocky/Barren Land
Mudflat/Marsh
Quary/Mining Land
River/Stream
Water Body
Water Logged
Bay of Bengal
Coastal Sand/Sand Dunes
Salt Pans
Aquaculture

REFERENCE

IRS RS-2 L4FMX
5.8 m Resolution
12 February/07 March 2016

SCALE

0 3 6 9 Kilometers

VISAKHAPATNAM STEEL PLANT (VSP)

मेकॉन लिमिटेड
MECON LIMITED

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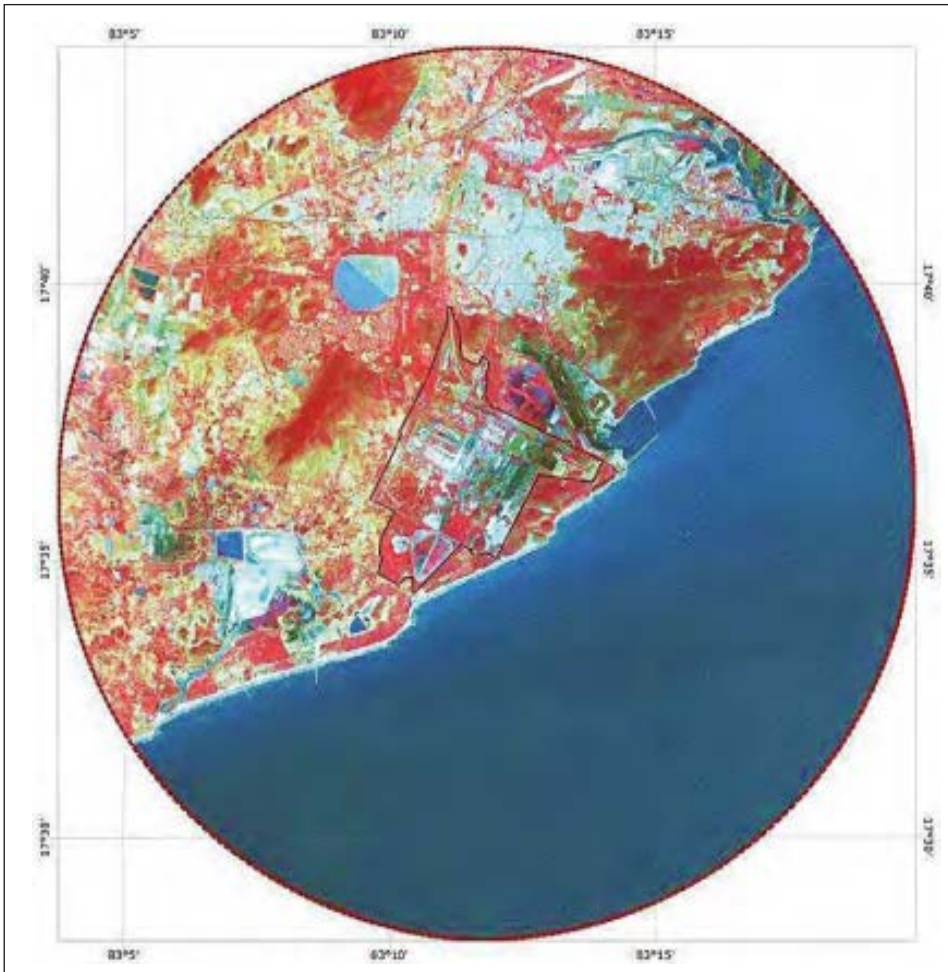


REFERENCE

Project Site

REFERENCE

IRS RS-2 L4FMX
5.8 m Resolution
12 February/07 March 2016

SCALE

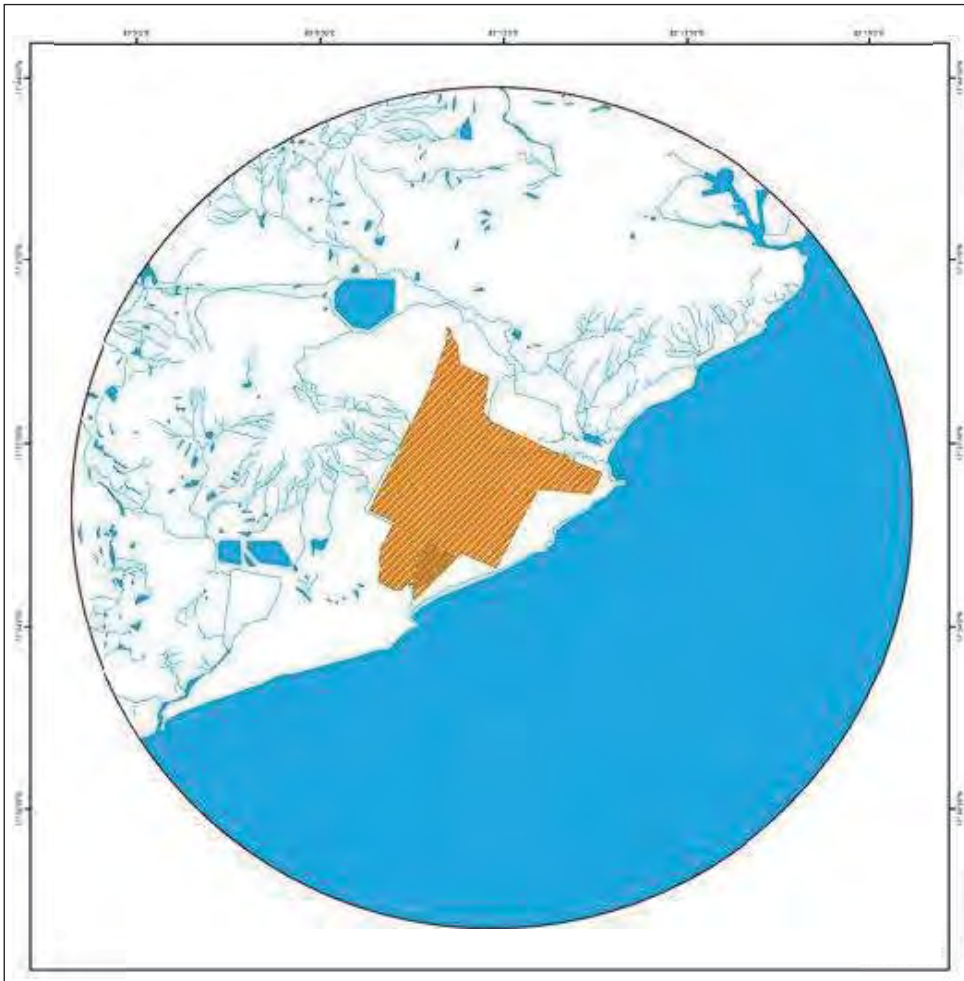
0 3 6 9 Kilometers

VISAKHAPATNAM STEEL PLANT (VSP)

मेकॉन लिमिटेड
MECON LIMITED

SECTION	ENV. ENGG.	EXPANSION OF INTEGRATED STEEL PLANT FROM 6.3 MTPA TO 7.3 MTPA LIQUID STEEL WITHIN THE PREMISES OF VIZAG STEEL PLANT
LOCATION	RANCHI	
DESIGNED		
DRAWN		SATELLITE IMAGE OF THE STUDY AREA FOR LULC
CHECKED & VERIFIED		
APPROVED	SIG.	SCALE : AS SHOWN / SHEET 2/2 / REV 0
	DATE	DRG NO : MEC/11/S2/Q7H4/04

REFERENCES: • 7 2 3 2 6 + ((7 1 2 6 (5 (5



REFERENCE

Vizag Steel Plant Layout
Drainage
10km_Radius
water Bodies

REFERENCE

Source: SOI Toposheets
E44R2&3-2012 | E44R6

SCALE

0 2.5 5 10 Kilometers

VISAKHAPATNAM STEEL PLANT (VSP)

मेकॉन लिमिटेड
MECON LIMITED

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LEGEND

Legend

DEM

Elevation

SCALE

2 0 2 4 6 8

Kilometers

VISAKHAPATNAM STEEL PLANT (VSP)

मेकॉन लिमिटेड
MECON LIMITED

SECTION	ENV. ENGG.	EXPANSION OF INTEGRATED STEEL PLANT FROM 6.3 MTPA TO 7.3 MTPA LIQUID STEEL WITHIN THE PREMISES OF VIZAG STEEL PLANT
LOCATION	RANCHI	
DESIGNED		
DRAWN		DIGITAL ELEVATION MODEL OF THE STUDY AREA
CHECKED & VERIFIED		
APPROVED	SIG.	SCALE : AS SHOWN / SHEET: 1/2 / REV: 0
	DATE:	DRG NO : MEC/11/S2/Q7H4/

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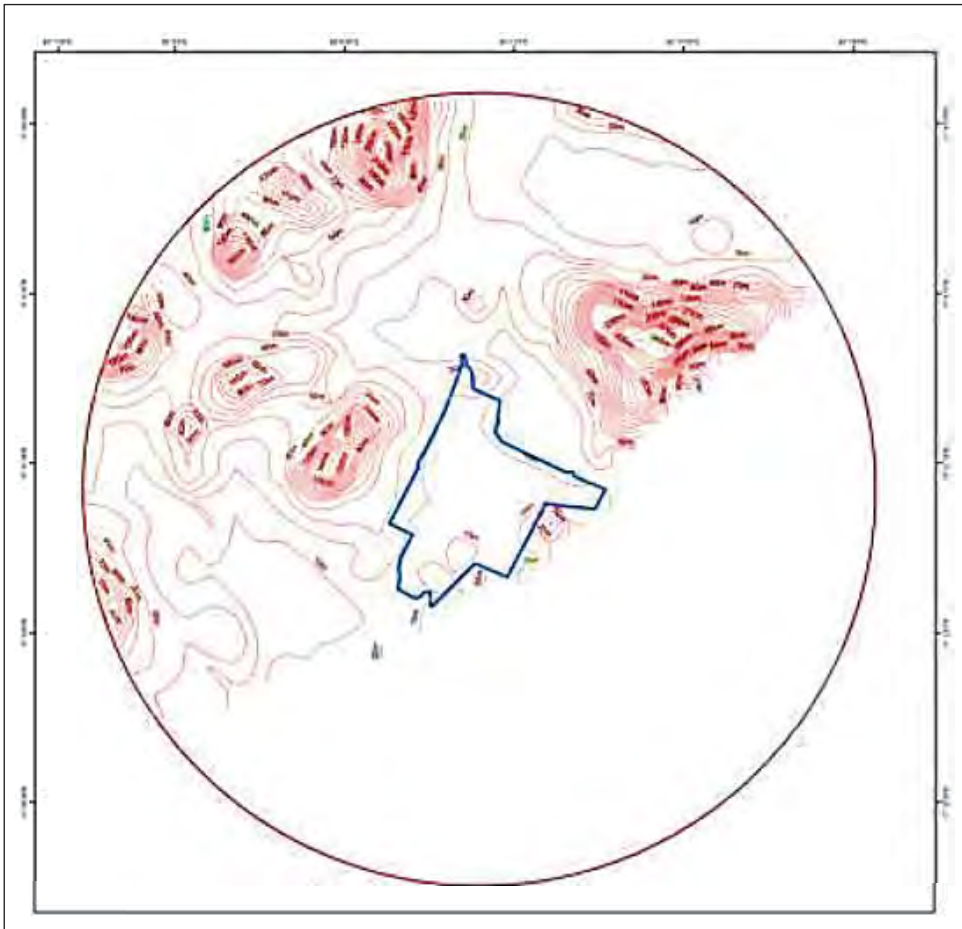
REFERENCES: • TOPOSHEET NOS. E44P3&34, E44P8



REFERENCE

Contours

Visakhapatnam Steel Plant

10 Km study area

REFERENCE

Source:SRTM 30 Dataset

SCALE

0 2.5 5 10

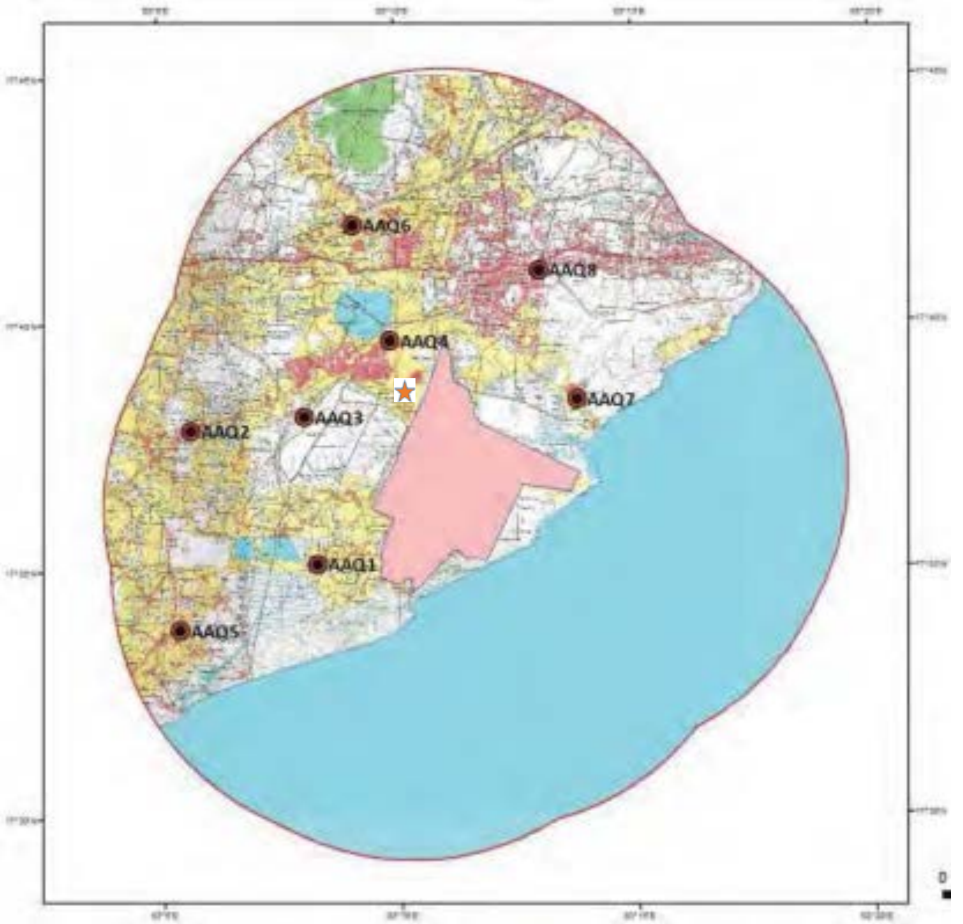
Kilometers

VISAKHAPATNAM STEEL PLANT (VSP)

मेकॉन लिमिटेड
MECON LIMITED

SECTION	ENV. ENGG.	EXPANSION OF INTEGRATED STEEL PLANT FROM 6.3 MTPA TO 7.3 MTPA LIQUID STEEL WITHIN THE PREMISES OF VIZAG STEEL PLANT
LOCATION	RANCHI	
DESIGNED		
DRAWN		CONTOUR MAP OF THE STUDY AREA
CHECKED & VERIFIED		
APPROVED	SIG.	SCALE : AS SHOWN / SHEET: 2/2 / REV: 0
	DATE:	DRG NO : MEC/11/S2/Q7H4/07

REFERENCES: • 7 2 3 2 6 + ((7 1 2 6 (5 (



REFERENCE

- RINL-VSP plant
- Bay of Bengal
- 10 km study area
- **Meteorological Station**
- AAQ1, Devada
- AAQ2, Gorlavanipalem
- AAQ3, Bhavani Nagar near Nadupudi RF
- AAQ4, Sector 3 VSP Quarters
- AAQ5, Chepurapalli
- AAQ6, Duvvada
- AAQ7, Gangavaram Port Adjacent
- AAQ8, Gajuwaka

SCALE

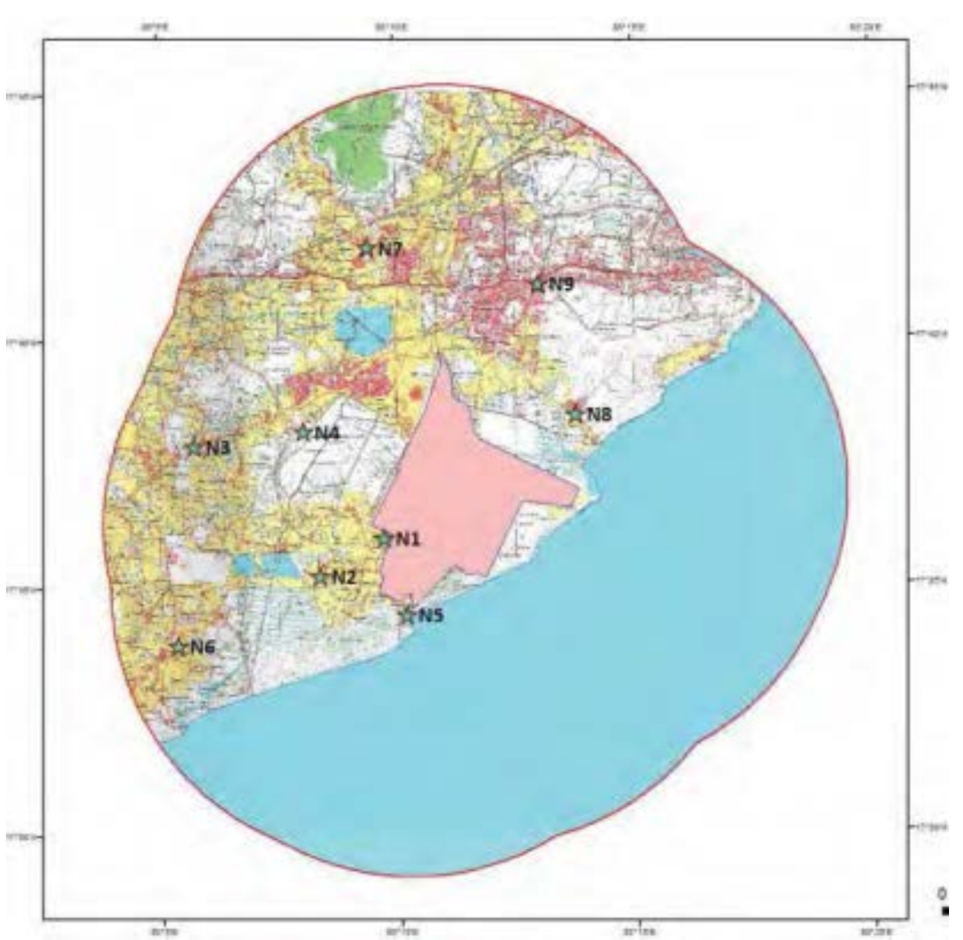
0 1 2 4 6 8 10 Km

VISAKHAPATNAM STEEL PLANT (VSP)

मेकॉन लिमिटेड
MECON LIMITED

SECTION	ENV. ENGG	EXPANSION OF INTEGRATED STEEL PLANT FROM 6.3 MTPA TO 7.3 MTPA LIQUID STEEL WITHIN THE PREMISES OF VIZAG STEEL PLANT
LOCATION	RANCHI	
DESIGNED		
DRAWN		AMBIENT AIR QUALITY STATIONS
CHECKED & VERIFIED		
APPROVED	SIG:	SCALE : AS SHOWN — SHEET 1/1 — REV 0
	DATE:	DRG NO : MEC/11/S2/Q7H4/08

REFERENCES: • TOPOSHEET NOS. E44R2&34, E44R6



REFERENCE

- RINL-VSP plant
- Bay of Bengal
- 10 km study area

Noise

- N1, Near Project Site
- N2, Devada
- N3, Gorlavanipalem
- N4, Nadupudi
- N5, Appikonda
- N6, VadaChipurapalli
- N7, Kurmannapalem
- N8, Gangavaram Port Adjacent
- N9, Gajuwaka

SCALE

0 1 2 4 6 8 10 Km

VISAKHAPATNAM STEEL PLANT (VSP)

मेकॉन लिमिटेड
MECON LIMITED

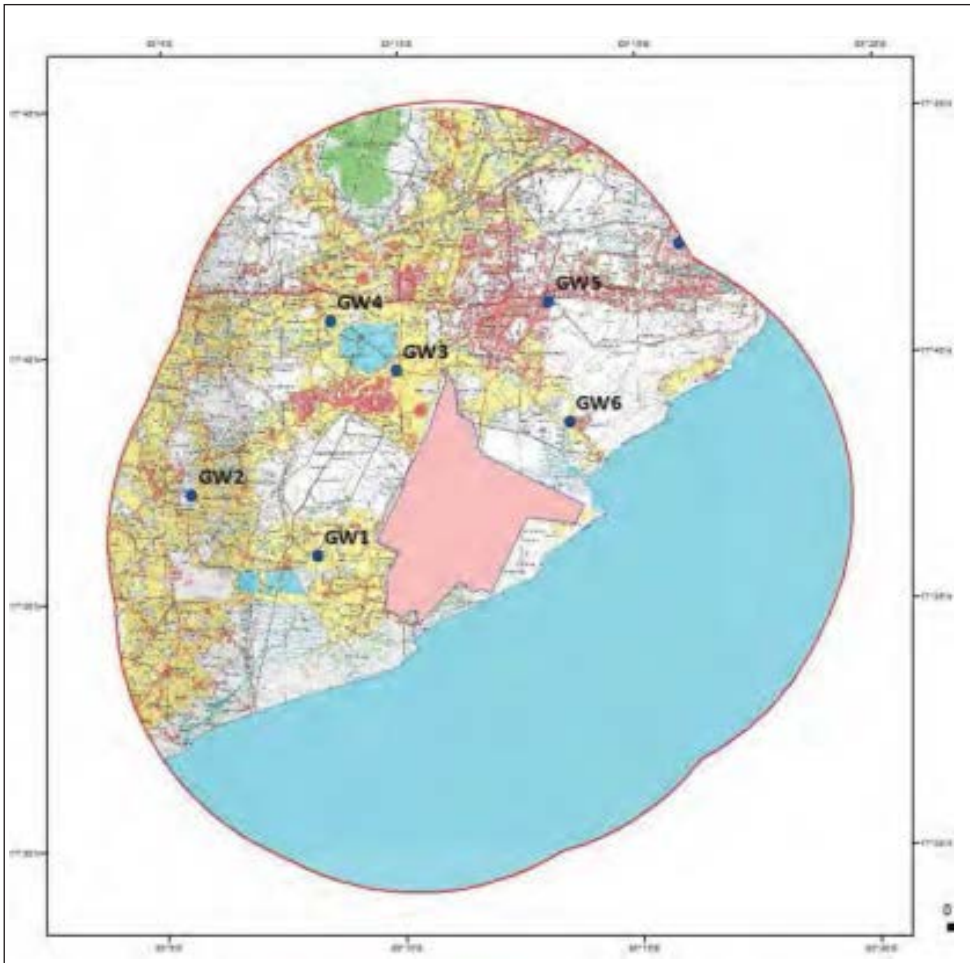
EXPANSION OF INTEGRATED STEEL PLANT FROM 6.3 MTPA TO 7.3 MTPA LIQUID STEEL

NOISE MONITORING STATIONS

SCALE : AS SHOWN — SHEET 1/1 — REV 0

DRG NO : MEC/11/S2/Q7H4/09

REFERENCES: •



REFERENCE

RINL-VSP plant
Bay of Bengal
10 km study area

Groundwater locations

- GW1, Dasaripeta
- GW2, Parawada
- GW3, Golla Konda Quarter
- GW4, Shanivada
- GW5, Gajuwaka
- GW6, Gangavaram
- GW7, Yarada

SCALE

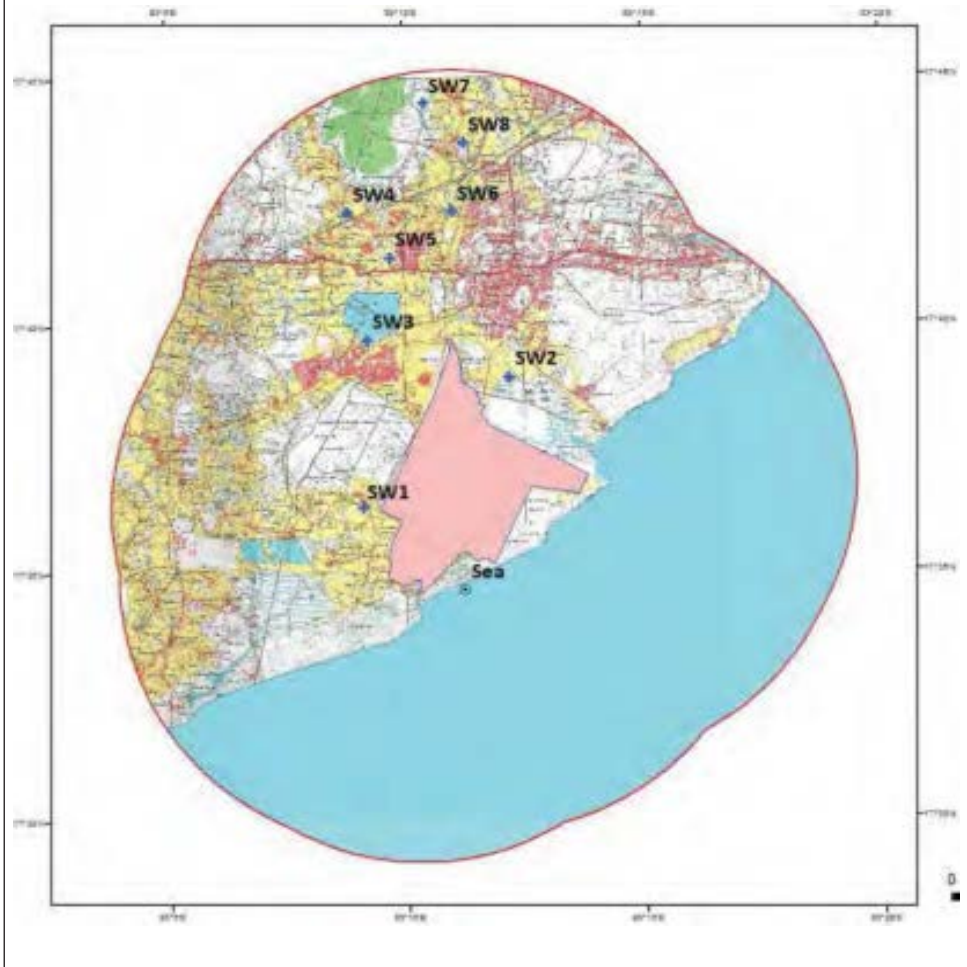
0 1 2 4 6 8 10 Km

VISAKHAPATNAM STEEL PLANT (VSP)

मेकॉन लिमिटेड
MECON LIMITED

SECTION	ENV. ENGG.	EXPANSION OF INTEGRATED STEEL PLANT FROM 6.3 MTPA TO 7.3 MTPA LIQUID STEEL WITHIN THE PREMISES OF VIZAG STEEL PLANT
LOCATION	RANCHI	
DESIGNED		
DRAWN		GROUND WATER SAMPLING LOCATIONS
CHECKED & VERIFIED		
APPROVED SIG.		SCALE : AS SHOWN / SHEET 1/1 / REV 0
DATE		DRG NO : MEC/11/S2/Q7H4/10

REFERENCES: • TOPOSHEET NOS. E44R2&34, E44R6



REFERENCE

RINL-VSP plant
Bay of Bengal
10 km study area

- SW1, Islampeta
- SW2, Desapatrunipalem
- SW3, Kanithi Reservior
- SW4, Duvvada
- SW5, Kurmanapalem
- SW6, Vadlapudi
- SW7, Sathivanipalem
- SW8, Kotta Narava
- Sea, Sea water near VSP

SCALE

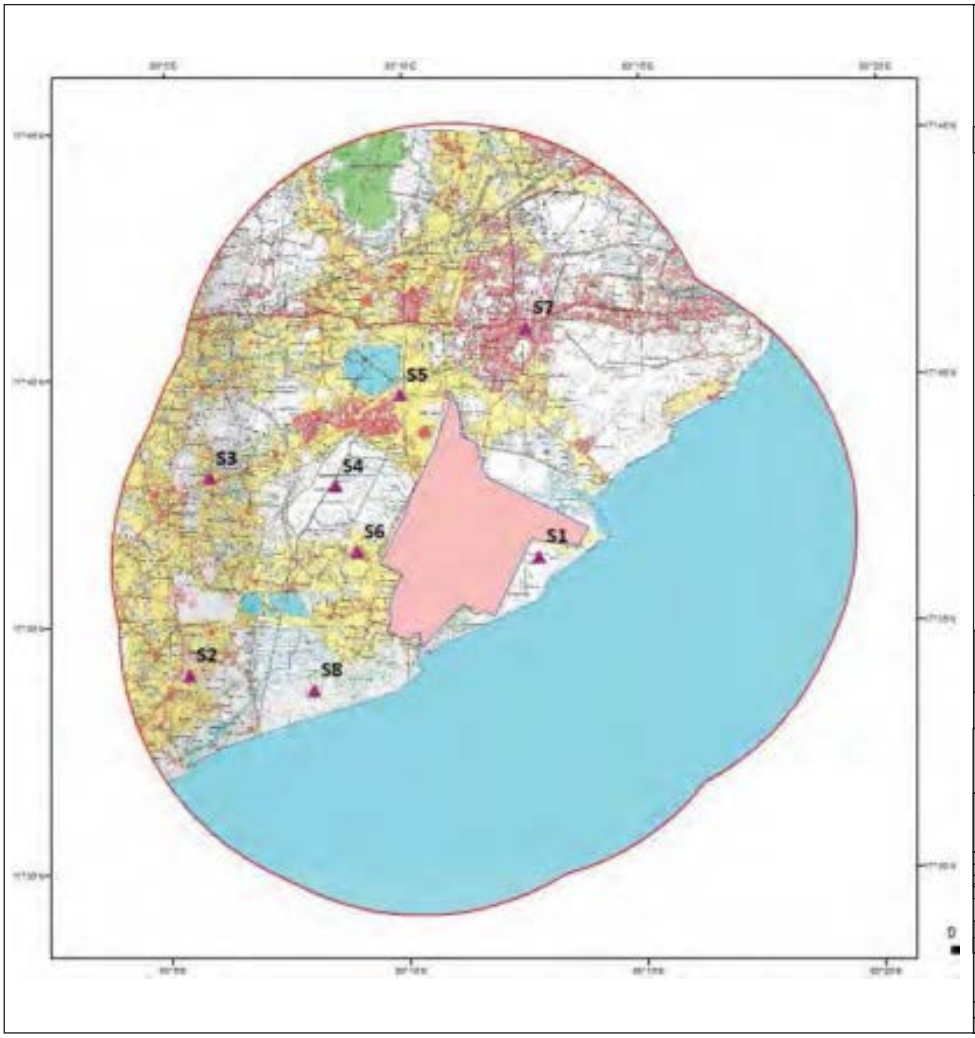
0 1 2 4 6 8 10 Km

VISAKHAPATNAM STEEL PLANT (VSP)

मेकॉन लिमिटेड
MECON LIMITED

SECTION	ENV. ENGG.	EXPANSION OF INTEGRATED STEEL PLANT FROM 6.3 MTPA TO 7.3 MTPA LIQUID STEEL WITHIN THE PREMISES OF VIZAG STEEL PLANT
LOCATION	RANCHI	
DESIGNED		
DRAWN		SURFACE WATER SAMPLING LOCATIONS
CHECKED & VERIFIED		
APPROVED SIG.		SCALE : AS SHOWN / SHEET 1/1 / REV 0
DATE		DRG NO : MEC/11/S2/Q7H4/11

REFERENCES: • TOPOSHEET NOS. E44R2&34, E44R6



REFERENCE

RINL-VSP plant
Bay of Bengal
10 km study area

Soil sampling locations

- S1, Pedda Konda
- S2, Gollapalem
- S3, Kotta Gorlevanipalem
- S4, Nadupuru Reserve Forest
- S5, Gollakonda Quarters
- S6, Islampet
- S7, Turakalapalem
- S8, Sediment

SCALE

0 1 2 4 6 8 10 Km

VISAKHAPATNAM STEEL PLANT (VSP)

मेकॉन लिमिटेड
MECON LIMITED

SECTION	ENV. ENGG.	EXPANSION OF INTEGRATED STEEL PLANT FROM 6.3 MTPA TO 7.3 MTPA LIQUID STEEL WITHIN THE PREMISES OF VIZAG STEEL PLANT
LOCATION	RANCHI	
DESIGNED		
DRAWN		SOIL SAMPLING LOCATIONS
CHECKED & VERIFIED		
APPROVED	SIG.	SCALE : AS SHOWN / SHEET / REV
	DATE	DRG NO : MEC/11/S2/Q7H4/12 / 1/1 / 0

REFERENCES: • TOPOSHEET NOS. E44R2&34, E44R6