



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



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 affects 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 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, and had setup all the facilities within 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 specified vide MoEFCC notification vide GSR.277(E) dtd. 31st Mar'2012. The furnaces producing hot metal and liquid steel were overdue for revamping and needed to be done urgently.

Keeping in view of the above, RINL contemplated modernizing its facilities along with revamping. This modernization and revamping drive led to enhanced capacities of some units. Concurrently, RINL had obtained Terms of reference (ToR) on 19thSeptember 2016 vide Lr. No. J-11011/196/2005-IA.II(I) 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 in the 28th meeting of EAC held during 5th to 7th Feb 2018 for environmental appraisal of industry-I sector. However, as per provisions of the EIA Notification, 2006 and amendments thereto, site activities pertaining to the modernization and revamping of various units were 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**, carried out without obtaining prior Environmental Clearance from Ministry of Environment, Forest & Climate Change (MoEFCC), **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 for obtaining prior Environmental Clearance under EIA Notification, 2006.**

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 (CO5 & Rebar mill) and (b) expansion/revamping units (BF1&2, SP1 & SMS2). 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 constructed,



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- Of the new units proposed, COB 5 is still in construction and is 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. BF1&2, SP1 & SMS2 have been modernized and are under operation. However, despite revamping of these facilities, no increase in production is observed from the capacities as indicated in existing EC for RINL's steel plant. This suggests that the impact of these expansion units will majorly constitute those attributed during the installation/modernization phase and less significantly by 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 its construction period. Also, no significant impact of operation of the revamped units is anticipated. Overall, it is observed that the revamping and modernization of existing units as well as 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 predicted damages caused due to the project activities during construction as well as operation of the units is elaborated in subsequent section. The overall impact of the project on completion of all facilities and operating in future 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 impact 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 adverse impacts of the project expected 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 lead to enhanced capacities, which improved the plant's capability to produce additional 1.0 MTPA of Crude steel. However, the activities pertaining to the same were carried out without obtaining prior Environmental Clearance, and hence attracts violation of the EIA notification 2006 and subsequent amendments thereto.

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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 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-14th June, 2018 at MoEFCC, Delhi.

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

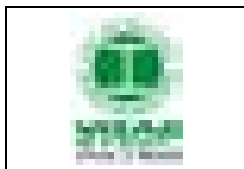
Sn	Event/Activity	Date
1	Applied online to MoEF&CC for EC amendment of 6.3 MTPA to 7.3 MTPA and hard copy sent through courier	05.02.2015
2	While pursuing the status with MoEF&CC – VSP was advised to resubmit the application and application was resubmitted	20.12.2015
3	VSP approached MoEF&CC for amendment of EC MoEF&CC advised VSP to apply afresh for TOR	28.01.2016
4	Applied online to MoEF&CC enclosing Form-1 & pre-feasibility report	30.06.2016
5	Presentation given to MoEF&CC	28.07.2016
6	TOR issued by MoEF&CC for conducting EIA	19.09.2016
7	Public Hearing conducted	15.06.2017
8	Applied online to MoEF&CC 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 MoEF&CC for appraisal by Violation Committee.	29.03.2018
12	Proposal included in the agenda for the meeting and TOR issued	14.06.2018

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

In agreement with the above, Chapter 4.0 of this EIA-EMP report discusses the impacts caused due to the expansion of the plant, when operated in future. The corresponding restitution and mitigation plan along with budget provisions are discussed in this chapter, in the subsequent sections.



11.5 DAMAGE ASSESSMENT & REMEDIATION PLAN

The assessment of environmental damage caused due to an industrial activity under violation of a regulatory framework needs to be measured across different aspects viz. natural degradation, socio-economic effects and economic benefits gained at the cost of these aspects. For the purpose of a comprehensive evaluation of the probable damages incurred to the environment as well as socio-economics of the nearby areas of RINL's Visakhapatnam steel plant, a Damage Assessment matrix has been developed based on published quality indices of air environment, water environment as well as other environmental attributes.

INSET-1
<p><i>Damage assessment matrix</i></p> <p><i>The damage to an environmental attribute can be resulted due to different causes and will lead to different impacts. An impact that poses risks to human health or degradation of environmental quality is considered as a significant damage due to the project activity.</i></p> <p><i>For the purpose of estimation of damage, firstly all causes/aspects of environmental degradation for a particular environmental attribute (like air, water etc.) are identified. Secondly, the degree of damage caused due to a particular aspect is scored based on the amount of change in quality of the environmental component observed between period of no activity (Control period) and after the activities have been carried out (impact period). Published quality indices for air, water etc. have been utilized to quantify the same. The scores of damage calculated as described above are further added weightage based on their potential to pose risks to Human health, Community infrastructure or depletion/degradation of natural resources to calculate Overall Damage Significance Ranking (ODSR).</i></p>

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



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.

11.5.1 Damage due To Project Location

The 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 shared with the new units. The locations 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 plot's 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.

The revamped units, on the other hand, were carried out within the existing individual complexes of the units. The land of the existing plant units is already under industrial use.

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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.

11.5.2 Damages caused during Construction Phase

Some of the units of the proposed expansion plan have already been installed and operating while for others, construction work is still in progress. The construction work of new Rebar Mill is yet to be started. The details regarding the same is discussed in Chapter-2 of the EIA-EMP report.

Construction phase of the project might have caused some impacts on land use, ground water, water quality, air quality, noise etc. of the study area. A brief discussion of the same on the different environmental as well as social components such as loss of property/infrastructure, loss of life, degradation of natural resources and loss of flora and faunas given hereunder. A measureable degree of the damage caused on the component is also estimated by way of damage score, as discussed in INSET-1 given above.

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
- Socio-economic Condition

11.5.2.1 *Land Environment*

Damages:



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, Rehabilitation and Resettlement (R&R) aspects were not applicable. As the project is being carried out within the plant premises, all of the construction activities were limited within the existing plant boundaries.

Due to prior industrialization in the Visakhapatnam area and the VSP steel plant region, the rural neighborhood of the existing facility has been upgraded into urban environment in the past decade and continued urbanization could be envisaged, leading to change in land use of the buffer area of the project, however the proposed expansion will not have any major impact on the urbanization of the area.

Moreover, Visakhapatnam is already a fairly good developed area with all sorts of infrastructure already available. It is therefore most unexpected that influx of construction labour changed present land use pattern. Further, this land use change during construction is only temporary and will persist during construction phase only.

Degree of damage:

An influx of approximately 4085 construction workers every 3 months was estimated for the overall duration of 22 months during which construction activities were carried out at site

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for the expansion/revamping projects. Considering the impact area to be all habitations within 10 km from the project site, it was identified that the community resources and social infrastructure available in the area is shared and utilized between a total of 4 mandals with 13 villages and 22 wards. The total population, as per Census 2011 was 3,96,945 with a growth rate of 53% from 2006 (as per District Handbook, Visakhapatnam published in 2013) and a population density of 4330 person/km² in the 10 km buffer area. The increasing population is mostly attributed to increased literacy as well as in-migration of literate people from nearby areas. Thus, the maximum absorptive capacity of the area can be assumed to be equal to the natural growth rate of the area as 53% in 5 years i.e. an increase in population by 42,076 persons in a year.

The degree of damage is in direct proportion to the increase in population due to labour influx in the area and assessed as per Table 11.2 given below.



Table 11.2 : Degree of Damage

Sn.	Influx population as (%) of maximum absorptive capacity(MAC) of the area	Degree of damage	Damage impact
1.	<15%	1.0	Minimal impact on existing infrastructure.
2.	15% to 30%	2.0	Increase in demand of potable water as well as demand for firewood.
3.	30% to 50%	3.0	Increased additional stress on existing infrastructure such as roads, public amenities, etc.
4.	50% to 100%	4.0	High stress on all existing facilities. Land required for temporary labour camps/shelters. Probable increase in criminal activities in the area.
5.	>100%	5.0	Area incapable of meeting infrastructural demands of the increased population of the area resulting in frequent man-conflicts in the area, disruption in law-order situation, encroachment of public lands and disruption in regular supply of basic amenities as water, electricity etc. for host community due to higher demand-supply gap.

Based on the above, the degree of damage for the construction labour influx due to expansion/revamping activities during construction phase is estimated and presented in below:

Population of impact area (2011)	Labour influx	Maximum absorptive capacity (MAC) of the area	Influx population as (%) of (MAC) of the area	Calculated Damage degree
3,96,945	4085	42,076 (53% of population(2011))	9.7%	1.0

Hence, no significant negative damage is assessed on the land environment and existing infrastructure of the impact area during the construction activities of RINL.

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Environmental significance of damage:

The influx of construction workers at site has the potential to negatively impact the existing natural vegetation (Nr) as well as community resources (Cr) due to additional demand stress on basic amenities. However, no direct impact on Health Risks (Hr) of existing population is anticipated. The overall environmental significance weightage is calculated below:

Environmental Significance weightage based on Potential for			Overall environmental significance weightage
Health Risks (Hr=2)	Natural resource degradation (Nr=1.5)	Community resource damage (Cr=1.2)	
N	Y	Y	1.8

Remedial measures:

No significant negative impact is envisaged due to the project on the existing land use of the area. Thus, no specific remedial measure is recommended.

11.5.2.2 *Ambient Air Quality*

Damages:

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 might have led to generation of fugitive dust.

Dust emissions from construction and other civil engineering activities are a common problem. Fine particles (PM₁₀) from these sources is significant cause of air pollution. Owing to their small size, they 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.

Gaseous pollutants like NO_x& CO were also contributed to the ambient air due to operation of diesel powered machinery and vehicles associated with this construction phase. Gaseous emissions from construction machineries 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 boundary.

During the construction period, the impacts that are associated with the 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 earth materials and from construction spoils.
- Generation of pollutants due to operation of heavy vehicles and movement of machineries and equipment for material handling, earth moving, laying of sands, metal, stones, asphalt, etc.

The present site was vacant and no concrete structures were existing and was used for storage yard.



Degree of damage:

As discussed earlier in Chapter-4 of this EIA-EMP report, the maximum construction activities spawned from April 2013 to October 2017 and the maximum contribution of plant construction activities on ambient environment at any time during this period was estimated using simulation models. These impacts were primarily contributed from

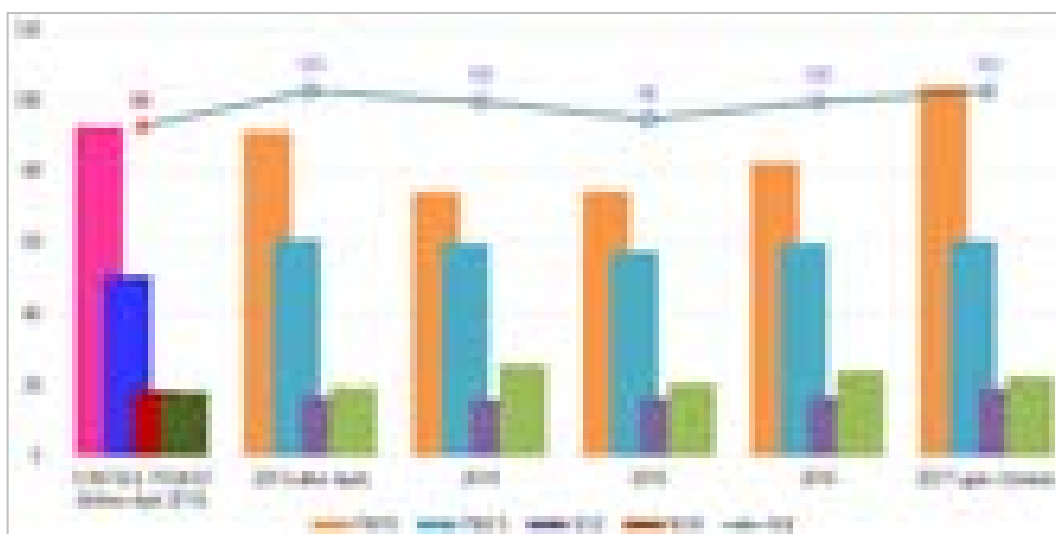
- Emissions due to fuel combustion by vehicles used for transportation of construction material and debris.
- Fugitive emission from paved/unpaved roads due to vehicular movement.
- Fugitive emissions due to ground clearing and levelling activities at site.

The results of simulation indicate effect of these activities on the work zone air quality. However, minimal effect on the air quality outside the plant premises was observed from the simulation results. The same was verified by analyzing the ambient air quality during this period for assessment of ambient air quality to infer the probable damages on the environment in the study area using Air Quality Index (AQI) published by CPCB.

The pollutant concentration levels for PM₁₀, PM_{2.5}, SO₂ and NO_x were used to calculate AQI values for the period before start of construction activities as well as during the construction period. The change in the quality of air as indicated by the AQI values was assumed to be attributed to construction activities. The same was used to calculate the degree of damage caused due to construction activities on the environment.



The maximum of average pollutant levels for the years during which peak construction activities were carried out (i.e. 2014 to 2017) monitored at 7 locations near the plant was compared with pollutant levels before construction activities were carried out (i.e. 2013). The same is exhibited in Fig. 11.1 below.

Fig. 11.1 : AMBIENT AIR QUALITY BEFORE AND DURING CONSTRUCTION
ACTIVITIES OF RINL'S EXPANSION PROJECT



NOTE: CONTROL PERIOD – Duration before construction activities

The above indicates slight increase in AQI values due to construction activities from the control period, mostly populated over 2015-16 when construction activities were at maximum. For the total duration of construction i.e. impact period, the average AQI was

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calculated to be 100 while for the period before construction activities i.e. the control period the AQI was calculated to be 93.

For the purpose of calculation of degree of damage, the AQI values based on the associated indicative air quality (as published by CPCB) are given an AQI grade (G_{aq}), which is then used to assess the degree of damage due to change in the AQI of the impact area. The AQI values and associated AQI grades are given below:

AQI Values	Quality of air as per CPCB	AQI Grade (G_{aq})
(0–50)	Minimal Impact	1
(51–100)	Minor breathing discomfort to sensitive people	2
(101–200)	Breathing discomfort to the people with lung, heart disease, children and older adults	3
(201–300)	Breathing discomfort to people on prolonged exposure	4
(301–400)	Respiratory illness to the people on prolonged exposure as well as Respiratory effects even on healthy people	5

The change in the quality of air, as indicated by change in the associated AQI grade is used to calculate the AQI change index (A_i), which is also taken as the degree of damage in this case. The same is shown below.

AQI change index (A_i)	Inference
[0-1]	No significant change in air quality, so minimal impact
[1-2]	Minor breathing discomfort to sensitive people
[2-3]	Breathing discomfort to the people with lung, heart disease, children and older adults
[3-4]	Breathing discomfort to people on prolonged exposure
[4-5]	Respiratory illness to the people on prolonged exposure as well as Respiratory effects even on healthy people

$$\text{AQI Change index } (A_i) = \frac{G_{aq}(\text{Impact}) - G_{aq}(\text{Control})}{G_{aq}(\text{Control})} + (G_{aq}(\text{Impact}) - 1)$$



Based on the above, the degree of damage for the air quality degradation due to expansion/revamping activities during construction phase is estimated and presented below:

AQI of Control period	Average AQI of Impact period	AQI Change index (A_i) / Damage degree	Inference on quality
93	100	1	Minor breathing discomfort to sensitive people

The above change in AQI values indicates there was an impact of construction activities. However, the use of effective emission control measures during construction phase is reflected through the minimal change observed in the air quality.

Environmental significance of damage:

The construction activities comprising of vehicular movement and site preparation and construction activities, has the potential to negatively impact the existing natural vegetation (N_r) as well as poses risks of degradation of human health (H_r) due to inhalation of polluted air. The deposition of air pollutants in nearby water sources and soil may also affect the community resources (C_r) in the area, contamination of water reserves. The overall environmental significance weightage is calculated below:

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Environmental Significance weightage based on Potential for			Overall environmental significance weightage
Health Risks (Hr=2)	Natural resource degradation (Nr=1.5)	Community resource damage (Cr=1.2)	
Y	Y	Y	3.6

Mitigation Measures Undertaken

Dust and fine particle generation from construction and demolition activities can be substantially reduced through carefully selected mitigation techniques and effective management. Once particles are airborne, it is very difficult to prevent them from dispersing into the surrounding area. The most effective technique is to control dust at source and prevent it from becoming airborne, since suppression is virtually impossible once it has become airborne.

During Earthworks, excavation and digging, vegetation cover was removed in discrete sections and not all at once. Earthworks, excavation and digging activities done were carried out during moderately damp conditions and avoided during exceptionally dry weather periods.

Regular Water sprinkling was done on roads to avoid dust and mud from roads through movement of vehicles, both on and outside the site. The trucks were covered to avoid spillages. Also, gaseous emissions from construction machineries and vehicles were minimized by enforcing regular servicing of machinery.

The above control measures were effectively used during the construction period, which was evident from the minimal change in air quality observed during the period.

11.5.2.3 Ambient Noise levels

Damages:

Noise was generated during construction due to operation of diesel powered excavators, trucks and cranes and handling of heavy metallic equipment, due to which the expected noise levels at a distance of 15 m from construction site was ~85 dB(A). Without attenuation, this will reduce to 35 dB(A) at the nearest habitation (i.e. Appikonda). 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 (i.e. 52.3 dB(A)), totaling to a noise level of 52.4 dB(A) at the nearest habitation. However, the actual noise levels would be even less due to attenuation by extensive greenbelt of the plant and plant building structures.

Degree of damage:

The CPCB standards for noise levels during the day and night for Industrial area, Sensitive areas and Residential areas are as indicated below:

CPCB Noise level Standards.	Industrial Areas	Sensitive areas	Residential areas
	75	50	55
	70	40	45

To quantify the intensity of damage that may have been caused due to the increase in noise levels at the nearest residential area and compared with the minimum noise level which has no severe impact (i.e. minimum background noise level). The same is indicated below:

Sn.	Increased noise levels(in dB(A)) over background level	Damage Grade (GN)	Damage impact
1.	<45 dB(A)	1.0	Minimal impact on existing health levels. Equivalent to a quiet room.No significant impact on human body.
2.	≥45 dB(A) <50 db(A)	2.0	Equivalent to audible noise from equipment such as forced air-heating systems or radio playing in the background. Can cause minimal annoyance. Can also lead to disruption in sleep leading to nocturnal awakenings.
3.	≥50 dB(A) <55 db(A)	3.0	Equivalent to outdoor noise levels in residential areas. Normal conversation levels also range in the same noise level. Can cause significant irritation to people working in offices, patients in hospitals as well as children studying in schools.
4.	≥55 dB(A) <70 db(A)	4.0	High noise levels equivalent to operational equipment as in industrial areas. Can lead to hypertension. Continued exposure may lead to temporary hearing losses in adults.
5.	≥70dB(A)	5.0	Very high noise levels that may lead to hearing losses to people on continued exposure, sleep deprivation and annoyingly loud to many people. A total exceeding 110 dB(A) will initiate pain in human ear and casue permanent hearing loss.

Sources: • National Institute on Deafness and Other Communication Disorders, Environmental Protection Agency, Noise Pollution Clearinghouse as published at <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1253729/>
• <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4844473/>
• Article "Environmental noise and sleep disturbances: A threat to health?" By DemianHalperin published in Sleep Science, 2014 of Brazilian Association of Sleep. Production and Hosting by Elsevier B.V. Available online at www.sciencedirect.com
• <http://www.industrialnoisecontrol.com/comparative-noise-examples.htm>

Based on the above, the degree of damage due to increased noise levels during construction phase is estimated and presented below:

Minimum Background noise level	Increased noise level at nearest habitation	Change in Damage grade	Calculated Damage degree
52.3 dB(A)	52.4 dB(A)	0.1 dB(A)	1
<i>Damage grade = 3.0</i>	<i>Damage grade = 3.0</i>	Change = 0.0	
$\text{Noise level grade index (Ni)} = \frac{G_{N(\text{Impact})} - G_{N(\text{Control})}}{G_{N(\text{Control})}} + (G_{N(\text{Impact})} - 2)$			

The above change indicates no change in significant noise levels in the area due to construction activities. However, the noise levels in the habitation area is already higher which makes it susceptible to deterioration on small increase in noise levels due to external factors.

Environmental significance of damage:

The construction activities comprising of vehicular movement and site preparation and construction activities, has the potential to negatively impact the existing human health (Hr) due to increase in noise levels. The overall environmental significance weightage is calculated below:

Environmental Significance weightage based on Potential for			Overall environmental significance weightage
Health Risks (Hr=2)	Natural resource degradation (Nr=1.5)	Community resource damage (Cr=1.2)	
Y	N	N	2



Mitigative Measures Undertaken

Protective gears such as earplugs, etc. were provided to construction personnel exposed to high noise levels as preventive measures by contractors. This system was strictly adhered to/enforced in order to minimize / eliminate any adverse impact.

It was also ensured that all the construction equipment and vehicles used are in good working condition, properly lubricated and maintained to keep noise within the permissible limits and engines turned off when not in use to reduce noise.

11.5.2.4 Water environment

Damages:

➤ Surface water

During construction, a lot of debris, mud etc. was generated. During the monsoon season, storm water run-offs contain large amounts of suspended solids. In order to reduce the suspended solids content of storm water run-offs, VSP has provided storm drains to route the storm water drains through catch pits. No large scale leveling was required as construction were to be carried out in the land which is already being used for industrial activity. Excavation was also limited.

➤ Ground water

As discussed before, the expansion of the steel plant was carried out within the existing plant boundary of VSP. The Steel plant 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. Therefore, no significant modification in the ground water regime (or quantity) of the area is anticipated.



However, a comparative analysis was carried out for change in groundwater quality for the period before and after the construction activities. The same has been done using published Groundwater Quality Index (GQI) as illustrated below.

Degree of damage:

As discussed before, the surface water is unaffected due to the construction activities as there is minimal interaction of site activities with the surface water bodies in the area. Also, the construction activities are being carried out within the plant premises, with a distance of over 5.0 km from the nearest surface water body. Thus, an effect due to storm water **overflowing into the buffer area's surface water bodies is minimal.**

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 below.

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

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Chloride (mg/l)	147	194
Sulphate (mg/l)	63	89
Nitrate (mg/l)	7	1
<i>Note: * Annual average of 38 locations in study area ** Annual average of 7 locations in study area</i>		

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 RPSingh 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 and the change in groundwater quality is given below:

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



Duration	OWQI	Associative grade of water quality	Change in groundwater quality grade	Calculated Damage degree
2010 (before construction)	86	Acceptable quality [2]	1	1.5
2016 (after construction)	65	Needs Treatment (Filtration & Disinfection) [3]		
$\text{Damage degree} = \frac{G_{wq(\text{Impact})} - G_{wq(\text{Control})}}{G_{wq(\text{Control})}} + (G_{wq(\text{Impact})} - 2)$				

The above indicates a minimal change in damage degree over the groundwater quality of the area.

Environmental significance of damage:

The construction activities has the potential to negatively impact the existing human health (Hr) due to increase in ground water pollutants as well as degradation of community resources (Cr). The overall environmental significance weightage is calculated below:

Environmental Significance weightage based on Potential for			Overall environmental significance weightage
Health Risks (Hr=2)	Natural resource degradation (Nr=1.5)	Community resource damage (Cr=1.2)	
Y	N	Y	2.4

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Mitigative Measures Undertaken

Quality of construction wastewater emanating from the construction site was controlled through the existing drainage system with sediment traps (silting basin as water intercepting ditch) for arresting the silt / sediment load before its disposal into the outfalls.

All the washable construction material was stored under sheds or within enclosed space fenced with brick or earth in order to prevent spillage into the drainage network, so that the same does not find its way into the surface water runoff.

The sediment traps and storm water drainage network were periodically cleaned and disposed to fill low-lying areas within the plant premises especially before monsoon season.

11.5.2.5 Ecological environment

Damages:

As previously discussed, the units installed under the expansion/revamping project of RINL were constructed and the ecological damages have been investigated for the units. Specific site investigation was carried out for new Coke Oven battery (COB-5) and new Kanithi Balancing reservoir (KBR-2). The same is elaborated below in subsequent paragraphs.

a) New Coke Oven Battery:

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.

Environmental Status Prior to Construction:

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 structurals & 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 Fig. 11.2).



Fig. 11.2 - Google Earth Image of 21st March, 2014 of Site of COB-5 inside Visakhapatnam Steel Plant (Before Pre-construction Activities)



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 small trees (*Acacia spp.*, *Prosopis juliflora*), shrubs (*Lantana camara*, *Calotropis gigantea*, *Ricinus communis*), herbs such as *Mimosa pudica*, *Tridax procumbens* and grasses (see Photos 11.A, 11.B and 11.C).

Photo 11.A: Vegetation in Vacant Plot Adjacent to COB – 5 Comprising of *Acacia spp.*, *Prosopis juliflora*, *Lantana*, *Calotropis*, *Tridax procumbens* and Grasses





Photo 11.B: *Ricinus communis* growing in COB – 5 Site



Photo 11.C: *Tridax procumbens* and *Mimosa pudica* growing in COB – 5 Site



No external injury / damage / lesions, which can be attributable to pollution was visible on the vegetation. The vegetation appeared to be healthy. Also several species of insects including beetles, and grass-hoppers / locusts were observed to be present in vegetation.

Among avifauna, Common Crows, Jungle Crows, Red-wattled Lapwings (*Vannellus indicus*), Jungle Babblers (*Turdoides striata*), Spotted Munia (*Lonchura punctulata*).

Changes Due to Construction:

The site was cleared as can be seen in the Google Earth Images during March, 2014 to December, 2017 (see Figs. 11.3-11.6). 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.



Fig. 11.3 : 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)



Fig. 11.4 : 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)



Fig. 11.5 : 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)



Fig. 11.6 - Google Earth Image of 21st Dec., 2017 of Site of COB-5 inside Visakhapatnam Steel Plant(Battery Erection Works in Progress)



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.

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 (Apikonda 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



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characterised by strong breezes, which disperse fugitive dust.

No external injury / damage / lesions, which can be attributable to pollution was visible on the vegetation. The vegetation appeared to be healthy. Also several species of insects including beetles, and grass-hoppers (notably *Poekilocerus pictus*) were observed to be present in vegetation.

Among avifauna, Common Crows, Jungle Crows, Red-wattled Lapwings (*Vannellus indicus*), Jungle Babblers (*Turdoides striata*), Spotted Munia (*Lonchura punctulata*).

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.

Photo 11.D: Close-up of Cashew Trees Just Outside Visakhapatnam Steel Plant on South-Western side Near Apikonda Village



Photo 11.E: Close-up of Trees Just Outside Visakhapatnam Steel Plant on South-Western side Near Apikonda Village



Photo 11.F: Close-up of Trees Just Outside Visakhapatnam Steel Plant on Northern side



Noise is also 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. Apikonda 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.**

Biological Impact Assessment:



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.

Ecological Consequences:

The consequences of the various biological impacts have been placed in 5 (five) levels depending the severity (Insignificant – 1; Severe – 5) as detailed in Table 11.3.

Table 11.3 : Biological Consequences Scoring Scheme

Consequences Score (CS)	Likely Impact Receiving Components (Ecosystem, Habitat and Species level)
Insignificant Consequence (Score – 1)	Site specific clearing of common herbs, shrubs, grasses, climbers.
	Vegetation composition does not form a habitat character for any species of conservation significance
	No short term or long term impacts are likely to adversely affect the surrounding habitat / ecosystem
	Site specific disturbance (e.g. movement pattern, displacement etc.) to common / generalist species of fauna
	No negative impact on surrounding ecosystem functioning or habitat ecology
Minor Consequence	Site specific clearing of some common regenerating tree saplings

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Consequences Score (CS)	Likely Impact Receiving Components (Ecosystem, Habitat and Species level)
(Score – 2)	Minor temporary impacts on ecosystem functioning or habitat ecology of common generalist species Minor short term or long term impacts on surrounding / immediate / adjacent habitats but are resilient to changes in habitat structure or conditions Impact on surrounding agro-ecosystem / agriculture when environmental data / parameters are within permissible limits
Moderate Consequence (Score – 3)	Site specific clearing of some common well grown trees Site specific loss of nesting / breeding habitat of common / generalist species of flora & fauna but will not result in permanent habitat loss Short term or long term impacts having potential to adversely affect the surrounding habitat character / habitat ecology / functioning of ecosystem Impact on surrounding agro-ecosystem / agriculture when physical parameters with marginal increase but can be mitigated. Or likely cumulative impact.
Major Consequence (Score – 4)	Site specific impact on threatened species but impacted species is widely distributed outside the project site. Short term impacts may lead to loss of abundance or extent, but unlikely to cause local population extinction Site specific habitat loss of Fauna listed in IUCN, WCMC, Birdlife International or any other international literature Impacts on habitats / ecosystems of international importance (e.g. Biosphere Reserves, Ramsar Sites)
Severe Consequence (Score – 5)	Impact on Notified Areas / species having legal protection under various acts / notifications including proposed area / species or under consideration. Species mentioned in Red Data Books published by Botanical Survey of India, Zoological Survey of India, any State Government Authority or Research / Educational of repute.

After identifying the severity of the consequence(s), the possibility of occurrence also needs to be estimated to visualise the entire gamut of biological impacts. Table 11.4 provides the probability ratings on a scale of 1 to 5. These ratings may be used for estimating the probability of each occurrence.

Table 11.4 : Occurrence Frequency Scheme

Description	Occurrence Frequency	Occurrence Frequency Score
Regular	Definite / constant / continuous event / each day	5
Frequent	Happen several times every year	4
Periodic	May happen a few time every year	3
Occasional	May happen few times during the project life cycle	2
Rare	Rare event during the projected life cycle or accidental / unintentional event	1

Biological Impact Score (BIS) is estimated by: $BIS = \text{Consequence Score (CS)} \times \text{Occurrence Frequency Score (OFS)}$.

It is to be noted that the BIS is a relative point score, rather than actual impact. The impact evaluation is carried out assuming an implementation of sound management procedures to maintain healthy environmental conditions.

Biological impacts are categorised into 3 (three) levels from Less Severe to Extremely Severe. Each level of impact needs different actions to mitigate properly as detailed in Table 11.5.



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Table 11.5 : Categorization of Biological Impacts

Score	Biological Impact	Necessary Action
>20	Extremely Severe	Proposed project activity should not proceed in current form unless clearance / approval / NOC (other than Env. Clearance) from competent authorities (e.g. Forest Clearance, Wildlife Clearance etc.)
11 - 20	Moderately Severe	Operation subject to management by operational controls. Proposed activity should be operated subject to strong management and strong operational controls / or modification
1 - 10	Less Severe	No immediate action required unless escalation of risk is possible. Operation subject to periodic monitoring / surveillance / observation

The following impacts have been identified on the basis of various project activities.

Table 11.6 : Likely Impacts on Biological Components on Account of COB - 5

Sl. No.	Proposed Project Activities	Aspects	Likely Impacts
Site Preparation Phase			
1.1	Site Clearance / Preparation	Clearance of vegetation	Loss of green cover Loss of animals' habitat
1.2	Excavation	Generation of fugitive dust, noise, ground vibrations (due to blasting of rocks). Dewatering of excavations.	Damage to vegetation due to dust deposition. Scaring away of fauna Damage to nearby buildings / structures. Depletion of ground water. Increased siltation in receiving water body.
1.3	Movement of heavy vehicles	Generation of fugitive dust, noise.	Damage to vegetation due to dust deposition. Scaring away of fauna
Construction Phase			
2.1	Operation of diesel powered material handling machinery	Emission of particulate matter & gases (NO _x , CO) from engines. Noise generation from engines.	Damage to vegetation and human health due to emissions from engines. Scaring away of fauna
2.2	Handling of construction material	Emission of particulate matter. Noise generation.	Damage to vegetation and human health from dust. Scaring away of fauna
2.3	Metal fabrication	Emission of particulate matter & gases (NO _x , CO) from metal cutting & / or welding. Noise generation.	Damage to vegetation and human health due to air emissions. Scaring away of fauna

Impacts on flora, fauna and habitats on account of COB-5 have been assessed on the basis of Biological Impact Score (BIS) as follows:



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Table 11.7 : Estimated Biological Impact Score (BIS) on Account of COB-5

Sl. No.	Likely Impact Description	Impact Scoring			Remarks
		CS	OFS	BIS	
Site Preparation Phase					
1	Loss of floral diversity: Project site encompassed common herbs, shrubs, grasses & small trees.	1	5	5	Less Severe
2	Loss of habitat and associated faunal diversity: Only common birds, small mammals & reptiles in a small area	1	5	5	Less Severe
3	Disturbance to fauna: Recorded species are very common ones. The project site is located within the integrated steel plant adjacent to existing COB-4.	1	5	5	Less Severe
Construction Phase					
4	Disturbance to fauna: Recorded species are very common ones. The project site is located within the integrated steel plant adjacent to existing COB-4. Moreover this is a temporary phase	1	5	5	Less Severe
5	Damage to vegetation due to dust deposition	2	4	8	Less Severe

Most of the biological impacts of the new COB-5 are classified as “Less Severe” as the project is located within the premises of an existing integrated steel plant adjacent to the existing operating COB-4. Part of the project site had no vegetation as it comprised of coal storage area; the rest of the site had sparse vegetation comprising of herbs shrubs and small trees. The nearest human habitation is ~4.2 km away and the nearest agricultural lands are about 8 km away across the rest of the steel plant and part of Visakhapatnam city. There are some Reserve Forests on the northern side of the steel plant, which have been created as part of the conditions stipulated in the Environmental Clearance granted to the plant. The operation of the integrated steel plant has not caused any visible injuries to the vegetation immediately **outside the steel plant’s boundaries**.

Mitigation Measures:

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.

b) New Reservoir

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



Photo 11.G: View of the Under-Construction New Water Reservoir (as on 23-07-18)



Photo 11.H: View of the Under-Construction New Water Reservoir (as on 23-07-18)



The site of the reservoir was an expanse of scrub land.



Fig. 11.7 : Google Earth Image of 13th April, 2018 of Site of New Water Reservoir



Fig. 11.8 : Google Earth Image of 15th Feb., 2015 of Site of New Water Reservoir



The vegetation consisted primarily of trees such as *Acacia nilotica*, *Prosopis juliflora* *Cassia siamea*, *Azadirachta indica*, *Borassus flabellifer*, shrubs such as *Calotropis gigantea*, *Ricinus communis*, *Jatropha gossypifolia*, herbs such as *Argemone mexicana*, *Parthenium hysterophorus*, *Datura spp.*, *Tridax procumbens*, *Mimosa pudica* etc. and grasses. Some of

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the original vegetation is still present at the edge of the reservoir site (see Photo eh).

Photo 11.1: Remnants of Natural Vegetation at Site of Under-Construction New Water Reservoir (*Prosopis juliflora* & *Parthenium hysterophorus* visible)



Based on studies of nearby areas, one can say that the fauna of this area comprised of squirrels, mongooses, common snakes (rat snakes, cobras), garden lizards, skinks and common birds.

The biological impacts of the New Reservoir are listed in Table 11.7.

Table 11.8 : Likely Impacts on Biological Components on Account of New Reservoir

Sl. No.	Proposed Project Activities	Aspects	Likely Impacts
Site Preparation Phase			
1.1	Site Clearance / Preparation	Clearance of vegetation	Loss of green cover Loss of animals' habitat
Construction Phase			
2.1	Excavation	Generation of fugitive dust, noise, ground vibrations (due to blasting of rocks). Dewatering of excavations.	Damage to vegetation due to dust deposition. Scaring away of fauna Damage to nearby buildings / structures. Depletion of ground water. Increased siltation in receiving water body.
2.2	Movement of heavy vehicles	Generation of fugitive dust, noise.	Damage to vegetation due to dust deposition. Scaring away of fauna
2.3	Construction of embankments, concreting of banks and construction of pipelines	Generation of fugitive dust, noise.	Damage to vegetation due to dust deposition. Scaring away of fauna

Biological Impact Score (BIS) has been estimated by: BIS = Consequence Score (CS) x Occurrence Frequency Score (OFS) (refer Table 11.3, Table 11.4 and Table 11.5 above).



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Table 11.9 : Estimated Biological Impact Score (BIS) on Account of New Water Reservoir

Sl. No.	Likely Impact Description	Impact Scoring			Remarks
		CS	OFS	BIS	
Site Preparation Phase					
1	Loss of floral diversity: Project site encompassed common herbs, shrubs, grasses & small trees.	3	5	15	Moderately Severe
2	Loss of habitat and associated faunal diversity: Only common birds, small mammals & reptiles in a small area	1	5	5	Less Severe
3	Disturbance to fauna: Recorded species are very common ones.	1	5	5	Less Severe
Construction Phase					
4	Disturbance to fauna: Recorded species are very common ones.	1	5	5	Less Severe
5	Damage to vegetation due to dust deposition	2	5	10	Less Severe

Degree of damage:



The new production units are coming up inside the existing premises of the operating integrated steel plant and at a considerable distance (>4 km) from the nearest human habitation and (>8 km) from the nearest agricultural land. There is no visible injury to vegetation, which can be attributable to the steel plant. There has been no large scale damage to ecology as indicated by the low Biological Impact Scores (BIS) which are mostly **less than 10 (i.e. classified as "Less Severe")**. **In a few cases the BIS is 15 i.e. "Moderately Severe"**. **But in these cases, the damages shall be offset by Beneficial Impacts and comprehensive innovative mitigation measures (e.g. Using fishes to control breeding of mosquitoes), which will benefit the local ecology.**

The damage degree is based on the average BIS score calculated in the above sections for all impacts identified, based on the categorization as indicated below.

Sn.	BIS Score	Damagedegree	Damage impact
1.	[1 to 5)	1.0	Insignificant damage
2.	[5 to 10)	2.0	Minor Damage
3.	[10 to 15)	3.0	Moderate Damage
4.	[15 to 20)	4.0	Major Damage
5.	[20 to 25]	5.0	Severe Damage

Thus the damage score calculated for ecological damage due to construction activities is as given below:

Impacts identified	Average BIS Score	Calculated Damage degree (based on average BIS score)
<ul style="list-style-type: none"> • Loss of floral diversity: Project site encompassed common herbs, shrubs, grasses & small trees. • Loss of habitat and associated faunal diversity: Only common birds, small mammals & reptiles in a small area • Disturbance to local fauna • Damage to vegetation due to dust deposition 	6.8	2.0

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The above indicates that the overall damage on the ecological environment estimated due to the construction activities is minor in nature.

Environmental significance of damage:

The construction activities has the potential to negatively impact the existing biological environment, which in turn will be significant to the natural resources and its degradation (Nr). Thus, the overall environmental significance weightage is calculated below:



Environmental Significance weightage based on Potential for			Overall environmental significance weightage
Health Risks (Hr=2)	Natural resource degradation (Nr=1.5)	Community resource damage (Cr=1.2)	
N	Y	N	1.5

11.5.2.6 Socio-economic condition

Damages:

The construction activities that can have probable negative impacts on the socio-economic condition of the area are emission of pollutants from vehicular movement and site construction activities in the air leading to degradation of health of the people. Also, an increase in construction labour will lead to stress on the existing infrastructure of the area. The worker influx may also lead to increase in criminal activity as well as reduced access to community infrastructure. However, the construction activities also generated employment opportunities for the semi-skilled and unskilled population of the area. The impacts of the construction phase on the socio-economic condition of the area are as listed below:

- 1) Employment opportunities:
 - The construction activities involved generation of both direct and indirect employment, which positively affected the economy of the study area.
- 2) Damage to Human Health:
 - The emissions due to construction activities were confined within the plant boundary and anticipated GLCs outside plant boundary are insignificant. No significant damage to Human health is expected to have occurred due to the construction activities (refer section 11.5.2.2 above).
 - Arrangements were made by VSP with local district health authorities along with their own medical facilities and manpower resources to hold periodical medical camps for the construction laborers at regular intervals.
 - VSP also developed no. of community toilets at various strategic locations inside the plant as well as in Visakhapatnam Steel Township.
- 3) Disturbance to local inhabitants of the area
 - Construction activities for the expansion/**revamping activities of RINL's VSP** was carried out well within the plant premises, and hence did not require additional acquisition of land and hence no resettlement or rehabilitation was required. However, an increase in influx of construction workers may have affected the availability of community resources to the local inhabitants. Also, an increase in criminal activity in the area might have also been probable.

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Degree of damage:

The degree of damage to socio-economic conditions is difficult to quantify as these impacts are perceptible and depends on extensive surveys. For assessing the same, degree of damage was estimated on the qualitative assessment of the magnitude of the positive as well as negative impacts. Thus, the degree of damage has been considered as 1.0. However, the significance of the damage is quantified based on the impacted component of the environment.

Negative impacts	Positive impacts	Calculated Damage degree
<ul style="list-style-type: none"> • Damage to air environment due to vehicular emissions and fugitive emissions due to site activities. • Influx of construction labour leading to increase in demand on public amenities such as water, power, etc. • Increase in labour influx leading to increase in slight criminal activity. • Reduced accessibility of community resources for local inhabitants. 	<ul style="list-style-type: none"> • Increase in employment opportunity created due to the construction activity of the RINL's VSP, thus generation of income is resulted. 	1

Environmental significance of damage:

The construction activities has the potential to negatively impact the existing human health (Hr) as well as community resources (Cr). However, the employment generation in the area is positively impacted due to the activities also. Thus, the overall environmental significance weightage is calculated below:

Environmental Significance weightage based on Potential for			Overall environmental significance weightage
Health Risks (Hr=2)	Natural resource degradation (Nr=1.5)	Community resource damage (Cr=1.2)	
Y	N	Y	2.4

11.5.3 Impacts during Operation Prior To Getting EC And Economic Benefits Derived Due to Violation

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. The time table for these plant developmental activities is given in Table 11.10.



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Table 11.10 : 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
1.	BF1 Revamping																							
2.	SMS2 Converter 3																							
3.	SMS2 Caster 4																							
4.	COB 5																							
5.	BF2 Revamping																							
6.	SP1 Revamping																							
7.	SP2 Revamping																							
8.	New Rebar Mill																							

Impacts 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 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.

Impacts due to Expansion/revamping Units (BFs 1 & 2, SP1 & SMS2)

For the units, which have undergone expansion/revamping, only the production, which is in excess of the rated capacity of the particular unit as per EC for 6.3 MTPA stage, shall be considered for impact prediction.

a. Blast Furnaces

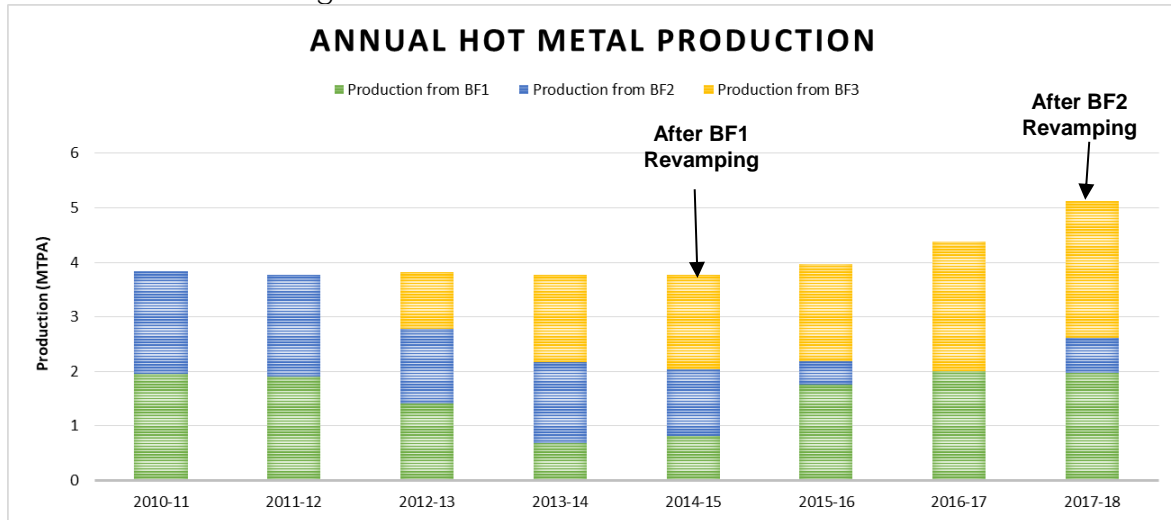
A graph showing trend of actual Hot Metal productions in the last few years is shown in Fig 11.9.



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Fig. 11.9 : Trend of Production of Hot Metal

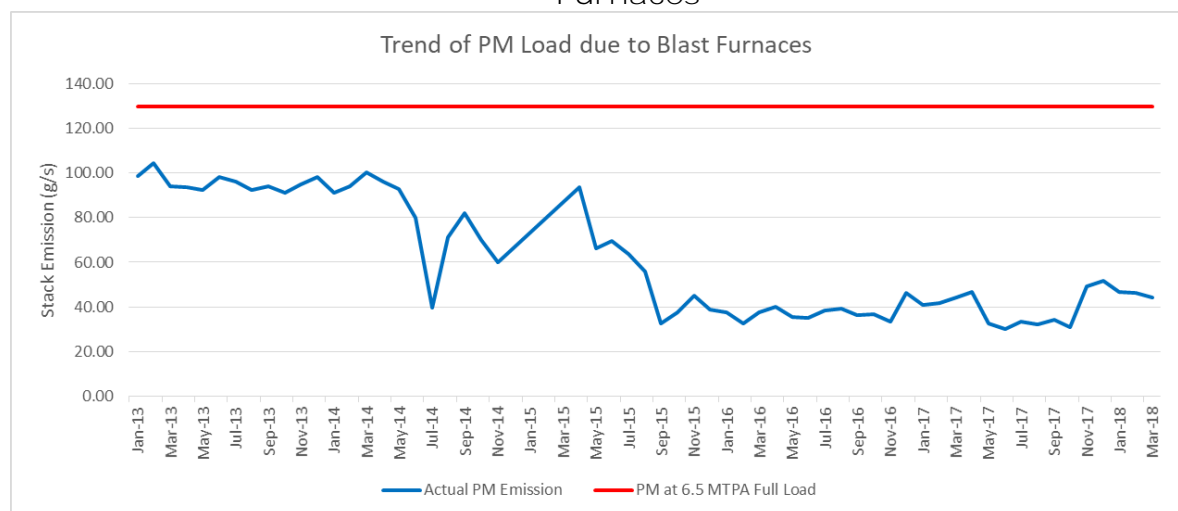


At 3.5 MTPA stage, RINL was having 2 X 2.0 MTPA hot metal production capacity. After expansion to 6.3 MTPA stage, a new BF3 of 2.5 MTPA was installed. The unit new was commissioned in 2012-13.

From the graph, it is evident that the gross hot metal production from all three blast furnaces has never exceeded maximum permitted capacity of 6.5 MTPA. The two existing blast furnaces #1 & #2 have continually been operated at near maximum capacity of 2.0 MTPA each. And even after revamping/expansion, the net hot metal production from BF1 has not exceeded permitted capacity of 2.0 MTPA as per EC for 6.3 MTPA stage. Therefore, no economic benefit has been derived out of violation by expansion of existing BF1 & BF2.

A graph showing monitored stack emission value of existing blast furnaces is shown in Fig 11.10.

Fig. 11.10 : Graph showing trend of emissions from existing Blast Furnaces



From the above two graphs, it can be concluded that keeping in touch with the latest environmental norms, RINL has continually upgraded the pollution control devices of the existing plant, thereby continually decreasing the emitted pollution load. In the last 5 years, RINL is gradually increasing the gross hot metal production, while the pollution load has been

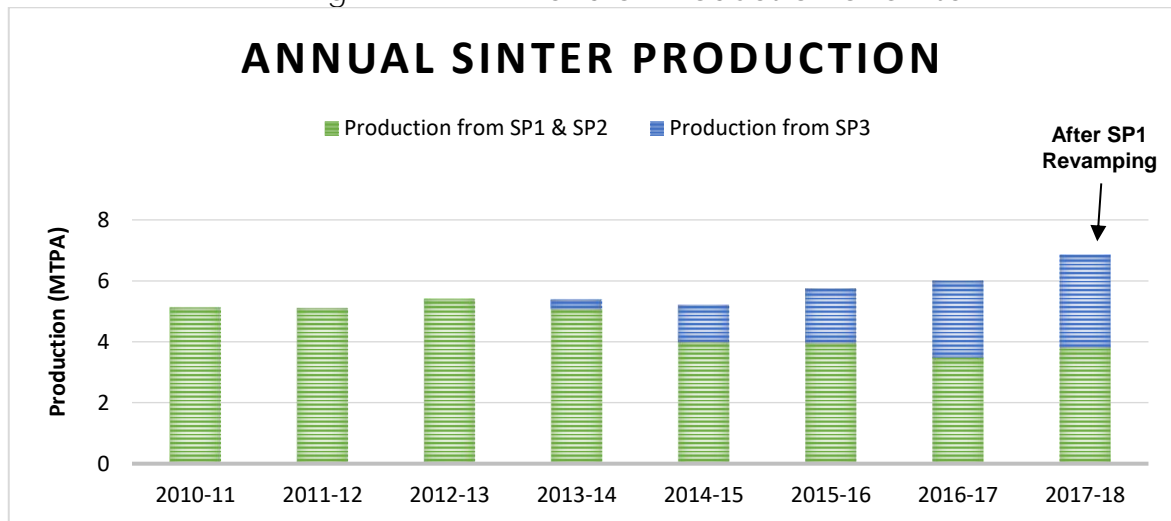
reduced to almost half. This has resulted in a reduction in specific emissions from blast furnaces. This can be attributed to the enhancements in pollution control devices which have been done as part of the revamping activities.

Therefore, a positive impact on ambient environment is observed.

b. Sinter Plants

A graph showing trend of actual sinter productions in the last few years is shown in Fig 11.11.

Fig. 11.11 : Trend of Production of Sinter

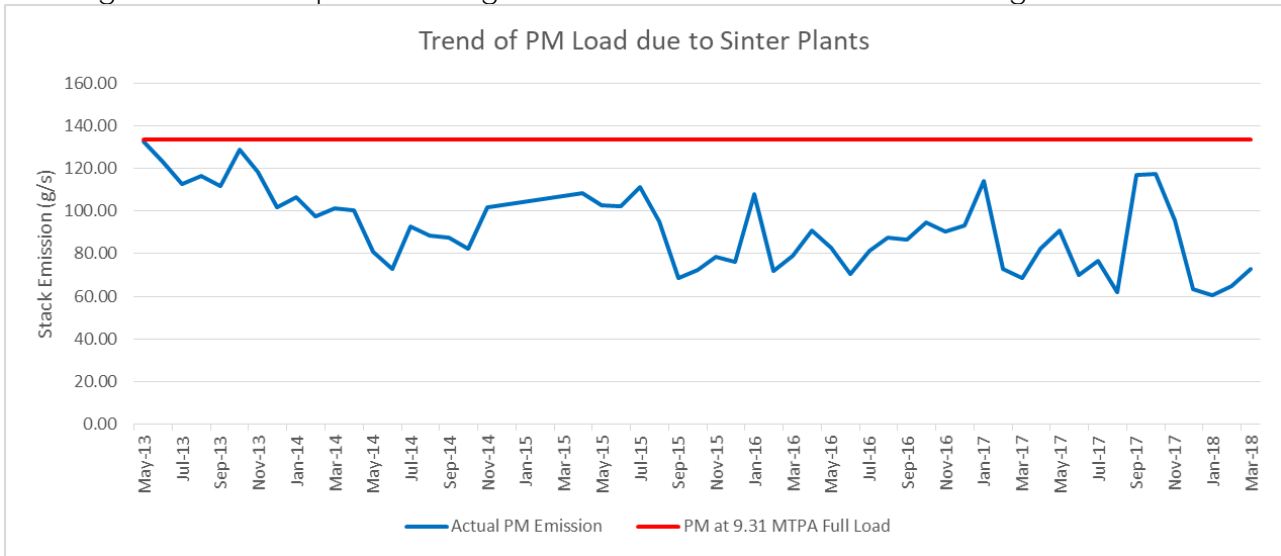


As described earlier, RINL is having two sinter plant complex housing 3 sinter machines. Sinter machine 1 & 2 are housing in the same complex. The maximum rated capacity of Sinter Plants 1 & 2 is 5.7 MTPA and that of SP3 is 3.61 MTPA. The gross total sinter production capacity of the plant stands at 9.31 MTPA as per EC.

From the above graph, it is evident that even though RINL is gradually increasing the gross sinter production each year, the rated capacity of 9.31 MTPA as per EC for 6.3 MTPA stage has never been achieved. The maximum total production from SP1 & SP2 stands at 5.4 MTPA which was achieved during 2012-13. And even after enhancement of production capacity of SP1 in 2017, the total production from machine 1 & 2 has not exceeded the maximum permitted capacity of 5.7 MTPA. Therefore, no economic benefit has been derived out of violation by expansion of existing SP1.

A graph showing monitored total stack emission loads of existing sinter plants is shown in Fig 11.12.

Fig. 11.12 : Graph showing trend of emissions from existing Sinter Plants

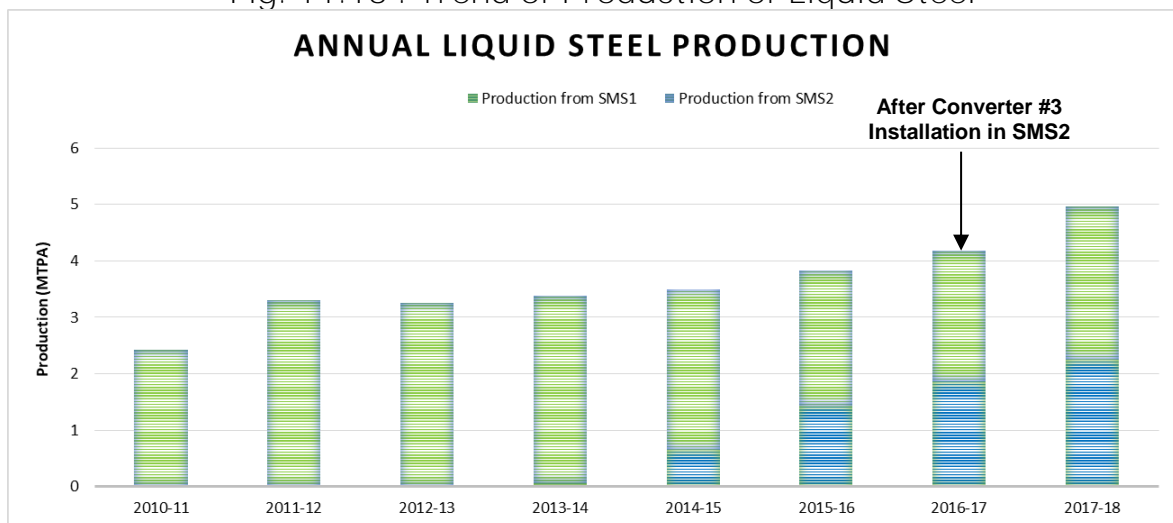


From the above two graphs, it can be concluded that even though RINL is gradually increasing the gross sinter production, a downward trend in emission loads is observed. This has resulted in an overall decrease in specific emission loads. The total emissions from the sinter plant has never exceeded the permitted emission level at full loads. A slight positive impact is observed on ambient air due to reduction in specific pollution loads.

c. Steel Melting Shops

A graph showing trend of actual Liquid Steel productions in the last few years is shown in Fig 11.13.

Fig. 11.13 : Trend of Production of Liquid Steel



Initially, the RINL was having one SMS complex with 3 converters having a total production capacity of 3.5 MTPA. After getting prior EC for expansion from 3.5 MTPA to 6.3 MTPA, a new SMS complex was installed with two converters having a total production capacity of 2.8 MTPA. The production from the new SMS complex started at the end of 2013-14. Since then



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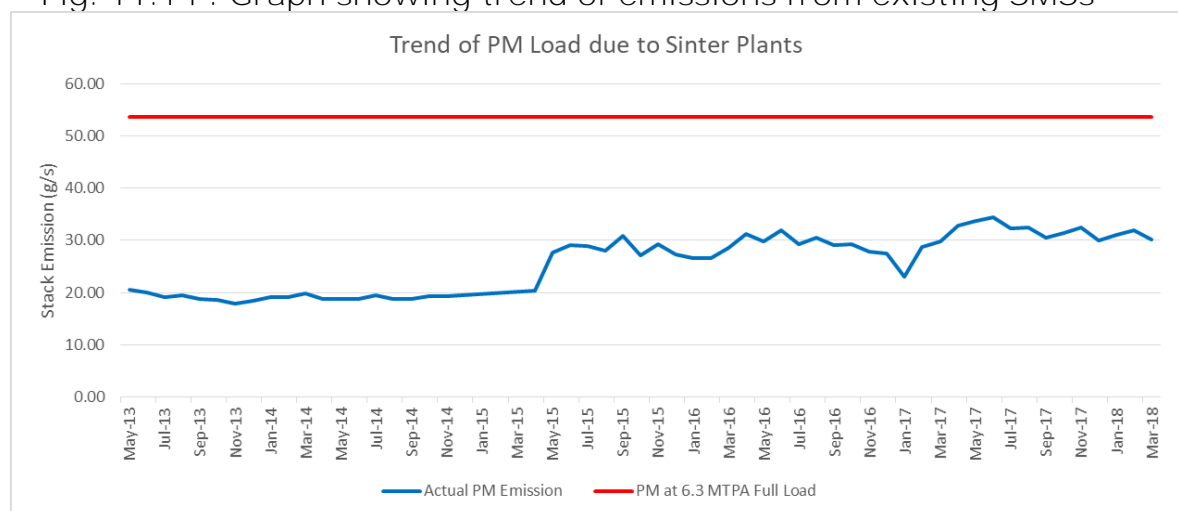
the production of liquid steel from SMS2 has gradually increased and reached a maximum of 2.25 MTPA in 2017-18.

A new converter 3 was installed and commissioned in SMS2 on 28/12/2017. Since the date of commissioning, the newly installed converted has been used as standby converter i.e. out of three converters only two have been used at a time. This arrangement has limited the maximum production capacity of SMS2.

From the graph, it is evident that the total hot metal production from two SMSs has never exceeded maximum permitted capacity of 6.3 MTPA as per EC. Therefore, no economic benefit has been derived out of violation by installation of new converter in within the existing SMS2 complex.

A graph showing monitored stack emission value of existing SMS complexes is shown in Fig 11.14.

Fig. 11.14 : Graph showing trend of emissions from existing SMSs

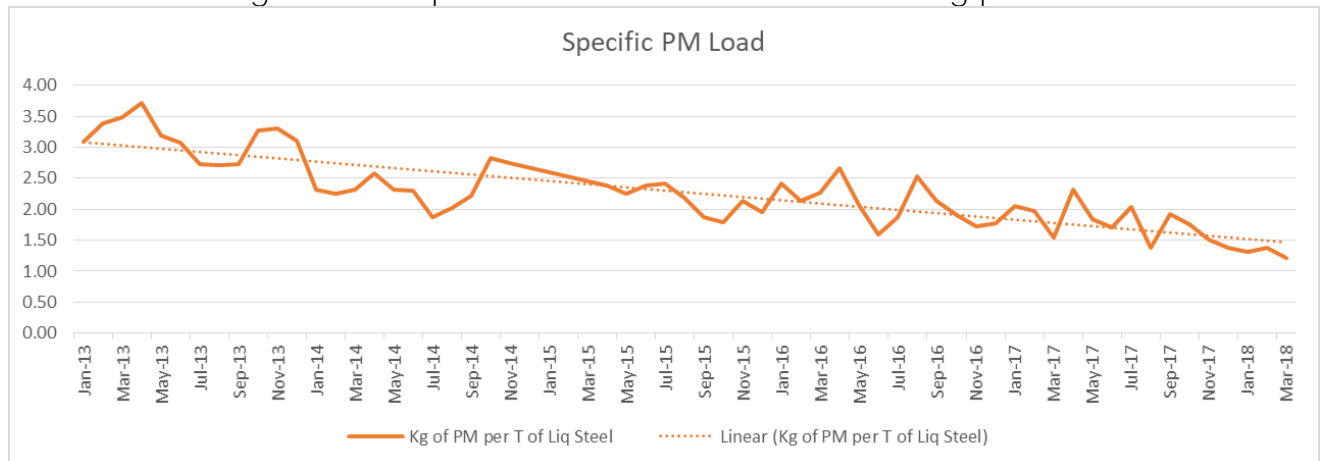


From the above two graphs, it is observed that liquid steel production is gradually increasing every year. A similar trend is observed in emission loads. However, rate of increase of pollution loads is much less as compared with rate of increase of production. Therefore, a slight decrease in specific emission rate is observed in last two years. And even though the annual production in 2017-18 was around 5 MTPA (~80% of approved capacity as per EC), the total pollution load was observed around 55% of the maximum load at 6.3 MTPA stage. This can be attributed to the enhancement in existing pollution control devices which has been done as part of the revamping activities.

d. 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 11.15.

Fig. 11.15 : 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.

In order to simulate the actual scenario, contribution of RINL-VSP on ambient air quality is estimated using AERMOD dispersion model using actual monitored stack emission values of May 2018 for all the existing stacks of VSP. Based on this data, total pollution loads for all the units installed at present were calculated to be 813 Kg/hr for PM, 2649 Kg/hr for SO₂ and 2034 Kg/hr for NO_x. These inputs were used to simulate the present contribution of RINL-VSP on ambient air quality using AERMOD dispersion model.

The results show a net decrease in ground level concentrations (GLCs) when compared with **the plant's GLCs at 100% operational capacity at 6.3 MTPA Stage. As RINL has** only achieved 80 % of the maximum rated capacity till date, it is observed that actual contribution of plant is much less than compared with GLCs when plant is running 100 % capacity.

Hence, it can be concluded that even though some of the units of the plants have been expanded to provide respective outputs at 7.3 MTPA stage of steel production capacity, none of the units have exceeded their actual production in excess of the approved capacity as per 6.3 MTPA EC. Moreover, at present, the plant is actually producing less than the approved capacity of 6.3 MTPA and at the same time, the emission loads are significantly less than the proportionate values of actual production.

11.5.3.1 Ambient Air Quality

Damages:

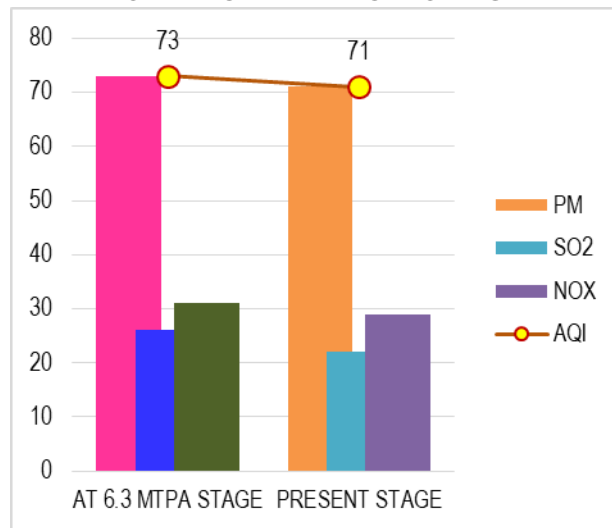
As discussed in the preceding paragraphs, the impact of operation of the units already commissioned under the expansion/revamping project of RINL is minimal (as the plant is still **not able to achieve its existing rated capacity of 6.3 MTPA**), when compared with the project's impacts as envisaged at rated capacity of 6.3 MTPA for which EC has already been granted.

Degree of damage:

Contribution of RINL-VSP on ambient air quality is simulated using AERMOD dispersion model utilizing actual monitored stack emission values of May 2018 for all the existing stacks of VSP for the actual scenario. Based on this data, the individual contribution to total pollution loads

for all the units installed at present were calculated and the net total ambient air quality at each station was estimated. This estimated ambient air quality values were used to calculate the corresponding AQI values (as per method elaborated in section 11.5.2.2 above) and again compared with the AQI values of the plant at its rated capacity. The same is shown in Fig. 11.16 below:

Fig. 11.16 : AMBIENT AIR QUALITY AT EC STAGE OF 6.3 MTPA AND AT PRESENT OPERATION STAGE



Note: Concentration of PM, SO₂ and NO_x in µg/m³

The above indicates a reduced impact of present operational activities of RINL as compared to the impact of the plant at the capacity of 6.3 MTPA for which it already has obtained EC. Thus, the operation of the expansion units of RINL, although are in violation of the existing regulatory framework and the provisions of the EIA Notification, 2006 with amendments thereto, have not caused any significant damage to the air environment as compared to its impact if it would have been running at 100% rated capacity of 6.3 MTPA, for which it has already been granted EC.



Based on the above, the degree of damage is calculated as shown below:

AQI at 6.3 MTPA EC stage	Average AQI at present operational stage	AQI Change index (Ai)/ Damage degree	Inference on quality
73	71	1	Minor breathing discomfort to sensitive people

The above change in AQI values indicates there is no significant negative impact of operation of expansion/revamped units of RINL on the air environment.

Environmental significance of damage:

The operation of expansion/revamped units of RINL comprising of process emissions as well as fugitive emissions, has the potential to negatively impact the existing natural vegetation (Nr) as well as poses risks of degradation of human health (Hr) due to inhalation of polluted air. The deposition of air pollutants in nearby water sources and soil may also affect the community resources (Cr) in the area, contamination of water

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reserves. The overall environmental significance weightage is calculated below:

Environmental Significance weightage based on Potential for			Overall environmental significance weightage
Health Risks (Hr=2)	Natural resource degradation (Nr=1.5)	Community resource damage (Cr=1.2)	
Y	Y	Y	3.6

Mitigation Measures Undertaken

In order to mitigate various impacts of air pollution during the operation phase, the following measures are being implemented in the installed new as well as expansion/revamping units:

Table 11.11 : Air Pollution Control Measures in installed Plant Units

Sl. No.	Unit	Details of APC	Design Limit
1.	Raw Material Handling System	<ul style="list-style-type: none"> • Covered conveyors • DFDS • DE system for material transfer points 	• DE stack outlet < 50 mg/Nm ³
2.	Sinter Plant	<ul style="list-style-type: none"> • Process Flue gas cleaning • Stock House dedusting • Sinter cooler DE system 	• Stack dust level < 50 mg/Nm ³
3.	Coke Ovens	<ul style="list-style-type: none"> • Charging & Pushing emissions control • CDQ • Waste heat recovery 	• DE stack outlet < 50 mg/Nm ³
4.	Blast Furnace	<ul style="list-style-type: none"> • Cast House Dedusting • Stock House dedusting 	• Stack dust level < 50 mg/Nm ³
5.	Steel Melting Shops	<ul style="list-style-type: none"> • Secondary emission control 	• Stack dust level < 50 mg/Nm ³
6.	RMP Kilns	<ul style="list-style-type: none"> • Process Flue gas cleaning 	• Stack dust level < 50 mg/Nm ³
7.	CPP Boilers	<ul style="list-style-type: none"> • Process Flue gas cleaning 	• Stack dust level < 50 mg/Nm ³

11.5.3.2 Water resource and Waste water Management

Impacts:

Total make-up water requirement for the existing steel plant at 6.3 MTPA stage is about 1,36,350 m³/day (30 MGD) and for township and others it is at 36,360 m³/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 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 m³/hr) of Coke oven and RO plant rejects is discharged into Sea after treatment to meet effluent discharge standards.



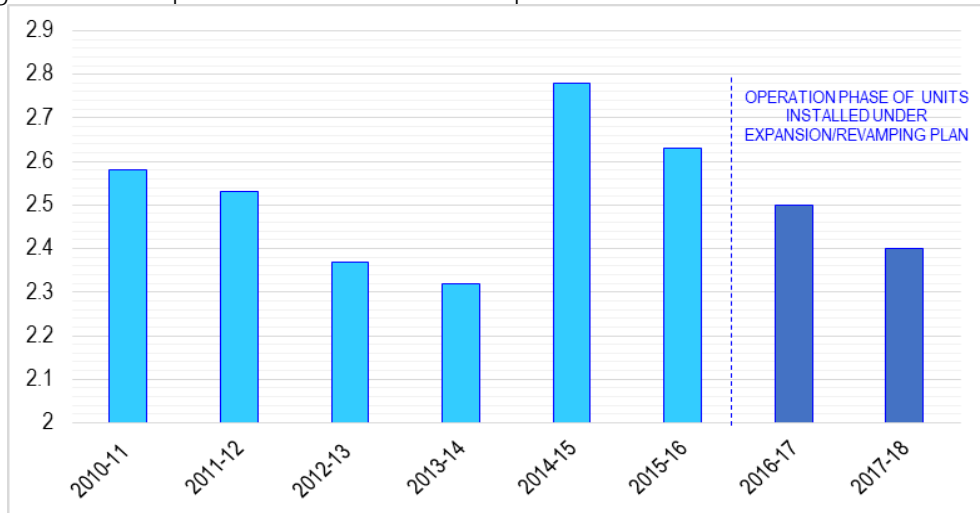
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The existing water requirement inclusive of the installed units under expansion/revamping units is lesser than the withdrawal quantity of 45 MGD for which RINL has already been accorded permission. Thus, the operational phase does not require any additional 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 Fig. 11.17 below.

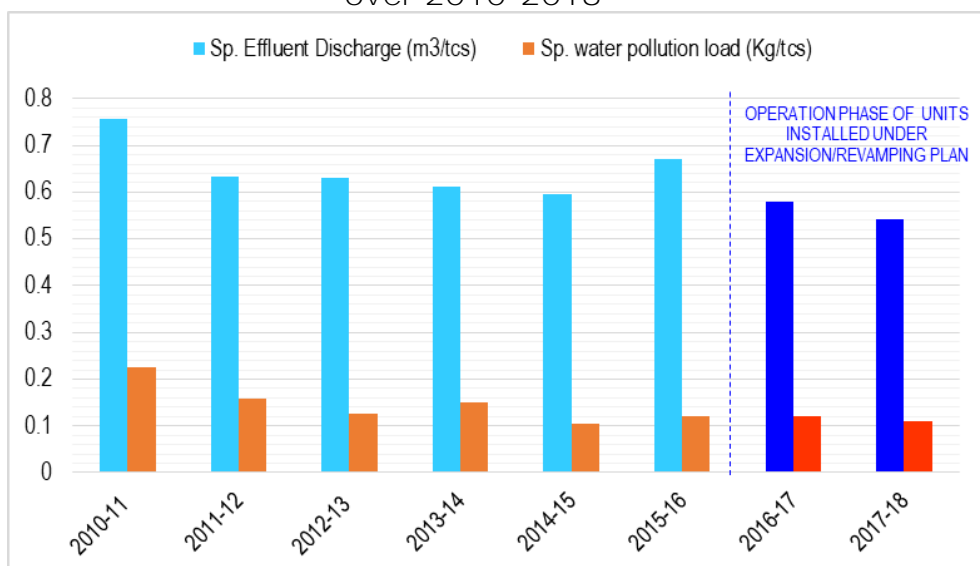
Fig. 11.17 : Specific water consumption trend over 2010-2018



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 11.18.

Fig. 11.18 : 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.

Degree of damage:

The average specific effluent discharge before the installation and operation of units under expansion/revamping units is estimated to be ~0.7 m³/tcs while the specific water pollution load for the same duration is estimated to be ~0.19 Kg/tcs. The values for the operation phase has been compared with the values during this duration for estimating the damage degree as follows:

Sn.	Increase in specific effluent discharge over control period	Increase in specific water pollution load over control period	Damage Grade (G _N)	Damage impact
1.	<20%		1.0	Minimal impact on existing water regime.
2.	20% to 40%		2.0	Significant impact on existing water resources. Existing water treatment systems may be upgraded for reducing the water pollutant load. Implementation of water recycling schemes for reduced effluent generation needs to be planned and implemented.
3.	40% to 60%		3.0	Moderate impact. Needs immediate and constant monitoring of effluent quality to ensure no further increase in pollutant load.
4.	60% to 80%		4.0	High impact on existing water resources. Needs effective treatment systems for reducing pollutant load. Needs reduction in generation of effluent quantity by extensive recycling, reuse mechanisms.
5.	80% to 100%		5.0	Very high impact on existing water resources. Needs additional conservation measures for preservation of natural water resources as well as creation of artificial water reserves for augmenting clean water availability in the area.
6.	>100%			



Based on the above, the degree of damage is calculated as shown below:

Specific effluent discharge (m ³ /tcs)			Specific water pollution load (kg/tcs)			Damage degree
Control period	Impact period	% change	Control period	Impact period	% change	
0.69	0.55	-20%	0.19	0.17	-10%	1

The above change in specific effluent discharge and specific water pollutant load indicates there is no significant negative impact of operation of expansion/revamped units of RINL on the water environment.

Environmental significance of damage:

The operation of expansion/revamped units of RINL comprising of wastewater generation

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as well as water consumption for operation of units under RINL's expansion/revamping project has the potential to negatively impact the availability of water in existing community water resources as well as pose risks of degradation of human health (Hr) due to contamination. The overall environmental significance weightage is calculated below:

Environmental Significance weightage based on Potential for			Overall environmental significance weightage
Health Risks (Hr=2)	Natural resource degradation (Nr=1.5)	Community resource damage (Cr=1.2)	
Y	N	Y	2.4

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 in the plant and the overflow is let 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.

11.5.3.3 Noise management

Impacts

During normal operations of the plant, ambient noise levels increase close to the compressors and blowers but this is confined only within plant boundary and that too within shops. The level is further minimized when the noise reaches the plant boundary and the nearest residential areas beyond the plant boundary. The noise levels of these equipment and machinery, usually are in the range of 90-100 dB(A) at 1 m from source. The estimated increase in the



Degree of damage:

The CPCB standards for noise levels during the day and night for Industrial area, Sensitive areas and Residential areas are as indicated below:

CPCB Noise level Standards.	Industrial Areas	Sensitive areas	Residential areas
	75	50	55
	70	40	45

To quantify the intensity of damage that may have been caused due to the increase in noise levels at the nearest residential area and compared with the minimum noise level which has no severe impact (i.e. minimum background noise level). The same is indicated in Table 11.1 in section 11.5.2.3 above:

Based on the above, the degree of damage due to increased noise levels during operation phase is estimated and presented below:

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Minimum Background noise level	Increased noise level at nearest habitation	Change in Damage grade	Calculated Damage degree
52.3 dB(A)	52.4 dB(A)	0.1 dB(A)	1
<i>Damage grade = 3.0</i>	<i>Damage grade = 3.0</i>	Change = 0.0	
$\text{Noise level grade index (Ni)} = \frac{G_{N(\text{Impact})} - G_{N(\text{Control})}}{G_{N(\text{Control})}} + (G_{N(\text{Impact})} - 2)$			

The above change indicates no significant change in noise levels in the area due to operation of the plant units. However, the noise levels in the habitation area is already higher which makes it susceptible to deterioration on small increase in noise levels due to any external factor.

Environmental significance of damage:

The operation activities comprising of operation of high noise equipment such as compressors etc. has the potential to negatively impact the existing human health (Hr) due to increase in noise levels. The overall environmental significance weightage is calculated below:

Environmental Significance weightage based on Potential for			Overall environmental significance weightage
Health Risks (Hr=2)	Natural resource degradation (Nr=1.5)	Community resource damage (Cr=1.2)	
Y	N	N	2

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, personnel working are 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 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.
- 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:

- Un-manned high noise zone are marked as "High Noise Zone".



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- In shops where measures are not feasible, operators are provided with soundproof enclosure to operate the system.
- Workers exposed to noise level are provided with protection devices like earmuffs and are advised to use them regularly, while at work.
- Workers exposed to noisy work place are provided with rotational duties.
- 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 depths within and surrounding plant premises further attenuate the sound levels reaching the receptors within and outside the plant premises.

11.5.3.4 Land Environment

Damages:

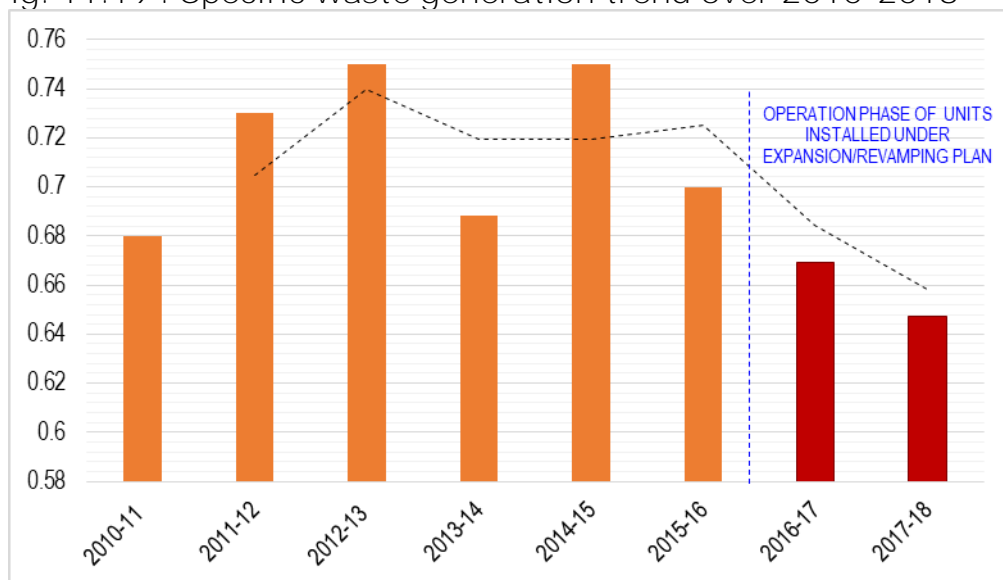
The operation of units under the expansion/revamping project of RINL has been installed within the premises of existing RINL steel plant. Hence, no land acquisition was required for the project and consequently, no changes in existing land use of the area is indicated.

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 – 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

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 Fig 11.19.

Fig. 11.19 : Specific waste generation trend over 2010-2018



As evident from the above trend variation of specific waste generation, it is easily deduced

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that the operation of the units installed under expansion/revamping plan of RINL did not lead to additional generation of solid waste, consequently leading to increase in load on the existing land resources for waste management as well as risk to contamination of existing **soil quality. The reducing trend indicates an improvement of plant's waste recycling**, reuses as well as optimized raw material utilization leading to lesser generation of waste and efficient resource management.

Degree of damage:

The average solid waste generation before the installation and operation of units under expansion/revamping units is estimated to be 0.705 t/tcs. The values for the operation phase has been compared with the values during this duration for estimating the damage degree as follows:

Sn.	Increase in specific waste generation over control period	Damage Grade (Gs)	Damage impact
1.	<20%	1.0	Minimal impact on existing land.
2.	20% to 40%	2.0	Significant impact on existing land resources. Up-gradation of solid waste management systems to be explored and implemented.
3.	40% to 60%	3.0	Moderate impact. Needs immediate and constant monitoring of waste generated to ensure no further increase in waste loading on the environment.
4.	60% to 80%	4.0	High impact on existing land resources. Needs up-gradation in process/technology for reducing waste generation from process. Needs up-gradation of existing waste disposal and recycling systems.
5.	80% to 100%	5.0	Very high impact on existing land resources. Needs overhaul of process and alternate production technology to be explored for low waste generating processes. Extensive waste recycling and reuse system to be implemented.
6.	>100%		

Based on the above, the degree of damage is calculated as shown below:



Specific effluent discharge (t/tcs)			Damage degree
Control period	Impact period	% change	1
0.705	0.66	-6.4%	

The above change in specific waste generation load indicates there is no significant negative impact of operation of expansion/revamped units of RINL on the land environment.

Environmental significance of damage:

The operation of expansion/revamped units of RINL comprising of waste generation under **RINL's expansion/revamping project has the potential to negatively impact the availability of land** as well as deterioration of soil quality in the area due to leaching in the soil. The overall environmental significance weightage is calculated below:

Environmental Significance weightage based on Potential for			Overall environmental significance weightage
Health Risks (Hr=2)	Natural resource degradation (Nr=1.5)	Community resource damage (Cr=1.2)	

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N	Y	N	1.5
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Mitigative Measures Undertaken

Most of the wastes generated are reused / re-utilised within the plant. 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. 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 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.

11.5.3.5 Ecological environment

Damages:

The units installed and under operation of the expansion/revamping project of RINL were investigated and the ecological damages have been identified for the units. Specific site investigation was carried out for the new Coke Oven battery (COB-5) under operation and new Kanithi Balancing reservoir (KBR-2), owing to their higher potential for ecological damage due to their higher proximity to natural habitats in the study area as compared to other units. The same is elaborated below in subsequent paragraphs.

a) New Coke Oven Battery:



The likely impacts of operation of a coke oven battery are mostly attributed to handling of coal, coking process, handling of hot coke (including quenching), recovery of By-products etc.

The detailed discussion of the impacts has already been done in section 11.5.2.5 above. As elaborated in this section, BIS (Biological Impact assessment) scoring has been used to quantify the magnitude of damages probably caused due to a project activity.

The following impacts have been identified on the basis of various project activities during operation of COB-5.

Table 11.12 : Likely Impacts on Biological Components on Account of COB - 5

Sl. No.	Proposed Project Activities	Aspects	Likely Impacts
Operation Phase			
1.1	Handling of coal	Generation of fugitive dust	Damage to vegetation and human health due to airborne dust
1.2	Coking process	Emission of particulate matter & gases (NO _x , SO ₂ , CO, H ₂ , CH ₄ , NH ₃ , C ₂ H ₆ , C ₆ H ₆ , Phenols, H ₂ S etc.)	Damage to vegetation and human health
1.3	Handling of hot coke (including quenching)	Emission of particulate matter, gases and heat	Damage to vegetation and human health
1.4	Recovery of By-products	Gaseous emissions	Damage to human health
1.5	Operation of ETP	Generation & release of waste water	Contamination of receiving water body & surrounding habitats

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Impacts on flora, fauna and habitats on account of COB-5 operation have been assessed on the basis of Biological Impact Score (BIS) as follows:

Table 11.13 : Estimated Biological Impact Score (BIS) on Account of COB-5

Sl. No.	Likely Impact Description	Impact Scoring			Remarks
		CS	OFS	BIS	
Operation Phase					
1	Damage to vegetation due to exposure to process emissions: Project site located inside integrated steel plant far from any major ecosystem.	2	5	10	Less Severe
2	Damage to human health due to exposure to process emissions and heat: Only the workers at the COB are at risk. Nearest populations centre is too far to be affected.	2	5	10	Less Severe
3	Disturbance to fauna: Recorded species are very common ones. The project site is located within the integrated steel plant adjacent to existing COB-4. Other ecosystems / habitats are too far to be affected.	1	5	5	Less Severe
4	Contamination of receiving water body & surrounding habitats due to discharge of treated effluents: Part of treated effluents utilised for industrial purposes in plant. Balance discharged after quality checks.	3	4	12	Moderately Severe

Most of the biological impacts of the new COB-5 are classified as “Less Severe” as the project is located within the premises of an existing integrated steel plant adjacent to the existing operating COB-4. The operation of the integrated steel plant has not caused any visible injuries to the vegetation immediately outside the steel plant’s boundaries.

Mitigation measures

- About 90% of the coking coal used by Visakhapatnam Steel Plant is imported. The imported coking coal is unloaded at Gangavaram Port located just beyond the steel plant’s north-eastern boundaries and transported to the coking coal storage yard of the steel plant by a ~1.6 km long conveyor. This conveyor is partially covered. The partially covered conveyor shall be converted into a fully covered conveyor.
- All conveyors inside the steel plant (except the one mentioned above) are fully covered conveyors (see following photograph).

Photo 11.10: Covered Conveyors inside Visakhapatnam Steel Plant





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- There are extensive green-belts and plantations inside Visakhapatnam Steel Plant. These are located along the plant boundaries (see Photo e11), alongside roads (see Photo e12) as well around various units (see Photos e13, e14 and e15). Prior to 2005 – 06, Visakhapatnam Steel Plant had planted 36,97,792 trees. From 2005 – 06 to July, 2018, the Agro Forestry Department of the Steel plant has planted ~16,13,500 trees. Every year additional trees are being planted.

Photo 11.11: Green Belt (left) in Visakhapatnam Steel Plant



Photo 11.12: Avenue Plantations in Visakhapatnam Steel Plant





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Photo 11.13: Tree Plantation in By-Product Plant Area of Visakhapatnam Steel Plant



Photo 11.14: Tree Plantation around Office Building inside VSP





Photo 11.15: Dense Tree Plantation (left) on Periferi of Raw Material Storage Yard inside Visakhapatnam Steel Plant





Twenty one (21) species of trees have been planted by the plant's Agro-Forestry Department which include *Alstonia scholaris*, *Cassia siamea*, *Albizia procera*, *Terminalia arjuna*, *Tabebuia rosea*, *Swietenia spp.* (Mahogany), *Polyalthia ongifolia* (Ashok tree), *Butea monsperma*, *Tectona grandis*, *Cassia fistula*, *Spathodea companulata*, *Embellica officinalis*, *Azadirachta indica*, *Ficus religiosa*, *Bambusa spp.*, *Lagerstroemia speciosa*, *Aegle marmelos*, *Bauhinia acuminata*, *Acacia auriculiformis*, *Pongamia pinnata*, *Delonix regia* .

In the past other species of trees had also been planted which included *Casuarina equisetifolia*, *Anacardium occidentale*, *Eucalyptus spp.*, *Jatropha curcas*, *Acacia nilotica*.

Presently the Agro-Forestry Department is planting on indigenous species. Planting of *Acacia auriculiformis* and *Eucalyptus* have been discontinued.

The COB – 5 shall comprise of the Coke Ovens and the By-Product Plant. It is not possible to plant trees near the coke-ovens due to non-availability of space for tree planting except at the boundaries. Only a ~7.5 m wide & 75 m long strip of land is available on the west-north-west boundary of Coke-oven area. It is proposed that this strip of land be developed as a green belt. Only Druping Ashok (*Polyalthia longifolia*) will be planted in this area. *Polyalthia longifolia* has dense foliage and has high tolerance to SO₂. {Ref. "**Sulphur-di-oxide Resistance of Indian Trees**" by Mohd. Farooq, R.P. Saxena, M.U. Beg. *Water, Air and Soil Pollution; August, 1988. Vol – 40, Issue 3 – 4, pp 307 – 316*}. Four rows of trees with a spacing of ~2.5 m will be planted in this area. The By-product Plant will be surrounded by a ~7.5 m wide green belt of four rows of *Polyalthia longifolia*.

- As part of the Green Visakha Programme, which is a massive tree plantation drive in Visakhapatnam area, various PSUs and industries were directed by the Parliamentary Standing Committee on Science and Technology, Environment and Forest to plant 40

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lakh trees in the Greater Visakhapatnam Municipal Corporation (GVMC) Area. **Visakhapatnam Steel Plant's share was initially fixed at 5 lakh trees over 5 years, which** was revised to 4.5 lakh trees. Till June, 2018 3,52,400 trees had been planted by VSP. Arrangements for planting 50,000 trees in the allotted areas are being made.

b) New Reservoir

The likely impacts of the new reservoir is mostly by virtue of its large area and collection of water over the large area, compounded by its proximity to human settlements.

The detailed discussion of the impacts has already been done in section 11.5.2.5 above. As elaborated in this section, BIS (Biological Impact assessment) scoring has been used to quantify the magnitude of damages probably caused due to a project activity.

The biological impacts of the New Reservoir are listed in Table 11.14.

Table 11.14 : Likely Impacts on Biological Components on Account of New Reservoir

Sl. No.	Proposed Project Activities	Aspects	Likely Impacts
Operation Phase			
1.1	Storage of water on surface	Raising of groundwater table	Increased plant growth in adjacent areas
		Growth of aquatic plants, new habitat for aquatic fauna	Increased biodiversity Increased incidence of diseases spread by insects which breed in water

Possible Impacts of Operation:

Creation of large surface fresh water body can have beneficial as well as adverse impacts.

The beneficial impact of the reservoir will include:

- Provide habitat for aquatic flora and fauna as well as birds which feed on aquatic biota
- Raise the ground water table
- Influence the local micro-climate

The adverse impact of the reservoir will be that it may become a breeding site for mosquitoes which spread diseases like malaria, dengue, chikungunya, encephalitis etc.

Biological Impact Score (BIS) has been estimated by: $BIS = \text{Consequence Score (CS)} \times \text{Occurrence Frequency Score (OFS)}$ (refer Table 11.3, Table 11.4 and Table 11.5 above).

Table 11.15 : Estimated Biological Impact Score (BIS) on Account of New Water Reservoir

Sl. No.	Likely Impact Description	Impact Scoring			Remarks
		CS	OFS	BIS	
Operation Phase					
1	Increased incidence of diseases spread by insects which breed in water	3	5	15	Moderately Severe
2	Increased biodiversity due to large surface water body: <i>This is a beneficial impact.</i>	3	5	15	Moderately Severe



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Mitigation Measures:

The adverse impacts of the presence of a large water reservoir are:

- Growth of large floating weeds (such as Water Hyacinth)
- Growth of submerged algae and other vegetation
- Breeding of harmful aquatic insects, notably mosquitoes which are a critical link in transmission of diseases like malaria, dengue etc.

Large floating weeds will be physically removed. Labourers using small boats will be deployed to physically collect the floating vegetation. The collected vegetation will be dried and used **as green manure in the plant's afforestation areas.**

At present addition of chemicals such as Sodium Hypochlorite (NaOCl) and on site generated Chlorine Dioxide (ClO₂) **are used at the Steel Plant's Recirculation Water Systems** in the plant for controlling algal growth. It is suggested that in the new reservoir submerged aquatic vegetation shall be controlled by releasing the following species of fish:



1. Grass Carp (*Ctenopharyngodon idella*) – which feeds voraciously on submerged as well as certain floating aquatic macrophytes.
2. Rohu Carp (*Labeo rohita*) - juveniles and adults are herbivorous column feeders, eating mainly phytoplankton and submerged vegetation.
3. Tilapia (*Tilapia spp.*) – which feed on algae

The fish will be procured from the State Fisheries Department. It is to be noted that Grass Carp is an exotic species and does not breed naturally in India. It is bred in India by artificially by State Fisheries Departments. It is also suggested that juvenile rohu-carp at least 5 – 6 inches long be released into the reservoir. This will reduce natural mortality and predation. *Tilapia* are prolific breeders and juvenile as well adult fish will be released into the reservoir.

Any stagnant fresh water body, regardless of size, is a potential site for breeding of mosquitoes and other insect vectors. It is of prime importance to control insect vectors to prevent incidence of diseases like malaria, dengue, chikungunya, encephalitis, filaria etc. Insect vectors may be controlled by use of insecticides / pesticides or by biological control. Use of insecticides & pesticides leads to long term ecological damage as not only insects are destroyed but along with them there are short term as well as long term toxic effects on other biotic components of the ecosystem also. Biological control of insect vectors is environment friendly as well as cost effective.

Biological control of insects in a water body involves release of fishes which feed on insect eggs / larvae and pupae. Several larvae eating fish have been suggested for controlling mosquitoes. These include Tilapia, Guppy (*Poecilia reticulata*), Gambusia (*Gambusia affinis*), which are exotic species; indigenous species include Zebra fish (*Danio rerio*), Climbing Perch (*Anabas testudinius*), Indian Flying Barb (*Esomus danricus*), Blue perch (*Badis badis*), Elongate glassy perchlet (*Chanda nama*), Two-spot barb (*Puntius ticto*), Slender Rasbora (*Rasbora daniconius*), Banded Gourami (*Colisa fasciatus*), Rice fish (*Oryzias melistigma*), (*Aphanius dispar*), Blue Panchax (*Aplocheilichthys panchax*) etc. National Institute of Malaria Research (NIMR), which is one of the research organisations of the Indian Council of Medical Research has conducted extensive research on use of larvicidal fish for control of mosquitoes with positive results.

Of the above fish, there are some negative reports about the use of Guppies. So guppies will not be used for mosquito control in this reservoir.

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It is suggested that assistance of NIMR and / or Institutions under Indian Council of Agricultural Research be approached to suggest suitable species and stocking densities for effective mosquito control. The suggested species can be procured from the State Fisheries Department, fish breeders or even collected from the field for release into the reservoir.

A positive outcome of the use of fishes for mosquito control will be that some of the fishes such as Tilapia, Two-spot barb breed prolifically in reservoirs and these will provide food for many fishing eating birds such as cormorants, kingfishers, egrets, herons etc.

The reservoir will be periodically restocked to replace losses due to natural mortality and predation. Also older carps (which do not breed naturally in reservoirs) will be periodically harvested and replaced with fingerlings to maintain a healthy growing stock. The ecology of the reservoir will be periodically monitored to check the efficacy of the control measures.



Degree of damage:

The damage degree is based on the average BIS score calculated in the above sections for all impacts identified, based on the categorization as indicated below.

Sn.	BIS Score	Damagedegree	Damage impact
1.	[1 to 5)	1.0	Insignificant damage
2.	[5 to 10)	2.0	Minor Damage
3.	[10 to 15)	3.0	Moderate Damage
4.	[15 to 20)	4.0	Major Damage
5.	[20 to 25]	5.0	Severe Damage

Thus the damage score calculated for ecological damage due to construction activities is as given below:

Impacts identified	Average BIS Score	Calculated Damage degree (based on average BIS score)
<ul style="list-style-type: none"> • Damage to vegetation due to exposure to process emissions: Project site located inside integrated steel plant far from any major ecosystem. • Damage to human health due to exposure to process emissions and heat: Only the workers at the COB are at risk. Nearest populations centre is too far to be affected. • Disturbance to fauna: • Contamination of receiving water body & surrounding habitats due to discharge of treated effluents: Part of treated effluents utilised for industrial purposes in plant. Balance discharged after quality checks. • Increased incidence of diseases spread by insects which breed in water • Increased biodiversity due to large surface water body: This is a beneficial impact. 	12	3

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The above indicates that the overall damage on the ecological environment estimated due to the operation of facilities is moderately severe and may require strong management and strong operational controls.

Environmental significance of damage:

Operation of the units has the potential to negatively impact the existing biological environment, which in turn will be significant to the natural resources and its degradation (Nr) as well as human health (Hr). Thus, the overall environmental significance weightage is calculated below:

Environmental Significance weightage based on Potential for			Overall environmental significance weightage
Health Risks (Hr=2)	Natural resource degradation (Nr=1.5)	Community resource damage (Cr=1.2)	
Y	Y	N	3.0

11.5.3.6 Socio-economic condition

Impacts:

The plant units require skilled and semi-skilled personnel for operation of the units. Many people in and around the neighboring villages will get opportunity for employment during the operational phase based on suitability. The total direct manpower requirement for Operation and Maintenance (O&M) of the plant during operation period is estimated to be 1600 persons. Further, more than 3000 personnel will be indirectly employed.



The increased employment generation is a positive outcome of the operation of the units. However, an increase in population in the area will be consequent to this positive impact, which may lead to minor increase in demands for water, power, land and other resources in the area.

The impacts of the operation phase on the socio-economic condition of the area are as listed below:

- 1) Creation of employment opportunities
 - The operation of the installed units need skilled and semi-skilled manpower, leading to employment generation.
- 2) Development of indirect employment opportunities
 - The increase in direct employment opportunities will in-turn lead to indirect job creation in the consumer market.
 - Creation of skill development facilities for catering to the demand of skilled and semi-skilled manpower due to the project.

Degree of damage:

The degree of damage to socio-economic conditions is difficult to quantify as these impacts are perceptible and depends on extensive surveys. For assessing the same, degree of damage was estimated on the qualitative assessment of the magnitude of the positive as well as negative impacts. Thus, the degree of damage has been considered as 1.0. However, the significance of the damage is quantified based on the affected component of the environment.

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Negative impacts	Positive impacts	Calculated Damage degree
<ul style="list-style-type: none"> • Damage to air environment due to process and fugitive emissions • Reduced accessibility of community resources for local inhabitants. 	<ul style="list-style-type: none"> • Increase in employment opportunity created due to the construction activity of the RINL's VSP, thus generation of income is resulted. • Creation of indirect employment opportunities • Development of skill development facilities for catering to the demand of skilled and semi-skilled manpower. 	1

Environmental significance of damage:



The operation of units installed under expansion/revamping project of RINL has the potential to negatively impact the existing human health (Hr) as well as minor impact on community resources (Cr). However, the employment generation in the area is positively impacted due to the activities also. Thus, the overall environmental significance weightage is calculated below:

Environmental Significance weightage based on Potential for			Overall environmental significance weightage
Health Risks (Hr=2)	Natural resource degradation (Nr=1.5)	Community resource damage (Cr=1.2)	
Y	N	N	2

A cumulative quantitative assessment of possible indirect and direct damages caused due to the project is presented in Table 11.15 below.

Table 11.16 : POSSIBLE INDIRECT AND DIRECT DAMAGES CAUSED DUE TO THE PROJECT

Sl. No.	Environmental Attribute	Aspect of Environmental degradation [Causes]	Probable Damages	Actual damage due to the project	Degree of Damage	Environmental Significance weightage based on Potential for			Overall Significant Damage Ranking (ODSR)
						Health Risks (Hr=2.0)	Natural resource degradation (Nr=1.5)	Community resource damage (Cr=1.2)	
1	Air environment	<p><i>Construction Phase:</i></p> <ul style="list-style-type: none"> • Emissions due to fuel combustion by vehicles used for transportation of construction material and debris. • Fugitive emission from paved/unpaved roads due to vehicular movement. • Fugitive emissions due to ground clearing and levelling activities at site. 	<ul style="list-style-type: none"> • Degradation of air quality due to increase in pollutant concentration leading to respiratory problems. • Deposition of particulates on buildings, roads etc. leading to damage to property as well as disturbance to the aesthetics of the area. • Air pollutant deposition as well as gaseous emissions from vehicles and heavy machinery can cause damage to leaves of local flora. 	<ul style="list-style-type: none"> • Marginal increase in pollutant concentrations indicated by AQI calculated for the construction period. The change in AQI suggested ambient air quality may lead to minor health issues. • No significant damage to natural vegetation, as observed from physical and chemical analysis of leaves of local flora was observed. • Insignificant damage to local infrastructure was observed during physical verification due to air pollutant deposition. 	1	Y	Y	Y	3.6
		<p><i>Operational Phase:</i></p> <ul style="list-style-type: none"> • Emissions from process stacks of new units as well as revamped units • Fugitive emissions from new units as well as expansion units • Fugitive emissions due to transportation of raw material • Vehicular emissions from trucks for material 							

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Sl. No.	Environmental Attribute	Aspect of Environmental degradation [Causes]	Probable Damages	Actual damage due to the project	Degree of Damage	Environmental Significance weightage based on Potential for			Overall Significant Damage Ranking (ODSR)
						Health Risks (Hr=2.0)	Natural resource degradation (Nr=1.5)	Community resource damage (Cr=1.2)	
		movement							
2	Noise levels	<p><i>Construction Phase:</i></p> <ul style="list-style-type: none"> • Vehicular movement for transportation of construction material & labour. • Site preparation activities including debris removal etc., using heavy machinery 	<ul style="list-style-type: none"> • 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. 	<ul style="list-style-type: none"> • An increase of 0.1 dB(A) was observed over the existing noise levels at the nearest habitation. However, the increase was insignificant leading to no change in the grade of noise quality in the area, as quantified by Noise index change. 	1	Y	N	N	2
		<p><i>Operation phase:</i></p> <ul style="list-style-type: none"> • Operation of high noise generating equipment such as compressors, blowers, ID fans etc. 			1	Y	N	N	2
3	Water environment	<p>Construction phase:</p> <ul style="list-style-type: none"> • Generation of Suspended Solids in storm water run offs during monsoon season • Washable construction material in run-offs • Use of groundwater for construction activities • Obstruction of groundwater percolation due to ground water 	<ul style="list-style-type: none"> • Increase in suspended solids in the nearby surface water bodies • Depletion of groundwater levels in the area • Contamination of ground water quality 	<ul style="list-style-type: none"> • No abnormal increase in Suspended Solid levels observed in the area indicating no impact of construction activities on nearby surface water bodies. • Nominal change in groundwater quality observed, mostly attributed to percolation of contaminated water at plant boundary. 	1.5	Y	N	Y	3.6



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Sl. No.	Environmental Attribute	Aspect of Environmental degradation [Causes]	Probable Damages	Actual damage due to the project	Degree of Damage	Environmental Significance weightage based on Potential for			Overall Significant Damage Ranking (ODSR)
						Health Risks (Hr=2.0)	Natural resource degradation (Nr=1.5)	Community resource damage (Cr=1.2)	
		cementing <ul style="list-style-type: none"> Percolation of contaminated groundwater quality near plant boundary 							
		Operation phase: <ul style="list-style-type: none"> Generation of effluent from different unit of the plant Use of water from community resources for plant purposes 	<ul style="list-style-type: none"> Increase in pollutant load, leading to contamination of community water resources in the area Decrease in water availability due to exhaustion of community water resources 	<ul style="list-style-type: none"> Reduction in specific water consumption indicates no damage to community water resources due to need for additional water for plant purposes. No water used for operation of plant units under expansion/revamping apart from water allocated to RINL for plant purposes. No increase in specific water pollutant load concentration suggested utilization of efficient water treatment schemes in the project, leading to lesser pollutant contaminant being discharged from the plant due to the expansion/revamping units. 	1	Y	N	Y	2.4
4	Land environment	Construction phase: <ul style="list-style-type: none"> Deployment of construction labour 	<ul style="list-style-type: none"> Increase in demand of land near project site for housing of construction labour Change in land use of 	<ul style="list-style-type: none"> Increase in existing population by 4085 people every 3 months in form of labour influx Increased influx is only 9.7% of the Maximum absorptive 	1	N	Y	Y	1.8

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Sl. No.	Environmental Attribute	Aspect of Environmental degradation [Causes]	Probable Damages	Actual damage due to the project	Degree of Damage	Environmental Significance weightage based on Potential for			Overall Significant Damage Ranking (ODSR)
						Health Risks (Hr=2.0)	Natural resource degradation (Nr=1.5)	Community resource damage (Cr=1.2)	
			<p>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.</p> <ul style="list-style-type: none"> • Creation of new land uses such as roads etc. for catering to infrastructural needs of labour 	capacity (MAC) of the area, hence minimal impact on existing resources anticipated.					
		<p>Operation phase:</p> <ul style="list-style-type: none"> • Generation of solid waste due to operation of the units • Acquisition of land for setting up and operation of the units. • Creation of supporting infrastructure for operation of units 	<ul style="list-style-type: none"> • Increase in land requirement for disposal of solid wastes generated • Change in land use of the area and destruction of existing land use such as existing access routes etc. 	<ul style="list-style-type: none"> • No increase in specific solid waste generation indicates more efficient resource utilization in the units installed under expansion/revamping project. • No additional transport infrastructure created at site as the present infrastructure is capable of handling the requirement of the project. 	1	N	Y	N	1.5
5	Ecological Environment	<p><i>Construction phase:</i></p> <ul style="list-style-type: none"> • Clearance of vegetation due to site clearance / 	<ul style="list-style-type: none"> • Loss of green cover • Loss of animals' habitat 	<ul style="list-style-type: none"> • Biological impact scoring was used to quantify the biological damages caused. An average score of 6.8 was observed which 	2	N	Y	N	3



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Sl. No.	Environmental Attribute	Aspect of Environmental degradation [Causes]	Probable Damages	Actual damage due to the project	Degree of Damage	Environmental Significance weightage based on Potential for			Overall Significant Damage Ranking (ODSR)
						Health Risks (Hr=2.0)	Natural resource degradation (Nr=1.5)	Community resource damage (Cr=1.2)	
		preparation <ul style="list-style-type: none"> • Generation of fugitive dust, noise, ground vibrations (due to blasting of rocks) and dewatering due to excavations • Generation of fugitive dust and noise due to movement of heavy vehicles as well as construction activities • Emission of particulate matter & gases (NO_x, CO) from engines & noise generation from engines due to operation of diesel powered material handling machinery • Emission of particulate matter & noise generation due to handling of construction material • Emission of particulate matter & gases (NO_x, CO) from metal cutting 	<ul style="list-style-type: none"> • Damage to vegetation due to dust deposition. • Scaring away of fauna • Damage to nearby buildings / structures. • Increased siltation in receiving water body. • Damage to vegetation and human health due to air emissions from engines as well as dust. 	indicates nominal damage to the environment.					





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Sl. No.	Environmental Attribute	Aspect of Environmental degradation [Causes]	Probable Damages	Actual damage due to the project	Degree of Damage	Environmental Significance weightage based on Potential for			Overall Significant Damage Ranking (ODSR)
						Health Risks (Hr=2.0)	Natural resource degradation (Nr=1.5)	Community resource damage (Cr=1.2)	
		& / or welding as well as noise generation from metal fabrication							
		<p><i>Operation Phase:</i></p> <ul style="list-style-type: none"> • Generation of fugitive dust due to handling of coal • Emission of particulate matter, gases (NO_x, SO₂, CO, H₂, CH₄, NH₃, C₂H₆, C₆H₆, Phenols, H₂S etc.) and heat due to Coking process and handling of hot coke (including quenching) • Gaseous emissions due to recovery of By-products • Generation & release of waste water from operation of ETP • Raising of groundwater table as well as growth of aquatic plants, new habitat for aquatic fauna due to storage of water on surface 	<ul style="list-style-type: none"> • Damage to vegetation due to exposure to process emissions: Project site located inside integrated steel plant far from any major ecosystem. • Damage to human health due to exposure to process emissions and heat: Only the workers at the COB are at risk. Nearest populations centre is too far to be affected. • Disturbance to fauna • Contamination of receiving water body & surrounding habitats due to discharge of treated effluents: Part of treated effluents utilized for industrial 	<ul style="list-style-type: none"> • Biological impact scoring was used to quantify the biological damages caused. An average score of 12 was observed which indicates moderately severe impact on the ecology of the area 	3	Y	Y	N	9

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Sl. No.	Environmental Attribute	Aspect of Environmental degradation [Causes]	Probable Damages	Actual damage due to the project	Degree of Damage	Environmental Significance weightage based on Potential for			Overall Significant Damage Ranking (ODSR)
						Health Risks (Hr=2.0)	Natural resource degradation (Nr=1.5)	Community resource damage (Cr=1.2)	
			<p>purposes in plant. Balance discharged after quality checks.</p> <ul style="list-style-type: none"> • Increased incidence of diseases spread by insects which breed in water • Increased biodiversity due to large surface water body: This is a beneficial impact. 						
	Socio-economic Condition	<p><i>Construction phase</i></p> <ul style="list-style-type: none"> • Vehicular emissions and fugitive emissions due to site activities. • Influx of construction labour • Creation of new infrastructure as well as reduced access to existing infrastructure for movement of material and labour during the construction phase 	<ul style="list-style-type: none"> • Decrease in air quality due to emissions and hence health issues to local inhabitants • Increased stress on local infrastructure due to influx of construction labour • Disturbance to safety in the area due to slight increase in criminal activity 	<ul style="list-style-type: none"> • The marginal change in AQI i.e. ambient air quality indicates minor health issues. • No major criminal incident recorded during the period, hence no significant damage due to the influx of construction labour identified. • No new infrastructure created for access of material and manpower movement during the construction phase and existing infrastructure available was used. However, reduction in availability of the resources to local inhabitants is probable. 	1	Y	N	Y	2.4

	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	
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Sl. No.	Environmental Attribute	Aspect of Environmental degradation [Causes]	Probable Damages	Actual damage due to the project	Degree of Damage	Environmental Significance weightage based on Potential for			Overall Significant Damage Ranking (ODSR)
						Health Risks (Hr=2.0)	Natural resource degradation (Nr=1.5)	Community resource damage (Cr=1.2)	
				<ul style="list-style-type: none"> • Employment generation is a positive impact of the construction activity during the period. 					
		<i>Operation phase:</i> <ul style="list-style-type: none"> • Process emissions and fugitive emissions in the air environment • Creation of employment opportunities • Development of indirect employment opportunities 	<ul style="list-style-type: none"> • Increase in employment generation both direct as well as indirect 	<ul style="list-style-type: none"> • Direct as well as indirect employment opportunities generated due to operation of the units. • Creation of secondary market of skill development institution created to cater to the demand of skilled and semi-skilled manpower. 	1	Y	N	N	2

	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	
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The Overall Damage degree score for all components is averaged and compared with the below mentioned damage criteria to identify overall damage of the project.

ODSR (Overall Damage Score)	Grade of damage severity	Remarks
1-6	LOW	Low possibility of occurrence, low damage, No major remediation required
7-12	MEDIUM	Moderate possibility of occurrence, short-term damage , Activities can proceed with control measures
13-18	HIGH	Highly likely to occur, long-term damage, Stop activity or modify to reduce risk level with control measures & periodic review of implementation efficacy

The average ODSR for the project, taking into consideration all components of the environment, is 3.1, which indicates that the damage caused due to the project activities of RINL are LOW IN SEVERITY.

A detailed compensatory remediation in terms of Natural resource as well as Community resource augmentation is provided to compensate for the environmental damages caused on account of the expansion/revamping project of RINL. The same is presented in subsequent section.

11.6 BUDGET FOR ENVIRONMENT RESTITUTION AND PROTECTION

RINL's Visakhapatnam Steel Plant (VSP) has always been 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 11.16 below: