भारत सरकार
GOVERNMENT OF INDIA
पर्यावरण, वन एवं जल वायु परिवर्तन मंत्रालय
MINISTRY OF ENVIRONMENT, FOREST & CLIMATE CHANGE

Integrated Regional Office
Ground Floor, East Wing
New Secretariat Building
Civil Lines, Nagpur – 440001
apccfcentral-ngp-mef@gov.in

F. No. 4-4/2010(ENV)/9076 **Dated: 29th December, 2021**

To,

The Scientist 'E' IA Division (Thermal),
Ministry of Environment, Forest & Climate Change,
Room No. 236, 2nd Floor Vayu Wing,
Indira Paryavaran Bhawan,
Jorbagh Road, New Delhi-110003
(Email: yogendra78@nic.in)

(Kind attention: Shri Yogendra Pal Singh, Scientist E)

Sub: A report on the Status of Compliances of various conditions stipulated in Environment Clearance granted by MOEF&CC vide letter No. J-13012/87/2007-IA-II(T) dated 04.01.2010 and its subsequent amendments dated 23.03.2017 & 29.05.2018 for 3x660 MW expansion of Coal Based Power Unit M/s Maharashtra State Power Generation Company Limited (MSPGCL) located at Koradi District Nagpur (Maharashtra) - reg.

Ref: i) MoEF&CC letter no. A-L-11011/112/2021-IA-I [E-168395]

ii) Project Proponent vide their letter No. CE(O&M)/KTPS/660MW/CD/Env. Cell/FL-23 No. 03462 dated 06.12.2021

iii) PP vide letter No. CE (O&M)/KTPS/660MW/CD/Env. Cell/FL-03671 dated 23.12.2021

Sir,

I am directed to refer to the above subject and letters under reference wherein, MOEF&CC requested to furnish Certified Compliance Report w.r.t. Environment Clearance granted by MOEF&CC vide letter No. J-13012/87/2007-IA-II(T) dated 04.01.2010 and its subsequent amendments dated 23.03.2017 & 29.05.2018 for 3x660 MW expansion of Coal Based Power Unit of M/s Maharashtra State Power Generation Company Limited (MSPGCL) located at Koradi District Nagpur (Maharashtra)

2. In view of the same, it is to inform that a site visit for the monitoring of compliance of conditions stipulated in the environment clearances has been conducted by Scientist-E of the Integrated Regional Office, Nagpur on 07.12.2021. As per the documents submitted by the project proponent during the monitoring, and also as informed/observed during the site visit, the details are reported to be as under:

Unit No.	Capacity (MW)	Commercial Operation Dates	Current Status
Koradi Unit 1	120 (de-rated to 105)	03 June1974	Decommissioned on 08.01.2011
Koradi Unit 2	120 (de-rated to 105)	24 March 1975	
Koradi Unit 3	120 (de-rated to 105)	03 March 1976	
Koradi Unit 4	120 (de-rated to 105)	22 July 1976	
Koradi Unit 5	210	15 July1978	De-commissioned from 15.03.2017
Koradi Unit 6	210	30 March1982	R&M completed in 2018 & in service
Koradi Unit 7	210	13 January1983	De-commissioned from 03.08.2021
Koradi Unit 8	660	16 Dec, 2015	In service
Koradi Unit 9	660	22 Nov, 2016	In service
Koradi Unit 10	660	17 Jan, 2017	In service

i. MOEF&CC vide letter No. J-13012/87/2007-IA-II(T) dated 04.01.2010 granted Environmental Clearance for 3 x 660 MW expansion of Coal Based Power Unit M/s Maharashtra State Power Generation Company Limited (MAHAGENCO) (Formerly known as MSEB) located at Koradi District Nagpur (Maharashtra) **(Annexure-A)**

ii. MOEF&CC vide letter No. J-13012/87/2007-IA-II(T) dated 27.03.2015 granted extension of validity of Environmental Clearance for 3 x 660 MW expansion of Coal Based Power Unit M/s MAHAGENCO (Formerly known as MSEB) located at Koradi District Nagpur (Maharashtra) **(Annexure-B)**

iii. Amendment in EC has been obtained from MOEF&CC vide letter No. J-13012/87/2007-IA-II(T) dated 23.03.2017 for 3 x 660 MW expansion of Coal Based Power Unit M/s MAHAGENCO (Formerly known as MSEB) located at Koradi District Nagpur (Maharashtra) **(Annexure-C)**

iv. Further, Amendment in EC has been obtained from MOEF&CC vide letter No. J-13012/87/2007-IA-II(T) dated 29.05.2018 for 3 x 660 MW expansion of Coal Based Power Unit M/s MAHAGENCO (Formerly known as MSEB) located at Koradi District Nagpur (Maharashtra) **(Annexure-D)**

v. Consent to Establish for Coal Based Thermal Power Plant for 3 x 660 MW was obtained vide letter No. BO/RO(P&P)/EIC No. NG-1855-09/E/CC-41 dated 29.01.2010 **(Annexure-E)**

vi. The first amalgamated Consent to Operate for 3X660 MW Koradi TPP from MPCB had been obtained vide letter No. Format1.0/CAC/UAN No. 0000030152/CAC-1906000774 dated 17.06.2019 **(Annexure-F)**.

vii. Renewal of Consent to Operate for Coal Based Thermal Power Plant for 3 x 660 MW was obtained vide letter No. Format 1.0/CAC/UAN No. 0000076926/CR-2007000590 dated 08.07.2020. Which is valid upto 31.08.2021 **(Annexure-G)**

viii. Undertaking has been submitted stating that "No legal cases with respect to Environment Clearance except ongoing petition no. 62/2021 at NGT (WB) are pending in any court of law till date". "No closure/ show-cause notice is issued to the project by CPCB. One show-cause notice was issued by MPCB. (**Annexure-H**).

ix. Agreement for Construction and operating on treatment and transmission facilities for reclaimed water usage between Nagpur Municipal Corporation and Maharashtra Power Generation Company Limited for it TPS Koradi and Khaparkheda was made on 04.10.2008. Copy of agreement with NMC for 130MLD Bhandewadi STP is enclosed as **(Annexure-I).**

x. First Amendment to the agreement was made on 09.10.2018 between Maharashtra Power Generation Company Limited, Nagpur Municipal Corporation and Nagpur Waste Water Management Private Limited for lifting tertiary treated water from 190 MLD Bhandewadi STP, copy of tri party agreement is enclosed as **(Annexure-J).**

xi. A certificate from NEERI has been submitted stating that 20,000 Bamboo plant has been planted at Koradi and Surrounding villages outside the MAHAGENCO premises. (**Annexure**-K)

xii. Monitoring reports for Stack, Ambient Air Quality, Effluent and ground water quality for FY: 2020-21 Koradi TPS, 3X660 MW are enclosed as **(Annexure-L).**

xiii. Expenditure made on environment protection measures is enclosed as **(Annexure-M)**.

xiv. PP has increased the ash bund height from 305.2 ML to 312.0 ML without amendment in EC, **which construe violation**. PP informed that they have obtained approval from Central Design Organization (CDO), Nashik for same. Copy of approval from CDO Nasik is enclosed as **Annexure-9 (a)**.

xv. Tertiary treated water reservoir at plant end was visited, one of the pump was having gland leakage and house-keeping found poor. It is suggested to attend the leakage on priority and maintained the house-keeping. The premises of the AAQM Station at Dilmia Pump House was not maintained w.r.t. housekeeping.

xvi. On the ash bund area some cattle/cows were observed roaming on dry area of bund. Proper security was not observed. It is suggested to increase the patrolling at ash bund area.

xvii. Thick Plantation with indigenous species around ash bund area, around pond no. 3 and in the periphery of the plant boundary is required. Green belt around the plant needs technical evidence. Bamboo plantation is not proper selection. Project proponent advised to take technical guidance from any research institute for development of Green belt around the plant and also suggested to develop plantation around ash pond, pond no. 3 with incorporating species diversity.

xviii. PP do not have their own Plant Nursery. It is advice to develop plant nursery inside the plant premises.

xix. Pond No. 3 which is a Raw water intake pond located across the National Highway 69 was observed with weed & siltation. It is advised to do the desilting, de-weeding of pond and fencing around the pond no. 3 (complete area) for restricting the entry of unauthorized person/safety.

xx. Ash was found on both the side of road heading towards ash bund area near underground railway bridge.

3. Further additional information sought by IRO to which PP replied as under;

Query raised by IRO	Reply from PP
Point No. i As on date total quantity of fly ash available within the plant premises.	Unutilized fly ash from silo and bottom ash is being mixed with water and transferred to ash bund in slurry form. Koradi TPS, 3X660 MW is using Khasara bund for disposal, ash available in the pond is 1,72,73,126 MT, while Koradi TPS, 210MW is using Koradi Ash bund for ash disposal and available ash in the pond is 1,46,00,492 MT as on 30.11.2021.

Point No. ii Action plan for future to lay HDPE lining in ash bund used for 660 MW.	Khasara Ash bund which is in use for Koradi TPS, 3X660 MW is live so the work of HDPE/ LDPE lining cannot be taken up in hand, however, all precautionary measures are taken and no breaching of bund happened or overflow of ash water over bund. Three drain wells are maintained inside the bund and water is recovered through waste weir. As a precautionary measure bund height is increased from 305.2 ML to 312.0 ML.
Point No. iii Quantity of fly ash lifted for construction of Roads and Metro pillar work.	Quantity of fly ash lifted for road construction from Koradi TPS, 3X660 MW is 4,38,476 MT for FY: 2020-21 and 3,92,443 MT for FY: 2021-22 up-to Nov-21.
Point No. iv Method of treatment of waste water coming out from ash bund area.	Effluent from ash bund is collected in a settling tank available at Khasala Ash Water Recovery (Khasara AWR) pump house from where it is lifted to Central Monitoring Basin (CMB) of Effluent Treatment Plant at Koradi TPS, 3X660 MW. From CMB, effluent is transferred to clarifier, followed by chemical treatment at stealing chamber and lastly to clear water sump. Chemical treatment involves dosing of alum/ lime depending upon nature of effluent. However, recently a new line from Khasara bund to TPS is laid and directly in use for Ash handling.
Point No. v On daily basis how much fly ash being generated and utilized.	Daily fly ash generation at Koradi TPS for both 3X660 MW and 210 MW is approximately 7822 MT which may vary depending on coal consumption for a day and coal ash percentage. Daily fly ash utilization of Koradi TPS 3X660 MW and 210 MW is about 7799 MT. It is to inform that daily fly ash utilization may vary as per requirement and demand of agencies. Above figures are average for the month of Nov.-2021.

4. **Three** of the EC conditions stipulated in EC dated 04.01.2010 is observed to be **not complied** by the PP:

EC dated 04.01.2010;

Condition No. i: At present, tender initiated for installation of wet limestone FGD and published on 04.11.2020, tenderization process is completed, LoA is for board approval. However, minimum time required for installation of Wet Limestone FGD shall be about 26 to 30 months. Considering present status & Lockdown situation due date Dec. 2022 (As per MoEF& CC Notification Dtd. 31.03.2021) is not achievable. Schedule date of completion - August 2023, delay of around 8 months is expected, considering the pandemic situation. Detailed chronology of FGD tenderization is enclosed as **Annexure-1 (b)**.

Condition No. xvii: The piezo wells shall be installed in periphery of ash ponds as per the norms of monitoring the ground water quality. Proposal for installation of piezo wells at Koradi & Khasara ash bund is under process at Head office. Copy of same is enclosed as **Annexure-17 (a).** Work will be completed by Dec-22.

Condition No. xxvi: PP informed that they have advertised environmental clearance letter in newspaper. However, unable to submit copy of the new paper cuttings.

5. **Twelve** of the conditions is observed to be **partially complied** by the PP:

EC dated 04.01.2010;

Condition No. vii: DPR is in process for bulk transportation of fly ash by railway & erection of platform along the railway track for loading of fly ash by loaders in open wagons.

Condition No. viii: Provision of three Remote silo is under construction and shall be made available by Feb-22.

Condition No. ix: PP mentioned that since the Khasara ash bund is live, the work of HDPE/ LDPE lining could not be taken up.

Condition No. xii: Commissioning of 2 Nos. of recovery lines from Khasara AWR to AHP of KTPS, 3X660 MW was proposed. Out of two lines, one line is commissioned and Second line will have commissioned by April-2022.

Condition No. xiv: Rain water harvesting at 3 locations has been finalized. Panjara side tank work is completed. The bore holes at Y-point (near Koradi Training Center) & behind Tertiary Treated Water Reservoir (TTWR) are completed. The setting tank, drains & filter media work is in progress. Work will be completed by July-22.

Condition No. xviii: Thick Green Belt of Indigenous species around the Ash Dump, Pond No. 3, VIP Guest House and around the plant premises has not been observed.

Condition No. xxxii: Connectivity of three CAAQMS stations with SPCB server is established and registration for connectivity with CPCB server is also completed. **Station has been processed and integration with CPCB is under process.**

EC dated 27.03.2015:

Condition No. xxxvii: The DPR for supply, installation & commissioning of solar roof top panel in the premises of 210 M Koradi Thermal Power Station and KTPS colony & Urja-bhavan building is submitted to H.O. DPR copy is given to MEDA on dated 08.11.2019 for approval. Approval awaited.

Condition No. xli: Thick Green Belt of Indigenous species around the Ash Dump, Pond No. 3, VIP Guest House and around the plant premises has not been observed.

EC dated 23.03.2017:

Condition No. iv: Compliance reports has not been uploaded on company's website.

EC dated 29.05.2018:

Condition No. (i) : Work for transportation of coal by closed pipe conveyor for a length of 16.1 km and with a capacity of 7.35 MTPA from Gondegaon and Bhanegaon mines to Koradi Thermal Power Plant via Khaperkheda Thermal Power Plant has been started as per EC amendment dtd. 29.05.2018. Consent to establish is received from MPCB for closed pipe conveyor system. 75% work completed and balance work is in progress will be completed by July-22.

Condition No. (ii): Dust Suppression system is incorporated in design of Coal pipe conveyor system. Work of dust suppression system is in progress will be completed by July-22.

This issues with the approval of the Regional Officer, Integrated Regional Office, MoEF&CC, Nagpur

Encl: as above

Yours faithfully,

(Dr. P.R. Sakhare)
Scientist 'E'/Additional Director

Copy to:

(i) Director RO HQ, MOEF&CC, IPB, 1st Floor Agni Wing, IPB, Jorbagh Road, ND-03. (Email: manoj.moefcc@gmail.com)

(ii) Director (Monitoring Cell), Ministry of Environment, Forest & Climate Change, Indira Paryavaran Bhawan, Aliganj, Jorbagh Road, New Delhi-110003 (Email: shruti.rai@nic.in)

(iii) The Principal Secretary & The Member Secretary, SEIAA, Environment Department, Government of Maharashtra Room No., 217, 2nd Floor, Mantralaya, Annex, Mumbai - 400 032 (Maharashtra) (**Email**: psec.env@maharashtra.gov.in)

(iv) Shri R S Bora, Under Secretary, (IA-I Division), Ministry of Environment, Forest & Climate Change, Indira Paryavaran Bhawan, Jorbagh Road, New Delhi-110003 (Email: rs.bora@nic.in)

(v) Shri P R Khandare, Chief Engineer (O&M), T.P.S., Koradi, Nagpur, (Maharashtra)-441111 (Email: cegenkoradi@mahagenco.in; cgmkrdproj@mahagenco.in) - with a request to submit time bound action plan to be taken for non/partially compliances mentioned in the report.

(vi) Guard File.

29/12/2021

(Dr. P.R. Sakhare)
Scientist 'E'/Additional Director

Monitoring the Implementation of Environmental Safeguards
Ministry of Environment, Forest & Climate Change
Integrated Regional Office, Nagpur
Monitoring Report
Part – I
DATA SHEET

1.	Project Type: River-valley / Mining / Industry /Thermal / Nuclear / Other (Specify)	Thermal
2.	Name of the Project	3X660 MW, Koradi TPS
3.	Clearance Letter (s) / OM No. and date	J-13012/87/2007-IA. II (T) dated 04.01.2010
4.	Location a. District (s) b. State (s) c. Latitude d. Longitude	 Nagpur Maharashtra 21.1456 79.0556
5.	Address for correspondence a. Address of concerned Project Chief Engineer (with Pin Code, Email & Telephone/ Telex/ Fax Numbers) : & Address of Executive Project Engineer / Manager (with pin code/fax numbers and email)	Shri P R Khandare, Chief Engineer (O&M), T.P.S., Koradi, Nagpur, Pin-441111. Phone: (07109) 262141 to 262146, 262106,262109 Fax: 262127 (Off), Email: cegenkoradi@mahagenco.in Shri. A H Ashtikar, Chief Engineer (P), Koradi Complex, Chhindwara road, Koradi-441111, Dist. Nagpur. Phone: 07109-264862(P), 264863, 264869(O), Fax: 07109-264866; Email: cgmkrdproj@mahagenco.in.
6.	Salient features a. Of the Project b. Of the Environmental Management Plan	Based on super-critical technology Use of Tertiary treated sewage water
7.	Break up of the Project area a. Submergence Area: Forest & Non Forest b. Others	NA
	a. Total Plot Area	1458 Sq. meter
	b. Built - Up Area (Including Road)	200 Sq. meter
	c. Open Space available	400.44 Sq. meter
	d. Green belt area	66.98 %
8.	Break up of the Project affected population with enumeration of those losing	

	houses/dwelling units only, agricultural land only, both dwelling units & both dwelling units & agricultural land & landless laborers/artisan a. SC, ST/Adivasis b. Others (Please indicate whether these figures are based on any scientific and systematic survey carried out or only provisional figures, if a survey carried out gives details and years of survey.)	No land was required for Koradi Expansion Project, same is mentioned in TOR.
9.	Financial Details a. Project costs as originally planned & subsequent revised estimates and the year of price reference. b. Allocations made for Environmental Management Plan with item wise & year wise breakup. c. Benefit Cost Ratio / Internal rate of Return and the year of assessment. d. Whether (c) includes the cost of Environmental Management as shown in the above. e. Actual expenditure incurred on the Project so far f. Actual expenditure incurred on the Environmental Management Plan so far	Originally planned project cost 11880 Cr. Further cost 14987.65 Cr. is approved by cabinet on dt. 20.02.2018. Above cost includes cost for Environmental Management Plan --- --- 14782.65 Cr. Cost mentioned in above point e. includes cost for Environmental Management Plan
10.	Forest land requirement: a. The status of approval for diversion of Forestland for non-forestry use b. The Status of clearing felling c. The status of compensatory Afforestation programme in the light of actual field experience	NA
11.	The status of clear felling in non-forest areas (such as submergence area of reservoir, Approach roads), if any with quantitative information	NA
12.	Status of construction a. Date of commencement (Actual and/or Planned) b. Date of completion (Actual and/or Planned)	March 2011. Unit 8: 16.12.2015. Unit 9: 22.11.2016. Unit 10: 17.01.2017.

13.	Reasons for the delay if the project is yet to start	Construction phase is over and all three units are commissioned.
14.	Dates of site visits a. The dates on which the Project was monitored by Regional Office on previous occasions, if any b. Date of site visit for this monitoring Report	17.07.2017 06.12.2021
15.	Details of correspondence with project authorities for obtaining action plan / information on status of compliance to safeguards other than the routine letters for logistic support for site visit. (The monitoring report may obtain the details of all the letters issued so far but the later reports may cover only the letters issued subsequently)	1. Letter No. CE(O&M)/KTPS/660MW/Env. Cell/FL-8 No. 01937 dtd. 19.07.2021 2. Letter No. CE(O&M)/KTPS/660MW/Env. Cell/FL-15 No. 00412 dtd. 15.02.2021. 3. Letter No. CE(O&M)/KTPS/660MW/Env. Cell/FL-15 No. 01906 dtd. 10.08.2020.

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A report on the Status of Compliances of various conditions stipulated in Environment Clearance granted by MOEF&CC vide letter No. J-13012/87/2007-IA-II(T) dated 04.01.2010 and its subsequent amendments dated 23.03.2017 & 29.05.2018 for 3x660 MW expansion of Coal Based Power Unit M/s Maharashtra State Power Generation Company Limited (Formerly known as MSEB) located at Koradi District Nagpur (Maharashtra)

A monitoring report on the status of compliance of conditions stipulated in Environmental clearance is given as under:

Sl. No.	Conditions as per EC's dated 04.01.2010	Compliance Status as on 07.12.2021
(i)	FGD with one unit of 660 MW will be installed initially to begin with & the requirement, if any, for the installation of FGD system with the other two units will depend upon the prevalent ambient levels of SO2. Provision for installation for FGD in all units shall be made.	**Not Complied.** At present, tender initiated for installation of wet limestone FGD and published on 04.11.2020, tenderization process is completed, LoA is for board approval. Copy enclosed as **Annexure-1 (a)**. However, minimum time required for installation of Wet Limestone FGD shall be about 26 to 30 months. Considering present status & Lockdown situation due date Dec. 2022 (As per MoEF& CC Notification Dtd. 31.03.2021) is not achievable. Schedule date of completion - August 2023, delay of around 8 months is expected, considering the pandemic situation. Detailed chronology of FGD tenderization is enclosed as **Annexure-1 (b)**.
(ii)	Hydro-geological study of the area shall be reviewed annually & results submitted to the Ministry & concerned agency in the State Govt. In case adverse impact on ground water quantity & quality is observed, immediate mitigating steps to contain any adverse impact on ground water shall be undertaken.	**Complied.** A detailed report of Hydro geological investigation for 3x660 MW Koradi project is carried out, report is enclosed as **Annexure-2 (a)**. Analysis of Ground Water is carried out periodically. The parameters are within desirable range.

		Recent Report enclosed as **Annexure-2 (b)**.
(iii)	Minimum required environmental flow suggested by the Competent Authority of the State Govt. shall be maintained in the Channel/ rivers even in lean season. It shall be ensured that natural drainage in the region is not disturbed due to activities associated with operation of the plant.	**Complied.** The 3X660 MW Koradi Project was installed on the land available with MAHAGENCO. The natural drainage system available on this land was not disturbed and Koradi TPS, 3X660 MW has constructed and commissioned its own independent system for trade and sewage effluent. Detailed plot plan is enclosed as **Annexure-3**.
(iv)	Tri-Flue stacks of 275 m height each shall be provided with continuous online monitoring equipment's for SOx, NOx & PM. Exit velocity of flue gases shall not be less than 22 m/sec. Mercury emissions from stack shall also be monitored on periodic basis.	**Complied.** One stack with three flue cans of 275 meters height is provided. Continuous Online monitoring system for PM, SO_2, NOx for Unit-8, 9 & 10 is commissioned and connected to CPCB & MPCB servers on 10.05.2017, OCEMS URLs are enclosed as **Annexure-4 (a)**. Exit velocity & mercury emission is monitored regularly for all three units, **Annexure-4 (b)** enclosed showing monthly average velocity & mercury data of all three units. However, it is to inform that exit velocity factor is load dependent and hence during partial load the velocity remains below 22 m/s. Whereas, during full load operation or units operating at more than 70% PLF, the exit velocity will remain more than 22 m/s.
(v)	High Efficiency Electrostatic Precipitators (ESPs) shall be installed to ensure that particulate emission does not exceed 50 mg/Nm^3.	**Complied.** High efficiency ESPs are installed at all three Units with design efficiency 99.9 % for particulate emission not more than 50 mg/Nm^3. Released construction data of ESP is enclosed as **Annexure-5**.

(vi)	Adequate dust extraction system such as cyclones/ bag filters & water spray system in dusty areas such as in coal handling & ash handling points, transfer areas & other vulnerable dusty areas shall be provided.	**Complied.** At Coal Handling plant 02 Nos. of mist type fogging systems are commissioned at both the stack yards & are operated as per requirement. The dust suppression system at all transfer points is in service. Also, the work of dust extraction & ventilation system is under process. DFDS system is installed at site to control coal dust. Additional spray system in CHP area is installed to prevent dust. Fire quenching line erected in stack yard to control fire in coal yard. To arrest the ash in ash handling plant following actions are taken: a) Ensure 100% availability of vent fans b) Monthly cleaning of ash filter bags. c) Ensuring optimum efficiency of filter bags purging system through regular routine check. d) Quarterly replacement of filter bags in each intermediate silo. e) Attending fly ash conveying pipelines leakage on priority and replacement of wear out portion of pipelines. f) Regular water sprinkling on nearby roads is carried out periodically. Photographs of dust extraction system are enclosed as **Annexure-6**.
(vii)	Utilization of 100 % fly ash generated shall be made from 4th year of operation of the proposed expansion. Status of implementation shall be reported to the	**Partially Complied.** a) Pond ash from Khasara ash bund is utilised for ash dyke raising, for bricks manufacturing, road constructions &

	Regional Office of the Ministry from time to time.	filling of low lying area. Ash dyke work started from November-2019 & till date. b) Dry fly ash is issued to agencies under 20 % & 80 % quota at free of cost. Advertisement for the same was published in various newspapers during Dec-2020 & Jan-2021 respectively. Advertisement enclosed as In response to the advertisement under 20 % quota, a sale order is issued to 5 brick manufacturers and under 80% quota sale order is issued to 8 cement companies/ agencies for road embankment. c) Establishment of fly ash-based product manufacturing industrial cluster. d) DPR is in process for bulk transportation of fly ash by railway & erection of platform along the railway track for loading of fly ash by loaders in open wagons. Details regarding Fly ash utilisation are enclosed as **Annexure-7**.
(viii)	Fly ash shall be collected in dry form & storage facility (silos) shall be provided. 100 % fly ash utilization shall be ensured from 4th year onwards. Unutilized fly ash shall be disposed off in the slurry form. Mercury & other heavy metals (As, Hg, Cr, Pb etc.) will be monitored in the bottom ash as also in the effluents emanating from the existing ash pond. No ash shall be disposed off in low lying area.	**Partially Complied.** Provision of three Remote silo is under construction shall be made available by Feb-22. However, a temporary arrangement is made for disbursement of dry fly ash utilization from intermediate/HCSD silo no. 1 up to 1500 MT/day quantity. Unutilized ash is disposed off by HCSD system in Khasara ash bund. Heavy metals are monitored regularly in ash samples & effluent of ash bund through MoEF&CC approved lab. Recent analysis report is enclosed as **Annexure-8**.

(ix)	Ash pond shall be lined with HDP/LDP lining or any other suitable implementation media such that no leachate takes place at any point of time. Adequate safety shall also be implemented to protect the ash dyke from getting breached.	**Partially Complied.** The Khasara ash bund is live, the work of HDPE/ LDPE lining cannot be taken up in hand, but all precautionary measures are taken and no breaching of bund happened or overflow of ash water over bund. Three drain wells are maintained within the bund and water is recovered through waste weir. The decanted water is being recycled and utilized again in plant. As a precautionary measure bund height is increased from 305.2 ML to 312.0 ML after approval received from Central Design Organization (CDO), Nashik. Copy of approval is enclosed as **Annexure-9 (a)**. Photographs of bund raising are enclosed as **Annexure-9 (b)**.
(x)	For disposal of bottom ash in abandoned mines (if proposed to be undertaken) it shall be ensured that the bottom & the side of the mines out area are adequately lined with clay before bottom ash is filled up. The project proponent shall inform the State Pollution Control Board well in advance before undertaking the activity.	**Complied.** Koradi TPS, 3X660 MW is trying to follow all the directions issued time to time. As per CPCB letter no. B-33014/07/2020/IPC-II/TPP/7704 dtd 30.09.2020, CPCB forwarded list of abandoned mines for backfilling purpose identified by Taskforce of MoP to state PCB's out of which 3 mines are of WCL situated in Maharashtra i.e. Talwasa OC, Dholwasa OC, Naveen Kunada OC are situated in Chandrapur district and not nearby Koradi TPS. PP has put matter to Head office. **Annexure-10**.
(xi)	Closed cycle cooling system with natural draft cooling towers shall be provided. The effluents shall be treated as per the prescribed norms.	**Complied.** Closed cycle cooling water system comprising of Natural Draft Cooling Tower is installed and in service for unit 8, 9 & 10. NDCT photographs enclosed **as Annexure-11**. The effluent from blow

		down is treated through ETP as per norm and reused for ash disposal.
(xii)	The treated effluents conforming to the prescribed standard only shall be re-circulated & reused within the plant. There shall be no discharge outside the plant boundary except during monsoon. Arrangements shall be made that effluents & storm water do not get mixed.	**Partially Complied.** In house ETP is installed and commissioned to treat trade effluents arising from power station premises. Currently, treated effluent is reused within the plant for ash disposal purpose. Separate storm water drainages are constructed in plant premises. Water from ash bund is again utilised for ash disposal through AWR pump house. Settling tank is provided from where bund effluent is pumped to TPS to avoid discharge outside the plant premises. Commissioning of 2 Nos. of recovery lines from Khasara AWR to AHP of KTPS, 3X660 MW was proposed. Out of two lines, one line is commissioned and Second line will commissioned by April-2022. Photographs of Khasara AWR lines are enclosed as **Annexure-12**.
(xiii)	A sewage treatment plant shall be provided & the treated sewage shall be used for raising green belt/plantation.	**Complied.** Two sewage treatment plants having capacity of 25 and 10 KLD are established and treated water is used for raising green belt / plantation. Photographs showing usage of treated STP water for gardening are enclosed as **Annexure-13**.
(xiv)	Rainwater harvesting should be adopted. Central groundwater, Authority/ Board shall be consulted for finalization of appropriate rainwater technology with a period of three months from the date of clearance & details shall be furnished.	**Partially Complied.** For rain water harvesting, central ground water Board had been consulted and approval was received by PP, copy of same is enclosed as **Annexure-14 (a)**. Rain water harvesting at 3 locations has been finalized. Panjara side tank work is completed. The bore holes at Y-

		point (near Koradi Training Center) & behind Tertiary Treated Water Reservoir (TTWR) are completed. The setting tank, drains & filter media work is in progress. Work will be completed by July-22. Photographs enclosed as **Annexure-14 (b)**.
(xv)	Adequate safety measure shall be provided in the plant area to check/minimize spontaneous fires in coal yard, especially during summer season. Copy of these measures with full details along with location plan layout shall be submitted to the regional Officers of the Ministry.	**Complied.** Fire quenching line erected in stack yard to control fire in Coal yard. Location plan layout is enclosed as **Annexure-15**.
(xvi)	Storage facility for auxiliary liquid fuel such as LDO/HFO & LSHS shall be made in the plant area in consultation with Departmental of Explosives, Nagpur. Sulphur content in the liquid fuel will not exceed 0.5%. Disaster Management Plan shall be prepared to meet any eventuality in case of an accident taking place due to storage of oil.	**Complied.** Oil handling plant is commissioned as per plan sanctioned by Explosive Department. License for oil handling plant is issued by Explosive department, copy enclosed as **Annexure-16 (a)**. LDO/ HFO is received from Oil India companies and use as received basis. Disaster management plan/ onsite emergency preparedness plan is prepared and enclosed as **Annexure-16 (b)**.
(xvii)	Regular monitoring of ground water level shall be carried out by establishing a network of existing wells & constructing new piezometers. Monitoring around the ash pond area shall be carried out particularly for heavy metal (Hg, Cr, As, Pb) & records maintained & submitted to the Regional office of the Ministry. The data so obtained should be compared with the baseline data so as to ensure that the ground water quality is not adversely affected due to the project.	**Not complied**. The piezo wells shall be installed in periphery of ash ponds as per the norms of monitoring the ground water quality. Proposal for installation of piezo wells at Koradi & Khasara ash bund is under process at Head office. Copy of same is enclosed as **Annexure-17 (a)**. Work will be completed by Dec-22. However, analysis of Ground Water is carried out periodically through MoEF&CC approved laboratory. Recent

		analysis report enclosed as **Annexure-2 (b)**.
(xviii)	Green Belt consisting of 3 tires of plantations of native species around plant & at least 100 m width shall be raised. Wherever 100 m width is not feasible, a 50 m width shall be raised & adequate justification shall be submitted to the Ministry. Tree density shall not be less than 2500 per ha with survival rate less than 70 %.	**Partially complied.** During construction of Units Koradi TPS has taken massive tree plantation as a social obligation. Available open land for plantation is 400.44 Hectare, Total area covered under plantation is 268.22 Hectare. Percentage of area covered under plantation is 66.98 %. Total progressive no. of trees planted up-to 31.03.2021 is 5,84,927. Details enclosed as **Annexure-18 (a)**. However, 100m / 50m width plantation is not feasible at periphery of KTPS as it is surrounded by existing National Highway, temple and villages. PP has engaged M/s National Environmental Engineering Research institute, Nagpur since February-2018 for development of Bamboo green belt for dust suppression at TPS premises using Eco-rejuvenation technology work orders for same are enclosed as **Annexure-18 (b)**. Thick Green Belt of Indigenous species around the Ash Dump, Pond No. 3, VIP Guest House and around the plant premises has not been observed.
(xix)	First aid & sanitation arrangements are to be made for the drivers & other contract workers during construction phase.	**Complied.** First aid & sanitation arrangements were made for the drivers & other contract workers during construction phase. Now, construction phase is over and all three units are commissioned.
(xx)	Noise levels emanating from turbines shall be so controlled such that the noise in the work zone shall be limited to 75 dBA. For people working in the high noise area,	**Complied.** Acoustic enclosures are provided to high noise generating auxiliaries. Sound

	requisite personal protective equipment like earplugs/ earmuffs etc. shall be provided. Workers engaged in noisy areas such as turbine area, air compressors etc. shall be periodically examined to maintain audiometric records & for treatment for any hearing loss including shifting to non-noisy/ less noisy area.	proof cabins are provided for staff working in high noise area. Personal protective equipments are provided to staff and contractor labors. Regular medical checkup is arranged by Colony hospital for audiometric examination. PP is also monitoring Noise level at high noise area, report is enclosed as **Annexure-19 (a)**. Photographs of cabins allocated to operators engaged in noisy area like turbine floor and compressor room are enclosed as **Annexure-19 (b)**.
(xxi)	Regular monitoring of ground level concentration of SO_2, NOx, RSPM (PM10 & PM2.5) & Hg shall be carried out in the impact zone & records maintained. If at any stage these levels are found to exceed the prescribed limits, necessary control measures shall be provided immediately. The location of the monitoring stations shall be decided in consultation with SPCB. Periodic reports shall be submitted to the regional Office of this Ministry. The data shall also be put on the website of the company.	**Complied.** KTPS Koradi, 3X660 MW, is carrying out ambient air quality monitoring twice in week at three different locations approved by SPCB. Three CAAQMS are installed around the premises of 3X660 MW Koradi at various locations as approved from SPCB. CAAQMS connectivity to SPCB server is established and copy of URLs are enclosed as **Annexure-4 (a)**. CAAQMS connectivity to CPCB server is under process. Koradi TPS is regularly carrying out GLC study, recently carried out in March- 2021 for PM, SO_2 & NOx emission. Report is enclosed as **Annexure-20**. The concentrations of pollutants predicted by Industrial source Complex (ISCST3) Dispersion model at various locations are well within limit. Data is available through online connectivity with MPCB server and will get available after establishing connectivity with CPCB server too.

(xxii)	A good action plan for R & R (if applicable) with package for the project affected persons be submitted & implemented as per prevalent R & R policy within three months from the date of issue of this letter.	**Complied.** As no land is required, R & R policy is not applicable to this project. No land was required for Koradi Expansion Project, same is mentioned in initial TOR issued for 2X800 MW and same is applicable to TOR of 3X660 MW. TOR copies with executive summery is enclosed as **Annexure-21**.
(xxiii)	An amount of Rs. 20 Crores shall be earmarked as per time capital case for CSR program. Subsequently a recurring expenditure of Rs.4 Crores per annum shall be earmarked as recurring expenditure for CSR activities. Details of the activities to be undertaken shall be along with road map for implantation.	**Complied.** Impact Assessment of implementation of CSR action plan adjoining villages of TPS had been carried out. Executive summary enclosed as **Annexure-22 (a)**. The activities undertaken by Mahagenco with capital cost of Rs. 20.00 cr. are completed. Details are enclosed as **Annexure-22 (b)** along with photographs as **Annexure-22 (c)**. And recurring cost of Rs. 4.00 cr. per annum is preferably utilized for paying stipend to PAP's inducted for vocational training and other CSR activities at Koradi TPS, 3X660 MW. Details of payment done for PAP candidates for 2020-21 is enclosed as **Annexure-22 (d)**.
(xxiv)	As part of CSR program the company shall conduct need based assessment for the nearby villages to study economic measures with action plan which can help in upliftment of poor section of society. Income generating projects consistent with the traditional skills of the people besides development of fodder farm, fruit bearing orchards, vocational training etc. can form a part of such community development activities & income generating program. This will be in addition to vocational training	**Complied.** The work orders for Bamboo plantation at Mahagenco's land are issued to the agency and the work is in progress. Mahila Bachat Gat are employed for maintenance of Bamboo plantation which is helping in upliftment of poor section of society. After development of Bamboo plantation training for making hand crafted items from Bamboos will be given to Mahila Bachat Gat for self-employment. Copy of work orders are

	for individuals imparted to take self-employment & jobs.	enclosed as **Annexure-23 (a)** along with fodder farm photographs as **Annexure-23 (b).**
(xxv)	Provision shall be made for the housing of construction labour within the site with all necessary infrastructure & facilities such as fuel for cooking, mobile toilets, mobile STP, safe drinking water, medical health care, crèche etc. The housing may be in the form of temporary structure to be removed after the completion of the project.	**Complied.** Already provided during construction phase. Provision were made for the housing of construction labour within the site along with all necessary infrastructure & facilities. As of now, construction phase is over and all three units are commissioned.
(xxvi)	The project proponent shall advertise in at least two local newspaper widely circulated in the region around the project, one of which shall be in the vernacular language of the locality concerned within seven days from the date of this clearance letter, informing that the project has been accorded environmental clearance & copies of clearance letter are available with the State Pollution Control Board/ Committee & may also be seen at Website of the Ministry of Environment & Forest at http://envfor.nic.in.	**Not Complied.** PP had advertised its accordance of environmental clearance in newspaper. However no advertisement copy provided.
(xxvii)	A copy of the clearance letter shall be sent by the proponent to concerned Panchayat, Zila Parishad /Municipal Corporation, Urban Local Body & the Local NGO, if any, from whom suggestions/ representation, if any, received while processing the proposal. The clearance letter shall also be put on the website of the company by the proponent.	**Complied.** PP had sent clearance letter to Panchayat, Zila Parishad /Municipal Corporation, Urban Local Body. NOC received from Grampanchayat is enclosed as **Annexure-24.** The EC of the project proponent was available on MoEF website along with the minutes of EAC. Also, as per new guidelines of MoEF&CC the project proponent shall upload the EC conditions on 'Parivesh' portal.

(xxviii)	A separate Environment Management Cell with qualified staff shall be set up for implementation of the stipulated environmental safeguards.	**Complied.** PP has set up the Environment Management cell, copy of the same is enclosed as **Annexure-25 (a)**. The organogram of staff available at Environment Management Cell is enclosed as **Annexure-25 (b)**.
(xxix)	The proponent shall upload the status of compliance of the stipulated EC conditions, including results of monitored data on their website & shall update the same periodically. It shall simultaneously be sent to the Regional Office of MoEF, the respective Zonal Office of CPCB & the SPCB. The criteria pollutant levels namely RSPM (PM10 & PM 2.5), SOx, NOx, (ambient levels as well as stack emissions) shall be displayed at a convenient location near the main gate of the company in the public domain.	**Complied.** Yes, compliance to EC conditions are regularly submitted to respective authorities by PP. Also, as per new guidelines of MoEF&CC the project proponent shall upload the EC conditions on 'Parivesh' portal. Monitoring of ambient air quality parameters is carried out regularly. The reports are submitted to regional office of SPCB. Compliance of the stipulated EC conditions sent to the Regional Office of MoEF through mail, copy is enclosed as **Annexure-26 (a)**. Electronic display board at entrance gate for display of CAAQMS & stack parameters is provided. Photocopy is enclosed as **Annexure-26 (b)**. Connectivity of three CAAQMS stations with SPCB server is established and registration for connectivity with CPCB server is also completed. Copy of e-mail received from CPCB is enclosed as **Annexure-26 (c)** which states that station has been processed and integration is under process. URL for MPCB server is enclosed as **Annexure-4 (a)**.
(xxx)	The project proponent shall also submit six monthly reports on the status of compliance of the stipulated EC conditions including results of monitored date (both in hard	**Complied.**

	copies as well as by e-mail) to the respective regional office of MoEF, the respective Zonal Office of CPCB & SPCB.	Yes, compliance is same as per Sr No: xxix.
(xxxi)	The environment statement for each financial year ending 31st March in Form-V as mandated to be submitted by the project proponent to the concerned State Pollution Control Board as prescribed under the Environment (Protection) Rules, 1986, as amended subsequently, shall also be put on the website of the company along with the status of compliance of EC conditions & shall also be sent to the respective Regional Offices of the Ministry by e-mail.	**Complied.** Environment statement in Form-V of 3X660 MW Koradi for FY 2020-21 is submitted online and copy of same is enclosed as **Annexure-27**.
(xxxii)	The project proponent shall submit six monthly reports on the status of the implementation of the stipulated environmental safeguards to the Ministry of Environment & Forests, its regional Office and Central Pollution Control Board & State Pollution Control Board. The project proponent shall upload the status of compliance of the environmental clearance conditions on their website & update the same periodically & simultaneously send the same by e-mail to the Regional office, Ministry of Environment & Forests.	**Partially Complied.** Yes, compliance is same as per Sr No: xxix.
(xxxiii)	Regional Office of the Ministry of Environment & Forests will monitor the implementation of the stipulated conditions. A complete set of documents including Environmental Impact Assessment Report & Environment Management Plan along with the additional information submitted from time to time shall be forwarded to the Regional office for their use during monitoring. Project proponent will up load the compliance status in their website & update the same from time to time at least six-monthly basis. Criteria pollutants levels	**Complied.** As per point No. xxix. Criteria pollutant levels displayed at TPS main gate, Photo of the same is enclosed as **Annexure-26 (b)**.

	including NOx (from stack & ambient air) shall be displayed at the main gate of the power plant.	
(xxxiv)	Separate funds shall be allocated for implementation of environment protection measures along with item wise break up. This cost shall be included as part of project cost. The funds earmarked for environment protection measures shall not be diverted for other purposes and year wise expenditure shall be reported to the ministry.	**Complied.** Yearly expenditure on Environmental protection measures is submitted to SPCB through yearly Environment statement. Copy of Expenditure is enclosed as **Annexure-28**.
(xxxv)	The project authorities shall inform the Regional Office as well as the Ministry regarding the date of financial closure & final approval of the project by the concerned authorities & the dates of start of land development work & commissioning of plant.	**Complied.** Date of approval of Project: 18.01.2008. The dates for Land development work were informed during the initiation phase of the project and subsequently the dates of COD for respective units are also intimated to MoEF&CC accordingly. Regarding date of financial closure, it will be intimated after compliance of EC conditions. Date of comm. /COD: U-8: 16/12/2015, U-9: 22/11/2016, U-10: 17/01/2017.
(xxxvi)	Full co-operation shall be extended to the Scientist/ Officers from the Ministry/ Regional office of the Ministry at Bangalore/CPCB/SPCB who would be monitoring the compliance of environment status.	**PP has consented to condition.**
	MoEF Letter Ref. No. J- 13012/87/2007-IA. II (T) dtd. 27/03/2015.	
xxxvii)	Harnessing solar power within the premises of the plant particularly at available rooftops shall be carried out and status of implementation including actual generation of solar power shall be submitted along with half yearly monitoring report.	**Partially Complied.** The DPR for supply, installation & commissioning of solar roof top panel in the premises of 210 M Koradi Thermal Power Station and KTPS colony & Urja-bhavan building is submitted to H.O. Copy enclosed as **Annexure-29 (a)**.

		DPR copy is given to MEDA on Dtd. 08.11.2019 for approval, copy enclosed as **Annexure-29 (b).** Approval awaited. Work will be completed by approx. 6months after getting approval.
xxxvii i)	A long-term study of radio activity and heavy metals contents on coal to be used shall be carried out through a reputed institute and results thereof shall be analyzed every two years and reported in monitoring reports. Thereafter mechanism for an in-built continuous monitoring system for radioactivity and heavy metals in coal and Fly ash (including bottom ash) shall be put in place.	**Complied.** This office has assured to access the current levels of Radioactivity in coal & ash. Accordingly, Coal & Ash samples were tested at Board of Radiation & Isotope Technology (BRIT), New Mumbai. Reports indicated that the measurement values of Coal & Ash samples are below the clearance level for radionuclides of natural origin in bulk solid material as per capital AERB (Atomic Energy Regulatory Board) directives 01/2010 (Table B) table 26.11.2010. Copy of report is enclosed as **Annexure-30.**
xxxix)	Fugitive emissions shall be controlled to prevent impact on agriculture or non-agriculture land.	**Complied.** KTPS is taking all out efforts to reduce source emissions thereby achieving ambient air quality such as installation of ESP with 99.9 % efficiency, and tangentially fired low NOx burners. Whereas, FGD installation is proposed to control SO2 emission. At Koradi TPS one stack consisting of three flue cans with height 275 m is installed which disperses the emission in wider area which minimize the impact of emission. Additionally, The dust suppression at all transfer points of CHP area and fogging system are in service. DFDS system is installed at site to control coal dust. Additional spray system in CHP area is installed to prevent dust. Measures taken to minimize the fugitive dust in

		CHP & AHP area. Photographs are enclosed as **Annexure-6.**
xl)	Fly ash shall not be used for agriculture purpose. No mine void filling will be undertaken as an option for ash utilization without adequate lining of mine with suitable media so that no leaching shall take place at any point of time. In case, the option for mine void filling is adopted, prior detailed study of soil characteristics of the mine area shall be undertaken from an institute of repute and installation of adequate clay lining shall be ascertained if required, by the State Pollution Control Board. The dumping in mine void shall be carried out in close co-ordination with the State Pollution Control Board.	**Complied.** No ash is made available for agriculture purpose and for mine void filling. Undertaking is taken from agencies on non-judicial stamp paper of Rs. 500/- regarding non-use of lifted fly ash for agriculture purpose and will be used for declared purpose as per their application while permitting to lift the pond ash/ fly ash. Copies of undertaking are enclosed as **Annexure-31**.
xli)	Green Belt of 20-50 m width shall also be developed around the ash pond, over and above the green belt around the plant boundary.	**Partially Complied.** As per point no. xviii. Out of total tree plantation about 23000 plants are planted near ash bund area. Copy of report is enclosed as **Annexure-32. Thick Green Belt of Indigenous species around the Ash Dump, Pond No. 3, VIP Guest House and around the plant premises has not been observed.**
xlii)	An Environment cell comprising of at least one expert in Environment Science/Engineering, Ecology, Occupational Health and Social Science, shall be created preferably at the project site itself and shall be headed by an officer of appropriate seniority and qualification. It shall be ensured that the head of the cell shall directly report to Head of the plant who would be accountable for implementation of Environmental regulations and social impact improvement/mitigation measures.	**Complied.** A separate Environment Cell is formed. Circular regarding same is enclosed as **Annexure-33**. Organization chart is enclosed as **Annexure-25 (b)**.

xliii)	For periodic monitoring of CSR activities, a CSR Committee or a Social Audit Committee or a suitable credible external agency shall be appointed. CSR activities shall be evaluated by an independent external agency, both concurrently and final.	**Complied.** After completion of activities under one-time capital Rs. 20.00 Cr. agency M/s Surya Envirotech has carried out CSR impact assessment study in the nearby villages of TPS and submitted the DPR. Copy of report is enclosed as **Annexure-22 (a).**
xliv)	The project proponent shall formulate a well laid Corporate Environment Policy and identify and designate responsible officers at all levels of its hierarchy for ensuring adherence to the policy and compliance with the conditions stipulated in this clearance letter and other applicable Environmental laws and regulations.	**Complied.** Environment Safeguard Responsibility Frame Work/Corporate Environment Policy is formulated by MAHAGENCO. Copy enclosed as **Annexure-34.**
	MoEF Letter Ref. No. J- 13012/87/2007-IA. II (T) dtd. 23/03/2017.	
i.	Ministry's Notification SO 3305(E) E(P) Amendments Rules, 2015 dated 07.12.2015 regarding revised emission standards for PM, SO2, NO2 & Hg shall be complied with and same shall be achieved within 2 years from the date of Publication of Notification for all unit 8, 9 & 10 (3X660 MW) i.e. on or before 07.12.2017.	**Not Complied.** Compliance is same as per Sr No: (i) of EC No. J- 13012/87/2007-IA. II (T) dtd. 04.01.2021.
ii.	Change in Coal source from Machhakuta Coal Mines to Gare palma coal Sector-II Block, Mand raigarh Coalfields, Raigarh District, Chhattisgarh is permitted.	**Complied.** At present coal supply from Gare palma coal Sector-II Block, Mand raigarh Coalfields, Raigarh District, Chhattisgarh is not started. However, Koradi TPS is receiving coal from various mines of WCL, MCL, SCCL & SECL. The disbursement of coal is as per the Fuel Supply Agreement as per the current requirement of TPS.
iii.	Ministry Notification No. GSR 02(E) Dtd. 02.01.2014 regarding supply of raw or blended or beneficiated coal with ash not	**Complied.** Koradi TPS has started using the wash coal with ash content around 31% at

	exceeding thirty- four percent shall be implemented, as applicable.	ADB basis. Now, Mahagenco and MSMC are in agreement for supply of wash coal for the period 5 years. Copy of agreement is enclosed as **Annexure-35**. The recent MoEF & CC notification Dtd 21.05.2020 states that, "Use of coal by thermal power plant without stipulations as regards ash contents or distance, shall be permitted subject to setting up technology solution for emission norms". In this context, it may please be informed that 660 MW units at Koradi are taking all out efforts for use of low ash content coal by blending raw coal with wash coal. However, adhering to the recent notification DT: 21.05.2020, 3 x 660 MW KTPS Koradi has installed high capacity ESP's for meeting emission norms.
iv.	The compliance of EC conditions shall be reviewed on quarterly basis. In this regard, a compliance mechanism shall be set up through plant head who is responsible for implementing the conditions stipulated in the Environmental clearance, non-compliances and violations. Budget to implement various environmental pollution control measures as proposed in the EMP shall be kept in a separate account and shall not be diverted for any other purposes. Compliance reports shall be uploaded on company's website.	**Partially complied.** PP has consented for the same. Organizational hierarchy is established for compliance reporting mechanism at plant level. Organization chart is enclosed **as Annexure- 25 (b).** Recently, as per EC conditions six monthly compliance report is submitted, copy enclosed as **Annexure- 26 (a). Uploaded Compliance reports could not be seen on company's website.**
	MoEF Letter Ref. No. J- 13012/87/2007-IA. II (T) dtd. 29/05/2018.	
i.	Construction of pillars in the water bodies (Rivers & Nallahs) shall be carried out in the dry season only.	**Partially Complied.** Work for transportation of coal by closed pipe conveyor for a length of 16.1 km and with a capacity of 7.35 MTPA from Gondegaon and Bhanegaon mines to Koradi Thermal Power Plant via Khaperkheda Thermal Power Plant has

		been started as per EC amendment dtd. 29.05.2018. Consent to establish is received from MPCB for closed pipe conveyor system, copy is enclosed as **Annexure-36 (a)**. 75% work completed and balance work is in progress will be completed by July-22. Photographs of pipe conveyor system are enclosed as **Annexure-36 (b).** Civil work is over.
ii.	Dust suppression system such as mist/dry for jet sprinklers to be setup at the transfer points to arrest the fugitive dust emissions.	**Partially complied.** Dust Suppression system is incorporated in design of Coal pipe conveyor system. Work of dust suppression system is in progress will be completed by July-22.
iii.	For every tree cut along the proposed route in the non-forest area, guidelines of Forest (Conservation) Act, 1980 shall be followed in consultation with the local State Forest Department.	**Complied.** PP informed that at Koradi premises no tree cut for pipe conveyor.
iv.	Noise level shall be in accordance with the Noise Pollution Rules.	**Complied.** Noise level is being maintained as per Noise Pollution Rules.

Sakhare 29/12/2021

(Dr. P.R. Sakhare)
Scientist 'E'/Additional Director

Annexure - A

DATE...

BY SPEED POST

J-13012/87/2007-IA.II (T)
Government of India
Ministry of Environment & Forests

Telephone. 011-24368526
Paryavaran Bhawan
CGO Complex, Lodi Road
New Delhi-110 003
Dated 4th January, 2010

To

M/s Maharashtra State Power Generation Co Ltd
Prakashgad, 3rd Floor, Plot No G-9
Bandra (E)
Mumbai – 4000 51

Sub: *2x660 MW Expansion of Coal Based Power units at Koradi TPP in Nagpur District in Maharashtra - reg. Environmental Clearance.*

Sir

The undersigned is directed to refer to letters dated 30.07.2009, 03.10.2009 and 01.12.2009 on the subject mentioned above. The Ministry of Environment & Forests has examined the application.

2. It has been noted that the proposal is for replacement of existing 4 units of 120 MW each by 1x660 MW unit and addition of 2x660 MW units. Additional fresh water will be required for the proposed expansion project will be met from the sewage collected by Nagpur Municipal Corporation after treatment. MoU with Nagpur Municipal Corporation is in place. No additional fresh water will be drwn, since only the allotted water from Pench River (through a canal) will be utilized. It is proposed to install a tri-flue stack of 275 m height. Coal requirement will be 30,638 TPD, which will be sourced from Machhakuta Coal filed in Orissa. Washed coal will be used for the project. Ash content of the coal will be 44 b5 % (maximum). Sulphur content will be 0.8 % (maximum). The slurry disposal method proposed will be based on high concentration slurry. NOC from AAI for 275 m stack height has been accorded. NOC from Gram Panchayat has also been obtained. Koler river is at a distance of 1.0 km from the site. No R&R is involved. Proposed units will be installed with 99.9 % efficiency ESP. FGD with one unit of 660 MW will be installed initially and the requirement if any, for the installation of FGD system with the other two units will depend upon the prevalent ambient levels of SO_2. There are no national parks, wildlife sanctuaries, biosphere/elephant/tiger reserves, heritage sites etc within 10 km of the site. Public hearing was conducted on 25.03.2009. Cost of the project will be Rs. 11,860.0 Crores.

3. The project has been considered in accordance with the provisions of the EIA notification issued by the Ministry of Environment & Forests vide S.O. 1533 (E), dated September 14, 2006.

4. Based on the information submitted by you, as at Para 2 above and others, the Ministry of Environment and Forests hereby accords environmental clearance to the above project under the provisions of EIA notification dated September 14, 2006 subject to the compliance of the following conditions:

(i) FGD with one unit of 660 MW will be installed initially to begin with and the requirement, if any, for the installation of FGD system with the other two units will depend upon the prevalent ambient levels of SO_2. Provision for installation for FGD in all units shall be made.

(ii) Hydro-geological study of the area shall be reviewed annually and results submitted to the Ministry and concerned agency in the State Govt. In case adverse impact on ground water quantity and quality is observed, immediate miligating steps to contain any adverse impact on ground water shall be undertaken

(iii) Minimum required environmental flow suggested by the Competent Authority of the State Govt. shall be maintained in the Channel/ Rivers even in lean season. It shall be ensured that natural drainage in the region is not disturbed due to activities associated with operation of the plant

(iv) A Tn-Flue stacks of 275 m height each shall be provided with continuous online monitoring equipments for SOx, NOx and PM. Exit velocity of flue gases shall not be less than 22 m/sec. Mercury emissions from stack shall also be monitored on periodic basis.

(v) High Efficiency Electrostatic Precipitators (ESPs) shall be installed to ensure that particulate emission does not exceed 50 mg/Nm^3

(vi) Adequate dust extraction system such as cyclones/ bag filters and water spray system in dusty areas such as in coal handling and ash handling points, transfer areas and other vulnerable dusty areas shall be provided.

(vii) Utilisation of 100% Fly Ash generated shall be made from 4th year of operation of the proposed expansion. Status of implementation shall be reported to the Regional Office of the Ministry from time to time

(viii) Fly ash shall be collected in dry form and storage facility (silos) shall be provided. 100% fly ash utilization shall be ensured from 4th year onwards. Unutilized fly ash shall be disposed off in the ash pond in the form of slurry form. Mercury and other heavy metals (As,Hg, Cr Pb etc) will be monitored in the bottom ash as also in the effluents emanating from the existing ash pond. No ash shall be disposed off in low lying area.

(ix) Ash pond shall be lined with HDP/LDP lining or any other suitable impermeable media suh that no leachate takes place at any point of time. Adequate safety measures shall also be implemented to protect the ash dyke from getting breached.

(x) For disposal of Bottom Ash in abandoned mines (if proposed to be undertaken) it shall be ensured that the bottom and sides of the mined out areas are adequately lined with clay before Bottom Ash is filled up. The project proponent shall inform the State Pollution Control Board well in advance before undertaking the activity.

(xi) Closed cycle cooling system with natural draft cooling towers shall be provided. The Effluents shall be treated as per the prescribed norms

(xii) The treated effluents conforming to the prescribed standards only shall be re-circulated and reused within the plant. There shall be no discharge outside the plant boundary except during monsoon. Arrangements shall be made that effluents and storm water do not do not get mixed.

(xxi) A sewage treatment plant shall be provided and the treated sewage shall be used for raising greenbelt/plantation.

(xxiv) Rainwater harvesting should be adopted. Central Groundwater Authority/ Board shall be consulted for finalization of appropriate rainwater harvesting technology within a period of three months from the date of clearance and details shall be furnished.

(xxv) Adequate safety measures shall be provided in the plant area to check/minimize spontaneous fires in coal yard, especially during summer season. Copy of these measures with full details along with location plant layout shall be submitted to the Ministry as well as to the Regional Office of the Ministry.

(xxvi) Storage facilities for auxiliary liquid fuel such as LDO and/ HFO/LSHS shall be made in the plant area in consultation with Department of Explosives, Nagpur. Sulphur content in the liquid fuel will not exceed 0.5%. Disaster Management Plan shall be prepared to meet any eventuality in case of an accident taking place due to storage of oil.

(xxvii) Regular monitoring of ground water level shall be carried out by establishing a network of existing wells and constructing new piezometers. Monitoring around the ash pond area shall be carried out particularly for heavy metals (Hg,Cr,As,Pb) and records maintained and submitted to the Regional Office of this Ministry. The data so obtained should be compared with the baseline data so as to ensure that the ground water quality is not adversely affected due to the project.

(xxviii) Green Belt consisting of 3 tiers of plantations of native species around plant and at least 100 m width shall be raised. Wherever 100 m width is not feasible a 50 m width shall be raised and adequate justification shall be submitted to the Ministry. Tree density shall not less than 2500 per ha with survival rate not less than 70 %.

(xxix) First Aid and sanitation arrangements shall be made for the drivers and other contract workers during construction phase.

(xxx) Noise levels emanating from turbines shall be so controlled such that the noise in the work zone shall be limited to 75 dBA. For people working in the high noise area, requisite personal protective equipment like earplugs/ear muffs etc. shall be provided. Workers engaged in noisy areas such as turbine area, air compressors etc shall be periodically examined to maintain audiometric record and for treatment for any hearing loss including shifting to non noisy/less noisy areas.

(xxxi) Regular monitoring of ground level concentration of SO_2, NOx, RSPM (PM_{10} & $PM_{2.5}$) and Hg shall be carried out in the impact zone and records maintained. If at any stage these levels are found to exceed the prescribed limits, necessary control measures shall be provided immediately. The location of the monitoring stations and frequency of monitoring shall be decided in consultation with SPCB. Periodic reports shall be submitted to the Regional Office of this Ministry. The data shall also be put on the website of the company.

(xxxii) A good action plan for R&R (if applicable) with package for the project affected persons be submitted and implemented as per prevalent R&R policy within three months form the date of issue of this letter.

(xxxiii) An amount of Rs. 20.0 Crores shall be earmarked as one time capital cost for CSR programme. Subsequently a recurring expenditure of Rs 4.0 Crores per annum shall be earmarked as recurring expenditure for CSR activities. Details of the activities to

be undertaken shall be submitted within one month along with road map for implementation.

(xxiv) As part of CSR programme the company shall conduct need based assessment for the nearby villages to study economic measures with action plan which can help in upliftment of poor section of society. Income generating projects consistent with the traditional skills of the people besides development of fodder farm, fruit bearing orchards, vocational training etc. can form a part of such programme. Company shall provide separate budget for community development activities and income generating programmes. This will be in addition to vocational training for individuals imparted to take up self employment and jobs.

(xxv) Provision shall be made for the housing of construction labour within the site with all necessary infrastructure and facilities such as fuel for cooking, mobile toilets, mobile STP, safe drinking water, medical health care, crèche etc. The housing may be in the form of temporary structures to be removed after the completion of the project.

(xxvi) The project proponent shall advertise in at least two local newspapers widely circulated in the region around the project, one of which shall be in the vernacular language of the locality concerned within seven days from the date of this clearance letter, informing that the project has been accorded environmental clearance and copies of clearance letter are available with the State Pollution Control Board/Committee and may also be seen at Website of the Ministry of Environment and Forests at http://envfor.nic.in.

(xxvii) A copy of the clearance letter shall be sent by the proponent to concerned Panchayat, Zila Parisad / Municipal Corporation, urban local Body and the Local NGO, if any, from whom suggestions/representations, if any, received while processing the proposal. The clearance letter shall also be put on the website of the Company by the proponent.

(xxviii) A separate Environment Management Cell with qualified staff shall be set up for implementation of the stipulated environmental safeguards.

(xxix) The proponent shall upload the status of compliance of the stipulated EC conditions, including results of monitored data on their website and shall update the same periodically. It shall simultaneously be sent to the Regional Office of MOEF, the respective Zonal Office of CPCB and the SPCB. The criteria pollutant levels namely; RSPM (PM_{10} & $PM_{2.5}$), SO_2, NO_x (ambient levels as well as stack emissions) shall be displayed at a convenient location near the main gate of the company in the public domain.

(xxx) The project proponent shall also submit six monthly reports on the status of compliance of the stipulated EC conditions including results of monitored data (both in hard copies as well by e- mail) to the respective Regional Office of MOEF, the respective Zonal Office of CPCB and the SPCB.

(xxxi) The environment statement for each financial year ending 31st March in Form-V as is mandated to be submitted by the project proponent to the concerned State Pollution Control Board as prescribed under the Environment (Protection) Rules, 1986, as amended subsequently, shall also be put on the website of the company along with the status of compliance of EC conditions and shall also be sent to the respective Regional Offices of the Ministry by e-mail.

(xxxii) The project proponent shall submit six monthly reports on the status of the implementation of the stipulated environmental safeguards to the Ministry of

Environment and Forests, its Regional Office, Central Pollution Control Board and State Pollution Control Board. The project proponent shall upload the status of compliance of the environment of the environmental clearance conditions on their website and update the same periodically and simultaneously send the same by e-mail to the Regional Office, Ministry of Environment and Forests.

(xxxiii) Regional Office of the Ministry of Environment & Forests will monitor the implementation of the stipulated conditions. A complete set of documents including Environmental Impact Assessment Report and Environment Management Plan along with the additional information submitted from time to time shall be forwarded to the Regional Office for their use during monitoring. Project proponent will up-load the compliance status in their website and up-date the same from time to time at least six monthly basis. Criteria pollutants levels including NOx (from stack & ambient air) shall be displayed at the main gate of the power plant.

(xxxiv) Separate funds shall be allocated for implementation of environmental protection measures along with item-wise break-up. These cost shall be included as part of the project cost. The funds earmarked for the environment protection measures shall not be diverted for other purposes and year-wise expenditure should be reported to the Ministry.

(xxxv) The project authorities shall inform the Regional Office as well as the Ministry regarding the date of financial closure and final approval of the project by the concerned authorities and the dates of start of land development work and commissioning of plant.

(xxxvi) Full cooperation shall be extended to the Scientists/Officers from the Ministry / Regional Office of the Ministry at Bangalore / CPCB/ SPCB who would be monitoring the compliance of environmental status.

4. The Ministry of Environment and Forests reserves the right to revoke the clearance if conditions stipulated are not implemented to the satisfaction of the Ministry. The Ministry may also impose additional environmental conditions or modify the existing ones, if necessary.

5. The environmental clearance accorded shall be valid for a period of 5 years to start operations by the power plant.

6. Concealing factual data or submission of false/fabricated data and failure to comply with any of the conditions mentioned above may result in withdrawal of this clearance and attract action under the provisions of Environment (Protection) Act, 1986.

7. In case of any deviation or alteration in the project proposed including coal transportation system from those submitted to this Ministry for clearance, a fresh reference should be made to the Ministry to assess the adequacy of the condition(s) imposed and to add additional environmental protection measures required, if any.

8. The above stipulations would be enforced among others under the Water (Prevention and Control of Pollution) Act, 1974, the Air (Prevention and Control of Pollution) Act, 1981, the Environment (Protection) Act, 1986 and rules there under, Hazardous Wastes (Management and Handling) Rules, 1989 and its amendments, the Public Liability Insurance Act, 1991 and its amendments.

9. Any appeal against this environmental clearance shall lie with the National Environment Appellate Authority, if preferred, within 30 days as prescribed under Section 11 of the National Environment Appellate Act, 1997

(LALIT KAPUR)
DIRECTOR

Copy to:-

1. The Secretary, Ministry of Power, Shram Shakti Bhawan, Rafi Marg, New Delhi 110001.
2. The Secretary (Environment), Forests and Environment Department Government of Maharashtra.
3. The Chairman, Central Electricity Authority, Sewa Bhawan, R.K. Puram, New Delhi-110066.
4. The Chairman, Maharashtra Pradesh State Pollution Control Board, Kalpataru Point, 3rd & 4th Floors, Sion Matunga Scheme Road No. 6, Opp. Cine Planet, Sion Circle, Sion (E), Mumbai – 400 022
5. The Chairman, Central Pollution Control Board, Parivesh Bhawan, CBD-cum-Office Complex, East Arjun Nagar, Delhi- 110032.
6. The Chief Conservator of Forests, Regional Office (WZ), E-5, Kendriya Paryavaran Bhawan, Arera Colony, Ravishankar Nagar, Bhopal - 462016.
7. The District Collector, Nagpur District, Govt. of Maharashtra.
8. The Director (EI), MOEF.
9. Guard file.
10. Monitoring file.

(LALIT KAPUR)
DIRECTOR

Annexure- B

[illegible] [illegible]@nic.in
[illegible]m_2879@yahoo.co.in
Telefax: 011-24695402

भारत सरकार
पर्यावरण, वन एवं जलवायु परिवर्तन मंत्रालय
GOVERNMENT OF INDIA
MINISTRY OF ENVIRONMENT, FORESTS AND CLIMATE CHANGE
इंदिरा पर्यावरण भवन, जोर बाग रोड,
अलीगंज, नई दिल्ली-110 003
INDIRA PARYAVARAN BHAWAN, JOR BAGH ROAD,
ALIGANJ, NEW DELHI-110 003
Website : moef.nic.in

F. No. J-13012/87/2007-IA.II (T)

2nd Level, JAL Block
Date: 27th March, 2015

To

M/s Maharashtra State Power Generation Co. Ltd.
[Formerly known as M.S.E.B]
Corporate Environment Health & Safety Unit
HDIL Towers, "A" Wing, 3rd Floor
Prof. A.K. Marg
Bandra (E), Mumbai- 400 051
Maharashtra
Ph: 022-26582424/26584225; Fax: 022-26477273

Subject: Extension of validity of Environment Clearance for 3x660 MW Expansion of coal based power units at Koradi Thermal Power Project, Distt. Nagpur, Maharashtra by M/s. Maharashtra State Power Generation Company Ltd.

Sir,

This has reference to your letters dated 19.12.2014, 16.01.2015 and 02.02.2015 on the above subject. It is noted that Environment Clearance (EC) was accorded for the above project on 4th January 2010.

2. The matter was placed before the EAC (Thermal Power) in its 30th Meeting held during 29th & 30th January, 2015. In acceptance of the recommendation of the EAC and in view of the information/clarification submitted by you with respect to implementation of the above mentioned power project, the validity of the said EC is extended till 30th June, 2016 to start the [illegible] operation of all the Units of the power plant.

3. Further, under Para no.4 of the said EC dated 4th January, 2010, after the condition no. (xxxvi), the following conditions shall be added:

xxxvii) Harnessing solar power within the premises of the plant particularly at available rooftops shall be carried out and status of implementation including actual generation of solar power shall be submitted along with half-yearly monitoring report.

A long term study of radio activity and heavy metals contents on coal to be used shall be carried out through a reputed institute and results thereof shall be analyzed every two year and reported in the monitoring reports. Thereafter mechanism for an in-built continuous monitoring for radio activity and heavy metals in coal and fly ash (including bottom ash) shall be put in place.

xxxix) Fugitive emissions shall be controlled to prevent impact on agricultural or non-agricultural land

xl) Fly ash shall not be used for agricultural purpose. No mine void filling will be undertaken as an option for ash utilization without adequate lining of mine with suitable media so that no leaching shall take place at any point of time. In case, the option of mine void filling is to be adopted, prior detailed study of soil characteristics of the mine area shall be undertaken from an institute of repute and installation of adequate clay lining shall be ascertained, if required, by the State Pollution Control Board. The dumping in mine void shall be carried out in close co-ordination with the State Pollution Control Board.

xli) Green belt of 20-50 m width shall also be developed around the Ash Pond over and above the Green Belt around the plant boundary.

xlii) An Environmental Cell comprising of at least one expert in environmental science/ engineering, ecology occupational health and social science, shall be created preferably at the project site itself and shall be headed by an officer of appropriate seniority and qualification. It shall be ensured that the Head of the Cell shall directly report to the Head of the Plant who would be accountable for implementation of environmental regulations and social impact improvement/mitigation measures.

xliii) For periodic monitoring of CSR activities, a CSR Committee or a Social Audit Committee or a suitable credible external agency shall be appointed. CSR activities shall also be evaluated by an independent external agency, both concurrently and final.

xliv) The project proponent shall formulate a well laid Corporate Environment Policy and identify and designate responsible officers at all levels of its hierarchy for ensuring adherence to the policy and compliance with the conditions stipulated in this clearance letter and other applicable environmental laws and regulations.

All other conditions mentioned in this Ministry's letter of even no. dated January, 2010 shall remain the same.

This is issued with the approval of the Competent Authority.

Yours faithfully,

(Sanchita Jindal)
Scientist 'F' & Director (I)

Copy to:

1. The Secretary, Ministry of Power, Shram Shakti Bhawan, Rafi Marg, New Delhi 110001.
2. The Secretary, Department of Environment, Govt. of Maharashtra.
3. The Chairman, Central Electricity Authority, Sewa Bhawan, R.K. Puram, New Delhi-110066.
4. The Chairman, Maharashtra Pollution Control Board, Kalpataru Point, 3rd & 4th Floors, Sion Matunga Scheme Road No. 6, Opp. Cine Planet, Sion Circle, Sion (E), Mumbai - 400 022.
5. The Chairman, Central Pollution Control Board, Parivesh Bhawan, CBD-cum-Office Complex, East Arjun Nagar, Delhi-110032.
6. The Chief Conservator of Forests, Regional Office (WZ), E-5, Kendriya Paryavaran Bhawan, Arera Colony, Ravishankar Nagar, Bhopal - 462016.
7. The District Collector, Nagpur District, Maharashtra.
8. Guard file.

(Sanchita Jindal)
Scientist 'F' & Director (I)

Annexure- C

Inward (E&F
Date:28.3

No. J-13012/87: A.II (T)
Governmen dia
Ministry of Environment, Fc nd Climate Change

3rd Floor, Vayu Block,
Indira Paryavaran Bhawan, Jor Bagh Road,
Aliganj, New Delhi-110003

Dated: 23.03.2017

To

M/s Maharashtra State Power Generation Co. Ltd.
(Formerly known as M.S.E.B)
Corporate Environment Health & Safety Unit
HDIL Towers, "A" Wing, 3rd Floor,
Prof. A K. Marg,
Bandra (E) Mumbai - 400 051

Ph: 022-26582424/26584225; Fax: 022-26477273

Sub: 3x660 MW Expansion of coal based power units at Koradi TPP, Distt. Nagpur, Maharashtra by M/s. Maharashtra State Power Generation Company Ltd.- reg. amendment of EC.

Sir,

This has reference to your letters dated 20.08.2016 on the above subject. It is noted that EC was accorded for the above project on 04.01.2010. Subsequently, the validity of the EC has been extended till 30.06.2016 on 27.03.2015.

2. The matter was placed before the Re-constituted EAC (Thermal Power) in its 1st Meeting held 28.12.2016. In acceptance of the recommendation of the EAC and in view of the information/clarification furnished by you with respect to implementation of the above mentioned power project, EAC recommended for the amendment of the Environmental Clearance with respect to installation of FGD and change in coal source. The Ministry accepts the recommendations of the EAC and hereby amends the following conditions of the said Environmental Clearance.

i. Specific condition 4(i) to be amended as "*Ministry's Notification SO 3305(E) E(P) Amendment Rules, 2015 dated 07.12.2015 regarding revised emission standards for PM, SO2, NO2 and Hg shall be complied with and the same shall be achieved within two years from the date of publication of the notification for all Units-8, 9 & 10 (3x660 MW) i.e. on or before 07.12.2017.*"

ii Change in coal source from Machhakata Coal Mines to Gare Palma Coal Sector-II Block, Mand Raigarh Coalfields, Raigarh District, Chhattisgarh is permitted.

iii. Ministry's notification no.GSR 02(E) dated 02.01.2014 regarding supply of raw or blended or beneficiated coal with ash not exceeding thirty four percent shall be implemented, as applicable.

iv. The compliance of EC conditions shall be reviewed on quarterly basis. In this regard, a compliance mechanism shall be set up through Plant Head who is responsible for implementing the conditions stipulated in the Environmental Clearance, non-compliances and violations. Budget to implement various environmental pollution control measures as proposed in the EMP shall be kept in a separate account and shall not be diverted for any other purposes. Compliance reports shall be uploaded on company's website.

4. All other conditions mentioned in this Ministry's letter of even no. dated 04.01.2010 and 27.03.2015 shall remain the same, as applicable.

This issues with the approval of the Competent Authority.

Yours faithfully,

(Dr. S. Kerketta)
Director

Copy to:

1. The Secretary, Ministry of Power, Shram Shakti Bhawan, Rafi Marg, New Delhi 110001.
2. The Secretary, Department of Environment, Govt. of Maharashtra.
3. The Chairman, Central Electricity Authority, Sewa Bhawan, R.K. Puram, New Delhi-110066.
4. The Chairman, Maharashtra Pollution Control Board, Kalpataru Point, 3rd & 4th Floors, Sion Matunga Scheme Road No. 6, Opp. cine Planet, Sion Circle, Sion (E), Mumbai – 400 022.
5. The Chairman, Central Pollution Control Board, Parivesh Bhawan, CBD-cum-Office Complex, East Arjun Nagar, Delhi-110032.
6. The Addl. Principal Chief Conservator of Forests (C), Ministry of Env., Forest and Climate Change, Regional Office (WCZ), Ground Floor, East Wing, New Secretariat Building, Civil Lines, Nagpur- 440001.
7. The District Collector, Nagpur District, Maharashtra.
8. Guard file.

[Dr. S. Kerketta]
Director

Annexure - D

No. J-13012/87/2007-IA.II (T)
Government of India
Ministry of Environment, Forests and Climate Change

3rd Floor, Vayu Wing,
Indira Paryavaran Bhawan, Jor Bagh Road,
Aliganj, New Delhi-110003

Dated: 29.5.2018

The Chief General Manager
M/s Maharashtra State Power Generation Co. Ltd.
(Formerly known as M.S.P.G.B.)
Corporate Environment Health & Safety Unit
HDIL Towers, "A" Wing, 3rd Floor,
Prof. A.K. Marg,
Bandra (E), Mumbai-400 051

Ph: 022-26583434/26584225, Fax: 022 26477270

Sub: *3x660 MW Expansion of coal based power units at Koradi TPP, Distt. Nagpur, Maharashtra and 1x500 MW Coal based expansion project at Khaperkheda Thermal Power Station at Khaperkheda, Nagpur, Maharashtra by M/s. Maharashtra State Power Generation Company Ltd.- reg. amendment of ECs.*

Sir,

This has reference to your online application nos. IA/MH/THE/24219/2010 dated 27.9.2017 and IA/MH/THE/10223/2005 dated 27.9.2017.

2. It has been noted that Environmental Clearance for 3x660 MW Koradi Thermal Power Plant has been issued vide Ministry' letter dated 4.1.2010. Further, validity of the said EC has been extended till 30.6.2015 vide Ministry's letter dated 27.3.2015. Further, an amendment in EC regarding change in coal source and meeting revised emission norms has been issued vide Ministry's letter dated 23.3.2017. Further, it has been noted that Environmental Clearance for 1x500 MW Khaperkheda Thermal Power Plant has been issued vide Ministry's letter dated 2.6.2010.

3. It has been noted that you have requested for amendment in EC for transporting the coal of approximately 7.35 MTPA through closed pipe conveyor for a length of 16.1 km from various mines of Western Coalfields Ltd to Koradi and Khaperkheda Power Plants. The coal requirement for 3x660 MW Koradi Power Plant and 1x500 MW Khaperkheda Power Plant is 10.11 MTPA and 2.5 MTPA respectively. It has been informed by you that the coal is being transported by road.

4 The total pipe conveyor length is 16.1 Km from Bhanegaon to Koradi TPP. The breakup of the proposed pipe conveyor length is as follows.

Sector	Distance
From Gondegaon mines to Bhanegaon IP	5.35 km
Bhanegaon IP to Khaparkheda TPP	2.84 km
Khaperkheda TPP to Koradi TPP	7.9 km
Total length of conveyor	16.1km

5. Coal from WCL's Gondegaon, Kamptee & Inder mines will be taken from a single point feeding at Gondegaon to be provided by WCL. The combined coal from Gondegaon will be delivered at an intermediate junction point at Bhanegaon where coal from other mines i.e. Singhori & Bhanegaon mines will also be fed. From this junction point, coal will be fed into Khaperkheda Power Plant [illegible] from Khaperkheda to Koradi plant [illegible] existing [illegible] route.

6. The designed capacity of the conveyor is 1200 TPH for all conveyors except [illegible] conveyors which will have capacity of 250 TPH. The details of mines along with the capacities are mentioned below:

Conveyors	Receipt of coal from mines	Total evacuation capacity	Capacity of conveyor
[illegible]	Gondegaon Kampte Inder	5.5 MTPA	1076 TPH*
1003CCPC-1	Singhori Bhanegaon	1.85 MTPA	316 TPH*

7. Total 2.79 Ha of private land will be purchased on mutual agreed terms. The proposed pipe conveyor will cross 3 rivers (Pench, Kanhan and Kolar) and 17 nallahs, 16 main roads, 13 HT lines and 20 HT lines. Proposed ESZ of Pench National Park and Mansingdev Wildlife Sanctuary is at 17.33 km. No forest land is involved in the proposed route.

8. Foundation for Pipe Conveyor supporting Trestles (Concrete Trestles approximately 5.5 m to 6.0 m from existing ground level @ 22.0 m have been considered and after every 110 m four legged concrete trestles are considered to transfer the longitudinal force to ground) and other trestles for inplant conveyor. The conveyor lift is 20 m and the pipe conveyor having diameter 45 cm will be placed on trestle. As part of conveyor system total 20 concrete pillars (8 in Pench, 8 in Kanhan and 4 in Kolar) will be constructed inside the river bed. Distance between two pillars is 36 m. The depth of the pillar foundation is 6-8 m inside the river bed. The river depth varies between 2.5-3.0 m. The cost of the project is Rs.516 Crores. Expected employment for the proposed activity is 30 people.

9. The matter was placed before the Re-constituted EAC (Thermal Power) in its 11th and 16th Meetings held 26.10.2017 and 19.4.2018 respectively. In acceptance of the recommendation of the EAC in its meeting held on 19.4.2018 and in view of the information/clarification furnished by you with respect to implementation of the above mentioned power project, the ***Ministry hereby amends the Environmental Clearances dated 4.1.2010 and 2.6.2010 for transportation of coal by closed pipe conveyor for a length of 16.1 km and with a capacity of 7.35 MTPA from Gondegaon and Bhanegaon mines to Koradi Thermal Power Plant via Khaperkheda Thermal Power Plant*** subject to the following additional conditions:

i. Construction of pillars in the water bodies (Rivers and Nallahs) shall be carried out in the dry season only.
ii. Dust suppression system such as mist/dry fog jet sprinklers to be setup at the transfer points to arrest the fugitive dust emissions.
iii. For every tree cut along the proposed route in the non-forest area, guidelines of Forest (Conservation) Act, 1980 shall be followed in consultation with the local State Forest Department.
iv. Noise level shall be in accordance with the Noise Pollution Rules.

4. All other conditions mentioned in this Ministry's letter of even no. dated 4.1.2010, 27.3.2015, 23.3.2017 and 2.8.2010 shall remain the same, as applicable.

This issues with the approval of the Competent Authority.

Yours faithfully,

(Dr. S. Kerkatta)
Director, IA.I

Copy to:

1. The Secretary, Ministry of Power, Shram Shakti Bhawan, Rafi Marg, New Delhi 110001.
2. The Chairman, Central Electricity Authority, Sewa Bhawan, R.K. Puram, New Delhi-110066.
3. The Chairman, Central Pollution Control Board, Parivesh Bhawan, CBD-cum-Office Complex, East Arjun Nagar, Delhi-110032.
4. The Addl. Principal Chief Conservator of Forests (C), Ministry of Env., Forest and Climate Change, Regional Office (WCZ), Ground Floor, East Wing, New Secretariat Building, Civil Lines, Nagpur- 440001.
5. The Principal Secretary, Department of Environment, 15th Floor, New Administrative Building, Madam Cama Road, Mantralaya, Mumbai – 400032.
6. The Chairman, Maharashtra Pollution Control Board, Kalpataru Point, 3rd & 4th Floors, Sion Matunga Scheme Road No. 6, Opp. cine Planet, Sion Circle, Sion (E), Mumbai – 400 022.
7. The District Collector, Nagpur District, Maharashtra.
8. Guard file/Monitoring File.
9. Website of MoEF&CC.

(Dr. S. Kerkatta)
Director, IA.I

Annexure- E

MAHARASHTRA POLLUTION CONTROL BOARD

Tel. : 2402 0781 / 2402 0432
Fax : 2402 0668
Website : http://mpcb.mah.nic.in
E-mail : mpcb@vsnl.net

Kalpataru Point,
2nd , 3rd & 4th floor,
Opp. Cineplanet,
Near Sion Circle, Sion (E),
Mumbai - 400 022.

INWARD NO /CTE/U/ 1563

DATE 30/11/10

RED/LSI

Consent No. BO/RO (P&P)/EIC No. NG-1855-09/E/CC-41 Date: 29/01/2010

Consent to Establish under Section 25 of the Water (Prevention & Control of Pollution) Act, 1974; under Section 21 of the Air (Prevention & Control of Pollution) Act, 1981 and Authorization under Rule 5 of the Hazardous Wastes (Management & Handling) Rules 1989 and Amendment Rules, 2003. [To be referred as Water Act, Air Act and HW (M&H) Rules respectively].

CONSENT is hereby granted to

M/s. Maharashtra State Power Generation Co. Ltd
Koradi Thermal Power Station at Koradi
Dist Nagpur

located in the area declared under the provisions of the Water Act, Air act and Authorization under the provisions of HW (M & H) Rules and amendments thereto subject to the provisions of the Act and the Rules and the Orders that may be made further and subject to the following terms and conditions:

1. **The Consent to Establish is granted for a period up to commissioning of the project or five years whichever is earlier.**

2. **The Consent is valid for the manufacture of:-**

Sr. No.	Product	Maximum Quantity
1)	Electricity Generation	3 x 660 MW

3. **CONDITIONS UNDER WATER (Prevention and Control of Pollution) ACT, 1974:**

(i) The quantity of trade effluent from the factory shall not exceed **10868 M^3/day.**

(ii) The daily quantity of sewage effluent from the factory shall not exceed **840 M^3/day.**

(iii) **Trade Effluent:**

Treatment: The applicant shall provide comprehensive treatment system consisting of primary / secondary and/or tertiary treatment as is warranted with reference to influent quality and operate and maintain the same continuously so as to achieve the quality of the treated effluent to the following standards:

The industrial effluent arising from various sections of Power Plant shall be given such treatment either collective or individually as the site condition permits that the final quality of effluent shall have following character standards:

a) **Condenser Cooling Water:**

1)	pH	Between 6.5 to 8.5
2)	Temperature	Not to exceed 5 Degree C. Higher than the intake water temperature.
3)	Free available Chlorine	Not to exceed 0.5 mg/l

Maharashtra Pollution Control Board Mumbai

02/01/11

b) **Boiler Blow down:**

1)	Suspended Solids	Not to exceed	100	mg/l.
2)	Oil & Grease	Not to exceed	20	mg/l.
3)	Copper (Total)	Not to exceed	1	mg/l.
4)	Iron (Total)	Not to exceed	1	mg/l.

c) **Cooling Tower Blow down:**

1)	Free available Chlorine	Not to exceed	0.5	mg/l.
2)	Zinc	Not to exceed	1	mg/l.
3)	Chromium (Total)	Not to exceed	0.2	mg/l.
4)	Phosphate	Not to exceed	5	mg/l.

d) **Ash Pond Effluent:**

1)	pH	Between 6.5 to 8.5		
2)	Suspended Solids	Not to exceed	100	mg/l.
3)	Oil & Grease	Not to exceed	20	mg/l.

e) **D.M. Plant Effluent:**

1)	PH	Between	5.5 to 9	
2)	BOD 3 days 27 Deg. C.	Not to exceed	30	mg/l.
3)	COD	Not to exceed	250	mg/l.
4)	Suspended Solids	Not to exceed	100	mg/l
5)	Oil & Grease	Not to exceed	10	mg/l.
6)	TDS	Not to exceed	2100	mg/l.

(iv) **Trade Effluent Disposal:** The treated effluent shall be maximum recycled/reused for dust suppression, for cooling tower, sprinkling on road, ash handling etc and remaining shall be used on own land for gardening.

(v) **Sewage Effluent Treatment:** The applicant shall provide comprehensive treatment system as is warranted with reference to influent quality and operate and maintain the same continuously so as to achieve the quality of treated effluent to the following standards.

(1)	Suspended Solids	Not to exceed	100	mg/l.
(2)	BOD 3 days 27 C.	Not to exceed	100	mg/l.

(vi) **Sewage Effluent Disposal:** The treated domestic effluent shall be used for gardening/irrigation. In no case, effluent shall find its way to any water body directly/indirectly at any time.

(vii) **Non-Hazardous Solid Wastes:**

Type of waste	Quantity	Treatment	Disposal
1) Fly Ash	8633 MT/D	—	Should be send to cement Manufacturer & dispose as per Govt. of India Guidelines / Notification vide No. SO 763(E), dtd 14-09-1999.
2) Bottom Ash & Waste Ash	2160 MT/D		

(viii) **Other conditions:**

a) The industry should monitor effluent quality regularly.

b) The firm shall provide continuous flow meter for the measurement of the flow of the effluent.

c) Industry shall adopt clean technology like ozonization for cooling water treatment.

d) Industry shall provide dry fly ash handling & collection system and utilize the fly ash as per the fly ash notification of the Govt. of India.

e) Transportation of coal & fly ash shall be by closed system. Conveyor system wherever possible.

f) Fly ash shall be 100% utilized within six years as per fly ash Notification vide No. SO 763(E), dtd 14-09-1999.

Maharashtra Pollution Control Board Mumbai

4. The applicant shall comply with the provisions of the Water (Prevention Control of Pollution) Cess Act, 1977 (to be referred as Cess Act) and Rules there under.
The daily water consumption for the following categories is as under:

(i)	Domestic	800 CMD
(ii)	Industrial Cooling	144000 CMD
(iii)	Boiler	6168 CMD
(iv)	Industrial Process	24000 CMD
(v)	Gardening	24000 CMD

The applicant shall regularly submit to the Board the returns of water consumption in the prescribed form and pay the Cess as specified under Section 3 of the said Act which is also available on MPCB website at http://mpcb.mah.nic.in/images/cessform1.pd

5. **CONDITIONS UNDER AIR (Prevention & Control of Pollution) ACT, 1981:**

(I) The applicant shall install a comprehensive control system consisting of control equipments as is warranted with reference to generation of Emission and operate and maintain the same continuously so as to achieve the level of pollutants to the following standards:

Standards for Emissions of Air Pollutants:

(i)	SPM/TPM	Not to exceed	50 mg/Nm^3
(ii)	SO_2	Not to exceed	342 TPD

(II) **The applicant shall observe the following fuel patter :-**

Sr. No.	Type of Fuel	Quantity
(i)	Coal	30638 T/Day
(ii)	Furnace Oil	80 T/Day
(iii)	LDO	40 T/Day

(III) **The applicant shall erect the chimney(s) of the following specifications:-**

Sr. No.	Chimney attached to	Height in Mtrs.
i)	Boiler of Unit No. I	275
ii)	Boiler of Unit No. II	275
iii)	Boiler of Unit No. III	275
iv)	DG Set 1500 KVA	12*

*= above roof of building where DG Set is installed

(IV) **Control Equipment:**

1. Electrostatic Precipitator of sufficient capacity shall be provided to Boiler and any other sources of particulate matter, so as to ensure that TPM emission do not exceed 50 mg/NM^3
2. Dust collection system and automatic water sprinkler system shall be provided to Coal Handling Plant.
3. Dust collector of sufficient capacity shall be provided to coal crusher and any other sources of SPM.
4. There shall not be any fugitive emission from coal storage yard.
5. Industry shall install opacity meter.
6. Closed containers shall be used for transportation of coal.
6. The industry shall make necessary provisions for installing FGD with sufficient efficiency in its design and layout, and sufficient floor space so that it can be installed in future, as and when directed by Board.

(V) **Conditions for DG Sets:-**

1. Noise from DG Sets shall be controled by providing acoustic enclosure or by treating the room acoustically.
2. Applicant should provide acoustic enclosure for control of noise. The acoustic enclosure/ acoustic treatment of the room shall be designed for minimum 25 dB(A) insertion loss or for meeting the ambient noise standards, whichever is on higher side. A suitable exhaust muffler with insertion loss of 25 dB(A) shall be provided. The measurement of insertion loss shall be done at different at 0.5 meters from acoustic enclosure/ room and then average.

3. The Applicant should make efforts to bring down noise level due to DG Set, near it's premises, with ambient noise level requirements by proper setting control measures.
4. Installation of DG Set must be strictly in compliance with recommendations of set manufacturer.
5. A proper routine and preventive maintenance procedure for DG Set shall be and followed in consultation with the DG manufacturers which would help to vent noise levels of DG Sets from deteriorating with use.
6. The DG set shall be operated only in case of power failure. The applicant shall make arrangement for regular electrical power.
7. The Applicant shall not cause any nuisance in the surrounding area due to operation of DG sets.
8. In case of problems, the D.G. set shall not be operated until it is set back to satisfactory position.

(VI) **Other Conditions:**

1. The coal handling system shall be covered with proper hooding and ventilation arrangements connected to dust suppress agent so as not to allow any fugitive emissions.
2. A separate environment monitoring cell with suitable qualified staff should be set up for implementation of the stipulated environmental safeguards.
3. The industry shall not cause any nuisance in surrounding area.
4. The industry shall install three Continuous Automatic Ambient Air & Micrometrological monitoring stations at locations specified by the State Pollution Control Board to be set up & operate at its own cost measure SO_2, NO_x and particulate matter. These CAAQMS shall also have necessary provision of online transfer of data to MPCB. The air quality observed shall be displayed for public information at the factory gate through the specialized display Board.
5. The industry shall install on-line stack monitoring system for the prescribed parameter with provision to transfer the data on-line to MPCB.
6. If due to any technological improvements or otherwise this Board is of opinion that all or any of the conditions referred above require variation (including the change of any control equipment either in whole or in part), this Board shall after giving the applicant an opportunity of being heard vary all or any of such conditions and thereupon the applicant shall be bound to comply with the conditions so varied.

(VII) The applicant shall provide ports in the chimney/(s) and facilities such as ladder, platform etc. for monitoring the air emissions and the same shall be open for inspection to/and for use of the Board's Staff. The chimney(s) vents attached to various sources of emission shall be designated by numbers such as S-1, S-2, etc. and these shall be painted / displayed to facilitate identification.

(VIII) The industry shall take adequate measures for control of noise levels from its own sources within the premises so as to maintain ambient air quality standard in respect of noise to less than 75 dB(A) during day time and 70 dB(A) during night time. Day time is reckoned in between 6 a.m. and 10 p.m. and night time is reckoned between 10 p.m. and 6 a.m.

5. **CONDITIONS UNDER HW (M &H) RULES, 1989 & AMENDMENT RULES, 2003:**

(I) The applicant shall handle hazardous wastes as specified below:

Sr. No.	Item No. of Process generating HW as per Schedule-I	Type of Waste	Quantity	Disposal
1	5.1	Spent oil	75 T/Y	Sale to MPCB/CPCB authorized re processor
2	5.2	Residual Oil	80 T/Y	
3		Used Battery	80 Nos /Y	
	34.4	ETP Sludge	500 T/Y	CHWTSDF

Maharashtra Pollution Control Board Mumbai

7. Whenever due to breakdown or other unforeseen act or event, such emissions occur or is apprehended to occur in excess of standards laid down, such information shall be forthwith reported to Board concerned Police Station, office of Directorate of Health Services, Department of Explosives, Inspectorate of Factories and Local body. In case of failure of pollution control equipments, the Production process connected to it shall be stopped.

8. General conditions:

(I) The applicant shall bring minimum 33% of the available open land under green coverage/ plantation. The applicant shall submit a yearly statement by 30th September every year on available open plot area, no. of trees surviving as on 31st March of the year and no. of trees planted by September end.

(II) The applicant shall provide for an alternate electric power source sufficient to operate all pollution control facilities installed by he applicant and operate the same in case of power failure to maintain compliance with the terms and conditions of the consent. In the absence of same, the applicant shall stop, reduce or otherwise, control production to abide by terms & conditions of this consent regarding pollution levels.

(III) The firm shall submit MPCB, the Environmental Statement Report for the financial year ending 31st March in the prescribed Form-V as pre the provisions of rule 14 of the Environment (Protection) (Second Amendment) Rules, 1992 before 30th September every year.

(IV) The applicant shall install a separate meter showing the consumption of energy for operation of domestic and industrial effluent treatment plants and air pollution control system. A register showing consumption of chemicals used for treatment shall be maintained. The applicant shall also submit a comparative statement of designed power and chemical consumptions vis-a vis actual power and chemical consumption along with Environmental statement.

(V) Separate drainage system shall be provided for collection of trade and sewage effluents. Terminal manholes shall be provided at the end of collection system with arrangement for measuring the flow. No effluent shall be admitted in the pipes/sewers down- stream of the terminal manholes. No effluent shall find its way other than in designed and provided collection system. Neither storm water nor discharge from other premises shall be allowed to mix with the effluents from the factory.

(VI) The applicant shall provide facility for collection of environmental samples and samples of trade and sewage effluents, air emissions and hazardous wastes to the Board staff at the terminal or designated points and shall pay to the Board for the services rendered in this behalf. An inspection book shall be opened and made available to the Board's officers during their visit to the applicant.

(VII) The industry shall ensure that fugitive emissions from the activity are controlled so as to maintain clean and safe environment in and around the factory premises.

9. Applicant shall ensure to implement mitigation measures mentioned in Environment Management Plan.

10. The applicant shall obtain Consent to Operate from Maharashtra Pollution Control Board, before Actual Commencement of the production activity.

11. The applicant shall comply with the conditions of Environmental Clearance granted by MoEF, GOI vide No. J-13012/67/2007-IA II(T), dated 04.01.2010.

Maharashtra Pollution Control Board Mumbai

12. This Board reserves the right to amend or add any conditions in this consent and the same shall be binding on the Applicant.

13. **This Consent is issued pursuant to the decision of Consent Appraisal Committee meeting held on 07.09.2009.**

14. The capital investment of the existing project is Rs. 332.5/- Crores & the capital investment of the proposed project is Rs. 11680/- Crores.

To,
M/s. Maharashtra State Power Generation Co. Ltd
Koradi Thermal Power Station at Koradi
Dist Nagpur

(Mahesh Pathak)
Member Secretary

Maharashtra Pollution Control Board Mumbai

Copy to:
1) Regional Officer, MPC Board, Nagpur.
2) Sub Regional Officer, MPC Board, Nagpur-I.
3) Chief Accounts Officer, MPC Board, Mumbai.

Received Consent fee of --

Amount	D. D. No.	Date	Drawn on
Rs. 2373000/-	852371	28.01.2008	Bank of Maharashtra
Rs. 7507000/-	68584	18.01.2007	Bank of Maharashtra

11,880/-

4) Cess Branch, MPC Board, Mumbai. 5) Master file.

ANNEXURE-I

1. The applicant shall maintain good house keeping and take adequate measures for control of pollution from all sources so as not to cause nuisance to persons living in and/inhabitants.

2. The applicant shall bring minimum 33% of the available open land under green coverage/ plantation.

3. *Solid Waste.*—The non-hazardous solid waste arising in the factory premises, sweepings, etc. be disposed of scientifically so as not to cause any nuisance/pollution. The applicant shall take necessary permission/s from civic authorities for disposal to dumping ground.

4. The applicant shall provide for an alternate electric power source sufficient to operate all pollution control facilities installed by the applicant to maintain compliance with the terms and conditions of the consent. In the absence, the applicant shall stop, reduce or otherwise, control production to abide by terms and conditions of this consent regarding pollution levels.

5. The applicant shall not change or alter the quantity, quality, the rate of discharge, temperature or the mode of the effluent/emissions or hazardous wastes or control equipments provided for without previous written permission of the Board.

6. The applicant shall provide facility for collection of environmental samples and samples of trade and sewage effluents, air emissions and hazardous wastes to the Board staff at the terminal or designated points and shall pay to the Board for the services rendered in this behalf.

7. The applicant shall make an application for renewal of the consent at least 60 days before the date of expiry of the consent.

8. The firm shall submit to this office, the 30th day of September of every year, the Environmental Statement Report for the financial year ending 31st March in the prescribed Form-V as per the provisions of rule 14 of the Environment (Protection) (Second Amendment) Rules, 1992.

9. An inspection book shall be opened and made available to the Board's officers during their visit to the applicant.

10. The applicant shall install accurate meter showing the consumption of energy for operation of domestic and industrial effluent treatment plants and air pollution control system. A register showing consumption of chemicals used for treatment shall be maintained.

11. Separate drainage system shall be provided for collection of trade and sewage effluents. Terminal manholes shall be provided at the end of collection system with arrangement for measuring the flow. No effluent shall be admitted in the pipe/sewer down-stream of the terminal manholes. No effluent shall find its way other than in designed and provided collection system.

12. Neither storm water nor discharge from other premises shall be allowed to mix with the effluents from the factory.

13. The industry shall ensure that fugitive emissions from the activity are controlled so as to maintain clean and safe environment in and around the factory premises.

ANNEXURE-II

TERMS AND CONDITIONS OF AUTHORISATION

1. The authorisation shall comply with the provisions of the Environment (Protection) Act, 1986 and the rules made thereunder.
2. The authorisation or its renewal shall be produced for inspection at the request of an officer authorised by the State Pollution Control Board.
3. The person authorised shall not rent, lend, sell, transfer or otherwise transport the hazardous wastes without obtaining prior permission of the State Pollution Control Board.
4. Any unauthorised change in personnel, equipment as working conditions as mentioned in the application by the person authorised shall constitute a breach of his authorisation.
5. It is the duty of the authorised person to take permission of the State Pollution Control Board to close down the facility.
6. An application for the renewal of an authorisation shall be made as laid down in rule 5 (6) (ii).
7. (a) Category No. — by land fill.

The hazardous waste to be disposed of through landfill shall not contain following constituents in excess of limits specified below :—

Sulphate	...	1000 mg/kg.
Chloride	...	1000 mg/kg.
Mixture of heavy metals (Cu+Ni+Cr+Zn)	...	25 mg/kg.
Lead	...	1.0 mg/kg.
Hg	...	0.01 mg/kg.

The firm shall take appropriate measures to put a lining to landfill site so as to arrest the passage of leachates to ground water. Leachates generated, if any, shall be connected to existing Effluent Treatment Plant facilities for treatment and disposed of as per the consent conditions stipulated under Water (Prevention and Control of Pollution) Act, 1974.

7. (b) Category No. — by land fill.

The wastes which are either disposed of through contractor or which are sold through the contractor shall be disposed of/sold under intimation of this office. The firm shall ensure that the Contractor/s hold/s valid consent under Water (Prevention and Control of Pollution) Act, 1974 and authorisation under Environment (Protection) Act, 1986, i.e. under Rules notified on 28th July, 1989 and 27th November, 1989.

8. Category No. — by incineration through incinerator.

The firm shall meet the emission standards as prescribed below for the incineration plant :—

Particulate	...	150 mg/Nm3.
HCl	...	100 mg/Nm3.
HF	...	2 mg/Nm3.
SO_x	...	300 mg/Nm3.
NO_x	...	50 ppm.
Lead	...	10 mg/Nm3.
Mixture of As+Cd+Cr+Hg+Ni	...	0.2 mg/Nm3.
TOC	...	20 mg/Nm3.
CO	...	100 ppm.

The firm shall make efforts to reduce emission by adopting—

(i) Improved burning technology.

(ii) Optimised technology for flue gas cleaning and shall create facilities for monitoring the gaseous emissions.

The ash generated in incinerator plant shall be disposed of through landfill at a designated site.

Annexure - F

MAHARASHTRA POLLUTION CONTROL BOARD

Tel: 24010437/24020783/24014701
Fax: 24024068 /24023515
Website: http://mpcb.gov.in
E-mail: cac-cell@mpcb.gov.in

Kalpataru Point, 2nd - 4th Floor,
Opp. Cine Planet Cinema,
Near Sion Circle, Sion (E)
Mumbai - 400 022

Consent No: Format 1.0/ BO/CAC-Cell/UAN No. 0000030152 /CAC - 1906000774 Date: --/10/2018-- 17/06/2019

To,
M/s. Koradi Thermal Power Plant,
3x660 MW (Coal based Thermal Power Plant),
MAHAGENCO (Unit-8,9 & 10),
Koradi, Tal: Kamptee, Dist: Nagpur-441111.

Subject: Renewal of Consent to Operate RED category.

Ref :1. Consent to operate granted by the Board vide no. Format 1.0/BO/CAC Cell/EIC No.0000011405/8th CAC 1704000482, Dt.11.04.17 (For Unit # 8)
2. Consent to operate granted by the Board vide no. Format 1.0/BO/CAC-Cell/NG-16/CAC/CAC-824 Dt. 03.10.2016 (For Unit # 9)
3. Consent to operate granted vide no. Format 1.0/BO/CAC-Cell/UAN No. 0000016152/CAC/ CAC-1612000970 Dt. 28.12.2016 (For Unit # 10)
4. Environmental Clearance granted by MOEF, GOI vide No. J-13012/87/2007-IA. II (T) Dated 04.01.2010.
5. The Minutes of CAC meeting held on 27.03.2018.

Your application: UAN No. 0000030152 Dated: 13.07.2017.
For: Consent to Operate under RED category.
under Section 26 of the Water (Prevention & Control of Pollution) Act, 1974 & under Section 21 of the Air (Prevention & Control of Pollution) Act, 1981 and Authorization under Rule 5 of the Hazardous and Other Wastes (M & T M) Rules 2016 is considered and the consent is hereby granted subject to the following terms and conditions and as detailed in the schedule I, II, III & IV annexed to this order:

1. The consent to operate is granted for a period up to 31.08.2019.
2. The actual capital investment of the industry is Rs. 14042.64 Crores as per certificate issued by Chartered Accountant. Earlier investment was Rs. 11880.00 Crores (as per consent granted vide above ref. no. 2).
3. The Consent is valid for the manufacture of–

Sr. No.	Product / By-Product Name	Maximum Quantity in MW
1	Electricity Generation [Coal based]	3 Nos X 660 MW [1980 MW]

4. Conditions under Water (P&CP), 1974 Act for discharge of effluent:

Sr.no.	Description	Permitted quantity of discharge (CMD)	Standards to be achieved	Disposal
1.	Trade effluent	12954	As per Schedule –I	100 % used Recycled/Reused for Ash handling, Spraying, Cleaning, dust suppression, Etc. and industry shall achieve zero discharge.
2.	Domestic Effluent	240	As per Schedule –I	On land for gardening purpose.

5. Conditions under Air (P& CP) Act, 1981 for air emissions:

Sr. no	Description of stack / source	Number of Stack	Standards to be achieved
1	Boiler (3 Nos X 660 MW)	01	As per Schedule –II
2	D.G. Set -3 x 1900 KVA (Standby)	03	

6. Conditions about Non Hazardous Wastes :

Sr. no	Type Of Waste	Quantity & UoM	Treatment	Disposal
1	Fly Ash	10800.0 T/D	--	Shall be send to Cement manufacturer, Brick manufacturer, dispose as per MOEF and CC, GOI, Notification vide no.SO 763 (E) dated 14.09.1999 and amended time to time thereof.
2	Bottom Ash	2770.0 T/D	--	

7. Conditions under Hazardous Waste (MH & TM) Rules, 2016 for treatment and disposal of hazardous waste:

Sr. No.	Type Of Waste	Category	Quantity	UOM	Treatment	Disposal
1	Used oil/ Spent oil	5.1	12.0	MT/A	--	Sale to authorized CPCB/ MPCB preprocessor/recycler
2	Spent Grease/Waste /residue containing oil	5.2	6.0	MT/A	--	sale to authorized CPCB/ MPCB preprocessor/recycler
3	Glass wool	--	5.0	MT/A	--	CHWTSDF
4	Waste resin	--	2.0	MT/A	--	CHWTSDF

8. The Board reserves the right to review, amend, suspend, revoke etc. this consent and the same shall be binding on the industry.

9. This consent should not be construed as exemption from obtaining necessary NOC/permission from any other Government authorities.

10. The applicant shall comply with conditions stipulated in Environmental Clearance granted by MOEF & CC vide no. J-13012/87/2007-IA.II (T) Dated 04.01.2010.

11. Industry shall promote adoption of clean coal (with ash content less than 34%) and clean power generation technologies and comply with the notification issued by MoEF for utilization of fly ash from coal or lignite based thermal power plants dated 14th September, 1999 and as amended on 3rd November, 2009 & amendment dated 02nd January 2014.

12. The applicant shall comply with the recommendations of the task force for implimantation of CREP recommendations for Thermal Power Plants.

13. Industry shall comply the standards stipulated by the Ministry of Environment, Forest and Climate Change vide Notification dated 07.12.2015.

14. The Sulphur and ash contents in the coal to be used in the project shall not exceed 0.5 % and 34 % respectively.

Maharashtra Pollution Control Board * Mumbai *

Schedule-I

Terms & conditions for compliance of Water Pollution Control:

1) A] As per your application, you have provided the Effluent Treatment Plant (ETP) with the design capacity of 12000 m3/D.

B] The Applicant shall operate the effluent treatment plant (ETP) to treat the trade effluent so as to achieve the following standards prescribed by the Board or under EP Act, 1986 and Rules made there under from time to time, whichever is stringent.

Sr No.	Parameters	Standards prescribed by Board
I.	Compulsory Parameter	Limiting Concentration in mg/l, except for pH
01	pH	Between 6.5 to 8.5
02	Oil & Grease	Not to exceed to 10 mg/l
03	BOD 3 days at 27°C	Not to exceed to 30 mg/l
04	Total Dissolved Solids	Not to exceed to 2100 mg/l
II.	For Condenser Cooling water	
01	Temperature	Not to exceed 5°C. than that of intake water temp.
02	Free available chlorine	Not to exceed 0.5 mg/l
III	Boiler Blow Down	
01	Suspended Solids	Not to exceed 100 mg/l
02	Oil & Grease	Not to exceed to 10 mg/l
03	Copper (Total)	Not to exceed 1.0 mg/l
04	Iron (Total)	Not to exceed 1.0 mg/l
IV.	Cooling Tower Blow Down	
1	Free available chlorine	Not to exceed 0.5mg/l
2	Zinc	Not to exceed 1.0mg/l
3	Chromium (Total)	Not to exceed 0.2 mg/l
4	Phosphate	Not to exceed 5.0 mg/l
V	D.M. Plant Effluent	
1	pH	Between 5.5 to 9
2	BOD 3 days	Not to exceed 30 mg/l
3	COD	Not to exceed 250 mg/l
4	Suspended Solids	Not to exceed 100 mg/l
5	Oil & Grease	Not to exceed 10.0 mg/l
6	TDS	Not to exceed 2100 mg/l

C] The treated effluent shall 100 % used Recycled/Reused for Ash handling, Spraying, Cleaning, dust suppression, Etc. and industry shall achieve zero discharge.

2) A.] As per your consent application, you have provided the sewage treatment plant of capacity 35 KLD consist of MBBR technology.

B] The Applicant shall operate the sewage treatment system to treat the sewage so as to achieve the following standards/ prescribed under EP Act, 1986 and Rules made there under from time to time, whichever is stringent.

(1)	Suspended Solids	Not to exceed	50	mg/l
(2)	BOD 3 days 27°C	Not to exceed	30	mg/l
(3)	COD	Not to exceed	100	mg/l

15. Industry shall comply MoEF office memorandum dated 26.08.2015 by protocol for sampling, analysis of coal and reporting of compliance in respect of implementation of the Gazette Notification on use & supply of raw or blended of beneficiated coal with ash content not exceeding 34% on quarterly average basis.

16. Industry shall either make the agreement with coal washeries or shall provide own washeries to get the blended/ beneficiated coal with ash content less than 34% and submit the BG of Rs. 10 lakhs towards compliance of the same.

17. Industry shall comply the directions with the direction issued by CPCB vide letter dated 11.12.2017 regarding installation of FGD within stipulated time period.

18. Industry shall install the Automatic real time monitoring system for coal ash analysis.

19. Industry shall ensure the connectivity of online monitoring system to MPCB server for the parameter TPM, SO2 and NOx.

20. This consent should not be construed as exemption from obtaining necessary NOC/permission from any other Government authorities.

For and on behalf of the
Maharashtra Pollution Control Board

(R. Ravendiran, IAS)
Member Secretary

Received Consent fee of –

Sr. No	Amount (Rs.)	D.D. No.	Date	Drawn On
1.	Rs.2,80,85,258/-	UTR NO. 94402091	05.07.2017	State Bank of India
2.	Rs.2,49,66,047/-	UTR NO. 109809556	29.05.2018	State Bank of India

Copy to:

1. Regional Officer, MPCB, Nagpur /Sub-Regional Officer –Nagpur-II, MPCB, Nagpur.
   - They are directed to ensure the compliance of the consent conditions.
2. Chief Accounts Officer, MPCB, Mumbai.
3. CC/CAC desk - for record & website updation purposes.

C] The treated effluent shall be Recycled/Reused for Ash handling, coal handling, Spraying, Cleaning, dust suppression, sprinkling on road and ash quenching purpose and remaining shall be utilized for plantation /gardening.

8) The Board reserves its rights to review plans, specifications or other data relating to plant setup for the treatment of waterworks for the purification thereof & the system for the disposal of sewage or trade effluent or in connection with the grant of any consent conditions. The Applicant shall obtain prior consent of the Board to take steps to establish the unit or establish any treatment and disposal system or and extension or addition thereto.

9) The industry shall ensure replacement of pollution control system or its parts after expiry of its expected life as defined by manufacturer so as to ensure the compliance of standards and safety of the operation thereof.

10) The Applicant shall comply with the provisions of the Water (Prevention & Control of Pollution) Act, 1974 and detailed water budget is given below.

Sr. no	Purpose for water consumed	Water consumption quantity (CMD)
1.	Industrial Cooling, spraying in mine pits or boiler feed	95000
2.	Domestic purpose	800
3.	Processing whereby water gets polluted & pollutants are easily biodegradable	40000
4.	Processing whereby water gets polluted & pollutants are easily biodegradable and are toxic	0

11) The Applicant shall provide Specific Water Pollution control system as per the conditions of EP Act, 1986 and rule made there under Environmental Clearance / CREP guidelines.

Maharashtra Pollution Control Board * Mumbai *

Schedule-II

Terms & conditions for compliance of Air Pollution Control:

1. As per your application, you have provided the Air pollution control (APC)system and also erected following stack (s) and to observe the following fuel pattern-

Sr. No.	Stack Attached To	APC System	Height in Mtrs.	Type of Fuel	Quantity & UoM	S%	SO2 Kg/Day
1.	Boiler unit no.8,9,10. [3X 660 MW]	ESP Each unit	275 each	Coal	30,000 MT/Day	0.5%	80000

Coal should have max 34% ash & 0.5% Sulphur content.

2. The Applicant shall provide Specific Air Pollution control equipment's as per the conditions of EP Act, 1986 and rule made there under from time to time / Environmental Clearance / CREP guidelines. (Concern section shall mention specific control equipment's)

3. The applicant shall operate and maintain above mentioned air pollution control system, so as to achieve the level of pollutants to the following standards:

1] Standard for unit 8, 9 &10:

I	Particulate Matter	Not to exceed	50 mg/ Nm^3
II	Sulphur Dioxide(SO_2)	Not to exceed	200 mg/ Nm^3 [For unit having capacity of 500 M and above]
III	Oxides of Nitrogen (NOx)	Not to exceed	300 mg/ Nm^3
Iv	Mercury (Hg)	Not to exceed	0.03 mg/ Nm^3

4. The Applicant shall obtain necessary prior permission for providing additional control equipment with necessary specifications and operation thereof, alteration, or replacement alteration well before its life come to an end or erection of new pollution control equipment.

5. The Board reserves its rights to vary all or any of the condition in the consent, if due to any technological improvement or otherwise such variation (including the change of any control equipment, other in whole or in part is necessary).

6. The applicant shall operate four continuous automatic ambient air and microbiological monitoring station at location indicated by MPC Board to set up and operate at its own cost measurement of So_2, NOx and particulate matter. These CAAQMS shall also have necessary provision of networking to the Air Quality Monitoring network of MPCB.

7. Control Equipment's:

a) Electrostatic Precipitator of sufficient capacity provided to each Boiler and any other sources of particulate matter shall be operate and maintain so as to ensure that TPM emission do not exceed 50 mg/Nm^3
b) Dust collection system and automatic water sprinkler system provided to Coal Handling Plant shall be operate and maintain continuously.
c) Dust collector of sufficient capacity provided to coal crusher and any other sources of SPM shall operate and maintain continuously.
d) There shall not be any fugitive emission from coal storage yard.
e) The industry shall make necessary provisions for installing FGD with 90 % efficiency in its design and layout ad sufficient floor space so that it can be installed in future, as & when directed by Board.

Schedule-III
Details of Bank Guarantees

BG fresh/extend Bank Guarantee:

Sr. No.	BG Code	Amt of BG Imposed	Submission Period	Purpose of BG	Compliance Period	Validity Date
	PNC1			Handling and disposal of fly ash		
1	PNC1a	1/- Lakh	15 Days	Mitigation of seepages from wet fly ash conveying system.	Continuous	31.12.2019
2	PNC1b	1/- Lakh	15 Days	Providing arrangement for reuse of 100% seepage water arising from ash pond for ash slurry.	Continuous	31.12.2019
3	PNC1c	1/- Lakh	15 Days	Scientific operation of ash pond i.e. uniform distribution of wet slurry in the pond so as to have minimum depth of water.	Continuous	31.12.2019
4	PNC1d	1/- Lakh	15 Days	Utilization of fly ash as per fly ash notification 1999.	Continuous	31.12.2019
5	PNC1e	5/- Lakh	15 Days	To switch over 100% usable dry fly ash collection & storage.	Continuous	31.12.2019
6	PNC1e	5/- Lakh	15 Days	Operation & maintenance of effluent treatment plant to achieve disposal standards.	Continuous	31.12.2019
7	PWO1	5/- Lakh	15 Days	Scientific closure of abandoned ash pond with soil cover & plantation over it.	Continuous	31.12.2019
8	PAO1	25/- Lakh	15 Days	Operation & maintenance of air pollution control device to achieve emission standards.	Continuous	31.12.2019
9	–	5/- Lakh	15 Days	Real time monitoring system for coal ash analysis.	Continuous	31.12.2019
10	–	25/- Lakh	15 Days	Installation of FGD for Unit No. 9 as per condition of environmental clearance.	Continuous	31.12.2019
11	–	10/- Lakh	15 Days	Installation of STP.	Continuous	31.12.2019

Note:

(1) The above bank guarantees shall be submitted by the applicant at the respective regional Office within 15 days of the date of combined consent and Authorization.

(2) Project proponent shall extend period of bank guarantee for a period up to: Validity of consent + 4 months period.

Schedule-IV

General Conditions:

1) The applicant shall provide facility for collection of environmental samples and samples of trade and sewage effluents, air emissions and hazardous waste to the Board staff at the terminal or designated points and shall pay to the Board for the services rendered in this behalf.
2) Industry should monitor effluent quality, stack emissions and ambient air quality monthly/quarterly.
3) The applicant shall provide ports in the chimney/(s) and facilities such as ladder, platform etc. for monitoring the air emissions and the same shall be open for inspection to/and for use of the Board's Staff. The chimney(s) vents attached to various sources of emission shall be designated by numbers such as S-1, S-2, etc. and these shall be painted/ displayed to facilitate identification.
4) Whenever due to any accident or other unforeseen act or even, such emissions occur or is apprehended to occur in excess of standards laid down, such information shall be forthwith Reported to Board, concerned Police Station, office of Directorate of Health Services, Department of Explosives, Inspectorate of Factories and Local Body. In case of failure of pollution control equipment's, the production process connected to it shall be stopped.
5) The applicant shall provide an alternate electric power source sufficient to operate all pollution control facilities installed to maintain compliance with the terms and conditions of the consent. In the absence, the applicant shall stop, reduce or otherwise, control production to abide by terms and conditions of this consent.
6) The firm shall submit to this office, the 30th day of September every year , the Environmental Statement Report for the financial year ending 31st March in the prescribed Form-V as per the provisions of rule 14 of the Environment (Protection) (Second Amendment) Rules, 1992.
7) The industry shall send used oil to reprocess/re refiners authorized by MPCB & the Hazardous Waste to CHWTSDF as per the provision contain in the HW(MH&TM) Rules 2016.
8) The industry should comply with the Hazardous Waste (M,H & TM) Rules, 2016 and submit the Annual Returns as per Rule 5(6) & 22(2) of Hazardous Waste (M,H & TM) Rules, 2016 for the preceding year April to March in Form-IV by 30th June of every year.
9) An inspection book shall be opened and made available to the Board's officers during their visit to the applicant.
10) The applicant shall obtain Consent to Operate from Maharashtra Pollution Control Board before actual commencement of the Unit/ Activity for proposed other units (in case of Consent to establish).
11) The applicant shall make an application for renewal of the consent at least 60 days before the date of the expiry of the consent.
12) Industry shall strictly comply with the Water (P&CP) Act, 1974, Air (P&CP) Act,1981 and Environmental Protection Act,1986 and Industry specific standard under EP Rules 1986 which are available on MPCB website(www.mpcb.gov.in).
13) The industry shall constitute an Environmental cell with qualified staff/personnel/agency to see the day to day compliance of consent condition towards Environment Protection.
14) Separate drainage system shall be provided for collection of trade and sewage effluents. Terminal manholes shall be provided at the end of the collection system with arrangement for measuring the flow. No effluent shall be admitted in the pipes/sewers downstream of the terminal manholes. No effluent shall find its way other than in designed and provided collection system.
15) Neither storm water nor discharge from other premises shall be allowed to mix with the effluents from the factory.
16) The applicant shall install a separate meter showing the consumption of energy for operation of domestic and industrial effluent treatment plants and air pollution control system. A register showing consumption of chemicals used for treatment shall be maintained.
17) Conditions for D.G. Set
a) Noise from the D.G. Set should be controlled by providing an acoustic enclosure or by treating the room acoustically.

b] Industry should provide acoustic enclosure for control of noise. The acoustic enclosure/ acoustic treatment of the room should be designed for minimum 25 dB (A) insertion loss or for meeting the ambient noise standards, whichever is on higher side. A suitable exhaust muffler with insertion loss of 25 dB (A) shall also be provided. The measurement of insertion loss will be done at different points at 0.5 meters from acoustic enclosure/room and then average.

c) Industry should make efforts to bring down noise level due to DG set, outside industrial premises, within ambient noise requirements by proper sitting and control measures.

d) Installation of DG Set must be strictly in compliance with recommendations of DG Set manufacturer.

e) A proper routine and preventive maintenance procedure for DG set should be set and followed in consultation with the DG manufacturer which would help to prevent noise levels of DG set from deteriorating with use

f) D.G. Set shall be operated only in case of power failure.

g] The applicant should not cause any nuisance in the surrounding area due to operation of D.G. Set.

h] The applicant shall comply with the notification of MoEF dated 17.05.2002 regarding noise limit for generator sets run with diesel

18) The industry should not cause any nuisance in surrounding area.

19) The industry shall take adequate measures for control of noise levels from its own sources within the premises so as to maintain ambient air quality standard in respect of noise to less than 75 dB (A) during day time and 70 dB (A) during night time. Day time is reckoned in between 6 a.m. and 10 p.m. and night time is reckoned between 10 p.m. and 6 a.m.

20) The applicant shall maintain good housekeeping.

21) The applicant shall bring minimum 33% of the available open land under green coverage/ plantation. The applicant shall submit a statement on available open plot area, number of trees surviving as on 31st March of the year and number of trees planted by September end, with the Environment Statement.

22) The non-hazardous solid waste arising in the factory premises, sweepings, etc. be disposed of scientifically so as not to cause any nuisance / pollution. The applicant shall take necessary permissions from civic authorities for disposal of solid waste.

23) The applicant shall not change or alter the quantity, quality, the rate of discharge, temperature or the mode of the effluent/emissions or hazardous wastes or control equipments provided for without previous written permission of the Board. The industry will not carry out any activity, for which this consent has not been granted/without prior consent of the Board.

24) The industry shall ensure that fugitive emissions from the activity are controlled so as to maintain clean and safe environment in and around the factory premises.

25) The industry shall submit quarterly statement in respect of industries' obligation towards consent and pollution control compliance's duly supported with documentary evidences (format can be downloaded from MPCB official site).

26) The industry shall submit official e-mail address and any change will be duly informed to the MPCB.

27) The industry shall achieve the National Ambient Air Quality standards prescribed vide Government of India, Notification dt. 16.11.2009 as amended.

28] The industry shall comply with the notification issued by MoEF for utilization of fly ash from coal or lignite based thermal power plants dated 14th September, 1999 and as amended on 3rd November, 2009.

29] Industry shall provide dry fly ash handling & collection system and utilize the fly ash as per the fly ash notification of the Govt. of India.

30] The use of beneficiated coal as per GOI Notification shall be implemented. Transportation of coal to site by seaways at port and further transportation of coal shall be carried out through trucks by covering tarpaulin properly till the railway facility from Railway station to the factory site provided.Fly ash shall be by transported through bunker having closed system,truck by covering tarpaulin properly and coal carrying conveyor belt shall be covered from all side with provision of water springing/spraying system properly.

31) The applicant shall Operate online opacity meter/continuous monitoring system for process stack emission analysis & same shall be directly connected to MPCB website http://mpcb.gov.in as well as to the respective Regional Office within 3 months period and operate the same regularly.

32) The applicant shall Operate three continuous automatic ambient air and micrometeorological monitoring station at location indicated by MPC Board to be set up and operate at its own cost for measurement of SO2, NOx and particulate matter. These CAAQMS shall also have necessary provision of networking to the Air Quality Monitoring network of MPCB.

33) They shall promote adoption of clean coal and clean power generation technologies.

34) The coal handling system shall be covered with proper hooding and ventilation arrangements connected to dust suppress agent so as not to allow any fugitive emissions.

35) If due to any technological improvements or otherwise this Board is of opinion that all or any of the conditions referred above require variation (including the change of any control equipment either in whole or in part), this Board shall after giving the applicant an opportunity of being heard very all or any of such conditions and thereupon the applicant shall be bound to comply with the conditions so varied.

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Maharashtra Pollution Control Board
MAHARASHTRA
Mumbai

Annexure - G

MAHARASHTRA POLLUTION CONTROL BOARD

Tel: 24019705/24010437
Fax: 24022514
Website: http://mpcb.gov.in
Email: cac-cell@mpcb.gov.in

Kalpataru Point, 2nd and 4th floor, Opp. Cine Planet Cinema, Near Sion Circle, Sion (E), Mumbai-400022

RED/L.S.I (R48)
No:- Format1.0/CAC/UAN No.0000076926/CR - 2007000590

Date: 08/07/2020

To,
Koradi Thermal Power Plant. MAHAGENCO,
3X660 MW, Unit No.8,9 & 10 (Coal Based Thermal Power Plant)
KHASARA NO 188-189,Koradi,
Tal-Kamptee,Dist-Nagpur.

Sub: Renewal of consent with increase in CI under RED category

Ref:
1. Earlier Consent granted by Board vide No.BO/CAC-CELL/UAN NO.30152/CAC1906000774 dated 17.06.2019 Valid up to 31.08.2019.
2. Minutes of Consent Appraisal Committee Meeting held on 04.05.2020.

Your application No.MPCB-CONSENT-0000076926 Dated 16.07.2019

For: grant of Consent to Operate under Section 26 of the Water (Prevention & Control of Pollution) Act, 1974 & under Section 21 of the Air (Prevention & Control of Pollution) Act, 1981 and Authorization under Rule 6 of the Hazardous & Other Wastes (Management & Transboundary Movement) Rules 2016 is considered and the consent is hereby granted subject to the following terms and conditions and as detailed in the schedule I, II, III & IV annexed to this order:

1. **The consent to renewal is granted for a period up to 31/08/2021**
2. **The capital investment of the project is Rs.14276.5872 Crs. (As per C.A Certificate submitted by Industry Existing-Rs. 14042.64 Cr + Increase in C.I. - Rs. 233.94 Cr= Total CI-Rs. 14276.5872 Cr.)**
3. **Consent is valid for the manufacture of:**

Sr No	Product	Maximum Quantity	UOM
Products			
1	Electricity Generation (3x660 MW) Unit No.8,9 & 10 (Coal Based Thermal Power Plant)	1980	MW

4. **Conditions under Water (P&CP), 1974 Act for discharge of effluent:**

Sr No	Description	Permitted Qty (CMD)	Standards to	Disposal Path
1.	Trade effluent	10739	As per Schedule-I	100% recyle/reused for dust suppression,cooling tower,Ash Handling Plant etc.
2.	Domestic effluent	283	As per Schedule-I	100% recyle/reused for dust suppression,cooling tower,Ash Handling Plant etc.

5. **Conditions under Air (P& CP) Act, 1981 for air emissions:**

Sr No	Stack No	Description of stack / source	Number of Stack	Standards to be achieved
1	3	BOILER	3	As per Schedule -II

6 **Non-Hazardous Wastes:**

Sr No	Type of Waste	Quantity	UoM	Treatment	Disposal
1	FLY ASH	10000	MT/Day	Recycle	Shall be sent to Cement Manufacturing Plant, Brick Manufacturing Plant and dispose as per MoEF-CC,GoI Notification No.SO-763(E) dated 14.09.1999 and as amended time to time thereof.
2	BOTTOM ASH	2400	MT/Day	Recycle	Shall be sent to Cement Manufacturing Plant, Brick Manufacturing Plant and dispose as per MoEF-CC,GoI Notification No.SO-763(E) dated 14.09.1999 and as amended time to time thereof.

7. **Conditions under Hazardous & Other Wastes (M & T M) Rules 2016 for treatment and disposal of hazardous waste:**

Sr No	Category No / Type	Quantity	UoM	Treatment	Disposal
1	5.1 Used or spent oil	10	MT/M	Recycle	Send to Authorised Recycler/Re-processor
2	5.2 Wastes or residues containing oil	6	MT/M	Incineration	CHWTSDF
3	Glass Wool	8	MT/M	Landfill	CHWTSDF
4	Waste Resin	2	MT/M	Landfill	CHWTSDF

8 The Board reserves the right to review, amend, suspend, revoke this consent and the same shall be binding on the industry.

9 This consent should not be construed as exemption from obtaining necessary NOC/ permission from any other Government authorities.

10 The applicant shall comply with the conditions of the Environmental Clearance granted by MoEF-CC, GoI vide letter No. J-13012/87/2007. IA.II (T) dtd. 04.01.2010.

11 Industry shall install online continuous monitoring system as per CPCB guidelines & data to be transmitted directly from Data Logger to Board server .

12 The Energy source for lighting purpose shall preferably be LED based

13 The PP shall harvest rainwater from roof tops of the buildings and storm water drains to recharge the ground water and utilize the same for different industrial applications within the plant

14 Industry shall promote adoption of clean coal (with ash content less than 34%) and clean power generation technologies and comply with notifications issued by MoEF for utilization of fly ash from coal or lignite based thermal power plant dated 14th September, 1999 and as amended on 3rd November, 2009 & amendment dtd 2nd January 2014

15 The applicant shall comply with the recommendations of the task force for implementation of CREP recommendation for Thermal Power Plants.

16 The industry shall comply the standards stipulated by the Ministry of Environment, Forest and Climate Change vide Notification dtd 25.02 2016.

17 The sulphur and ash content in the coal to be used in the project shall not exceed 0.5% and 34% respectively

18 Industry shall comply MoEF office memorandum dated 26.08.2015 by protocol for sampling, analysis of coal and reporting of compliance in respect of implementation of the Gazette Notification on use & supply of raw or blended of beneficiated coal with ash content not exceeding 34% on quaterly average basis

19 Industry shall either make the agreement with coal washeries or shall provide own washeries to get the blended/ beneficiated coal with ash content less than 34% and submit the BG of Rs.10 lakhs towards compliance of the same

20 Industry shall install the Automatic real time monitoring system for coal ash analysis within six month period.

21 PP shall submit revised time bound program towards completion of ETP, up-gradation of air pollution control system so as to meet the revised standards dtd. 07.12.2015. Provision of FGD & provision of online real time coal ash analyzer within a month.

22 PP shall ensure usage of low ash content coal. PP shall comply with fly Ash Notification

23 PP shall ensure the OCEM & CAAQMS connectivity to the Board server within a month.

24 The applicant shall make an application for renewal of consent 60 days prior to date of expiry of the consent.

For and on behalf of the
Maharashtra Pollution Control Board.

(E. Ravendiran IAS)
Member Secretary

Received Consent fee of -

Sr No	Amount(Rs.)	Transaction-DR.No.	Date	Transaction Type
1	28780045.00	5452316	21/06/2019	RTGS
2	28794185.00	MPCB-DR-0573	24/06/2020	RTGS

Copy to:

1. Regional Officer, MPCB, Nagpur and Sub-Regional Officer, MPCB, Nagpur I
   - They are directed to ensure the compliance of the consent conditions.
   - They are directed to forfeit the bank guarantee of Rs.25.0 Lakh towards non compliance of consent conditions, for JVS exceedance & for not using the coal with ash content less than 34% and obtain top up BG of Rs.50.0 Lakh from the industry
2. Chief Accounts Officer, MPCB,Sion, Mumbai
3. CAC desk for records and website updation purpose.

SCHEDULE-I

Terms & conditions for compliance of Water Pollution Control:

I. A) As per your application, you have provided the Effluent Treatment Plant (ETP) with the design capacity of 12000 m3/day.

B) The Applicant shall operate the effluent treatment plant (ETP) to treat the trade effluent so as to achieve the following standards prescribed by the Board or under EP Act, 1986 and Rules made there under from time to time, whichever is stringent:

Sr.No	Parameters	Limiting concentration not to exceed in mg/l, except for pH
For Condenser Cooling Water		
(1)	pH	Between 6.5 to 8.5
(2)	Temperature	Not to exceed 5°C than that of intake water temp.
(3)	Free available chlorine	Not to exceed 0.5 mg/l
(4)	pH	Between 6.5 to 8.5
(5)	Temperature	Not to exceed 5°C than that of intake water temp.
(6)	Free available chlorine	Not to exceed 0.5 mg/l
Boiler Blow Down		
(1)	Suspended Solids	Not to exceed 100 mg/l
(2)	Oil & Grease	Not to exceed 10 mg/l
(3)	Copper (Total)	Not to exceed 1 mg/l
(4)	Iron (Total)	Not to exceed 1 mg/l
Cooling Tower Blow Down		
(1)	Free available chlorine	Not to exceed 0.5 mg/l
(2)	Zinc	Not to exceed 1 mg/l
(3)	Chromium (Total)	Not to exceed 0.2 mg/l
(4)	Phosphate	Not to exceed 5 mg/l
(5)	Phosphate	Not to exceed 5 mg/l
D.M. Plant Effluent		
(1)	pH	5.5 to 9
(2)	Suspended Solids	Not to exceed 100 mg/l
(3)	Oil & Grease	Not to exceed 10 mg/l
(4)	BOD 3 days	Not to exceed 30 mg/l
(5)	COD	Not to exceed 250 mg/l
(6)	TDS	Not to exceed 2100 mg/l

C) The industry shall ensure connectivity online monitoring system to the MPCB server including separate energy meter for pollution control system.

D) The treated effluent shall be recycled for secondary purposes to the maximum extent and remaining shall be discharged on land for gardening within premise. In no case, effluent shall find its way to outside factory premises.

2. A] As per your application, you have provided Sewage Treatment Plant of designed capacity 35 CMD for the treatment of 283 CMD of sewage.

   B] The Applicant shall operate the sewage treatment system to treat the sewage so as to achieve the following standards.

1	Suspended Solids	Not to exceed	50 mg/l
2	BOD 3 days 27oC	Not to exceed	30 mg/l
3	COD	Not to exceed	100 mg/l

   C] The treated sewage shall be recycled for secondary purposes to the maximum extent and remaining shall be discharged on land for gardening within premise. In no case, sewage shall find its way to outside factory premises.

3. The Board reserves its rights to review plans, specifications or other data relating to plant setup for the treatment of waterworks for the purification there of & the system for the disposal of sewage or trade effluent or in connection with the grant of any consent conditions. The Applicant shall obtain prior consent of the Board to take steps to establish the unit or establish any treatment and disposal system or an extension or addition thereto.

4. The industry shall ensure replacement of pollution control system or its parts after expiry of its expected life as defined by manufacturer so as to ensure the compliance of standards and safety of the operation thereof.

5. The Applicant shall comply with the provisions of the Water (Prevention & Control of Pollution) Act, 1974 and as amended, by installing water meters and other provisions as contained in the said act:

Sr. No.	Purpose for water consumed	Water consumption quantity (CMD)
1.	Industrial Cooling, spraying in mine pits or boiler feed	92501.00
2.	Domestic purpose	942.59
3.	Processing whereby water gets polluted & pollutants are easily biodegradable	0.00
4.	Processing whereby water gets polluted & pollutants are not easily biodegradable and are toxic	0.00
5.	Gardening	90

6. The Applicant shall provide Specific Water Pollution control system as per the conditions of EP Act, 1986 and rule made there under from time to time/ Environmental Clearance/ CREP guidelines.

SCHEDULE-II

Terms & conditions for compliance of Air Pollution Control:

1. As per your application, you have provided the Air pollution control (APC) system and erected following stack (s) to observe the following fuel pattern:

Stack No.	Stack Attached To	APC System	Height in Mtrs	Type of Fuel	Quantity & Unit	S%	SO_2 (kg/hr.)
1	BOILER of unit No.8	ESP	275	COAL	10000 MT/Day	0.50	100000.00
2	BOILER of unit No.9	ESP	275	COAL	10000 MT/Day	0.50	100000.00
3	BOILER of unit No.10	ESP	275	COAL	10000 MT/Day	0.50	100000.00

2. The Applicant shall provide Specific Air Pollution control equipments as per the conditions of EP Act, 1986 and rule made there under from time to time/ Environmental Clearance / CREP guidelines.
3. The applicant shall operate and maintain above mentioned air pollution control system, so as to achieve the level of pollutants to the following standards:

Parameters	Standards	
Total Particulate Matter	Not to exceed	50 mg/ Nm3
Sulphur Dioxide(SO2)	Not to exceed	200 mg/ Nm3 (For the unit having 500 MW and above)
Oxides of Nitrogen(NOx)	Not to exceed	300 mg/ Nm3
Mercury	Not to exceed	0.03 mg/ Nm3

4. The Applicant shall obtain necessary prior permission for providing additional control equipment with necessary specifications and operation thereof or alteration or replacement/alteration well before its life come to an end or erection of new pollution control equipment.
5. The Board reserves its rights to vary all or any of the condition in the consent, if due to any technological improvement or otherwise such variation (including the change of any control equipment, other in whole or in part is necessary).
6. The applicant shall operate four continuous automatic ambient air and micrometeorological monitoring station at location indicated by MPC Board to be setup and operate at its own cost for measurement of SO2,NOX and particulate matter. These CAAQMS shall also have necessary provisions of networking to the Air Quality Monitoring network of NPCB.
7. Control Equipment.
   a) Electrostatic Precipitator (ESP) of sufficiet capacity provided to Boiler and any other sources of particulate matter shall be Operate and maintain so as to ensure that TPM emission doesnot exceed 100 mg/Nm3.
   b) Dust collecting system and automatic water sprinkler system provided to Coal Handling Plants shall be operate and maintain continuously.
   c) Dust collector of sufficient capacity provided to coal crusher and any other source of SPM shall operate and maintain continuously.
   d) There shall not be any fugutive emission from coal storage yard.
   e) The industry shall make necessary provisions for installing FGD with 90% efficiency in its design and layout ad sufficient floor space so that it can be installed in future, as & when directed by Board.

SCHEDULE-III
Details of Bank Guarantees:

Sr. No.	Consent (CTE/ CTO/ CCA)	Amt of B.G in form of	Submission Period	Purpose of BG	Completion Period	Validity Date
1	C2R	Rs. 70 Lakh	15 days	Towards Operation and Maintenance of Air Pollution Control Devices to achieve emission standards.	Continuous	31.12.2022
2	C2R	Rs. 10 Lakh	15 days	Installation of Real Coal Ash Analyser	6 months	31.12.2022
3	C2R	Rs. 5 Lakh	15 days	To switch over to 100 % usable dry fly ash collection and storage	6 months	31.12.2022
4	C2R	Rs. 1 Lakh	15 days	Towards utilization of fly ash as per fly ash notification 1999.	Continuous	31.12.2022
5	C2R	Rs. 1 Lakh	15 days	Towards Mitigation of seepages from wet fly ash conveying system	3 months	31.12.2022
6	C2R	Rs. 1 Lakh	15 days	Towards Scientific operation of ash pond i.e. uniform distribution of wet slurry in the pond so as to have minimum depth of water	Continuous	31.12.2022
7	C2R	Rs. 1 Lakh	15 days	Towards providing arrangement for reuse of 100% seepage water, arising from ash pond, for ash slurry	3 months	31.12.2022
8	C2R	Rs. 5 Lakh	15 days	Towards Scientific closure of abandoned ash pond with soil cover and plantation over it	6 months	31.12.2022
9	C2R	Rs. 5 Lakh	15 days	Towards Operation & maintenance of the Effluent Treatment Plant to achieve disposal standards	Continuous	31.12.2022

Sr. No.	Consent (C2R/ C2I/ A2R)	Amt of BG Imposed	Submission Period	Purpose of BG	Compliance Period	Validity Date
10	C2R	Rs. 25 Lakh	15 days	Towards installation of FGD to unit No.9	6 months	31.12.2022
11	C2R	Rs. 10 Lakh	15 days	Towards installation of STP of adequate capacity	6 months	31.12.2022

BG Forfeiture History

Sr. No.	Consent (C2R/ C2I/ A2R)	Amount of BG Imposed	Submission Period	Purpose of BG	Amount of BG Forfeited	Reason for the Forfeiture
NA						

BG Return details

Sr. No.	Consent (C2R/ C2I/ A2R)	BG No.	Amount of BG	Purpose of BG	Amount of BG Returned
NA					

SCHEDULE-IV
General Conditions:

1. Conditions for D.G. Set
   a) Noise from the D.G. Set should be controlled by providing an acoustic enclosure or by treating the room acoustically.
   b) Industry should provide acoustic enclosure for control of noise. The acoustic enclosure/ acoustic treatment of the room should be designed for minimum 25 dB (A) insertion loss or for meeting the ambient noise standards, whichever is on higher side. A suitable exhaust muffler with insertion loss of 25 dB (A) shall also be provided. The measurement of insertion loss will be done at different points at 0.5 meters from acoustic enclosure/room and then average.
   c) Industry should make efforts to bring down noise level due to DG set, outside industrial premises, within ambient noise requirements by proper sitting and control measures.
   d) Installation of DG Set must be strictly in compliance with recommendations of DG Set manufacturer.
   e) A proper routine and preventive maintenance procedure for DG set should be set and followed in consultation with the DG manufacturer which would help to prevent noise levels of DG set from deteriorating with use.
   f) D.G. Set shall be operated only in case of power failure.
   g) The applicant should not cause any nuisance in the surrounding area due to operation of D.G. Set.
   h) The applicant shall comply with the notification of MoEFCC, India on Environment (Protection) second Amendment Rules vide GSR 371(E) dated 17.05.2002 and its amendments regarding noise limit for generator sets run with diesel.
2. The applicant shall maintain good housekeeping.
3. The non-hazardous solid waste arising in the factory premises, sweepings, etc. be disposed of scientifically so as not to cause any nuisance / pollution. The applicant shall take necessary permissions from civic authorities for disposal of solid waste.
4. The applicant shall not change or alter the quantity, quality, the rate of discharge, temperature or the mode of the effluent/emissions or hazardous wastes or control equipments provided for without previous written permission of the Board. The industry will not carry out any activity, for which this consent has not been granted/without prior consent of the Board.
5. The industry shall ensure that fugitive emissions from the activity are controlled so as to maintain clean and safe environment in and around the factory premises.
6. The industry shall submit quarterly statement in respect of industries obligation towards consent and pollution control compliance's duly supported with documentary evidences (format can downloaded from MPCB official site).
7. The industry shall submit official e-mail address and any change will be duly informed to the MPCB.
8. The industry shall achieve the National Ambient Air Quality standards prescribed vide Government of India, Notification No. B-29016/20/90/PCI-L dated. 18.11.2009 as amended.
9. The Board reserves its rights to review plans, specifications or other data relating to plant setup for the treatment of waterworks for the purification thereof & the system for the disposal of sewage or trade effluent or in connection with the grant of any consent conditions. The Applicant shall obtain prior consent of the Board to take steps to establish the unit or establish any treatment and disposal system or an extension or addition thereto.
10. The industry shall ensure replacement of pollution control system or its parts after expiry of its expected life as defined by manufacturer so as to ensure the compliance of standards and safety of the operation thereof.

11. The PP shall provide personal protection equipment as per norms of Factory Act
12. Industry should monitor effluent quality, stack emissions and ambient air quality monthly/quarterly.
13. Whenever due to any accident or other unforeseen act or even, such emissions occur or is apprehended to occur in excess of standards laid down, such information shall be forthwith Reported to Board, concerned Police Station, office of Directorate of Health Services, Department of Explosives, Inspectorate of Factories and Local Body. In case of failure of pollution control equipments, the production process connected to it shall be stopped.
14. The applicant shall provide an alternate electric power source sufficient to operate all pollution control facilities installed to maintain compliance with the terms and conditions of the consent. In the absence, the applicant shall stop, reduce or otherwise, control production to abide by terms and conditions of this consent.
15. The industry shall recycle/reprocess/reuse/recover Hazardous Waste as per the provision contain in the Hazardous and Other Wastes (M & TM) Rules 2016, which can be recycled /processed /reused /recovered and only waste which has to be incinerated shall go to incineration and waste which can be used for land filling and cannot be recycled/reprocessed etc. should go for that purpose, in order to reduce load on incineration and landfill site/environment.
16. An inspection book shall be opened and made available to the Board's officers during their visit to the applicant.
17. Industry shall strictly comply with the Water (P&CP) Act, 1974, Air (P&CP) Act, 1981 and Environmental Protection Act, 1986 and industry specific standard under EP Rules 1986 which are available on MPCB website (www.mpcb.gov.in).
18. Separate drainage system shall be provided for collection of trade and sewage effluents. Terminal manholes shall be provided at the end of the collection system with arrangement for measuring the flow. No effluent shall be admitted in the pipes/sewers downstream of the terminal manholes. No effluent shall find its way other than in designed and provided collection system.
19. Neither storm water nor discharge from other premises shall be allowed to mix with the effluents from the factory.
20. The industry should not cause any nuisance in surrounding area.
21. The industry shall take adequate measures for control of noise levels from its own sources within the premises so as to maintain ambient air quality standard in respect of noise to less than 75 dB (A) during day time and 70 dB (A) during night time. Day time is reckoned in between 6 a.m. and 10 p.m. and night time is reckoned between 10 p.m. and 6 a.m
22. The industry shall create the Environmental Cell by appointing an Environmental Engineer, Chemist and Agriculture expert for looking after day to day activities related to Environment and irrigation field where treated effluent is used for irrigation.
23. The applicant shall provide ports in the chimney/(s) and facilities such as ladder, platform etc. for monitoring the air emissions and the same shall be open for inspection to/and for use of the Board's Staff. The chimney(s) vents attached to various sources of emission shall be designated by numbers such as S-1, S-2, etc. and these shall be painted/ displayed to facilitate identification.
24. The industry should comply with the Hazardous and Other Wastes (M & TM) Rules, 2016 and submit the Annual Returns as per Rule 6(5) & 20(2) of Hazardous and Other Wastes (M & TM) Rules, 2016 for the preceding year April to March in Form-IV by 30th June of every year.

25. The applicant shall install a separate meter showing the consumption of energy for operation of domestic and industrial effluent treatment plants and air pollution control system. A register showing consumption of chemicals used for treatment shall be maintained.
26. The applicant shall bring minimum 33% of the available open land under green coverage/ plantation. The applicant shall submit a yearly statement by 30th September every year on available open plot area, number of trees surviving as on 31st March of the year and number of trees planted by September end.
27. The Board reserves its rights to review plans, specifications or other data relating to plant setup for the treatment of waterworks for the purification thereof & the system for the disposal of sewage or trade effluent or in connection with the grant of any consent conditions.
28. The firm shall submit to this office, the 30th day of September every year, the Environment Statement Report for the financial year ending 31st March in the prescribed FORM-V as per the provisions of Rule 14 of the Environment (Protection) (second Amendment) Rules, 1992.
29. The Applicant shall obtain necessary prior permission for providing additional control equipment with necessary specifications and operation thereof or alteration or replacement/alteration well before its life come to an end or erection of new pollution control equipment.
30. The Board reserves its rights to vary all or any of the condition in the consent, if due to any technological improvement or otherwise such variation (including the change of any control equipment, either in whole or in part is necessary).
31. The applicant shall provide facility for collection of environmental samples and samples of trade and sewage effluents, air emissions and hazardous waste to the Board staff at the terminal or designated points and shall pay to the Board for the services rendered in this behalf.

Annexure - H

MAHAGENCO
Maharashtra State Power Generation Co. Ltd.
MAHARASHTRA STATE POWER GENERATION CO. LTD.
KORADI THERMAL POWER STATION
(ISO 9001:2008, ISO 14001:2004 & ISO 18001:2007)
Office of Chief Engineer (O & M), T.P.S., Koradi, Nagpur, PIN - 441111
Phone (07109) 262141 to 262146,262106, 262109 FAX: 262127(DR)
CIN: U40100MH2005SGC153648 Email – cegenkoradi@mahagenco.in

UNDERTAKING

TO WHOMSOEVER IT MAY CONCERN

This is to certify that, No legal cases with respect to Environment Clearance granted vide letter no. J-13012/87/2007-IA. II (T) dtd. 04.01.2010 and its subsequent additions/ amendments dtd. 27.03.2015, 23.03.2017 and 29.05.2018 except ongoing petition no. 62/2021 at NGT (WB) are pending in any court of law till date.

No closure/ show-cause notice is issued to the project by CPCB. One show-cause notice was issued by MPCB vide letter no. MPCB/SCN/2111020001 dtd. 02.11.2021 to which reply was filed vide letter no. CE(O&M)/KTPS/660MW/Env. Cell/FL-01/03178 dtd. 11.11.2021. No communication from MPCB in this regard received by Koradi TPS, 3X660 MW.

Chief Engineer
Koradi TPS, 3X660 MW

Annexure - I

CONSTRUCTION AND OPERATING AGREEMENT

OF TREATMENT & TRANSMISSION FACILITIES

FOR RECLAIMED WATER USAGE

Between

Nagpur Municipal Corporation,
Nagpur

And

Maharashtra Power Generation Company Ltd.
For its Thermal Power Stations at
Koradi & Khaperkheda, Nagpur.

2008-2009

NMC

MAHAGENCO

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महाराष्ट्र MAHARASHTRA

BD 951275

दिनांक – 3 OCT 2008

CONSTRUCTION AND OPERATING AGREEMENT OF TREATMENT & TRANSMISSION FACILITIES FOR RECLAIMED WATER USAGE

THIS CONSTRUCTION AND OPERATING AGREEMENT ("Agreement") is entered into this 4th day of Oct. 2008, between the Nagpur Municipal Corporation OF NAGPUR ("NMC") and MAHARASHTRA POWER GENERATION COMPANY ("MAHAGENCO").

RECITALS

A. NMC desires to deliver reclaimed water to MAHAGENCO for Non-Potable application in Thermal Power Plant.

B. MAHAGENCO desires to accept reclaimed water for Non- Potable application in Thermal Power Plant.

C. The Parties desire to construct and operate certain facilities for the treatment and transmission of water.

P.T.O.

AGREEMENT

I. DEFINITIONS

1.1 "Daily Amount" means 110 mld + 10% of treated waste water.

1.2 "Emergency" means an unanticipated event which causes a malfunction of either Party's facilities, preventing either the delivery or the acceptance of water.

1.3 "Independent Engineer" means the engineering firm or Chief Engineer of MJP, Nagpur, MPCB or independent expert or organization mutually agreed by NMC / MAHAGENCO by the Parties to serve as the Independent Engineer.

1.4 "Joint Oversight Committee" (JOC) means that committee comprised of six members, three representatives each from NMC and MAHAGENCO (as given Exhibit-6) established to share information and coordinate each Party's respective operation and maintenance work, the environmental review process, the construction of the Project, and implementation of the Mitigation Monitoring and Operation Plan.

1.5 "Point-of-Delivery" means the point at which NMC delivers water to MAHAGENCO located at Pioli nadi STP sump The exact location and design of the Point-of-Delivery shall be specified in the Project's engineering plans and specifications.

1.6 "Project Completion" means that point in time when the Project has been constructed tested successfully in accordance with Project specifications, the facilities are ready for full operation and the Project has been accepted in writing by the JOC.

1.7 "Third Party" means any person or entity (governmental or private) other than NMC or MAHAGENCO.

1.8 "Reclaimed Water" means Treated water from sewage treatment plant of Nagpur Municipal Corporation.

1.9 "Raw Sewage" means Sewage water of Pioli Nadi.

1.10 "Sewage Treatment Plant" (STP) means Proposed Sewage Treatment plant of north zone, on the bank of Pioli Nadi or Existing Sewage Treatment plant at Bhandewadi.

NMC

MAHAGENCO

1.11 "NMC" means Nagpur Municipal Corporation

1.12 "MAHAGENCO" means Maharashtra Power Generation Company

1.13 "Power Plant" means Thermal Power Plants at Koradi & Khaperkheda

1.14 "MLD" means Million Liter per day

1.15 "MM^3" means Million Cubic Meter.

1.16 Module 'A' means and includes Intake of sewage from Pioli Nadi or sewage collection system up to inlet chamber of sewage treatment plant

1.17 Module "B" means and includes Secondary Treatment Plant means, inlet chamber grit chamber, primary clarifier, secondary clarifier, Aeration, digester, sludge disposal, gas holder, gas, turbine etc. i.e. completed treatment process & equipment to meet the water quality as per pollution control norms for disposal to natural water bodies

1.18 Module "C" means and includes Tertiary treatment is a process & equipment to meet the spesific water quality for MAHAGENCO's requirement.

1.19 Module "D" means and includes Transmission system from outlet of STP at Pioli Nadi to inlet sump at MAHAGENCO's premises. (inclusive of sump pump house, pipe line & allied civil, electrical mechanical & instrumentation work)

1.20 Module "E" means and includes Transmission system from outlet of STP at Bhandewadi to Pioli Nadi outlet sump (i.e. Module D) inclusive of sump, pump house at Bhandewadi pipe line & allied civil, electrical, and mechanical & instrumentation work.

2. QUANTITY

2.1 "Demand"

MAHAGENCO needs 40 mm^3/year (110 mld + 10% climate) of reclaimed water for proposed power plant (3x660mw) at Koradi by year 2011.

P.T.O.

2.2 "Supply"

Estimated waste water available at North Zone is 100 MLD with average flow rate of 73 MLD and peak flow of 180 MLD. Existing STP capacity available at North Zone is nil.

Central Zone average flow 160 MLD and peak flow is 406 MLD and STP capacity available is 100 MLD with operating capacity of 70MLD

NMC shall provide guaranty to MahaGenco for the availability of minimum 110 mld + 10 % sewage at proposed treatment plant North Zone at Pol Nad.

NMC shall make stand by arrangement for transferring secondary treated water to proposed STP of North Zone by laying pipeline and pumping station at Bhandewadi STP to make up any shortfall for whatsoever reasons. The Secondary Treated water supplied by NMC from Bhandewadi to make up any shortfall shall be without any additional cost.

3. "QUALITY"

MahaGenco shall use secondary or tertiary treated wastewater for power plant and quality parameters for meeting physical, biological and chemical characteristics of reclaimed water shall be the criteria for selection of treatment technology, O & M practices

NMC & MahaGenco shall follow the Quality Management Systems and preferably obtained the ISO 9001 certification for existing and proposed STP respectively.

4. "COST & Payment"

4.1 "Capital Cost"

The project is funded jointly by NMC and MahaGenco. NMC shall pay up to 70% of estimated capital cost of project or Rs. 90 crore whichever is less for all the module A, B, C, D & E. MahaGenco shall be responsible to meet the balance capital cost in actual including price and physical variation during execution.

4.1.1 Payment towards capital expenditure: NMC shall pay 70% towards capital cost as and when demanded by MahaGenco or as per physical Progress of work, whichever is later. Mahagenco shall be responsible for all the capital cost other than NMC's share

4.1.2 NMC shall reimburse MahaGenco for the capital expenditure made by latter on behalf of NMC share for early completion of project. NMC shall not pay any interest or charges for delay in reimbursement.

4.1.3 Incase the additional grant, if available from JnNJRM for this project. NMC will apply for the same and will finance the project without any additional charges to MahaGENCO.

4.1.4 As the ownership of the project is with NMC, NMC shall not charge any Municipal taxes/duties and or yearly property tax on project premises during and/or after completion of the project.

4.2 "Minimum Monthly Cost to MahaGenco"

MahaGenco shall be responsible for all the cost in actual towards operations and maintenance cost of STP. MahaGenco shall be responsible for capital cost needed time to time during contract period for keeping plant in efficient working condition. MahaGenco shall pay the monthly payment to NMC as per 'Exhibit -5 '

In case MahaGenco not able to utilize the agreed quantity, MahaGenco shall pay NMC for minimum charges to NMC as per Exhibit-5

4.2.1 Due Date of Payment: 1st Day of each calendar month after commissioning of plant

4.2.2 Delayed Payment. If actual date of payment by MahaGenco exceeds more than 30 days from due date of payment will be treated as delayed payment.

4.2.3 Interest on Delayed payment. The interest rate of 10% per annum will be charged on delayed payment up to actual date of payment by MahaGenco to NMC.

4.2.4 Non Payment Non-payment of cost exceeds 6 calendar months from due date of payment shall be treated as non-payment by MahaGenco to NMC. NMC can act as per section 23

4.3 "Reclaimed Water Base Tariff"

NMC shall charge the fixed base tariff, with agreed escalation percentage as per the Exhibit-5

5. "OPERATION & MAINTENANCE"

NMC shall handover the responsibility of O & M and possession of land with treatment plant for entire contract period to MahaGenco.

MahaGenco shall be responsible for O & M of sewage treatment plant and will have direct control over the contractor to maintain the desired quality for discharge or reuse.

MahaGenco shall responsible for payment to O & M contractor.

O & M contractor appointed by MahaGenco. The additional payment apart from agreed cost of O &M up to secondary treatment shall be born by MahaGenco.

6. "PERIOD OF AGREEMENT"

The minimum period of agreement shall be for 30 years or project life as mutually agreed upon. Renewable of agreement shall be for further period of 20 years upon mutually agreed terms

NMC shall make the water supply commitment for minimum period of 30 years

7. "OWNERSHIP"

The ownership of Land and treatment facility with piping and equipment of module A B and E shall be with NMC, whereas, the ownership of Land and the treatment facility with piping and equipments etc. of module C and D will be with MAHAGENCO as per the legal status of land.

8. "END USE OF RECLAIMED WATER"

MahaGenco will have all rights for end use of reclaimed water of agreed quantity for any non-potable application, the sludge, gas, manure etc. i.e. any byproduct generated by the treatment will be property of MSPGCL for the agreement period and MSPGCL will be at liberty to dispose as per applicable norms of the statutory authority / sell the same or utilize the same at its own discretion. However, NMC shall provide necessary space

and permits the disposal of waste generated from the Sewage Treatment Plant at NMC's dumping yard at Bhandewadi without any additional cost.

The capacity of proposed sewage treatment shall be 110 Mld and MahaGenco shall discharge the unused water i.e. to the maximum extent of 110 Mld (capacity of treatment facility) in to Pioli Nadi or any other drain after minimum secondary level of treatment as per the norms of the statutory authority.

The MAHAGENCO will be responsible to treat only 110 MLD of raw sewage. Over and above the capacity of the STP; NMC will make their further arrangement as required. Further the proposed STP is on the inlet source of Pioli Nadi and the inlet flow will enhance during the monsoon i.e. more than proposed capacity of the plant. In the circumstances MAHAGENCO will treat the inflow to the extent of only 110 MLD and the balance inflow will be let out in to the natural stream with out any treatment.

9. "LAND"

9.1 "STP Land"

NMC shall hand over the peaceful and vacant possession of the land proposed for the treatment plant to MahaGenco within a period of 6 months from the date of signing of this agreement for the purpose of constructing STP without consideration. MahaGenco shall transfer the land if available with in project premises to NMC (Exhibit-7) for the project construction without any financial considerations.

9.2 Right of Way for Pipeline

NMC shall provide or arrange all the permissions for laying of transmission main along the roads within NMC limit and up to the Railway track of MahaGenco.

All permissions with railways, including the railway crossing within NMC limit and land outside NMC limit shall be arranged by MahaGenco.

MahaGenco shall pay the necessary road cutting charges and railway crossing or canal crossing charges to respective departments.

10 "POWER SUPPLY"

Mahagenco shall responsible for erecting Sub-station & Express feeders for power supply to all the Module of project. NMC shall assist MahaGenco.

11. "RIGHTS, PERMISSIONS, STATUTORY OBLIGATIONS"

NMC shall be responsible for all the rights permissions and statutory obligations of any kind on waste water collection or lifting from Pipli Nadi transfer/discharge of effluent from existing or proposed STP and meeting the norms of state or central pollution control board or water right issues with water resources department or any other government department.

12 DESIGN AND CONSTRUCTION OF THE PROJECT

12.1 MahaGenco shall conduct the design and construction of all modules. Technology selection for treatment under module B shall be informed to NMC and the suggestion if any from NMC will be incorporated to complete construction in a timely manner. MahaGenco shall conduct design and construction of module C & D as per its own requirement.

12.2 MahaGenco shall obtain an agreement in writing from each consultant and general contractor who performs work on the Project requiring that each consultant or contractor hold harmless, indemnify and defend each Party from all liability from its acts and omissions related to the Project.

12.3 MahaGenco shall obtain an agreement in writing from each consultant and contractor who performs work on the Project requiring that each consultant and contractor name both Parties as additional insured under all insurance policies obtained in connection with the Project.

12.4 MahaGenco shall prepare complete engineering plans and specifications for each module of the Project and design of each module shall be confirm to CPHEEO norms.

12.5 Mahagenco shall be responsible for submission of quarterly progress report to JNNURM monitoring committee during project execution through NMC. Mahagenco shall responsible for the physical progress of project as per schedule.

13. DELIVERY AND ACCEPTANCE OF WATER

13.1 Upon Commencement of Operations, NMC shall deliver to MAHAGENCO at the Point-of-Delivery the daily Amount as reduced by amounts of water authorized by the JOC for supply interruption as set forth in Clause-19 or excused as provided in Clause-16. Delivery of water shall be at the rates set forth in Exhibit-3.

13.2 Upon Commencement of Operations, MAHAGENCO shall accept from NMC at the Point-of-Delivery the daily Amount as reduced by amounts of water authorized by the JOC for supply interruption as set forth in Clause-19 or excused as provided in Clause-18. Acceptance of water shall be at the rates set forth in Exhibit-3.

13.3 For the purpose of measuring the Parties' compliance with this section, the day shall be the twenty-four hours period commencing on 12.00 noon on the first day of the month following Commencement of Operations.

14. QUALITY OF WATER

14.1 MAHAGENCO shall have access to NMC facilities and records for the purpose of either testing or verifying the quality of the raw sewage.

14.2 If the raw sewage quality (as per raw sewage quality parameter as given by NMC for engineering plan and specifications for selection of sewage treatment process) exceeds the quality performance set for secondary treatment plant at Koli Nadi for whatsoever reason then MAHAGENCO's option MAHAGENCO may: i) accept the water delivered ii) require NMC to supply water exclusively from the Bhandewadi Sewage Treatment Plant which meets the requirements of Exhibit-4 until the water quality problem is corrected at Koli Nadi (Raw Sewage).

15. NO RESALE OF WATER

MAHAGENCO shall not sell water delivered by NMC for any purpose other than Non-Potable application for Thermal Power Plant without the consent of NMC.

16. JOINT OVERSIGHT COMMITTEE

16.1 The Parties shall establish the JOC. The goal of the JOC shall be to achieve maximum efficiency of the overall Project.

16.2 Each Party shall designate its representatives within 10 days following execution of this Agreement and each Party shall provide notice to the others pursuant to clause 39.

16.3 The JOC shall keep written minutes of its meetings.

16.4 Each Party may by written or oral notice to the other Party, designate an alternate or substitute to act as its representative in the absence of any of its regular members or to act on specified occasions with respect to specific matters

17. DUTIES OF JOINT OVERSIGHT COMMITTEE

17.1 The JOC shall have no authority to modify this Agreement. At least two MAHAGENCO representatives shall be present at all meetings. Each Party shall have one vote on the JOC and all decisions shall be unanimous

17.2 The JOC shall share information between the Parties and coordinate the operations of the parties in order to achieve maximum efficiency of the overall Project and resolve disputes between the Parties. However, JOC will not have any right to verify the design and supervise the quality of construction works. This will be the sole responsibility of MAHAGENCO

17.3 The JOC shall be responsible for the periodic review and/or modification of the water quality parameters of Exhibit 4. Sampling protocol shall be established by the JOC

17.4 The JOC shall meet either in person or by telephone whenever requested by a member of the JOC.

17.5 If the JOC is unable to act on any issue raised by a member of the JOC, the JOC shall refer the issue to mediation

17.6 The JOC shall review the progress of plant construction and conduct regular meeting to monitor the progress and recommendation for release of payment from NMC based on progress after receipt of installment from GoM & Co

17.7 The JOC will review and monitor the quantity of short supply of sewage at Pipli Nadi and give direction for release of secondary treated water from Bhandewadi

18. FORCE MAJEURE

18.1 No Party shall be considered to be in default in the performance of any of its obligations when a failure to perform is due to or materially contributed to by an act of God, war, fire, earthquake, windstorm, flood, and other natural calastrophe, civil disturbance or disobedience labor disputes vandalism, sabotage, terrorism, restraint by order of a

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court or administrative agency with jurisdiction which such Party could not reasonably have been expected to avoid and which by exercise of due diligence has been unable to overcome.

18.2 The Party whose performance is affected by force majeure shall, as soon as practicable, but in any event no later than 14 days thereafter give written notice of the event of force majeure to the other Party.

18.3 The Parties shall use their best efforts and cooperate with each other to mitigate the effects of force majeure.

19. SUPPLY INTERRUPTIONS

19.1 To allow maintenance or in an Emergency, the JOC may authorize an interruption of delivery and acceptance of water. The Parties' respective duty to deliver and accept water under this Agreement is temporarily suspended during a supply interruption authorized by the JOC.

19.2 The Parties shall use their best efforts to minimize the length of supply interruption.

20. TERM OF AGREEMENT AND PAYMENT TO NMC

This Agreement shall become effective when executed by both Parties and shall remain in force for a period of thirty years from Project Completion, provided, however, that MAHAGENCO shall have the right to terminate this Agreement at any time after the twentieth year by giving written notice to NMC no later than two years before the proposed termination date. If NMC terminates this Agreement pursuant to Section-23 or if MAHAGENCO terminates this Agreement prior to the end of the thirtieth year pursuant to the preceding sentence, MAHAGENCO shall provide to NMC the agreed annual cost per year as shown in Exhibit-5 for each year or part of a year (to a maximum of ten years) that the 30-year term of the contract is reduced.

21. COVENANTS

21.1 If in any week NMC delivers less than 70% of the average daily Amount as reduced pursuant to Section-13.1, NMC shall use its best efforts to make up the amount that is less than 70% in the two succeeding weeks. NMC shall get credit for water which NMC is capable of delivering but which MAHAGENCO does not accept as required by this Agreement, for the rates specified in Exhibit-3 or 70 mld whichever is less.

21.2 If in any month NMC delivers less than 95% of the daily Amount as reduced pursuant to Section-13.1, and NMC fails to make up the shortfall in the seven succeeding days, then NMC shall pay MAHAGENCO the amount specified in Exhibit-5, unless NMC has terminated this Agreement pursuant to Section-23.

21.3 If in any month MAHAGENCO accepts less than the rate specified in Exhibit-3 of the daily Amount as reduced pursuant to Section-13.2 and MAHAGENCO fails to accept then MAHAGENCO shall pay NMC the amount specified in Exhibit-5, unless MAHAGENCO has terminated this Agreement pursuant to Section-23. NMC may, but shall not be required to make up the shortfall not accepted by MAHAGENCO. MAHAGENCO shall get credit for water which MAHAGENCO is capable of accepting, but which NMC does not deliver, up to 1.2 times the rates shown in Exhibit-3 or 110 mld + 10% whichever is less.

21.4 The credit that MAHAGENCO is entitled to in any given year under Section-21.3 above shall not exceed 10% of the Annual Amount.

22. OBLIGATIONS AND RELATIONSHIP OF THE PARTIES

A) Obligations of NMC

i) NMC shall make available the clear (i.e. free from encroachments) land to MAHAGENCO within six months from the date of agreement for execution of Module-A & B.

ii) NMC shall be responsible for arranging all permissions within its area for laying of transmission mains along the roads in its area.

iii) NMC shall arrange for all the permissions for collection or lifting of the waste water from Pipli Nadi.

iv) NMC shall deliver to MAHAGENCO at the Point-of-Delivery the daily amount of sewage water or the amount of water as reduced by or authorized by the JOC.

v) If NMC is unable to deliver the water to MAHAGENCO from the Pipli Nadi then NMC shall supply the water to the MAHAGENCO STP from its plant at Bhandewadi.

vi) NMC shall be responsible for maintaining the quality and quantity of the sewage water to be supplied to the MAHAGENCO STP.

B) Obligations of MAHAGENCO

i) MAHAGENCO shall prepare the design of the STP according to its needs and complete the construction in a timely manner.

ii) MAHAGENCO shall be responsible for obtaining the permissions with railways including the railway crossing within NMC limit and land outside NMC limit.

iii) MAHAGENCO will be responsible for the construction, operation and maintenance of the sewage treatment plant.

iv) MAHAGENCO shall make payments regularly to NMC on the date agreed in this agreement.

v) MAHAGENCO shall use the treated water only for the purpose mentioned in this agreement and for no other purpose.

C) General Obligations

i) Each Party shall use its best efforts and work diligently in good faith, and in a timely manner to carry out the duties and obligations imposed by this Agreement.

ii) Each Party shall provide to the other Party services to permit efficient and reliable operations under this Agreement as follows.

iii) If the services can be readily performed or obtained by the providing Party using its existing personnel, equipment and facilities, without making materia alteration in its operations and at a nominal cost to the providing Party, the services shall be provided free of charge.

iv) If the criteria specified in Section-3S are not met, the Parties shall mutually agree to a reasonable charge reflecting the providing Party's incremental cost in provicing the services to the other Party.

v) The covenants, obligations, rights and liabilities of the Parties under this Agreement are intended to be several and not joint or collective, and nothing herein is intended to create an association, joint venture, trust, or partnership or to impose a trust or partnership covenant, obligation or liability on or with regard to NMC or MAHAGENCO.

vii) Except as expressly provided for in this Agreement or other Project agreements, no Party shall be deemed the agent of or have the right or power to bind any other Party.

23. DEFAULT

If either Party to this Agreement defaults in respect to any of its obligations or under any of the clauses of this Agreement, the non-defaulting Party may notify the defaulting Party in writing, setting out in what respects the non-defaulting Party deems the defaulting Party to be in default. If within thirty (30) days or such other period as agreed to by the Parties in writing after receipt of notice, the defaulting Party has corrected the default alleged by the non-defaulting Party, the defaulting Party shall no longer be in default. Neither the service of notice, nor the doing of acts by the defaulting Party aimed to correct any or all of the alleged defaults, shall be deemed an admission or presumption that the defaulting Party has failed in any respect to perform its obligations hereunder. If the defaulting Party fails to correct all or any of the alleged defaults within the allowable time, the non-defaulting Party, after having exhausted the required mediation procedures shall have the option to declare the defaulting Party in breach of this Agreement or seek specific performance as provided in Section 26.

24. DISPUTE RESOLUTION

24.1 All unresolved disputes between the Parties arising under this Agreement shall be submitted to non-binding mediation pursuant to the following procedure and terms:

24.1.1 After the Parties has conducted reasonable and good faith negotiations to resolve disputes under this Agreement, either Party may request, in writing, that a dispute be mediated pursuant to this section.

24.1.2 The Independent Engineer shall act as mediator.

24.1.3 Within seven (7) days of the receipt of the written request to mediate, the Parties shall meet to schedule the mediation process.

24.1.4 Each Party shall bear one-half (½) of the cost of the mediation.

24.1.5 Either Party may pursue any legal or equitable remedies that it may have if the mediation process described in this section is

not successfully concluded within sixty (60) days of the receipt of a written request for mediation pursuant to Section-24.1 above.

25. TERMINATION OF AGREEMENT

25.1 NMC may terminate this Agreement if

25.1.1 MAHAGENCO has breached this Agreement except that NMC may only terminate for MAHAGENCO's failure to accept water in conformance with less than 70% of rates shown in exhibit J for more than 3 years in continuations after commissioning of plant.

25.1.2 MAHAGENCO fails to meet the obligations under clause 4, 5 & 12 and only after Mahagenco breached this agreement as provided in Clause-23

25.2 MAHAGENCO may terminate this Agreement if

25.2.1 NMC fails to deliver at least 80 percent of three times the Annual Amount as reduced pursuant to Sections 13.1 and 13.2 in any 36-month period; or

25.2.2 NMC fails to deliver at least 50 percent of one-sixth of the Annual Amount as reduced pursuant to Sections 13.1 and 13.2 in any two-month period; or

25.2.3 NMC has breached this Agreement as provided in Section 22 except that MAHAGENCO may only terminate for NMC's failure to deliver water as set forth in Sections 21.1 or 21.2

26 SPECIFIC PERFORMANCE

In addition to other remedies upon default the non-defaulting Party may obtain specific performance of this Agreement including a temporary restraining order and preliminary injunction to prevent a default of this Agreement or to compel performance by the defaulting party

27. NO COMPENSATION

The representatives of each Party to this Agreement shall serve without compensation except for reimbursements made in accordance with this Agreement or as expressly agreed to in writing by both Parties

P.T.O

28. ASSIGNMENTS

No Party shall assign, either in whole or in part, any of the rights, duties or obligations created or imposed under this Agreement without the prior written consent of the other Party, except to another Party to this Agreement or to a subsidiary, affiliate or any other entity succeeding to all or substantially all of the affected interests and assets of that Party provided that such subsidiary, affiliate or succeeding Party shall assume the assigning Party's obligations hereunder in writing. No delegation of any obligation owed, or of the performance of any obligation, by any Party, may be made without the prior written permission of the other Party. Any attempted assignment or delegation shall be wholly void and totally ineffective for all purposes unless made in conformity with this Section-28. Consent may be withheld, refused, or conditioned if the economic viability of the other Party is a concern, provided, however, that consent may not be unreasonably withheld, conditioned or delayed.

29 INSURANCE

29.1 Each Party shall maintain the following minimum insurance coverage's during the term of this Agreement, or in the alternative, a Party may provide Notice of Self-Insurance to the other Party in the amounts specified in Sections 29.1.1, 29.1.2 and 29.1.4 below. Any Party providing a notice of Self-Insurance must supply evidence of fiscal responsibility reasonably satisfactory to the other Party, including where appropriate audited financial statements.

29.1.1 Workers compensation insurance with statutory limits and Employer's Liability for all persons employed in the construction and operation of the Project, in accordance with applicable law.

29.1.2 Commercial general liability insurance covering and insuring against liability for both bodily injury and/or property damage, coverage per occurrence, including, but not limited to, endorsements for personal injury, premises-operations, products and completed operations, explosion hazard, and blanket contractual and independent contractors liability.

29.1.3 Any consultant or contractor employed in support of Project construction shall maintain coverage's similar to those required in Section-29.1.4 and professional liability insurance for protection against claims arising out of the performance of their services, caused by errors, omissions or other acts for which they are liable.

25.1.4 Business automobile liability insurance coverage for owned non-owned and hired automobiles

29.2 Each Party shall secure, in favor of each of the other Party, a waiver of subrogation rights from the carrier that issues a policy of general liability or automobile liability insurance pursuant to the proceeding sections. Each insured Party shall cause the public liability insurer to acknowledge its waiver of subrogation in writing by appropriate liability policy endursement. If a Party is self-insured, such Party hereby waives all claims of right to subrogation or liability against the other Party or against the insurer of the other Party.

30 INDEMNITY

30.1 NMC's Responsibilities. NMC shall, to the fullest extent permitted by law, defend, indemnify and hold harmless MAHAGENCO, its present and future members, officers, directors, employees and agents from and against (a) any and all liabilities and losses resulting from claims or causes of action by any third party to the extent that claims or causes of action arise out of, or are in any way related to NMC's active negligence or willful misconduct in the performance of NMC's responsibilities under this Agreement, and (b) the consequences of NMC's violation or alleged violation of permits, statutes, ordinances, orders, rules or regulations of any governmental entity to the extent that a violation or alleged violation arises out of, or is in any way related to NMC's responsibilities.

30.2 MAHAGENCO's Responsibilities. MAHAGENCO shall, to the fullest extent permitted by law, defend, indemnify and hold harmless NMC, their present and future members, officers, directors, employees and agents from and against (a) any and all liabilities and losses resulting from claims or causes of action by any third party, to the extent that claims or causes of action arise out of, or are in any way related to MAHAGENCO's active negligence or willful misconduct in the performance of MAHAGENCO's responsibilities under this Agreement, and (b) the consequences of MAHAGENCO's violation or alleged violation of permits, statutes, ordinances, orders, rules or regulations of any governmental entity to the extent that a violation or alleged violation arises out of, or is in any way related to, MAHAGENCO's responsibilities.

30.3 Insurers' Responsibilities. The provisions of this section shall not be construed to relieve any insurer of its obligation to pay any insurance proceeds under any insurance policy.

P.T.O.

30.4 Notwithstanding anything contained herein, neither party shall be responsible to the other for consequential or indirect damages.

31 NO DEDICATION OF FACILITY

Any undertaking by a Party under any provision of this Agreement is rendered strictly as an accommodation and shall not constitute the dedication of any facility by the undertaking Party to the public, to the other Party or to any Third Party. NMC shall have no interest in any facility owned or operated by MAHAGENCO and shall not be responsible for any shutdown, abandonment or cleanup of any facility. MAHAGENCO shall have no interest in NMC's facilities and shall not be responsible for any repairs, shutdown, abandonment or cleanup of any NMC facilities.

32. NO THIRD PARTY BENEFICIARIES

None of the promises, rights or obligations contained in this Agreement shall inure to the benefit of any person or entity not a Party to this Agreement.

33. GOVERNING LAW

This Agreement shall be governed by the laws of the Maharashtra State & Union of India without reference to its conflict of laws rules.

34. ENTIRE AGREEMENT

This Agreement represents and contains the entire agreement and understanding between the Parties with respect to the subject matter hereof and supersedes any and all prior oral and written agreements and understandings. No promises, agreements, or warranties additional to this Agreement shall be deemed to be a part hereof, nor will any alteration, amendment or modification hereto be effective unless confirmed in writing by both Parties.

35. COMPLIANCE WITH LAWS

Both Parties shall comply with all applicable federal, state and local laws and the rules and regulations of any federal, state, local or other government agency having jurisdiction over the activities and operations conducted pursuant to this Agreement.

36 SEVERABILITY

This agreement shall be irreversible agreement. In the event that any term covenant or condition of this Agreement or the application of any such term covenant or condition shall be held invalid as to any person entity or circumstance by any court or agency having jurisdiction, such term, covenant or condition shall remain in force and effect to the extent not held invalid, and all other terms covenants and conditions of this Agreement and their application shall not be affected thereby but shall remain in full force and effect unless a court holds that such provisions are not severable from the other provisions of this Agreement.

37. WAIVER

Any waiver at any time by a Party of its rights with respect to any matter arising in connection with this Agreement shall not be deemed a waiver with respect to any subsequent matter. Any waiver must be in writing.

38. AMENDMENT AND MODIFICATION

This Agreement may be amended or modified in any way at any time by an instrument in writing signed by the Parties hereto

39. NOTICES

39.1 Any and all notices or other communications required or permitted by this Agreement or by law to be delivered to, served on by mail or fax, or given to either Party to this Agreement shall be dated and in writing and shall be deemed properly delivered, served, or given when personally delivered or faxed to the Party to whom it is directed or, five business days after deposited in the United States mail, first-class postage prepaid, addressed to the Parties as follows

Party	Address
NMC of Nagpur	Attn: Municipal Commissioner Nagpur Municipal Corporation Civil Lines, Nagpur – 440 001
Maharashtra Power Generation Company	Attn: Managing Director Maharashtra Power Generation Company Prakashgad, Plot no. G-9, Bandra (East), Mumbai – 440 051

P.T.O

39.2 Any Party hereto may change its address for the purpose of Section 39.1 by giving written notice of such change in the manner prescribed by Section 39.1 to the other Party to this Agreement.

40 RECORDATION

This Agreement may be recorded by either Party, after 4th Oct. 08 or any other date agreed to in writing by the Parties.

IN WITNESS WHEREOF, both Parties have executed this Agreement the day and year first above written.

Nagpur Municipal Corporation

Commissioner

Municipal Commissioner
Nagpur Mpl. Corporation

MAHAGENCO

Managing Director

MAHARASHTRA STATE POWER GEN CO LTD
MUMBAI-01.

EXHIBITS

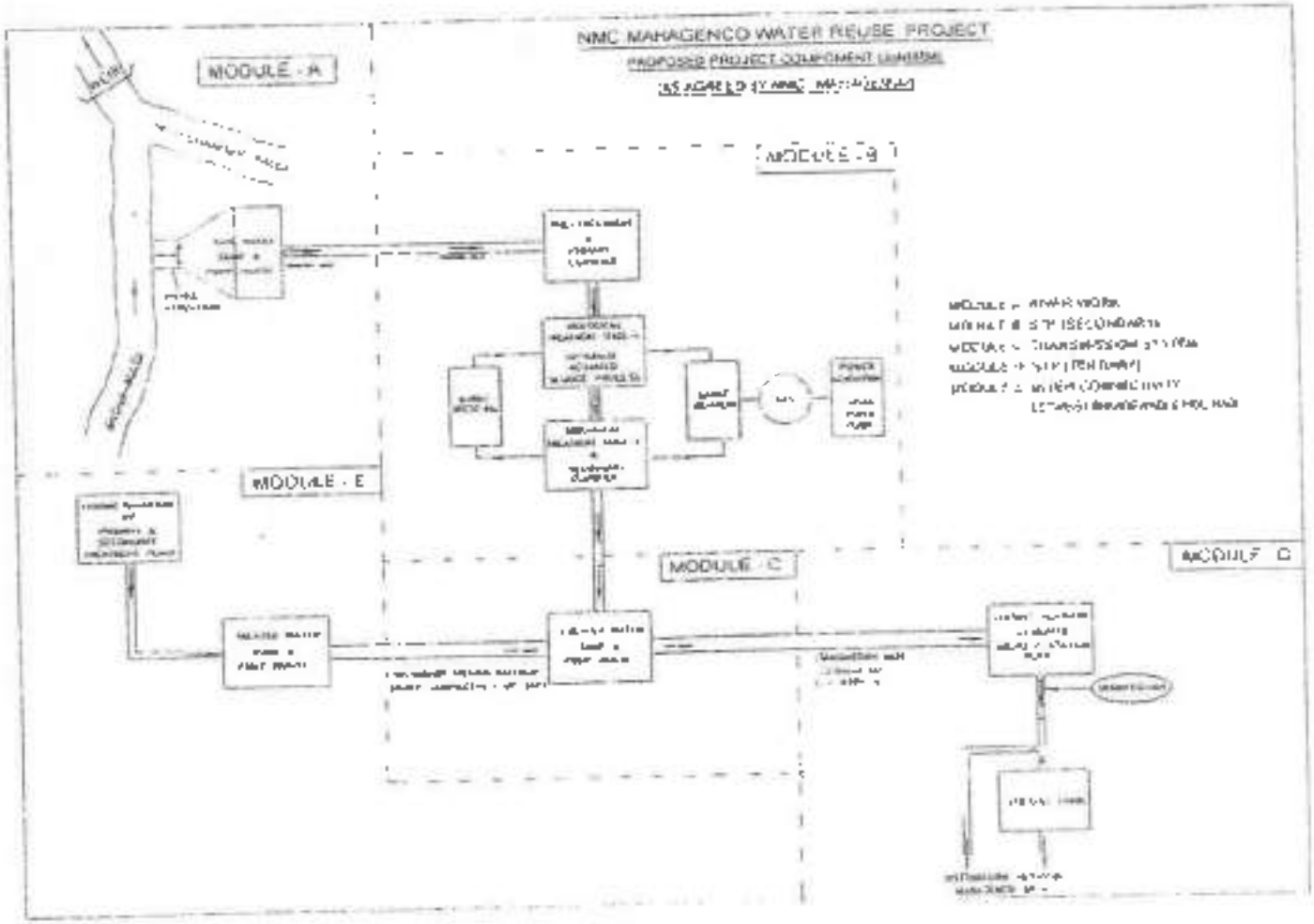

NMC MAHAGENCO WATER REUSE PROJECT
MODULE - A
MODULE - B
MODULE - C
MODULE - D
MODULE - E

EXHIBIT 1

EXHIBIT 2

PROJECT SCOPE OF WORK

PFM	O & M	Ownership	Constructions	Capital Cost	
Module -A Intake Works	MahaGenco	NMC	MahaGenco	NMC	MahaGenco
Module -B Secondary Treatment Plant	MahaGenco	NMC	MahaGenco	NMC	MahaGenco
Module -C Tertiary treatment	MahaGenco	MahaGenco	MahaGenco	NMC	MahaGenco
Module -D Transmission pipeline upto Mahagenco premises	MahaGenco	MahaGenco	MahaGenco	NMC	MahaGenco
Module -E Interconnectivity with Bhandewadi STP	MahaGenco	NMC	MahaGenco	NMC	MahaGenco
Engineering Technical, Admin Legal for Module - ABCD	MahaGenco	NMC (Land) related matter	MahaGenco	MahaGenco	

P.T.O

EXHIBIT 3

TABLE OF DELIVERY RATES

Month	Flow (m³)
January	110
February	110
March	110
April	110
May	110
June	110
July	110
August	110
September	110
October	110
November	110
December	110

EXHIBIT 4

Water Quality Standards for MAHAGENCO Acceptance and NMC Delivery From Bhandewadi (Secondary Treated Sewage)

Sr No	Parameters	Unit	Analysis Results	
			Inlet Sample	Outlet Sample
01]	pH		7.5	7.3
02]	Total Dissolved Solids	mg/l	586	520
03]	Suspended Solids	mg/l	154	38
04]	Dissolved Oxygen	mg/l	1.0	5.0
05]	Ammonia	mg/l	7.00	0.82
06]	NO_3-N	mg/l	1.07	0.78
07]	NO_2-N	mg/l	3.80	3.46
08]	Total Phosphorus	mg/l	1.07	1.18
09]	Biological Oxygen Demand	mg/l	205.1	20.0
10]	Chemical Oxygen Demand	mg/l	161.5	40.0
11]	Alkalinity	mgCaCO3/l	220	200
12]	Hardness Total	mgCaCO3/l	138	130
13]	Calcium	mg/l	41.6	36.8
14]	Magnesium	mg/l	20.2	20.2
15]	Sodium	mg/l	37.4	45.0
16]	Potassium	mg/l	11.0	12.4
17]	Chloride	mg/l	53.0	51.0
18]	Sulphate	mg/l	28.9	27.6
19]	Carbonate	mg/l	0.0	0.0
20]	Bicarbonate	mg/l	134.0	122.0
21]	Silicate as SiO_2	mg/l	22.1	21.9
22]	Iron	mg/l	2.4	2.3
23]	Aluminium	mg/l	N.D	N.D
24]	Copper	mg/l	N.D	N.D
25]	Zinc	mg/l	0.005	0.013
26]	Cadmium	mg/l	N.D	N.D
27]	Chromium	mg/l	N.D	N.D
28]	Sulphide	mg/l	N.D	N.D
29]	Total Colliform	MPN/100 ml	>16.00000	30,000
30]	Faecal Colliform	MPN/100 ml	>16.00000	22,000

NMC

MAHAGENCO

EXHIBIT 5

01]	Minimum fixed payment [upto 110 MLD – 12% of treated waste water payable by MahaGenco to NMC on 1st of each calendar month	Rs. 125 lakhs / month = Rs. 15 crore / year (Fixed rate for the contract period)
02]	Base Tariff payable [110 MLD – 220 MLD] for treated waste water	Rs. 2.05 per 1000 Ltrs
03]	O&M cost of Module A, B, C, D & E treated waste water (including Energy Cost)	As above by MahaGenco for the contract period
04]	Up-gradation or Replacement of equipment	As actual by MahaGenco for the contract period
05]	Taxes, Statutory Fees	As actual by MahaGenco for the contract period
06]	On short supply of Raw Sewage NMC shall credit the MahaGenco as per Section 21.2	Rs. 1.67 per 1000 ltrs of short supply
07]	Escalation for 01], 02] & 06] above	10% every 3 years

Nagpur Municipal Corporation

MAHAGENCO

Commissioner
Municipal Commissioner
Nagpur Mpl. Corporation

Managing Director

Annexure - J

महाराष्ट्र MAHARASHTRA ◐ 2018 ◐ UB 802075

This stamp paper is part and parcel of the First Amendment to the Agreement dated December 15, 2017 entered into between the Maharashtra State Power Generation Company Ltd, The Nagpur Municipal Corporation and Nagpur Environmental Management Pvt Ltd dtd 30/11/2018.

Director (Projects)
MAHAGENCO

14/11/18

AMENDMENT TO THE AGREEMENT DTD DECEMBER 29, 2017

This First Amendment to the Agreement dated December 29, 2017 is made and entered on this 10th day of December, 2018 ("**First Amendment**") by and between:

MAHARASHTRA STATE POWER GENERATION COMPANY LIMITED, a company incorporated under the provisions of the Companies Act, 1956 bearing CIN U40100MH2005SGC153648 having its registered office at Prakashgad, Plot No. G-9, Anant Kanekar Marg, Bandra (East), Mumbai 400051, Maharashtra, India (hereinafter referred to as the "**MAHAGENCO**" which expression shall, unless the context otherwise requires, includes its successors and permitted assigns) of the First Part.

AND

THE NAGPUR MUNICIPAL CORPORATION, constituted under the City of Nagpur Corporation Act, 1948 and having its principal place of business at Civil Lines, Nagpur, Maharashtra, India acting through its Commissioner (hereinafter referred to as the "NMC" which expression shall, unless the context otherwise requires, includes its administrators, successors and permitted assigns) of the Second Part.

AND

NAGPUR WASTE WATER MANAGEMENT PRIVATE LIMITED, a company incorporated under the provisions of the Companies Act, 1956 bearing CIN U74999MH2014PTC258517 having its registered office at 116A, 11th Floor, Maker Chambers VI, 220, Narimam Point, Mumbai 400021, Maharashtra and corporate office at 4th Floor, Madhav Tower, Laxmi Bhuvan Square, Dharampeth, Nagpur 440010, Maharashtra, India (hereinafter referred to as the "**OPERATOR**" which expression shall, unless the context otherwise requires, includes its successors and permitted assigns) of the Third Part.

"MAHAGENCO", "NMC" and "OPERATOR" are collectively referred to as "**Parties**" and individually as "Party".

RECITALS:

WHEREAS

1. The Parties had entered into an Agreement dated **December 29, 2017 ("the Original Agreement")** *inter alia* recording their rights and obligations with regard to (i) NMC and MAHAGENCO granting and authorizing the OPERATOR to inter alia build, operate and transfer the Project facilities as set out in **Schedule 1** and **Schedule 2** of the Original Agreement, (ii) the quality and the quantity to be supplied by the NMC through

Director (Projects)
MAHAGENCO

the OPERATOR, (viii) delivery and performance of the Tertiary Treated Water and (ix) other obligations and relationships of the Parties.

B. In terms of the Original Agreement, MAHAGENCO had agreed to offtake an assured Daily Quantity of 150 MLD from the NMC through the OPERATOR, out of which 100 MLD of Tertiary Treated Water was to be delivered at the Points of Delivery for Khaperkheda Thermal Power Plant and 50 MLD of Tertiary Treated Water was to be delivered for Koradi Thermal Power Plant from the date of Commencement of Operation till the expiry of the Water Supply Period.

C. MAHAGENCO, after revalidation of its business plans envisages an additional demand of 40 MLD of Tertiary Treated Water for the Koradi Thermal Power Plant and desires to purchase the additional 40 MLD of Tertiary Treated Water from the NMC through the OPERATOR, subject to the technical feasibility of the OPERATOR to supply additional 40 MLD of Tertiary Treated Water at Koradi Thermal Power Plant at the Base Water Rate, Effective Water Rate and Treated Water Rate as agreed under the Original Agreement.

D. Considering MAHAGENCO's additional demand of 40 MLD of Tertiary Treated Water for its Koradi Thermal Power Plant, the OPERATOR assessed the additional demand of 40 MLD of Tertiary Treated Water and vide its Letter No. NWWMPL/18-19/44 dated September 19, 2018 confirmed the technical feasibility of supplying additional 40 MLD of Tertiary Treated Water at the Point of Delivery at the Koradi Thermal Power Plant after making suitable changes to the designs and engineering of the STP, TTP and the Transmission Pipelines to be constructed by the NMC through the OPERATOR.

E. Based on the aforesaid confirmations by the OPERATOR as to the technical feasibility of fulfilling the additional demand of 40 MLD of Tertiary Treated Water by MAHAGENCO for its Koradi Thermal Power Plant, the Board of Directors of MAHAGENCO in its meeting held on September 28, 2018 vide B R Ref. No. MSPGCL/CS/BM/183/183.12 dated October 6, 2018 vide Board Resolution No.2018 / 2787 had decided to increase the offtake of assured Daily Quantity of Tertiary Treated Water from 150 MLD to 190 MLD on such terms and conditions (including the Base Water Rate, Effective Water Rate and Treated Water Rate) as has been agreed to by the Parties under the above said Original Agreement.

F. The Parties also took note of the various Conditions Precedent to be complied by each of the Parties under Clause 15 of the Original Agreement and the status of the implementation of the Project. The Parties also took note of the expiry of the Compliance Date and agreed to extend the same by 90 (Ninety) days from the date of execution of this First Amendment and as a consequence also agreed to amend the definition of the Compliance Date and Clause 15 of the Original Agreement.

G. Accordingly, the Parties are entering in to this First Amendment to amend the Original Agreement.

Director (Project)
MAHAGENCO

NOW THEREFORE, IN CONSIDERATION OF THE BELOW MENTIONED CONDITIONS AND COVENANTS, THE ADEQUACY OF WHICH THE PARTIES HEREBY CONFIRM, IT IS AGREED AS FOLLOWS:

1. Amendment

1.1 The Parties hereby agree that the existing definition of **"Compliance Date"** in the Original Agreement shall stand deleted and replaced as below:

1.1.9 "Compliance Date" means the date falling after 90 (Ninety) days after the date of execution of the First Amendment or such other date as agreed between Parties by which time the Parties fulfil their Conditions Precedent (under Clause 15), by the issuance of **"Certificate of Compliance"** to each other by the respective Parties / their authorized representatives.

1.2 The Parties hereby agree that the existing definition of **"Daily Quantity"** in the Original Agreement shall stand deleted and replaced as below:

1.1.13 "Daily Quantity" means committed purchase quantity by MAHAGENCO of 190 MLD (90 MLD for Koradi Thermal Power Plant and 100 MLD for Khaperkheda Thermal Power Plant) of Tertiary Treated Water.

1.3 The Parties hereby agree that the existing definition of **"Minimum Payment"** in the Original Agreement shall stand deleted and replaced as below:

1.1.21 "Minimum Payment" per day means payment equivalent to 90% of (190 MLD * Treated Water Rate * 1000 per day)

1.4 The Parties hereby agree that the existing definition of **"Tertiary Treatment Plant"** in the Original Agreement shall stand deleted and replaced as below:

1.1.48 **"Tertiary Treatment Plant"** or **"TTP"** means 190 MLD tertiary treatment plant constructed by NMC through the OPERATOR at Bhandewadi, Nagpur to produce Tertiary Treated Water confirming to quality standards specified in Schedule 4 to this Agreement and of capacity suitable to cater peaks and off peaks in the availability of raw / secondary treated sewage so as to ensure delivery of 190 MLD tertiary treated water at the Points of Delivery and any expansion thereof.

1.5 The Parties hereby agree that the existing Clause No. 2.3 of the Original Agreement shall stand deleted and replaced as below:

2.3 Notwithstanding anything contained herein or in any other agreement, the purchase of the Daily Quantity is a take or pay obligation on the

Director (Projects)
MAHAGENCO

part of MAHAGENCO such that MAHAGENCO is absolutely and irrevocably required to accept and pay for the Daily Quantity from date of Commencement of Operation till the expiry of the Water Supply Period at the price set forth in Clause 5.1 of the Agreement and Schedule 5 of the Agreement. For the avoidance of doubt, it is clarified that the Operator makes available to, but Quantity is not drawn by MAHAGENCO entitled to payment equal to 190 MLD x No of days in the month x Tripled Water Rate x 1000. Payment for shortfall in offtake in accordance with this Clause shall be deemed to be liquidated damages for MAHAGENCOs breach of its obligation to take the Daily Quantity.

1.6 The Parties hereby agree that the existing Clause No. 3.1 of the Original Agreement shall stand deleted and replaced as below:

> 3.1 **Demand by MAHAGENCO:** MAHAGENCO agrees to offtake an assured Daily Quantity of 190 MLD, out of which 100 MLD of Tertiary Treated Water shall be delivered at the Point of Delivery for Khaperkheda Thermal Power Plant and 90 MLD of Tertiary Treated Water shall be delivered for Kamal Thermal Power Plant from the date of Commencement of Operation till the expiry of the Water Supply Period. For the avoidance of doubt, it is clarified that MAHAGENCO guarantees that it shall take 190 MLD quantity of water supplied by NMC through Operator or else pay to the Operator for such 190 MLD quantity even though MAHAGENCO is unable to take 190 MLD quantity.

1.7 The Parties hereby agree that the existing Clause No. 3.2 of the Original Agreement shall stand deleted and replaced as below:

> 3.2 **Supply by NMC through OPERATOR:** NMC through the OPERATOR agrees to supply 190 MLD of Tertiary Treated Water to MAHAGENCO at the Points of Delivery as agreed to in this agreement.

1.8 The Parties hereby agree that the existing Clause No. 5.2 of the Original Agreement shall stand deleted and replaced as below:

> 5.2 **Treated Water Rates** per cubic meter shall be as per Schedule 5 to this Agreement, and shall be payable for all the 190 MLD irrespective of actual supply as long as the supply of full quantity is available with the OPERATOR but not taken in full by MAHAGENCO.

1.9 The Parties hereby agree that the existing Clause No. 5.5 of the Original Agreement shall stand deleted and replaced as below:

> 5.5 MAHAGENCO shall deposit all amounts payable by them to the OPERATOR under Clause 5 and Schedule 5 of this Agreement upto

Director (Projects)
MAHAGENCO

the Escrow Account at least one working day before the due date irrespective of whether MAHAGENCO deposits such amounts or not, the Escrow Bank shall transfer any amounts due to the Operator under this Agreement from the balances available in the Escrow Account without the need for any instructions from MAHAGENCO. If there is a shortfall in the Escrow Account then the Escrow Bank shall replenish the Escrow Account from the balances available in the existing bank account of MAHAGENCO. Additionally, MAHAGENCO shall deposit and maintain at all the times during the Water Supply Period, an amount equal to 3 months i.e. 90 days payments to the OPERATOR under Clause 5 and Schedule 5 of this Agreement in the Escrow Account. For avoidance of doubt, minimum balance to be maintained by MAHAGENCO in Escrow Account shall be equal to (150,000 cum x 90 days x Treated Water Rate as per schedule 5 to this agreement)

1.10 The Parties hereby agree that the existing Clause No. 5.6 of the Original Agreement shall stand deleted and replaced as below:

5.6 During the Water Supply Period, MAHAGENCO shall be liable to pay to the Operator a sum equivalent to (190000 cum x No of days in the previous month x Treated Water Rate determined as per terms of this Agreement). The Escrow Agent shall transfer this amount automatically to the Operator. Any addition/reduction in cost shall be reconciled half yearly in accordance with Clause 5.10.

1.11 The Parties hereby agree that the existing Clause No. 7.2 of the Original Agreement shall stand deleted and replaced as below:

7.2 The OPERATOR will be responsible for tertiary treatment of 190 MLD of Secondary Treated Sewage. The sludge, gas, manure, etc. i.e. any by-product generated by the tertiary treatment will be the property of the OPERATOR during the Water Supply Period and the OPERATOR will be at liberty to dispose the same as per applicable norms of the Statutory Authority / sell the same or utilize the same at its own discretion. However, NMC shall provide necessary space and permits for the disposal of waste generated from the STP and TTP at NMC's dumping yard at Bhandewadi without any additional cost.

1.12 The Parties hereby agree that the existing Clause No. 14.2 of the Original Agreement shall stand deleted and replaced as below:

14.2 If the Operator fails to supply Daily Quantity of 190 MLD, OPERATOR shall be entitled to get a period of 30 days to compensate the shortfall quantity to MAHAGENCO to the extent of 7.5 MLD daily only. In case, the OPERATOR fails to compensate supply of the shortfall quantity, the OPERATOR shall be liable for penalties on the

Director (Projects)
MAHAGENCO

shortfall volume at the rate on [illegible] basis [illegible]

Applicable range of supply		Penalty on the Operator (for shortfall volume)
More than	Equal to or less than	
MLD	MLD	Rs. Per m^3
0	100	2
100	150	[illegible]
150	190	[illegible]

For example, if 90 MLD is actual supply by the Operator, [illegible] will be the penalty for that day [illegible] rupees.
= (1000 * ((190 - 150) * 4) + ((150 - 100) * [illegible]

1.13 The Parties hereby agree that the existing Clause No. 15 (Conditions Precedent of the Parties) of the Original Agreement shall stand deleted and replaced [illegible]

15.1 **Conditions Precedent for the Operator**
The Conditions Precedent required to be satisfied by the Operator on or before the Compliance Date, and shall be deemed to have been fulfilled when the Operator shall have:

15.1.1 subject to Clause 15.[illegible] below, achieved Financial Close;

15.1.2 executed the Financing Agreements and delivered to the other Parties, three (3) true copies thereof, duly attested by a Director of the Operator;

15.1.3 delivered to the other Parties, three (3) true copies of the **Financial Package** and the Financial Model, duly attested by a **Director of the Operator**, along with three (3) soft copies of the Financial Model in MS Excel version or any substitute thereof, which is acceptable to the Lenders;

15.2 **Condition Precedent for the NMC**
The Conditions Precedent required to be satisfied by the NMC on or before the Compliance Date, and shall be deemed to have been fulfilled when the NMC shall have:

15.2.1 procured for the Operator the right of way to the Project site;

15.2.2 procured all applicable permits relating to environmental protection, and conservation in respect of land forming part of the right of way;

15.2.3 procured forest clearance for and in respect of land forming part of the right of way under Clause 15.2.1 and 15.2.2, save and except permission for cutting trees; and procured approval of the general arrangement drawings for the road / rail over bridges / under bridges at level crossings on the

Director (Projects)
[illegible]

Project.

15.2.2 obtain exemptions from taxes, levies and duties in respect of the Project.

15.2.3 obtain any concessions or benefits, available in municipal codes.

15.3 **Condition Precedent for the Mahagenco**

The Conditions Precedent required to be satisfied by the Mahagenco on or before the Compliance Date, and shall be deemed to have been satisfied when the Mahagenco shall have:

15.3.1 received authorizations required for the execution and implementation of the Project and of its rights under this Agreement.

15.3.2 open special purpose account & approval for Escrow arrangement through account.

15.3.3 facilitate to arrange debt on interest of 9% to Operator in order to raise the fund to execute the Project. However, in case Mahagenco fails to provide the approval for such loan within sixty (60) days of the date of execution of the First Amendment, then Operator shall arrange for the loan from the market; and in such case the Financial Closure shall be achieved by the Operator on or before the Compliance Date;

15.3.4 execute and procure execution of the Substitution Agreement;

15.3.5 providing express feeder of required capacity for the operations of treatment plant;

15.3.6 to get approval of Maharashtra Electricity Regulatory Commission for the Project.

15.4 **Obligations to Satisfy Conditions Precedent**

15.4.1 Each Party hereto shall use all reasonable endeavours at its cost and expense to procure the satisfaction in full of its respective Conditions Precedent set out above within time provided in this Agreement;

15.4.2 Upon satisfaction in full of all Conditions Precedent for a Party, the other Party shall forthwith issue to such Party a Certificate of Compliance with Conditions Precedent (the "**Certificate of Compliance**");

15.4.3 Each Party shall bear its respective costs and expenses of satisfying such Conditions Precedents unless otherwise expressly provided.

15.4.4 Any of the Conditions Precedent may be extended post Commencement Date, if mutually agreed by all the Parties.

15.14 The Parties hereby agree that the existing Clause No. 16.1.3 of the Original Agreement shall stand deleted and replaced as below:

16.1.3 MMC shall be responsible for making available sufficient Raw Sewage

Director (Projects)
MAHAGENCO

to the STP so as to deliver 15.0 MLD at the Defined Point of Delivery.

1.15 The Parties hereby agree that the existing Clause No. 27.3.2 of the Original Agreement shall stand deleted and replaced as below:

27.3.2 **If Termination occurs on or after the Project Completion Date:**

27.3.2.1 Net present value of payments as per Clause 5 (Operator Payment) and Schedule 5 of the Agreement for 150 MLD supply for balance Water Supply Period discounted with rate @ SBI fixed deposit interest rate per annum for one year term.

27.3.2.2 Any amounts due and payable by either Parties under this Agreement.

Upon Termination on account of event of default attributable to OPERATOR, MAHAGENCO shall pay to the OPERATOR:

1.16 The Parties hereby agree that the existing Clause No. 27.3.4 of the Original Agreement shall stand deleted and replaced as below:

27.3.4 **If Termination occurs on or after the Project Completion Date:**

27.3.4.1 Net present value of payments as per Clause 5 (Operator Payment) and Schedule 5 of the Agreement for 150 MLD supply for balance Water Supply Period discounted with rate @ SBI fixed deposit interest rate per annum for one year term.

27.3.4.2 Any amounts due and payable by either Parties under this Agreement.

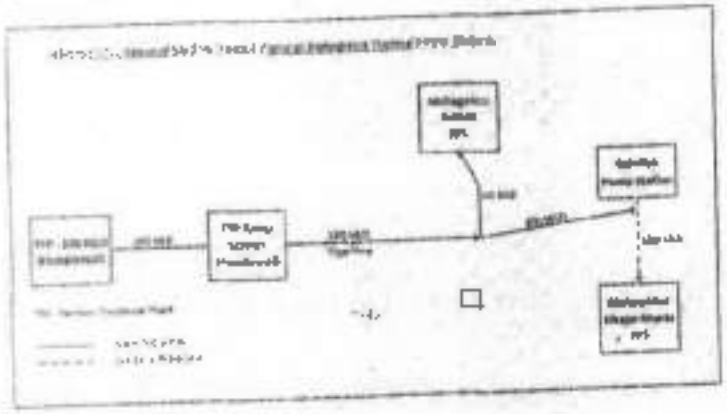
Upon termination on account of event of default attributable to OPERATOR, the MAHAGENCO shall pay to the OPERATOR as under:

1.17 The Parties hereby agree that the existing Schedule - I of the Original Agreement shall stand deleted and replaced as below:

Director (Projects)
MAHAGENCO

SCHEDULE-I

Schematic of the Project:



18. The Parties hereby agree that the existing Schedule-2 to the Original Agreement shall stand deleted and replaced as below:

SCHEDULE-2

Scope of the Project:

Planning, Design, Detail Engineering, Construction, Finance, Installation, Commissioning and Operation and Maintenance of Tertiary Treatment Plant of 190 MLD and Transmission Pipeline up to Point of Delivery for MAHAGENCO's Koradi Thermal Plant and Khaperkheda Thermal Power Plant.

Major components of Project are as below:-

S.N.	Components	Capacity / Quantity
1	Tertiary Treatment Plant - Fibre Disc Filtration	190 MLD
2	Disinfection System for Tertiary Treated Water	1 No.
3	Tertiary Treated Water Pumping Station	190 MLD
4	Supply, Laying, Lowering, Jointing, Testing of Treated Sewage Pipeline up to Point of Delivery	From Bhandewadi to Koradi junction - 190 MLD From Koradi junction to Koradi TPS Point of Delivery - 90 MLD From Koradi junction to Dalora Pump house - 100 MLD
5	PLC and SCADA system for Entire Plant	1 No.

Director (Projects)
MAHAGENCO

Note: The above table depicts the broad scope of the Project. The details of scope of Project shall be set out in the detailed project report developed by the Operator to the Independent Engineer and approved by the Independent Engineer. Besides the scope of the Project may be changed from time to time in accordance with the procedure set out in the Agreement. Any reference to scope of the Project in the Agreement shall be deemed to be a reference to the scope of the Project as amended from time to time.

1.19 The Parties hereby agree that the existing Schedule C to the Original Agreement shall stand deleted and replaced as below:

SCHEDULE-C
TABLE OF DELIVERY VOLUME

Month	Daily Volume Flow (MLD) For Khaperkheda Thermal Power Plant	Daily Volume Flow (MLD) For Koradi Thermal Power Plant
January	100	90
February	100	90
March	100	91
April	100	92
May	100	89
June	100	91
July	100	90
August	100	91
September	100	90
October	100	90
November	100	90
December	100	91

1.20 The Parties hereby also agree that as a consequence of the above amendments in the Original Agreement under this clause, the Drafts of Escrow Agreement and Substitution Agreement as set forth in Schedule-S and T to the Original Agreement shall, as and where required, stand suitably modified.

5. Amendment to remain in full force and effect:

5.1 This First Amendment shall form an integral part of the Original Agreement and shall be read along with the Original Agreement.

5.2 This First Amendment shall modify the Original Agreement and understandings set out in the Original Agreement, as applicable, only to the limited extent set out herein. Except as specifically and expressly amended by this First Amendment, all other provisions of the Original Agreement including the Base Water Rate, Effective Water Rate and Treated Water Rate shall remain unchanged and in full force and effect and shall continue to remain applicable and binding on the Parties.

5.3 This First Amendment shall be co-extensive and co-terminus with the Original Agreement and shall stand terminated upon termination of the Original Agreement.

5.4 In the event of conflict between the terms of this First Amendment and the provisions of the Original Agreement, the provisions of this First Amendment shall prevail in relation to the matters set out herein.

IN WITNESS WHEREOF, each Party (or their duly authorized representatives) has executed this First Amendment on the dates appearing below:

for Maharashtra State Power Generation Co. Ltd (MAHAGENCO) Name: V. G. JAPDEO Designation: Director (Projects) MAHAGENCO.	D.R. Munde Chief Engr. Mahagenco Mumbai Witness:.....
for Nagpur Municipal Corporation (NMC) Name: Designation:	R. J. Dufare Dy. Engr. NMC Witness:.....
for Nagpur Waste Water Management Pvt. Ltd. (OPERATOR) Name: SUDHAKAR RAMA LAKHANE Designation: EXECUTIVE DIRECTOR	A. J. Kolekar Witness:.....

Nehru Marg,
Nagpur, Maharashtra - 440 020.
(Website: www.neeri.res.in)

Annexure-K

NEERI

Dr. Lal Singh
Senior Scientist
Environmental Biotechnology & Genomics Division

Office Phone : 0712-2249764 / 2249885 Extn. : 538
E-mail : lalsingh@neeri.res.in
Mobile No : +91-9404958627

Date: October 28, 2021

To,

The Superintending Engineer (CIVIL)

3x660MW, KTPS, Koradi

Subject: Reg. Plantation of bamboo species (Eco-Rejuvenation) at 3x660MW, KTPS, Koradi, MSPGCL, TPS, Koradi (KTPS/3X660MW/SE/CIVIL), 27/10/2021

Dear Sir,

As per the mail received on 27/10/2021, regarding the plantation of bamboo saplings through Eco-Rejuvenation Technology. Till now, we have completed/planted 20000 bamboo plants at Koradi and surrounding villages outside the MAHAGENCO Premises.

1. 4000 bamboo sp. planted as per PO. No. 4500106437 (Plantation work completed)
2. 4000 bamboo sp. planted as per PO No. 4500106434 (Plantation work completed)
3. 4000 bamboo sp. planted as per PO No.4500101669 (Plantation work completed)
4. 4000 bamboo sp. planted as per PO No. 4500106434 (Plantation work completed)
5. 4000 Bamboo sp. planted as per PO No. 4500106433 (Plantation work completed)

other progress as per PO (growth parameters, soil/ fly ash dumped waste characteristics after plantation is under progress.

28/10/21

Dr. Lal Singh
Senior Scientist
Environmental Biotechnology & Genomics Division CSIR-NEERI, Nehru Marg, Nagpur-20

Nagpur, Maharashtra - 440 020.
(Website: www.neeri.res.in)

NEERI

Dr. Lal Singh
Senior Scientist
Environmental Biotechnology
& Genomics Division

Office Phone : 0712-2249764 / 2249885
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Mobile No : +91-9404950627

Date: October 28, 2021

To,

The Superintending Engineer (CIVIL)

3x660MW, KTPS, Koradi

Subject: Reg. Plantation of bamboo species (Eco-Rejuvenation) at 3x660MW, KTPS, Koradi, MSPGCL, TPS, Koradi (KTPS/3X660MW/SE/CIVIL), 27/10/2021

Dear Sir,

As per the mail received on 27/10/2021, regarding the plantation of bamboo saplings through Eco-Rejuvenation Technology. Till now, we have completed/planted 28000 bamboo plants at Koradi Premises.

1. 12000 bamboo sp. planted as per PO. No. 4500104439 (Plantation work completed)
2. 12000 bamboo sp. planted as per PO No. 4550001477 (Plantation work completed)
3. 4200 bamboo sp. planted as per PO No.450001478 (Under Progress)

Remaining plantation of bamboo species (4000 no.) and other progress (growth parameters, soil/ dumped waste characteristics after plantation against the PO No. 450001478 is under progress.

28/10/21

Dr. Lal Singh
Senior Scientist
Environmental Biotechnology & Genomics
Division CSIR-NEERI, Nehru
Marg, Nagpur-20

Annexure - L

Koradi Thermal Power Station, 3X660 MW

AMBIENT AIR QUALITY MONITORING DATA FROM APRIL- 2020 to MARCH- 2021

LOCATION	MONTH	PARAMETER											
		PM 2.5	PM 10	SO_2	NO_x	NH_3	O_3	CO	Pb	Benzo Pyrene	Benzene (C6H6)	Nickel (Ni)	Arsenic (As)
		ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	mg/m3	ug/m3	ng/m3	ug/m3	ng/m3	ng/m3
Arya Nagar	Apr-20	21.0	52.0	10.0	15.0	22.0	21.0	0.81	BDL	BDL	1.03	3.40	BDL
	May-20	21 0	51.1	10.0	15 0	21.0	20.0	0 86	BDL	BDL	1 00	3.80	0 39
	Jun-20	22 0	50.0	14 0	16 0	20 0	20 0	1 05	BDL	BDL	1.30	3 68	0 40
	Jul-20	11.0	22 0	12.0	8 0	20.0	BDL	1 04	BDL	BDL	1.23	4.00	0 38
	Aug-20	11.0	21.0	11.0	8 0	21.0	20 0	0.81	BDL	BDL	1.00	BDL	BDL
	Sep-20	14 0	38.0	13.0	10.0	21.0	20.0	0.90	BDL	BDL	1 00	3.20	BDL
	Oct-20	21.0	50 3	14 3	11.7	21 7	20.0	0 92	BDL	BDL	1 08	3.36	BDL
	Nov-20	23.0	59 0	14.0	15.0	22 0	20 0	0 96	BDL	BDL	1 12	3 40	0 32
	Dec-20	27.0	68 0	16.0	21.0	24.0	21.0	0 98	BDL	BDL	1.11	3 30	0 31
	Jan-21	29 0	67.0	17.0	20 0	24.0	24.0	0.94	BDL	BDL	1.12	3.60	0.31
	Feb-21	26.0	60.0	16 0	19 0	24.0	21.0	0 97	BDL	BDL	1.08	3.40	0.31
	Mar-21	28.0	63.0	13 0	18 0	23 0	21 0	0 99	BDL	BDL	1.07	3.50	0 33
	Avg	**21.17**	**49.96**	**13.63**	**14.55**	**21.97**	**20.73**	**0.94**	**BDL**	**BDL**	**1.10**	**3.51**	**0.34**
Bokhara	Apr-20	25 0	59.0	11.0	16 0	22.0	20.0	0 77	BDL	BDL	1.00	3.50	0.32
	May-20	25.0	60.0	10 0	15 0	23.0	21.0	0.96	BDL	BDL	1.10	4.10	0.38
	Jun-20	23.0	49.0	15 0	17 0	21 0	20 0	1.05	BDL	BDL	1.27	3.60	0.45
	Jul-20	10.0	24.0	11 0	7.0	21 0	20 0	1.04	BDL	BDL	1.13	4 00	0 42
	Aug-20	10.0	19 0	11.0	8 0	21 0	20.0	0 73	BDL	BDL	BDL	3 00	BDL
	Sep-20	14 0	37.0	14.0	10 0	21.0	21.0	0.92	BDL	BDL	BDL	3.20	BDL
	Oct-20	25 0	51.0	14.0	13 0	22.0	20.0	0.95	BDL	BDL	1.10	3.31	BDL
	Nov-20	21.0	58.0	13 0	15 0	21.0	20.0	0 89	BDL	BDL	1.13	3.40	0.32
	Dec-20	25.0	69.0	18 0	20.0	23 0	20 0	0.88	BDL	BDL	1.13	3 20	0.31
	Jan-21	26.0	65.0	16.0	19.0	23.0	24 0	0 81	BDL	BDL	1.13	3 60	0.32
	Feb-21	26 0	59 0	16.0	19.0	23.0	21 0	0.92	BDL	BDL	1.11	3 60	0.33
	Mar-21	27 0	63.0	13.0	17 0	23.0	20.0	0.96	BDL	BDL	1.11	3 40	0.33
	Avg	**21.42**	**51.08**	**13.50**	**14.67**	**22.00**	**20.58**	**0.91**	**BDL**	BDL	1.12	**3.49**	**0.36**
Khasala	Apr-20	28 0	59 0	11.0	16.0	22 0	21.0	0.83	BDL	BDL	1.10	3.40	0.34
	May-20	27 0	60.0	11.0	16.0	23.0	21.0	1.05	BDL	BDL	1 00	4 10	0 37
	Jun-20	24.0	50.0	15.0	18 0	21.0	20.0	1.08	BDL	BDL	1 31	3 67	0.42
	Jul-20	14.0	22.0	13 0	6 0	21.0	20.0	1 05	BDL	BDL	1.25	3.90	0.43
	Aug-20	11.0	21.0	11.0	8 0	21.0	20.0	0 81	BDL	BDL	1.00	BDL	BDL
	Sep-20	15.0	37.0	14.0	11.0	21.0	20 0	0 98	BDL	BDL	1.08	3.10	BDL
	Oct-20	21.0	53.0	15.0	13.0	21.0	20 0	0.93	BDL	BDL	1.13	3 27	BDL
	Nov-20	24.0	62.0	15.0	15 0	22.0	20.0	0.94	BDL	BDL	1 19	3 40	0.32
	Dec-20	26.0	69.0	19 0	20 0	23 0	20.0	0.88	BDL	BDL	1.17	3.30	0.32
	Jan-21	30.0	71 0	18.0	21.0	24.0	22.0	0 96	BDL	BDL	1.17	3.50	0.32
	Feb-21	28 0	63 0	17.0	20.0	23.0	23 0	1.00	BDL	BDL	1.14	3.50	0.32
	Mar-21	29.0	60.0	13.0	24 0	25.0	21.0	1.00	BDL	BDL	1.13	3.40	0 34
	Avg	**23.08**	**52.25**	**14.33**	**15.67**	**22.25**	**20.67**	**0.96**	**BDL**	**BDL**	**1.14**	**3.50**	**0.35**

Koradi Thermal Power Station, 3X660 MW

GROUND WATER SAMPLE ANALYSIS AVERAGE REPORT FOR APRIL - 2020 to MARCH - 2021

October - 2020 (Post-Monsoon)

VILLAGE	SAMPLES	Temp	pH	Residual free Chlorine	TDS	TSS	Dissolved Phosphate (as PO_4)	Fluorides F	DO	BOD	COD	Oil & Grease	Fixed Dissolved Solids	Free Ammonia	Total Kjeldahl Nitrogen	Cyanide (as CN)	Sulphide (as S)	Sulphate (as SO_4)
		(°C)	–	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Panjara	Dugwell	27	7.7	RDL	360	BDL	0.062	0.432	6.2	5.0	18	N.D	250	BDL	0.460	N.D	N.C	22.0
	Borewell	29	7.3	BDL	1203	BDL	0.064	0.437	6.4	2.8	10	N.D	679	0.30	0.448	N.D	N.D	247
Mahadula	Dugwell	29	7.6	BDL	950	BDL	0.077	0.441	6.4	2.3	9	N.D	600	BDL	0.380	N.D	N.D	190
	Borewell	30	7.8	BDL	1111	BDL	0.088	0.422	6.3	4.1	14	N.D	656	0.11	0.450	N.D	N.D	140
Koradi	Dugwell	29	7.5	BDL	456	BDL	0.09	0.400	6.1	4.8	15	N.D	318	0.14	0.450	N.D	N.D	53.8
	Borewell	30	7.6	BDL	690	BDL	0.08	0.387	6.3	2.2	7	N.D	491	BDL	0.320	N.D	N.D	64
Nanda	Dugwell	29	7.9	RDL	449	BDL	0.090	0.414	6.4	3.5	13	N.D.	315	BDL	0.340	N.D	N.D	58
	Borewell	30	7.7	BDL	845	RDL	BDL	0.423	6.4	2.5	8	N.D.	452	BDL	0.280	N.D	N.D	65
Suradevi	Dugwell	29	7.6	BDL	975	BDL	0.08	0.326	6.2	4.1	14	N.D	600	0.11	0.390	N.D	N.D	110
	Borewell	30	7.4	BDL	729	BDL	BDL	0.423	6.3	2.4	8	N.D.	590	0.10	0.340	N.D	N.D	90
Khasala	Dugwell	28	7.5	BDL	880	BDL	BDL	0.429	6.4	2.9	14	N.D	620	0.11	0.340	N.D	N.D	140
	Borewell	29	7.8	BDL	1388	BDL	0.084	0.396	6.5	1.8	6	N.D	971	0.11	0.260	N.D	N.C	170
Khairy	Dugwell	29	7.8	BDL	862	BDL	0.091	0.450	6.2	2.3	11	N.D	504	BDL	0.390	N.D	N.D	195
	Borewell	30	7.8	BDL	1380	BDL	0.043	0.367	6.3	2.2	7	N.D	949	BDL	0.340	N.D	N.D	168
Nawatha	Dugwell	28	7.9	BDL	1531	BDL	0.042	0.441	6.4	3.8	12	N.D	908	0.12	0.340	N.D	N.D	245
	Borewell	29	7.9	BDL	1108	BDL	0.089	0.439	6.5	2.7	7	N.D	738	BDL	0.220	N.D	N.D	180
Khairi	Dugwell	28	7.7	BDL	990	BDL	0.081	0.414	6.0	3.6	13	N.D	558	BDL	0.450	N.D	N.D	134
	Borewell	29	7.6	RDL	1302	BDL	0.11	0.407	6.2	2.5	6	N.D	780	0.10	0.390	N.D	N.D	148

VILLAGE	SAMPLES	Nitrate (as NO_3)	Phenolic Compounds (as C_6H_5OH)	Iron (as Fe)	Copper (as Cu)	Lead (as Pb)	Zinc (as Zn)	Arsenic (as As)	Mercury (as Hg)	Chromium Hexavalent (as Cr^{6+})	Nickel (as Ni)	Chromium Trivalent (as Cr^{3+})	Selenium (as Se)	Chromium Total (as Cr)	Cadmium (as Cd)	Manganese (as Mn)	Vanadium (as V)	Bioassay Test
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	–
Panjara	Dugwell	1.25	N.D.	0.187	N.D	N.D	0.057	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	BDL	BDL	Free From Acute lethal toxicity
	Borewell	15.3	N.D	BDL	N.D	N.D	0.068	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	BDL	BDL	Free From Acute lethal toxicity
Mahadula	Dugwell	41.3	N.D	0.162	BDL	N.D	0.051	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	BDL	BDL	Free From Acute lethal toxicity
	Borewell	30.3	N.D	0.174	N.D	N.D	0.076	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	BDL	BDL	Free From Acute lethal toxicity
Koradi	Dugwell	44	N.D	0.148	BDL	N.D	0.061	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	BDL	BDL	Free From Acute lethal toxicity
	Borewell	35.4	N.D.	0.712	N.D	N.D	0.048	N.D	N.D	N.D	N.D.	N.D.	N.D	N.D	N.D	BDL	BDL	Free From Acute lethal toxicity
Nanda	Dugwell	30.0	N.D.	BDL	N.D	N.D	0.071	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	BDL	RDL	Free From Acute lethal toxicity
	Borewell	37.2	N.D	0.174	N.D	N.D	0.058	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	BDL	BDL	Free From Acute lethal toxicity
Suradevi	Dugwell	24.8	N.D	0.375	BDL	N.D	0.080	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	BDL	BDL	Free From Acute lethal toxicity
	Borewell	43.5	N.C	0.225	N.D	N.D	0.074	N.C	N.D	N.D	N.D	N.D	N.D	N.D	N.D	BDL	BDL	Free From Acute lethal toxicity
Khasala	Dugwell	5.01	N.C	0.174	N.D	N.D	0.038	N.D	N.D	N.C	N.D	N.D	N.D	N.D	N.C	BDL	BDL	Free From Acute lethal toxicity
	Borewell	43.3	N.D.	0.157	N.D	N.D	0.051	N.D.	N.D	N.D	N.D	N.D	N.D	N.D	N.D	BDL	BDL	Free From Acute lethal toxicity
Khairy	Dugwell	33.4	N.D	0.152	N.D	N.D	0.030	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	BDL	BDL	Free From Acute lethal toxicity
	Borewell	12.0	N.D	0.174	N.D	N.D	0.087	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	BDL	BDL	Free From Acute lethal toxicity
Nawatha	Dugwell	32.5	N.D	0.184	BDL	N.D	0.046	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	BDL	BDL	Free From Acute lethal toxicity
	Borewell	4.84	N.D	0.286	BDL	N.D	0.067	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.C	BDL	BDL	Free From Acute lethal toxicity
Khairi	Dugwell	11.7	N.D	0.187	BDL	N.D	0.030	N.D	N.D	N.D	BDL	N.D	N.D	N.D	N.C	BDL	BDL	Free From Acute lethal toxicity
	Borewell	31.5	N.D	0.300	BDL	N.D	0.087	N.D	N.D	N.D	BDL	N.D	N.D	N.D	N.D	BDL	BDL	Free From Acute lethal toxicity

EFFLUENT ANALYSIS REPORT FOR APRIL- 2020 to MARCH- 2021

LOCATION	MONTH	Temp.	pH	Residual free chlorine	TDS	TSS	Chloride (as Cl)	Total phosphate (as PO4)	Fluoride (as F)	DO	BOD	COD	Oil & Grease	Free Ammonia	Total Kjeldahl Nitrogen	Sulphide (as S)	Iron (Fe)	Manganese (as Mn)	Copper (as Cu)	Lead (Pb)	Zinc (Zn)	Arsenic (as As)	Mercury	Nickel (as Ni)	Chromium Total (as Cr)	Cadmium (as Cd)	Phenolic Compounds (as C6H5OH)	Bioassay Test
		(°C)	-	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	-
Ash Bund (Khasara)	Apr-20	30.0	8.9	BDL	780.0	45.0	189.0	0.5	1.1	5.8	11.5	40.0	N.D.	BDL	0.8	N.D.	1.0	0.1	BDL	BDL	0.1	BDL	N.D.	BDL	BDL	BDL	N.D.	N.A.
	May-20	30.0	8.3	BDL	790.0	45.0	188.0	0.5	1.1	5.8	11.5	40.0	N.D.	BDL	0.8	N.D.	1.0	0.1	BDL	BDL	0.1	BDL	N.D.	BDL	BDL	BDL	N.D.	N.A.
	Jun-20	28.0	8.2	BDL	974.0	38.0	199.0	1.7	1.1	5.8	9.1	32.0	N.D.	BDL	0.6	N.D.	0.6	0.1	BDL	BDL	0.1	N.D.	N.D	BDL	BDL	BDL	N.D.	N.A.
	Jul-20	27.0	8.4	BDL	721.0	56.0	133.0	1.5	1.0	5.9	8.4	28.0	N.D.	BDL	0.6	N.D	0.6	0.1	BDL	BDL	0.1	N.D.	N.D.	BDL	BDL	BDL	N.D.	N.A.
	Aug-20	28.0	8.1	BDL	609.0	45.0	105.0	0.8	0.8	6.0	8.4	28.0	N.D.	BDL	0.8	N.D.	0.8	0.1	BDL	BDL	BDL	0.1	N.D.	N.D.	BDL	N.D	N.D.	N.A.
	Sep-20	28.0	8.0	BDL	847.0	36.0	110.0	0.2	1.7	5.2	11.0	36.0	N.D	0.1	0.4	N.D.	0.4	0.1	N.D	N.D	0.1	N.D.	N.D.	BDL	BDL	N.D.	N.D.	N.A.
	Oct-20	29.0	8.3	BDL	843.0	31.0	131.0	0.4	1.1	6.0	13.5	50.0	N.D	N.D	0.7	N.D.	1.3	0.1	N.D	BDL	0.1	N.D.	N.D.	BDL	N.D	BDL	N.D.	N.A.
	Nov-20	28.0	8.3	BDL	690.0	29.0	170.0	0.3	1.1	5.8	16.0	52.0	N.D.	0.1	0.7	N.D	0.5	0.0	0.1	N.D	0.8	N.D	N.D	BDL	BDL	BDL	N.D.	N.A.
	Dec-20	27.0	8.5	BDL	701.0	31.0	137.0	0.4	1.1	5.9	13.5	44.0	N.D.	0.1	0.5	N.D.	0.2	0.1	N.D	N.D	0.1	N.D.	N.D.	BDL	N.D.	BDL	N.D.	N.A.
	Jan-21	27.0	8.4	BDL	819.0	57.0	179.0	0.7	0.5	5.8	10.2	34.0	N.D.	0.2	1.0	N.D	0.7	0.1	BDL	BDL	0.1	N.D.	N.D.	N.D.	N.D.	BDL	N.D.	N.A.
	Feb-21	27.0	8.2	BDL	925.0	34.0	149.0	0.2	0.6	5.5	10.4	36.0	N.D.	BDL	0.6	N.D.	0.6	0.1	BDL	BDL	0.1	N.D.	N.D.	N.D.	BDL	BDL	N.D.	N.A.
	Mar-21	25.0	8.0	BDL	585.0	16.0	145.0	0.6	0.6	5.6	9.7	32.0	N.D.	0.1	0.6	N.D	0.3	0.1	N.D	BDL	0.0	N.D.	N.D.	N.D.	N.D	N.D	N.D.	N.A.
	Average	27.9	8.3	BDL	785.7	39.3	154.8	0.7	0.9	5.8	11.1	37.7	N.D.	0.13	0.64	N.D.	0.58	0.07	0.12	BDL	0.13	N.D.	N.D.	BDL	BDL	BDL	N.D.	N.A.

Annexure - N

KORADI THERMAL POWER STATION, 3X660 MW

EFFLUENT ANALYSIS REPORT FOR APRIL- 2020 to MARCH- 2021

LOCATION	MONTH	Temp.	pH	Residual free chlorine	TDS	TSS	Chloride (as Cl)	Total phosphate (as PO4)	Fluoride (as F)	Oil & Grease	BOD	COD	Oil & Grease	Free Ammonia	Total Kjeldahl Nitrogen	Sulphide (as S)	Iron (Fe)	Manganese (as Mn)	Copper (as Cu)	Lead (ph)	Zinc (Zn)	Arsenic (as As)	Mercury	Nickel (as Ni)	Chromium Total (as Cr)	Cadmium (as Cd)	Phenolic Compounds (as C6H5OH)	Bioassay Test
		(°C)	–	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	–
ETP outlet	Apr-20	29.0	7.8	BDL	982.0	17.5	265.0	0.4	0.7	5.0	10.2	36.0	N.D.	BDL	0.6	N.D.	0.4	0.1	BDL	BDL	0.u	BDL	N.D.	BDL	BDL	BDL	N.D	N.A.
	May-20	29.0	7.8	BDL	962.0	17.5	265.0	0.4	0.7	5.0	10.2	36.0	N.D.	BDL	0.6	N.D.	0.4	0.1	BDL	BDL	0.0	N.D	N.D	BDL	BDL	3DL	N.D	N.A.
	Jun-20	30.0	8.0	BDL	908.0	12.0	203.0	0.3	0.6	5.0	11.0	36.0	N.D.	BDL	0.5	N.D	0.5	0.1	BDL	BDL	0.0	N.D	N.D	BDL	BDL	BDL	N.D.	N.A.
	Jul-20	28.0	7.8	BDL	438.0	44.0	103.0	0.8	0.6	6.0	7.3	24.0	N.D.	BDL	0.7	N.D	0.5	0.1	N.D	BDL	0.1	N.D.	N.D.	N.D	N.D.	N.D	N.D.	N.A.
	Aug-20	30.0	7.9	BDL	718.0	38.5	196.0	0.5	0.8	6.0	8.4	28.0	N.D.	BDL	0.4	N.D.	0.5	0.1	BDL	BDL	0.5	N.D.	N.D	N.D	BDL	N.D	N.D	N.A.
	Sep-20	30.0	7.9	BDL	698.0	13.0	196.0	0.5	0.8	5.0	9.4	32.0	N.D.	0.1	1.0	N.D.	0.1	0.0	N.D	N.D	0.1	N.D.	N.D	N.D	N.D.	N.D	N.D	N.A.
	Oct-20	31.5	7.9	BDL	790.0	20.0	184.5	0.4	4.4	6.0	15.4	50.0	N.D.	BDL	0.7	N.D.	0.2	0.1	N.D	BDL	0.1	N.D.	N.D.	BDL	N.D.	BDL	N.D	N.A.
	Nov-20	28.0	7.8	BDL	1016.0	7.0	269.0	0.1	0.6	6.0	7.9	26.0	N.D.	BDL	1.0	N.D.	0.4	0.1	BDL	BDL	0.1	N.D.	N.D.	BDL	N.D.	BDL	N.D.	N.A.
	Dec-20	26.0	7.7	BDL	832.0	7.0	212.0	0.2	0.6	6.0	7.9	26.0	N.D	BDL	1.0	N.D.	0.4	0.1	BDL	N.D	N.D	N.D.	N.D.	BDL	N.D.	BDL	N.D	N.A.
	Jan-21	25.0	8.1	BDL	1121.0	16.0	282.0	0.3	0.5	5.0	9.9	32.0	N.D	BDL	0.8	N.D.	0.3	BDL	BDL	BDL	0.1	N.D	N.D	N.D.	N.D.	BDL	N.D	N.A.
	Feb-21	24.0	8.1	BDL	946.0	20.0	290.6	0.5	0.6	5.0	6.7	22.0	N.D.	BDL	0.8	N.D.	0.3	0.1	BDL	BDL	0.1	N.D.	N.D.	BDL	BDL	BDL	N.D.	N.A.
	Mar-21	27.0	8.2	BDL	965.0	24.0	298.0	0.2	0.6	10.1	5.7	32.0	N.D	0.2	0.7	N.D	0.2	BDL	N.D	N.D	0.1	N.D.	N.D	N.D.	BDL	BDL	N.D.	N.A.
	Average	28.0	7.9	BDL	885.0	19.5	224.8	0.4	0.6	6.4	9.2	31.7	N.D.	0.1	0.7	N.D.	0.4	0.1	BDL	BDL	0.1	N.D.	N.D.	BDL	BDL	BDL	N.D.	N.A.

KORADI THERMAL POWER STATION, 3X660 MW

EFFLUENT ANALYSIS REPORT FOR APRIL - 2020 to MARCH- 2021

LOCATION	MONTH	Temp.	pH	Residual free chlorine	TDS	TSS	Chloride (as Cl)	Total phosphate (as PO4)	Fluoride(as F)	DO	BOD	COD	Oil & Grease	Free Ammonia	Total Kjeldahl Nitrogen	Sulphide (as S)	Iron(Fe)	Manganese (as Mn)	Copper (as Cu)	Lead (pb)	Zinc (Zn)	Arsenic (as As)	Mercury	Nickel (as Ni)	Chromium Total (as Cr)	Cadmium (as Cd)	Phenolic Compounds (as C6H5OH)	Biodata Test
		(°C)	–	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	–
STP outlet (25 KLD)	Apr-20	33.0	8.0	BDL	760.0	46.0	188.0	0.5	1.1	5.8	11.6	40.0	N.D.	BDL	0.5	N.D.	0.7	0.1	BDL	BDL	0.1	N.D.	N.D.	BDL	BDL	BDL	N.D.	N.A.
	May-20	30.0	8.3	BDL	780.0	46.0	188.0	0.5	1.1	5.8	11.5	40.0	N.D.	BDL	0.5	N.D.	0.7	0.1	BDL	BDL	0.1	BDL	N.D.	BDL	BDL	BDL	N.D.	N.A.
	Jun-20	29.0	7.9	BDL	400.0	BDL	30.5	2.0	0.4	5.7	10.2	34.0	N.D.	BDL	0.6	N.D.	0.2	BDL	BDL	BDL	0.1	N.D.	N.D.	N.D.	BDL	BDL	N.D.	N.A.
	Jul-20	28.0	8.0	BDL	349.0	14.0	42.5	1.1	0.8	5.0	7.3	24.0	N.D.	BDL	0.7	N.D.	BDL	BDL	N.D.	N.D.	0.6	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.A.
	Aug-20	28.0	8.2	BDL	545.0	28.0	117.0	1.9	0.4	6.1	9.1	30.0	N.D.	BDL	0.7	N.D.	0.2	BDL	BDL	N.D.	0.6	N.D.	N.D.	BDL	BDL	N.D.	N.D.	N.A.
	Sep-20	28.0	7.9	BDL	431.0	6.0	124.0	0.6	0.3	6.0	9.6	32.0	N.D.	BDL	1.0	N.D.	0.1	0.0	N.D.	N.D.	0.1	N.D.	N.D.	BDL	N.D.	BDL	N.D.	N.A.
	Oct-20	27.0	9.2	BDL	627.0	7.0	64.0	0.8	0.3	5.9	20.0	62.0	N.D.	BDL	0.5	N.D.	0.2	BDL	N.D.	N.D.	0.0	N.D.	N.D.	N.D.	BDL	BDL	N.D.	N.A.
	Nov-20	26.0	8.1	BDL	481.0	6.0	56.5	0.6	0.4	5.6	8.5	28.0	N.D.	BDL	0.5	N.D.	0.1	BDL	BDL	BDL	0.1	N.D.	N.D.	BDL	BDL	BDL	N.D.	N.A.
	Dec-20	25.0	8.2	BDL	545.0	20.0	114.5	0.7	0.3	5.9	7.9	26.0	N.D.	BDL	1.2	N.D.	0.3	0.1	BDL	N.D.	0.0	N.D.	N.D.	N.D.	N.D.	BDL	N.D.	N.A.
	Jan-21	25.0	8.4	BDL	792.0	15.0	120.5	0.4	0.6	5.8	7.2	24.0	N.D.	0.1	0.3	N.D.	0.2	BDL	N.D.	N.D.	0.1	N.D.	N.D.	N.D.	N.D.	BDL	N.D.	N.A.
	Feb-21	23.0	7.9	BDL	479.0	24.0	76.2	0.5	0.5	5.7	11.2	36.0	N.D.	BDL	0.6	N.D.	0.3	0.1	BDL	BDL	0.1	N.D.	N.D.	N.D.	BDL	BDL	N.D.	N.A.
	Mar-21	26.0	8.1	BDL	548.0	11.0	109.0	0.5	0.6	5.0	7.0	24.0	N.D.	0.2	0.9	N.D.	0.2	0.0	N.D.	N.D.	0.0	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.A.
	Average	26.9	8.13	BDL	561.92	20.3	103.8	0.87	0.58	5.66	10.1	33.33	N.D.	0.14	0.68	N.D.	0.28	0.05	BDL	N.D.	0.06	BDL	N.D.	0.06	BDL	BDL	N.D.	N.A.

Koradi Thermal Power Station, 3X660 MW
Environmental Expenditure For April- 2020 to March- 2021

Sr. No.	Section	Particulars	F. Y. 2020-21 (In Lakhs)	F. Y. 2021-22 (In Lakhs)
1	C&I	AMC for OCEMS, AMC of CEMS analysers for remote calibration and online connectivity, AMC of Knowledge Lens software data transmission support of ETP/STP to CPCB/MPCB server.	38.57804	37.40000
2	OS	Housekeeping, cleaning and hazardous waste handling	353.57819	354.31822
3	AHP	ESP mainte. & procurement of spares for ESP mainte.	69.69826	132.38224
		Procurement of bag filters and mainte. At Ash Handling	915.39349	747.10310
4	TM	Maintenance of pipelines and procurement of fume absorber for acid tank	25.00000	34.70000
5	Civil	Plantation of plants & its maintenance	176.28941	308.99328
6	Env. Cell	O&M of ETP/STP & CAAQMS; online connectivity of CAAQMS stations, Environmental Monitoring by mobile van, HW disposal	185.30129	252.22110
7	Major Stores	Nil	0	0
8	FAU	Nil	0	0
9	Env. Cell	MPCB JVS monitoring	Not Received	Not Received
10	IT	Nil	0	0
11	BM	Nil	0	0
12	EM	Spares and maintenance of ESP pass and rapper system, ESP control system	19.59980	34.60000
13	CHP	Flexible hoses, SS fire fighting nozzle, magnetic plate	6.00000	7.00000
		Total	1789.54142	1936.72784

Annexure - M

Annexure-1(a)

Projects & Planning Section
Ref No. CE (P&P)/KRD/3x660MW/FGD/495
Date: 12 JUL 2021

NOTE TO THE BOARD:

Subject: Tender No. 3000013388 –"Design, Engineering, Manufacture, Assembly, Testing at Works, Supply at Site; Civil, Structural & Architectural Works and Erection, Testing & Commissioning of FGD System for Koradi 3x660MW Thermal Power Station Including O&M of the FGD system for the span of 3 years."- Award of LoA - Proposal for deliberation & decision regarding award of Contract.

Reference:

1) MERC- DPR approval MERC/CAPEX/FY- 2020-21/WFH/SBR/05 dated 31.05.2020. ---C-9
2) B.R. No. MSPGCL/CS/BM198/199.16 dated. 15.10.2020. ---C-15
3) B.R. No. MSPGCL/CS/BM185/185.15 dated. 13.11.2018 ---C-
4) Tender No. 3000013388 published on 04.11.2020 .
5) Techno-commercial bids opened on dated. 25.02.2021.
6) Price bids opened on dated. 19.04.2021.
7) Reverse auction held on dated. 18.05.2021.
8) Ltr. CE (P&P)/FGD/KRD 3x660MW/3000013388/0320 dated 09.03.2021.
9) ON CE(P&P)/KRD 660MW/FGD/292 dated 05.04.2021. ---C-67
10) ON CE(P&P)/KRD 3x660MW/FGD/356 dated 04.05.2021. ---C-82
11) M/s EPIL Letter No DLI/BDD/TEN-146/087 dated 21.05.2021 ---C-89
12) M/s BHEL Letter No PS/SMG/R&M/KRD-FGD dated 24.05.2021 ---C-96

1.0 PREAMBLE TENDER No. RFx-3000013388 FOR INSTALLATION OF FGD FOR KORADI-8, 9, 10 INCLUDING O&M FOR 3 YEARS & REVERSE BIDDING MECHANISM

1.1 Tender no. 3000013388 for installation of FGD System for Koradi 3x660MW including O&M of the FGD system for the span of 3 years was published on 04.11.2020 by incorporating Reverse Bidding Mechanism with due approval of the competent authorities. The basic estimated cost of the tender is Rs. 805.00 Cr (Excl. GST) & Rs. 949.90 including taxes & duties.

1.2 The techno-commercial bids of all four bidders mentioned below who had submitted their online bids & physical copies of techno-commercial bids were opened on date 25.02.2021.

Page 1 of 9

Annexure-1(b)

MAHAGENCO

MAHARASHTRA STATE POWER GENERATION CO. LTD.

Office of the Chief Engineer (Projects &Planning),
3rd Floor, Prakashgad, Prof. A.K.Marg, Bandra (East), Mumbai, Maharashtra INDIA Pin-400051
Phone (O) 26474211 / 26472131 (P) 26475759 Fax No 022-26475329
email-cegmgcp@mahagenco.in

Ref: No. CE (P&P)/ FGD/3x660MW Koradi/ 1176 Date: 03 NOV 2021

To
Chief Engineer (O&M)
Koradi Thermal Power Station
Koradi, Nagpur-441111.

Subject: Installation of Flue Gas Desulphurization for 3x660MW Koradi TPS -Detailed Compliance against petition filed before NGT regarding.

Reference: 1. CE(O&M) KTPS/660MW/CD/Env Cell/PL-10/3067 dated 29.10.2021
2. Application No. 62/2021, Diary No. 270413807210/2021 before the NGT (WZ), Pune.

This has reference to the letter under ref. (2) and petition filed before the Bench of NGT, Pune on dated 17.08.2021 by Krushi Vigyan Aarogya Santha against MSPGCL, MoEF, State of Maharashtra and Maharashtra Pollution control Board.

Detail Chronology and Status of Installation of FGD system at 3x660MW Koradi TPS is as under:

1. **Koradi 1st tender: Tender No. 45876**

   Open tender no. 45876 for Installation of FGD system for Unit-10 of 3x660MW Koradi TPS was published on 30.05.2017 and it was cancelled to get very competitive price by comprising all the three units (Unit- 8,9 & 10) for the tender.

2. **Koradi 2nd tender: Tender No. 81943**

   Open tender no. 81943 for Installation of FGD system for 3x660MW units was published on 01.03.2019. The price bid was opened on 27.07.2019. One of bidder had raised objection over alteration in the price bid formats. After scrutiny of Price bids, it was observed that all the bidders have made alterations in the price bid formats. After reviewing the alteration by bidders in price bid format, price bids of all the bidders were not considered for evaluation. Hence, the tender was cancelled.

3. **Koradi 3rd tender: RFx.3000005995**

Open Tender RFx 30000005995 for installation of FGD system for Koradi 3x660MW units was published on 25.09.2019. The price bid was opened on 19.11.2019. MERC accorded approval for Capital Expenditure Scheme (DPR) of FGD system for Unit-8, 9 & 10 on 31.05.2020. After MERC approval the proposal was put up to the MSPGCL Board. Meanwhile, Ministry of Finance (MOF), Department of Expenditure has issued order on 23.07.2020, under "Restriction under Rule-144(xi) of the General Financial Rule (GFRs) 2017" The guideline is," **Any bidders including consortium/JV partner from a country which shares land border with India will be eligible to bid only if the bidders is register with competent authority.**" *If the tendering process has crossed the first exclusionary stage, if the bidders include from such countries, the entire process shall be scrapped and initiated de novo. The de novo process shall adhere to the conditions prescribed in the order.* One of bidders has participated in the tender in consortium with a Chinese company who was not registered with Competent Authority as notified by GOI, MOF at the time of bidding. In view of this, MSPGCL Board resolved for cancellation of the tender and float new tender incorporating all the guidelines issued by GOI. Hence the tender RFx.3000005995 was cancelled.

4. **Koradi 4th tender: RFx.3000013388**

Open tender RFx.3000013388 for Installation of FGD for Koradi 3x660MW units, was published on 04.11.2020. The price bid of all qualified bidders was opened on 19.04.2021. Reverse auction of the tender was conducted on 18.05.2021. One of the bidder have raised objection over the reverse auction process. The matter is with GoM and Mahagenco is awaiting directives from GoM.

This is for your information and necessary action please.

Chief Engineer (P&P)
MSPGCL, Mumbai, India

Copy s.w.r.s.to.-

1. Director (Projects), MSPGCL, Mumbai
2. Exe. Director (Projects), MSPGCL, Mumbai

Annexure - 2 (a)

Preparation of Hydro Geological Investigation Report for Approval of Rain Water Harvesting System, at Koradi

Report Prepared For

MAHAGENCO Koradi 3X660 MW Coal Based Thermal Power Plant,
Koradi, Dist. Nagpur

Report Prepared By

Surya Envirotech

237, Hanuman Nagar, Nagpur

September - 2016

Preparation of Hydro Geological Investigation Report for Approval of Rain Water Harvesting System, at Koradi

REPORT PREPARED BY

Surya Envirotech,

237 Hanuman Nagar, Nagpur

REPORT PREPARED FOR

Maharashtra State Power Generation Company Ltd. [MAHAGENCO]

MAHAGENCO

Maharashtra State Power Generation Co. Ltd.

September - 2016

Preparation of Hydro Geological Investigation Report for Approval of Rain Water Harvesting System, at Koradi

REPORT PREPARED BY

Surya Envirotech,

237 Hanuman Nagar, Nagpur

REPORT PREPARED FOR

Maharashtra State Power Generation Company Ltd. [MAHAGENCO]

MAHAGENCO

Maharashtra State Power Generation Co Ltd

September - 2016

भारत सरकार
Government of India
जल संसाधन, नदी विकास एवं गंगा संरक्षण मंत्रालय
Ministry of Water Resources, River Development & Ganga Rejuvenation
केन्द्रीय भूमिजल बोर्ड
Central Ground Water Board
मध्य क्षेत्र
Central Region

No. CGWB/CR/Authority/Tech. Approval/RWH/2016-17/ 1124
Date: 4/10/2016

By Speed Post

To,

The Deputy Chief Engineer (Civil)
Civil Construction Circle, M.S.P.G.C.L
Koradi, District – Nagpur -441 111

Sub: Technical Approval for implementation of proposed Rainwater Harvesting Scheme at Koradi 3 X 660 MW Expansion Project.

Ref: Your letter No. DY.CE(C)/C.C.C./KRD/Tech./2404 dated 22.9.2016.

Sir,

This has a reference to the subject cited above. In this connection your project report entitled **"Preparation of Hydrogeological investigation report for approval of rainwater harvesting system" for Mahagenco, Koradi 3 X 330 MW expansion project"** submitted vide above referred letter for accord of technical approval of CGWB has been evaluated. Based on the project report, the scheme for implementation of Rain Water Harvesting Scheme is found technically feasible and the same is technically approved with following comments and recommendations for its successful implementation.

Comments and Recommendations

1) Sincere efforts shall be made to utilize a total rainwater harvesting potential of 16,27,550.76 m^3/year available in the project area for augmentation of groundwater resource.

2) The proposed two (2) nos. surface water ponds with an area of 45000 sq.m and depth of 2.0 m are found feasible hence approved with modifications. Since the estimated runoff potential of the project area is quite high, it is recommended to increase depth of the surface water pond upto 4 m bgl to create storage potential of 1,80,000 m^3 in single filling. Considering repetitive annual three (3) fillings, the gross storage capacity of one (1) surface water pond will be 5,40,000 m^3. Thus the two (2) no surface water ponds will have a gross storage potential of **10,80,000 m^3.**

3) The proposed 10 nos. recharge / injection wells within the two (2) surface water ponds are also found feasible and hence approved. This will enhance the recharge rate into the sub-surface aquifer and will also ensure maximum infiltration with less evaporation losses.

4) Periodic cleaning of both two (2) nos. storage reservoirs / ponds should be carried out on regular basis, preferably prior to the onset of monsoon to maintain the recharge efficiency of these structures.

5) It is recommended that storm water from all the surface water drains should be passed through the filters before diverting into 2 nos. storage reservoir to avoid siltation for maintaining the storage capacity and also to enhance the recharge efficiency. The filters should also be periodically cleaned preferably prior to the onset of monsoon.

6) Casing pipe of 4.5 m above the bottom of storage pond / tank shall be provided to avoid the siltation in all the recharge / injection well *(Annexure - I)* constructed at the bottom of tank.

7) Since, the recommended depth of proposed depth of the storage reservoir is 4.0 m bgl, hence proper safety/ precautionary measures may be taken up by construction of wire fencing around the surface water pond to prevent any mishap.

8) Regular monitoring of ground water levels shall be carried out in the project area. For this, it is advised to construct 1 no. piezometer at suitable location in the project area preferably in downstream area. The depth of piezometer should be 30 m below ground level. The groundwater levels shall be monitored in the piezometer on monthly basis, preferably on last day of every month.

9) Groundwater quality should also be checked from the piezometer during pre-monsoon season (May month) of every year to keep track of groundwater quality.

10) Ground water level and water quality data should be regularly submitted to the office of the Regional Director, CGWB, Central Region, Nagpur on quarterly basis and record should also be maintained with the project authority and produced at the time of inspection by this office.

11) After the completion of the project, selected good quality representative photographs of all the rain water harvesting structures along with their construction and capacity details should be sent to this office for perusal and record.

After the construction of the proposed artificial recharge and rain water harvesting structures, this office may be informed for carrying out the inspection of the structures. The present technical approval of the proposed structures is subject to implementation of above recommendations. Further yearly inspection of the ground water scenario in general and recharge/conservation structures in particular may also be carried out by CGWB. This office may be consulted for any further technical guidance/assistance during the course of implementation of the RWH project.

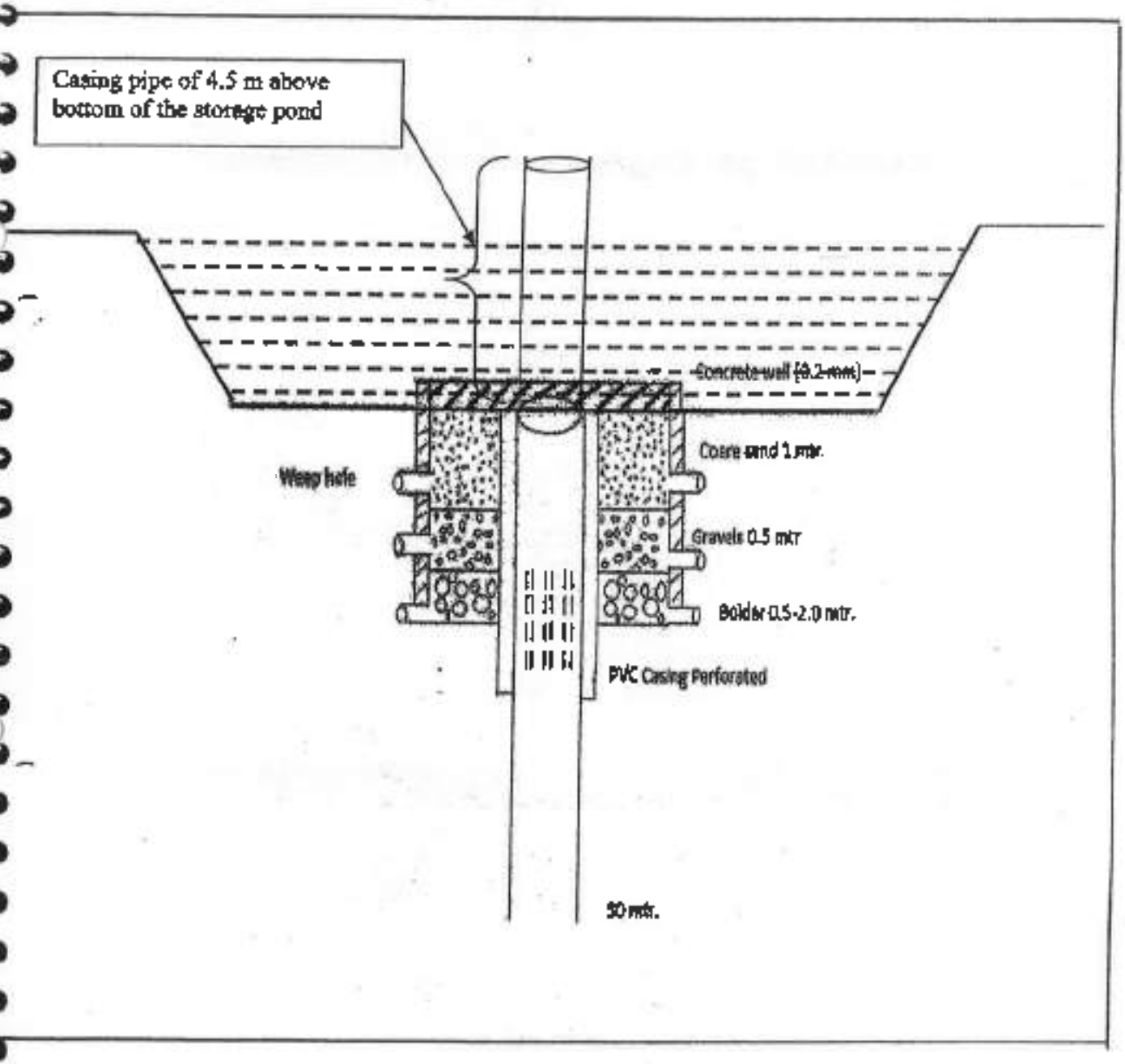
Yours faithfully,

4/10/16

(D. Subba Rao)
Regional Director

Annexure - I

APPROVDED DESIGN OF RECHARGE / INJECTION WELL APPROVED FOR CONSTRUCTION WITHIN THE 2 NUMBERS STORAGE PONDS



INDEX

Chapter I
Introduction

Preamble

Maharashtra State Power Generation Company Ltd. (MAHAGENCO) Koradi is one of the largest Thermal Power Plant, Taluka Kamptee, District Nagpur, and Maharashtra State. To meet the energy requirements of rural and urban sector and the industrial demand, MAHAGENCO has been playing a leading role by constructing and operating power generating plants at Koradi in Maharashtra State. The project is one of the most ecofriendly projects with minimum impact on environment.

Water requirement will be as follow-51MM^3 /year for 3 units, 40MM^3 recycled water from NMC Sewage Treatment Plant (Bhandewadi), 11MM^3 from existing source (pench). It's probably the first power project in India, utilizing water from the treated sewage water of a city, thus avoiding use of fresh water which can be utilized for other necessary requirements such as drinking, agriculture etc.

With a view to minimize the gap between power demand and actual supply, MAHAGENCO has decoded to install a 3X660MW Thermal Power Plant, village Koradi, Taluka Kamptee, District Nagpur, Maharashtra State.

The Expansion power plant site is situated nearly 18 km in southeastern direction from the district place i.e. Nagpur. It is accessible by all season tar road from Nagpur. **(Fig. 1: Index map).**

1.0 Reconnaissance

Maharashtra State Power Generation Company proposes to install 3x660 MW Thermal Power Project at Koradi, Taluka Kamptee, District Nagpur, Maharashtra State.

1.1 Project Description

The Expansion Koradi Thermal Power Project (3X660 MW) is a coal based thermal power project based on super-critical boiler parameters. It shall be located in Koradi between Panjra and Mahadula villages. Koradi town is at 1-1.5 km and district head quarter is 15 kms from the expansion project site. The geographical location of the township and ash disposal areas are as follows:

The main plant and township area is located from Latitude 21^0 14' 44.060"N and 79^0 6' 52.734"E Longitude and Ash disposal Area is located from Latitude 21^0 14' 49.972"N and 79^0 9' 28.918"E Longitude.

The site is approachable from Nagpur-Betul National Highway. The commercial airport is Nagpur located at about 23 km. The Koradi Thermal power plant area is bounded by Panjra village at East, Koradi and Waregaon village at the east, Bokhara village at the West and Nanda North and Mahedula at the West. The township is situated very close to the plant site on the Center. The expansion project's ash disposal area is located in the South- East of main plant.

1.2 Objectives of the study

Thermal power project consume large quantities of water for their operation, which is obtained from the surface water source, which may affect the surface water hydrology of the area. In addition, there are certain structures and activities which may affect the ground water hydrology also such as – dewatering during construction of the project, construction of water impoundment structure on stream to draw water, construction of raw water reservoir inside main plant area, construction and operation of ash dyke area etc. Further, fresh water becoming a scare resource day by day, MAHAGENCO understands its responsibility towards conservation of surface and ground water resources for the benefit of the project as general population within the study area, (10 km from the boundary of the project.)

1.3 The study area

The present study area is of 10 km radial aerial distance around the Expansion Project site. Out of all the 29 villages and one plant site are selected for sampling. These 29 villages which are in the area of 10 km aerial radial distance from the Expanded Thermal Power Plant were selected for sampling of both hydrogeological study and 13 locations in the near vicinity were selected for the study of ground water quality and all is depicted in **Table 1.1** (* marked are the locations considered for water quality). The map showing villages under study area is shown in **Figure 1.2**.

97% of all fresh water that is found on planet is stored underground. This vast water reserve, on which atleast 1500 million people depend for their drinking water supply, is stored in

the pores that exist in materials such as sand and gravel, and in the fractures that are found i rocks such as sandstone and limestone.

Groundwater supplies are recharged by rainwater that infiltrates down through the so and the unsaturated layer below it. When rainwater reaches the water table and joins an aquifer

Groundwater supplies are coming under increasing pressure from growing human populations that consume increasing amounts of water as development proceeds. One result is that many groundwater reserves, particularly in arid areas, are being over-exploited with wate being abstracted from them at unsustainable rates.

Groundwater is also becoming increasingly polluted. One of the major sources is fou water and sewage from cities in developing countries with inadequate sanitation systems. In many urban aquifers, levels of nitrate are high and potentially dangerous microorganisms are finding their way into wells and boreholes used for drinking water. The rain from rubbish tips and landfills, eventually finding their way into aquifers leach other industries is also polluting groundwater.

Many aquifers are being over-exploited in the sense that is being abstracted from them faster than the average rate of recharge. This leads to a reduction in groundwater in permanent storage and is sometimes called groundwater mining. Development of this kind is unsustainable and deprives future generations of a resource which is being used up by this generation.

M/s SURYA ENVIROTECH Nagpur, a Consultancy Firm working in the field of Environment conservation has been appointed to carry out the Hydro-geological study. This study has been carried out during May 2018 and it pertains to the study area spread over 10 km radius from project site (**Fig.** 1.2: Study area map).

Table No. 1.1

Sampling Locations

Sr. no.	Village	Latitude	Longitude
1	Pipla	21° 18'10.976N	79°4'9.200"E
2*	Plant Site	21° 14'20.045"N	79°5'51.013"E
3*	Bokhara	21° 13'40.132"N	79° 4'15.782"E
4	Dorli	21° 16'46.839"N	79° 9'52.937"E
5*	Kawatha,	21° 13'26.383"N	79° 8'24.315"E
6	Soholi	21° 16'38.194"N	79° 8'40.016"E
7*	Lonkhairi	21° 16'35.405"N	79° 3'40.503"E
8*	Waregaon	21° 14'49.972"N	79° 9'28.918"E
9*	Suradevi	21° 14'40.962"N	79° 7'19.045"E
10	Juni Kamptee	21° 14'53.840"N	79° 10'59.758"E
11*	Nanda	21° 16'42.616"N	79° 4'43.083"E
12	Lonare	21° 14'18.835"N	79° 3'30.225"E
13*	Rohana	21° 19'5.214"N	79° 6'29.557"E
14*	Khairi	21° 12'56.659"N	79° 9'18.215"E

Sr. no.	Village	Latitude	Longitude
15	Khasala	21° 13'13.345"N	79° 7'2.721"E
16*	Mhasala	21° 12'49.811"N	79° 8'9.496"E
17	Ranala	21° 12'23 596"N	79° 10'38.881"E
18	Sonegaon	21° 19'8.981"N	79° 9'14.036"E
19	Walni	21° 19'25.503 N	79° 5'19.314"E
20	Silleware	21° 17'21.415"N	79° 7'29.153"E
21*	Koradi.	21° 14'44.060"N	79° 6'52.734"E
22*	Mahadula	21° 15'3.949"N	79° 4'55.092"E
23	Borgaon	21° 10'51.781"N	79° 3'14.325"E
24	Sadar	21° 12'18 934"N	79° 4'42.431"E
25	Nara	21° 12'2.360"N	79° 5'30 662"E
26	Nagesh Nagar	21° 11'2.391"N	79° 5'41.931"E
27	Jhingaba Takli	21° 11'26 529"N	79° 4'30 716"E
28	Shantinagar	21° 9'38.124"N	79° 7'30 515"E
29	Kalamna	21° 10'22.918"N	79° 8'36.458"E

* These are the locations for water quality.

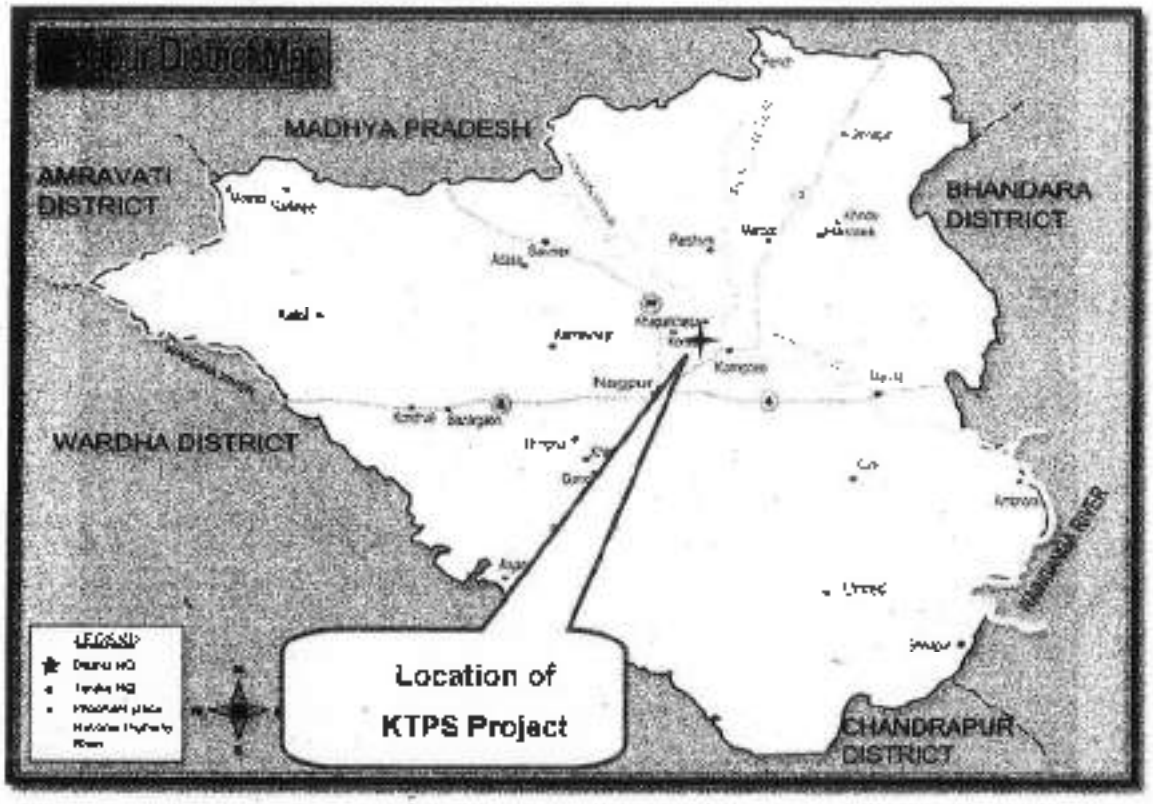


Fig. 1.1: Index map

Figure 1.2 Study Area Map

Chapter II Geology & Hydrogeology

2.0 GEOLOGY

The geology of the Nagpur region is famous for the metamorphic rocks, which occur in all the districts in the Nagpur region except Wardha and some part of Nagpur district. The other geological formation Deccan Traps occur in the Wardha and North and North-West part of Nagpur District.The Koradi Thermal Power Plant premises of the firm is situated in Koradi village. The premises cover an area of about 173 95 hectares i e., 1.7395 sq.km or 1739513 sq.m. Out of this Rooftop area is around 60057 sq.m, Greenbelt Area is 166967 sq.m, Road/Pavement area is 166023 sq.m, area under other utility is 1302446 sq.m.

The present area has Deccan trap formations occurring in the south-east, Archaean in south, alluvium in north, while the Gondwana, Lameta and Sausar formations occurs in an isolated patch. The thick alluvium cover in the north of the area makes it difficult to demarcate the limits and extension of different formations, due to scanty out crops. The tentative stratigraphic sequence in the area, given in Geological Survey of India Map (Fig. 2.1) is as follows.

Lithology	Group, Super Group	Age
Soil alluvium	-	Quaternary
Basalt	Deccan Trap	Cretaceous - Paleocene
Conglomerate, Sandstone/Shale	Lameta Group	Cretaceous
Ferruginous Sandstone (Kamthi)	Gondwana Super group	Permian - Triassic
Quartzite/Quartz, Muscovite schist, Calc-gneiss, Marble	Lohangi, Chorbaoli Formation - Sausar Group	Meso Proterozoic
Granite gneisses	Tirodi Gneissic Complex	Archaean

a) **Archaean-** The crystalline rocks comprising of granite gneiss is the main formations occurring in Southern parts of the area. In these rocks, weathered zone which is down to a depth of 25 - 30 m.bgl, forms the important shallow aquifer for dugwells. In hard crystalline rocks, the occurrence of ground water is mainly controlled by joints and fractures. Higher yields are generally associated with lineaments. Ground water at places occurs in fractured zones at depth in semi-confined to confined conditions.

b) **Sausar Group-** The rocks of this group are represented by Lohangi, and Chorbaoli formations, which are exposed in Mahadula – Suradevi – Koradi area. They represent intensely deformed and metamorphosed sediments such as Calc-gneiss and marbles (Lohangi), Quartzite/Quartz Muscovite schist (Chorbaoli). These rocks and are noticed in Kanhan – Kolar river section.

c) **Gondwana Sediments-** Gondwana formation occurs in an isolated patch. This super group is represented by Barakar and Kamthi formations in this area. Among the Gondwanas, Kamthis generally consist of sandstone which is coarse, gritty and ferruginous in nature. These constitute the important water bearing formations in the area. Barakars are usually associated with coal seams of economic importance. Coal Mines in Walni, Silewada villages indicates existence of Barakar Formation.

d) **Lameta Group-** Lamata Group rocks are located in and around Nagpur city area. Lamatas include fine to medium grained sandstone Conglomerate and Shale.

e) **Deccan Traps-** Basalt is the formation of the area occupies south-east portion of the area. Ground water occurs under phreatic conditions in the exposed lava flows and in semi-confined to confined state in the subsurface flows. Ground water is present in pore spaces in the vesicular unit of each flow and in the jointed and fractured portions of massive unit. However, secondary porosity and permeability developed on account of weathering, fracturing and joints play a very important role in the storage and movement of ground water. This has given rise to good aquifers. Weathering not only produces granular materials but also widens the fractures, joint and shear zones.

f) **Unconsolidated Alluvial Formations**

Alluvium consisting of sand, silt, clay and kankar forms the potential water bearing formations and occurs in northern part of the area. The alluvium of recent to sub-recent age and varied thickness is confined to the area around the Kolar and Kanhan River and occupies plain area of northern portion. It is composed of loose, medium and fine sand. Isolated patches of exposure and coal mines around the area indicate that they overlie the older formations such as Archeans and Gondwana. These formations are highly productive aquifers and sustain long duration pumping with very less drawdown and fast recuperation. Ground water occurs in water table and semi-confined conditions in the alluvial formation.

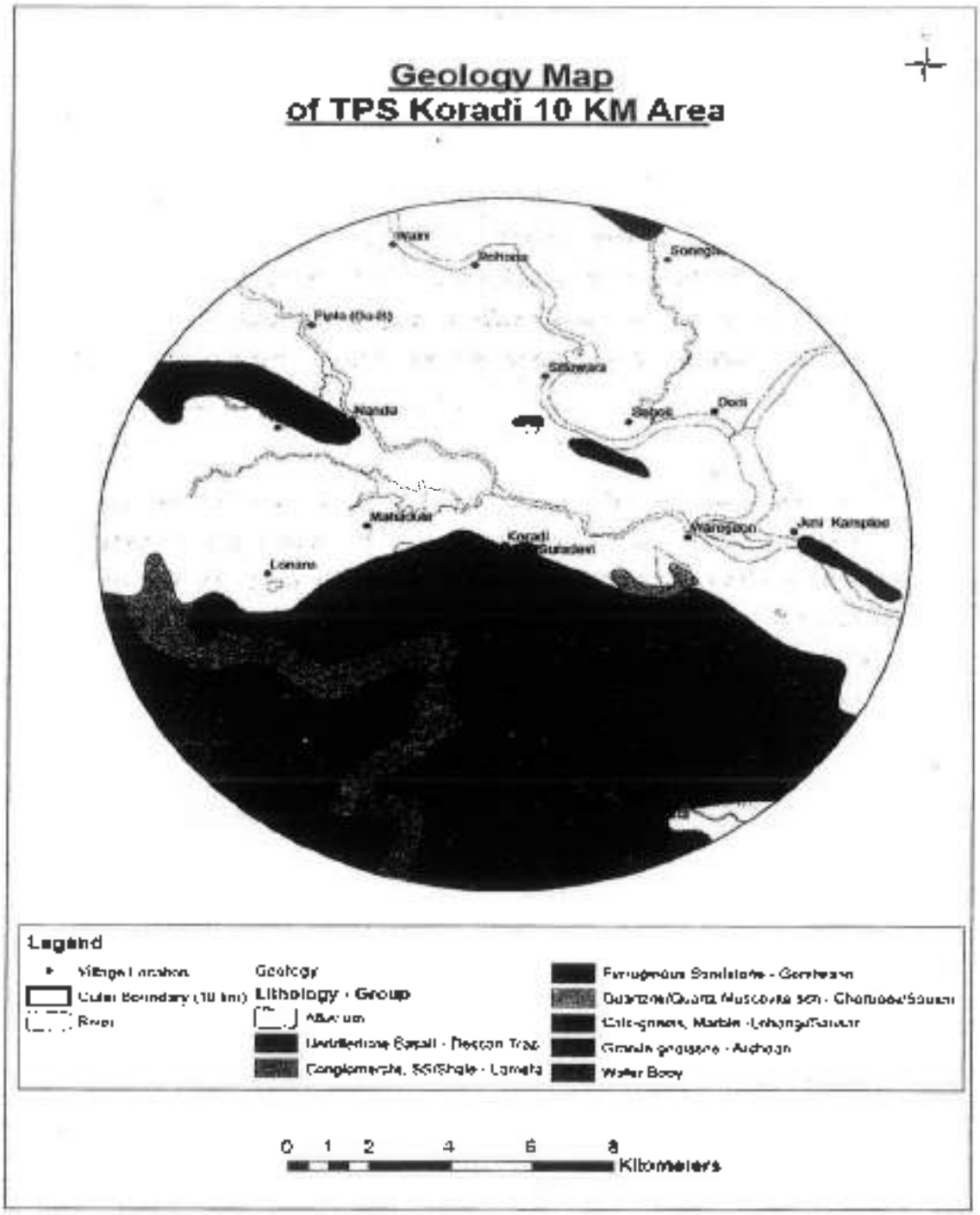


Fig. 2.1: Geology Map of TPS Koradi

2.1 CLIMATE AND RAINFALL

2.1.1 Temperature

The climate of the area (Sourced from Nagpur district website) is tropical in nature and is characterized by a hot summer and general dryness throughout the year except during the south-west monsoon season. The daily mean temperature starts rising from month of February and May is the peak summer and the maximum temperature during these months often rises above 45°C. The temperature recedes after May due to onset of monsoon, which lasts from June to September. It shows significant drop in temperature from month of October. Normally, December and January are the coolest months, when average temperature falls to 12°C.

2.1.2 Rainfall

Rainfall forms important parameter of climatological feature. Rainfall pattern is dependent on various factors. The southwest monsoon is the main source of rainfall. The rainfall falling on the area is important as it is the only available source for recharging the groundwater naturally as well as artificially. Almost entire quantum of this rain is brought by the southwest monsoon winds during the summer and about 90% of rainfall occurs during the monsoon months. The monsoon arrives in the month of June. The maximum intensity of rainfall is normally witnessed during the months of July and August.

The maximum rainfall at Nagpur during the last 14 years starting from 2001 to 2014 is 1679 mm (2005) and minimum is 631 mm (2004).

YEAR	RAINFALL
2001	1007 mm
2002	904 mm
2003	1171 mm
2004	631 mm
2005	1679 mm
2006	1114 mm
2007	1031 mm
2008	814 mm
2009	1280 mm

- 2010 1520 mm
- 2011 1366 mm
- 2012 1077 mm
- 2013 1444mm
- 2014 868mm
- **AVERAGE** **1136** mm

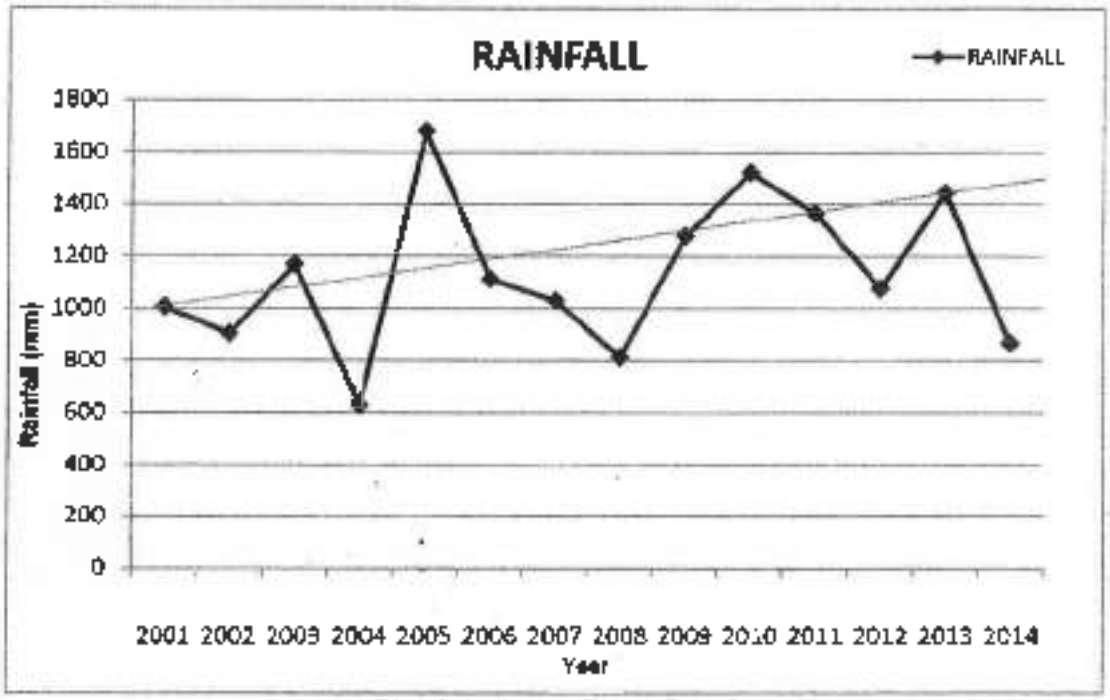


Fig. 2.2 : Long Term Rainfall - Nagpur

Thus average annual rainfall for Nagpur during last 14 years comes out about 1136 mm. Further the variation of annual rainfall with time and the rainfall trend is given below. The rainfall trend is rising for the period of 14 years from 2001 to 2014

The IMD bulletin indicates that the average number of rainy days during monsoon are 43 and most of the rainy days i.e., about 38.7% in June, 59.8% in July, 59.2% in August and 41.7% have moderate rainfall intensity up to 35 mm/day, thus on an average 50% of days are having rainfall intensity up to 35 mm/day and rainy days with rainfall intensity of more than 35 mm are limited to about 6% and no rain days are 44%. Similarly significant rainfall days (RF>2.5 mm/day) are 35. 80% which comes out to be about 31.50 days; say 31 days of total rainy days of 43 days as seen from the table 2 given below.

Table 2.1

Rainy Days, Nagpur

Month	No Rain Days (%)	Very Light Rain (0.1 to 2.4 mm/day) (%)	Light Rain (2.5 to 7.5 mm/day) (%)	Moderate Rain (8 to 35 mm/day) (%)	Heavy Rain days (>35 mm/day) (%)	Significant Rain days (>2.5 mm/ day) (%)
June	57.2	14.1	11.6	13.0	4.1	28.7
July	32.4	23.3	14.7	21.8	7.8	44.3
August	33.3	23.6	14.3	21.4	7.4	43.1
September	54.2	18.3	10.1	13.3	4.0	27.4
Average	44.28	19.8	12.68	17.38	5.83	35.875

Source: IMD Bulletin, Climate of Nagpur

2.1.3 Humidity

The humidity is low during the summer months due to increased evaporation losses from the atmosphere. The diurnal variations in humidity during this period are high.

2.2 General Site Conditions

2.2.1 Soil Type

The type of the soils present in the area are reddish brown in color and silty to clayey loam in nature and vary in depth from 3 to 5 m locally known as Wardi soils. The soil analysis results carried out at 8 locations in and around the project area indicates that sand content in the soil ranges from 19% to 42%, whereas silt contents range from 16% to 35% and the clay contents range from 36% to 48% (Source: Environmental Impact Assessment Report for 3X660 MW Coal Based Thermal Power Project Koradi). The high clay content indicates that the infiltration capacity of the top soils as low to moderate. The high percentage of clay and low infiltration rate imply that the natural recharge of rain water falling over the soils will get hampered and run off generated will be more. Thus soil characteristics play an important role in deciding the type and nature of rain water harvesting structures.

2.2.2 FIELD INVESTIGATION

Soil borings

The boreholes of 150 mm diameter were progressed using shell and auger/rotary drilling as per the strata conditions to the specified depth.Casing was used to keep the borehole stable. The work was in general accordance with IS- 1892-1979.

Standard Penetration Tests (SPT) were conducted in the soil/severely weathered rock formation the boreholes at 1.5 m depth interval by connecting a split spoon sampler to 'A' rods and driving it by 45 cm using a 63.5 kg hammer falling freely from a height of 75 cm. The tests were conducted in accordance with IS. 2131-1981.

The number of blows for each 15 cm of penetration of the split spoon sampler was recorded. The blows required to penetrate the initial 15 cm of the split spoon for seating the sampler is ignored due to the possible presence of loose materials or cutting from the drilling operation. The cumulative number of blows required to penetrate the balance 30 cm of the 45cm sampling interval is termed the SPT value or the 'N' value. The 'N' values are presented on the soil profile for each borehole.

Disturbed samples were collected from the split spoon after conduction standard penetration test. The samples were preserved in transparent polythene test. The samples were collected by attaching 100 mm diameter thin walled 'Shelby' tubes and driving the sampler by light hammering using a 63.5 kg hammer in accordance with IS: 2132-1986. The tubes were sealed with wax at both ends. All samples were transported to our NABL accredited laboratory at Noida for further examination and testing.

Rock Drilling

Rotary drilling through the rock was performed using heavy-duty, skid-mounted joy Voltas 12B diamond coring rotary drill machines. The drill machine has a hydraulic feed and is driven by a bevel gear system rum y a 28 HP Perkins engine. The drill chuck has four jaws to accommodate NW size drill roc.

Drilling and sampling of the rock was performed using a NX size double tube core barrel. A 32-carat diamond impregnated bit was used to drill through rock strata. It was attached to the end of a core barrel, which is connected to the machine by a string of NW drill rods and rotated by the drilling machine.

Water was circulated through the drill rods to the bottom of the hole. The water serves the purpose of lubrication, cooling and protection of the diamond drill bit in addition to flushing the cuttings out of the hole. A reciprocating pump was used to circulate the casing with a diamond shoe bit was used to assist the casing to advance.

The percent recovery and Rock Quality Designation (RQD) was measured for each core run. The percent recovery is defined as the per cent ratio of the cumulative length of core sample recovered to the total length of the core run. The Rock Quality Designation (RQD) is defined as the ratio of the cumulative length of core pieces 10 cm or longer to the total length of the core run, expressed as percentage. The Rock Mass Rating (RMR), an engineering parameter that assists in assessing the rock quality and behaviour is also presented on the individual rock profiles.

Details of samples collected and their respective RQD are presented on the rock profiles at various depths. The net effective drilling time, a qualitative assessment of the nature of the strata, is also included on the borehole logs. The colour of return water and the extant of water los while drilling the borehole recorded on the boring logs may be used go an

assessment of the nature of rock, water-tightness of joints and possible presence of interconnected channels/cavities.

Electrical Resistivity Tests

Electrical resistivity of the soil at the site was determined at the specified location. The earth resistivity test is used for shallow subsurface exploration by means of electrical measures made at the ground surface. Resistivity measurements were made by driving four electrodes about 10 to 15 cm in to the ground at pre-selected electrode spacing.

The test procedure was conducted in accordance with IS: 3043: 1966 using Wenner's four-electrode method on two orthogonal axes. The four electrodes were spaced at equal distance along a line.

Measurements were made by causing a current (I) to pass through the earth and distribute within a relatively large hemispherical earth mass. The portion of the current that flows along the surface produce a voltage drop (V) measured by the inner electrodes. The apparent resistivity (ρ) was determined from the following equation –

$$V=2\pi a\,(V/I)$$

Where:

ρ	=	apparent resistivity, ohm-m.
a	=	spacing between the electrodes, metres
V	=	voltage drop, Volts
I	=	current, Amp.
V/I	=	R, resistance, ohms.

2.2.3 Site levels

The ground levels provided at various test locations are with respect to the Mean Sea Level (MSL) at Koradi.

The final grade level (FGL) in the Chimney area is planned to be at MSL (+) 310.0 m The existing ground levels (EGL) at the borehole locations in the Chimney area range from MSL (+) 310.280 m to MSL (+) 310.610 m, indicating that minor cutting shall be required to achieve the final grade level (FGL) in this area.

2.2.4 Site Stratigraphy

The stratigraphy encountered in the Chimney Area is described below:

Stratum-1: Silty Clay/ Silty Sand with Zones of Disintegrated Rock:-The surficial soils in the chimney area consist of silty sand/ silty clay of high plasticity from the ground surface to about 1.5m ~ 3.0 m depth [MSL (+) 309.0 m ~ 307.3m]

Below this, clayey silt stratum containing discontinuous zones of severely weathered, disintegrated rock are encountered at most borehole locations till the top of the underlying rock formation.Field SPT values in this stratum range from 22 to 57 (with some higher values) until refusal (N >100) is encountered on the top of the underlying rock formation.

There is significant variation in the SPT values encountered within the overburden stratum across the site, largely due to the presence of discontinuous zones of disintegrated, severely weathered rock fragments/formation at various locations and depths.The thickness of the overburden stratum (and, consequently, the depth of the underlying rock formation) varies significantly across the chimney area.

Stratum-1: Severely Weathered, Disintegrated rock

Severely weathered , weak and disintegrated Biotite schist rock formation is encountered at most locations in the chimney area at about 3.0 to 6.0 m depth below EGL [MSL (+) 307.5~ 304.4 m]. However, the depth of continuous disintegrated rock formation at BH-35 location is significantly deeper, where it is encountered at about 10.0m depth [~ MSL (+) 300.5m].

As per the data from nine (9) boreholes completed in the chimney area, the rock formation in the chimney area seems to be slopping down towards the North-Northeast (with respect to the construction North)

The core recoveries and RQD values in the rock formation are generally nil to about 22 ~ 27 m depth [MSL (+) 288.5 ~ 283 m]. Below this, core recoveries range from 21 to 50 per cent with nil RQD values to the maximum explored depth of 30 m [~ MSL (+) 280 m].

The following table summarizes the detailed stratigraphy at the various borehole locations:

BH No./ Structure	Depth (RL),m		Site Stratigraphy	Field N-values	Rock core Recovery, %	RQD, %	RMR value
	From	To					
BH-33	0.0 [MSL (+)310.3 m]	3.0 [MSL (+) 307.3 m]	Medium dense grey silty sand	15	-	-	-
	3.0 [MSL (+) 307.3 m]	25.0 [MSL (+) 285.3 m]	Very weak grey BIOTITE SCHIST, severely weathered, disintegrated	>100	0	0	15
BH-34	0.0 [MSL (+)310.4 m]	1.5 [MSL (+) 308.9m]	Dense grey silty sand	33	-	-	-
	1.5 [MSL (+) 308.9 m]	6.0[MSL (+) 304.4 m]	Very dense grey silty medium to coarse and intermixed with BIOTITE SCHIST	53-57			
	6.0[MSL (+) 304.4 m]	8.0[MSL (+) 302.4 m]	Moderately weak grey BIOTITE SCHIST, severely weathered	>100	27-53	7-35	20
	8.0[MSL (+) 302.4 m]	22.5[MSL (+) 287.9 m]	Moderately weak grey BIOTITE SCHIST, severely weathered disintegrated	>100	0	0	15

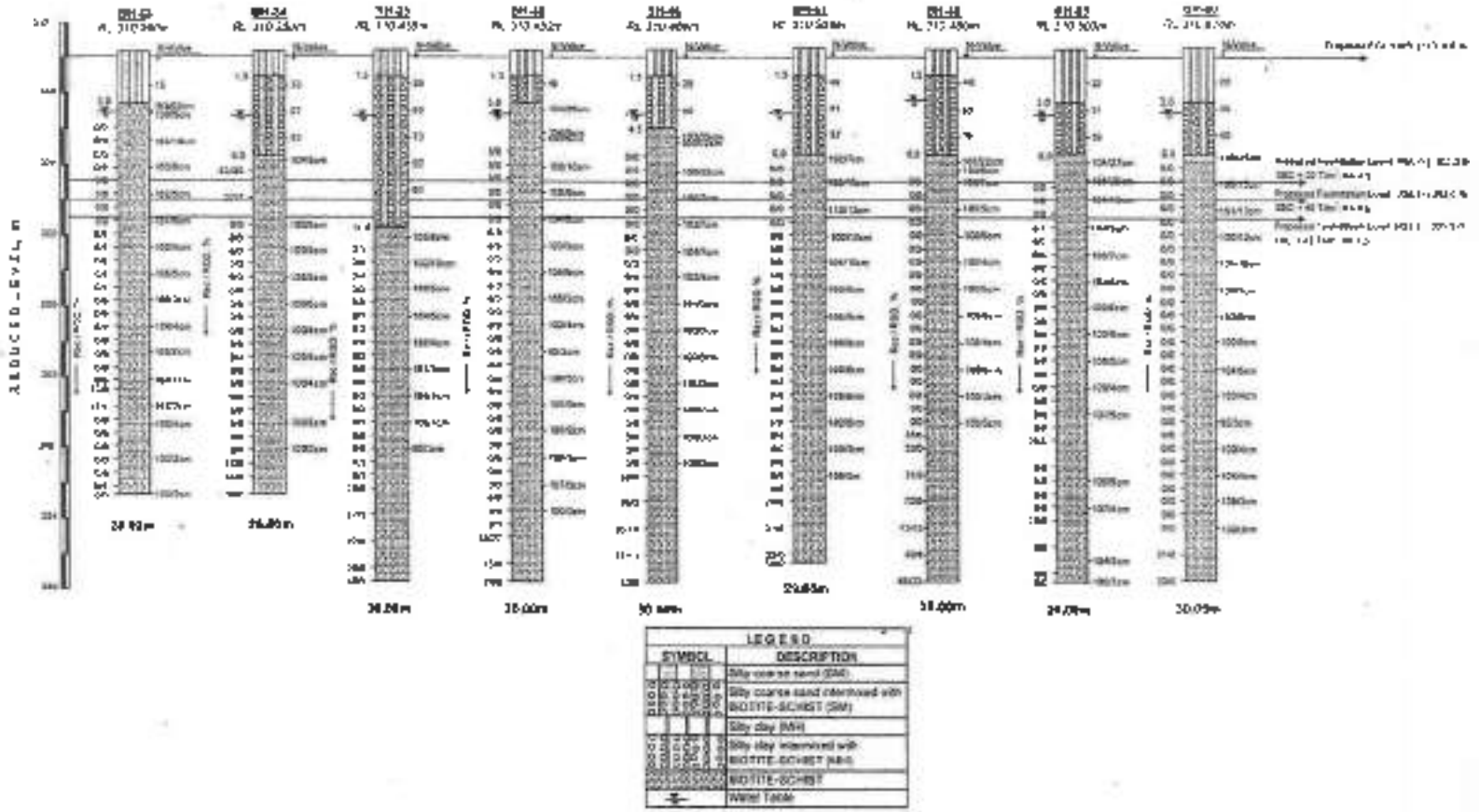
	22.5[MSL (+) 287.9 m]	25.0[MSL (+) 285.4 m]	Weak grey BIOTITE SCHIST, severely weathered, disintegrated	>100	26-38		
BH-36	0.0 [MSL (+)310.3 m]	1.5 [MSL (+) 309.0 m]	Medium dense grey silty sand	26			
	1.5 [MSL (+) 309.0]	10.0 [MSL (+) 300.5 m]	Very dense silty medium to course sand intermixed with BIOTITE SCHIST	50-92	-	-	-
	10.0 [MSL (+) 300.5 m]	24.0 [MSL (+) 286.5 m]	Very weak grey BIOTITE SCHIST, severely weathered, disintegrated	>100	0	0	15
	24.0 [MSL (+) 286.5 m]	30.0 [MSL (+) 280.5 m]	Weak grey BIOTITE SCHIST, severely weathered, disintegrated	>100	25-49	0	18
BH-36	0.0 [MSL (+)310.4 m]	1.5 [MSL (+) 309.0 m]	Hard grey silty clay with gravel, high plastic	-	-	-	-
	1.5 [MSL (+) 308.9 m]	3.0[MSL (+) 307.5 m]	Hard grey silty clay with gravel, high plastic intermixed with BIOTITE	46	-	-	-

			SCHIST				
	3.0[MSL (+) 307.5 m]	26.8[MSL (+) 283.7 m]	Very weak grey BIOTITE SCHIST, severely weathered, disintegrated	>100	0	0	15
	26.8[MSL (+) 283.7 m]	30.0[MSL (+) 275.5 m]	Very weak grey BIOTITE SCHIST, severely weathered, disintegrated	>100	15-35	0-27	20
BH-46	0.0 [MSL (+)310.4 m]	1.5 [MSL (+) 309.0 m]	Very stiff brown silty clay, high plastic	29	-	-	-
	1.5 [MSL (+) 309.0 m]	4.5 [MSL (+) 306.0 m]	Very dense silty medium sand intermixed with BIOTITE SCHIST	90	-	-	-
	4.5 [MSL (+) 306.0 m]	25.5 [MSL (+) 306.0 m]	Very weak grey BIOTITE SCHIST, severely weathered, disintegrated	>100	0-26	0	15
	25.5 [MSL (+) 306.0 m]	30.0 [MSL (+) 275.4 m]	Moderately strong Grey BIOTITE SCHIST, highly weathered	>100	35-40	0-13	
BH-57	0.0 [MSL (+)310.3 m]	1.5 [MSL (+) 309.0 m]	Hard grey silty clay with gravel, high plastic	-	-	-	-

	1.5 [MSL (+) 309.0 m]	6.0[MSL (+) 304.5 m]	Hard grey silty clay, high plastic intermixed with BIOTITE SCHIST,	41-57	-	-	-
	6.0[MSL (+) 304.5 m]	24.8[MSL (+) 285.7 m]	Very weak grey BIOTITE SCHIST, severely weathered, disintegrated	>100	0	0	15
	24.8[MSL (+) 285.7 m]	29.0[MSL (+) 281.5 m]	Weak grey BIOTITE SCHIST, severely weathered, disintegrated	>100	21-50	0	20
BH-58	0.0 [MSL (+)310.5 m]	1.50 [MSL (+) 309.0]	Hard grey silty clay with gravel, high plastic	-	-	-	-
	1.50 [MSL (+) 309.0]	6.0[MSL (+) 304.5 m]	Hard grey silty clay, high plastic intermixed with BIOTITE SCHIST,	40-70	-	-	-
	6.0[MSL (+) 304.5 m]	21.5[MSL (+) 289.0 m]	Very weak grey BIOTITE SCHIST, severely weathered, disintegrated	>100	0	0	15
	21.5[MSL (+) 289.0 m]	24.0[MSL (+) 286.5 m]	Weak grey BIOTITE SCHIST, severely weathered, disintegrated	>100	31-35	0	20

	24.0[MSL (-) 266.5 m]	30.0[MSL (+) 280.5 m]	Moderately weak grey BIOTITE SCHIST, severely weathered. disintegrated	>100	62-73	0-33	35
BH-59	0.0 [MSL (+)310.5 m]	3.0 [MSL (+)307.5 m]	Very stiff grey silty clay with traces of gravel, high plastic	22	-	-	-
	3.0 [MSL (+)307.5 m]	6.0[MSL (+) 304.5 m]	Hard grey silty clay. high plastic intermixed with BIOTITE SCHIST	31-36	-	-	-
	6.0[MSL (+) 304.5 m]	30.0[MSL (+) 280.5 m]	Very weak grey BIOTITE SCHIST, severely weathered, disintegrated	>100	0	0	15
BH-60	0.0 [MSL (+)310.6 m]	3.0 [MSL (+)307.5 m]	Very stiff grey silty clay, high plastic	26	-	-	-
	3.0 [MSL (+)307.5 m]	6.0[MSL (+) 304.5 m]	Hard grey silty clay, high plastic intermixed with BIOTITE SCHIST	35-40			
	6.0[MSL (+) 304.5 m]	28.5[MSL (+) 282.1 m]	Very weak grey BIOTITE SCHIST. severely weathered.	>100	0	0	15

			disintegrated				
	28.5[MSL (+) 282.1 m]	30.0[MSL (+) 274.6 m]	Weak grey BIOTITE SCHIST, severely weathered, disintegrated	>100	21-23	0	20



SUMMARY OF BOREHOLE PROFILE

Location : Chanrai
Koradi TPS, Expansion Project (1x660 MW Unit : 9,9 & 10, Koradi, Maharashtra

Fig: 2.3 Borehole Profile of TPS Koradi

2.3 GROUND WATER AVAILABILITY

2.3.1 Water Level Scenario

The project area occurs in North-eastern part of the Nagpur district. To know the precise hydrogeological conditions existing in the project area and its surroundings, hydrogeological survey was carried out and about 29 wells have been studied which also included some of the bore wells/ Dug Wells / hand pumps.

2.3.2 Depth to Water Level – summer

The depth to water levels during summer ranges between 0.60 m bgl (Koradi) and 18.70 m bgl (Walni). Spatial variation in summer depth to water levels is shown in **Table 2.2** and **Figure 2.5**. In the entire area the water levels are within 0.90 to 18 m bgl. Water levels of 10 - 18 m bgl are the most dominant range occupying alluvial parts of area. Water levels of less than 2 m bgl are observed in metamorphic terrain occurs at Koradi and Panjra TPS site.

It is observed that in unconfined aquifer system (Dug wells) of metamorphic area of TPS, despite variation in rainfall, summer water levels are shallow. It may indicate either less withdrawal or wells are influence by local water bodies. **(Figure 2.4)**

2.3.3 Aquifer Parameters

As per CGWB, Nagpur district report, the aquifer parameters are available from pumping tests conducted at 9 exploration sites. The transmissivity of Deccan Traps varies between 0.67 (Kanyadoh) and 248 m2/day (Narkhed) while the storage coefficient varies from 5.51x10-5 to 2.95x10-3. In Archean gneisses transmissivity varies from 49.18 (Ramzanghoti) to 279.13 m2/day (Bothia Palora) and storage coefficient varies from 4.12x10-4 to 6.9x10-4. In Gondwana transmissivity varies from 9.32 (Pipla Dakbangla) to 250 m2/day (Silewara) and storage coefficient varies from 5.8x10-4 to 9.8x10-3. (Source: Nagpur District Brochure, CGWB web site)

Table 2.2

Details of Dugwells around site Premises

Sr. No.	Village	Latitude	Longitude	Water Level (m bgl)
1	Pipla	21° 18'10.975N	79°4'9.200'E	11.00
2	Plant Site	21° 14'20.045'N	79°5'51.013'E	1.90
3	Bokhara	21° 13'40.132'N	79° 4'15.782'E	3.50
4	Dorli	21°16' 46.839'N	79° 9'52.937'E	10.70
5	Kawatha	21° 13'26.383'N	79° 8'24.315'E	2.00
6	Soholi	21° 16'38.194'N	79° 8'40.016"E	13.40
7	Lonkhairi	21° 16'35.405'N	79° 3'40.503'E	2.80
8	Waregaon	21° 14'49.972'N	79° 9'28.918'E	1.90
9	Suredevi	21° 14'40.962'N	79° 7'19.045'E	1.70
10	Juni Kamptee	21° 14'53.840'N	79° 10'59.758'E	4.00
11	Nanda	21° 16'42.616'N	79° 4'43.083'E	7.00
12	Lonare	21° 14'18.835'N	79° 3'30.225'E	2.80
13	Rohana	21° 19'5.214'N	79° 6'29.557'E	16.00
14	Khairi	21° 12'56.659'N	79° 9'18.215'E	4.90
15	Khasala	21° 13'13.345'N	79° 7'2.721'E	1.60
16	Mhasala	21° 12'49.811'N	79° 8'9.496'E	1.70
17	Ranala	21° 12'23.596'N	79° 10'38.861'E	7.80
18	Sonegaon	21° 19'8.981'N	79° 9'14.036'E	9.00

Sr. No.	Village	Latitude	Longitude	Water Level (m bgl)
19	Walni	21° 19'25.503"N	79° 5'19.314"E	18.70
20	Sillewara	21° 17'21.415"N	79° 7'29.153"E	11.60
21	Koradi	21° 14'44.060"N	79° 6'52.734"E	0.80
22	Mahadula	21° 15'3.349"N	79° 4'55.092"E	3.40
23	Borgaon	21° 10'51.781"N	79° 3'14.325"E	3.10
24	Sadar	21° 12'18.934"N	79° 4'42.431"E	8.80
25	Nara	21° 12'2.360"N	79° 5'30.662"E	4.80
26	Nagesh Nagar	21° 11'2.391"N	79° 5'41.931"E	9.80
27	Jhingabai Takli	21° 11'26.529"N	79° 4'30.716"E	3.95
28	Shantinagar	21° 9'36.124"N	79° 7'30.515"E	7.80
29	Kalamna	21° 10'22.918"N	79° 8'36.458"E	9.20

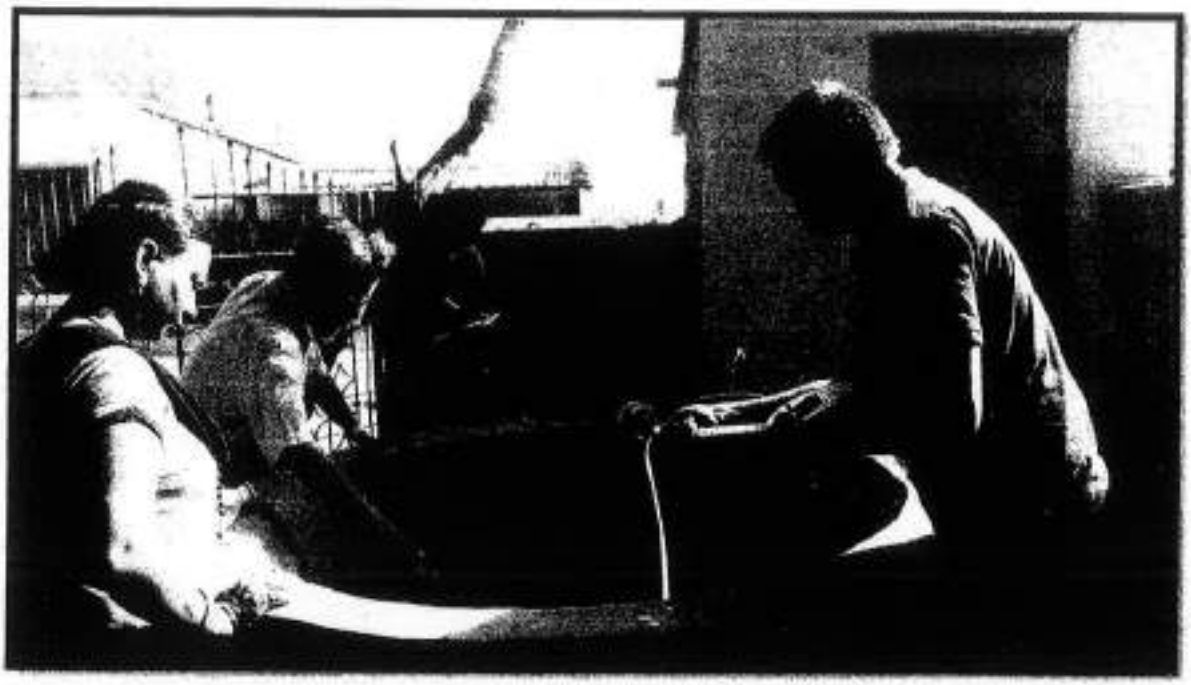


Fig. 2.4: Measurement of Ground Water Level

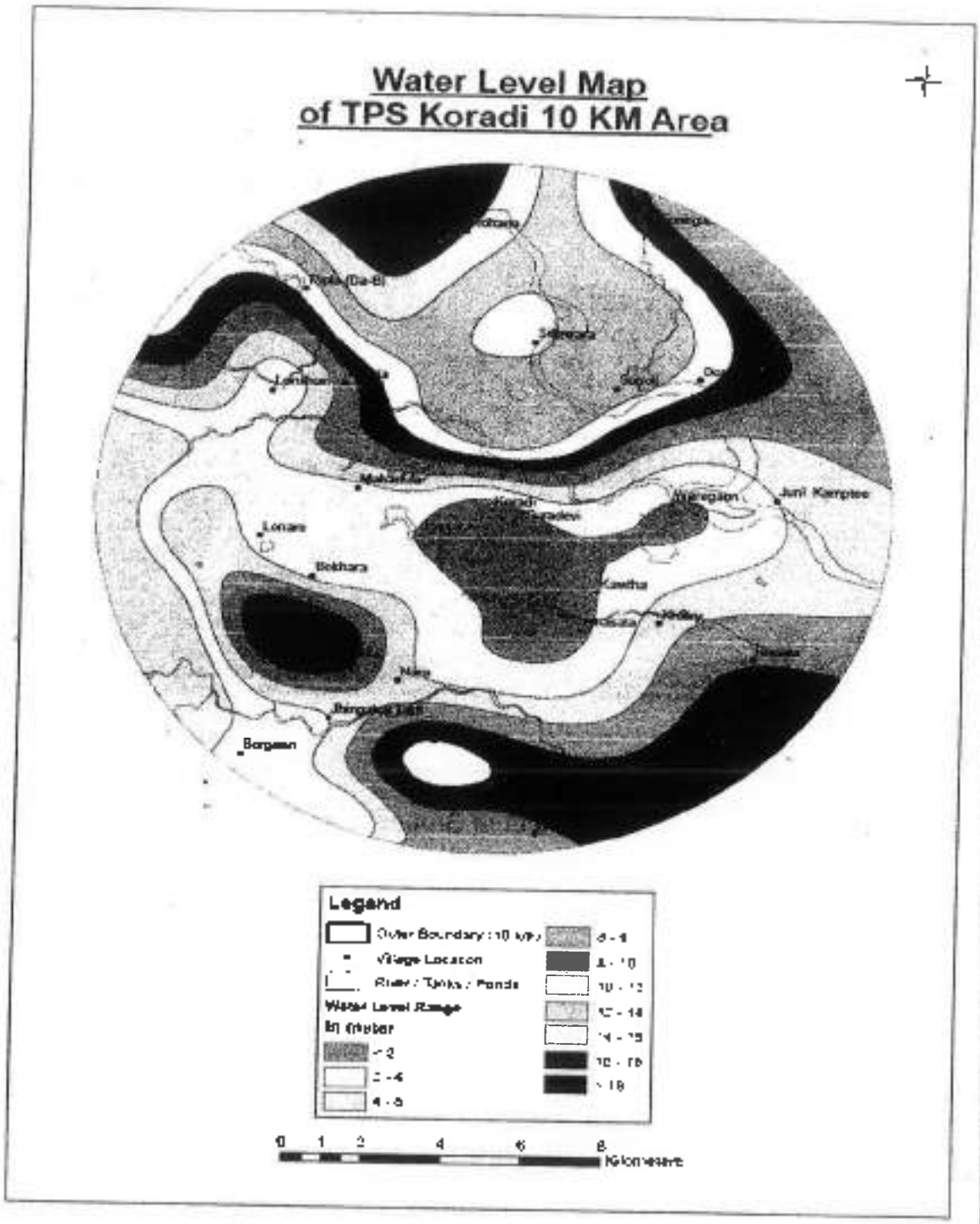


Fig. 2.5: Ground Water Table of Study Area

2.4 INFILTRATION TEST

Fig. 2.6: Preparation for Infiltration Test

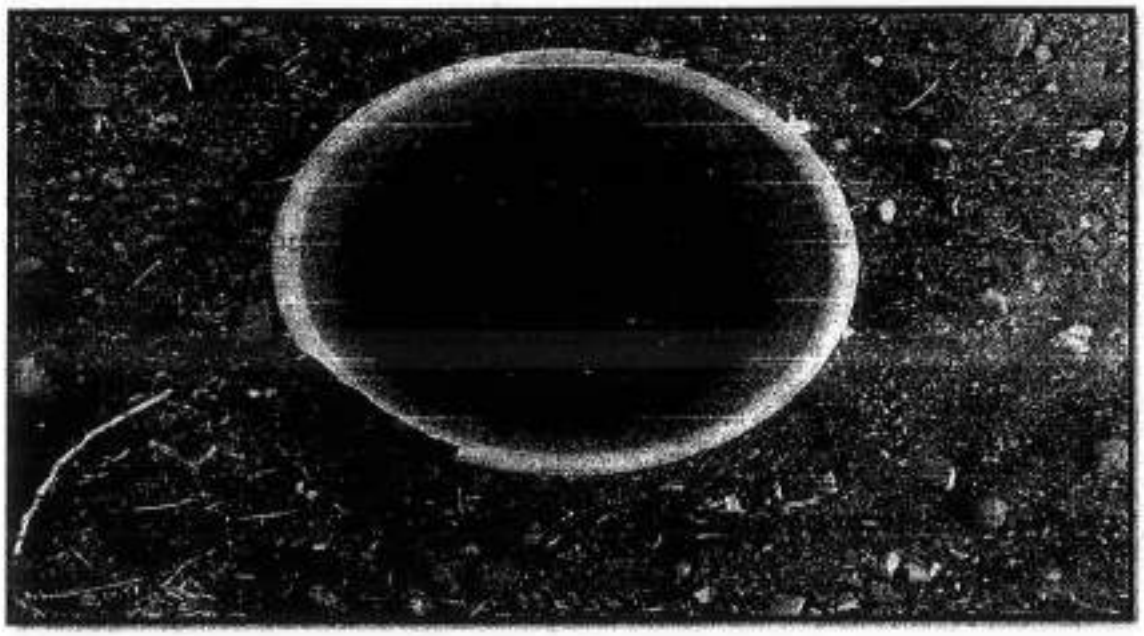


Fig. 2.7 : Infiltration Test

Infiltration as the downward entry of water into soil, and infiltration rate (infiltration capacity) the maximum rate at which a soil will absorb water impounded on the surface at a shallow dep when adequate precautions are taken regarding border, or fringe, effects. The volume of wat passing into the soil per unit of area per unit of time.

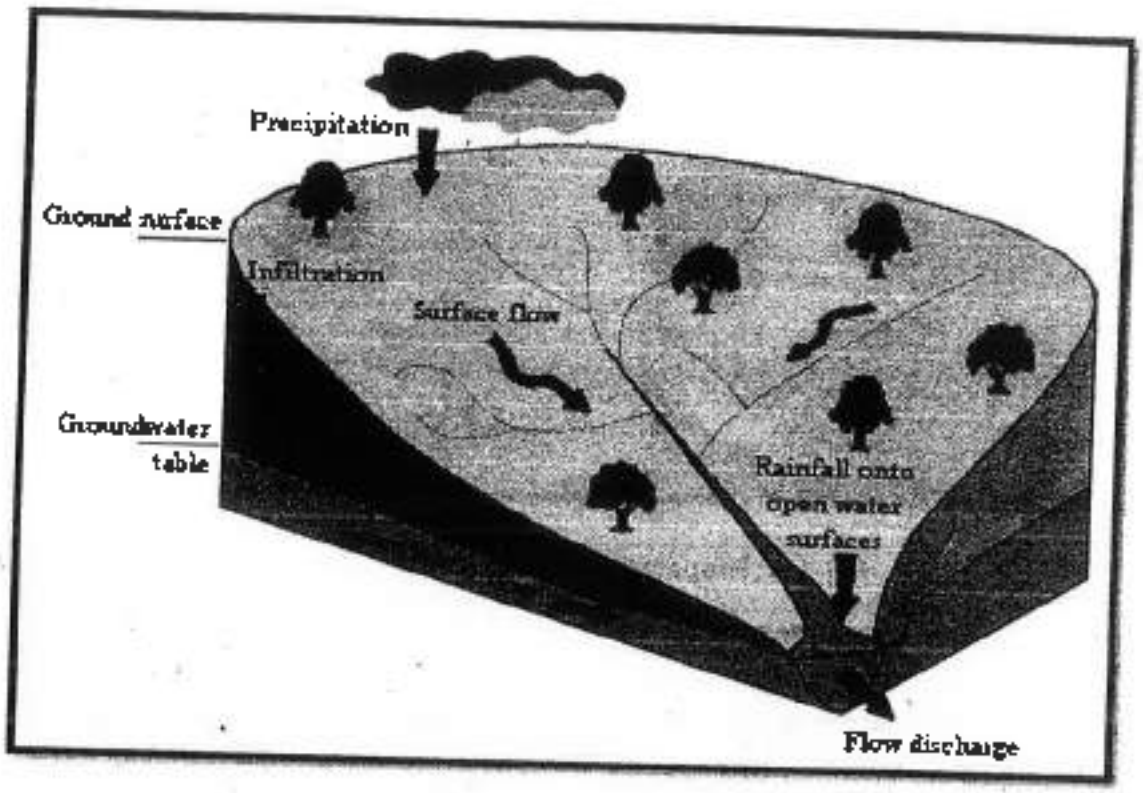


Fig. 2.8:The infiltration process depending on soil type and flow

Factors which influence infiltration

The main factors that influence the infiltration are:

- The soil type (texture, structure, hydrodynamic characteristics). The soil characteristics influence capillary forces and adsorption.
- The soil coverage. Vegetation has positive influence on infiltration by increasing the time of water penetration in soil;
- The topography and morphology of slopes;

- The flow supply (rain intensity, irrigation flow);
- The initial condition of soil humidity. Soil humidity is an important factor of infiltration regime. The infiltration regime evolves differently in time for dry or wet soils;
- Soil compaction due to rain drop impact and other effects. The use of hard agricultural equipment can have consequences on the surface layer of soil.The infiltration test is shown in below Table 2.6.

Table:2.3

Infiltration Test

Sr No.	Name of Village	Height (cm)	Inseration of cylinder in soil (cm)	Infiltration Time (min.)	InfiltrationRate (h/infiltration time; cm/min)
1	Mahadula	24	6.0	3.42	3.42
2	Plant Site	24	6.0	21.15	1.13
3	Bokhara	24	7.0	10.19	2.35
4	Mhasala	24	6.0	10.47	2.29
5	Kawatha	24	7.0	81.33	0.29
6	Khairy	24	7.0	13 70	1.75
7	Lonkhairy	24	6.0	10.62	2.26
8	Waregaon	24	7.0	12 70	1.88
9	Suradevi	24	6.0	10.37	2.31
10	Koradi	24	6.0	0.81	0 81
11	Nanda	24	7.0	0.75	0.75
12	Khasala	24	7.0	5.00	4.8
13	Rohana	24	7.0	12.36	6.5

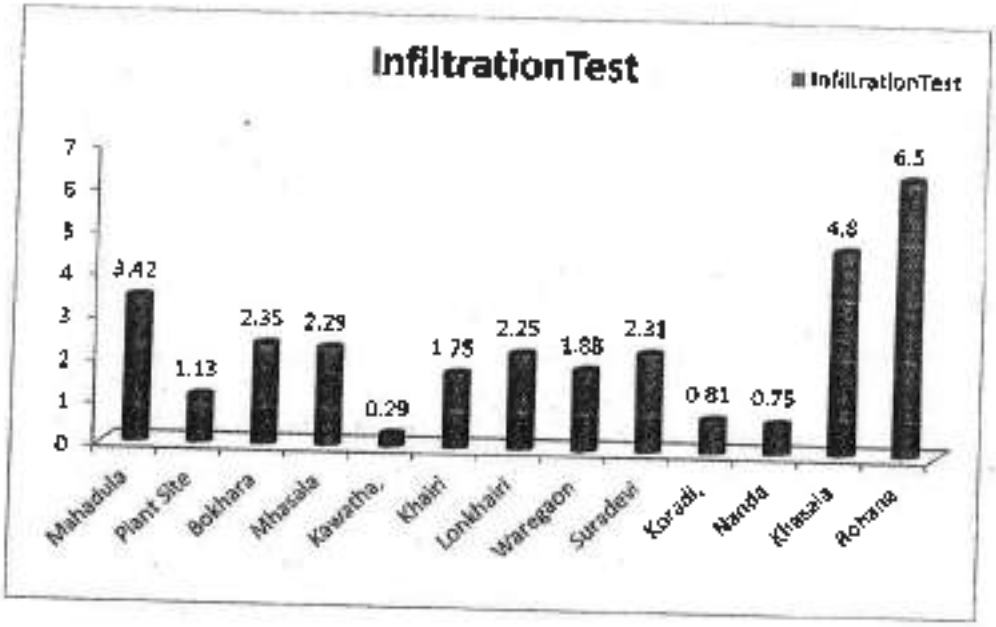


Fig. 2.9 : Infiltration Test

The infiltration tests concludes that the rate was low and hence the rainwater runoff is more in the study area.. Village Rohana reports highest value where as kawatha lowest.

Chapter III
Ground Water Quality

3.0 Introduction

Water is dynamic system. During sampling the water is removed from its natural environment. Due to this change the chemical composition of water may not remain same but may tend to adjust itself according to its new environment. Constituents of the water sample may interact with the surface wall of the container and consequently their concentration may be altered. This is particularly true for metals.

The raw water quality assessment is to maintain and restore the desirable level of environment quality in general (wholesomeness) and then the requirements of the 'best designated uses'. With this approach, protection of best designated use is not abandoned, but the overall health of ecosystem is given its rightful place. In case of major organized uses of water, three important uses are common in India, that is:-

1) Domestic
2) Irrigation
3) Industrial

The Primary Water Quality Criteria, developed by CPCB was based on 'designated best use' concept, which is there is one use that demands highest level of water quality. The water quality monitoring results were assessed with respect to indicator of oxygen consuming substances (Bio-chemical oxygen demand). Over the period it has become necessary to review the criteria for enlarging the base of parameters for optimum interpretation of water quality getting deteriorated due to municipal and industrial discharge

The objective of the sampling is to collect a portion of material small enough in volume to be conveniently transported to and handled in the laboratory while still accurately representing the material being sampled

3.1 Objectives of Determining Water Quality

- To study the existing surface water and groundwater resources within the impact zone of the action with respect to Water Quality Criteria developed by CPCB
- To predict the quantitative impacts on the water resources due to the proposed water use / abstraction of ground water on account of the action
- To predict the changes in the water quality due to the effluent discharge into water bodies from proposed actions by following water quality prediction models criteria

- To evaluate the adequacy of the proposed water conservation measures, like recycling and reuse, to meet the various water quality criteria
- To recommend the water pollution mitigation measures at source, pathway and receptors.

3.2 Planning for Site Selection

The monitoring of water quality to give reliable and usable data requires that analytical and other resources are used to the best advantage. The first step in the planning of water monitoring is to decide what data is needed and how it is useful. The type of investigation, purpose of study and anticipated variations are other points to be considered.

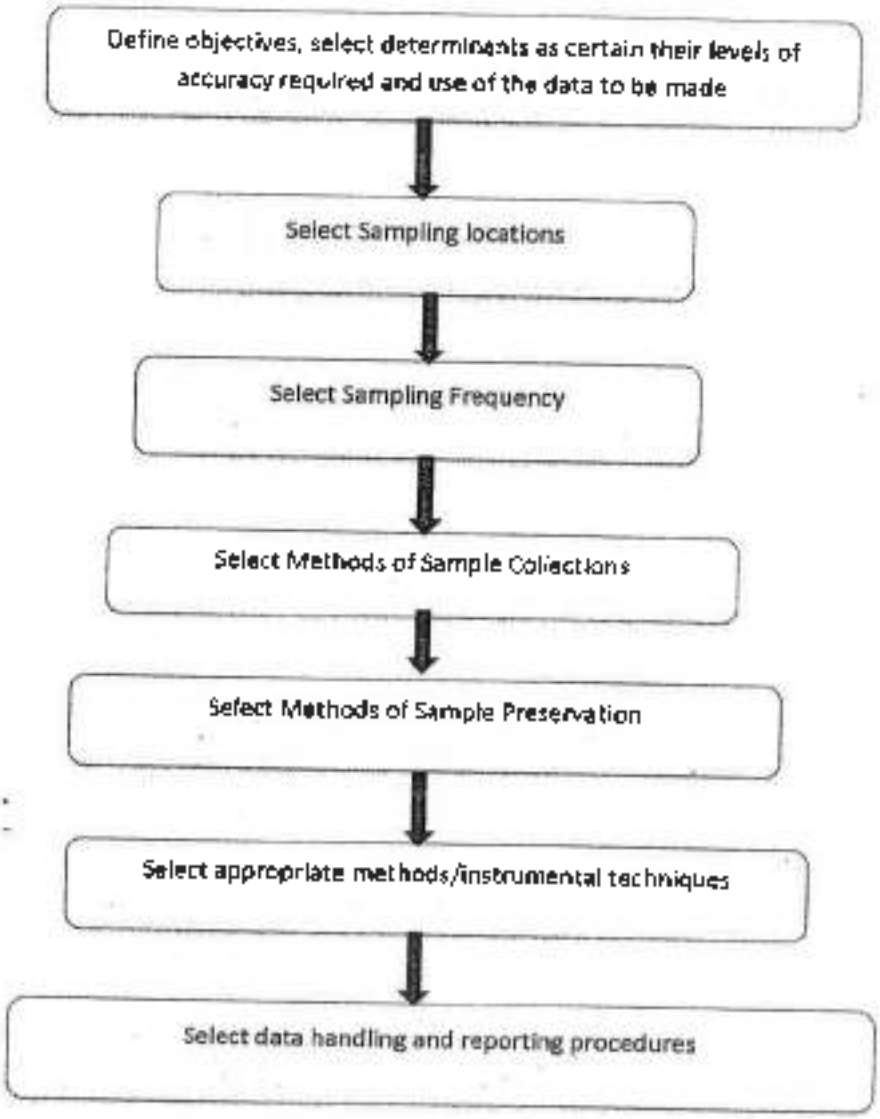


Fig. 3.1: Sequential Steps In Designing Sampling Programme

Fig. 3.2: Water Sampling at Site

3.3 Sample Preservation, Handling and Transport

By the time that a sample is collected in the field and transported for analysis in the laboratory, some physical change and chemical / biochemical reactions, may take place in the sample container which will change the intrinsic quality of the sample. It is therefore, necessary to preserve the sample before shipping to prevent or minimize these changes. This done by various procedures such as keeping the samples in the dark, adding chemical preservatives lowering the temperature to retard reactions by freezing or by a combination of these methods. **(Figure 3.2)**

3.4 METHODOLOGY FOR WATER ANALYSIS

1) pH – The pH is determined by measurement of the electromotive force of a cell comprising an indicator electrode (an electrode responsive to hydrogen ions such as glass electrode) immersed in the test solution and a reference electrode (usually a mercury calomel electrode). Contact is achieved by means of a liquid junction, which forms a

part of the reference electrode. The emf of this cell is measured with pH meter. This is a high impedance electrometer calibrated in terms of pH.

2) Conductivity –Conductivity is the capacity of water to carry an electrical current and varies both number and a type of ions in the solution, which is turn, is related to the concentration of ionized substances in the water Conductivity measurement by conductivity cell consisting of a pair of rigidly mounted electrodes. Each conductivity cell has its own cell constant depending on its shape, size and the position of the electrodes. Using standard solution of KCL (0.01 M) .The result may be expressed as milli Siemens/meter or micro Siemens/cm.

3) Total Suspended Solids (TSS) - All solids are measured gravimetrically. Filter a suitable volume of a sample through a glass fiber (GF) filter paper dried at 105^{0}and. Cool in a desiccator weighed then calculate TSS.

4) Total Dissolved Solids (TDS) - All solids are measured gravimetrically. Residue left after the evaporation and subsequent drying in oven at specific temperature 103-105^{0}C or 180^{0}C of a known volume of sample are total solids. Total solids includes are total suspended solids and total dissolved solids. Take a known volume of sample in a china dish ignited to constant weight. Evaporate the sample to dryness at 103-105^{0}C for 24 hrs. Cool in a desiccator, weigh and record the reading then calculate TDS.

5) Chemical oxygen demand (COD) - Test determines the oxygen equivalent of organic matter is susceptible to oxidation with the help of strong chemical oxidant .COD estimation by open reflux method. The organic matter gets oxidized completely by potassium dichromate and silver sulphate catalyst in the presence of concentrated sulphuric acid to produce carbon dioxide and water. The excess potassium dichromate remaining after the reaction is titrated with ferrous ammonium sulphate. The dichromate consumed gives the oxygen required for oxidation of the organic matter.

6) Biochemical Oxygen Demand (BOD) –It is the quantity of oxygen utilized by a mixed population of micro-organism in the aerobic oxidation of decomposable organic matter in a sample of water under controlled conditions of temperature and incubation period. The BOD test is widely used to determine the pollution load of water, the degree of pollution in water body at any time and their utilized during a specified incubation period for the biochemical degradation of organic material and oxygen used to oxidize inorganic material such as sulfides' and ferrous ions by computing a difference between initial and

final and DO. Generally temperature is controlled at 20°C and the test is conducted for 5 days, as 70 to 80 % of the waste is oxidized during the period. The test can also performed at any other temperature at 27°C and 3 day BOD.The incubation period in days and temperature in°C is essential to be mentioned.

7) **Dissolved oxygen (DO)**-Analysis of DO is a key test in water pollution control .It is necessary to know DO level to assess quality of raw water and to keep a check on stream pollution. The determination of DO the method is Winkler or iodometric method with Azide Modification. Oxygen present in sample rapidly oxidizes the dispersed divalent manganous hydroxide to its higher valency which is precipitated as a brown hydrated oxide after the addition of NaOH and KI. Acidification manganese reverts to divalent state and liberates iodine from KI equivalent to the original DO content. The liberated iodine is titrated against $Na_2S_2O_3$ using starch as an indicator.

8) **Dissolved Phosphate**-Presence of phosphate in water analysis is necessary for biological degradation of wastewater. Phosphorus is an essential nutrient for the growth of organisms and help for the primary productivity of a body of water In acidic condition orthophosphate reacts with ammonium molybdate to form molybdophosphoric acid, it is further reduced to molybdenum blue by adding reducing agent such as stannous chloride .The intensity of the blue coloured complex is measured at 690 nm which is directly proportional to the concentration of phosphate present in the sample.

9) **Nitrate**-Nitrate is the most highly oxidized form of nitrogen compounds commonly present in natural waters. Measurement of the ultraviolet absorption at 220 nm enables rapid determination of nitrate. The nitrate estimation with UV Spectrophotometric Method. In this method dissolved organic matter may also absorb at 220 nm and nitrate does not absorb at 275 nm. Take 50ml sample filtered after add 1ml of 1N HCL and mixed thoroughly. Read the absorbance at 220nm and 275nm.

10) **Ammonia**-Ammonia is produced by the microbiological degradation of organic nitrogenous matter. It appears therefore in many ground as well as surface waters. Concentrations of ammonia above a certain level in water polluted either due to sewage or industrial wastes are toxic to fish. Ammonia produces a yellow colored compound when reacted with alkaline (NaOH) Nessler reagent provided the sample is clarified properly Pretreatment with $ZnSO_4$ and NaOH precipitates. Addition of EDTA (before Nessler

reagent) or Rochelle salt solution prevents precipitation of residual Ca and Mg in the presence of alkaline Nessler reagent. Take the absorbance at 410nm.

11) Heavy Metals-Estimation of metals in portal water is very important because some metals are essential where as other may adversely affect water consumers, treatment systems or the biological systems of water bodies. A few metals may be either beneficial or toxic depending on their concentrations. Estimation of heavy metals by Atomic Absorption spectrometry (AAS) In AAS a light beam is directed through the flame into a monochromatic and onto a detector that measure the amount of light absorbed by the atomized element in the flame emission. Take well mixed 50ml samples add 5ml Concentrate HCL heat for 15-30 min. On a sand bath filter through 0.45um membrane filter paper. Volume makeup to 50 ml with distilled water and analysis.

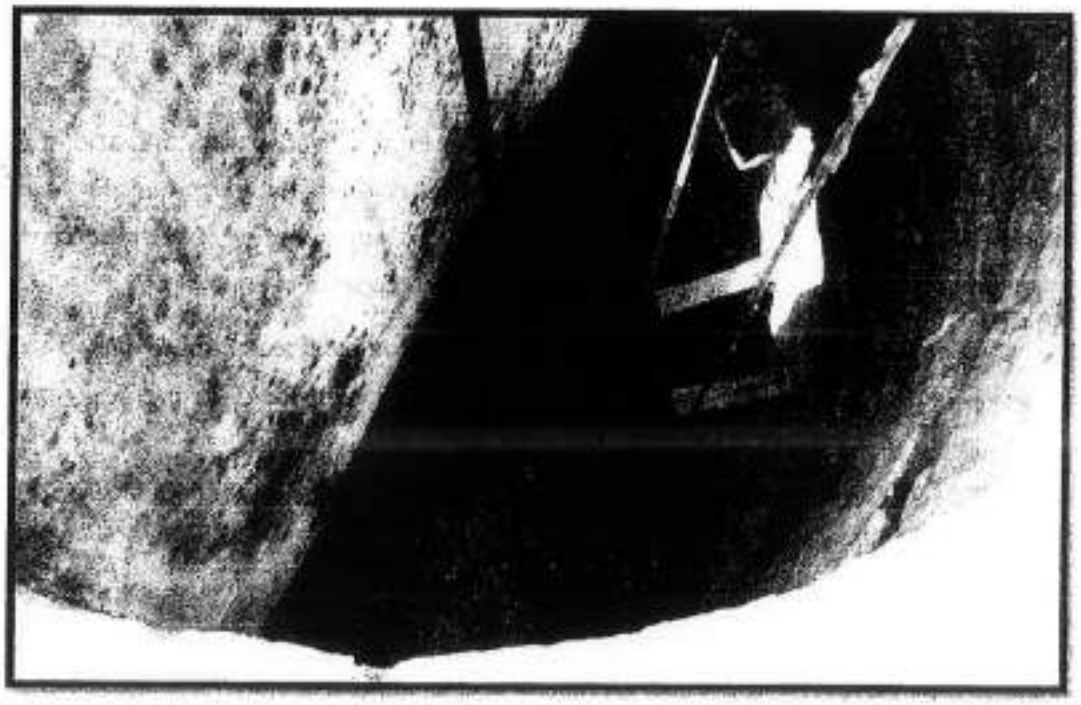


Fig. 3.3: Ground Water Sampling

3.5 Results and Discussions

Table 3.1

Physico-Chemical Parameters of Ground Water Samples

Name of village	pH	TSS mg/lit	TDS mg/lit	Dissolved Oxygen mg/lit	COD mg/lit	BOD mg/lit	Dissolved Phosphate mg/lit	Nitrate as NO_3 mg/lit	Ammonia mg/lit	Chlorides mg/lit	Fluoride mg/lit
Mahadula	7.9	1	389	5.2	5.0	4	0.03	1.23	0.01	78 0	0.4
Plant Site	7.8	4	704	5.6	5.3	2	0.42	1.56	0.02	69.0	0.2
Bokhara	8.1	1	541	5 8	5.0	3	0.40	2.0	0.02	72.0	0.4
Mhasala	7.8	1	582	6 0	5.2	3	0.21	2.21	0.01	70.0	0.3
Kawatha,	8.0	2	562	5.5	5 4	2	0.12	2.21	0.02	69.0	0.6
Khairy	7.9	1	486	6.0	5 6	4	0.01	0.33	0.01	71.0	0.5
Lonkhairi	8.0	2	578	5.2	5.0	3	0.22	0.36	0.01	72 0	0.2
Waregaon	7.9	4	731	3.8	5.0	2	1.2	2.10	0.02	74:0	0.3
Suradevi	8.1	1	601	5.5	5.0	3	1.08	1.95	0.02	76 0	0 3
Koradi	7.9	1	191	5.4	3.8	3	0.45	1 94	0 01	74.0	0.4
Nanda	8.0	1	584	5.8	4.3	2	0 02	1.01	0.01	75.0	0 5
Khasala	8.1	1	545	6.1	4.8	3	0.01	1.33	0.01	72.0	0 6
Rohana	7.9	1	412	5.9	5 4	2	0.01	1.00	0.01	73.0	0.5

Table 3.2

Heavy Metal - Ground Water Sample in mg/lit

Name of village	Arsenic as As*	Cobalt as Co*	Chromium as Cr*	Copper as Cu	Magnesium as Mg	Manganese as Mn	Nickel as Ni	Lead as Pb*	Zinc as Zn	Iron as Fe
Mahadula	0.01	ND	ND	ND	32.00	0.01	0.01	0.05	0.03	0.13
Plant Site	0.02	ND	ND	ND	63.00	0.01	0.02	0.04	0.14	0.28
Bokhara	0.01	ND	ND	ND	45.00	0.01	0.02	0.04	0.07	0.14
Mhasala	0.01	ND	ND	ND	52.00	0.01	0.01	0.06	0.09	0.13
Kawatha,	0.03	ND	ND	ND	44.00	0.02	0.001	0.06	0.41	0.21
Khairy	0.01	ND	ND	ND	29.00	0.02	0.01	0.02	0.10	0.25
Lonkhairi	0.01	ND	ND	ND	79.00	0.01	0.01	0.06	0.21	0.24
Waregaon	0.04	ND	ND	ND	65.00	0.01	0.02	0.01	0.01	0.11
Suradevi	0.03	ND	ND	ND	58.98	0.02	0.02	0.08	0.01	0.13
Koradi	0.01	ND	ND	ND	45.00	0.01	0.01	0.02	0.01	0.21
Nanda	0.01	ND	ND	ND	61.00	0.01	0.01	0.02	0.12	0.11
Khasala	0.02	ND	ND	ND	36.00	0.02	0.01	0.03	0.25	0.13
Rohana	0.02	ND	ND	ND	55.00	0.02	0.01	0.07	0.21	0.20

Table 3.3

Prescribe Limits of Indian Standards for Drinking Water

Sr. No	Parameter	Requirement desirable Limit
1	pH	6.5-8.5
2	TSS mg/lit	NS
3	TDS mg/lit	NS
4	Dissolved Oxygen mg/lit	NS
5	COD mg/lit	NS
6	BOD mg/lit	NS
7	Dissolved Phosphate mg/lit	NS
8	Nitrate as NO_3 mg/lit	45
9	Ammonia mg/lit	0.05
10	Chloride mg/lit	0.6 – 1.2
11	Fluoride mg/lit	250
12	Arsenic as As* mg/lit	0.05
13	Cobalt as Co* mg/lit	0.02
14	Chromium as Cr* mg/lit	0.05
15	Copper as Cu mg/lit	0.05
16	Magnesium as Mg mg/lit	30
17	Manganese as Mn mg/lit	0.1
18	Nickel as Ni mg/lit	0.02
19	Lead as Pb* mg/lit	0.1
20	Zinc as Zn mg/lit	5.0
21	Iron as Fe mg/lit	0.3

***CPCB follows the same Standard IS10500 as the Desirable limits for Drinking Water**

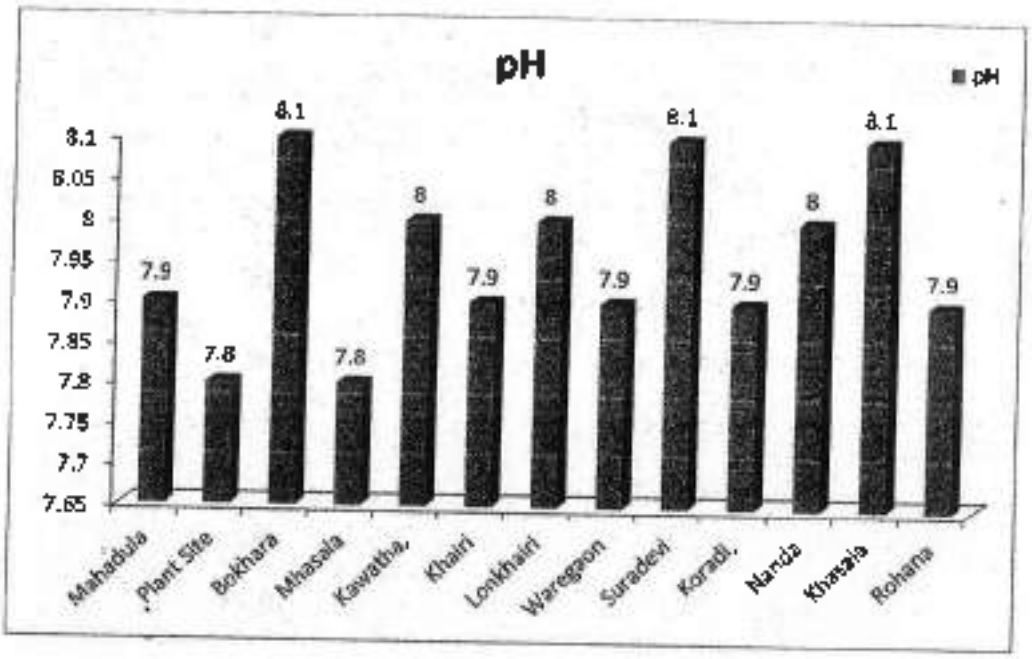


Fig. 3.4: Analytical Results for pH in Water Samples

The pH is monitored at all the 13 locations and the different values of pH at all the locations were obtained. The pH is alkaline at all the locations and within the prescribed limits laid by CPCB. pH ranges between 7.8-8.1 The highest alkaline pH values received are a Bokhara, Suradevi & Khasala i.e. 8 1 while lowest at Mhasala & Plant Site are 7.8. If the pH level of water either get acidic or alkaline beyond the stipulated limits it will affect the mucous membrane of living beings and Material of Construction of water supply system.

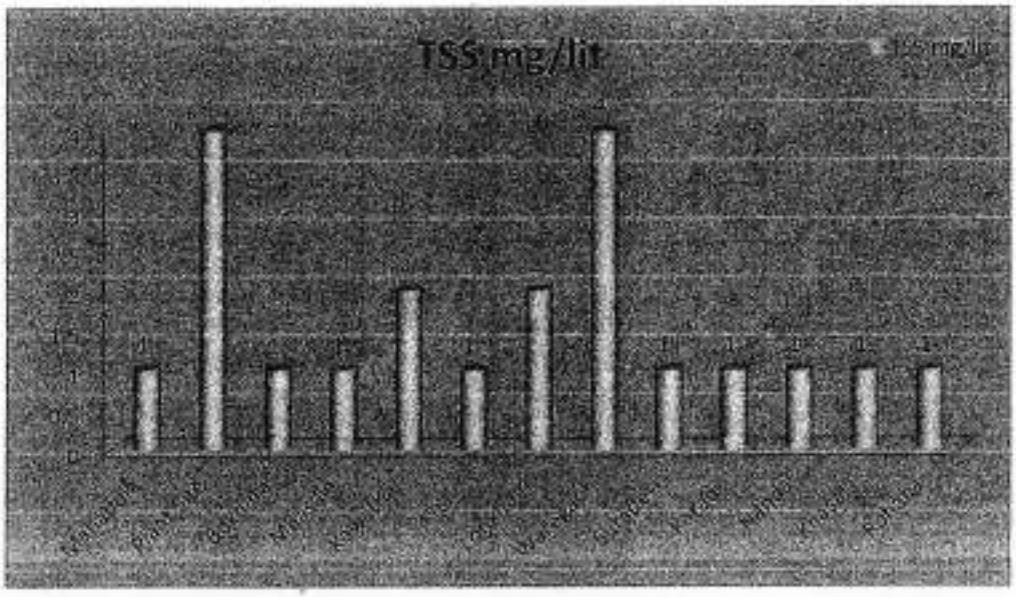


Fig. 3.5: Analytical Results for Total Suspended Solids in Water Samples

The values of Total Suspended Solids (TSS) in all the 13 locations are well within the prescribed limits laid by CPCB. TSS ranges between 1-4 mg/lit .The presence of TSS in almost 09 samples is 1.0mg/lit. While it is highest but well within the limit is at Weregaon & Plant Site i.e. 4.0 mg/lit.

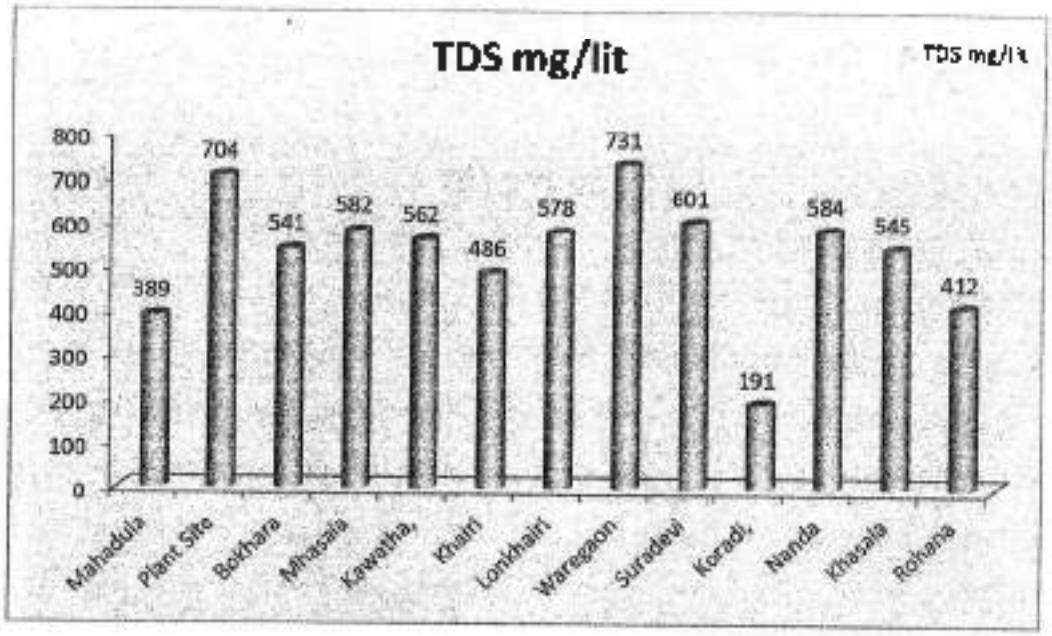


Fig. 3.6: Analytical Results for Total Dissolved Solids in Water Samples

The values of Total Dissolved Solids (TDS) in all the 13 locations are well within the prescribed limits laid by CPCB. TDS ranges between 191- 731 mg/lit. Highest value of TDS at Waregaon i.e. 731 mg/lit due to some dissolved solids are present and lowest value of TDS at Koradi i.e 191 mg/lit.

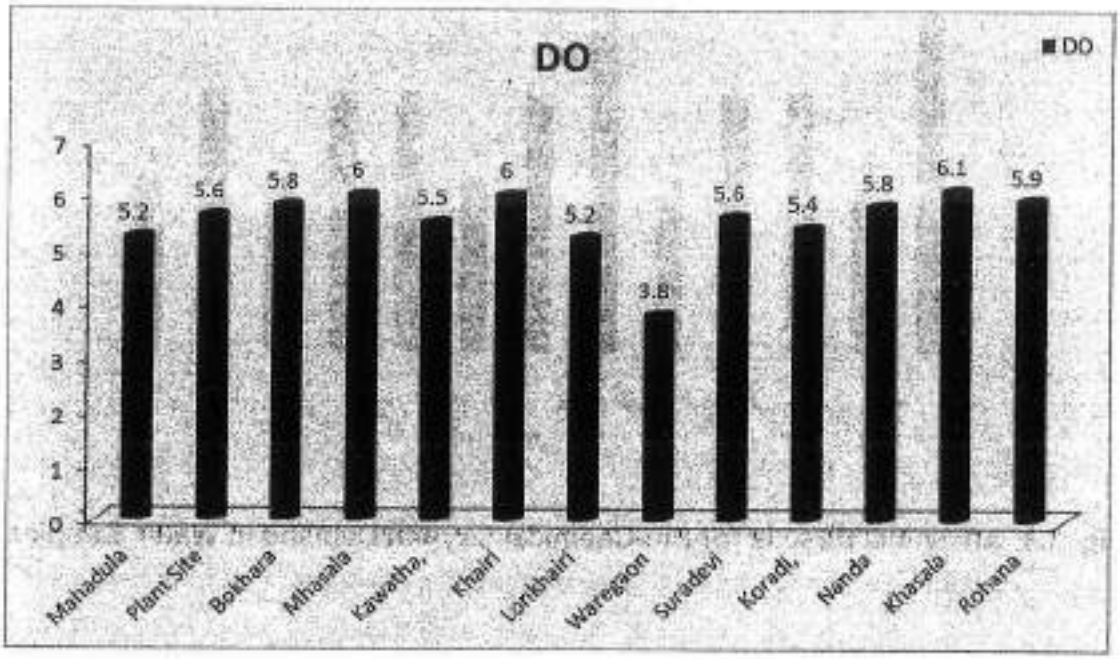


Fig. 3.7: Analytical Results for Dissolved Oxygen in Water Samples

Dissolved Oxygen in the water samples (DO) in all the 13 locations are well within the prescribed limits laid by CPCB. The highest value of DO found in the sample collected khasala and it is 6.1 mg/lit whereas the lowest is 3.8 mg/lit at Waregaon

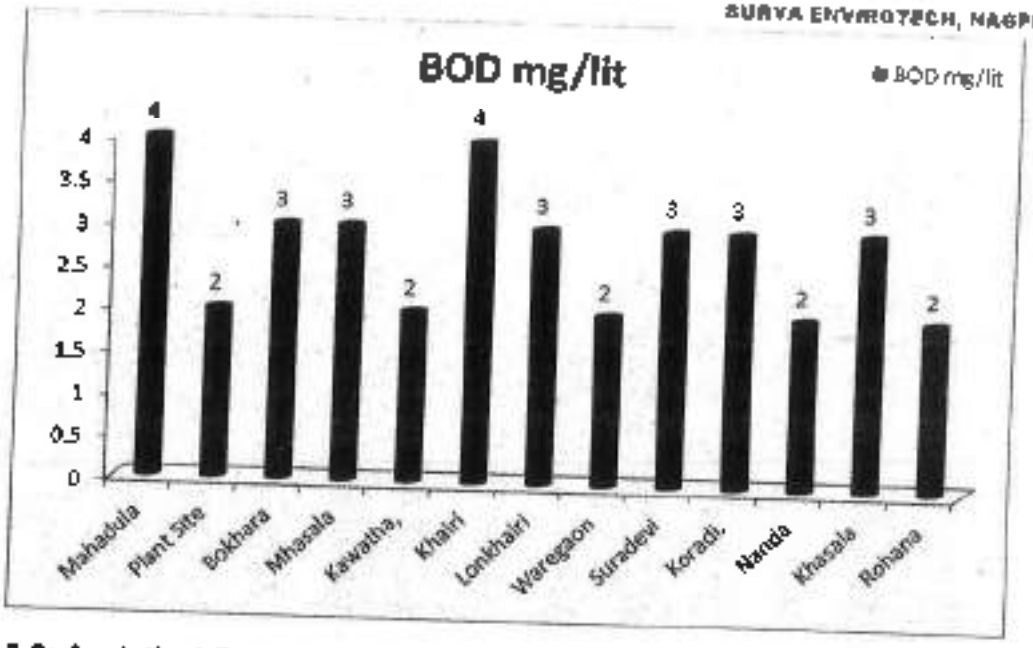


Fig. 3.8: Analytical Results for Bio-Chemical Oxygen Demand in Water Samples

The values of Bio-Chemical Oxygen Demand (BOD) in all the 13 locations are wi within the prescribed limits laid by CPCB The ranges of BOD are less than 5. The value of BO is lowest 2 mg/lit at 04 locations out of 13 sampling locations. The highest value is found i Mahadula and Khairy i.e. 4.0 mg/lit.

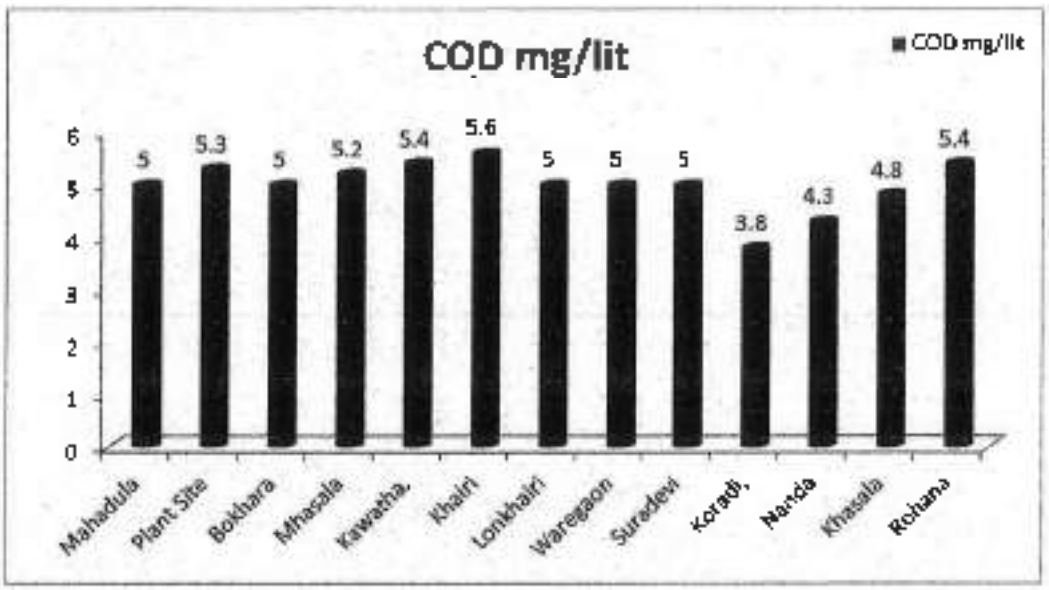


Fig. 3.9: Analytical Results for Chemical Oxygen Demand in Water Samples

The values of Chemical Oxygen Demand (COD) in all the 13 locations are very low within the prescribed limits laid by CPCB. The value of COD is lowest 3.8 mg/lit at Koradi .The highest value is found at Khairy i.e. 5.6 mg/lit.

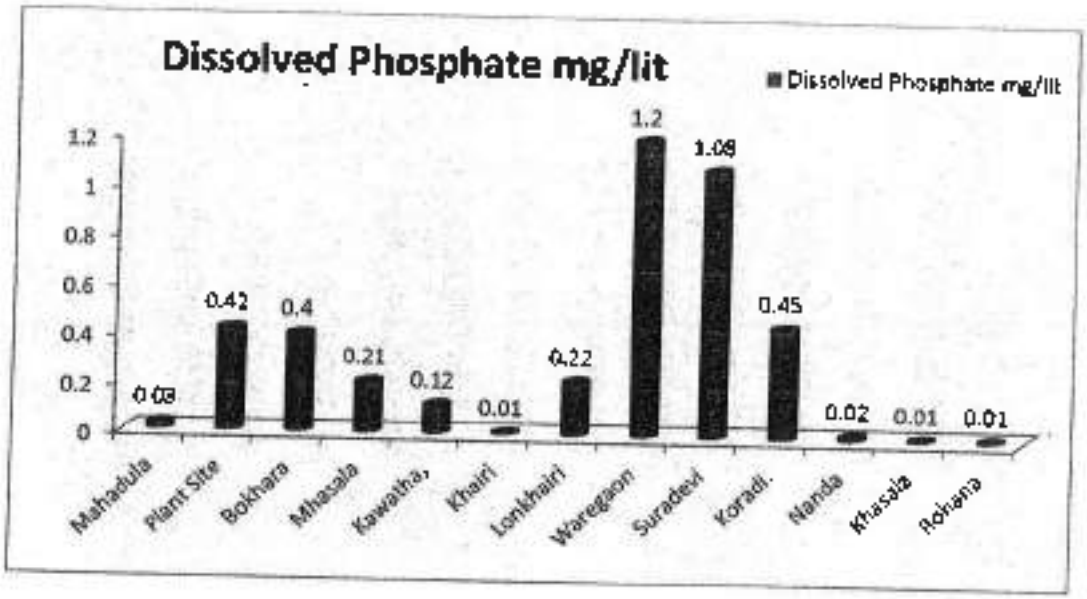


Fig. 3.10: Analytical Results for Dissolved Phosphate in Water Samples

The values of Dissolved Phosphate in all the 13 locations are well within the prescribed limits laid by CPCB. The value of Dissolved Phosphate is lowest 0.01 mg/lit at Khairy & Khasala. The highest value is found at Waregaon i.e. 1.2 mg/lit.

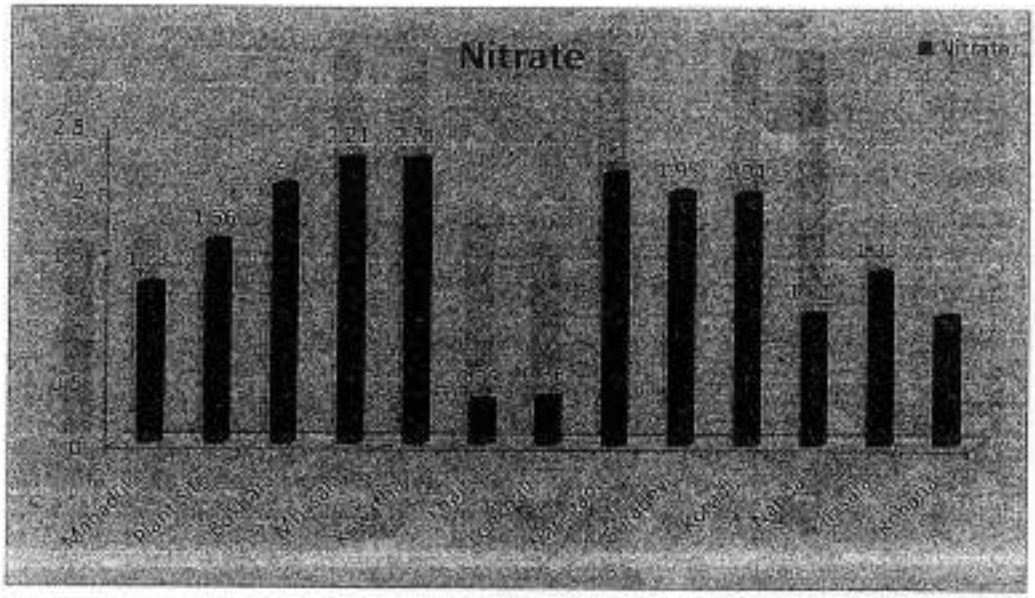


Fig. 3.11: Analytical Results for Nitrate in Water Samples

The presence of Nitrate as NO_3 in the ground water samples is well within the prescribed limits laid by CPCB. The highest value in all the 13 locations was found in Mhasala and Kawatha location and the value is 2.21 mg/lit whereas lowest value is at Khairy i.e. 0.33 mg/lit. If the water exceeds the higher limit and get consumed by human being will affect by the disease viz. methanemoglobinemia and in plant kingdom eutrophication may takes place.

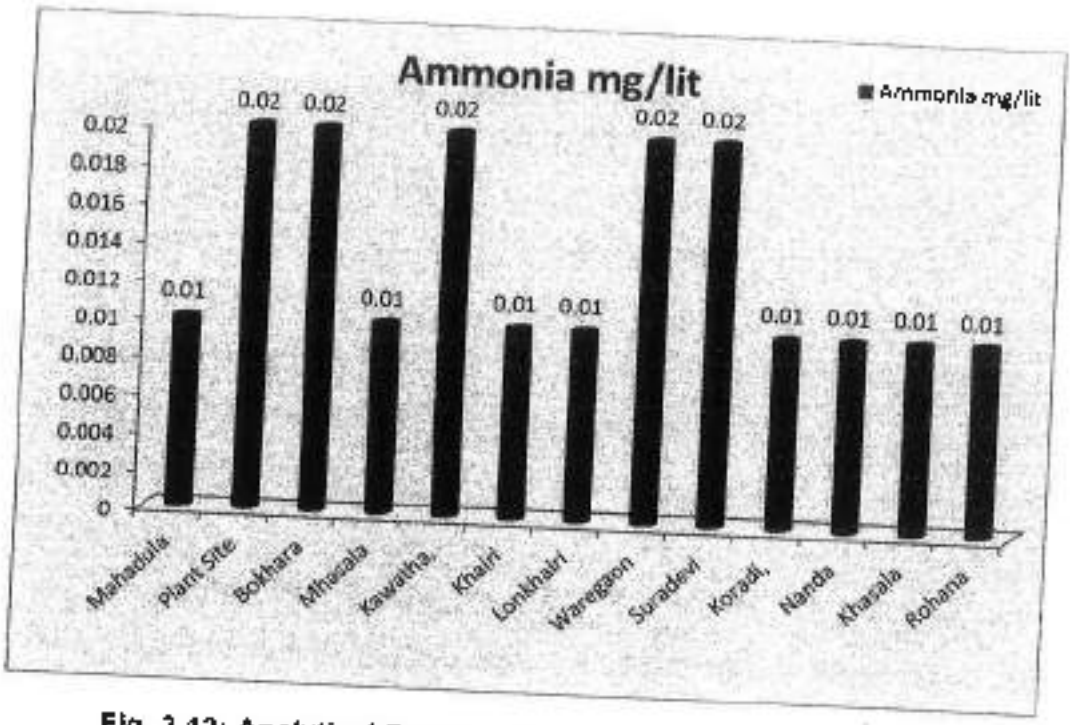


Fig. 3.12: Analytical Results for Ammonia in Water Samples

The presence of Ammonia in the ground water samples is well within the prescribe limits laid by CPCB The ranges between 0.01 to 0.02 mg/lit The highest value in all the 1: locations was found in Plant Site, Bokhara, Kawatha, Waregaon & Suradevi location and th detected value is 0.02 mg/lit whereas lowest value is at Mahadula, Mhasala, Khairy, Lonkhairy Koradi, Nanda, Khasala and Rohana i.e 0.01 mg/lit.

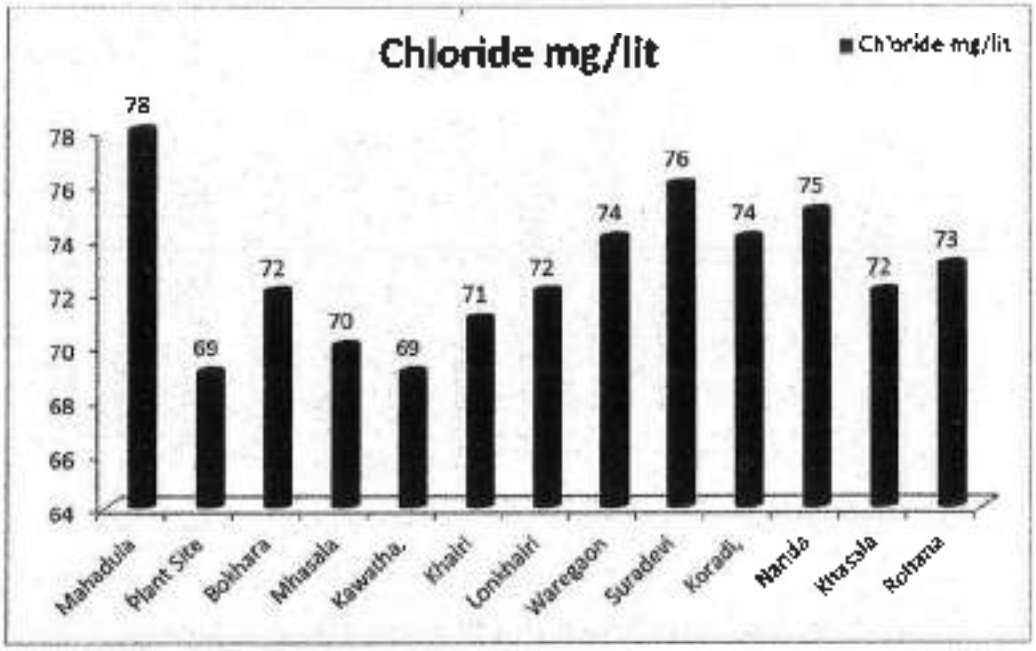


Fig. 3.13: Analytical Results for Chloride in Water Sample

The presence of Chloride in the ground water samples is well within the prescribed limits laid by CPCB.The ranges between 69 to 78 mg/lit. The highest value in all the 13 locations was found in Mahadula location and the detected value is 78 mg/lit whereas lowest value is at Plant Site and Kawatha i.e. 69 mg/lit.

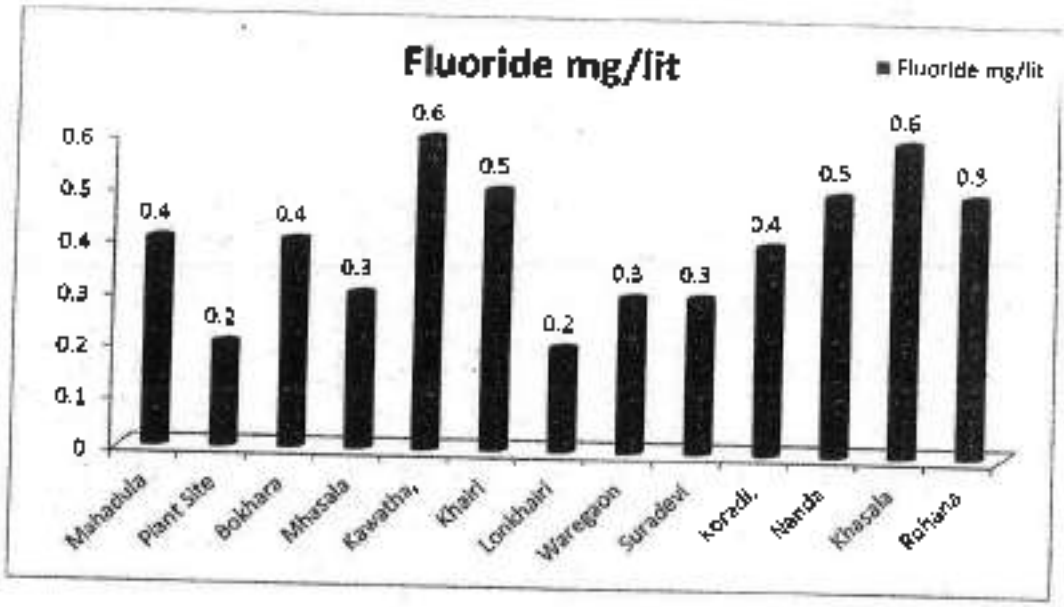


Fig. 3.14: Analytical Results for Fluoride in Water Sample

The presence of Fluoride in the ground water samples is well within the prescribed limit laid by CPCB.The ranges between 0.2 to 0.6 mg/lit. The highest value in all the 13 location was found in Kawatha and Khasala location and the detected value is 0.6 mg/lit whereas lowest value is at Plant Site and Lonkhairi i.e 0.2 mg/lit.

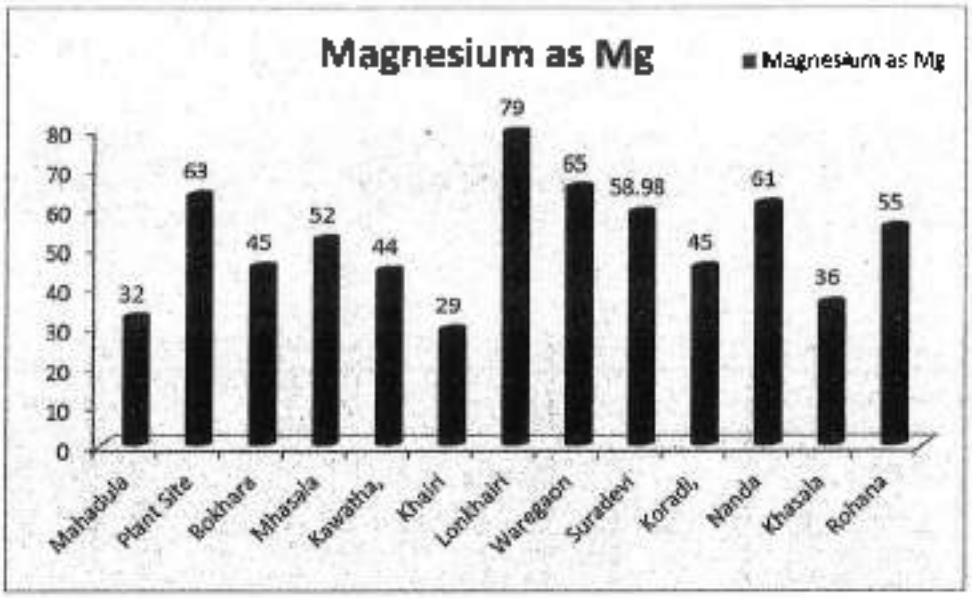


Fig. 3.15: Analytical Results for Magnesium in Water Samples

The presence of Magnesium (heavy metal) in the ground water samples is well within the prescribed limits laid by CPCB. The highest value in all the 13 locations was found in Lonkhairy location and the value is 79 mg/lit whereas lowest value is at Khairy is 29 mg/lit. The results show that the alarming situation is at Plant Site, Lonkhairy, Waregaon and Nanda. The slight increase in concentration of Mg in ground water results in Encrustation in water supply structure, allied pipelines used for water supply, household water collections utensils and adverse effects on domestic use.

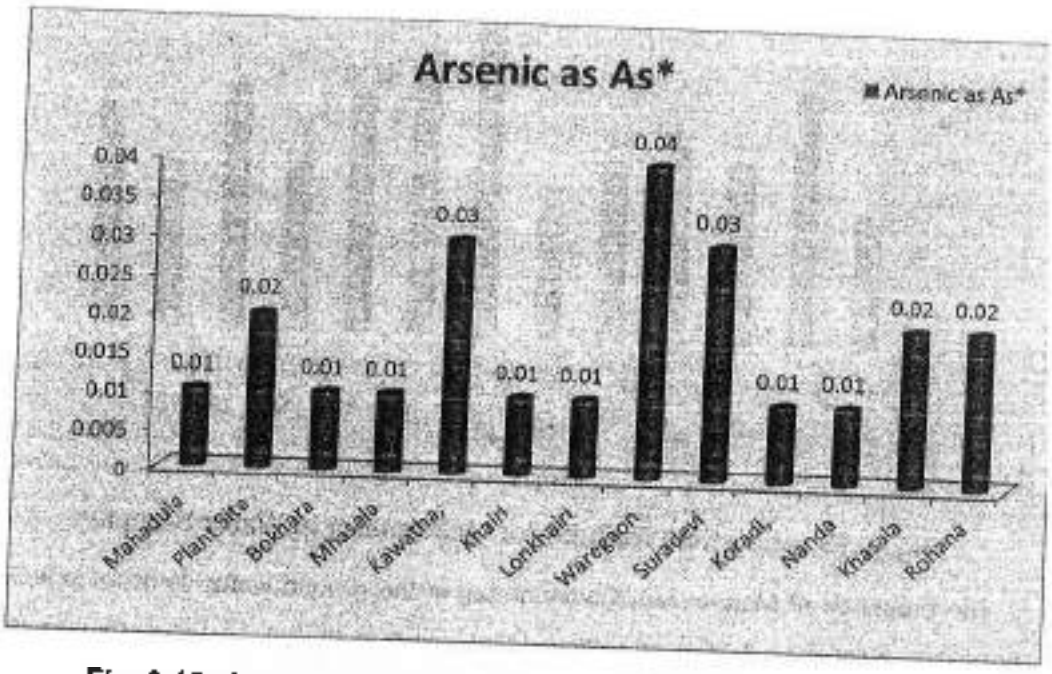


Fig. 3.16: Analytical Results for Arsenic in Water Samples

The presence of Arsenic (heavy metal) in the ground water samples is well within th prescribed limits laid by CPCB. The constration of Arsenic exceeds the limit is at Kawtha ie 0 C mg/lit The highest value in all the 13 locations was found in kawatha. Waregaon & Surade location and the value is 0.03, 0.04, 0.03 mg/lit respectively. whereas lowest value is a Mahadula, Bokhara. Mhasala. Khairy, Lonkhairy, Koradi, Nanda, i.e. 0.01 mg/lit. Beyond this th water becomes toxic. Limit is 0.05.

The ash bund of the Koradi thermal power plant is at Kawatha village whereas o Khaparkheda is at Waregaon village. The village Suradevi is at near vicinity of ash bund area o Koradi Thermal Power Plant. The concentration of Arsenic should be maintained at lower side in water as it is toxic heavy metal.

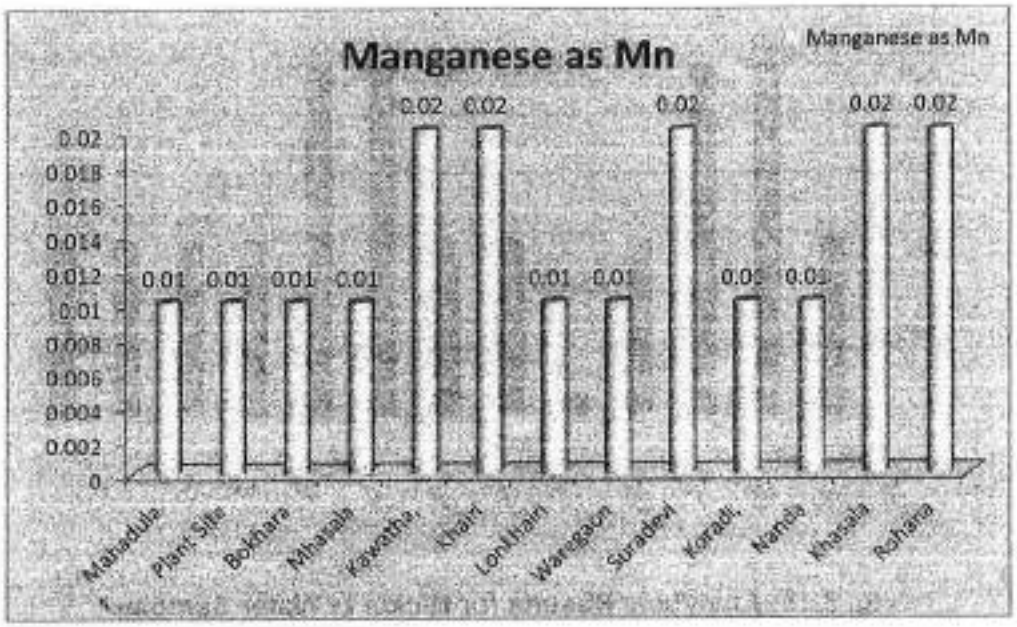


Fig. 3.17 Analytical Results for Manganese in Water Samples

The presence of Manganese (heavy metal) in the ground water samples is well within the prescribed limits laid by CPCB. The highest value in all the 13 locations was found in Kawatha, Khairi, suradevi, Khasala and Rohana location and the value is 0.02 mg/lit whereas lowest value is at Mahadula, Plant Site, Bokhara, Mhasala, Lonkhairi, Waregaon, Koradi, Nanda, i e. 0 01 mg/lit. If the ground water quality gets contaminated by exceeding the limit of this heavy metal which is 0.1 mg/lit the taste / appearance of water get affected. It has adverse effect on domestic uses and water storage structures

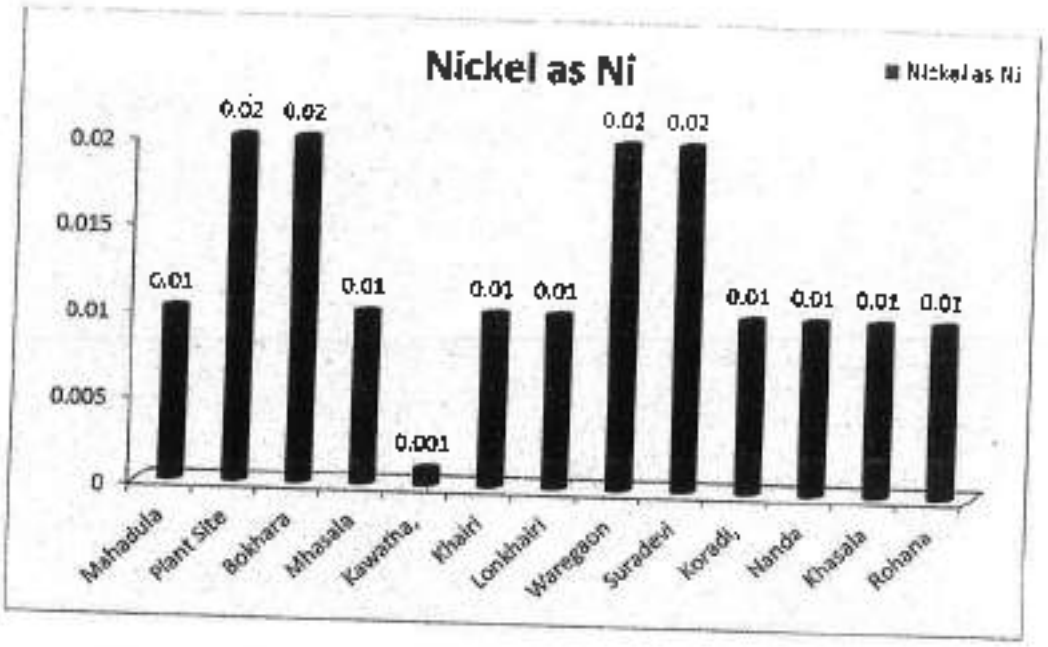


Fig. 3.18: Analytical Results for Nickel in Water Samples

The presence of Nickel (heavy metal) in the ground water samples is well within the prescribed limits laid by CPCB. The highest value in all the 13 locations was found in Plant Site, Bokhara, Waregaon & Suredevi location and the value is 0.02 mg/lit whereas lowest value is at Kawatha, i.e. 0.001 mg/lit.

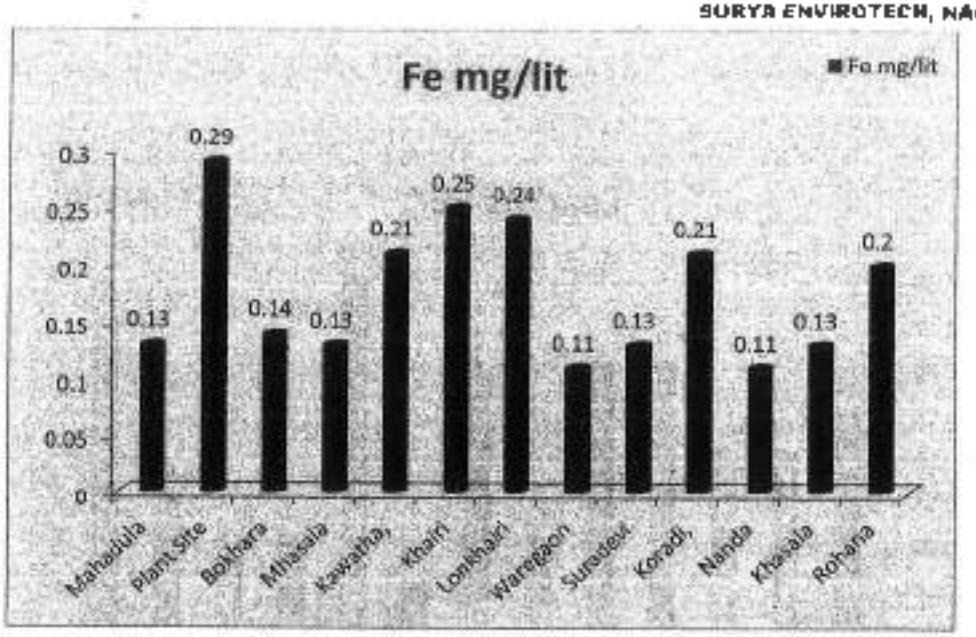


Fig. 3.19: Analytical Results for Iron in Water Samples

The presence of Iron (heavy metal) in the ground water samples is well within the prescribed limits laid by CPCB. The highest value in all the 13 locations was found in Plant Site location and the value is 0.29 mg/lit whereas lowest value is at Waregaon, Nanda, i.e. 0.11 mg/lit. Beyond this limited taste / appearance are affected has adverse effect on domestic uses and water structures and promotes iron bacteria

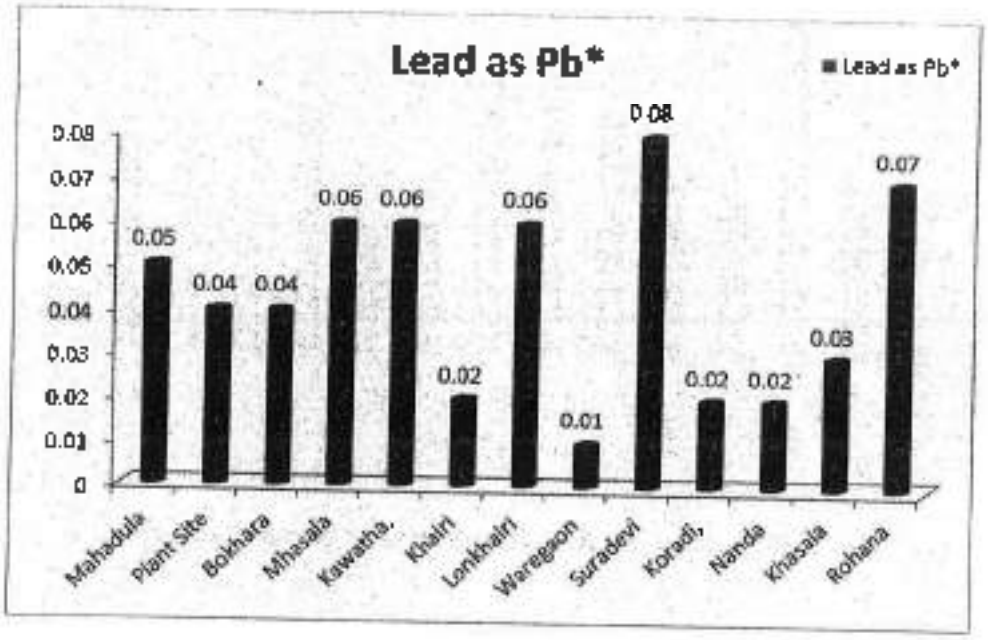


Fig. 3.20: Analytical Results for Lead in Water Samples

The presence of Lead (heavy metal) in the ground water samples is well within the prescribed limits laid by CPCB. The highest value in all the 13 locations was found in Suradevi location and the value is 0.08 mg/lt whereas lowest value is at Waregaon, i.e. 0.01 mg/lt. the excess concentration may become water toxic.

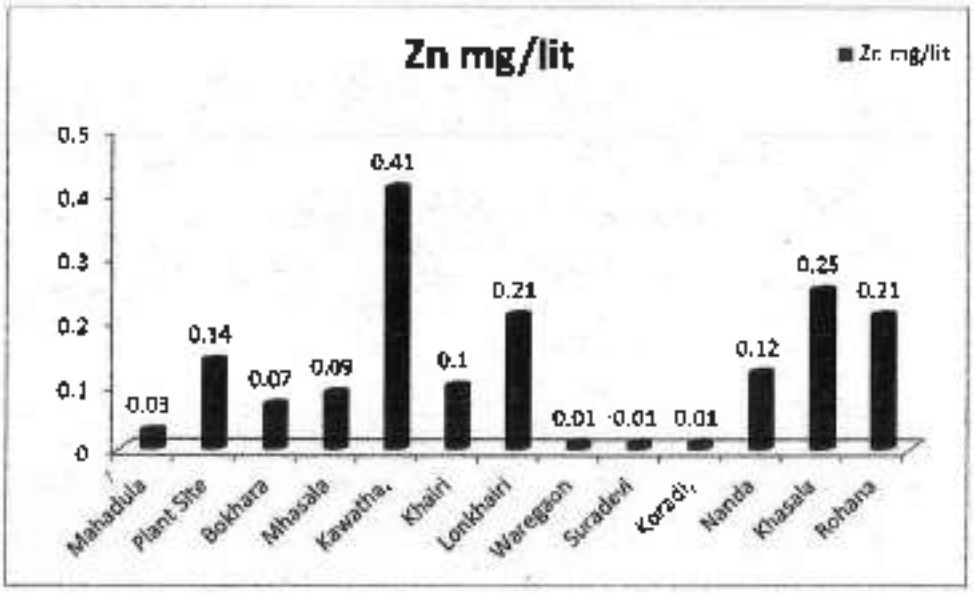


Fig. 3.21: Analytical Results for Zinc in Water Samples

The presence of Zinc (heavy metal) in the ground water samples is well within the prescribed limits laid by CPCB. The highest value in all the 13 locations was found in Kawatha village and the value is 0.41 mg/lit whereas lowest value is at Waregaon, Suradevi, Koradi, i.e. 0.01 mg/lit. Beyond this it can cause astringent taste and opalescence in water.

Chapter IV
Rain Water Harvesting Schemes

4.0 RAIN WATER HARVESTING AND INDUCED RECHARGE STRUCTURES

The concept of rain water harvesting is an ancient one and has become popular in recent times because of the vagaries of the monsoon, depleting water resources but the most important of all is its user friendliness. It has become an important and ecofriendly tool to protect ground water and useful and cost effective method to boost water resources in any area. Rainwater harvesting is the technique of collection and storage of rainwater in surface or sub-surface aquifers, before it is lost as surface run-off. The technique of rain water harvesting involves collection of rain water from localized catchment such as roofs, paved area, and open land, etc. or impounding of runoff by creating barriers across small streams/rivulets.

Induced recharge to ground water is the way of recharging the aquifers by artificial means by utilizing the surplus water resources available. This helps in directly recharging the targeted ground water aquifer by bypassing the unfavorable strata.

Taking into account the topographical situation, hydrogeological situation, rainfall incident and space availability of the plant area, one type of structures is suggested i.e. Surface water pond with recharge shaft.

As the June to September is monsoon period, maximum rainfall is during this period and the annual normal monsoon rainfall is 275 mm (73%).

4.1 Rain Water Available for Harvesting

The project is spread over 17, 39,513 sq. m area. The breakup of area as per the land use/surface type and proportionate amount of rainwater occurring on respective areas is tabulated below. The runoff for the project area has been calculated as follows:

$Q = A * I * C$

Where Q = Run off

A = Total catchment area in hectare

I = Intensity of Rainfall in mm/hr

C = Runoff coefficient

The CPWD has provided a run off co-efficient for calculating rain water availability from different types of surfaces such as roof top area, ground surface area, paved area, road area etc. The same were used for calculation of rain water endowment of that particular area

The Koradi Thermal Power Plant Expansion project area receives an average annual rainfall of about 559 mm. There are 6 different land use / surface area types in the project layout with their area and generation of runoff i.e., availability of rain water over these surfaces is as tabulated in **Table.4.1**

Table 4.1 Area Bifurcation in Expansion Project

Area Type	Area (sq.m)	Rainfall (m)	Runoff Co-efficient	Total Yearly Runoff generated and available for RWH (m3)
Rooftop area	80057	1.2	0.8	76854.72
Greenbelt Area	168987	1.2	0.15	30417.66
Road/Pavement area	188023	1.2	0.85	191783.46
Other area exposed to sky (Ash pond and utilities)	1302446	1.2	0.85	1326494.92
Total area	1739513 Sq. mt.			1627550.76

Thus from the total area, yearly rainfall run off that can be harvested is about 1627550.76 m3. The rain water harvesting system is to be designed for rainfall intensity of 100 mm/h which is the most probable maximum occurring rainfall in a single day.

The rainwater harvested is advised to be filtered before collecting in the lagoons/ water conservation-cum-recharge ponds. For this, the terminal 25 to 30 m section of the storm water drains; just before their connection with the surface water ponds is advised to be filled with #2mm to #3mm sized sand to filter out the suspended particles. This sand will act as a filter to

separate the suspended particles that will settle over the rooftops of various buildings. This sand should be kept fixed in its place with the help of mesh of appropriate size.

This pond can also be used from aesthetic point of view as a part of landscaping of the KTPP campus, however proper safety measures such as fencing around the lagoon should be provided to avoid any mishaps as the depth of the lagoon will be 2m. The KTPP shall construct four number of this kind of rainwater harvesting pond in their premises. (Figure 4.1).

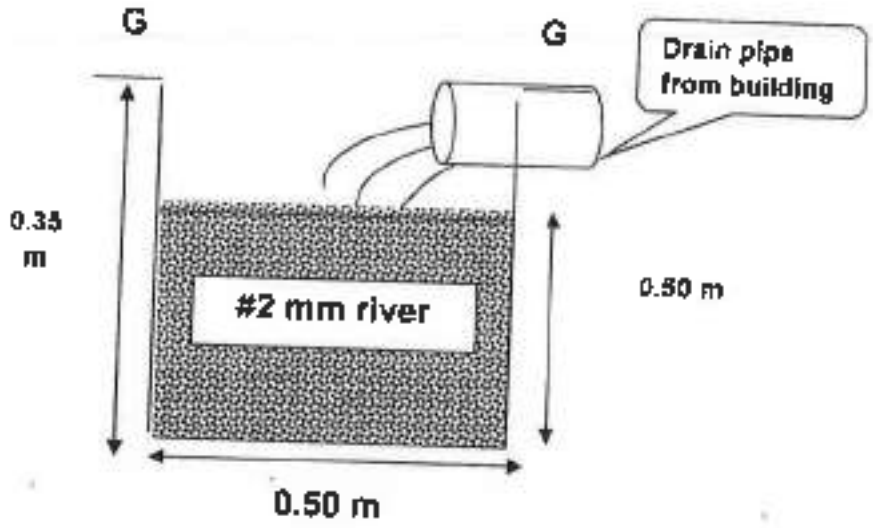


Fig. 4.1: Vertical Section of Storm water Drain

4.2 Viable Rain Water Harvesting Structures

Metamorphic rocks are occurring in and around the KTPS campus area. Depth to Water level data, infiltration rate analysis and aquifer studies by different agencies also reveals that in metamorphic terrain, due to thick overburden (10 – 20 m) of clayey nature derived from rock in situ, groundwater infiltration rate is very poor. Due to poorly permeable Clayey overburden, the dug well of this area are not capable to accept artificial recharge by means Roof top rain water harvesting. Considering the terrain condition of the area, to harvest the available quantity of rain water following structures are suggested.

A. Surface water ponds

The surface water ponds suggested are in 02 numbers in the study area. The rainwater is collected in the collection ponds shown in (Figure 4.3) layout map and the collected water is then poured to surface water ponds. The design parameters and size of the ponds is as follows:

Surface water pond:

Area	45,000 sq.m.
Depth	. 2.0 m
Single filling	. 90,000 cu.m
Harvesting potential considering 2 fillings	: 1, 80,000cu.m.
@ 95% efficiency	: 1, 71,000 cu. m. or 0.17 MCM

To prevent silting of these lakes/ponds, the end portion of the storm water drain pipes carrying the rain water from the catchments is advised to be provided with appropriate online filters. Similarly regular de-silting of these structures should be done so that maximum benefit is obtained due to rain water harvesting and recharging.

B. Rainwater Harvesting Through Recharge Shaft

This type of recharge shaft will be done in the natural water pond available in the adjacent village which is 2 km away from the plant area. The pipe should be extended to the pond from storm water collection pond to natural water pond. As the infiltration rate is low and water table is shallow the rain water get collected in the pond will recharge ground water in post monsoon season when the water table starts declining.

This is most efficient and cost effective technique to recharge unconfined aquifer overlain by poorly permeable strata A bore well of 115 to 150 mm diameter is drilled up to depth of more permeable strata below top impermeable strata. The PVC casing is used to case the collapsible formation of bore well. A circular pit of 2 meter diameter is constructed around the bore well. The weep holes are kept at regular interval to allow water to infiltrate in to the pit. The pit is filled with Boulder at bottom followed by gravel and coarse sand. Such types of shaft are very useful to construct in Nala or Tanks / Ponds, where clay layer impedes the infiltration of water to the aquifer. It is observed that during rainy season tanks / ponds are fully filled up but water from this tank does not percolate due to clayey overburden or siltation. During summer water from

tank/ponds gets evaporated and it is not available for drinking and irrigation use. By constructing recharge shaft in tanks/ponds, surplus water can be recharge to groundwater.

Proposed Recharge Shafts

Numbers	: 10
Depth	: 30.0 m from bottom of pond
Pit Dimensions (Circular)	: Diameter 2m

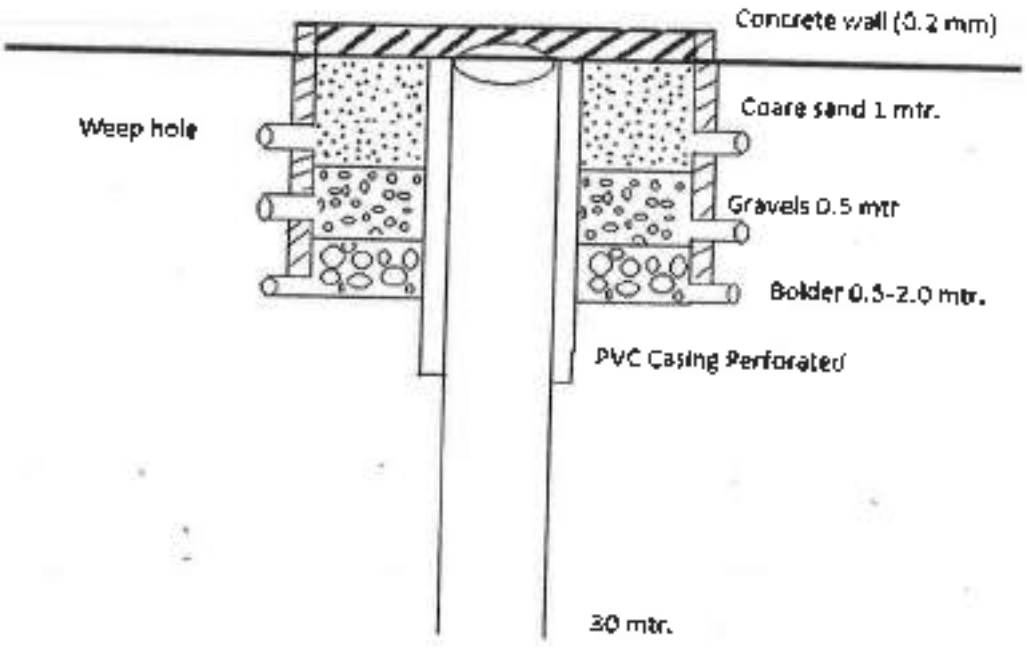


Fig. 4.2: Vertical Cross Section of Recharge Shaft

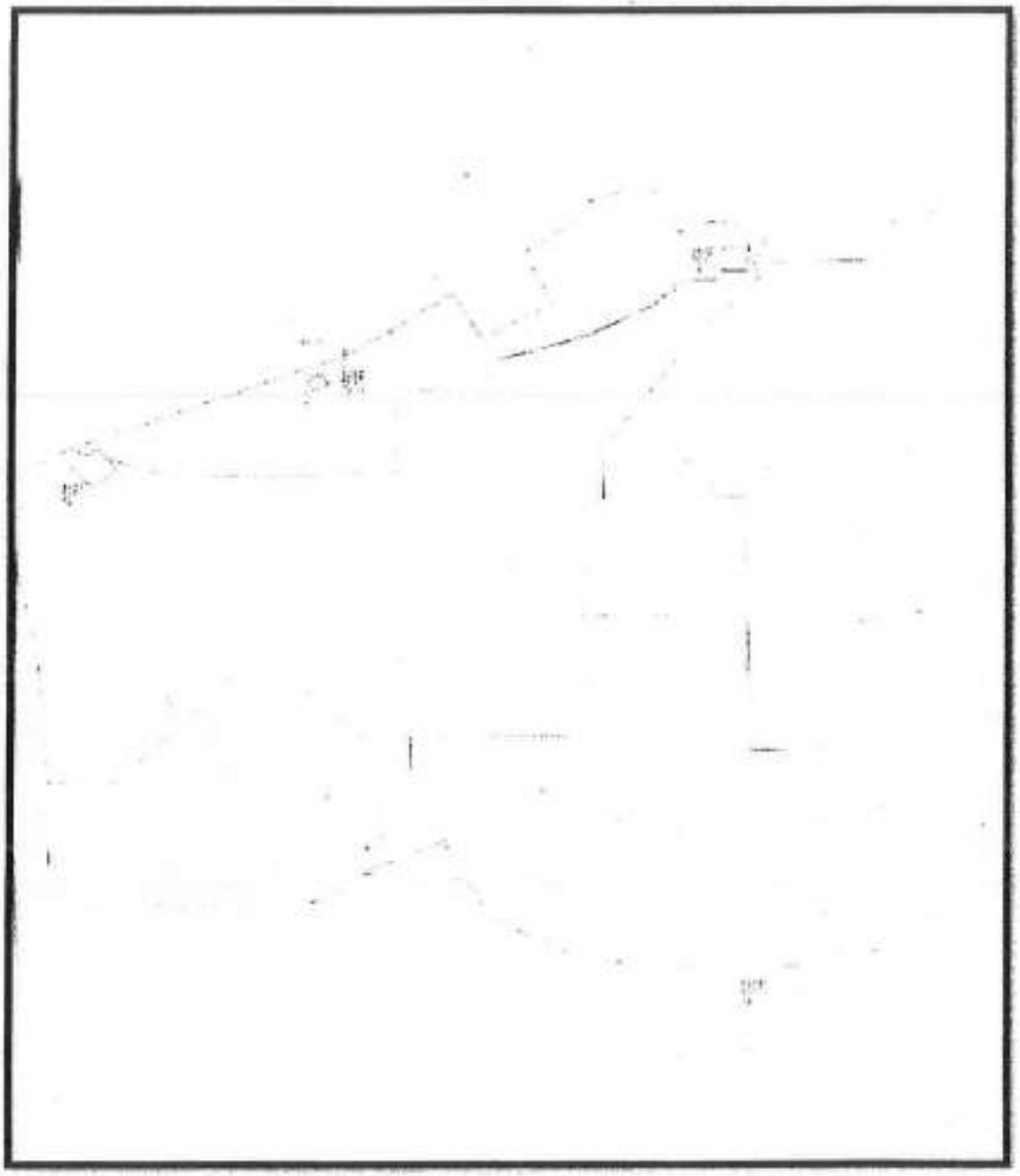


Fig. 4.3: RWH Pond

Chapter V Inference of the Hydro-Geological Study

5.0 Inference of the Hydrogeological Study in the Project Area.

The precipitation of rain water in the earth curst through ground surface is responsibl for the recharge ground- water table. Due to increase in population, urbanization an industrialization the utilization of surface and ground water is increasing day by day and groun water table is trailing its level tremendously.

The Project Authority of MAHAGENCO, keeping in mind the concept of sustainabl development decided to carryout Rainwater Harvesting Scheme in the project area. Th infiltration test results conclude that Runoff is 45 % in the study area result shown in Table 2.6.

Runoff is defined as the portion of the precipitation that makes its way towards rivers o oceans as surface or subsurface flow. After the occurrence of infiltration and other loses from the precipitation (rainfall), the excess rainfall flows out through the small natural channels on the land surface to the main drainage channels. Such types of flow are called surface flows. This surface flow in modern infrastructural development flow out in sewerage collections and go to vain. The increase in precipitation by artificial recharge to enhance ground water level is achieved by suggesting suitable recharge structures for the study area. The implementation of the suggested structures will help in increase in ground water recharge by reducing rain runoff. These structures are efficient and runoff may reduce and recharge percentage may increase from 55 to 90 %.

The present ground water quality in the study is good and all the parameters analyzed are well within prescribed limits. The project authority should be always aware every time to maintain the status of their Effluent Treatment Plant, Sewerage Treatment Plant treated water quality before its reutilization even for irrigation for greenbelt they had developed in their plant premises. The walls and corners of Ash Bund should be protected from leakage. The parameters of heavy metals are at the higher side and may cross the prescribed limit hence proper mitigation measures should be taken during operation of the plant.

Groundwater quality was monitored to assess the impact of the Hydrogeological activity. The assessment parameters indicated highly mineralized parameters. Presently ash is made into ash slurry and discharged into ash pond. Ash pond overflow is again recycled back for ash slurry preparation. The groundwater quality around ash pond does not indicate any impact due to seepage from the pond on the groundwater.

Koradi Thermal Power Station, 3X660 MW

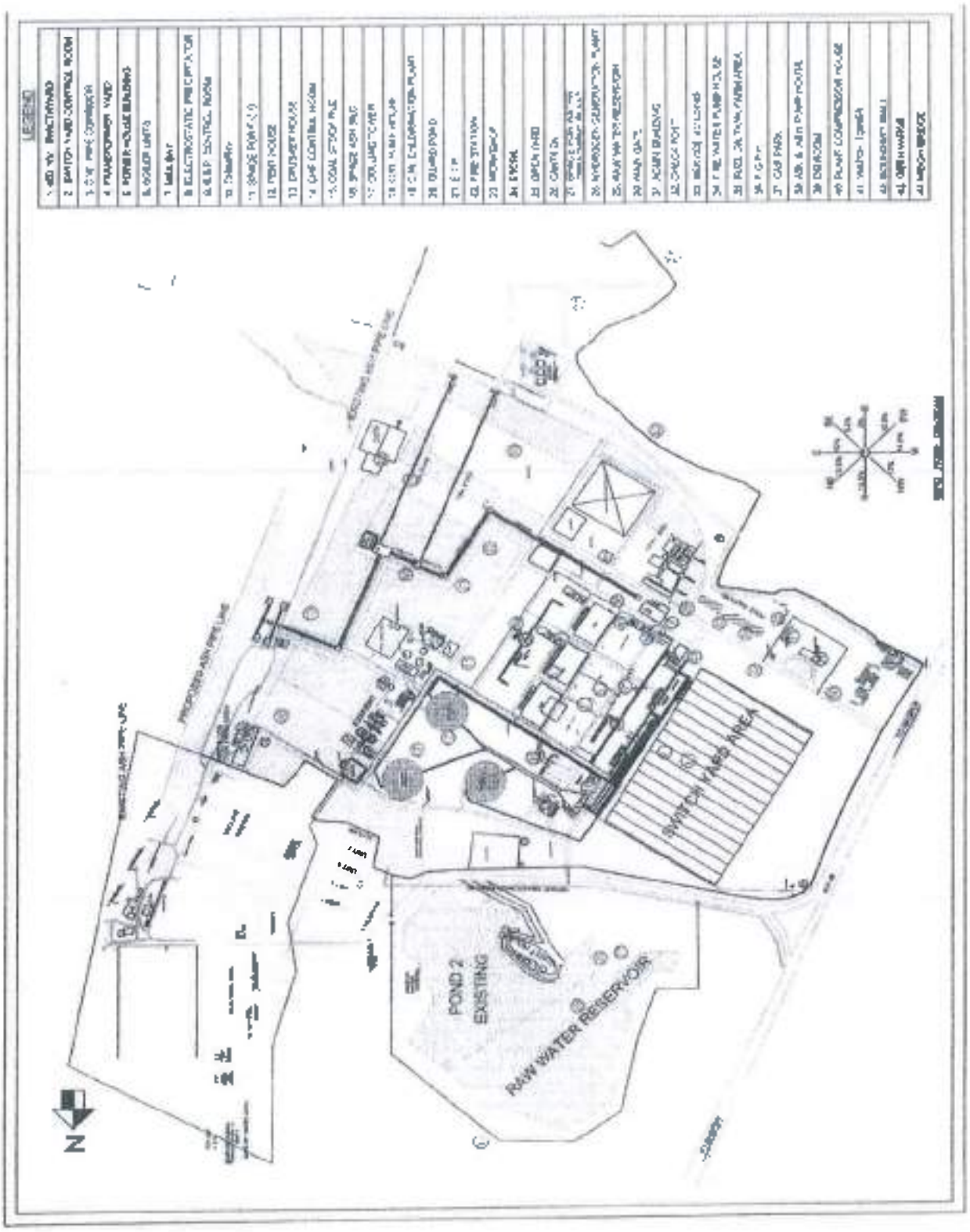
GROUND WATER SAMPLE ANALYSIS AVERAGE REPORT FOR APRIL- 2020 to MARCH- 2021

October - 2020 (Post-Monsoon)

VILLAGE	SAMPLES	Temp	pH	Residual free chlorine	TDS	TSS	Dissolved Phosphate (as PO_4)	Fluoride (F)	DO	BOD	COD	Oil & Grease	Fixed Dissolved Solids	Free Ammonia	Total Kjeldahl Nitrogen	Cyanide (as CN)	Sulphide (as S)	Sulphate (as SO_4)	Nitrate (as NO_3)	Phenolic Compounds (as C_6H_5OH)	Iron (as Fe)	Copper (as Cu)	Lead (as Pb)	Zinc (as Zn)	Arsenic (as As)	Mercury (as Hg)	Chromium Hexavalent (as Cr^{6+})	Nickel (as Ni)	Chromium Trivalent (as Cr^{3+})	Selenium (as Se)	Chromium Total (as Cr)	Cadmium (as Cd)	Manganese (as Mn)	Vanadium (as V)	Bioassay Test
		(°C)	–	mg/L	mg/L	mg/L	mg/L	mg/l	mg/L	mg/L	mg/L	mg/l	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/l	mg/L	mg/l	mg/L	mg/l	mg/L	mg/L	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/L	–
Pargaon	Dugwell	27	7.7	BDL	360	BDL	0.099	0.432	5.2	5.0	18	N.D	255	BDL	0.450	N.D	N.D	72.0	1.25	N.D	0.187	N.D	N.D	0.597	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	BDL	BDL	Free From Acute lethal toxicity
	Borewell	29	7.3	BDL	1205	BDL	0.064	0.432	6.4	2.8	10	N.D	879	0.10	0.448	N.D	N.D	217	15.3	N.D	BDL	N.D	N.D	0.568	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	BDL	BDL	Free From Acute lethal toxicity
Mhadula	Dugwell	29	7.6	BDL	850	BDL	0.077	0.441	6.4	2.0	8	N.D	653	BDL	0.390	N.D	N.D	190	41.2	N.D	0.165	BDL	N.D	0.061	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	BDL	BDL	Free From Acute lethal toxicity
	Borewell	30	7.8	BDL	1111	BDL	0.089	0.433	6.3	4.1	14	N.D	856	0.11	0.450	N.D	N.D	140	30.9	N.D	0.174	N.D	N.D	0.026	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	BDL	BDL	Free From Acute lethal toxicity
Korega	Dugwell	29	7.5	BDL	495	BDL	0.09	0.405	6.1	4.8	15	N.D	310	0.14	0.450	N.D	N.D	40.8	44	N.D	0.145	BDL	N.D	0.051	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	BDL	BDL	Free From Acute lethal toxicity
	Borewell	30	7.6	BDL	660	BDL	0.05	0.387	6.9	2.2	7	N.D	461	BDL	0.390	N.D	N.D	34	39.4	N.D	0.213	N.D	N.D	0.048	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	BDL	BDL	Free From Acute lethal toxicity
Nanda	Dugwell	28	7.6	BDL	449	BDL	0.088	0.414	6.4	1.5	11	N.D	315	BDL	0.340	N.D	N.D	56	30.1	N.D	BDL	N.D	N.D	0.071	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	BDL	BDL	Free From Acute lethal toxicity
	Borewell	30	7.7	BDL	645	BDL	BDL	0.473	6.4	7.5	8	N.D	457	BDL	0.330	N.D	N.D	85	37.0	N.D	0.174	N.D	N.D	0.058	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	BDL	BDL	Free From Acute lethal toxicity
Suradevi	Dugwell	29	7.5	BDL	975	BDL	0.06	0.396	6.2	4.1	14	N.D	680	0.11	0.390	N.D	N.D	114	24.8	N.D	0.275	BDL	N.D	0.030	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	BDL	BDL	Free From Acute lethal toxicity
	Borewell	30	7.4	BDL	778	BDL	BDL	0.427	6.1	2.4	5	N.D	590	0.10	0.340	N.D	N.D	50	45.5	N.D	0.225	N.D	N.D	0.074	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	BDL	BDL	Free From Acute lethal toxicity
[illegible]	Dugwell	28	7.5	BDL	880	BDL	BDL	0.423	6.4	2.2	10	N.D	570	0.11	0.340	N.D	N.D	140	5.01	N.D	0.174	N.D	N.D	0.025	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	BDL	BDL	Free From Acute lethal toxicity
	Borewell	30	7.8	BDL	1086	BDL	0.064	0.396	6.5	1.6	6	N.D	971	0.11	0.250	N.D	N.D	172	13.2	N.D	0.157	N.D	N.D	0.051	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	BDL	BDL	Free From Acute lethal toxicity
Khasala	Dugwell	29	7.0	BDL	860	BDL	0.055	0.450	6.2	2.0	11	N.D	604	BDL	0.290	N.D	N.D	106	32.4	N.D	0.152	N.D	N.D	0.030	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	BDL	BDL	Free From Acute lethal toxicity
	Borewell	30	7.8	BDL	1380	BDL	0.042	0.387	6.3	2.2	7	N.D	989	BDL	0.341	N.D	N.D	126	12.0	N.D	0.173	N.D	N.D	0.067	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	BDL	BDL	Free From Acute lethal toxicity
Kawtha	Dugwell	28	7.9	BDL	1531	BDL	0.047	0.441	6.4	3.8	17	N.D	906	0.12	0.340	N.D	N.D	240	32.5	N.D	0.184	BDL	N.D	0.048	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	BDL	BDL	Free From Acute lethal toxicity
	Borewell	29	7.5	BDL	1106	BDL	0.029	0.432	6.5	2.2	7	N.D	738	BDL	0.320	N.D	N.D	150	4.84	N.D	0.788	BDL	N.D	0.057	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	BDL	BDL	Free From Acute lethal toxicity
Khairi	Dugwell	28	7.7	BDL	530	BDL	0.099	0.414	5.9	3.6	12	N.D	558	BDL	0.450	N.D	N.D	134	11.1	N.D	0.187	BDL	N.D	0.030	N.D	N.D	N.D	BDL	N.D	N.D	N.D	N.D	BDL	BDL	Free From Acute lethal toxicity
	Borewell	28	7.5	BDL	1202	BDL	0.11	0.402	6.2	2.5	6	N.D	780	0.10	0.390	N.D	N.D	145	20.5	N.D	0.300	BDL	N.D	0.067	N.D	N.D	N.D	BDL	N.D	N.D	N.D	N.D	BDL	BDL	Free From Acute lethal toxicity
Average		29	7.7	BDL	935	BDL	0.07	0.429	6.3	3.1	10	N.D.	655	BDL	0.371	N.D	N.D	136	25.1	N.D	0.202	BDL	N.D	0.062	N.D.	N.D.	N.D.	N.D.	N.D.	N.D	N.D.	N.D.	BDL	BDL	Free From Acute lethal toxicity

Annexure-2(b)

Annexure-3



LAYOUT OF PROPOSED PLANT

Annexure-4(a)

OCEMS URL DETAILS

Sr No	SITE	URL
1	OCEMS Enviroconnect CPCB Site	cpdms.forbesmarshall.in:8080/enviroconnect/
2	OCEMS MPCB Site	onlinecems.ecmpcb.in/#/login

Annexure-4(b)

KORADI THERMAL POWER STATION, 3X660 MW			
STACK EMISSION DATA FOR APRIL- 2021 TO OCT- 2021			
MONTH	**Unit**	**Velocity (m/sec)**	**Mercury (mg/Nm³)**
Apr-21	8	22.4	0.0012
May-21	8	23.9	0.0012
Jun-21	8	24.2	0.0014
Jul-21	8	22.9	0.0010
Aug-21	8	23.3	0.0010
Sep-21	8	23.6	0.0011
Oct-21	8	22.7	0.0011
Avg.:		**23**	**0.0011**
Apr-21	9	22.7	0.0011
May-21	9	22.9	0.0013
Jun-21	9	23.4	0.0011
Jul-21	9	23.4	0.0011
Aug-21	9	23.3	0.0012
Sep-21	9	23.1	0.0012
Oct-21	9	23.0	0.0008
Avg.:		**23**	**0.0011**
Apr-21	10	23.2	0.0011
May-21	10	23.5	0.0011
Jun-21	10	23.4	0.0012
Jul-21	10	23.1	0.0010
Aug-21	10	23.6	0.0012
Sep-21	10	22.5	0.0010
Oct-21	10	23.7	0.0010
Avg.:		**23**	**0.0011**

Annexure - 5

KORADI TPS EXPANSION PROJECT - 3 x 660 MW (UNIT # 8, 9 & 10), KORADI, MAHARASHTRA

OWNER:	MAHARASHTRA STATE POWER GENERATION CO. LTD
OWNER'S CONSULTANT:	DEVELOPMENT CONSULTANTS PRIVATE LIMITED.
EPC CONTRACTOR:	LARSEN & TOUBRO LIMITED.
EPC CONTRACTOR'S CONSULTANT:	L&T-SARGENT & LUNDY LIMITED
BOILER CONTRACTOR:	L&T-MHI BOILERS PRIVATE LIMITED.

L&T PROJECT No.: C1090)

LMB CONTRACT NO.: 51001 LMB JOB NO.: 51001A

TITLE:

DESIGN INFORMATION FOR ELECTOSTATIC PRECIPITATOR

DOC/DRG NO : D20-570-1	REV: 0	TOTAL NO. OF PAGES : 05 TOTAL NO. OF DRAWINGS. : NIL

FOR INFORMATION

NOTE : THIS INFORMATION IS APPLICABLE FOR JOB NO.: 51001B,51001C (UNIT#9&10) ALSO

Released For Construction

REVISION CERTIFICATION									
REVISION NO.	PREPARED			REVIEWED			APPROVED		
	NAME	SIGN	DATE	NAME	SIGN	DATE	NAME	SIGN	DATE
A	Prajyuta		30-07-2010	PMSK		30-07-2010	KCR		30-07-2010
0	CM		01-11-2010	PMSK		01-11-2010	KCR		01-11-2010

INDEX

Rev. 0 History:

This document is revised as per the Mahagenco/ DCPL comment on this document DCPL-K8A06/KORD-L&T-6/V7/336 dated 21-Aug-2010 and comment on ESP General drawing DCPL-K8A06/KORD-L&T-06/V7/421 dated. 21-Oct-2010.

L&T-MHI BOILERS PVT. LIMITED	MAHARASHTRA STATE POWER GENERATION CO.LTD. KORADI TPS EXPANSION PROJECT, 3 X 660 MW	
STEAM GENERATOR AND AUXILIARIES PACKAGE	DESIGN INFROMATION FOR ELECTOSTATIC PRECIPITATOR	Rev: 0
Job No. – 5100IA	DOC/DRG NO. – DZ0-570-1	Date: 01-11-2010

1. Electroetatic Precipitator System Description

One set of Electrostatic Precipitators (ESP) shall be provided per boiler. The ESP will be installed in between of airheater (AH) and the induced draft fan (IDF). The flue gas will passes through the ESP where the flue gas will get cleaned by help of the discharge electrode and the collecting electrode provided inside the ESP casing. Adequate number of electrical field shall be provided the clean the flue gas as per the contract requirement.

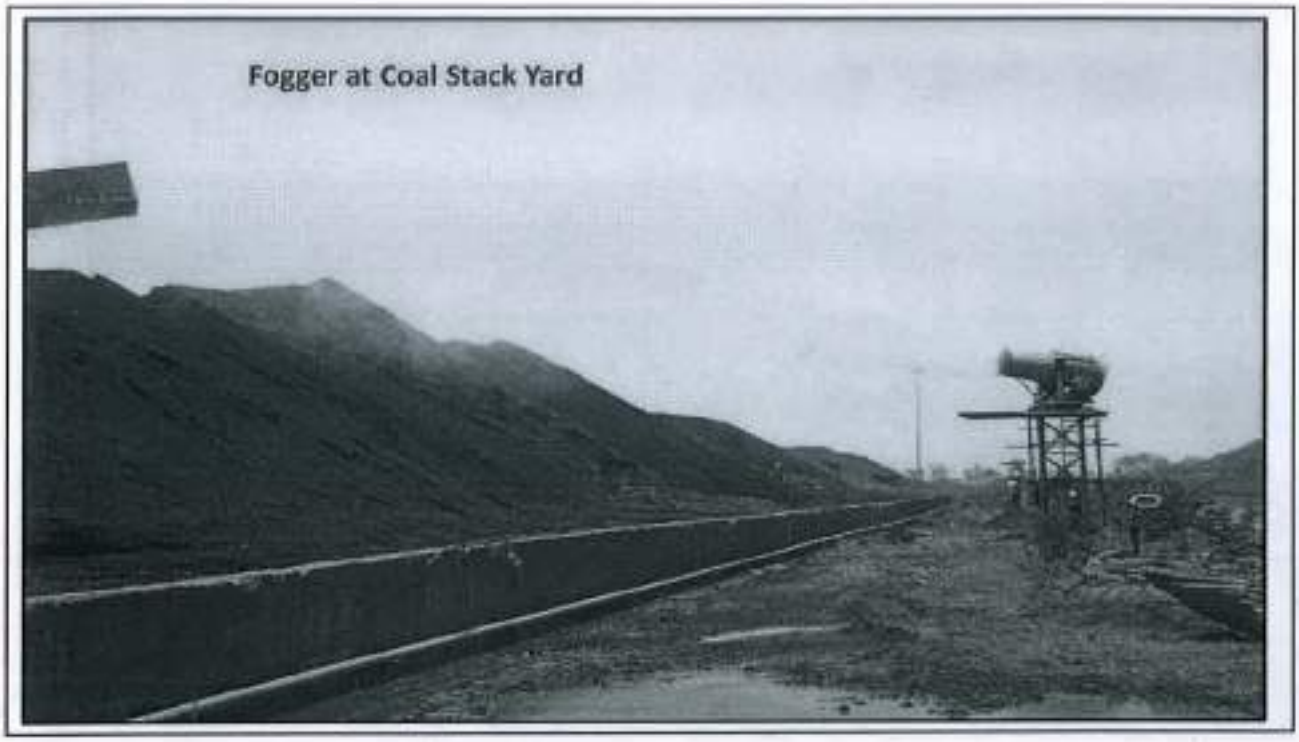
The number of flue gas stream (path) and number of electrical field shall be as per the ESP supplier's standard design practice. But the outlet dust concentration of the Electrostatic precipitator shall be not more than 50 mg/Nm^3 of the flue gas under the following condition as per the contract requirement.

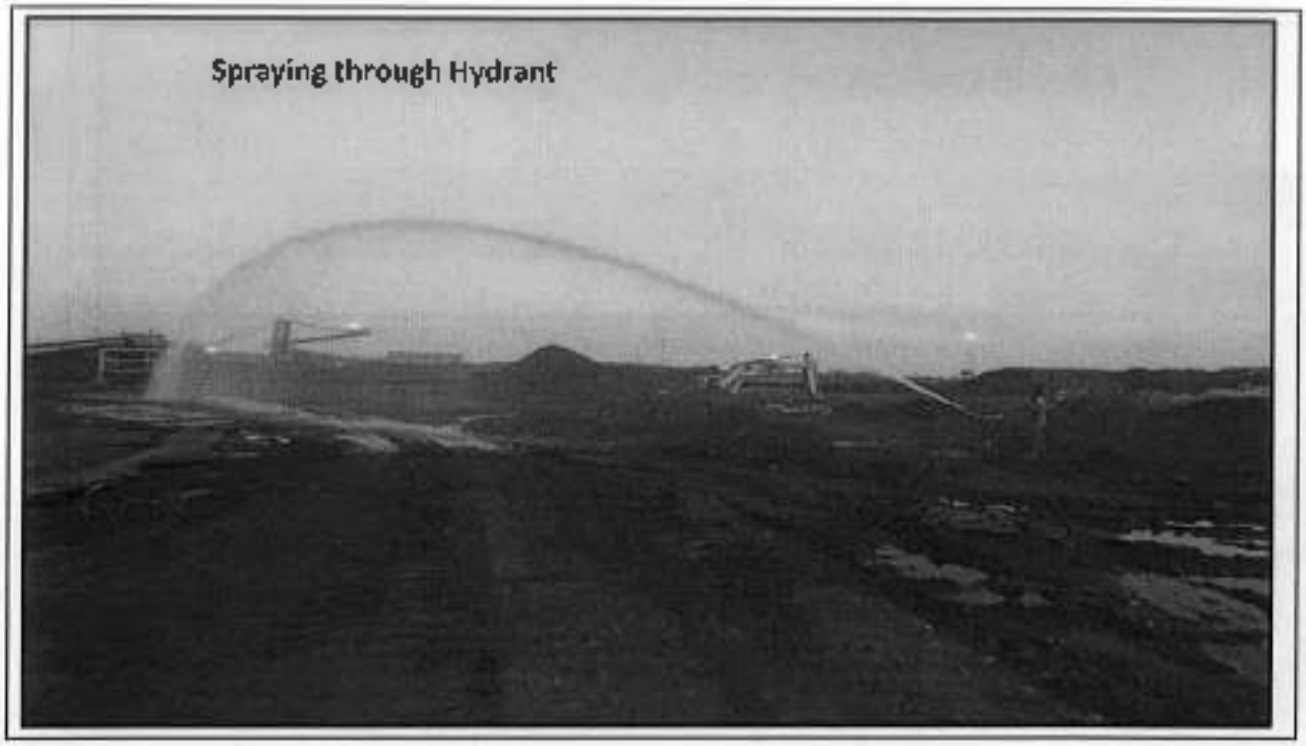
1. At 100% TMCR, worst coal firing with one series field out of service
2. At 100% BMCR, worst coal firing with all field operating
3. ESP is designed to handle the maximum dust concentration (considering 90% of total ash generation as fly ash with coal having 46% ash content) with one field out of service (100% TMCR) condition.
4. Other technical requirement as per the contract specification.

Please refer attachment – 1 for coal analysis as per the contract.

Annexure - 6

12/4/2021

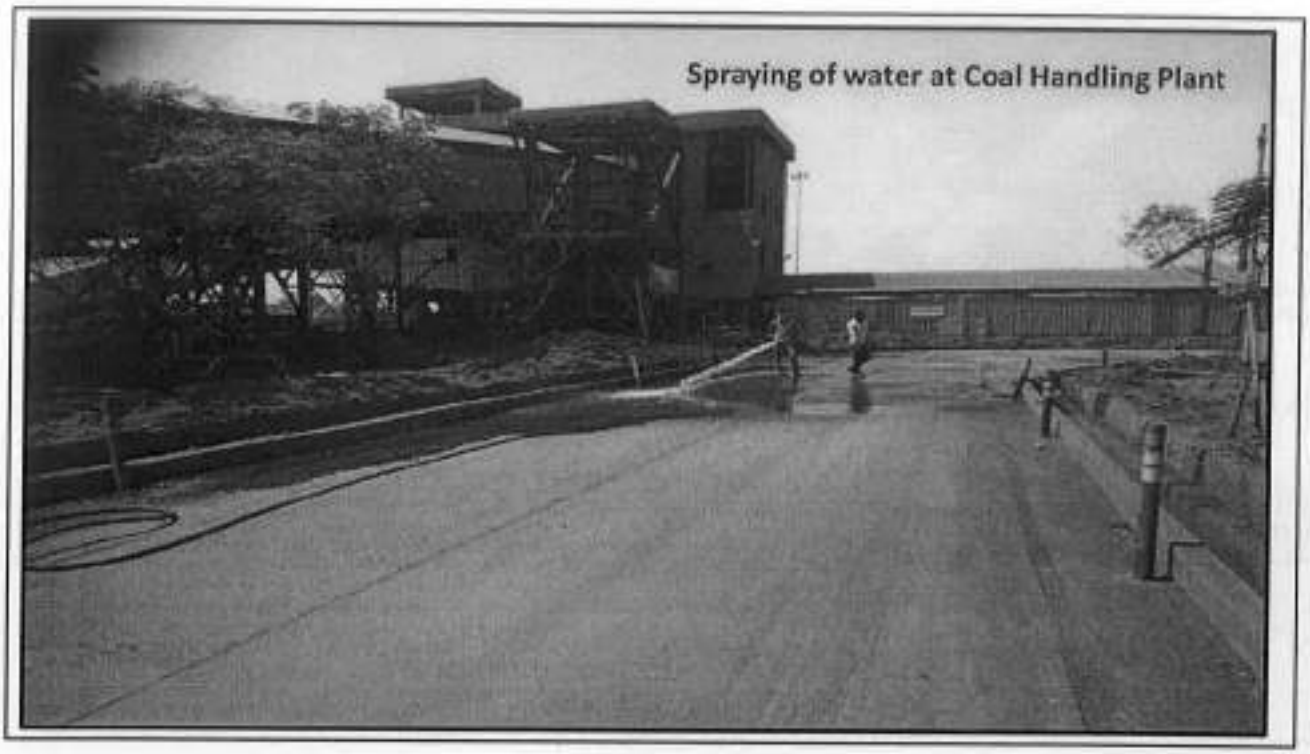


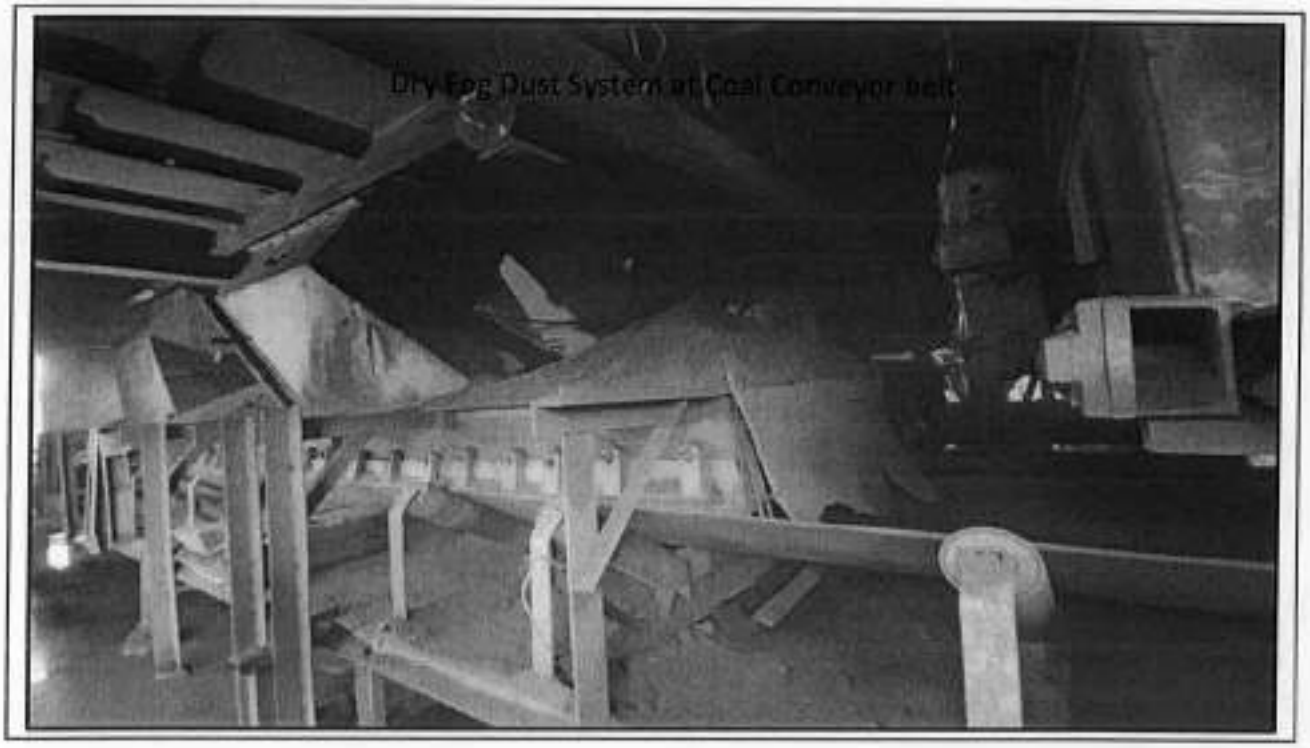

Spraying through Hydrant


Water Sprinkling on Coal Conveyor belt


Water Sprinkling at Coal Conveyor Belt


Spaying of water wagon tippler


Spraying of water at Coal Handling Plant


Dry Fog Dust System at Coal Conveyor belt

Annexure : 7

MAHAGENCO
Maharashtra State Power Generation Co. Ltd.
CIN : U40100MH2005SGC153648

MAHARASHTRA STATE POWER GENERATION CO. LTD.
KORADI THERMAL POWER STATION
(ISO 9001:2008, 60 14001:2004 & ISO 18001:2007)
Office of Chief Engineer (O & M), K.T.P.S., Koradi Dist. Nagpur PIN - 441111
Phone: (07109) 262141 to 262146,262166, 262109 Fax: 262127(CE)
Email –cegenkoradi@mahagenco.in

Compliance to mandatory 100 % Fly Ash Utilization

KoradiThermal Power Station geographic location, which is such that they are surrounded by number of Government and private sector power plants such as Khaparkheda Thermal Power Station, Chandrapur Super Thermal Power Station, NTPC(Mauda) , DhariwalTPP(Chandrapur Dist.), GMR Energy Ltd (Warora),Wardha Power Co. Ltd (Warora), Adani Power Ltd.(Tiroda),Ratan India Power Ltd. (Amravati). These plants are providing ash, free of cost to the users along with value added services such as bearing part of transportation cost.

Koradi TPS being near to Nagpur City, various restrictions are imposed by Traffic Department on ash vehicle movements in peak hours to avoid traffic congestion in city.

Also, one of the most important reasons for low ash utilization is absence of major ash-based industries in nearby vicinity of Nagpur area like cement plant industries, whoare bulk consumer of fly ash.

As major cement industries are located far away from Koradi TPS, transportation of fly ash to the area of cement plant industry becomes uneconomical looking towards distance and toll charges. However, ash utilization status of Koradi TPS isgradually improvingas per details shown in table below:

Station Ash Utilization (210 MW and 660 MW)

Sr.No	Year	Coal Consumed (MT)	Ash Generation (MT)	Total Ash Utilization (MT)	% Ash Utilization
1.	FY 2018-19	6402586	2643276	775245	29.32%
2.	FY 2019-20	7100389	2857170	1215895	42.56%
3.	FY 2020-21	6709392	2811456	2276198	80.96%
4.	FY 2021-22	3436266	1306964	822837	62.96% *

- Due to CoronaPandemic,
- In Monsoon season ash utilization reduces drastically.

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Email -cegenkoradi@mahagenco.in

Action planfor 100 % ash utilization is formulated and steps are taken to implement the same:-

I) Dry Fly Ash Utilization :-

To increase the dry fly ash utilization, as a promotional activity,regularly advertisement are published in various Newspapersfor agencies under 80% quota (i.e.cement, bricks, blocks, tiles manufacturing industries, processing industries, grinding units, EPS wall panel manufacturing industries. road construction agencies etc.)and 20 % quota(SSI Units such as brick manufacturer) for DFA lifting at free of cost from 3x660 MW, Koradi TPS as below:

Sr.No.	Date of Advertisement in various Newspapers	Name of the Newspaper
1.	30.05.2018	Navbharat, Lokmat, Hitvada
2.	16.06.2018	Lokmat, Hitvada, Navbharat
3.	03.02.2020	Lokmat ,Hitvada, Navbharat
4.	13.03.2020	Lokmat, Sakal, Hitvada
5.	29.12.2020	Matrubhumi,DainikBhaskar, Navbharat, BhandaraPatrika
6.	15.01.2021	Hitvada, Lokmat
7.	23.08.2021	Navbharat, Hitvada

In response to above advertisement, sale order for dry fly ash at free of cost issued to various agencies (Such as Brick Manufacturing, Ash user for Road embankment, RMC units and Cement manufacturing) under 80% quota for lifting dry fly ash from silos provided at 3x660 MW KTPS, Koradi as below:

Sr. No.	Name of Agency	Order No. And date	Period	Quantity Alloted	Quantity Lifted
1	M/s Ambuja Cement Ltd., Thane	No.1664 Dtd. 26.05.2018	1 Month	400 MT/Day	1062 MT
2	M/s ACC Ltd. Thane	No.1662 Dtd. 26.05.2018	1 Month	400 MT/Day	
3	M/s N.C.C. limited, Hyderabad	No.1446 13.06.2020	9 Months	Approx.500-1000 MT/Month	7002 MT
4	M/s Nagpur improvement trust.	No.1388 dtd 05.06.2020	3 Months	15000 MT	133 MT

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Email – cegenkoradi@mahagenco.in

5	M/s Technology Resource Partner, Paras	No.1447 Dtd.13.06.2020	Upto31 March 2021	60 MT per day	1563 MT
6	M/s. RCCPL Butibori, Nagpur	No.1387 dtd 05.06.2020	Upto30 June 2020	300-400 MT/Day	102 MT
7	M/s N.C.C. limited, Hyderabad	No.888 Dtd. 31.03.2021	Upto 31 Aug 2021	1000 MT/Month	10717 MT
8	M/s Technology Resource Partner, Paras	No.2304 Dtd.18.08.2020	Upto31 March 2023	5000 MT/Month	4775 MT
9	M/s N.C.C. limited, Hyderabad	No.2294Dtd. 18.08.2021	Upto 31 Aug 2023	1000 MT/Month	5628 MT
10	M/s Orient cement Ltd., jalgaon	No.2249 dtd.16.09.2019	One year	500 MT/Day	18808 MT
11	M/s Orient cement Ltd., jalgaon	No.2299 dtd.18.08.2020	Upto31 March 2023	500 MT/Day	
12	M/s. RCCPL Butibori, Nagpur	No.1784dtd 05.06.2021	Upto 31 Aug 2021	10000 MT/Month	8318 MT
13	M/s. RCCPL Butibori, Nagpur	No.2298dtd18.0 8.2021	Upto 31 Aug 2023	10000 MT/Month	
14	M/s.Skylon Projects (India) Pvt Ltd, Nashik	NO.228 Dtd. 23.01.2021	Upto 31 Aug 2021	150000 MT / month	Not started lifting
15	M/s.Skylon Projects (India) Pvt Ltd, Nashik	NO.2303 Dtd. 18.08.2021	Upto 31 Aug 2023	150000 MT / month	
16	M/s Mahi Buildcon	NO.2585 Dtd. 10.09.2021	Upto 31 Aug 2023	40000 MT / month	Not started lifting
17	M/sIsmail Infratech	NO.2806 Dtd. 06.10.2021	Upto 31 Aug 2023	2500-3000 MT /Day	Not started lifting
18	M/sBirla Corporation Ltd., Kolkata	NO.2297 Dtd. 18.08.2021	Upto 31 Aug 2023	15000 MT /Month	Not started lifting

The Sale Order under 20% Quota(SSI Units such as brick manufacturer) issued to various agencies are as below:-

Sr. No.	Name of Agency	Order No. And date	Period	Quantity Allotted	Quantity Lifted
1	M/s Irshad Enterprises, Mankapur , Nagpur	No.2255Dtd. 21.09.2020	31.03.2021	1500 MT MT/Month	2124 MT
2	M/s Satyam Bricks	No.168Dtd. 26.05.2018	1 Month	2000 MT MT/Month	NIL
3	M/s Bhoyar Bricks	No.167dtd.16.0 1.2021	Upto Jan-2024	500 MT MT/Month	227 MT
4	M/s Royal Uniforce	No.169	UptoJan-	2000 MT	246 MT

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Email -cegenkoradi@mahagenco.in

	Chinwada				
5	M/s Gaurav Bricks manufacturer, Nagpur	No.444 Dtd.18.02.2021	UptoFeb - 2024	3000 MT MT/Month	175 MT
6	M/s Irshad Enterprises, Mankapur , Nagpur	No.534 Dtd. 23.02.2021	01.04.2021 to 31.03.2024	3000 MT MT/Month	486 MT

Tender (eT-71980) against 80% quota was floated for sale / disposal of dry fly ash from 3 x 660 MW Unit of Koradi TPS for a period of fifteen years.Award of contract against through e-tender was issued to M/s Dristti Structural engineering Pvt. Ltd. for lifting 75 MT / day DPA lifting.

2) Pond Ash Utilization :-

a) Ash Dyke Raising:

Pond ash from Khasara ash bund is utilised for ash dyke raisingstarted from November-2019 & to till continued. Till date 15, 69,213 MT of pond ash ash is utilized for ash dyke raising of Khasara ash bund.

b) Koradi Ash Pond:

For ash utilization from Koradi ash pond of 210 MW following sale orders are issued at Free of Cost with site using charges:

Sr. No.	Name of Agency	Order No. And date	Period	Quantity Lifted
1.	M/s MEP Infrastructure ltd	No. 479 dtd 28.02.2019	From dtd 14.02.2018 to dtd 13.02.2019	21570 MT
2.	M/s Sai Engineering & Works	No. 3032 Dtd 28.12.2019	From dtd 29.12.2019 to dtd 28.12.2020	21 ,93,817 MT
3.	M/s Shri sai construction	No. 1478 Dtd 21.11.2020	From dtd 29.12 2020 to dtd 28.12.2021	893154 MT

c) Khasara Ash Pond:

For ash utilization from KhasaraAsh Pond of 3 x 660 MW following sale order is issued at Free of Cost with site using charges per day:

Sr. No.	Name of Agency	Order No. And date	Period	Quantity Lifted
1.	M/s MEP Infrastructure ltd.	No.292 dtd 14.02.2018	From dtd 14.02.2018 to dtd13.02.2019	21570 MT
	M/s	No. 244	From dtd	7515 MT

	mutiSamaaj.		to dtd 07.02.2019	
3.	M/s Singh Metal Works	No 2489 Dtd 04.09.2021	From dtd 04.09.2021 to dtd03.09.2022	336490 MT

3) Remote Silo: -

At present, remote silo with separate approach road is under commissioning stage Thiswork is executed by ProjectDepartment and commissioning of1stremotesilo shall be completedby end of Nov-2021 and 2nd& 3rdsilo by end of Dec-2021. However, Koradi TPS has made temporary arrangement from HSCD silo no. 1 for disbursement of Dry fly ash in a quantity of 2000 MT /day.

4) Separate Weighbridge:-

Due to increase in coal truck traffic, there is long queue at CHP weighbridge hence, for weighment of ash vehicles the time required is more than two hours, due to which some fly ash users are reluctant to lift fly ash from Koradi TPS. Hence separate weighbridge construction is in progress undercivil project office.

5) Cluster: -

To promote the fly ash utilisation as per the MSPGCL & State Ash Utilisation Policy, Maharashtra Govt. accorded approval to set up a fly ash-based industry at 23 hector occupied land of Koradi thermal power station. For the setup of industrial fly ash-based cluster, a Govt of Maharashtra issued a G.R. for changing the purpose of land vide G.R. LAND-2018/P.S.161/URJA-4 dtd. 10th July 2018.

Expression of Interest was published by MAHAGAMS for inviting prospective Fly ash based industries in proposed cluster.

In response officers of M/s. Shree Cement Ltd. Beawar, Dist. Ajmer (Raj.) India visited Koradi TPS on 13.10.2020 & 14.10.2020 for feasibility study for setting up of cement plant of capacity 2.5 million Metric Ton per year in the vicinity of Koradi fly ash cluster area. Their tentative requirement of ash is 3000 to 3500 MT/day. Agency shall also use pond ash when ever required.

In response to this follow up letters|ref no. KTPS/3X660 MW/ FAU/PL-60/2586 dtd 10.09.2021 & KTPS/3X660 MW/ FAU/PL-60/605 dtd 27.02.2021) given to M/s Shree Cement Ltd.

As per letter no.173 dtd 14.10.2021 from Director (Mining),8.17 Hector land from this industrial cluster is propused to be allotted to NIT, Nagpur for establishing ash based industries and for rehabiliation of unauthorised & displaced licensed holder of bricks manufactures under NIT Maujia, Bharatwada&Punapur at proposed industrial cluster - 1 near Koradi ash bund of Koradi Thermal Power Station.

6) Correspondence with Fly Ash based User:-

Correspondence is done with various prospective users of fly ash such as NHAI, MSRDC vide letter no. 1949 dtd 14.08.2020 & letter no. 1863 dtd 26.07.2019 respectively for their ongoing road projects.

Also correspondence is done with cement companies such as (a) M/s. Dalmia Cements (Bharat) Ltd, Yadwad vide letter no. KTPS/CE (O&M)/DFA/2020-21/1805 dtd29.07.2020. (b) M/s Dalmia cement works, Chandrapur vide letter no. KTPS/3X660 MW/FAU/2634 dtd 15.09.2021 and(c) M/s Wonder cement ltd. vide mail dated 23.08 2021.

In addition to above correspondence is done with various RMC units and Brick Manufacturer.

Also, it is requested to M/s. RCCPL to go for a long-term contract agreement with MSPGCL,request letter sent with ref no. KTPS/CE (O&M)/DFA/RCCPL/2020-21/1386 DTD 05.06.2020, Koradi TPS for ensuring utilization as a major customer.

In response M/s Birla Corporation Limited& M/s RCCPL Private Limited(Subsidiary of Birla Corporation Limited) officials visited 3x 660 MW Koradi Thermal Power Station for Lifting Fly Ash for their Cement plant which will be operational from end Dec -21 at Mukutban (Capacity 3.6 L T/Yr.) Taluka - Zari Jamani District – Yavatmal& RCCPL (0.8 L T/yr (Butibori, Nagpur already operational. The requirement of Fly Ash 1,10,000 MT/Month for Mukutban plant & 30,000 MT/Month for Butibori Plant.

To maximiseutilisation a one to one correspondence has made with fly ash-based brick manufacturer within the area of Nagpur region as a prospective user, however their daily consolidated requirement is not constant and very low i.e. below 1% as compared to generation of ash.

7) Back Filling of Mines:-

Koradi Thermal Power Station is exploring possibilities of use of fly ash for back filling of abandoned mines as per the MOEF guidelines by coordinating with WCL.

Officials of Koradi Thermal Power Station visited WCL Office on dated 13.07.2020 & 17.07.2020.

The main concerned of WCL is that most of the mines are situated near river bank namely Pench, Kanhan, Wardha rivers and hence cannot be given for ash filling as per environment norms due to fear of river water contamination.

As per CPCB letter no. B-33014/07/2020/IPC-II/TPP/7704 dtd 30.09.2020.CPCB forwarded list of abandoned mines for backfilling purpose identified by Taskforce of MoP to state PCB's. Out of which 3 mines are of WCL situated in Maharashtra i.e. Talwasa OC, Dholwasa OC, NaveenKunadaOC. These mines are situated in Chandrapur district and are not nearbyKoradi TPS.

8) Bulk transportation of Fly ash through railway wagons: -

Feasibility survey carried out by M/s RITES. DPR for bulk transportation of fly ash by railway & erection of platform along the railway track for loading of fly ash by loaders in open wagons is prepared by civil section and proposal for infrastructure development of railway line is submitted to HO for approval.

9) Use of washed coal with less ash content.

10) 24 X 7 ash loading facility:-

Koradi TPS is providing 24x7 hrs service for ashLifting vehicle for maximizing ash utilization. Continuous efforts will be taken to achieve the target of dry fly ash utilization.

नवभारत

MAHAGENCO

MAHARASHTRA STATE POWER GENEARATION CO. LTD., KORADI THERMAL POWER STATION.

ADVERTISMENT

Subject: Allotment of Fly Ash to units manufacturing fly ash or clay-fly ash bricks, blocks and tiles under 20% quota.

Applications are invited from manufacturers of fly ash or clay-fly ash bricks, blocks and tiles etc. on long term i.e. for 3 years / short term for 6 months basis as per the need & suitability of agency.

Applicants should submit following documents along with application, indicating fly ash quantity requirement (based on consumption/Plant Capacity):-

a) Valid consent to operate from MPCB.
b) Certificate from District Industries Centre (DIC).
c) GST registration.
d) Undertaking regarding purpose of fly ash.
e) No Objection Certificate from respective Village-Council/ Municipal corporation.
f) 7/12 Extract of Business area from revenue Department.
g) PAN Card in the Name of Business.
h) Electricity Bill of business area (DG set will not be taken into consideration).
i) Map showing the distance of manufacturing unit/plant of applicant from Thermal Power Station.

Last Date for applications to reach on or before 15/01/2021 at C/o The Chief Engineer(O&M), KTPS, Koradi -

Your Application should reach on or before 15/01/2021 **Office Address:** **C/o The Chief Engineer(O&M),** Koradi Thermal Power Station, Koradi, Urjabhavan, Koradi. PIN Code No.- 441111 EmailID:- cegenkoradi@mahagenco.in	**OR** **Contact:Shri D. B. Chaudhari,** Executive Engineer, (Ash Utilization Cell), Koradi Thermal Power Station, Koradi, Urjabhavan, Koradi PIN Code No.- 441111 Mobile No.- 8411004532 Email ID:-eekoradi@mahagams.in

Nagpur Edition
29-december-2020 Page No. 2
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MAHAGENCO

MAHARASHTRA STATE POWER GENERATION CO LTD.
KORADI TPS

ADVERTISMENT

Applications are invited for Dry Fly Ash lifting "Free of cost "at Koradi TPS 2x660 MW Salt/Ash Industries/Consortium/Individuals who are ash product manufacturer (i.e. cement/ bricks/ blocks, tiles manufacturing industries, processing industries, grinding units, EPS wall panel manufacturing industries, road construction agencies etc.) following terms and conditions.

ANNEXURE "A"

A)Special Terms & conditions are as below :-

1) Quantity: As per your requirement and availability of ash from the allotted area of Koradi TPS, (i.e.2x660 MW)

i) In case of less availability of dry fly ash at power station then the demand, proportionate quantity of dry fly ash will be issued on first come first serve basis. Decision of the Executive Engineer (Ash Utilisation Cell) in this regard will be final and binding on you.

ii) Agency should quote their daily & monthly requirement of dry fly ash. This will help in planning proper distribution of ash to various eligible agencies.

2) Validity of order: -This permission will be valid till 31.08.2021 & non-transferable. However, it can be cancelled by the Chief Engineer (O&M) at any time during its validity by giving a 7 days' notice in writing without assigning any reason thereof.

3) Manufacturer of ash-based products should submit relevant license of their business (i. e. consent to operate from pollution control board of respective area).

4) Transportation: - The dry fly ash should be transported preferably in closed trucks or tankers /Bulkers. The Trucks should be properly covered by tarpaulin to avoid spreading of ash during transportation.

a) The agency shall have to arrange on their own for Lifting, loading and unloading of ash & transporting in bulkers to avoid spreading of ash during transportation.

b) There should not be any type of Pollution while transportation of ash, if found permission will be stopped immediately.

c) You should submit the detail documents of your bulkers and drivers to EE (Ash Utilisation Cell) before starting the work.

d) Your bulkers should not be overloaded, if observed permission will be terminated.

5) **Sale rate of ash: - "Free of cost".**

a) Transportation cost is to be borne by the agency.

b) Security Deposit - Rs 25,000/- (in the form of cash/DD to be submitted after receipt of order for lifting of dry fly ash within a period of 7 days and before starting the work of lifting of dry fly ash.)

c) Above rate will be applicable till further guidelines from MSPGCL Corporate office, Mumbai.

6) **Safety & Security:** - It will be your responsibility to ensure safety & security of your personnel and property as well as the safety and security of MSPGCL personnel and property inside power station. The drivers of the ash transporting trucks and his assistant (cleaner) should be provided with safety shoes, helmets, nose mask and (PPE's) other safety equipment & ensure that they utilize the same while on job.

7) Your personnel will have to restrict their movement only in specific area of ash site. Any movement of your Personnel outside the specific area may lead to stoppage of issue of ash to you. In such case, the defaulters shall also be prosecuted.

8) You will be solely responsible for any accident, loss/damages caused to any person or to the MSPGCL property, plantation work etc. or the properties of surrounding owners etc arising during collection & transportation of ash. You will have to bear the cost incurred for repairing of made in good serviceable condition to any type of damages.

9) MSPGCL will not be responsible for any accident to your Drivers/ cleaners/ labours/ workers etc while removing/transporting ash. The labours engaged on trucks should follow the discipline.

10) Drivers of the vehicles should have valid license & vehicles should be on road with all necessary documents required like registration, insurance including valid PUC (Pollution control) Certificate, fitness certificate, permit etc. as per R.T.O. norms.

11) In case MSPGCL has to pay any amount towards any claim or compensation or penalty due to any accident and due to non-observance of any law, all the cost of defending and /or settlement etc will be recovered from & you shall be solely responsible for the same.

12) Lifting time is 24 hrs in a day, preferably you should plan maximum upto 12 night hours.

13) The agency should submit declaration/undertaking on non-judicial stamp paper of Rs. 500/- regarding (a) Non-use of lifted fly ash for agriculture purpose and will be used for declared purpose as per your application. (b) Transportation cost shall be borne by the agency.

14) You should ensure that your employees or the employees of agencies working on your behalf do not indulge in any attempt of the theft of the MSPGCL property. It may be noted that you will be held responsible for any event of theft or damage caused by them to the power station property and in the event of any such happening in addition to the legal action against the culprits, your permissions will be withdrawn, and all actions as may be deemed necessary shall be initiated against you.

15) You should submit Police verification reports of all your drivers/cleaners/labours/workers, which are authorized by you for this work.

16) Your activities of ash collection should not in any way cause any disruption /operational/ environmental effects in the day to day functioning of Koradi TPS. You will have to cooperate with the other agencies, permitted to collect fly ash from power station. In case of any dispute the same may be brought to the knowledge of the EE, (Ash Utilisation Cell). The habit of creating disputes by any of the agency will result in cancellation of its order and debarment from issuing any permission of ash collection in future.

17) You should depute your representative /employee who will co-ordinate the movement of your vehicles and report daily to Ash utilisation section regarding day to day lifting.

18) You will have to submit an affidavit on stamp paper regarding observance of all labours laws, Road Transport Acts, Pollution Control Act, responsibility & compensation for any accident inside/outside power station etc and absolve MSPGCL from all responsibilities of payment of any fine, claim of compensation etc. which may arise due to non-observance of any law related to collection, transportation and disposal of dry fly ash issued from Koradi TPS by you, your employees or employees of the agencies working on your behalf. Also, you will be responsible for payment of damages caused by you or your employees, or employees of the agencies working on your behalf, to any person or property, whether belonging to MSPGCL or any other person caused during any operation of collection, handling or transporting of dry fly ash issued by Koradi TPS.

19) Please ensure that while transporting the ash, it should not cause any pollution. If any fly-ash pollution is caused due to negligence of drivers of fly ash transporting vehicles, the penalty of Rs 500/- per occasion will be levied and it will be deducted from your security deposit. Similarly, if any agency / fly-ash user is penalized for such type of act 5 times, then agency's permission will be cancelled, and agency shall not be allowed for lifting the ash for next 6 months.

20) You should acknowledge and convey your acceptance before lifting of fly ash.

Interested bidders fulfilling all above conditions should submit their valid application within 15 days from the date of publication of advertisement and shall submit required proper documents to following address with mentioning - Applicant's name/unit name/telephone no. & **"Application for lifting of Dry Fly Ash at Free of cost" on sealed envelope."**

Your Application should reach on or before 01/02/2021 **Office Address:** **C/o The Chief Engineer (O&M).**	OR **Contact: Shri D. B. Chaudhari,** Executive Engineer, (Ash Utilization Cell), Koradi Thermal Power Station, Koradi.

लोकमत

नागपूर महानगरपालिका, नागपूर
(बाजार विभाग)
दुकान / ओटे ई-लिलाव

हनुमान नगर झोन क्र. 03 अंतर्गत म.न.पा. राष्ट्रीय गांधी मार्केट सक्करदरा येथील रिक्त दुकान / ओटे ई-लिलाव व्दारे आवंटन करण्यात येत आहे. इच्छुक व्यक्तीस सायंकाळच्या www.eauction.gov.in या संकेतस्थळावर दुकानाचे लिलावाबाबत विस्तृत माहिती तसेच ई-लिलावाच्या तारखेचा तपशीलवार प्राप्त करुन घेता येईल.

Advt No : 771/PR
Date : 12/03/2020

बाजार अधिक्षक
म.न.पा.नागपूर

MAHAGENCO
ADVERTISEMENT
जाहिरात

Extension of last date of Submission for Application of for dry fly ash lifting at Free of cost from Koradi TPS 3 X 660 MW silo from Industries/consortium/individuals.

Ref no KTPS/CE/Mahagams/ advertisement for availability of dry fly ash at free of cost

Nature of work : Application are invited for dry fly ash lifting at Free of cost from Koradi TPS 3 X 660 MW silo from fly ash based industries/consortium/individuals who fulfil conditions as per our earlier published advertisement in daily news paper on 26.02.2020

कामाचे स्वरूप : दिनांक २६.०२.२०२० रोजी मुख्य पेपर मध्ये प्रसिद्ध केलेल्या जाहिरातीच्या अटींची पूर्तता करणाऱ्या संबंधित आधारित उद्योग / समूह / व्यक्ती यांच्या कडून ३ x ६६० मे.वट, कोराडी औ.वि केंद्रातील उपलब्ध असलेली कोरडी राख मोफत देण्याबाबत अर्ज मागविण्यात येत आहेत.

Extended last date for submission of application अर्ज करण्याची वाढविलेली शेवटची दिनांक	**23.03.2020 upto 15hrs.** **दिनांक २३.०३.२०२० रा. १५.०० वाजेपर्यंत**
For further details please contact	cegenkoradi@mahagenco.in eekoradi@mahagams.in. https://mahagenco.in->webmail\tenders-> KORADI advt. for availability of dry fly ash at free of cost

MAHAGENCO
CIN: U40100MH2005SGCL153648

MAHARASHTRA STATE POWER GENERATION CO. LTD.
KORADI THERMAL POWER STATION (3x660MW)
Office of Chief Engineer (O & M), T.P.S., Koradi, Dist. Nagpur, PIN – 441111
Phone: (07109) 262141 to 262146,262306, 267109 FAX: 262127(OM)
Email – cegenkoradi@mahagenco.in

Ref. No.:KTPS/3X660MW/CIVIL/ No - 498 **Date:** 23 MAY 2021

OFFICE NOTE

Subject: Part A) FSR, DPR & project management consultancy and construction of proposed BG railway siding & allied work for utilization of Fly ash at 3x660MW, TPS, Koradi.

Part B) Development & construction of store sheds, roads, drains, UCR masonry work, RCC open material yard & modification to existing store sheds of major store phase-II at 3x660MW, TPS, Koradi.

The power generation capacity of TPS, Koradi has been enhanced by 3x660MW super critical unit 8, 9 &10 which were commissioned in year 2015, 2016 & 2017 respectively, all the three units are in operation.

Further as per discussion held during the video conference on dtd-09.07.2020 with railway authority of Nagpur division along with TPS, Khaperkheda & M/s Adani Power (Tiroda Unit), railways are planning to transport fly ash generated from various Thermal Power Station to the End user by facilitating the provision of empty rakes for transportation with discount in freight charges & provision of mini rakes comprising 20 to 30 rail wagons etc. for both direct loading in wagons or in jumbo (ash) bags.

If railways are offering such facilities, ash utilization of 3x660MW, TPS, Koradi shall be enhance which shall fulfill the MOEF condition for ash utilization. Hence for utilizing such facility from railway ash loading facility in wagons at remote silo shall require at 3x660MW, TPS, Koradi.

In view of above, it has been requested to Chief Engineer (Civil-I), HO, Mumbai vide letter CE|O&M)/3X660MW/DFA/Railway feasibility study/2020/1674 dt. 11.07.2020 to explore the possibility of rail track below remote silo for fly ash utilization.

Hon M.D. MAHAGAMS directed in ash utilization review meeting of all TPS conducted through video conference on dtd-11.01.2020 to take-up the work of readiness of remote silo and railway siding for transportation of fly ash through railway on top priority. Also Chief Operating Officer vide their letter COO/MAHAGENCO/F.A. Transportation/Railway/Infra/236 date. 24.09.2020 asked for conducting a feasibility study survey for the construction of railway siding for utilization of fly ash.

As such M/s Rites has submitted competitive offer along with drawing vide letter RITES/PO/NGP/BD-2019/G-43/VOL 72/4060, Dtd-04.09.2020 & revised offer emailed on dtd- 22.01.2021 for Construction of BG. Railway siding for ash utilization from remote silo at 3x660MW, TPS, Koradi.

As per discussion with M/S. RITES representative, the budgetary tentative cost estimate Rs. 35,14,33,025.10 for the B.G. Railway siding for ash utilization at 3x660MW TPS, Koradi has been prepared considering all the demolition of structures which are fouling

Ref. No.:KTPS/3X660MW/CIVIL/ **Date:**

in the alignment of proposed B.G. Railway siding such as major store phase-I sheds (6 Nos), UCR compound wall at 2 locations, concrete road crossing at 2 location, remote silo platform foundation, MSETCL tower foundation , shifting of 130MLD pipeline. And also in the budgetary offer of M/s. RITES the cost of restoration of demolished UCR compound wall at 2 locations & construction of new internal UCR wall to isolate the major store phase-I has been considered.

The details of tentative budgetary gross estimate cost Rs. 35,14,33,025.10 submitted by M/s. RITES is tabulated hereunder:

SR.No	Detail of Head	Estimated Cost in Rs.
	Railway Premises	
1	Civil & P-way works	19,10,44,428.00
2	OHE Works	3,19,75,104.50
3	Cost of S&T Works	3,50,00,000.00
	Total in Rs(Excluding GST if any)	**25,80,19,529.00**
	GST (18%)	4,64,43,515.22
	Contingencies @ 3%	77,40,585.87
	Railway fees on SN.1 @ 4%	76,41,777.00
	Railway fees on SN.2 @ 6.25%	19,98,444.03
	Railway fees on SN.3 @ 6.25%	21,87,500.00
	RITES fees @ 9%	**2,32,21,787.61**
	GST (18%) on RITES Fees	41,79,916.37
	Gross estimate cost	**35,14,33,025.10**

As described above, major store phase-I sheds (6nos), fouling in the alignment of proposed BG railway siding for ash utilization are required to be reconstructed& also requires modification work of existing store shed (4Nos). In phase-I of major store no sufficient area is available to accommodate new store shed construction.

However, to accommodate new store shed the sufficient area is available in major store phase-II premises. In order to construct new store shed in major store

phase-II premises a complete development work of major store phase-II area is required along with provision of following work.

1. 9.00 Nos of shed of size 20mx30m (6.00 Nos shed which are fouling in proposed BG railway siding & additional 3.00 Nos new shed)
2. 1.00 No new shed of size 40mx60m with EOT crane arrangement.
3. Concrete roads & drains work in phase-I & phase-II area with complete development.
4. Modification work of existing M/s. L&T store shed 4.00 Nos. of size 12.50mx40m.
5. Peripheral UCR masonry wall work for major store area phase-II.

The details of tentative budgetary gross estimate cost Rs. 33,17,09,205.20 is tabulated hereunder:

Estimate cost	246587277.33
Add 1% for Insurance	2465872.77
Add 8% for Electrification + 2% for EOT Crane	24658727.73
Add 2% for security system	4931745.55
Add 1% for Fire fighting	2465872.77
Net Total (without GST)=	281109496.16
Net Total (with GST)=	331709205.20

Therefore, the estimate is prepared by considering above work & accordingly DPR is prepared.

Part A) FSR, DPR & project management consultancy and construction of proposed BG railway siding & allied work for utilization of Fly ash at 3x660MW, TPS, Koradi.

The Estimated cost of this work Rs. 35,14,33,025.10 (With GST)

Part B) Development & construction of store sheds, roads, drains, UCR masonry work, RCC open material yard & modification to existing store sheds of major store phase-II at 3x660MW, TPS, Koradi.

The Estimated cost of this work Rs. 33,17,09,205.00 (With GST)

MAHAGENCO
Maharashtra State Power Generation Co. Ltd
CIN: U40100MH2005SGC151648

MAHARASHTRA STATE POWER GENERATION CO. LTD.
KORADI THERMAL POWER STATION (3x660MW)
Office of: Chief Engineer (O & M), T.P.S., Koradi, Dist. Nagpur, PIN – 441111
Phone: (07109) 262141 to 262146,262106, 262109 FAX: 262127(Off)
Email –cegenkoradi@mahagenco.in

Ref. No.:KTPS/3X660MW/CIVIL/ **Date:**

the total expenditure for the complete scheme for above mentioned work (Part A+ Part B) is **Rs.68,31,42,230/- (With GST).**

The budget provision is not available for this work, as such it is proposed to take up this work in CAPEX budget of 3x660MW, TPS Koradi. In view of above it is requested to process the above DPR for administrative approval from competent authority.

Chief Engineer (O&M)
3x660MW, TPS, Koradi.

To,
Chief Engineer (CIVIL)-III
MSPGCL, Mumbai

Annexure- 8

Mahabal Enviro Engineers Pvt. Ltd.

Engineer, Consultant, Environmental Monitoring Laboratory & Contractor
Plot Nos. 13,14,17,18, Grampanchayat Bokhara, 9 km from Nagpur City,
Opp. Patel Petrol Pump, Chhindwara Road, Koradi, Dist.Nagpur-441111
Phone : 91-712-2612162, 2612212, WP:9326279040 Email: mahabal.nagpur@gmail.com

Test Report

Report No.: ME-NG12615-210914-SA-KTPS-KORADI			**Date:** 14.09.2021
Name and Address of Customer	**THE CHIEF ENGINEER, MAHARASHTRA STATE POWER GENERATION COMPANY LIMITED,** Koradi Thermal Power Station(3X660MW) Koradi, Dist. Nagpur		**Order Reference:** PO NO: KTPS/ 4550005523 /0951 PO Date: 24.09.2020
Sample Description/Type	Industrial Effluent	**Sample Collected by**	Laboratory
Sampling Location	Ash Bund (Khasara)	**Sample Quantity/Packing**	10 L X 1 No. PVC Can 100 mL X 1 No PVC Can 500 mL X 1 No. PVC Can 1 L X 1 No. Glass Bottle
Date of Sampling	02.09.2021	**Date of Receipt of Sample**	02.09.2021
Sampling Procedure	IS:3025(Part I): 1987 RA2003. APHA 23rd Ed. 2017, 1060-B, 1-40		
Date of Start of Analysis	02.09.2021	**Date of Completion of Analysis**	14.09.2021

Sr. No.	Parameter	Unit	Result	#Limit	Method Reference
Discipline: Chemical Testing; Product Group: Pollution & Environment (Waste Water)					
1.	Temperature	°C	28	Shall not exceed 5°C above the receiving water temperature	APHA 23rd Ed. 2017, 2550-B, 2-74
2.	pH	-	8.3	5.5 to 9.0	APHA 23rd Ed. 2017, 4500-H+-B, 4-95
3.	Total Dissolved Solids	mg/L	731	-	IS 3025 (Part 16):1984 RA 2006, Ed.2.1(1999-12)
4.	Total Suspended Solids	mg/L	12	100 Max.	APHA 23rd Ed. 2017, 2540-D, 2-70
5.	Total Residual Free Chlorine	mg/L	BDL (DL:0.05)	1.0 Max.	APHA 23rd Ed. 2017, 4500-Cl-G, 4-72
6.	Sulphate (as SO_4)	mg/L	59.4	-	APHA 23rd Ed. 2017, 4500-SO_4-E, 4-199
7.	Phosphate Total (as P)	mg/L	0.484	5.0 Max.	APHA 23rd Ed. 2017, 4500-P E, 4-164
8.	Fluoride (as F)	mg/L	1.06	2.0 Max.	APHA 23rd Ed. 2017, 4500-F- D, 4-90
9.	Nitrate (as NO_3-N)	mg/L	6.79	10 Max.	APHA 23rd Ed. 2017, 4500-NO_3-E, 4-131
10.	Dissolved Oxygen	mg/L	5.9	-	APHA 23rd Ed. 2017, 4500-O. B, 4-144 & C, 4-146
11.	Biochemical Oxygen Demand (3days 27°C)	mg/L	5.6	30 Max.	IS 3025 (Part 44). 1993, Reaffirmed 2009
12.	Chemical Oxygen Demand	mg/L	20	250 Max.	APHA 23rd Ed. 2017, 5220-B, 5-18

Plot No. F-7, Road No. 21, MIDC Wagle Estate, Thane West - 400604, Maharashtra
(Turn Opp Toyota Show Room 600 m from Hotel Rukhmini Palace, Next to Ashida Electrical Near I B Sawant Bus Stop)
Phone: 2582 0658/3139/1663/3154 Fax:+91-22-25823543 thane@mahabal.com

Mahabal Enviro Engineers Pvt. Ltd.
Engineer, Consultant, Environmental Monitoring Laboratory & Contractor
Continuation Sheet

Report No.12615 Cont...

Sr. No.	Parameter	Unit	Result	# Limit	Method Reference
13.	Oil and Grease	mg/L	N.D.	10 Max.	IS 3025 (Part 39). 1991, Reaffirmed 2009, Amds.1
14.	Sulphide (as S)	mg/L	N.D.	2.0 Max.	APHA 23rd Ed. 2017, 4500-S -C 4-163, F-4-167
15.	Chloride (as Cl)	mg/L	181	-	APHA 23rd Ed. 2017, 4500-Cl-B, 4-75
16.	Fixed Dissolved Solids	mg/L	601	-	APHA 23rd Ed. 2017, 2540-C, 2-69, E. 2-71
17.	Phenolic Compounds (as C_6H_5OH)	mg/L	N.D.	1.0 Max.	APHA 23rd Ed. 2017, 5530- B & C, 5-49, 5-50
18.	Cyanide (as CN)	mg/L	N.D.	0.2 Max.	APHA 23rd Ed. 2017, 4500-CN, C & E, 4-44 & 4-46
Residues in water (Trace metal Element)					
19	Iron (as Fe)	mg/L	0.550	3 Max.	IS 3025(Part 2), 2019
20.	Manganese (as Mn)	mg/L	BDL (DL:0.01)	2 Max.	IS 3025(Part 2), 2019
21.	Copper (as Cu)	mg/L	BDL (DL:0.01)	3.0 Max.	IS 3025(Part 2), 2019
22.	Lead (as Pb)	mg/L	N.D.	0.1 Max.	IS 3025(Part 2), 2019
23.	Zinc (as Zn)	mg/L	0.056	5.0 Max.	IS 3025(Part 2), 2019
24.	Arsenic (as As)	mg/L	N.D.	0.2 Max.	IS 3025(Part 2), 2019
25.	Mercury (as Hg)	mg/L	N.D.	0.01 Max.	APHA 23rd Ed. 2017, 3112-B, 3-25
26.	Chromium Hexa (as Cr^{6+})	mg/L	N.D.	0.1 Max.	APHA 23rd Ed. 2017, 3500- Cr-B, 3-71
27.	Chromium Total (as Cr)	mg/L	N.D.	2.0 Max.	IS 3025(Part 2), 2019
28.	Cadmium (as Cd)	mg/L	N.D.	2.0 Max.	IS 3025(Part 2), 2019
29.	Selenium (as Se)	mg/L	N.D.	0.05 Max.	IS 3025(Part 2), 2019
30.	Nickel (as Ni)	mg/L	BDL (DL:0.01)	3.0 Max.	IS 3025(Part 2), 2019
31.	Vanadium (as V)	mg/L	BDL (DL:0.01)	-	IS 3025(Part 2), 2019

Remarks: #: Limits as per E(P)A rules- general standard for disposal in inland surface water; N.D. - Not Detected; BDL: Below Detection Limit, DL: Detection Limit

END

FOR MAHABAL ENVIRO ENGINEERS PVT. LTD.

Harish Mendhi
TECHNICAL MANAGER

Note
1. The result listed refers only to the tested sample(s) and applicable parameter(s).
2. This report is not to be reproduced except in full, without written approval of the laboratory.

QF/SALA 07 Issue No 03 Dt 05.12.2019 Amd 00 Dt 00

Plot No. F-7, Road No. 21, MIDC Wagle Estate, Thane West - 400604, Maharashtra
Phone: 2582 0658/3139/1663/3154 Fax:+91-22-25823543 thane@mahabal.com

Mahabal Enviro Engineers Pvt. Ltd.

Engineer, Consultant, Environmental Monitoring Laboratory & Contractor
Plot Nos. 13,14,17,18, Grampanchayat Bokhara, 8 km from Nagpur City,
Opp. Patel Petrol Pump, Chhindwara Road, Koradi, Dist.Nagpur-441111
Phone : 91 712 2612162, 2612712, WP.9326279040 Email: mahabal.nagpur@gmail.com

Test Report

Report No.: ME-NG12615-210914-SA-KTPS-KORADI			**Date:** 14.09.2021
Name and Address of Customer	**THE CHIEF ENGINEER, MAHARASHTRA STATE POWER GENERATION COMPANY LIMITED,** Koradi Thermal Power Station(3X660MW) Koradi, Dist. Nagpur.		**Order Reference:** PO NO:.KTPS/ 4550005523/ 0051 Date:24.09.2020
Sample Description / Type	Industrial Effluent	**Sample Collected by**	Laboratory
Sampling Location	Ash Bund (Khasera)	**Sample Quantity / Packing**	10 L X 1 No. PVC Can 500 mL X 1 No. PVC Can
Date of Sampling	02.09.2021	**Date of Receipt of Sample**	02.09.2021
Sampling Procedure	IS:3025(Part 1): 1987 RA2003, APHA 23rd Ed. 2017, 1060-B, 1-40		
Date of Start of Analysis	02.09.2021	**Date of Completion of Analysis**	14.09.2021

Sr. No.	Parameter	Unit	Result	#Limit	Method Reference
1.	Free Ammonia (as NH_3)	mg/L	0.116	5.0 Max.	MERI Manual Page 51
2.	Total Kjeldahl Nitrogen	mg/L	0.616	100 Max.	APHA 23rd Ed. 2017, 4500 NH_3-B & C, 4-114, 4-116 or F 4-119&4500 N_{org} B-4-139
3.	Chromium Trivalent (as Cr^{3+})	mg/L	N.D.	0.1 Max.	IS 3025(Part 2), 2019
4.	Bioassay test	-	Free from acute lethal toxicity	-	IS 6582:1971, Reaffirmed 2003

Remarks. #: Limits as per E(P)A rules- general standard for disposal in inland surface water; N.D. = Not Detected, BDL: Below Detection Limit, DL: Detection Limit;

END

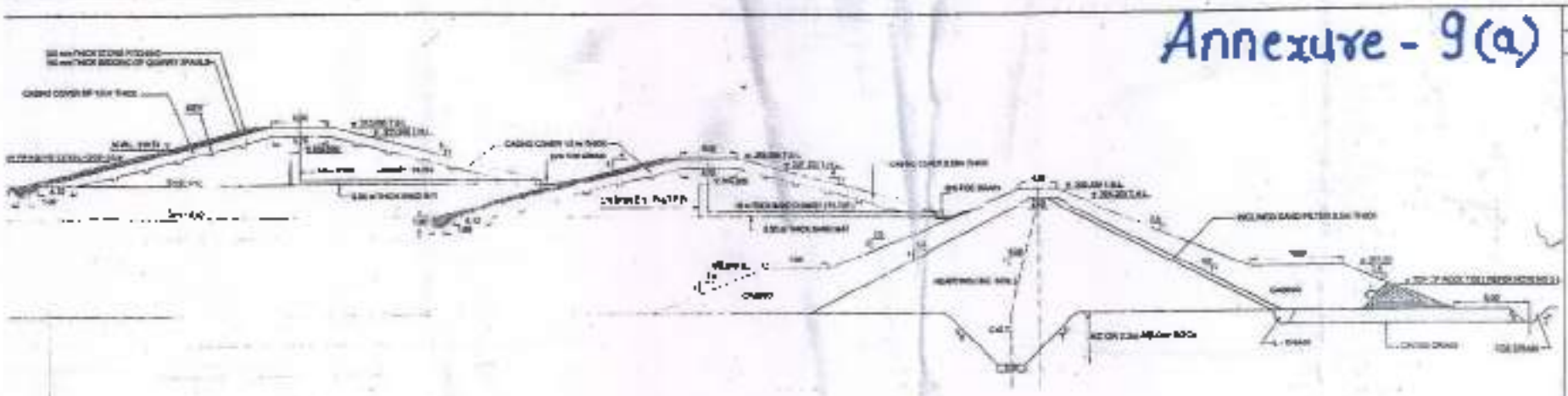
FOR MAHABAL ENVIRO ENGINEERS PVT. LTD.

Harish Mendhi
TECHNICAL MANAGER

Note
1. The result listed refers only to the tested sample(s) and applicable parameter(s)
2. This report is not to be reproduced except in full, without written approval of the laboratory.

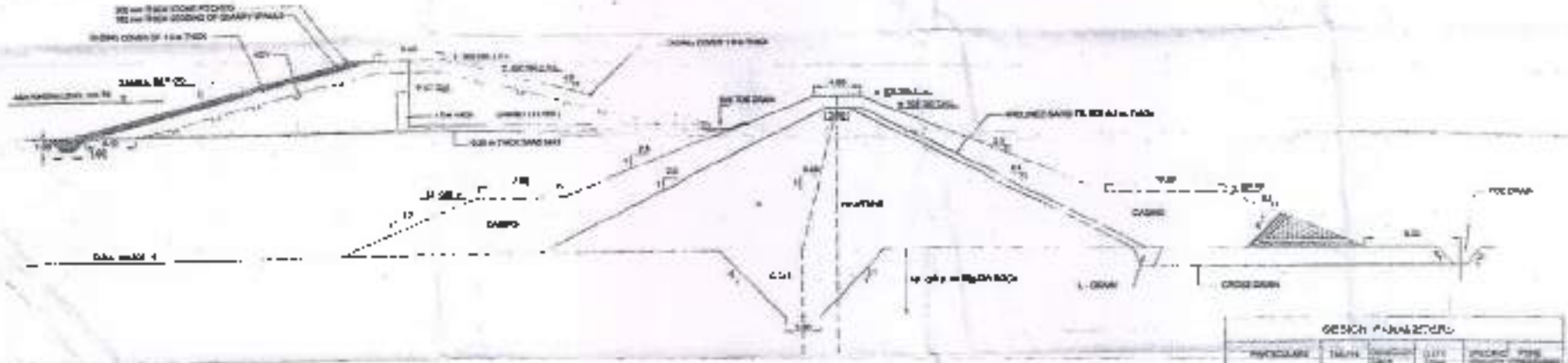
Plot No. F-7, Road No. 21, MIDC Wagle Estate, Thane West - 400604, Maharashtra
(Land Opp. Toyota Show Room 600 m from Hotel Rukhmini Palace, Next to Ashida Electrical, Near J B Sawant Bus Stop)
Phone: 2582 0658/3139/1663/3154 Fax:+91-22-25823543 thane@mahabal.com

Annexure - 9(a)



CROSS SECTION OF ASH BUND AT R.D. 895.000 m UP TO R.L. 312.00m AS PHASE II

(APPLICABLE FROM R.D. 0.00 TO 344.00 m)



CROSS SECTION OF ASH BUND AT R.D. 895.000 m UP TO R.L. 308.500m AS PHASE-I

(APPLICABLE FROM R.D. 0.00 TO 344.00 m)

DESIGN PARAMETERS

PARTICULARS					
HEARTING (R.C.C.C.)	0.0	3.0	1.0	2 nd	100%
HEARTING(FLY ASH)	1.0	0.0	0.0	2.0	100%
FOUNDATION					
FD = FLY ASH	0.0	3.0	0.0	2.0	
FD = R.C.C.C.	0.0	0.0	1.0	2.0	
FD = SAND STONE	0.0	0.0	0.0	2.0	
FD = HARD ROCK	0.0	0.0	1.0	0.0	

GENERAL NOTES

1 ALL DIMENSIONS ARE IN METRIC EXCEPT

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GOVERNMENT O

CENTRAL DESIGN

MAHARASHTRA STATE ELEC

KORADI THERMAL POW

ASH BUND AT

CROSS SECTIONS OF AS

AT R.D. 895.0 m UP TO T

PHASE - I And 312.00m

Annexure - 9(A)

Annexure- 9(b)

12/4/2021

Annexure-10

MAHAGENCO

MAHARASHTRA STATE POWER GENERATION CO. LTD.
KORADI THERMAL POWER STATION
[illegible]

Ref. No: KTPS/CE (O&M) /2020-21/CGM (EAS)/ [illegible] Date: 12 JAN 2021

To

The Chief General Manager (E&S),
MSPGCL,
H.D.I.L. Bldg., 4th floor, Prof A. K. Marg,
Bandra (E), Mumbai - 400051.
Email: cgmenvsafe@mahagenco.in

Sub: MPCB directives regarding Hon'ble NGT order dtd. 13/02/2020 in O.A. No. 117,499,102/2014 on utilization of fly ash for mine backfilling.

Ref:

1) Govt. of India Min of Power Letter No. 9/7/2011-St. Th. (Vol.5) Dtd. 06.07.2020.
2) CPCB letter No. B-33014/07/2020/IPC-II/TPP/7704 Dtd. Sept. 30, 2020.
3) MPCB letter No. MPCB/JD(APC)/TB-2/B-168 Dtd. 01.01.2021.

With respect to the subject matter and the letter under reference (1), as per Hon'ble NGT order, Min. of Power has conveyed to CPCB a List of 21 mines identified for fly ash filling in CIL and SCCL.

As per letter under reference (2), CPCB has forwarded the list of abandoned mines for mine back-filling purpose identified by Task Force of MoP to State PCBs.

As per ref. (3) MPCB has directed us to approach WCL for signing MoU for back-filling of abandoned mines in the state nearby power station by ash. The mines indentified in WCL Company (Administrative area Majri Dist.Chandrapur) which are around 120 KM from Koradi TPS (As per Google Map distance between Koradi to Majri in KM).

It is requested to put up the matter for the appraisal of Competent Authority at HO and convey us the further directives.

Submitted for further needful in the matter please.

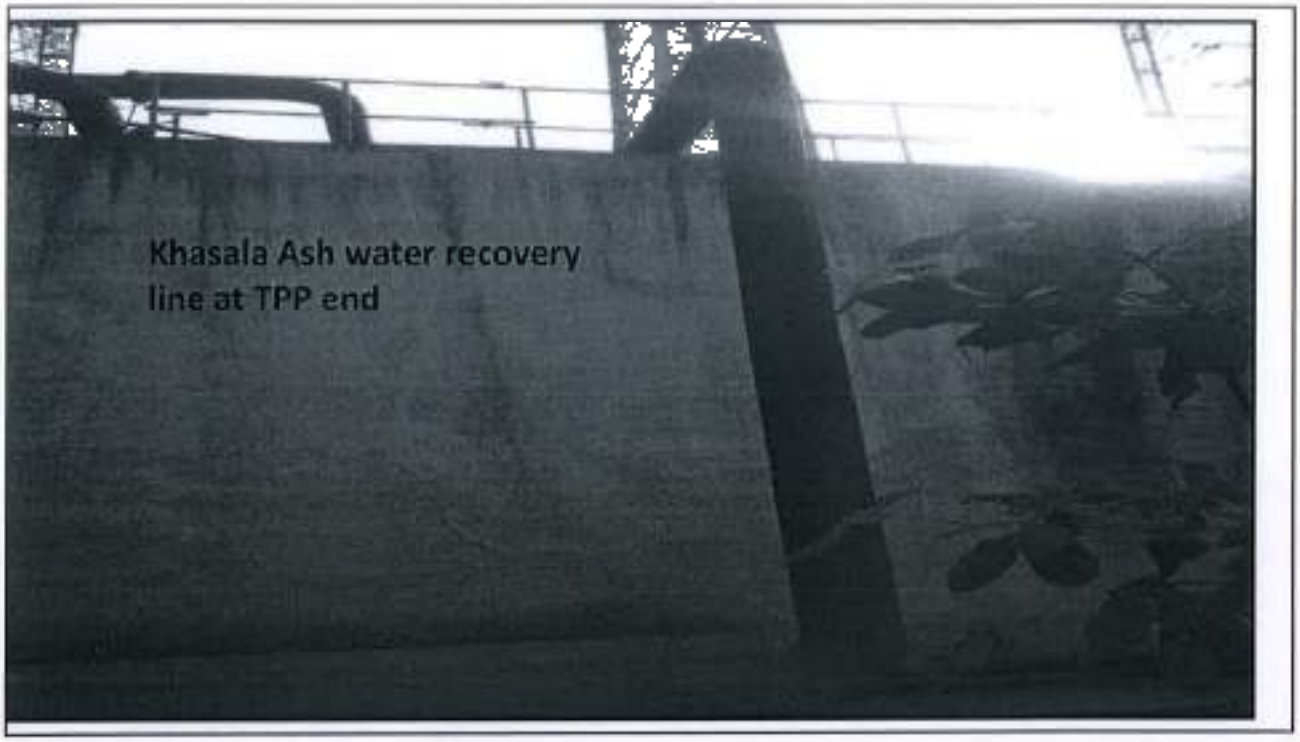
Chief Engineer (O&M),
Koradi TPS.

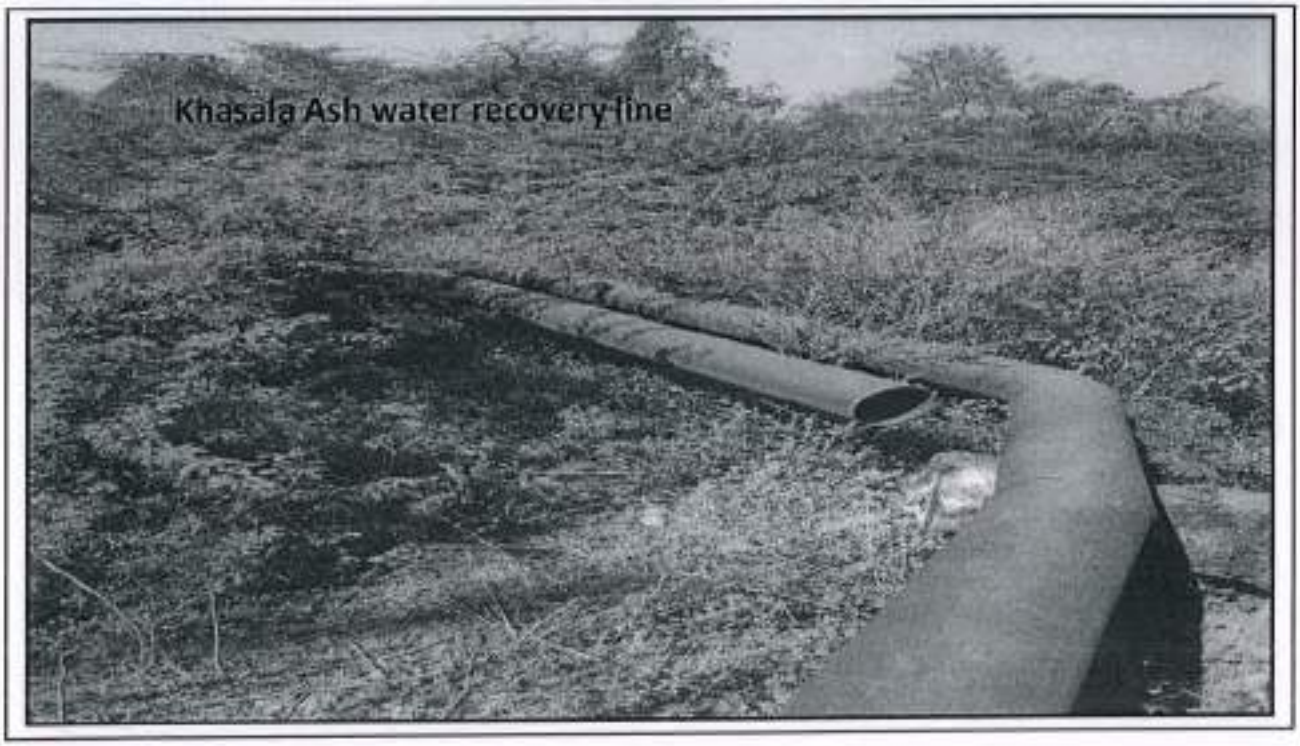
Annexure- 11

Natural Draft Cooling Tower available at
3X660 MW, Koradi TPS

Annexure - 12

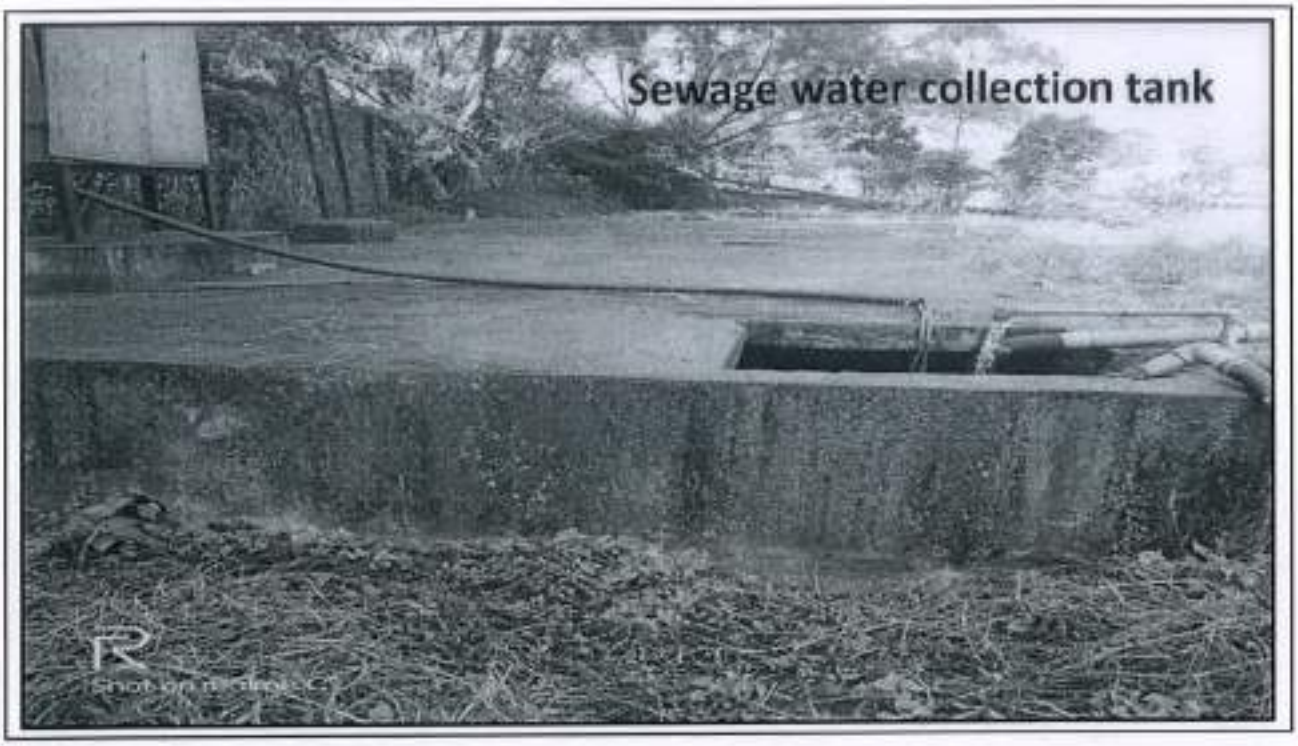
12/4/2021

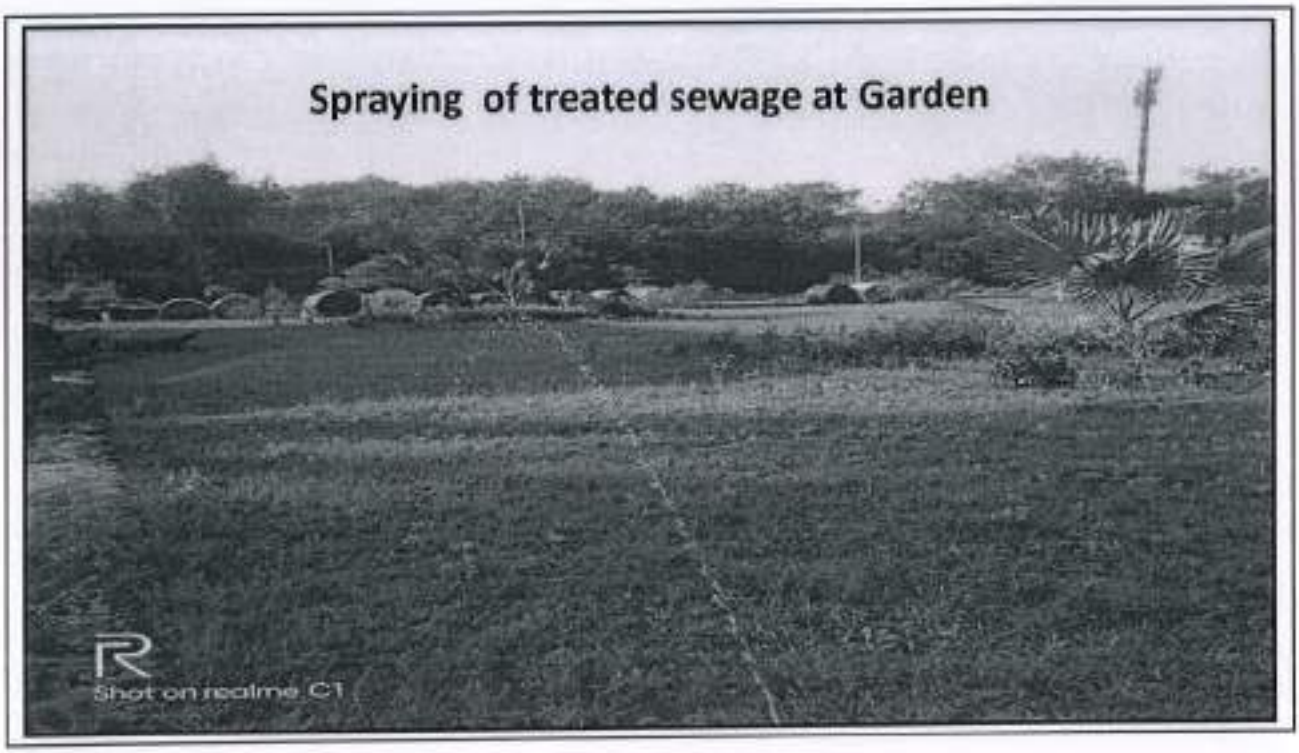




Annexure - 13

12/4/2021





Annexure - 14(a)

भारत सरकार
Government of India
जल संसाधन, नदी विकास एवं गंगा संरक्षण मंत्रालय
Ministry of Water Resources, River Development & Ganga Rejuvenation
केन्द्रीय भूमिजल बोर्ड
Central Ground Water Board
मध्य क्षेत्र
Central Region

No. CGWB/CR/Authority/Tech. Approval/RWH/2016-17/ 1 1 2
Date: 4/10/2016

By Speed Post

The Deputy Chief Engineer (Civil)
Civil Construction Circle, M.S.P.G.C.L
Koradi, District – Nagpur -441 111

Sub: Technical Approval for implementation of proposed Rainwater Harvesting Scheme at Koradi 3 X 660 MW Expansion Project.

Ref: Your letter No. DY.CE(C)/C.C.C./KRD/Tech./2404 dated 22.9.2016.

Sir,

This has a reference to the subject cited above. In this connection your project report entitled "Preparation of Hydrogeological investigation report for approval of rainwater harvesting system" for Mahagenco, Koradi 3 X 330 MW expansion project" submitted vide above referred letter for accord of technical approval of CGWB has been evaluated. Based on the project report, the scheme for implementation of Rain Water Harvesting Scheme is found technically feasible and the same is technically approved with following comments and recommendations for its successful implementation.

Comments and Recommendations

1) Sincere efforts shall be made to utilize a total rainwater harvesting potential of 16,27,550.76 m^3/year available in the project area for augmentation of groundwater resource.

2) The proposed two (2) nos. surface water ponds with an area of 45000 sq.m and depth of 2.0 m are found feasible hence approved with modifications. Since the estimated runoff potential of the project area is quite high, it is recommended to increase depth of the surface water pond upto 4 m bgl to create storage potential of 1,80,000 m^3 in single filling. Considering repetitive annual three (3) fillings, the gross storage capacity of one (1) surface water pond will be 5,40,000 m^3. Thus the two (2) no surface water ponds will have a gross storage potential of 10,80,000 m^3.

3) The proposed 10 nos. recharge / injection wells within the two (2) surface water ponds are also found feasible and hence approved. This will enhance the recharge rate into the sub-surface aquifer and will also ensure maximum infiltration with less evaporation losses.

4) Periodic cleaning of both two (2) nos. storage reservoirs / ponds should be carried out on regular basis, preferably prior to the onset of monsoon to maintain the recharge efficiency of these structures.

5) It is recommended that storm water from all the surface water drains should be passed through the filters before diverting into 2 nos. storage reservoir to avoid siltation for maintaining the storage capacity and also to enhance the recharge efficiency. The filters should also be periodically cleaned preferably prior to the onset of monsoon.

6) Casing pipe of 4.5 m above the bottom of storage pond / tank shall be provided to avoid the siltation in all the recharge / injection well *(Annexure – I)* constructed at the bottom of tank.

7) Since, the recommended depth of proposed depth of the storage reservoir is 4.0 m bgl, hence proper safety/ precautionary measures may be taken up by construction of wire fencing around the surface water pond to prevent any mishap.

8) Regular monitoring of ground water levels shall be carried out in the project area. For this, it is advised to construct 1 no. piezometer at suitable location in the project area preferably in downstream area. The depth of piezometer should be 30 m below ground level. The groundwater levels shall be monitored in the piezometer on monthly basis, preferably on last day of every month.

9) Groundwater quality should also be checked from the piezometer during pre-monsoon season (May month) of every year to keep track of groundwater quality.

10) Ground water level and water quality data should be regularly submitted to the office of the Regional Director, CGWB, Central Region, Nagpur on quarterly basis and record should also be maintained with the project authority and produced at the time of inspection by this office.

11) After the completion of the project, selected good quality representative photographs of all the rain water harvesting structures along with their construction and capacity details should be sent to this office for perusal and record.

After the construction of the proposed artificial recharge and rain water harvesting structures, this office may be informed for carrying out the inspection of the structures. The present technical approval of the proposed structures is subject to implementation of above recommendations. Further yearly inspection of the ground water scenario in general and recharge/conservation structures in particular may also be carried out by CGWB. This office may be consulted for any further technical guidance/assistance during the course of implementation of the RWH project.

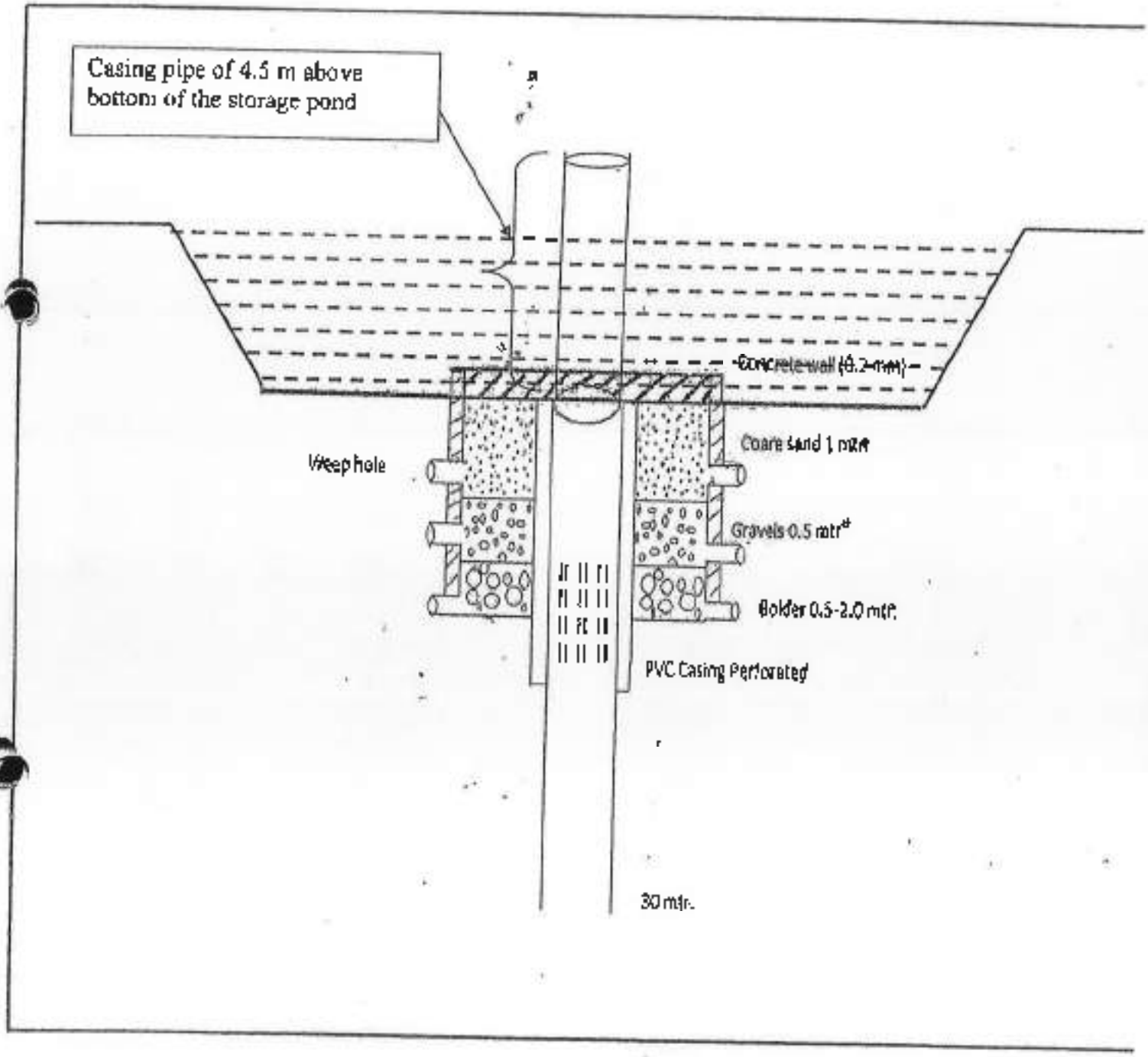
Yours faithfully,

4/10/16

(D. Subba Rao)
Regional Director

Annexure – I

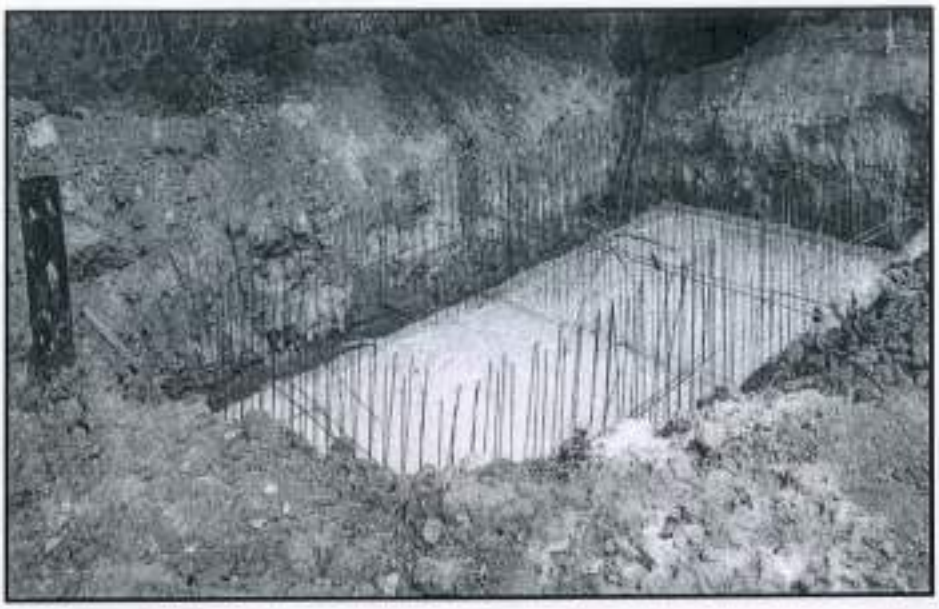
APPROVDED DESIGN OF RECHARGE / INJECTION WELL APPROVED FOR CONSTRUCTION WITHIN THE 2 NUMBERS STORAGE PONDS



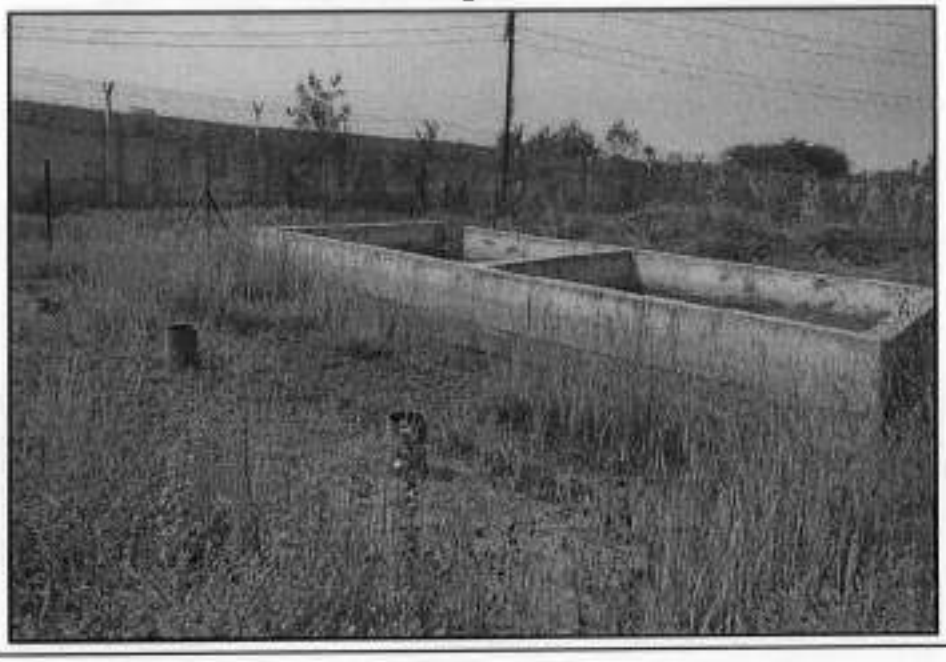
Annexure-14(b)

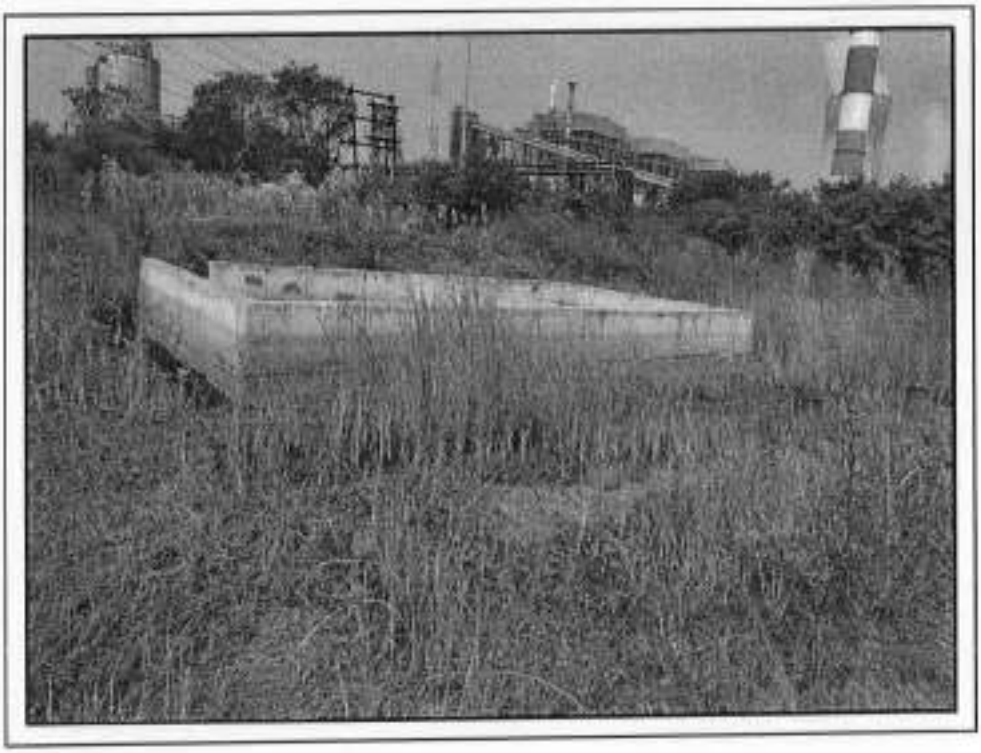
12/4/2021

Work at Tertiary Treated water reservoir



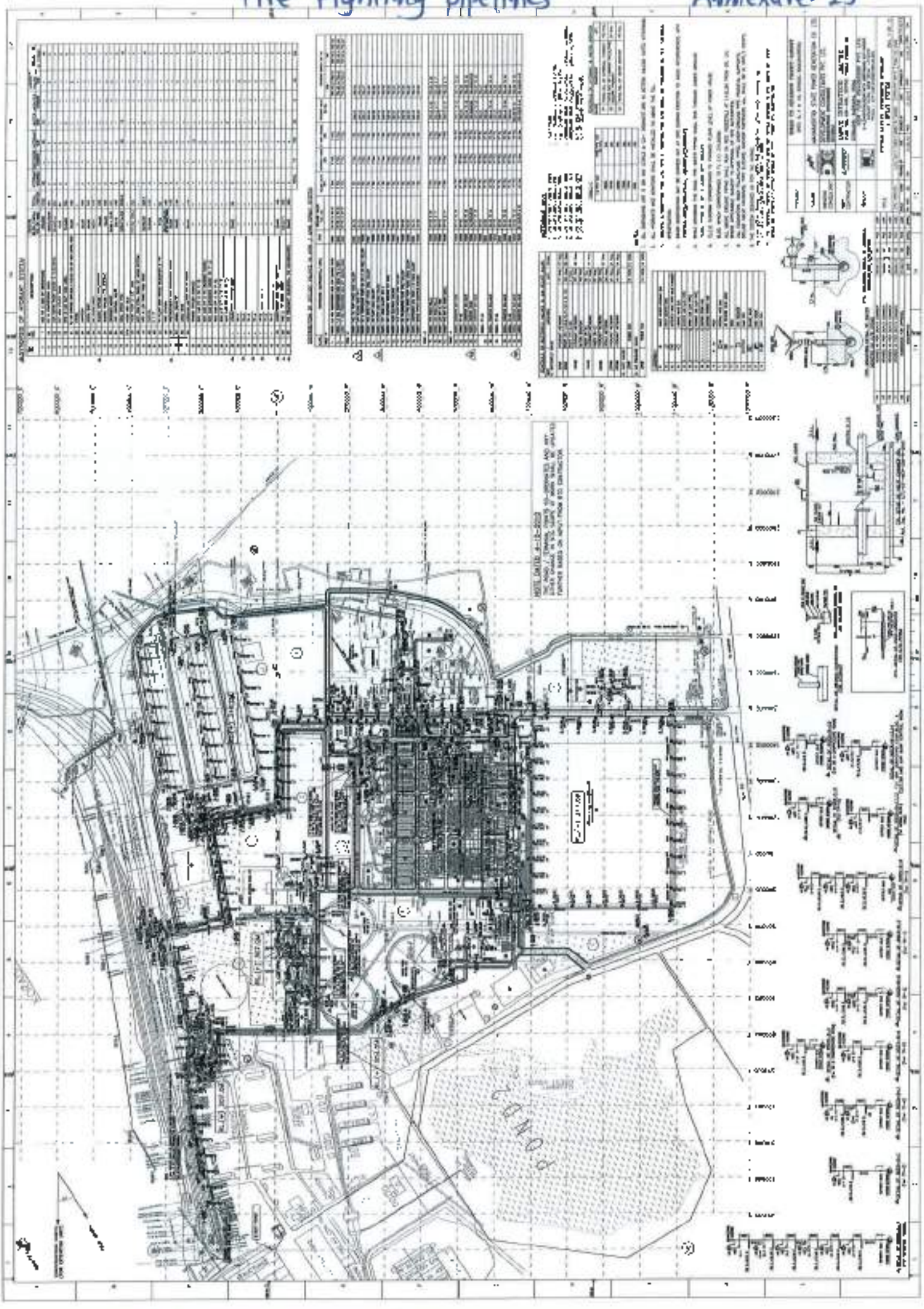
Rain water harvesting tank at Panjara Side





Y- point work is In progress

Fire Fighting pipelines Annexure-15



Annexure- 16(a)

[illegible]
Government of India
[illegible]
Ministry of Commerce & Industry
[illegible]
Petroleum & Explosives Safety Organisation (PESO)

E-mail : [illegible]mumbai@explosives.gov.in
Phone/Fax No : 022 - 27575946,27573881

[illegible]/Dated : 01/11/2017

[illegible]/No : P/HQ/MH/15/6191 (P305883)

[illegible]/To,

M/s. The Chief Engineer,Maharashtra State Power Generation Company Limited,
3X660 MW Koradi Expansion Project,.
Koradi Complex,Chhindwara Road,,
Koradi,
Nagpur (Rural),
Taluka: Nagpur (Rural),
District: NAGPUR,
State: Maharashtra
PIN - 441111

- 8 NOV 2017

[illegible]/Sub : Khasra No, 285,286,287 and 94/1,94/2, 3X660 MW Expansion Prohect, Koradi, Taluka: Nagpur (Rural), District: NAGPUR, State: Maharashtra, PIN: 441111 [illegible] C [illegible] P/HQ/MH/15/6191 (P305883) [illegible]
Existing Petroleum Class C installation at Khasra No, 285,286,287 and 94/1,94/2, 3X660 MW Expansion Prohect, Koradi, Taluka: Nagpur (Rural), District: NAGPUR, State: Maharashtra, PIN: 441111 - Licence No. P/HQ/MH/15/6191 (P305883) - Renewal regarding.

[illegible]/Sir,

[illegible] OIN133245 [illegible] 14/10/2017 [illegible]
Please refer to your letter No : OIN133245 dated 14/10/2017

[illegible] P/HQ/MH/15/6191 (P305883) [illegible] 12/11/2014 [illegible] 31/12/2022 [illegible]
Licence No. P/HQ/MH/15/6191 (P305883) dated 12/11/2014 is forwarded herewith duly renewed upto 31/12/2022

[illegible] 2002 [illegible] 149 [illegible] Jt. Chief Controller of Explosives, West Circle, Mumbai [illegible]
Please follow the procedure strictly as laid down in rule 149 of the Petroleum Rules, 2002 and submit complete documents for the Renewal of the licence to Jt. Chief Controller of Explosives, West Circle, Mumbai, so as to reach his office on or before the date on which Licence expires.

[illegible]
Please acknowledge the receipt.

[illegible]/Yours faithfully

(Signature)

([illegible] singh Meena)

Dy. Controller of Explosives
[illegible]
For Jt. Chief Controller of Explosives
Mumbai

([illegible] http://peso.gov.in [illegible])
(For more information regarding status,fees and other details please visit our website: http://peso.gov.in)

FORM XV
(see Article 6 of the First Schedule)

LICENCE TO IMPORT AND STORE PETROLEUM IN AN INSTALLATION

ence No. . **P/HQ/MH/15/6191(P305883)** Fee Rs. **16000/- per y**

Licence is hereby granted to **M/s. The Chief Engineer,Maharashtra State Power Generation Company Limited, 3X660 M Koradi Expansion Project,, Koradi Complex,Chhindwara Road,, Koradi, Nagpur (Rural), Taluka: Nagpur (Rur District: NAGPUR, State: Maharashtra, PIN: 441111** valid only for the importation and storage of **6000.00 KL** Petroleum the class(es) and in quantities as herein specified and storage thereof in the place described below and shown on the approv plan No **P/HQ/MH/15/6191(P305883)** dated **14/07/2014** attached hereto subject to the provisions of the Petroleum Act, 19 and the rule made thereunder and to the further conditions of this Licence.

The Licence shall remain in force till the 31st day of December 2014

Description of Petroleum	Quantity licenced in KL
Petroleum Class A, in bulk	**NIL**
Petroleum Class A, otherwise than in bulk	**NIL**
Petroleum Class B, in bulk	**NIL**
Petroleum Class B, otherwise than in bulk	**NIL**
Petroleum Class C, in bulk	**6000.00 KL**
Petroleum Class C,otherwise than in bulk	**NIL**
Total	**6000.00 KL**

July 14, 2014

For Chief Controller of Explosiv
HQ, Nagp

1). Amendment dated - 12/11/2014

DESCRIPTION AND LOCATION OF THE LICENSED PREMISES

The licensed premises, the layout , boundaries and other particulars of which are shown in the attached approved plan a situated at **Khasra No: 285,286,287 and 94/1,94/2, 3X660 MW Expansion Project , Koradi, Taluka: Nagpur (Rura District: NAGPUR, State: Maharashtra, PIN: 441111** and consists of **4 Above Ground tank(s) for CLASS C** , together w connected facilities.

Licence No. P/HQ/MH/15/6191 (P305883)

SPACE FOR ENDORSEMENT OF RENEWALS

This licence shall be renewable without any concession in fee for ten years in the absence of contravention of any provisions of the Petroleum Act, 1934 or of the rules framed thereunder or of any of the conditions of this licence	Date of Renewal	Date of Expiry of license	Signature and office stamp of the licencing authority.

This licence is liable to be cancelled if the licensed premises are not found conforming to the description given on the approved plan attached hereto and contravention of any of the rules and conditions under which this licence is granted and the holder of this licence is also punishable for the first offence with simple imprisonment which may be extend to one month, or with fine which may extend to one thousand rupees, or with both and for every subsequent offence with simple imprisonment which may extend to three months, or with fine which may extend to five thousand rupees or with both.

31-12-20

Konark

31-12-20

Konark

31-12-20

[illegible]
Government of India
[illegible]
Ministry of Commerce & Industry
[illegible]
Petroleum & Explosives Safety Organisation (PESO)

E mail : jtccemumbai@explosives.gov.in
Phone/Fax No : 022 - 27575946,27573881

[illegible]/No : P/HQ/MH/15/6192 (P327547)

[illegible]/Dated : 31/10/2017

[illegible]/To

Mrs. The Chief Engineer (Project),Maharashtra State Power Generation Company Limited,
3x660 MW Koradi Expansion Project,,
Koradi Complex,Chindwara Road,
KORADI,
Nagpur (Rural),
Taluka: Nagpur (Rural),
District: NAGPUR,
State: Maharashtra
PIN: 441111

- 6 NOV 2017

[illegible]/Sub : Khasra No, 285,286,287 and 94/1,94/2, 3x660 MV Expansion Project, Koradi, Taluka: Nagpur (Rural), District: NAGPUR, State: Maharashtra, PIN: 441111 [illegible] P/HQ/MH/15/6192 (P327547) [illegible]
Existing Petroleum Class C Installation at Khasra No, 285,286,287 and 94/1,94/2, 3x660 MV Expansion Project, Koradi, Taluka: Nagpur (Rural), District: NAGPUR, State: Maharashtra, PIN: 441111 - Licence No P/HQ/MH/15/6192 (P327547) - Renewal regarding.

[illegible]/Sir
(s)

[illegible] OIN133248 [illegible] 14/10/2017 [illegible]

Please refer to your letter No.: OIN133248, dated 14/10/2017

[illegible] P/HQ/MH/15/6192 (P327547) [illegible] 12/11/2014 [illegible] 31/12/2022 [illegible]

Licence No. P/HQ/MH/15/6192 (P327547) dated 12/11/2014 is forwarded herewith duly renewed upto 31/12/2022.

[illegible] 2002 [illegible] 148 [illegible] 30 [illegible] Jt. Chief Controller of Explosives, West Circle, Mumbai [illegible]

Please follow the procedure strictly as laid down in rule 148 of the Petroleum Rules, 2002 and submit complete documents for the Renewal of the licence to Jt. Chief Controller of Explosives, West Circle, Mumbai, so as to reach his office on or before the date on which Licence expires.

[illegible]
Please acknowledge the receipt.

[illegible]/Yours faithfully,

(kanak singh Meena)

Dy. Controller of Explosives
[illegible]
For Jt. Chief Controller of Explosives
Mumbai

[illegible] http://peso.gov.in [illegible]
(For more information regarding status,fees and other details please visit our website: http://peso.gov.in)

1635

FORM XV
(see Article 6 of the First Schedule)

LICENCE TO IMPORT AND STORE PETROLEUM IN AN INSTALLATION

Licence No. P/HQ/MH/15/6192(P327547) Fee Rs. 15000/- per year

Licence is hereby granted to M/s. The Chief Engineer (Project),Maharashtra State Power Generation Company Limited, 3x660 MW Koradi Expansion Project,, Koradi Complex,Chindwara Road, Koradi, Taluka: Nagpur (Rural), District: NAGPUR, State: Maharashtra, PIN: 441111 valid only for the importation and storage of 1500.00 KL Petroleum of the class (es) and in quantities as herein specified and storage thereof in the place described below and shown on the approved plan No P/HQ/MH/15/6192(P327547) dated 14/07/2014 attached hereto subject to the provisions of the Petroleum Act, 1934 and the rule made thereunder and to the further conditions of this Licence.

The Licence shall remain in force till the 31st day of December 2014

Description of Petroleum	Quantity licenced in KL
Petroleum Class A, in bulk	NIL
Petroleum Class A, otherwise than in bulk	NIL
Petroleum Class B, in bulk	NIL
Petroleum Class B, otherwise than in bulk	NIL
Petroleum Class C, in bulk	1500.00 KL
Petroleum Class C,otherwise than in bulk	NIL
Total	1500.00 KL

July 14, 2014

For Chief Controller of Explosives
HQ, Nagpur

1). Amendment dated - 12/11/2014

DESCRIPTION AND LOCATION OF THE LICENSED PREMISES

The licensed premises, the layout , boundaries and other particulars of which are shown in the attached approved plan are situated at Khasra No: 285,286,287 and 94/1,94/2, 3x660 MV Expansion Project , Koradi, Taluka: Nagpur (Rural), District: NAGPUR, State: Maharashtra, PIN: 441111 and consists of 3 Above Ground tank(s) for CLASS C , together with connected facilities.

Licence No. P/HQ/MH/15/6192 (P327547)

SPACE FOR ENDORSEMENT OF RENEWALS

This licence shall be renewable without any concession in fee for ten years in the absence of contravention of any provisions of the Petroleum Act, 1934 or of the rules framed thereunder or of any of the conditions of this licence.	Date of Renewal	Date of Expiry of license	Signature and office stamp of the licencing authority
		31-12-2015	

This licence is liable to be cancelled if the licensed premises are not found conforming to the description given on the approved plan attached hereto and contravention of any of the rules and conditions under which this licence is granted and the holder of this licence is also punishable for the first offence with simple imprisonment which may be extend to one month, or with fine which may extend to one thousand rupees, or with both and for every subsequent offence with simple imprisonment which may extend to three months, or with fine which may extend to five thousand rupees or with both.

31-12-2016

31-12-2017

31-12-2022

ONSITE EMERGENCY PREPAREDNESS & RESPONSE PLAN FOR

Annexure-16(b)

MAHAGENCO

(3 X 660 MW), COAL BASED THERMAL POWER PLANT, KORADI, NAGPUR

SURYA ENVIROTECH (OPC) PVT. LTD.

NAGPUR

Onsite Emergency Preparedness & Response Plan

(3 x 660 MW), Coal Based Thermal Power Plant, Koradi, Nagpur

For

MAHAGENCO
Maharashtra State Power Generation Co. Ltd.

Maharashtra State Power Generation Company Ltd.

Prepared By

Surya Envirotech (OPC) Pvt. Ltd.

237, Hanuman Nagar, Nagpur

March 2021

FOREWORD

M/s MAHAGENCO Thermal Power Station, 3X660 MW, Koradi, Dist. Nagpur; has resolute to conduct "**Onsite Emergency Preparedness & Response Action Plan**" to identify and eliminate the adverse effects occurred due to potential hazards due to malfunctioning in Operations at their manufacturing unit.

In order to assess and avoid the potential hazards and needs of the people for enhancement of their Quality of life **M/s MAHAGENCO Thermal Power Station, 3X660 MW, Koradi, Dist. Nagpur;** retained **M/s Surya Envirotech (OPC) Pvt. Ltd., Nagpur** to undertake Report for "**Onsite Emergency Preparedness & Response Action Plan.**"

The emergency Preparedness & Response Action Plan Report presents hazard identification and categorization, Emergency Organization Structure, Preparation to Response Emergencies.

The timely co-operation and assistance rendered by officials of **M/s MAHAGENCO Thermal Power Station, 3X660 MW, Koradi, Dist. Nagpur.,** is gratefully acknowledged.

Place: Nagpur
Date:

Mr. Milind Joshi
Director
Surya Envirotech (OPC) Pvt. Ltd.

Project Personnel

Technical Team

Mr. Tameshwar Sarwa (Mechanical Engineer)

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Executive Summary

1.1 Preamble

3X660 MW Koradi Thermal Power Plant is located at Koradi in Nagpur district of Maharashtra. The power plant is one of the coal based power plants of Maharashtra State Power Generation Company (Mahagenco) The process of electricity production is hazardous and hence the emergency may occur any time. To be prepared to face such possible emergencies. to minimize the estimated impact the Emergency Preparedness and Response Plan for the industry is very essential as a guide to handle it. The scope of work for preparation of Emergency Preparedness and Response Plan includes 2X210 MW unit 6 & 7 as well as 3X660 MW units 8, 9 & 10.

"Emergency" can be defined as any major hazardous situatron arising out of accident, fires etc , which has the potential to cause serious danger to property, persons either inside or outside the factory premises.

Emergencies are termed as "on-sites" when it confines itself within the factory even though it may require external help and "off-sites" when emergency conditions extend beyond factory premises.

1.2 Planning during Conceptual Stage

Proper planning at the conceptual stage of a corridor facility helps in enhancing the safety of the plant and workers and increasing the efficiency of the plant. These eventually help to minimize loss of life and property, which are the direct consequences of accidents. In order to achieve the above, the following needs to be taken note of:

- Risk associated with the process technology.
- Safety measures,
- Siting of facility,
- Layout of the facility
- Emergency preparedness, and
- Compliance with the regulatory requirements.

1.3 Types of Emergencies

Level I. Operator/Factory level

Level II: An ONSITE CRISIS

Level III: An OFFSITE CRISIS

2.1 Hazard Identified in the following sections

A) Chemical Storage Area
B) Hydrazine and Ammonia Drums
C) Ammonia Dosing
D) LDO, FO Tanks
E) Coal Handling Plant
F) Dispensary
G) Hydrogen & Chlorine Plant
H) Fire fighting Section

2.2 Distribution of Roles and Responsibility

Sr. No.	Department	Responsibility for Execution	Responsibility for Monitoring
1	Coal Handling Plant	Department Head	• In-charge/CHP • Sampler & Lab Tech. • Loco driver &Optr./Supervisor • Tippler operator • Contractors workers • Maintenance In-charge
2	Boiler & Auxiliaries	Operation Department	• Field Opr /Shift In-charge • Lab. Opr /Shift In-charge
3	Turbine	Operation Department	• Field Opr / Inst Tech./Shift In-charge • Inst Tech /Shift In-charge
4	Generator	Operation Department	• Field Opr / Inst Tech./Shift In-charge
5	Electrical Safety	Department Head	• Optr. / Area In-charge
6	Water Treatment Plant	Executive Chemist	• Field Opr / Inst Tech./Shift In-charge
7	Cooling Tower	Operation Department	• Field Opr / Inst Tech./Shift In-charge
8	Boiler	Department Head	• All Operators / Super.
9	Maintenance of CEP	Department Head	• Operator/ Supervisor
10	Boiler Overhaul	Department Head	• Optr./ Supervisor • Site Engineer/In-charge

11	Motor Maintenance & Testing	Department Head	• Optr./ Supervisor
12	Transformer Maintenance And Testing	Department Head	• Maint. Crew/ Super.
13	Turbine Overhaul	Department Head	• Supervisors/Engrs. • Maint Crew/ Super.
14	Switchgear Installation And Testing	Department Head	• Optr./ Supervisor
15	Synchronization of Generator	Department Head	• Optr./ Supervisor
16	Boiler Feed Pump	Department Head	• Main Crew/ Supervisor
17	Railway Track Maintenance	Department Head	• Maintenance Crew/ Supervisor
18	High Voltage Bus	Department Head	• Operator / Supervisor • Elect /Supervisor
19	Generator Overhaul	Department Head	• Operator / Supervisor
20	Fire Prevention & Fire Fighting	Department Head	• All Operators / Super. • Operators/Super/House keeping • Firemen/ Fire Officer • Security • Combat team
21	Safety Department	Department Head	• Safety officer/In-charge • Dept head

3.1 ACCIDENT INVESTIGATION PRINCIPLES

An accident is any unplanned event that results in personal injury or in property damage. When the personal injury requires little or no treatment, it is minor. If it results in a fatality or in a permanent total, permanent partial, or temporary total (lost-time) disability, it is serious. Similarly, property damage may be minor or serious. Investigate all accidents regardless of the extent of injury or damage. Thousands of industrial accidents occur every day.

Accident investigations determine not only what happened, but also how and why. The information gained from these investigations can prevent recurrence of similar or perhaps more disastrous accidents. Accidents investigators are interested in each event as well as in sequence of events that led to an accident. The accident type is also important to the investigator.

Accidents represent problems that must be solved through investigations. Several formal procedures solve problems of any degree of complexity. This section discusses two of the most common procedure: **Change Analysis** and **Job Safety Analysis**.

Change Analysis: As its name implies, this technique emphasizes change. To solve a problem, an investigator must look for deviations from the norm. Consider all problems to results from some unanticipated change. Make an analysis of the change to determine its causes.

Job Safety Analysis: Job Safety Analysis (JSA) is part of many existing accident prevention programs. In general, JSA breaks a job into basic steps, and identifies the hazards associated with each step. The JSA also prescribes controls for each hazard A JSA is chart listing these steps. hazards. and controls. Review the JSA during the investigation if a JSA has been conducted for the job involved in an accident. Perform a JSA as a part the investigation to determine the events and conditions that led to the accident. As noted above, an accident investigation is not complete until a report Is prepared and submitted to proper authorities.

3.2 ASSESSING HAZARDS ON THE JOB

A job hazard analysis can be performed for all jobs in the workplace, whether the job is "special" (non-routine) or routine. Even one step jobs, such as those in which only a button is pressed, can and perhaps should be analyzed by evaluating surrounding work conditions. To determine which jobs should be analyzed first, review job injury and illness reports. Obviously, a job hazard analysis should be conducted first for jobs with the highest rates of accidents and disabling injuries Also, jobs where "close calls" or near misses " have occurred should be given priority. Analyses of new jobs and jobs where changes have been made in processes and procedures should follow. Eventually, a job hazard analysis should be conducted and made available lo employees for all jobs in the workplace. Once a job has been selected for analysis, discuss the procedure with the employee performing the job and explain its purpose. Point out that you are studying the job itself not checking on the employee's job performance Involve the employee in all phases of the analysis –from reviewing the job steps to discussing potential hazards and recommended solutions. Before actually beginning the job hazard analysis. take a look at the general conditions under which the job is performed and develop a checklist.

A job hazard analysis can do much towards reducing accidents and injuries in the workplace, but it is only effective if it is reviewed and updated periodically. Even if no changes have been made in a job, hazards that were missed in an earlier analysis could be detected. If an accident or injury occurs on a specific job, the job hazard analysis should be reviewed immediately to determine whether changes are needed in the job procedure. In addition, if an

accident results from an employee's failure to follow job procedures, this should be discussed with all employees performing the jobs. Any time a job hazard analysis is revised, training in the new job methods or protective measures be provided to all employees affected by the changes. A job hazard analysis also can be used to train new employ on job steps and job hazards.

3.3 Emergency Preparedness against Chemicals

i. Ammonia (NH3)
ii. Dowex* Marathon*
iii. Dowex Mac-3 Ion Exchange resin
iv Hydrate Lime
v. Strong base Anion
vi. HCL
vil Solid Sulpher
viii. Caustic Soda
ix. Hydrazine Hydrate 80%
x. Ozone
xl. Sodium Hexametaphosphate
xii. Trisodium Phosphate

4.1 GENERAL REQUIREMENT OF THE FIRE DETECTION & ALARM SYSTEM

Facility is provided on the Fire Alarm Control Panels for simulating the fire condition to enable testing of the various alarm circuits.

All the fire alarm circuits will be of modular design using electronic printed card circuits to facilitate easy replacement of faulty circuits with spare cards. All the electronic components and cards will be compatible to non-air-conditioned environment for working satisfactorily.

The system design will be such that operation/resetting of alarms for one zone/detector will not block availability of alarm for any other zone. Also the alarm/ system resetting will be by common push button and not by individual switches or different zones / Detectors.

4.2 Emergency Responses & Facilities

MAHAGENCO's Medical Services are headed by Chief Medical Officer (CMO) and manned with qualified doctors and well trained and experienced paramedical staff.

First Aiders and Ambulance drivers are available in all shifts to give first aid treatment to any injured. Industrial Physician carries out medical treatment to injured person and also certifies whether he is fit for duty or not.

4.3 Transport and Evacuation Arrangements

In view of any major emergency, administration dept and security departments are equipped with the necessary transportation and evacuation facilities. Their roles during the emergency are already well defined. In major emergency it may be necessary to evacuate personnel from affected areas and, as a precautionary measure, to further evacuate non-essential personnel from areas likely to be affected should the emergency escalate. For evacuation all personnel will be directed to safe assembly point. Administration dept. will arrange the transportation and Security Key persons will control evacuation movement to the assembly point Arrangement details for transport.

Establish procedures for assuring health and safety of response personnel operating at hazardous material incidents as per guideline. Because of the scale of activity which will be activated after the declaration of a major emergency, it is advisable to restrict the authority to declare it. However, it is not necessary to limit this authority to the Incident Controller and his appointed Deputy. The need is to have a declaration as early as possible and other responsible persons, particularly on large complex, may be closer to the incident when it occurs and capable of making the necessary judgments.

4.4 On-site Emergency Actions

Emergency Actions are required to be initiated and individual roles to be performed by each member of the emergency response agencies, groups and crews against the following scenarios have been clearly defined in the On-site Emergency Plan.

4.5 Off-site Emergency Actions

Off-site Emergency is a catastrophic situation and is a result of sudden occurrence of chain of unforeseen events or calamity due to natural causes which affects normal working within the factory premises and also in the vicinity and causes serious injuries, loss of lives and extensive damage to the property. The day-to-day pattern of life is, in many instances suddenly disrupted and the people are plunged into helplessness and sufferings; and as a result need protection, clothing and shelter, medical and social care and other necessities of life.

4.6 Post Emergency Actions

- Structural parts or building parts which can collapse shall be demolished on priority

- Debris shall be segregated on broad classification like building material, piping & equipment, insulation materials etc.
- Photographs or video shooting should be taken if required by the appointed Inquiry Committee
- Drainage cleaning
- Absorption of left out materials by sorbent pads, sand or neutralization material shall be done before cleaning activities
- Post emergency crew to be deputed as standby
- Suspension of vehicular traffic within/near the effected process plant.

4.7 Organizing Mock Drill

The frequency of mock drill shall be fixed as per the company policy. According to the legal requirements as per Factories Act 1948 at least two Mock (Evacuation) drills shall be conducted each year and involve all occupants.

Special arrangement with special rescue Expert team for those with medical conditions, pregnant women and Disabled persons to be brought out at assembly area safely

5.1 Emergency Planning During Natural Disaster

A natural disaster is the effect of a natural hazard that affects the environment, and leads to financial, environmental, Industrial and/or human losses. Calamitous event that seriously disrupts the functioning of a community or society and causes human, material, and economic or environmental losses that exceed the community's or society's ability to cope using its own resources. Though often caused by nature, disasters can have human origins.

5.1.1 Earthquake

Earthquakes cannot be predicted. The following are best practices to prepare for earthquakes.

- Consider maintaining an emergency supply kit for your office.
- Store heavy or breakable objects in closed cabinets, as low as possible
- Secure refrigerators, book shelves, appliances, bookcases and other heavy items to prevent them from falling during an earthquake.
- Evaluate where hanging objects are placed. Mirrors, pictures, or other hangings near seating or sleeping areas could fall and cause injury. Arrange these items so they do not pose a fall hazard to those below.

5.1.2 Flood

A flood is an overflow of water that 'submerges' land. In the sense of 'flowing water', the word may also be applied to the inflow of the tides. Flooding may result from the volume of water within a body of water, such as a river or lake, which overflows, causing some of the water to escape its usual boundaries. While the size of a lake or other body of water will vary with seasonal changes in precipitation and snow melt, it is not a significant flood unless the water covers land used by man, like a village, city or other inhabited area, roads, expanses of farmland, etc.

5.1.3 Collapse of Structure

The purpose of this procedure is to establish guidelines for the response of fire department personnel and equipment to structural collapse rescue incidents. Because structural collapse rescue operations present a significant danger to fire department personnel, the safe and effective management of these operations require special considerations. This procedure identifies some of the critical issues which must be included in managing these incidents.

5.1.4 Procedure in case of Risk of Terrorist Attack

Terrorism is one of the major challenges in the context of ensuring safety both from the global perspective, as well as from regional or domestic point of view. As an international threat it goes beyond the traditionally understood conflicts and crisis situations.

5.1.5 Bomb at Premises

Evacuation from home	Evacuation from institution/company	Evacuation from public places
Take only the most necessary things (documents, supply of water and food, necessary medications, change of clothing, basic toiletries, a flashlight, possibly a light blanket, a sleeping bag and a foam sleep pad);	Take only the most necessary personal things;	Pay attention to location of staircases and emergency exits;
Cut off water, gas and electricity before evacuating;	Cut off electricity and gas and safely remove all flammable materials;	Think how to evacuate the building, train station or other crowded places in a

		hurry;
Do not use lifts;	Do not use lifts;	Do not use lifts;
Move as instructed by the evacuating party.	Move as instructed by the evacuating party;	Move as instructed by the evacuating party;
	Find out whether returning home is possible or whether the evacuated persons will be directed to other places;	Find out whether returning home is possible or whether the evacuated persons will be directed to other places

6.1 Recommendation

Activity wise emergency recommendations have been delineated in details.

CHAPTER 1

Chapter I

Introduction

1.0 Preamble

3X660 MW Koradi Thermal Power Plant is located at Koradi in Nagpur district of Maharashtra. The power plant is one of the coal based power plants of Maharashtra State Power Generation Company (Mahagenco) The process of electricity production is hazardous and hence the emergency may occur any time. To be prepared to face such possible emergencies, to minimize the estimated impact the Emergency Preparedness and Response Plan for the industry is very essential as a guide to handle it. The scope of work for preparation of Onsite Emergency Preparedness and Response Plan includes 2X210 MW unit 6 & 7 as well as 3X660 MW units 8, 9 & 10.

"Emergency" can be defined as any major hazardous situation arising out of accident, fires etc., which has the potential to cause serious danger to property, persons either inside or outside the factory premises.

Emergency Preparedness Programme (EPP) are formulated based on, site visit to hazard prone locations and processes in the plant, secondary data collected from proponent and technical as well as logical discussions between Safety officer and expert team responsible to prepare response plan with organization to react to various situations and implement mitigation measures.

There are two types of Emergencies visualized.

1) Emergency due to Human Interference & Malfunctioning of Machine
   - i. Fires
   - ii. Transport Accidents
   - iii. Industrial Accidents
   - iv. Oil Spillage
   - v. Nuclear Explosion

2) Emergencies due to natural calamities
   - a. Earthquake
   - b. Flood
   - c Cyclone
   - d. Collapse of structures

1.1 Concept

The Importance of an effective workplace safety and health program cannot be overemphasized. There are many benefits from such a program including increased productivity. improved employee morale. reduced absenteeism and illness, and reduced workers compensation rates; however, incidents still occur in spite of efforts to prevent them. Therefore. proper planning for emergencies is necessary to minimize employee injury and property damage. Typical emergencies include accidental releases of toxic gases, chemical spills, fires, explosions. and bodily harm and trauma caused by workplace violence

The effectiveness of response during emergencies depends on the amount of planning and training performed. Senior level management must show its support or plant safety programs and the importance of emergency planning. If management is not interested in employee protection and in minimizing property less, little can be done to promote a safe workplace. It is therefore management's responsibility to see that a program is instituted and that it is frequently reviewed and updated. The input and support of all employees must be obtained to ensure an effective program. The emergency response plan should be developed locally and should be comprehensive enough to deal with all types of emergencies specific to do at site. When emergency action plans are required by a particular OSHA standard, the plan must be in writing; except for firms with 10 or fewer employees, plan may be communicated orally to employees. The plan must include, as a minimum the following elements:

- Emergency escape procedures and emergency escape route assignments,
- Procedures to be followed by employees who remain to perform (or shut down) critical plant operations before the plant is evacuated.
- Procedures to account for all employees after emergency evacuation has been completed,
- Rescue and medical duties for those employees who are to perform them,
- The preferred means for reporting fires and other emergencies, and
- Names or regular job title of persons or departments to be contacted for further information or explanation of duties under the plan.

Industrial Safety deals with the areas of safety engineering and public health that are concerned with the protection of workers health, through control of the work environment to reduce or eliminate hazard. Industrial accidents and unsafe working conditions can result in temporary or permanent injury, illness, or even death. They also impact on reduce efficiency and loss of productivity. In the United States before 1900 the safety of workers was of little

concern to employers. Only with the passage of Workmen's Compensation Laws and related labour statutes between 1908 and 1948 did US employer start to pay attention to industrial safety; making the work environment safer was less costly than paying compensation. A new national policy was established in 1970 when for the first time all industrial worker in businesses affected by interstate commerce were covered by the occupational safety and health act. Under this act the national institute for occupational safety and health (NIOSH) was given responsibility for conducting research on occupational health and safety standard, and occupational safety and health administration (OSHA) was charged with setting and enforcing appropriate standards in industry. Various external factors, such as chemical, biological, or physical hazards, can cause work related injury. Poor working posture or improper design of the work place often result s in muscle strain. sprains, fractures, bruises, and back pain (e g. Repetitive stress injury). In recent years engineers have attempted to develop a systems approach (Termed safety engineering) to industrial accident prevention. The system's approach examines all work locations to eliminates or control hazards It also examines operating methods and practices and the training of employees and supervisors.

1.2 Planning during Conceptual Stage

Proper planning at the conceptual stage of a corridor facility helps in enhancing the safety of the plant and workers and increasing the efficiency of the plant. These eventually help to minimize loss of life and property, which are the direct consequences of accidents. In order to achieve the above, the following needs to be taken note of.

- Risk associated with the process technology,
- Safety measures,
- Siting of facility,
- Layout of the facility
- Emergency preparedness, and
- Compliance with the regulatory requirements.

1.3 Types of Emergencies

The emergency conditions may broadly be categorized into three levels depending upon the availability of in-plant facilities and extent of emergency level and resources required meeting the emergency. The Level I emergency is combated at plants level and no external help in the form of facilities or expertise is required. In other levels of emergencies, in addition to implant facilities, external help is required to combat the emergency as indicated below:

Level I: Operator/Factory level.

This category emergency can be taken as situation aroused out of routine operational activities.

Level II: An ONSITE CRISIS corresponds to level II category emergencies. In such emergencies normally only the corridor area is affected but the intensity of crisis is such as to warrant help from outside agencies, neighbours such as mutual aid scheme partners.

Level III: An OFFSITE CRISIS corresponds to level III situations. The consequences of level III emergencies may escalate to such a magnitude that it affects the outside population and environment and this calls for an action plan to handle the emergency smoothly with minimum effect on life and property to avoid happening of disaster. Hence in offsite crisis, assistance is further required from local bodies e.g Civil Defence, Police Station, hospitals, etc.

1.4 Objectives of the Management plan

The emergency management plan is developed to make the best possible use of resources at command and also outside services.

1. Advance planning for each possible emergency to combat and minimize the adverse effect
2. Recommendations on initial actions to be taken like warning, evacuation of surrounding personnel etc.
3. Containment of incident and control it with minimum damage
4. Rescue, relief and assistance to the affected people

CHAPTER 2

Chapter II

Manufacturing Process & Associated Hazards

Thermal power generation plant or thermal power station is the most conventional source of electric power. Thermal power plant is also referred as coal thermal power plant and steam turbine power plant. Before going into detail of this topic, we will try to understand the line diagram of electric power generation plant.

2.0 Theory of Thermal Power Station

The theory of thermal power station or working of thermal power station is very simple. A power generation plant mainly consists of alternator runs with help of steam turbine. The steam is obtained from high pressure boilers. Generally in India, bituminous coal, brown coal and peat are used as fuel of boiler. The bituminous coal is used as boiler fuel has volatile matter from 8 to 33 % and ash content 5 to 16 %. To increase the thermal efficiency, the coal is used in the boiler in powder form.

In coal thermal power plant, the steam is produced in high pressure in the steam boiler due to burning of fuel (pulverized coal) in boiler furnaces. This steam is further supper heated in a super heater. This supper heated steam then enters into the turbine and rotates the turbine blades. The turbine is mechanically so coupled with alternator that its rotor will rotate with the rotation of turbine blades. After entering in turbine the steam pressure suddenly falls and corresponding volume of the steam increases. After imparting energy to the turbine rotor the steam passes out of the turbine blades into the condenser. In the condenser the cold water is circulated with the help of pump which condenses the low pressure wet steam. This condensed water is further supplied to low pressure water heater where the low pressure steam increases the temperature of this feed water, it is again heated in high pressure.

For better understanding we furnish every step of function of a thermal power station as follows,

1) First the pulverized coal is burnt into the furnace of steam boiler.

2) High pressure steam is produced in the boiler.

3) This steam is then passed through the super heater, where it further heated up.

4) This supper heated steam is then entered into a turbine at high speed.

5) In turbine this steam force rotates the turbine blades that means here in the turbine the stored potential energy of the high pressured steam is converted into mechanical energy.

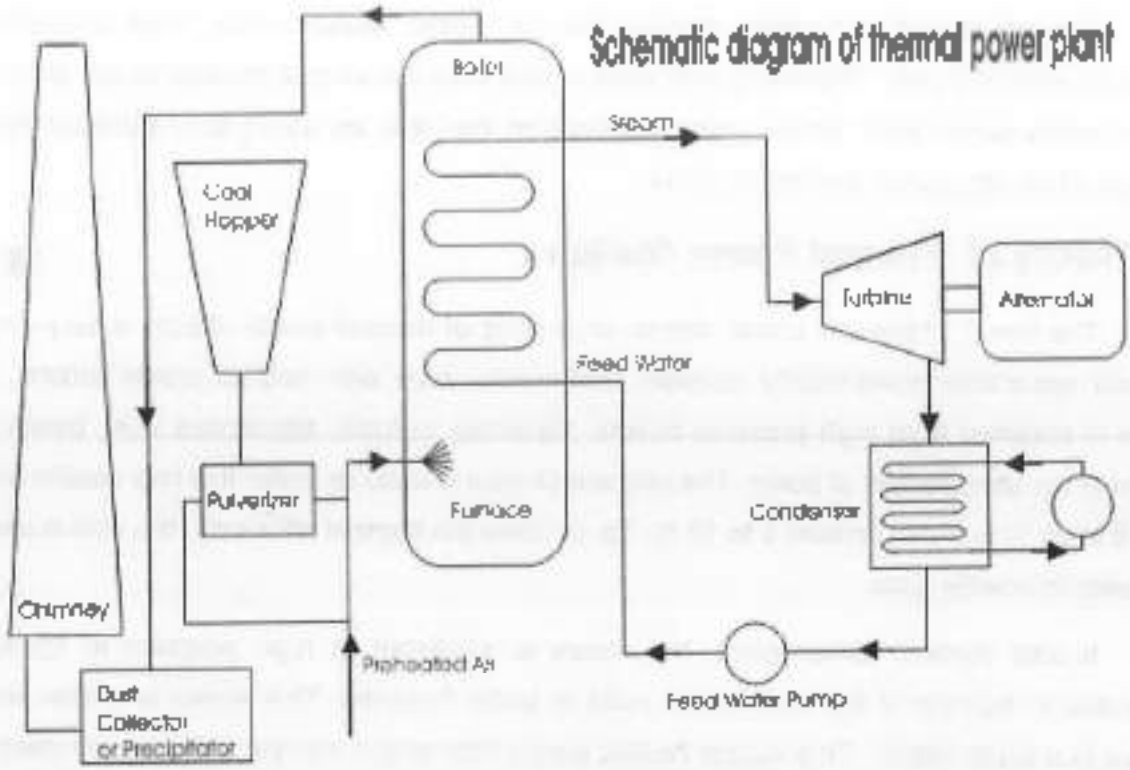


Figure 2.1 Line Diagram of Power Plant

6) After rotating the turbine blades, the steam has lost its high pressure, passes out of turbine blades and enters into a condenser.

7) In the condenser the cold water is circulated with help of pump which condenses the low pressure wet steam.

8) This condensed water is then further supplied to low pressure water heater where the low pressure steam increases the temperature of this feed water, it is then again heated in a high pressure heater where the high pressure of steam is used for heating.

9) The turbine in thermal power station acts as a prime mover of the alternator.

2.1 Overview of Thermal Power Plant

A typical Thermal Power Station Operates on a Cycle which is shown below.

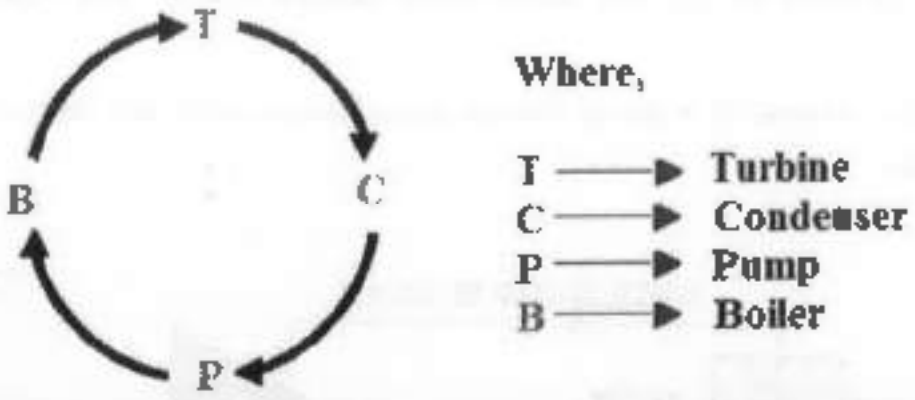


Figure 2.2 Typical Thermal Power Station Operates on a Cycle

The working fluid is water and steam. This is called feed water and steam cycle. The ideal Thermodynamic Cycle to which the operation of a Thermal Power Station closely resembles is the RANKINE CYCLE

In steam boiler the water is heated up by burning the fuel in air in the furnace & the function of the boiler is to give dry super-heated steam at required temperature.

The steam so produced is used in driving the steam Turbines This turbine is coupled to synchronous generator (usually three phase synchronous alternator), which generates electrical energy.

The exhaust steam from the turbine is allowed to condense into water in steam condenser of turbine, which creates suction at very low pressure and allows the expansion of the steam in the turbine to a very low pressure. The principle advantages of condensing operation are the increased amount of energy extracted per kg of steam and thereby increasing efficiency and the condensate which is fed into the boiler again reduces the amount of fresh feed water.

The condensate along with some fresh make up feed water is again fed into the boiler by pump (called the boiler feed pump).

In condenser the steam is condensed by cooling water Cooling water recycles through cooling tower. This constitutes cooling water circuit.

The ambient air is allowed to enter in the boiler after dust filtration. Also the flue gas comes out of the boiler and exhausted into atmosphere through stacks. These constitute air and flue gas circuit. The flow of air and also the static pressure inside the steam boiler (called draught) is maintained by two fans called Forced Draught (FD) fan and Induced Draught (ID) fan.

The total scheme of a typical thermal power station along with different circuits is illustrated below.

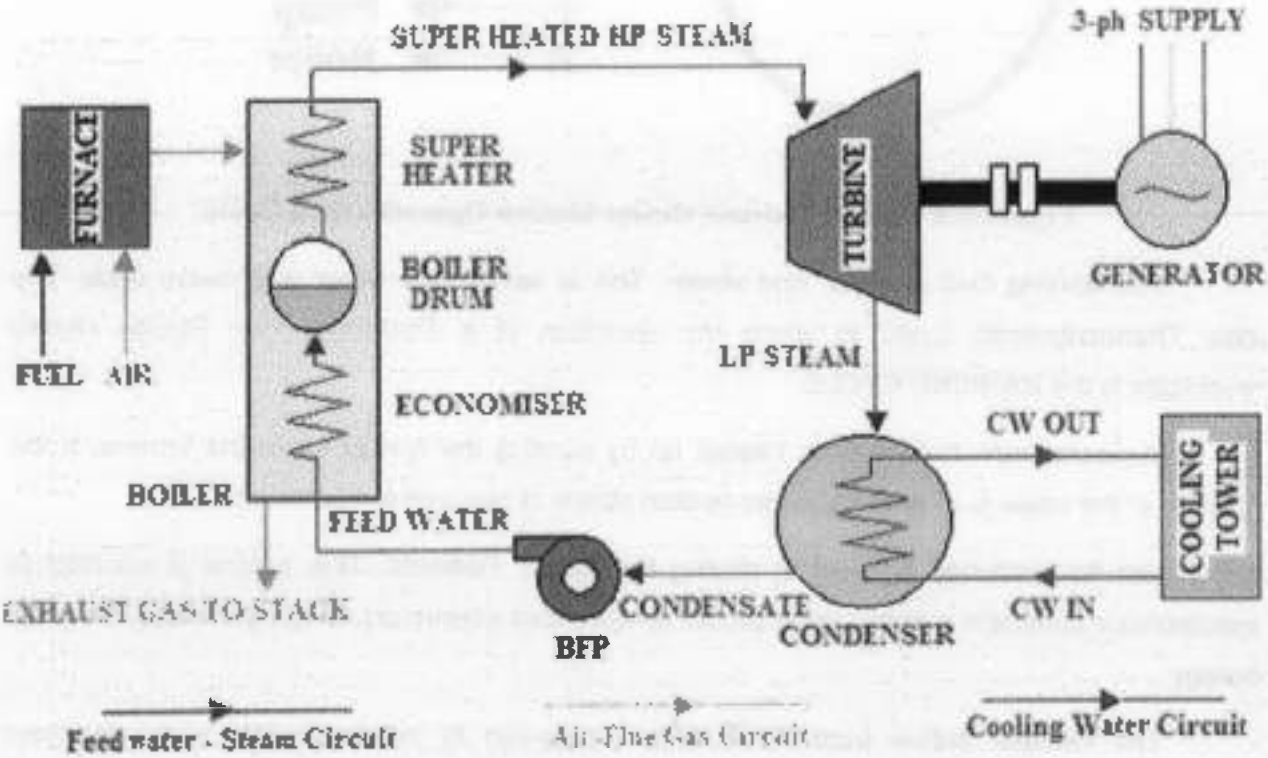


Figure 2.3 Total Scheme of a Typical Thermal Power Station

Inside the boiler there are various heat exchangers, viz.' Economizer', 'Evaporator' (not shown in the fig above, it is basically the water tubes, i.e. down-comer riser circuit), 'Super Heater' (sometimes 'Reheater', 'air preheater' are also present).

In Economizer the feed water is heated to considerable amount by the remaining heat of flue gas.

The Boiler Drum actually maintains a head for natural circulation of two phase mixture (steam + water) through the water tubes.

There is also Super Heater which also takes heat from flue gas and raises the temperature of steam as per requirement.

A thermal power station is a power plant in which the prime mover is steam driven. Water is heated, turns into steam and spins a steam turbine which drives an electrical generator. After it passes through the turbine, the steam is condensed in a condenser and recycled to where it was heated; this is known as a Rankin cycle. The greatest variation in the design of thermal power stations is due to the different fossil fuel resources generally used to heat the water. Some prefer to use the term energy centre because such facilities convert forms of heat energy into electrical energy. Certain thermal power plants also are designed to produce heat energy for industrial purposes of district heating, or desalination of water, in addition to generating electrical power. Globally, fossil fuelled thermal power plants produce a large part of man-made CO_2 emissions to the atmosphere, and efforts to reduce these are varied and widespread.

Power plants burning coal, fuel oil, or natural gas are often called *fossil-fuel power plants*. Non-nuclear thermal power plants, particularly fossil-fuelled plants, which do not use co-generation, are sometimes referred to as conventional power plants.

Commercial electric utility power stations are usually constructed on a large scale and designed for continuous operation. Electric power plants typically use three-phase electrical generators to produce alternating current (AC) electric power at a frequency of 50 Hz or 60 Hz.

2.2 Boiler and Steam Cycle

A fossil fuel steam generator includes an economizer, a steam drum, and the furnace with its steam generating tubes and super heater coils. Necessary safety valves are located at suitable points to avoid excessive boiler pressure. The air and flue gas path equipment include forced draft (FD) fan, air preheater (AP), boiler furnace, induced draft (ID) fan, fly ash collectors (electrostatic precipitator or bag house) and the flue gas stack.

In some industrial settings, there can also be steam-producing heat exchangers called heat recovery steam generators (HRSG) which utilize heat from some industrial process. The steam generating boiler has to produce steam at the high purity, pressure and temperature required for the steam turbine that drives the electrical generator.

2.3 Feed Water Heating and Desertion

The boiler feed_water used in the steam boiler is a means of transferring heat energy from the burning fuel to the mechanical energy of the spinning steam turbine. The total feed water consists of recirculate condensate water and purified makeup water. Because the metallic materials it contacts are subject to corrosion at high temperatures and pressures, the makeup water is highly purified before use A system of water softeners and ion exchange demineralizers produces water so pure that it coincidentally becomes an electrical insulator, with conductivity in the range of 0.3–1.0 micro Siemens per centimeter. The makeup water in a 500 MW plant amounts to perhaps 120 US gallons per minute (7.6 L/s) to replace water drawn off from the boiler drums for water purity management, and to also offset the small losses from steam leaks in the system

The feed water cycle begins with condensate water being pumped out of the condenser after traveling through the steam turbines. The condensate flow rate at full load in a 660 MW plant is about 6,000 US gallons per minute (400 L/s).

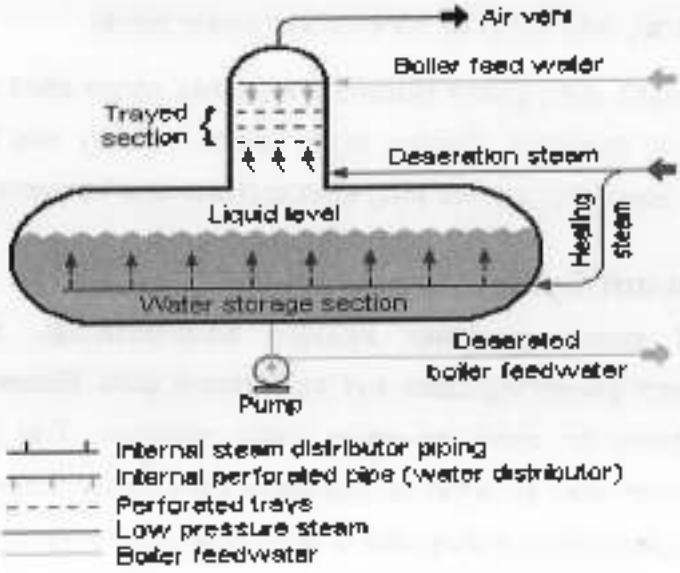


Figure 2.4 Boiler Feed Water Deaerator

(With vertical, domed aeration section and horizontal water storage section).

The water is pressurized in two stages, and flows through a series of six or seven intermediate feed water heaters, heated up at each point with steam extracted from an appropriate duct on the turbines and gaining temperature at each stage Typically, in the middle of this series of feed water heaters, and before the second stage of pressurization, the

condensate plus the makeup water flows through a Deaerator that removes dissolved air from the water, further purifying and reducing its corrosiveness. The water may be dosed following this point with hydrazine, a chemical that removes the remaining oxygen in the water to below 5 parts per billion (ppb) It is also dosed with pH control agents such as ammonia or morpholine to keep the residual acidity low and thus non-corrosive.

2.4 Boiler Operation

The boiler is a rectangular furnace about 50 feet (15 m) on a side and 130 feet (40 m) tall. Its walls are made of a web of high pressure steel tubes about 2.3 inches (58 mm) in diameter.

Pulverized coal is air-blown into the furnace through burners located at the four corners, or along one wall, or two opposite walls, and it is ignited to rapidly burn, forming a large fireball at the centre. The thermal radiation of the fireball heats the water that circulates through the boiler tubes near the boiler perimeter. The water circulation rate in the boiler is three to four times the throughput. As the water in the boiler circulates it absorbs heat and changes into steam. It is separated from the water inside a drum at the top of the furnace The saturated steam is introduced into superheat pendant tubes that hang in the hottest part of the combustion gases as they exit the furnace. Here the steam is superheated to 1,000 °F (540 °C) to prepare it for the turbine.

Plants designed for lignite (brown coal) are increasingly used in locations as varied as Germany, Victoria, Australia and North Dakota. Lignite is a much younger form of coal than black coal. It has a lower energy density than black coal and requires a much larger furnace for equivalent heat output. Such coals may contain up to 70% water and ash, yielding lower furnace temperatures and requiring larger induced-draft fans. The firing systems also differ from black coal and typically draw hot gas from the furnace-exit level and mix it with the incoming coal in fan-type mills that inject the pulverized coal and hot gas mixture into the boiler.

Plants that use gas turbines to heat the water for conversion into steam use boilers known as heat recovery steam generators (HRSG). The exhaust heat from the gas turbines is used to make superheated steam that is then used in a conventional water-steam generation cycle, as described in gas turbine combined-cycle plants section below

2.5 Boiler Furnace and Steam Drum

The water enters the boiler through a section in the convection pass called the economizer. From the economizer it passes to the steam drum and from there it goes through down comers to inlet headers at the bottom of the water walls From these headers the water rises through the water walls of the furnace where some of it is turned into steam and the mixture of water and steam then re-enters the steam drum. This process may be driven purely by natural circulation (because the water is the down comers are denser than the water/steam mixture in the water walls) or assisted by pumps. In the steam drum, the water is returned to the down comers and the steam is passed through a series of steam separators and dryers that remove water droplets from the steam The dry steam then flows into the super-heater coils.

The boiler furnace auxiliary equipment includes coal feed nozzles and igniter guns, soot blowers, water lancing and observation ports (in the furnace walls) for observation of the furnace interior. Furnace explosions due to any accumulation of combustible gases after a trip-out are avoided by flushing out such gases from the combustion zone before igniting the coal.

The steam drum (as well as the super heater coils and headers) have air vents and drains needed for initial start-up.

2.6 Super-heater

Fossil fuel power plants often have a super-heater section in the steam generating furnace. The steam passes through drying equipment inside the steam drum on to the super-heater, a set of tubes in the furnace. Here the steam picks up more energy from hot flue gases outside the tubing and its temperature is now superheated above the saturation temperature. The superheated steam is then piped through the main stream lines to the valves before the high pressure turbine.

Nuclear-powered steam plants do not have such sections but produce steam at essentially saturated conditions. Experimental nuclear plants were equipped with fossil-fired super heaters in an attempt to improve overall plant operating cost.

2.7 Steam Condensing

The condenser condenses the steam from the exhaust of the turbine into liquid to allow it to be pumped. If the condenser can be made cooler, the pressure of the exhaust steam is reduced and efficiency of the cycle increases.

The surface condenser is a shell and tube heat exchanger in which cooling water is circulated through the tubes. The exhaust steam from the low pressure turbine enters the shell where it is cooled and converted to condensate (water) by flowing over the tubes as shown in the adjacent diagram. Such condensers use steam ejectors or rotary motor-driven exhausters for continuous removal of air and gases from the steam side to maintain vacuum.

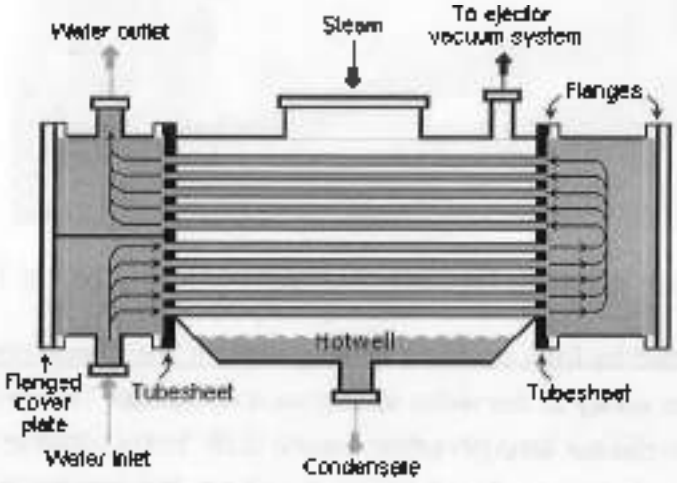


Figure 2.5 Typical Water-Cooled Surface Condensers

For best efficiency, the temperature in the condenser must be kept as low as practical in order to achieve the lowest possible pressure in the condensing steam. Since the condenser temperature can almost always be kept significantly below 100 °C where the vapor pressure of water is much less than atmospheric pressure, the condenser generally works under vacuum. Thus leaks of non-condensable air into the closed loop must be prevented.

Typically the cooling water causes the steam to condense at a temperature of about 35 °C (95 °F) and that creates an absolute in the condenser of about 2–7 kPa (0.59–2.07 inHg), i.e. a vacuum of about −95 kPa (−28 inHg) relative to atmospheric pressure. The large decrease in volume that occurs when water vapor condenses to liquid creates the low vacuum that helps pull steam through and increase the efficiency of the turbines.

The limiting factor is the temperature of the cooling water and that, in turn, is limited by the prevailing average climatic conditions at the power plant's location (it may be possible to lower the temperature beyond the turbine limits during winter, causing excessive condensation in the turbine). Plants operating in hot climates may have to reduce output if their source of condenser cooling water becomes warmer; unfortunately this usually coincides with periods of high electrical demand for air conditioning.

The condenser generally uses either circulating cooling water from a cooling tower to reject waste heat to the atmosphere, or once-through water from a river, lake or ocean.

Figure 2.6 A Marley Mechanical Induced Draft Cooling Tower

The heat absorbed by the circulating cooling water in the condenser tubes must also be removed to maintain the ability of the water to cool as it circulates. This is done by pumping the warm water from the condenser through either natural draft, forced draft or induced draft cooling towers (as seen in the image to the right) that reduce the temperature of the water by evaporation, by about 11 to 17 °C (20 to 30 °F)—expelling waste heat to the atmosphere. The circulation flow rate of the cooling water in a 500 MW unit is about 14.2 m^3/s (500 ft^3/s or 225,000 US gal/min) at full load.[13]

The condenser tubes are made of brass or stainless steel to resist corrosion from either side. Never the less they may become internally fouled during operation by bacteria or algae in the cooling water or by mineral scaling, all of which inhibit heat transfer and reduce thermodynamic efficiency. Many plants include an automatic cleaning system that circulates sponge rubber balls through the tubes to scrub them clean without the need to take the system off-line.

The cooling water used to condense the steam in the condenser returns to its source without having been changed other than having been warmed. If the water returns to a local water body (rather than a circulating cooling tower), it is tempered with cool 'raw' water to prevent thermal shock when discharged into that body of water.

Another form of condensing system is the air-cooled condenser. The process is similar to that of a radiator and fan. Exhaust heat from the low pressure section of a steam turbine runs through the condensing tubes, the tubes are usually finned and ambient air is pushed through the fins with the help of a large fan. The steam condenses to water to be reused in the water-steam cycle. Air-cooled condensers typically operate at a higher temperature than water-cooled versions. While saving water, the efficiency of the cycle is reduced (resulting in more carbon dioxide per megawatt of electricity).

From the bottom of the condenser, powerful condensate pumps recycle the condensed steam (water) back to the water/steam cycle.

2.8 Reheater

Power plant furnaces may have a reheater section containing tubes heated by hot flue gases outside the tubes. Exhaust steam from the high pressure turbine is passed through these heated tubes to collect more energy before driving the intermediate and then low pressure turbines.

2.9 Air path

External fans are provided to give sufficient air for combustion. The Primary air fan takes air from the atmosphere and. first warming it in the air preheater for better combustion, injects it via the air nozzles on the furnace wall.

The induced draft fan assists the FD fan by drawing out combustible gases from the furnace, maintaining a slightly negative pressure in the furnace to avoid backfiring through any closing.

2.10 Steam Turbine Generator

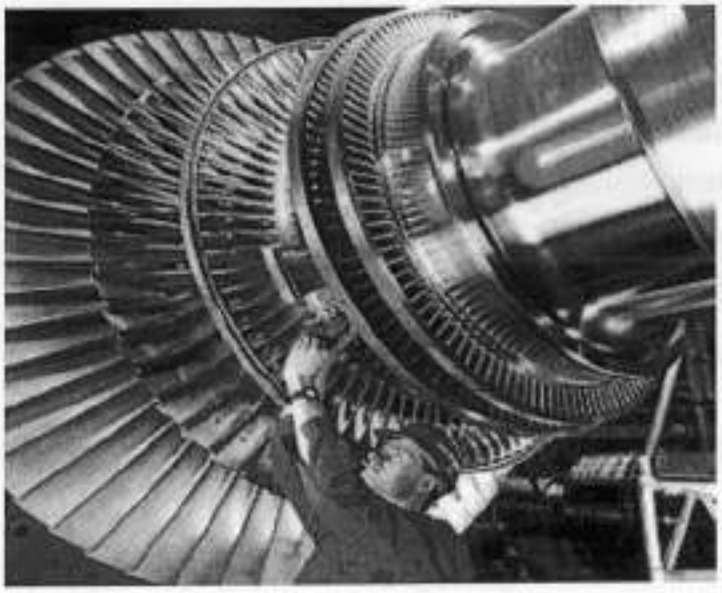


Figure 2.7 Rotor of a Modern Steam Turbine, used in Power Station

The turbine generator consists of a series of steam turbines interconnected to each other and a generator on a common shaft. There is a high pressure turbine at one end, followed by an intermediate pressure turbine, two low pressure turbines, and the generator. As steam

moves through the system and loses pressure and thermal energy it expands in volume, requiring increasing diameter and longer blades at each succeeding stage to extract the remaining energy. The entire rotating mass may be over 200 metric tons and 100 feet (30 m) long. It is so heavy that it must be kept turning slowly even when shut down (at 3 rpm) so that the shaft will not bow even slightly and become unbalanced. This is so important that it is one of only five functions of blackout emergency power batteries on site. Other functions are emergency lighting, communication, station alarms and turbo-generator lube oil.

Superheated steam from the boiler is delivered through 14–16-inch (360–410 mm) diameter piping to the high pressure turbine where it falls in pressure to 600 psi (4.1 MPa) and to 600 °F (320 °C) in temperature through the stage. It exits via 24–26-inch (610–660 mm) diameter cold reheat lines and passes back into the boiler where the steam is reheated in special reheat pendant tubes back to 1,000 °F (540 °C). The hot reheat steam is conducted to the intermediate pressure turbine where it falls in both temperature and pressure and exits directly to the long-bladed low pressure turbines and finally exits to the condenser.

The generator, 30 feet (9 m) long and 12 feet (3.7 m) in diameter, contains a stationary stator and a spinning rotor, each containing miles of heavy copper conductor—no permanent magnets here. In operation it generates up to 21,000 amperes at 24,000 volts AC (504 MW) as it spins at either 3,000 or 3,600 rpm, synchronized to the power grid. The rotor spins in a sealed chamber cooled with hydrogen gas, selected because it has the highest known heat transfer coefficient of any gas and for its low viscosity which reduces wind age losses. This system requires special handling during startup, with air in the chamber first displaced by carbon dioxide before filling with hydrogen. This ensures that the highly explosive hydrogen–oxygen environment is not created.

The power grid frequency is 60 Hz across North America and 50 Hz in Europe, Oceania, Asia (Korea and parts of Japan are notable exceptions) and parts of Africa. The desired frequency affects the design of large turbines, since they are highly optimized for one particular speed.

The electricity flows to a distribution yard where transformers increase the voltage for transmission to its destination.

The steam turbine-driven generators have auxiliary systems enabling them to work satisfactorily and safely. The steam turbine generator being rotating equipment generally has a heavy, large diameter shaft. The shaft therefore requires not only supports but also has to be kept in position while running. To minimize the frictional resistance to the rotation, the shaft has

a number of bearings. The bearing shells, in which the shaft rotates, are lined with a low friction material like Babbitt metal. Oil lubrication is provided to further reduce the friction between shaft and bearing surface and to limit the heat generated.

2.11 Stack Gas Path and Clean-up

As the combustion flue gas exits the boiler it is routed through a rotating flat basket of metal mesh which picks up heat and returns it to incoming fresh air as the basket rotates. This is called the air preheater. The gas exiting the boiler is laden with fly, which are tiny spherical ash particles. The flue gas contains nitrogen along with combustion products carbon dioxide, sulphur dioxide, and nitrogen oxides. The fly ash is removed by fabric bag filters or electrostatic precipitators. Once removed, the fly ash by product can sometimes be used in the manufacturing of concrete. This cleaning up of flue gases, however, only occurs in plants that are fitted with the appropriate technology. Still, the majority of coal-fired power plants in the world do not have these facilities. Legislation in Europe has been efficient to reduce flue gas pollution. Japan has been using flue gas cleaning technology for over 30 years and the US has been doing the same for over 25 years. China is now beginning to grapple with the pollution caused by coal-fired power plants.

Where required by law, the sulphur and nitrogen oxide pollutants are removed by stack gas scrubbers which use a pulverized limestone or other alkaline wet slurry to remove those pollutants from the exit stack gas. Other devices use catalysts to remove Nitrous Oxide compounds from the flue gas stream. The gas travelling up the flue gas stack may by this time have dropped to about 50 °C (120 °F).

In India, atmospheric dispersion modelling studies are required to determine the flue gas stack height needed to comply with the local air pollution regulations. As per the requirements of Air (Pollution, Control & Prevention of Pollution) 1981, the height of a flue gas stack to comply with what is known as the "Good Engineering Practice (GEP)" stack height. In the case of existing flue gas stacks that exceed the GEP stack height, any air pollution dispersion modelling studies for such stacks must use the GEP stack height rather than the actual stack height.

2.12 Fly Ash Collection

Fly ash is captured and removed from the flue gas by electrostatic precipitators, located at the outlet of the furnace and before the induced draft fan. The fly ash is periodically removed from the collection hoppers below the precipitators or bag filters. Generally, the fly ash is pneumatically transported to storage silos for subsequent transport by trucks or railroad cars.

2.13 Bottom Ash Collection and Disposal

At the bottom of the furnace. there is a hopper for collection of bottom ash. This hopper is always filled with water to quench the ash and clinkers falling down from the furnace. Some arrangement is included to crush the clinkers and for conveying the crushed clinkers and bottom ash to a storage site. Ash extractor is used to discharge ash from Municipal solid waste–fired boilers.

2.14 Auxiliary systems

2.14.1 Boiler Make-up Water Treatment Plant and Storage

Since there is continuous withdrawal of steam and continuous return of condensate to the boiler, losses due to blow_down and leakages have to be made up to maintain a desired water level in the boiler steam drum. For this, continuous make-up water is added to the boiler water system. Impurities in the raw water input to the plant generally consist of calcium and magnesium salts which impart hardness to the water. Hardness in the make-up water to the boiler will form deposits on the tube water surfaces which will lead to overheating and failure of the tubes. Thus, the salts have to be removed from the water, and that is done by water demineralizing treatment plant (DM) A DM plant generally consists of Cation. anion, and mixed bed exchangers. Any ions in the final water from this process consist essentially of hydrogen ions and hydroxide ions, which recombine to form pure water. Very pure DM water becomes highly corrosive once it absorbs oxygen from the atmosphere because of its very high affinity for oxygen.

The capacity of the DM plant is dictated by the type and quantity of salts in the raw water input. However, some storage is essential as the DM plant may be down for maintenance. For this purpose, a storage tank is installed from which DM water is continuously withdrawn for boiler make-up. The storage tank for DM water is made from materials not affected by corrosive water, such as PVC. The piping and valves are generally of stainless steel. Sometimes, a steam blanketing arrangement or stainless steel doughnut float is provided on top of the water in the tank to avoid contact with air. DM water make-up is generally added at the steam space of the surface condenser (i.e., the vacuum side). This arrangement not only sprays the water but also DM water gets deaerated, with the dissolved gases being removed by a de-aerator through an ejector attached to the condenser.

2.15 Fuel preparation system

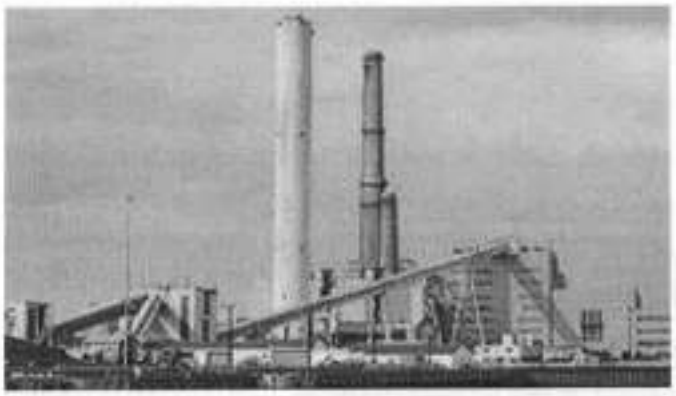


Figure 2.8 Conveyor System for moving Coal (visible at far left) into a Power Plant

In coal-fired power stations, the raw feed coal from the coal storage area is first crushed into small pieces and then conveyed to the coal feed hoppers at the boilers. The coal is next pulverized into a very fine powder. The pulverisers may be ball mills, rotating drum grinders, or other types of grinders.

Some power stations burn fuel oil rather than coal. The oil must kept warm (above its pour point) in the fuel oil storage tanks to prevent the oil from congealing and becoming unpumpable. The oil is usually heated to about 100 °C before being pumped through the furnace fuel oil spray nozzles.

Boilers in some power stations use processed natural gas as their main fuel. Other power stations may use processed natural gas as auxiliary fuel in the event that their main fuel supply (coal or oil) is interrupted. In such cases, separate gas burners are provided on the boiler furnaces.

2.16 Barring Gear

Barring gear (or "turning gear") is the mechanism provided to rotate the turbine generator shaft at a very low speed after unit stoppages. Once the unit is "tripped" (i.e., the steam inlet valve is closed), the turbine coasts down towards standstill. When it stops completely, there is a tendency for the turbine shaft to deflect or bend if allowed to remain in one position too long. This is because the heat inside the turbine casing tends to concentrate in the top half of the casing, making the top half portion of the shaft hotter than the bottom half. The shaft therefore could wrap or bend by millionths of inches.

This small shaft deflection, only detectable by eccentricity meters, would be enough to cause damaging vibrations to the entire steam turbine generator unit when it is restarted. The

shaft is therefore automatically turned at low speed (about one percent rated speed) by the barring gear until it has cooled sufficiently to permit a complete stop.

2.17 Oil System

An auxiliary oil system pump is used to supply oil at the start-up of the steam turbine generator. It supplies the hydraulic oil system required for steam turbine's main inlet steam stop valve, the governing control valves, the bearing and seal oil systems, the relevant hydraulic relays and other mechanisms.

At a pre-set speed of the turbine during start-ups, a pump driven by the turbine main shaft takes over the functions of the auxiliary system.

2.18 Generator Cooling

While small generators may be cooled by air drawn through filters at the inlet, larger units generally require special cooling arrangements. Hydrogen gas cooling, in an oil-sealed casing, is used because it has the highest known heat transfer coefficient of any gas and for its low viscosity which reduces wind age losses. This system requires special handling during start-up, with air in the generator enclosure first displaced by carbon dioxide before filling with hydrogen. This ensures that the highly flammable hydrogen does not mix with oxygen in the air.

The hydrogen pressure inside the casing is maintained slightly higher than atmospheric pressure to avoid outside air ingress. The hydrogen must be sealed against outward leakage where the shaft emerges from the casing. Mechanical seals around the shaft are installed with a very small annular gap to avoid rubbing between the shaft and the seals. Seal oil is used to prevent the hydrogen gas leakage to atmosphere.

The generator also uses water cooling. Since the generator coils are at a potential of about 22 kV, an insulating barrier such as Teflon is used to interconnect the water line and the generator high-voltage windings. Demineralized water of low conductivity is used.

2.19 Generator High-voltage System

The generator voltage for modern utility-connected generators ranges from 11 kV in smaller units to 22 kV in larger units. The generator high-voltage leads are normally large aluminium channels because of their high current as compared to the cables used in smaller machines. They are enclosed in well-grounded aluminium bus ducts and are supported on suitable insulators. The generator high-voltage leads are connected to step-up transformers for connecting to a high-voltage electrical substation (usually in the range of 115 kV to 765 kV) for further transmission by the local power grid.

The necessary protection and metering devices are included for the high-voltage leads. Thus, the steam turbine generator and the transformer form one unit. Smaller units may share a common generator step-up transformer with individual circuit breakers to connect the generators to a common bus.

2.20 Monitoring and Alarm System

Most of the power plant operational controls are automatic. However, at times, manual intervention may be required. Thus, the plant is provided with monitors and alarm systems that alert the plant operators when certain operating parameters are seriously deviating from their normal range.

2.21 Battery-supplied Emergency Lighting and Communication

A central battery system consisting of lead acid cell units is provided to supply emergency electric power, when needed, to essential items such as the power plant's control systems, communication systems, turbine lube oil pumps, and emergency lighting. This is essential for a safe, damage-free shutdown of the units in an emergency situation.

2.22 Transport of Coal Fuel to Site and to Storage

Most thermal stations use coal as the main fuel. Raw coal is transported from coal mines to a power station site by trucks, barges, bulk cargo ships or railway cars. Generally, when shipped by railways, the coal cars are sent as a full train of cars. The coal received at site may be of different sizes. The railway cars are unloaded at site by rotary dumpers or side tilt dumpers to tip over onto conveyor belts below. The coal is generally conveyed to crushers which crushes the coal to about ¾inch (19 mm) size. The crushed coal is then sent by belt conveyors to a storage pile. Normally, the crushed coal is compacted by bulldozers, as compacting of highly volatile coal avoids spontaneous ignition.

The crushed coal is conveyed from the storage pile to silos or hoppers at the boilers by another belt conveyor system.

During site visit to Unit 8,9 & 10 (3x660MW) of Coal based Thermal Power Plant, the experts accompanied by the plant safety officer look into the vulnerable location which may deviate towards either fire hazard or toxic dispersions in the atmosphere. The detail observations are as follows:

2.23 Observations during Site Visit

A) Chemical Storage Area:

The chemical storage area consists of HCL and NaOH storage tanks.

1) There are 02 tanks of Hydrochloric acid (HCl) & 02 tanks of Sodium Hydroxide (NaOH) having capacity of 20MT each.
2) Corrosion in tanks due to fugitive emission of HCL.
3) Stairs are corroded and may damage any time
4) Working platforms at tank s manhole at acid alkali tank are corrode and shall not be useful for any work
5) The tanks are surrounded by required volume of dike but dike has very big hole which spoils the purpose of dike.
6) No poly coating Liner at alkali Tank Dike
7) Both HCL & NaOH tanks are present in same dike
8) The tanks are at height of around 4 meters and hence if jet occurs may go outside the dike area and previous accident data evident the same
9) After Leakage in the acid tank, the acid is shifted to Poly-plastic tanks (Syntax tank) which is at sever risk and not advisable to store in such MoC for even very short time
10) Level Indicator is not available at Alkali tank
11) Level Indicator is present at Acid Tank but it is not in working condition
12) Liner present at acid tank dike but in damaged condition
13) The dike has big hole which has spoiled the purpose
14) Eye washer is present but not in approach to use and situated at very near to poly-plastic acid tanks
15) In DM plant section, some of the tanks are provided with level Indicators but they are not in working condition
16) Working person in DM Plant when works on tank's manhole are at high risk because theses tanks are not provided with safe platform to work at the height
17) Fume absorber is not available in chemical storage area.

B) Hydrogen Storage

1) In hydrogen storage area leak detection system in not observed
2) Fire proof wiring and flame proof light are observed
3) Water shower, gas detector, leak detector are not present
4) Resin Containers are present in hydrogen storage area which is at sever risk

5) Emergency Exit Doors are blocked by cylinders
6) In Hydrogen storage area Nitrogen, Carbon Dioxide. Argon and Hydrogen cylinders are present
7) Fire hydrant is located near hydrogen storage area but not in approach to use due to fencing
8) Fire hydrant is not installed considering wind flow pattern
9) Wind Socks are not present on the roof of Hydrogen Storage, chemical storage area and WTP office building
10) No proper approach road from clarifier to filter level, the working persons walk on wooden plank and jump from window in filter section this action and situation is at sever risk
11) Smoke detectors are observed in TTWR
12) In TTWR naked wires are inserted in electric switch boards
13) Opposite end of electric Panel room of TTWR is not provided with railing wall which is at more than 15 m high
14) No proper approach from Service water pump to city service water pump.

C) PCR 8 & 9

1) Alternate Exit Path is full of garbage and not possible to walk through it hence proper housekeeping of alternate exit path ways to be maintained
2) Fire fighting hose pipe is missing for the place most of the locations

D) Major Store

1) Office of Major store has only one exit and no alternative exit provision is observed
2) Lubricant oil and transfer oil is present which is flammable
3) Turbo ventilator is present in every godown

E) Service Building

1) S.E. (Maintenance BM & TM) does not have alternative gate
2) S.E. (Operations) does not have alternative gate
3) The moving corridor at each floor is congested and non-ventilated
4) At third and fourth floor, it is observed that most of the working persons sitting are 45+, having more anxiety less physical efficiency to run or jump

F) Hydrazine and Ammonia Dosing

1) SCABA is not available
2) No water source near storage vessels
3) No water Jets and eye wash is available near dosing facility
4) Hydrazine and Ammonia Drums are kept without identification near dosing facility area
5) The dosing tanks have ladder to climb for manual dosing of both ammonia and hydrazine

G) Chlorine Dosing Area

1) 3 Set of SCABA is Present
2) Gas detector is not observed
3) Wind sock is present
4) 2 nos. of Lime Solution tank and 3 nos. of Dosing platform are observed.
5) Chlorine dosing area is located on fore-bay where the toner transportation is not advised, it shall be relocated as this area is at sever Risk

H) LDO, HFO Tanks

1) LDO tank 1000 KL x 2
2) HFO tank 2000 KL x 2
3) The tanks are surrounded by dyke of sufficient volume without Epoxy coating
4) LDO and HFO tanks have separate dikes
5) Storm drain is available in the dyke but housekeeping is not proper.
6) Spill drain are also available but chock with mud
7) Water Showers & Foam Spray system is not available around the tanks
8) The tanks and associated pipelines are lined with insulating material
9) Fire fighting system is available
10) Heat or Thermal arrestors are absent
11) Flame or Smoke Detectors are absent
12) Level indictor of HFO is not working
13) Pressure indictor of LDO tank is not provided.

I) Coal Handling Plant

1) Water showers for dust suppression in wagon tippler area are present but not in working condition

2) Dust absorber is not present
3) Safety control system are installed but not in working condition
4) Flameproof lights are available at confined and unconfined area
5) Proper earthlings are provided
6) Lightings on stairs are available but not illuminating the whole staircase area
7) The staircases in the confined area are damaged & difficult to use in less illuminated area
8) Dust extraction system is available but not in working condition
9) Drinking water quality is not matching with the requirements of IS 10500
10) RO filters are installed but not in working condition.

J) Coal Sampling Preparation Lab

1. Illumination is very poor in office as well as in coal preparation area of Lab
2. Turbo ventilations System, Cross Ventilations System and Dust Suppreseion System are not present in the area
3. Drinking water quality is not matching with the requirements of IS 10500
4. RO filter are installed but not in working.

K) Natural Draught Cooling Tower (NDCT)

1. Lightening Arrestors are provided but not earth properly at NDCT 10
2. Lightening Arrestors are break and earth wires are not reached down to earth properly at NDCT 8 & 9
3. Aviation Lights are not working.

L) Fire fighting Section

1) Fire section is headed by Fire Station In-charge.
2) 01 Fire officer with Diver cum fire engine operator and contractor fire man is present in Fire station
3) Total 03 number of fire Tender is available out of which 02 is Mullipurpose Tender and 01 is Water Tender.
4) 12 fire Assistance are available which are under the Authority of Contract actor
5) There sitting arrangement is at Seva Sadan which far away from Unit 8, 9 & 10.
6) Fire Extinguisher location chart is available
7) Mutual aid is done with Khaperkheda Thermal Power Plant.

8) 76 number of Reducer Jets/ Branch are available which are 19 multipurpose Jet, 04 Fog Branch, 35 Standard Branch, 03 Revolving head Branch, 06 Foam making Branch, 09 Jumbo curtain nozzle Branch,01 Hand controlled branch.
9) Mock drill once in 06 month is carried out
10) Daily testing of hydrants is carried out.
11) SCBA is available with fire tenders
12) During discussion with Fire Officer, he told that there were 17 minor fir accidents and 02 major fire accidents occurs in the year 2019-20 and in year 2020-21 fire accidents occurred are 10.
13) Fire Emergency Alarms system is not installed.
14) Fire Alarm is local & the responsible person calls to Fire office.
15) 31number of fire monitor and 315 numbers of Hydrants are installed in plant.
16) First- aid training attained by employees.
17) Fire Extinguisher Training section wise in house to engineers, Technicians and Even to Contractors worker on monthly basis is given.
18) Fire Extinguisher Practical Training is given during Fire Week
19) No Standard fire alarm is available.
20) Emergency information is given by Phone cell.

L) Dispensary

1) The Medical Centre at Koradi Thermal Power Plant is equipped with 05 bedded indoor medical facilities. The present medical staff is in capacity to handle only 05 victims during emergency with available staff and facilities at the centre
2) It is inference that the Medico Centre Staff instead of bringing the victim to the centre they refer to the well equipped with all super speciality hospitals instead of wasting the precious time due to lack of facilities in the centre
3) The occupational diseases noticed till date are
    i) Allergic Skin Reactions
    ii) Respiratory Tract Infections
    iii) Sun Stroke
    iv) Burn Cases
    v) Traumatic Injuries
4) Standard and Safe Operating Procedures to handle Medical Emergences in Plant are not yet prepared for the work in plant in co-ordination with Safety officers

5) There are 02 doctors out of one is Medical Superintendent and another is assistant to him. Both are MBBS as their basic graduation and MS has done his PG in Environmental Health
6) There is only 01 Female Nurse who is GNM and one more post is vacant
7) The Medical centre has very ordinary medical equipment viz Nebulizer, Glucometer, BP apparatus, Autoclave, ice pack etc.
8) The First Aid Training is carried out by outsourcing Dr Dandge (MBBS, AFIH) use to conduct ones in the year, the orientation program are organized by the centre quarterly
9) There are only 02 first aiders per section but it do not satisfy the need
10) There is 01 ambulance present at the plant round the clock whereas 01 high tech ambulance is present at centre with cardiac life support system
11) The Medical Superintendent is aware of requirement of Emergency Medical Room at plant as per MFR and he proposed the location at or near Service building
12) Ambulance drivers are in control of vehicle department and hence MS is not aware who will be deputed for ambulance driving and he is aware of all remote locations in the plant
13) Due to lack of facilities no epidemic camps are arranged by centre for staff, colony or for adjacent villages
14) The medical staff tries to reach to the location where emergency occurs within 05 minutes after getting information but telephonic communication is the only mode of information which may be late some time
15) PPEs available with centre to face emergencies are medical PPEs, Gumboots, Caps, Protective aprone, specialised PPE Kits etc.

M) Security

1) There are 269 Security Guards present
2) There are 22 Security Officers
3) 04 numbers of gates
4) Mutual aid with State Police Department
5) First Aid training are provided

Emergencies are identified and tabulate in the **Table 2.1**

Table 2.1

Hazard Identification & Categorization

Sr. NO.	Department	Hazards Identified		
		Severe Risk	Medium Risk	Low Risk
1	Boiler	1) Spillage of Oil 2) Hazardous Waste 3)Explosion 4) Electric Shock 5)Steam & Gas Leakage 6)Thermal Radiation	1) Tools & Tackles 2) Occupational Health Hazards	1) House Keeping
2.	Turbine	1) Spillage of Oil 2) Hazardous Waste 3) Thermal Radiation 4) Electric Short Circuit 5) Compressor Belts	1) Tools & Tackles 2) Occupational Health Hazards	1) House Keeping 2) Obstacles on Walkways
3.	Coal Handling Plant	1)Conveyor Belt 2)Dust / Gas Explosion 3)Rail Wagon Derailment 4)Wagon Tippler 5) Fire hazard 6) Short circuit 7) Lack of illuminance in confined space (Negative Level) 8) Malfunctioning in Wagon Tippler handling	1) Dust Explosion 2) Electrocution 3) Electric Shock	1)Occupational Diseases to exposed persons 2) Hazards due to close proximity with the workplace 3) Slippery walkways due to dust & water accumulation 4) less ventilation at confined space
4.	Electrical	1) Static Electricity 2) Electrocution	1)Tools & Tackles	1) House Keeping
5	Water Treatment Plant	1) Hydrazine Dosing 2) Ammonia Dosing Plant 3) Corrosion of storage tanks of Acid and Alkali 4) Storage of Acid in plastic water tank	1) Bulk Storage	1)Approaching Roads
6.	**Operations**			
	Coal Mill	1)Static Electricity 2)Dust Explosion 3)Illumination 4) Fire	1) Noise 2)Water 3) Marshy Area	1) Railings 2)Grills 3)Ladders

	Transformer	1)Bursting 2) Spillage	-	-
	ESP	1)Work Permit System 2)Bottom Ash 3) Ash Clinker Removing Process 4) Hopper pipeline chocking	1) Ash Dust Explosion	1) House Keeping
	Turbine	1)Hydrogen Leakage 2) Steam Leakage	1) Noise	-
	Oil Handling Plant	1) Oil Spillage 2) Steam Leakage 3)Rupture of oil transfer Pipeline	Oil transfer pipeline from oil unloading point to storage tank	-
	Compressor	1)Rupture of Pipeline 2)Oil Spillage	1) Noise	
	Ash Handling Plant	1)Rupture of Pipeline 2) Dust Explosion	1) Illumination	1) House Keeping
	Pump House	-	1) Marshy Land 2) Noise	
8.	**Major Stores**	1)Hazardous Waste 2)Batteries 3)Glass Wool 4) Oil	-	Housekeeping
9.	**Fire Fighting**	1)Temporary Fuel Storage		
10.	**Cooling Towers**	1) Lighting 2)Aviation Traffic		
11.	**Security**	1)Alcohol & Tobacco Consumption 1) Smoking Zones		
12.	**Assembly points**	1)Stampede	1)Chaos	
13.	**Vehicles**	1)Spark at silencer 2) Over-speed Driving	1) Wrong side Driving	
14.	**Canteen**	1) Leakage of LPG 2)Spillage of Hot Food	1)House Keeping 2) Contaglous Diseases to workers	1)Cleaning of Kitchen & Dining Hall

Method: *(Subjective Judgement)*

CHAPTER 3

Chapter III

Emergency Organization Structure

3.0 Site Main Controller

Chief Engineer / SSM - (The senior most functionaries available at site).

The Chief Engineer / Site Shift Manager (SSM) will be designated as the Site Main Controller at the time of an emergency and report at the Emergency Control Centre (ECC) which will be the Primary Command Post. He will be the Chief Co-ordinator and take overall command of the emergency management. He will be assisted by other co-ordinators as designated for various functions. The Site Main Controller will provide all decisions support and resources support to the Site Incident Controller at the incident site for initiating appropriate actions for emergency control. He will also liaise with mutual aid members and all outside agencies including Local Crisis Management Committee, District Contingency Plan Committee (District Collector), Police, Civil Defence, Factories Inspectorate, etc. to seek assistance/help and provide necessary information to them.

Normally, the SSM is available on round the clock duty at the site to co-ordinate overall manufacturing activities and management of emergency (if any). In the event of an emergency, the Site Shift Manager (SSM) will assume the charge of the Site Main Controller till the Executive or the Chief Engineer arrives

3.1 Site Incident Controller

CE / Dy. CE / SE / EE. - (next lower to the senior most functionary of operation available at site)

The next lower to senior most functionary of operation available at site will be Site Incident Controller. On receiving information about the emergency, he will report at the incident site and take over from the Deputy Incident Controller (shift-in-charge). He will take overall command of the emergency control operation as the Site Incident Controller and will take decisions in co-ordinations with Site Main Controller for controlling emergency situation. He will co-ordinate with all the key personnel, fire fighting and rescue team leaders. He will also provide other support services to provide necessary information and advice to them for effectively managing control measures / actions.

3.2 Deputy Incident Controller

The shift-in-charge is available on round the clock duty in every plant. He is competent for plant operation and responsible for all activities related to production / maintenance including prevention / control of incidents and handling emergencies (if any) in the plant. He will be designated as the Deputy Incident Controller. In the event of an emergency in the plant, he will immediately assume the charge of the site Incident Controller and take decisions in consultation with the Site Main Controller. To initiate immediate actions for controlling/mitigating emergency situation at the incident site till the Site Incident Controller (next senior personnel in production) arrives.

3.3 Emergency Control Centre (ECC) (The Primary Command Post)

In the event of an emergency, SSM Office will be designated as the Emergency Control Centre, which will be known as the Primary command Post. If, the SSM office is likely to be affected due to unfavourable wind direction or any other reasons, the Emergency Control Centre will be shifted to the Construction Conference Room which will be having necessary facilities to connect communication links as provided in the SSM Office.

3.4 Field Command Post (Incident Site)

An emergency requires co-ordination of numerous activities beyond spill containment and counter measure efforts from a safe location at the incident scene. The Field Command Post will be established in the "Cold Zone" for staging deployed apparatus, resources and equipment with means of communications and manning to effectively co-ordinate control efforts.

3.4.1 Coordinators

(The senior most functionaries available in the respective services)

The senior most functionaries available at site in the respective services will be the coordinators at the time of an emergency. They will report at the Emergency Control Centre (EFF), known as the Primary Command Post, unless and otherwise instructed by the Chief Coordinator (The Site Main Controller). They will assist and advise the Site Main Controller in all matters for effectively managing control measures and mitigating operations.

(Note: In case, only one senior person of operation function is available at site, the priority shall go for the Site Incident Controller).

3.4.2 Key Personnel

(Next lower to the senior most functionaries of the respective services available at site)

The senior most functionaries of respective services become the coordinators and next lower to the senior most functionaries of the respective services available at site will be Key Personnel They will report at Field Command Post (the incident site) or as instructed by the respective Coordinators and work in co-ordination with and under the command of the Site Incident Controller. They will provide necessary assistance / resources to the Site Incident Controller for effectively controlling the cause of the emergency situation and in mitigating actions. Key Personnel of operation function will be Site Incidental controller. Coordinators and the Key Personnel for various Disciplines / Services are presented in **Table 5.1**.

3.5 Role of Individuals

3.5.1 Role of Site Main Controller

The Site Main Controller will be the chief coordinator and shall be assisted by other coordinators (senior most functionaries in the respective disciplines) He will take overall command of the emergency management and his duties and the responsibilities are as below

He will:

- Report at the Emergency Control Centre as soon as he gets information about the emergency at site and will assume overall responsibility if taking decisions and directing actions as necessary for mitigating the situation and managing the emergency effectively with due consideration and priorities for personnel safety, safety to the company's property and the environment
- Assess the magnitude of the situation in co-ordination with the Incident Controller / Dy. Incident Controller and decide whether major emergency exists or is likely to develop, requiring external assistance. Accordingly, he will decide to inform Local / District Emergency Chief and other emergency control groups for help and the nature of help required including assistance from mutual aid members and declare on-site emergency
- Decide the safe route of entry for external assistance / help to reach at site of the incident considering wind direction and the place of the incident and also the place of reporting such assistance. He will also direct the security to guide them properly
- Ensure that the Key Personnel and Coordinators are called in

- Ensure that all non-essential workers, visitors, contractors are safely moved to assembly points and direct for search and rescue operation within the affected areas, if necessary
- Be in constant communication with the Site Incident Controller to continuously review and assess the situation and possible developments
- Direct actions for safe shut down of plant(s) or section of the plant and evacuation of plant personnel and other necessary action is in consultation with the other coordinators
- Exercise direct operational control over areas in the complex other than those affected in consultation with other coordinators
- To liaise with the local meteorological office to receive early notification of changes in wind direction and weather conditions
- Liaise with the senior officials of Police, Fire Brigade, Medical and Factories Inspectorate and pass on information on possible effects to the surrounding areas outside the factory premises and necessity of evacuating the area and moving the people to safe places
- Liaise with various coordinators to ensure that various team are functioning well, casualties are receiving attention and traffic movement within the works is well regulated
- Arrange for a log of the emergency to be maintained in the Primary Command Post
- Release authorized information to press through the media coordinator
- Control rehabilitation of the affected persons and the affected areas after cessation of the emergency

3.6 Role of Site Incident Controller

The Site Incident Controller is the Key Personnel for operations function reporting at the incident site and will take the overall command of actions for emergency control operation on his arrival at the incident site. He will be supported by other key personnel representing various emergency services and initiate emergency control actions under the direction of the Site Main Controller (Primary Command Post). The duties and the responsibilities of the Site Incident Controller include the following:

He will:

- Report at the incident site immediately after getting information about an emergency. Upon his arrival at the site, he will assess the scale of emergency in consultation with the Deputy Incident Controller and evaluate, if a major emergency exists or is likely to develop and inform Emergency Control Centre (primary Command Post) accordingly asking for assistance and indicating kind of support needed
- Take overall control of handling the emergency at site and take action for isolation of source of containment loss to the extent feasible. Simultaneously, in case of fire organize appropriate fire response in co-ordination with Key personnel (Fire & Safety) to get the situation under control and to prevent it's escalation
- Set up communication point (Field Command Post) and establish contact with Site Main Controller (Primary Command Post) and keep him informed about the development
- Keep on assessing the emergency situation at the site and communicate to the Site Main Controller (Primary Command Post) and keep him informed about the development
- Co-ordinate the activities of other key personnel reporting at the Field Command Post, under his overall command
- Direct all operation with the affected areas giving due priorities for safety of personnel and to minimize damage to environment, plant and property
- Provide advice and information to Fire fighting and rescue personnel, external fire services and other emergency services / teams as and when they arrive at the incident site and co-ordinate with them for effective control actions
- Ensure that all non-essential workers and staff within the affected area are evacuated to appropriate assembly points and that areas are searched for casualties
- Organize rescue teams for search of casualties in the affected areas (if any) and send them to safe areas / medical centre for first aid and medical relief
- Seek additional support and resources as may be needed through Primary Command Post

- Send decision support from the Primary Command Post for decision such as precautionary shut down of neighbouring facilities, precautionary evacuation of people in the neighbouring facilities, activating mutual aid plan, etc.
- Be in constant liaison with the Site Main Controller and keep him informed about the situation at the incident site
- Preserve all evidences so as to facilitate any inquiry into the cause and circumstances, which caused or escalated the emergency (to arrange photographs, video, etc.)
- Arrange for head count after the emergency is over with respect to the personnel on duty in the affected areas

3.7 Role of Deputy Incident Controller

Normally, the Shift-in-charge of a plant being always available at the plant site and well aware of the plant operating conditions at all times will be designated as the Deputy Incident Controller and assume the charge of the Site Incident Controller at the time of an emergency till the Site Incident Controller arrives at the incident site, he will assist the Site Incident Controller on his arrival and work under his direction in emergency control operation.

The responsibilities and duties of the Deputy Incident Controller will be as defined for the Site Incident Controller. In addition he will ensure the following:

He will:

- In the event of an emergency, caused due to any incident in the plant, he will immediately actuate plant level emergency siren (hooter) to warn the field personnel, contractors' employees, etc. and also arrange for announcement about the emergency and necessary instruction for them for assembling at the safe assembly point or evacuation, etc.
- Ensure that the SSM and senior plant personnel have been informed about the emergency

3.8 Role of Fire Services Personnel

Main Role of Fire Services personnel are fire fighting and rescue operations, helping in operations like, prevention of loss of containment of hydrocarbon, spill / leak containment, etc. Their main responsibilities and duties are described specifically as below:

3.8.1 Role of the Chief of Fire (or next senior most fire personnel available)

- He will be the Key Personnel for the Fire and Safety Services at the incident scene and coordinating and commanding all the related operations in consultation with the Site Incident Controller
- He will report at the Field command Post (Incident Site) immediately after receiving the information about an emergency at site, contact the Site Incident Controller and the first turn out leader for necessary information/advice to decide control strategies
- He will take overall command of fire fighting / rescue operations and other measures as necessary to control and mitigate the situation and lead the fire fighting crew including outside / mutual aid fire fighting teams
- He will assess the severity / magnitude of the situation and decide the level of the emergency in consultation with the Site Incident Controller and inform the Site Main Controller (Primary Command Post) at ECC. He will also advise him for declaring on-site emergency (if necessary)
- He will call for additional resources / help from other Depts. (AFS personnel), mutual aid members, etc. through Primary Command Post as necessary and deploy them appropriately for fire fighting and rescue operation at the incident scene. He will also coordinate with other key personnel
- He will ensure that sufficient personnel protective equipment, masks, Breathing Air sets, Spare Breathing Air Cylinders etc. are available at the field Command Post for use by the crew members and ensure that no one access the "Hot Zone" without adequate personnel protection. He will call for logistic support (mobilizing additional supplies through Primary Command Post (Site Main Controller/HSE&F Coordinator)
- He will keep constant contact with Primary Command Post and seek decision support from the Site Main Controller in critical matters / operations and also inform him, if other plants in the complex or surrounding population are likely to be affected
- He will co-ordinate with Security Key Personnel for access control and barricading the affected area in order to prevent vehicular movement
- He will assist in rescue and first aid operations

3.8.2 Role of Shift Fire Officer (Riding Officers)

- Upon receiving emergency call / alarm, he will quickly prepare for the fire turn out and mount the leading fire tender along with the crew members and rush to the incident site taking a safe route of entry considering the wind direction
- Report to the Dy. Incident Controller/the Incident Controller and Position the Fire Tender strategically at a location in consultation with the Dy. Incident Controller/the Incident Controller
- He will decide the line of action for fire fighting and/or other control actions at the scene in consultation with the Dy. Incident Controller / Incident Controller and take appropriate actions for fire fighting and control measures
- He will guide and lead the fire fighting crew in fire fighting and rescue operation till the arrival of F&S Key person (the Chief of Fire or next senior most person)
- He will ensure the safety of the crew members and that crew members are fully equipped with necessary personnel protection prior to enter "Hot Zone"
- He will assess the severity of the situation and may call for second turnout / additional help through the Dy. Incident Controller/Incident Controller (Field Command Post)
- He will keep constant contact with the key personnel (F&S) at the Field Command Post and inform about the situation and probable developments

3.8.3 Role of Firemen on Duty at the Fire Control Room

- The fireman on duty at the Fire Control Room will acknowledge the emergency alarm received on the panel and promptly note the plant area/where the incident occurred
- He will note down the information, if emergency call is received through telephone, hot line or messenger
- He will sound the fire bell to inform the fire crew to get ready and take their positions, simultaneously brief the Shift Fire Officer about the emergency message
- He will intimate the Site Shift Manager and the Security Dept. about the emergency giving short description about the occurrence (if known)
- He will actuate emergency siren after receiving instruction from Primary Command Post (Site Main Controller/HSE&F Coordinator)

- He will ask telephone operator to pass on to the communication about the emergency to the Auxiliary Fire Squad of all the plants/selected plants on receiving the instruction from HSE&F Coordinator/Site Main Controller
- He will always be ready and alert for receiving any message/instructions from Primary Command Post/Field Command Post

3.8.4 Role of Auxillary Fire Squad Members

AFS Members shall be ready on hearing emergency siren and will report to site incident controller at site (Field Command Post) on receiving message from ECC

- They will do the fire fighting under the instruction of Shift Officer. Help to bring fire fighting equipment from nearby plants
- AFS Members of the plant under emergency will immediately go to the emergency site and will start first aid fire fighting
- As per the emergency situation they will use the fixed fire fighting equipment to protect plant equipment from heat exposure
- They will guide non-essential personnel in case of evacuation
- They will do monitoring/closing of storm water drains if required
- They will help key personnel for taking action on site. Help to Security Personnel for traffic Control

3.8.5 Role of Mutual Aid Members

MAHAGENCO 3X660 MW Koradi, Nagpur shall make an agreement for mutual aid with the neighbouring industries for mutual help / assistance in the event of an emergency. All the mutual aid member of companies is bound to respond promptly to the emergency call as and when communicated to them in line with the agreement.

All the industries shall get hot line facilities for emergency communication. Nagpur Municipal Corporation Fire Brigade though not in Mutual Aid agreement can also be called for help depending upon the situation through the Primary Command Post.

- The Mutual Aid Member Industries will be called as necessary in the event of any emergency at MAHAGENCO 3X660 MW Koradi, Nagpur. They shall respond promptly on call and sent their fire tenders / crew members along with necessary supplies/material at the incident site, as requested

- The outside fire crew / tenders will report at the Security Gate (as the case may be) and get directions from the Security Officer on duty. The MAHAGENCO 3X660 MW Koradi, Nagpur, Security Officer will guide the place of the incident or / and place of reporting to them as soon as they reach the gates. If needed, the Security Officer on duty will arrange for an escort for guiding them properly to reach to the correct place
- The outside fire crew leaders from the Mutual Aid Member organization, upon arriving at the incident site shall report to the Site Incident Controller / Key Person (Fire and Safety Services) and initiate actions for fire fighting / other control operations under the direction of the Key person (Fire and Safety Services)
- The Crew in-charge of the outside Mutual Aid Fires Services shall ensure safety of their crew members engaged in emergency operations

3.8.6 Non-essential Personnel

The MAHAGENCO employees, contractors' employees, visitors, etc. (other than emergency response personnel) present at the incident site that is not required to be present at the incident site during the emergency at the site. In the event of declaration of an emergency in the plant / area, these persons shall quickly assemble at the safe assembly point of the plant / area and shall respond as instructed by the Site Incident Controller.

3.8.7 Instruction to the Non-essential Personnel

- Do not panic. Ensure that persons in your immediate vicinity are warned
- Remain alert for announcement from the Control Room, such "Proceed to Safe Assembly Point" and act accordingly
- Do not rush to the scene to be a spectator
- Await instructions at the Assembly Point, report your presence to the superiors / or the Site Incident controller, inform his whereabouts of your colleagues if they have not arrived
- Do not engage telephone / talk back system and other communication channels, unnecessarily
- Do not approach Control Centres without urgent/or important reasons
- If you are not assigned any specific role, move away as directed
- Do not offer non-authentic information / unconfirmed facts / fact / or conjecture

3.8.8 Role of Telephone Operator

At the time of emergency, communications both inwards as well as outward are very essential and telephone operator's swift action becomes very important. He plays very important part in communicating information / messages to the concerned personnel / outside agencies / mutual aid members / staff members etc. and also receiving a large numbers of outside calls. His main responsibilities and duties are as below:

- He will keep the board free to the extent possible for incoming calls
- He will immediately convey message to the "Key Personnel" and the "Coordinator" about the emergency as per the instruction of the Site main controller. The designated personnel list is given in the On-site Emergency Plan (Flip Chart)
- The telephone operator will follow instructions from the Site Main Controller / or Media Coordinator only, for passing on any information to outside agency about the emergency or direct all such queries to the media coordinator for appropriate reply
- As far as possible he should not entertain unknown / unimportant outside calls / inquiries during initial few hours of the emergency

3.9 Role of the Coordinators

3.9.1 HSE & F Coordinator

- He will report at the Emergency Control Centre (Primary Command Post) immediately after receiving information about the emergency. He will assist the Site Main Controller for taking critical decisions and provide necessary advice and information
- He will co-ordinate with Key Person (Fire & Safety) and will assist the Site Main Controller for providing decision support and resources support to the Key Persons (Fire & Safety), as may be necessary
- He will arrange for mobilizing off-duty fire personnel from their residence; and call other members of the staff for assistance
- He will ensure that the AFS members have been called for assistance and liaise with mutual aid members / Nagpur Fire Brigade for mobilization of additional resources
- He will co-ordinate with the materials / stores coordinator and mobilize additional resources, viz., spillage containment equipment / fire fighting equipment / material,

personal protective equipment, spare breathing air cylinders, etc., as may be required at the incident site for control measures

- He will liaise with Factory Inspectorate / Pollution Control authorities in consultation with the Site Main Controller and provide necessary information. He will also ask for the help, if necessary to evacuate neighbouring area outside the complex as advised by the Site Main Controller
- He will organize relieving groups for fire fighting
- He will also initiate necessary actions to minimize Impact on Environment

3.9.2 Medical Coordinator

The Chief Medical Officer (or the next in command available at site) will be the Medical Coordinator and perform the following duties:

- He will contact the Site Main Controller immediately after receiving the information about the emergency
- He will report immediately at the Emergency Control Centre (Primary Command Post) or OHC as instructed by the Site Main Controller and contact the Key personnel (Medical) and take stock of the situation
- He will assist and advise the Site Main Controller in all critical decisions in the area of health / medical services to the affected persons and keep constant liaisons with him
- Organize rescue and first aid arrangements for the affected persons at the site in the "cold Zone", as may be necessary with essential staff / equipment and post additional ambulance for transporting seriously injured persons
- Ensure that adequate paramedical staff, equipment and medicines are available at the OHC. He will mobilize additional resources from neighbouring industries, if necessary
- To liaise with the Local Medical Authorities and City Hospitals, if the causalities are more and situation demands treatment at additional medical centres
- To co-ordinate with the Transport Coordinator for transporting victims to various hospitals
- To arrange for additional ambulances from other hospitals / Nagpur Municipal Corporation

- The Medical Coordinator should ensure the upkeep of agreed medical supplies, antidotes and equipment that should always be kept in stock for treating victims of burns and hazardous chemicals. The medical authorities should be aware of the type of treatment to be administered
- He will liaise with the media coordinator for release of news to the press.

3.9.3 Security Coordinator

The Chief of Security or the next in command available at site shall be the Security Coordinator He will have the following duties / responsibilities:

- He will instruct and deploy plant security personnel to ensure that the law and order is maintained; and unnecessary gathering of the personnel at the scene of emergency is prevented and ensure control of traffic movement in and out of the factory areas
- He will instruct the security personnel / Security Gates to direct and guide external emergency vehicles (Fire tenders/ambulances etc.) called for assistance/help from neighbouring industries / Local administration, to the scene of incident
- He will instruct security personnel who could be spared to assist Site Incident Controller/Key Personnel (fire and Safety) in fire fighting and evacuation of personnel, at the Incident Site
- He will take action to regulate traffic movement and prevention of traffic jams inside the works as well as outside the factory gates for proper and speedy movement of the emergency vehicles, ambulances, other vehicles carrying outside resources, etc.
- He will mobilize additional security force for help, as necessary
- He will liaise with the police and other local authorities for external help, as necessary for evacuation of the neighbouring areas outside the factory premises in consultation with the Site Main Controller
- If necessary, he will arrange for announcement through the mobile P.A. system for alerting and instructing the population in the surrounding areas as directed by the Site Main Controller

3.9.4 Engineering Coordinator

- He will report to the Site Main Controller at the Emergency Control Centre (Primary Command Post) immediately after receiving information about On-site emergency
- He will take stock of the situation and assist/advise the Site Main Controller in deciding control strategies

- He will mobilize the team from the Maintenance Dept. to assist the Site Incident Controller in control operation at the Field Command Post
- Arrange isolation of electrical lines from distribution point/substations as required by the Site Incident Controller by calling the Electrical Engineer / Electricians
- Provide all other engineering support, as may be required
- Liaise with Key Personnel (Eng./Maintenance) and co-ordinate with other groups

3.9.5 Communication Coordinator

Communication Coordinator plays very important part at the time of an emergency particularly when extensive disruption of services takes place He has the following duties and responsibilities:

- To ensure all available communications links remain functional
- To quickly establish communication links between the Field command Post (if this happens to be in remote off site area) and the Primary Command Post
- To arrange for announcement on the public address system and maintain contacts with congregation points like canteen, main gate, control rooms etc.
- To ensure that previously agreed inventory of various types of communication equipment is maintained in working condition and frequent checks are carried out and records maintained
- To maintain voice record of significant communications with timings received/passed from the Primary Command Post
- To provide additional/alternate communication facilities as required at the site

3.9.6 P&A Coordinator

He will report at the Primary Command Post (ECC) immediately after getting information about an emergency at the site and assist / advise the Site Main Controller in taking important decisions in the matters related to welfare / necessities/of emergency personnel at site, care / needs of the affected persons. His duties and responsibilities include the following:

- He will ensure that a record of affected personnel is prepared with their local / permanent addresses and telephone numbers
- He will ensure that the relatives of the affected personnel have been informed

- Assign officials at the hospitals to look after the needs of the affected personnel under medical treatment
- Co-ordinate with the Finance Coordinator for necessary funds required to cater the needs of effected personnel, emergency purchases and for other requirements
- To arrange for refreshments, snacks, food, and other needs as may be required for the emergency personnel from time to time
- Co-ordinate with the Purchase Coordinator for necessary emergency procurement of necessary items
- Ensure that staff personnel as necessary for assistance and help are informed/called from their residences
- He will co-ordinate with the instruct Key Personnel transport/welfare & canteen for mobilizing additional resources, as may be required
- To co-ordinate with the neighbouring industries for additional vehicles/ambulances and other resources as may be required
- To liaise with the Local Administration for additional assistance/help as may be needed.

3.9.7 Transport Coordinator

The Transport Coordinator shall perform the following duties

- Mobilize all available company's vehicles for emergency use along with the drivers
- Arrange for transport of victims to hospitals / dispensaries
- Arrange for duty rotation of the drivers to meet the emergency situation
- To direct refuelling of the vehicles
- To co-ordinate with the neighbouring industries for additional vehicles / ambulances as may be required
- To mobilize buses of the State Transport, if necessary
- To co-ordinate with the neighbouring industries for additional vehicles / ambulances as may be required
- To arrange for vehicles from outside local transport agencies, if required
- To keep in contact with the Site Main Controller for evacuation of personnel and transportation of victims.

3.9.8 The Welfare / Canteen Coordinator

The Welfare Coordinator will have the following responsibilities:

- Ensure that casualties receive adequate attention and arrange additional help (ex-gratia payment etc), if required with consultation with the Chief Coordinator
- Inform the relatives of the victims
- When emergency is prolonged, he will arrange for relieving personnel and organize refreshment / catering facilities and arrangements for their rest (bedding, and other necessities)
- He will arrange to procure and keep stocks of necessary food items and other necessary supplies as may be required for the personnel working round-the-clock
- He will arrange for hot drinks / snacks and food and other necessary items for emergency response personnel, as required.

3.9.9 Media Coordinator

The Media Coordinator will co-ordinate the following under the direction of the Site Main Controller (The Chief Coordinator):

- He will liaise with various media and release written statements to the press through prior concurrence of the Chief Co-ordinate
- He will handle media interview with various media groups make arrangements for televising the information about the incident, the number of casualties, etc.
- He will inform State and Central Government and the statutory bodies of the nature and magnitude of the incident, the number of casualties, etc.
- He will locate himself such that media persons/third parties do not need to go past the complex security gates and that adequate communication links exists
- Media personnel often insist on visiting incident scene. He will escort media team(s) if such visits are approved by the Chief Coordinator
- He will be in constant contact with the Medical Coordinator, and other coordinators to be aware of latest development and closely liaise with the Chief Coordinator.

3.9.10 Finance Coordinators

- He will report at the Emergency Control Centre immediately after getting information about the emergency at site

- He will release finance (cash / cheques, etc) as directed by the Site Main Controller (Chief Coordinator)
- He will assist the Purchase Coordinator for emergency procurement
- He will liaise with Insurance Company personnel as directed by the Site Main Controller.

3.9.11 Purchase Coordinator

- The Purchase Coordinator will report at the Emergency Control Centre as soon as he is informed about an emergency at site
- He will assist the Site Main Controller and arrange for emergency purchase of necessary items as maybe required during the emergency
- He will co-ordinate with the Materials Coordinator and other coordinator for necessary emergency items to be procured
- He will mobilize necessary manpower as may be required, etc.

3.9.12 Materials Coordinator

The Materials Coordinator will ensure:

- Availability of the materials required by the Site Incident Controller
- Arrange issues of materials from the General Stores round-the-clock during an emergency
- Arrange emergency procurements form local dealers / vendors or from neighbouring industries
- Arrange transportation of materials from General Store to the Incident Site in co-ordination with the Transport Coordinator.

3.9.13 Emergency Services Coordinator

The Coordinators and the Key Personnel for Emergency Services and Key Personnel for Safety are presented in Table 3.1.

Table 3.1

Distribution of Roles and Responsibility

Sr.No.	Department	Responsibility for Execution	Responsibility for Monitoring
1	Coal Handling Plant	Department Head	• In-charge/CHP • Sampler & Lab. Tech. • Loco driver & Optr./Supervisor • Tippler operator • Contractors workers • Maintenance In-charge
2	Boiler & Auxiliaries	Operation Department	• Field Opr /Shift In-charge • Lab. Opr /Shift In-charge
3	Turbine	Operation Department	• Field Opr / Inst Tech./Shift In-charge • Inst Tech./Shift In-charge
4	Generator	Operation Department	• Field Opr / Inst Tech./Shift In-charge
5	Electrical Safety	Department Head	• Optr. / Area In-charge
6	Water Treatment Plant	Executive Chemist	• Field Opr / Inst Tech./Shift In-charge
7	Cooling Tower	Operation Department	• Field Opr / Inst Tech./Shift In-charge
8	Boiler	Department Head	• All Operators / Super.
9	Maintenance of CEP	Department Head	• Operator/ Supervisor
10	Boiler Overhaul	Department Head	• Optr./ Supervisor • Site Engineer/In-charge
11	Motor Maintenance & Testing	Department Head	• Optr./ Supervisor
12	Transformer Maintenance And Testing	Department Head	• Maint. Crew/ Super.
13	Turbine Overhaul	Department Head	• Supervisors/Engrs. • Maint. Crew/ Super.
14	Switchgear Installation And Testing	Department Head	• Optr./ Supervisor
15	Synchronization of Generator	Department Head	• Optr./ Supervisor
16	Boiler Feed Pump	Department Head	• Main Crew/ Supervisor
17	Railway Track Maintenance	Department Head	• Maintenance Crew/ Supervisor
18	High Voltage Bus	Department Head	• Operator / Supervisor • Elect. /Supervisor
19	Generator Overhaul	Department Head	• Operator / Supervisor
20	Fire Prevention & Fire	Department Head	• All Operators / Super. • Operators/Super/House

	Fighting		keeping • Firemen/ Fire Officer • Security • Combat team
21	Safety Department	Department Head	• Safety officer/In-charge • Dept head

CHAPTER

4

Chapter IV

Preparation to Response Emergency

4.0 Accident Investigation Principles

An accident is any unplanned event that results in personal injury or in property damage. When the personal injury requires little or no treatment, it is minor. If it results in a fatality or in a permanent total, permanent partial, or temporary total (lost-time) disability, it is serious. Similarly, property damage may be minor or serious. Investigate all accidents regardless of the extent of injury or damage. Thousands of industrial accidents occur every day.

The failure of people, equipment, supplies, or surroundings to behave or react as expected causes most of the accidents. Accident investigations determine how and why these failures occur. By using the information gained through an investigation, a similar or perhaps more disastrous accident may be prevented. Conduct accident investigations with accidents prevention in mind. The objectives of investigations are not to place blame.

Accidents are part of a broad group of events that adversely affect the completion of a task. These events are incidents. For simplicity, the procedures discussed below refer only to accidents. They are, however, also applicable to incidents. Accidents are usually complex. Accident may have 10 or events that can be causes.

A detailed analysis of an accident will normally reveal three cause levels: basic, indirect, and direct (refer to **Figure 4.1**).

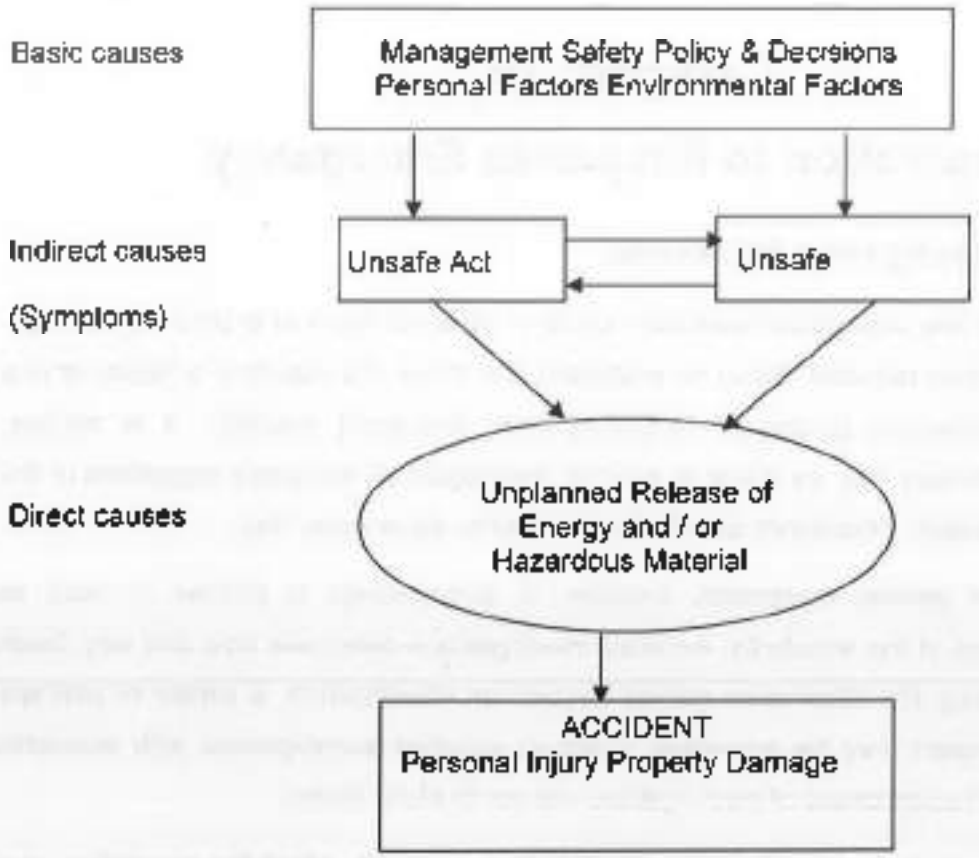


Fig. 4.1 Three Cause Levels of Any Accident

At the lowest level, an accidents results only when a person or object receives an amount of energy or hazardous material that cannot be absorbed safely. This energy or hazardous material is the direct cause of the accident. The direct cause is usually the result of one or more unsafe acts or unsafe conditions, or both.

Unsafe acts and conditions are the indirect causes or symptoms. In turn, indirect causes are usually traceable to poor management policies and decisions, or to personal or environmental factors. These are the basic causes. In spite of their complexity, most accidents are preventable by eliminating one or more causes.

Accident investigations determine not only what happened, but also how and why. The information gained from these investigations can prevent recurrence of similar or perhaps more disastrous accidents. Accidents investigators are interested in each event as well as in sequence of events that led to an accident The accident type is also important to the investigator.

The recurrence of accidents of particular type or those with common causes shows areas needing special accident prevention emphasis.

The actual procedures used in a particular investigation depend on the nature and results of the accident. The agency having jurisdiction over the location determines the administrative procedures. In general, responsible officials will appoint an individual to be in charge of the investigation. The investigator uses most following steps:

1. Define the scope the investigation.
2. Select the investigators. Assign specific tasks to each (preferably in writing).
3. Present a preliminary briefing to the investigating team, including .
    1. Description of the accident, with damage estimates
    2. Normal operating procedures
    3. Maps (local and general)
    4. Location of the accident site
    5 Location of witnesses
    6. Events that preceded the accident,
4. Visit the accident site to get updated information
5. Inspect the accident site
    a) Secure the area. Do not disturb the scene unless a hazard exists
    b) Prepare the necessary sketches and photographs. Label each carefully and keep accurate records,
6. Interview each victim and witness. Also interview those who were present before the accident and those who arrived at the site shortly after the accident. Keep accurate records of each interview. Use a tape recorder if desired and if approved.
7. Determine what was not normal before the accident; where the abnormality occurred; when it was first noted; and how it occurred.
8. Analyse the data obtained in step 7. Repeat any of the prior steps, if necessary.
9. Determine why the accident occurred: a likely sequence of events and probable causes (direct, indirect, basic), and alternatives.
10. Check each sequence against the data from step 7.
11. Determine the most likely sequence of events and the most probable causes.
12. Conduct a post-investigation briefing.

13. Prepare a summary report, including the recommended actions to prevent a recurrence. Distribute the report, according to applicable instructions.

An investigation is not complete until all data are analysed and a final report is completed. In practice, the investigation work, data analysis, and report preparation proceed simultaneously over much of the time spent on the investigation

Gather evidence from many sources during an investigation. Get information from witnesses and reports as well as by observation. Inspect the accident site before any changes occur. Take photographs and make sketches of the accident scene. Record all pertinent data on maps Get copies of all reports. Documents containing normal operating procedures, flow diagrams, maintenance charts, or reports of difficulties or abnormalities are particularly useful. Keep complete and accurate notes in a bound notebook. Record pre-accident conditions. In addition, document the location of victims, witnesses, machinery, energy sources, and hazardous materials.

In some investigations, a particular physical or chemical law, principle, or property may explain a sequence of events. Include laws in the notes taken during the investigation or in the later analysis of data. In addition, gather data during the investigation that may lend itself to analysis by these laws, principles, or properties. An appendix in the final report can include an extended discussion.

In general, experienced personnel should conduct interviews. If possible, the team assigned to this task should include an individual with a legal background. In conducting interviews, the team should:

1. Appoint a speaker for the group
2. Get preliminary statements as soon as possible from all witnesses
3. Locate the position of each witness on a master chart (including the direction of view)
4. Arrange for a convenient time and place to each witness
5. Explain the purpose of the investigation (accident prevention) and put each witness at ease
6. Listen, let each witness speak freely, and be courteous and considerate
7. Take notes without distracting the witness. Use a tape recorder only with consent of the witness
8. Use sketches and diagrams to help the witness

9. Emphasize areas of direct observation. Label hearsay accordingly
10. Be sincere and do not argue with witness
11. Record the exact words used by the witness to describe each observation. Do not "put words into a witness' month"
12. Word each question carefully and be sure the witness understands
13. Identify the qualifications of each witness (name, address, occupations, years of experience, etc.)
14. Supply each witness with a copy of his or her statements. Signed statements are desirable

After interviewing all witness, the team should analyse each witness 'statement. They may wish to re-interview one or more witnesses to confirm or clarify key points While there may be inconsistencies in witnesses' statements, investigations should assemble the available testimony into a logical order. Analyse this information along with data from the accident site. Not all people react in the same manner to particular stimulus. For example, a witness within close proximity to the accident may have an entirely different story from one who saw it at a distance. Some witnesses may also change their stories after they have discussed it with others. The reason for the change may be additional clues. A witness who has had a traumatic experience may not be able recall the details of the accident. A witness who has a vested interest in the results of investigation may offer biased testimony. Finally, eyesight, hearing, reaction time, and the general condition of each witness may affect his or her powers of observation. A witness may omit entire sequences because of a failure to observe them or because their importance was not realized.

Accidents represent problems that must be solved through investigations. Several formal procedures solve problems of any degree of complexity. This section discusses two of the most common procedure: **Change Analysis** and **Job Safety Analysis**

Change Analysis: As its name implies, this technique emphasizes change. To solve a problem, an investigator must look for deviations from the norm. Consider all problems to results from some unanticipated change. Make an analysis of the change to determine its causes. Use the following step in this method

1. Define the problem (What happened?)
2. Establish the norm (What should have happened?)

3. Identify, locate and describe the change (What, where, when to what extent)
4. Specify what was and what was not affected
5. Identify the distinctive features of the change
6. List the possible causes
7. Select the most likely causes.

Job Safety Analysis: Job Safety Analysis (JSA) is part of many existing accident prevention programs. In general, JSA breaks a job into basic steps, and identifies the hazards associated with each step. The JSA also prescribes controls for each hazard. A JSA is chart listing these steps, hazards, and controls. Review the JSA during the investigation if a JSA has been conducted for the job involved in an accident. Perform a JSA as a part the investigation to determine the events and conditions that led to the accident. As noted above, an accident investigation is not complete until a report is prepared and submitted to proper authorities.

Special report forms are available in many cases. Other instances may require a more extended report. Such reports are often very elaborate and may include a cover page, a title page, an abstract, a table of contents, a commentary or narrative portion, a discussion of probable causes, and a section on conclusions and recommendations.

The following outline is useful in developing the information to be included in the formal report:

1. Background Information (a. Where and when the accident occurred; b. Who and what were involved; Operating personnel and other witness)
2. Account of the Accident (What happened?)(a. Sequence of events; b. Extent of the damage; c. Accident type; d. Agency or source (of energy or hazards materials))
3. Discussion (Analysis of the Accident –**HOW; WHY:**

   a) Direct causes (energy sources; hazards materials),

   b) Indirect causes (unsafe acts and conditions);

   c) Basic causes (management policies; personal or environmental factors).

4. Recommend at ones (to prevent a recurrence) for immediate and long-range action to remedy:

a. Basic causes;

b. Indirect causes;

c. Direct causes (such as reduced quantities or protective equipment or structures).

Thousands of accidents occur daily throughout the United States. These result from a failure of people, equipment, supplies, or surroundings to behave as expected. A successful accident investigation determines not only what happened, but also finds how and why the accident occurred

Investigations are an effort to prevent a similar or perhaps more disastrous sequence of events. Most accident investigations follow formal procedures. This discussion covered two of the most common procedures: Change Analysis and Job Safety Analysis.

An investigation is not complete however, until completion of a final report.

Responsible officials can then resulting information and recommendations to prevent future accidents.

4.1 Assessing Hazards on the Job

Job-related injuries occur every day in the workplace Often these injuries occur because employees are not trained in the proper job procedure. One way to prevent workplace injuries is to establish proper job procedures and train all employees in safer and more efficient work methods establishing proper job procedures is one of the benefits of conducting a job hazard analysis –that is carefully studying and recording each step of a job, identifying existing or potential job hazards (both safety and health), and determining the best way to perform the job to reduce or eliminate these hazards. Improved job methods can reduce costs resulting from employee absenteeism and workers' compensation, and can often lead to increased productivity.

It is important to note that the job procedures in the booklet are for illustration only and do not necessarily include all steps, hazards or protections for similar jobs in industry. In additions, standards issued by the Occupational Safety and Health Administration (OSHA) should be referred to as part of the overall job hazard analysis. There are OSHA standards that apply to most job operations, and compliance with these standards is mandatory

A job hazard analysis can be performed for all jobs in the workplace, whether the job is "special" (non-routine) or routine. Even one step jobs, such as those in which only a button is pressed, can and perhaps should be analysed by evaluating surrounding work conditions. To determine which jobs should be analysed first, review job injury and illness reports. Obviously, a job hazard analysis should be conducted first for jobs with the highest rates of accidents and disabling injuries Also, jobs where "close calls" or near misses " have occurred should be given

priority. Analyses of new jobs and jobs where changes have been made in processes and procedures should follow. Eventually, a job hazard analysis should be conducted and made available to employees for all jobs in the workplace. Once a job has been selected for analysis, discuss the procedure with the employee performing the job and explain its purpose. Point out that you are studying the job itself not checking on the employee's job performance. Involve the employee in all phases of the analysis from reviewing the job steps to discussing potential hazards and recommended solutions. Before actually beginning the job hazard analysis, take a look at the general conditions under which the job is performed and develop a checklist. The following are some sample questions to ask:

1. Is there material on the floor that could trip a worker?
2. Is lighting adequate?
3. Are there any live electrical hazards at the job site?
4. Are there any explosive hazards associated with the Job or likely to develop?
5. Are tools, including hand tools, machines, and equipment in need of repair?
6. Is there excessive noise in the work area hindering worker communication and increasing risk of hearing loss?
7. Is fire protection equipment readily assessable and have employees been trained to use it?
8. Are emergency exists clearly marked?
9. Are trucks or motorized vehicles properly equipped with brakes, overhead guards, backup signal, horns, steering gear and identification, as necessary?
10. Are all employees operating vehicles and equipment properly trained and authorized?
11. Are employees wearing proper personal protective equipment (PPE) for the jobs they are performing?
12. Have any employees complained of headaches breathing problems, dizziness or strong odours?
13. Is ventilation adequate?
14. Does the job involve entry into a confined space?
15. Have tests been made for oxygen deficiency and toxic fumes?

Naturally, this list is by no means complete, because each worksite has its own requirements and environmental conditions. It is recommended to take photographs of the workplace, if appropriate, for use in making a more detailed analysis of the work environment. Nearly every job can be broken into steps. In the first part of the job hazards analysis, list each step of the job in order of occurrence as you watch the employee performing the job. Be sure to

record enough information to describe each job action, but do not make the breakdown too detailed. Later, go over the jobs steps with the employee. After recording the jobs steps, next examine each steps to determine the hazards that exist or that might occur. Ask these kinds of questions:

1. Is the worker wearing clothing or jewellery that could get caught in the machinery?
2. Are there fixed objects that may cause injury, such as sham, machine edges?
3. Is the worker required to make movements that could cause hand or foot injuries, repetitive motion injuries, or strain from lifting?
4. Can the worker be struck by an object, lean against or strike a machine part or object?
5. Do suspended loads or potential energy (such as compressed springs, hydraulics or jacks) pose hazards?
6. Can the worker fall from one level to another?
7. Can the worker be injured from lifting objects, or from carrying heavy objects?
8. Do environmental hazards, such as dust, chemicals, radiation, welding rays, heat or excessive noise result from the performance of the job?
9. Is the worker at any time in an off-balance position? Is the worker positioned to the machine in a way that is potentially dangerous?
10. Can the worker get caught in or between machine parts? Can the worker be injured by reaching over moving machinery parts or materials?
11. Repeat the job observation as often as necessary until all hazards have been identified. The next step is to look into what would cause these hazards. You need to think about what events could lead to an injury or illness for each hazard you identified. Typically questions are.
12. Is the worker wearing protective clothing and equipment, including safety belts or harnesses that are appropriate for the job? Does it fit properly?
13. Has the worker been trained to use appropriate PPE?
14. Is work positions, machinery, pits or holes, and hazards operations adequately guarded?
15. Are locked procedures used for machinery deactivation during maintenance procedures?
16. Is the flow of work improperly organized (e.g., is the worker required to make movements that are too rapid)?
17. How are dusts and chemicals dispersed in the air? What are the sources of noise, radiation and heat?
18. What causes a worker to contact sharps surfaces?

19. Why would a worker be tempted to reach into moving machine parts?

Recommendations should be based on the reliability of the solution. In general, the most reliable protection is to eliminate the source or cause of the hazard. Hazards might be eliminated by redesigning equipment, changing tools, installing ventilation, or adding machine guards. If the hazard cannot be eliminated, the danger should be reduced as much as possible improving the procedure or using personal protective equipment are some primary ways to reduce the danger. These changes should be accompanied by training programs that are aimed at covering the procedures and equipment in detail. Note that some OSHA standards require formal training for employees.

After you have listed each hazard or potentiel have reviewed them with the employee performing the job, determine whether the job could be performed in another way to eliminate the hazards, such as combining steps or changing the sequence, whether safety equipment and precautions are needed to reduce the hazards, or whether training is recognize hazards. If safer and better job steps can be used, list each new step, such as describing a new method for disposing of materiel. List exactly what the worker needs to know to perform the job using a new method Do not make general statements about the procedure, such as "Be careful." Be as specific as you can in your recommendations. If hazards are still present, try to reduce the necessity for performing the job or the frequency of performing it. Review the recommendations with all employees performing the job and ask for their suggestions Their ideas about the hazards and proposed recommendations may be valuable. Be sure that they understand what they are required to do and reasons for the changes in the jobs procedures.

A job hazard analysis can do much towards reducing accidents and injuries in the workplace, but it is only effective if it is reviewed and updated periodically. Even if no changes have been made in a job, hazards that were missed in an earlier analysis could be detected. It an accident or injury occurs on a specific job, the job hazard analysis should be reviewed immediately to determine whether changes are needed in the job procedure. In addition, if an accident results from an employee's failure to follow job procedures, this should be discussed with all employees performing the jobs. Any time a job hazard analysis is revised, training in the new job methods or protective measures be provided to all employees affected by the changes. A job hazard analysis also can be used to train new employ on job steps and job hazards. To show how a job hazards analysis from is prepared, a sample worksheet for grinding castings is given below. Both safety and health hazards are noted, as well as recommendations for safer methods and protection. Employees have the right to file a complaint with their employers, their

unions, OSHA, or another government agency about workplace safety and health hazards Section 11 (c) of the Occupational Safety and Health (OSH) Act makes it illegal for employees to be discriminated against for exercising this right and for participating in other jobs safety and health-related employee activities These projected activities include: Submitting complaints individually or with other directly to management concerning job safety conditions; Filing formal complaints with government agencies such as OSHA or state safety and health agencies, fire departments, etc. (An employee's name can be withheld from the complaint, if so requested.); Testifying before any panel, agency or court of law concerning job hazards; Participating in walk-around inspections.

4.2 Work at Height

Working at height remains one of the biggest causes of fatalities and major injuries Common cases include falls from ladders and through fragile surfaces. 'Work at height' means work in any place where, if there were no precautions in place, a person could fall a distance liable to cause personal injury (for example a fall through a fragile roof).

This section shows how employers can take simple, practical measures to reduce the risk of any of their workers falling while working at height. The work should be planned as per 'Work at Height Regulation 2005'.

The work must be properly planned, supervised and carried out by competent people with the skills, knowledge and experience to do the job. Right type of equipment should be used for working at height.

Sensible approach should be taken while considering precautions. Low-risk, relatively straightforward tasks will require less effort when it comes to planning and there may be some low-risk situations where common sense tells us no particular precautions are necessary.

4.3 Control measures

First assess the risks. Factors to weigh up include the height of the task, the duration and frequency, and the condition of the surface being worked on.

Before working at height work through these simple steps.

- **avoid** work at height where it's *reasonably practicable* to do so
- where work at height cannot be easily avoided, **prevent** falls using either an existing place of work that is already safe or the right type of equipment
- **minimize** the distance and consequences of a fall, by using the right type of equipment where the risk cannot be eliminated

For each step, always consider measures that protect everyone at risk (collective protection) before measures that only protect the individual (personal protection).

Collective protection is equipment that does not require the person working at height to act for it to be effective. Examples are permanent or temporary guardrails, scissor lifts and tower scaffolds.

Personal protection is equipment that requires the individual to act for it to be effective. An example is putting on a safety harness correctly and connecting it, with an energy-absorbing lanyard, to a suitable anchor point.

Dos and don'ts of working at height

Do....

- as much work as possible from the ground
- ensure workers can get safely to and from where they work at height
- ensure equipment is suitable, stable and strong enough for the job, maintained and checked regularly
- take precautions when working on or near fragile surfaces
- provide protection from falling objects
- consider emergency evacuation and rescue procedures

Don't....

- Overload ladders – consider the equipment or materials workers are carrying before working at height. Check the pictogram or label on the ladder for information
- overreach on ladders or stepladders
- rest a ladder against weak upper surfaces, e.g glazing or plastic gutters
- use ladders or stepladders for strenuous or heavy tasks, only use them for light work of short duration (a maximum of 30 minutes at a time)
- let anyone who is not competent (who doesn't have the skills, knowledge and experience to do the job) work at height

4.3.1 Assembly Points

- Two alternate locations for safe assembly points have been earmarked at all the operating plants. These locations are designated for assembling non-essential workers, visitors, and other persons who are not required in the plant site at the time of emergency but they are to be moved to safe places. These locations have been provided with sign boards displaying "Assembly Points" for easy identification
- In addition, there are complex Safe Assembly Points proposed at the Security Gate No. 1 and Coal Handling Plant. At the time of an emergency, the non-essential personnel shall move to one or two of these Assembly Points (depending upon the wind direction), as advised/instructed
- The persons required to be assembled at the assembly point should choose safer assembly point out of the two, considering the wind direction at that time. The plant control room will also announce the same on the plant PA system, if possible
- The person assembled at the assembly point shall follow the instruction for evacuation of the plant area and move to safe locations as directed. They should move in the cross wind direction or up-wind direction, whichever is more safer

4.3.2 Recommendation for selecting assembly area under Emergency Response Plan for Evacuation

A. Selection of the Assembly Area (AA)

The chief Engineer will, with the help of his Safety Department & fire Department, identify at least 2 or 3 locations outside every section/ building premises to serve as assembly area (AA).

The safety & fire department as well as fire & safety committee will assess and decide the best location as assembly area and remaining as alternative.

B. Selection criteria for the Assembly Area

The following criteria are recommended for the selection of the Assembly Area.

- The area shall be familiar and readily accessible to the evacuees
- It shall be able to accommodate the full occupant load or evacuees
- It shall be far enough to avoid falling debris, collapsing structures and/or spread of spilled/ leaked inventory or the fire/ incident
- A distance at least equal to the height of the building and not less than 20 m away is recommended for locating Assembly Area or alternately, it can be in the protected area shielded from the burning building by afire barriers or fire wall
- The location for assembly area shall be at upstream of dominant wind flow direction in the plant area.
- Location decision shall also consider the domino effect occurred due to incident
- The assembly Area shall not interfere with the fire fighting/ response operations and/ or its responding forces

If the Assembly Area located across any road there shall be designated traffic controller appointed to perform traffic control to ensure the safety of the occupants crossing the road to reach Assembly Area.

4.4 Emergency Response

Where a fall restraint or fall-arrest system is used, provisions shall be made to enable the safe rescue of a person who falls. These provisions should include:

- An effective rescue plan for that site is developed prior to work commencing
- Personnel are appropriately trained in height rescue and first aid and
- Appropriate rescue equipment available

The rescue plan should enable the person to be removed from the suspended position as quickly as possible to prevent the fallen person developing suspension trauma.

4.5 Assessing Confined Space Operations

Many operations involved job functions in confined spaces. Examples of such locations are boilers, a cupola ,degreaser ,furnace, pipeline ,pit ,pumping station, reactions process

vessel ,septic tank ,sewage digester, sewer ,silo. storage tank, ship's hold, utility vault, or similar type enclosure These locations present unique hazards for works and therefore require special attention when evaluating the risks and management of the operations required in them. A confined space is a space which has any one of the following characteristics.

- Limited openings for entry and exist
- Unfavourable natural ventilation
- It is not designed for continues worker occupancy
- It is not designed for continues for entry and exit.

Confined space openings are limited primarily by size or location. Openings are usually small in size, perhaps as small as 18 inches in diameter and are difficult to move through easily. Small openings may make it very difficult to get needed equipment in or out of the spaces, especially protective equipment such as respirators needed for entry into spaces with hazards atmospheres, or life-saving equipment when rescue is needed. However, in some cases openings may be very large, for example open-topped spaces such as pits. degreasers, excavations, and ship's holds. Access to open-topped spaces may require the use of ladders, hoists, or other devices, and escape from such areas may be very difficult in emergency situations.

Because air may not move in and out confined spaces freely due to the design, the atmosphere inside a confined space can be very different from the atmosphere outside. Deadly gases may be trapped inside, particularly if the space is used to store or process chemical or organic substances which may decompose. There may not be enough oxygen inside the confined space to support life, or the air could be so oxygen -rich that it is likely to increase the chance of fire or explosion if a source of ignition is present. Most confined spaces are simply not designed for workers to enter and work in them on a routine basis They are designed to store a product, enclose materials and processes, or transport products or substances. Therefore, occasional worker entry for inspection, maintenance, repair, cleanup, or similar tasks is often difficult and dangerous due to chemical or physical hazards within the space. A confined space found in the workplace may have a combination of these three characteristics, which can complicate working in and around these spaces as well as rescue operations during emergencies. Among the list of hazards associated with confined space operations is a hazardous atmosphere.

The atmosphere in a confined space may be extremely hazardous because of the lack of natural air movement. This characteristic of confined spaces can result in oxygen-deficient atmospheres, flammable atmosphere, and/or toxic atmospheres. An oxygen-deficient atmosphere has less than 19.5% available oxygen (O_2). Any atmosphere with less than 19.5% available oxygen should not be entered without an approved self-contained breathing apparatus (SCBA). The oxygen level in a confined space can decrease because of work being done, such as welding, cutting, or brazing; or it can be decrease by certain chemical reactions (rusting) or through bacterial action (fermentation). The oxygen level is also decreased if oxygen is displaced by another gas, such as carbon dioxide or nitrogen. Total displacement of oxygen by another gas, such as carbon dioxide, will result in unconsciousness, followed by death. In the case of a flammable atmosphere, there are two contributing factors: the oxygen in air; and a flammable gas, vapor, or dust in the proper mixture. Different gases have different flammable ranges. If a source of ignition (e.g., a sparking or electrical tool) is introduced into a space containing a flammable atmosphere, an explosion will result. An oxygen-enriched atmosphere (above 21%) will cause flammable materials, such as clothing and hair, to burn violently when ignited. Therefore, never use pure oxygen to ventilate a confined space. One should always ventilate with normal air. Toxic atmospheres in confined spaces result from a variety of situations Examples include product storage, work being performed in the confined space, and toxicants produced by work in the area of confined spaces can enter and accumulate.

4.5.1 The Product Stored in the Confined Space: The product can be absorbed into the walls and give off toxic gases when removed or when cleaning out the residue of a stored product, toxic gases can be given off. Example: Removal of sludge from tank decomposed material can give off deadly hydrogen sulphide gas.

4.5.2 The Work being performed in a Confined Space: Examples of such include welding cutting, brazing, painting, scraping, degreasing, etc. Toxic atmospheres are generated in various processes. For example, cleaning solvents are used in many industries for cleaning/degreasing. The vapours from these solvents are toxic in a confined space.

It is important to understand that some gases or vapours are heavier than air and will settle to a confined space: Also, some gases are lighter than air and will be found around the top of confined space. Therefore, it is necessary to test all areas (top, middle, and bottom) of a confined space with properly calibrated testing instruments to determine what gases are present.

If testing reveals oxygen-deficiency. or the presence of toxic gases or vapours, the space must be ventilated and retested before workers enter If ventilation is not possible and entry is necessary (for emergency rescue, for example), workers must have appropriate respiratory protection.

Never trust your senses to determine if the air in a confined space is safe to breathe. Many hazards gases cannot be smelled or can be masked by other odours. Figure 2 illustrates the proper approach to assessing the atmosphere in a confined space.

Ventilation by a blower or fan may be necessary to remove harmful gases and vapours from confined space. There are several methods for ventilating a confined space. The method and equipment chosen are dependent upon the size of the confined space openings, the gases to be exhausted (e.g., are they flammable?), and the sources of makeup air. Under certain conditions where flammable gases or vapours have displaced the oxygen level, but too rich to burn, forced air ventilation may dilute them until they are within the explosive range. Also, If insert gases (e.g. carbon dioxide, nitrogen, argon) are used in the confined space, the space should be well ventileted and retested before a worker may enter.

A common method of ventilation requires a large hose, one end attached to a fan and the other lowered into a manhole or opening, for example, a manhole would have the ventilating hose run to the bottom to blow out all harmful gases and vapours. The air intake should be placed in an aree that will draw in fresh air only. Ventilation should be continues where possible, because in many confined spaces the hazardous atmosphere will form again when the flow of air is stopped.

4.5.3 Isolation: Isolation of a confined space is a process where the space is removed from service by locking out (electrical sources, preferably at disconnect switches remote from the equipment), blanking and bleeding pneumatic and hydraulic lines, disconnecting belt and chain drives, and mechanical linkages on shaft-driven equipment where possible, and securing mechanical moving parts within confined spaces with inches, chains, chocks blocks or other devices. Refer to Figure 3 and 4 for common examples.

4.5.4 Respiratory Protection: Respirators were already discussed in Chapter 5. Respirators are devices that can allow workers to safely breathe without inhaling toxic gases or particles. Two basic types are air –purifying, which filter dangerous substances from the air, and air – supplying, which deliver a supply of safe breathing air from a tank or an uncontaminated area nearby .Only air-supplying respirators should be used in confined spaces where there is not

enough oxygen. Selecting the proper respirator for the job, the hazard, and the person is very important, as is thorough training in the use and limitations of respirators.

A self-contained breathing apparatus, or SCBA, sometimes referred to as a compressed air breathing apparatus (CABA), or simply breathing apparatus (BA), is a device worn by rescue workers, firefighters, and others to provide breathable air in an IDLH (immediate danger to life and health) atmosphere. When not used underwater, they are sometimes called industrial breathing sets. The term "self-contained" means that the breathing set is not dependent on a remote supply (e.g., through a long hose). If designed for use under water, it is called SCUBA (self-contained *underwater* breathing apparatus).

An SCBA typically has three main components: a high-pressure tank (e.g., 2,216 to 4,500 psi (15,280 to 31,030 kPa), about 150 to 300 atmospheres), a pressure regulator, and an inhalation connection (mouthpiece, mouth mask or face mask), connected together and mounted to a carrying frame.[1]

A self-contained breathing apparatus may fall into two different categories. These are open circuit and closed circuit.[2]

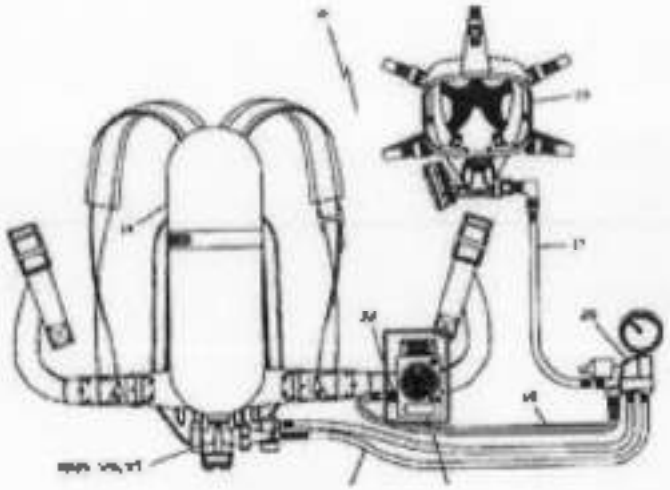
4.6 Closed-circuit SCBAs

The closed-circuit type filters, supplements, and recirculates exhaled gas; see rebreather for more information. It is used when a longer-duration supply of breathing gas is needed, such as in mine rescue and in long tunnels, and going through passages too narrow for a big open-circuit air cylinder. Before open-circuit SCBA's were developed, most industrial breathing sets were rebreathers, such as the Siebe Gorman Proto, Siebe Gorman Savox, or Siebe Gorman Salvus. An example of modern rebreather SCBAs would be the SEFA (Selected Elevated Flow Apparatus) Rebreathers used underwater have the advantage of not releasing tell-tale bubbles, making it more difficult to detect divers involved in covert operations

4.7 Open-circuit SCBAs

Open-circuit industrial breathing sets are filled with filtered, compressed air, rather than pure oxygen. Typical open-circuit systems have two regulators; a first stage to reduce the pressure of air to allow it to be carried to the mask, and a second stage regulator to reduce it even further to a level just above standard atmospheric pressure. This air is then fed to the mask via either a demand valve (activating only on inhalation) or a continuous positive pressure valve (providing constant airflow to the mask).

An open-circuit rescue or firefighter SCBA has a full-face mask, regulator, air cylinder, cylinder pressure gauge, and a harness with adjustable shoulder straps and waist belt which lets it be worn on the back. The air cylinder usually comes in one of three standard sizes: 4 liter, 6 liter, or 6.8 liter. The duration of the cylinder can be calculated with this formula: volume (in liters) * pressure (in bars) / 40 - 10 in minutes (the 10 is subtracted to provide a safety margin), so a 6 liter cylinder, of 300bar, is 6 X 300 / 40 - 10 = 35 minutes working duration. The relative fitness, and especially the level of exertion of the wearer, often results in variations of the actual usable time that the SCBA can provide air, often reducing the working time by 25% to 50%



4.7.1 SCBA apparatus with PASS device (ADSU)

Air cylinders are made of aluminium, steel, or of a composite construction (usually carbon-fiber wrapped.) The composite cylinders are the lightest in weight and are therefore preferred by fire departments (UK: fire and rescue services previously called fire brigades), but they also have the shortest lifespan and must be taken out of service after 15 years. Air cylinders must be hydrostatically tested every 5 years. During extended operations, empty air cylinders can be quickly replaced with fresh ones and then refilled from larger tanks in a cascade storage system or from an air compressor brought to the scene.

4.7.2 Standby and Rescue:

A standby person should be assigned to remain on the outside of the confined space and be in constant contact (visual or speech) with the workers inside. The standby person should not have any other duties but to serve as standby and know who should be notified in case of emergency. Standby personnel should not enter a confined space until help arrives, and then only with proper protective equipment, life lines, and respirators. Over 50% of the worker who die in confined spaces are attempting to rescue other workers. Rescuers must be trained in

and follow established emergency procedures and use appropriate equipment and techniques (lifelines, respiratory protection, standby persons, etc.) Step for safe rescue should be included in all confined space entry procedures. Rescue should be well planned and drills should be frequently conducted on emergency procedures. Unplanned rescue, such as when someone instinctively rushes in to help a downed co-worker, can easily result in a double fatality, or even multiple fatalities if there are more than one would –be rescuers. **Table 4.1** provides a confined space entry check list that can be used to assess safe entry check list that can be used to essesa safe entry conditions.

Table 4.1

Confined Space- Safe Entry Checklist.

Check One		ASSESSMENT CRITERIA
Yes	No	
		Is entry into confined space necessary for personnel?
Air Quality Test Questions		
		Are instruments to be used to test the atmosphere appropriate and are they properly calibrated?
		Was the atmosphere in the confined space tested?
		Is the oxygen level least at least 19.5%, but not more than 21%?
		Were any toxic, flammable, or oxygen-displacing gases/vapors detected? If yes, what are they and their concentrations?
		Was hydrogen sulfide detected during air sampling?
		Was carbon monoxide detected during air sampling?
		Was carbon dioxide detected during air sampling?
		Was methane detected during air sampling?
Air Quality Monitoring Questions		
		Will it be necessary to monitor the atmosphere in the confined space while work is being implemented?
		Will monitoring be done on a continuous basis?
		Will monitoring be performed intermittently? If so, provide details on the sampling interval and required measurement time per sample:
		Will sampling be performed at more than one location within the confined space? If so, specify locations:
Pre-entry Conditions		
		Has the confined space been cleaned prior to issuing a permit to enter?
		Has the confined space been purged of any solvents or hazardous vapour prior to issuing a permit?

		Has he confined space been steamed?
		It the confined space been steamed, Is there time to cool before entry?
Ventilation Questions		
		Has the space has been ventilated before entry?
		Will ventilation be continued during entry?
		Is the air intake for the ventilation system located in an area that is free combustible dusts, vapours and toxic materials?
		If the atmosphere was found to be unacceptable, and then ventilated, was it retested before entry?
Isolation Questions		
		Has the confined space been isolated from other system?
		Has electrical equipment been locked out?
		Have disconnects been used?
		Has all mechanical equipment been blocked, chocked, and disengaged?
		Have lines under pressure been blanked and bled?
PPE Questions		
		Is special CPC required for the operation? If so, specify :
		Is special required for (e.g., rescue equipment, communications equipment, etc.)? Specify the equipment:
		Are special tools required (e.g . spark proof)? If so, specify:
		Is respiratory protection required and if so, specify types and numbers?
		Can a worker fit through the opening of the confined space suited up in full protection gear, including respirator?
		Have the workers been trained in the proper use of the respirator?
		Have the workers been properly trained on the use of all safety and rescue gear?
		Have the workers been trained on the operations to be performed?
Standby and Rescue		

		Will there be a standby person on the outside in constant visual or auditory communications with the person inside the confined space?
		Will the standby person be able to see and/or see and or hear the person on the inside?
		Have the standby personnel been trained in rescue procedures?
		Will safety lines and harness be required to remove a person's?
		Are there written rescue procedures available and have the workers been trained/ drilled on them?
		Do the workers know who and how to notify a responsible party in the event of an emergency?
		Has rescue gear been checked, tested and serviced recently? Make notation for last check?
Permit: The permit is an authorization in writing that states that the space has been tested by a qualified person; that the space is safe to enter; what precautions, equipment, etc. are required; and work is to be performed.		
		Has the confined space entry permit been issued? Specify the duration (time/date):_____
		Does the permit include a list of emergency telephone numbers?

4.8 Material Safety Data Sheets and Other Health Risk Information

MSDSs are readily avarlable with WTP & Safety Department in the plant. There are a wide variety of data bases from which one can research the hazardous properties of the chemicals being handled at a site. The user should recall that a MSDS is designed to provide both workers and emergency personnel with the proper procedures for handlings or working with a substance. An MSDS will include such information as physical properties (e.g., melting point, boiling point, flash point temperature, specific gravity, solubility, and other), toxicity, health effects, first aid, chemical reactivity, storage, disposal, recommended protective equipment, emergency procedures for spills and fires.

4.8.1 Emergency Preparedness against Chemicals:

Ammonia, NH_3

Chemical Name: Ammonium hydroxide water solution, >14N NH4OH (25-30% as ammonia, NH3)

Emergency overview-

Appearance: colorless liquid.

Danger! Causes eye and skin burns.

Causes digestive and respiratory tract burns.

Harmful if inhaled or swallowed.

Target Organs: Eyes, skin, mucous membranes

Potential Health Effects

- **Eye:** Contact with liquid or vapour causes severe burns and possible irreversible eye damage. Lachrymator (substance which increases the flow of tears).
- **Skin:** Causes severe skin irritation. Causes skin burns. May cause deep, penetrating ulcers of the skin. Contact with the skin may cause staining, inflammation, and thickening of the skin.
- **Ingestion:** Harmful if swallowed. May cause severe and permanent damage to the digestive tract. Causes gastrointestinal tract burns. Causes throat constriction, vomiting, convulsions, and shock.
- **Inhalation:** Effects may be delayed. Causes severe irritation of upper respiratory tract with coughing, burns, breathing difficulty, and possible coma.
- **Chronic:** Prolonged inhalation may cause respiratory tract inflammation and lung damage. Prolonged or repeated exposure may cause corneal damage and the development of cataracts and glaucoma.

First Aid Measures

- **Eyes:** In case of contact, immediately flush eyes with plenty of water for a t least 15 minutes. Get medical aid immediately.
- **Skin:** In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Get medical aid immediately. Wash clothing before reuse.

- **Ingestion:** If swallowed, do NOT induce vomiting. Get medical aid immediately. If victim is fully conscious, give a cupful of water. Never give anything by mouth to an unconscious person.
- **Inhalation:** If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid
- **Notes to Physician:** After inhalation exposure, observe for 24 to 72 hours as pulmonary edema may be delayed.

Accidental Release Measures

General Information: Use proper personal protective equipment as indicated in Section 8. **Spills/Leaks:** Absorb spill with inert material (e.g. vermiculite, sand or earth), then place in suitable container. Neutralize spill with a weak acid such as vinegar or acetic acid. Avoid runoff into storm sewers and ditches which lead to waterways. Clean up spills immediately, observing precautions in the Protective Equipment section. Provide ventilation. Approach spill from upwind.

Handling and Storage

- **Handling:** Wash thoroughly after handling. Remove contaminated clothing and wash before reuse. Do not get in eyes, on skin, or on clothing. Keep container tightly closed. Discard contaminated shoes. Do not breathe vapour Use only with adequate ventilation.
- **Storage:** Do not store in direct sunlight. Store in a tightly closed container. Store in a cool, dry, well-ventilated area away from incompatible substances. Corrosives area. Isolate from oxidizing materials and acids. Walls, floors, shelving, fittings, lighting and ventilation systems in storage area should be made from carbon steel or stainless steel which do not react with ammonium hydroxide.

Exposure Controls, Personal Protection

Engineering Controls: Use process enclosure, local exhaust ventilation, or other engineering controls to control airborne levels below recommended exposure limits. Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower.

Personal Protective Equipment-

Eyes: Wear chemical splash goggles and face shield.

Skin: Wear appropriate gloves to prevent skin exposure.

Clothing: Wear appropriate protective clothing to prevent skin exposure.

Respirators: Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.

DOWEX* MARATHON*

Product Name: DOWEX* MARATHON* C (H) Cation Exchange Resin

Emergency Overview

Colour: White to yellow

Physical State: Beads

Odour: Odourless to mild

Hazards of product: DANGER! Causes severe eye burns. Evacuate area. Keep upwind of spill. Slipping hazard.

Potential Health Effects

- **Eye Contact:** May cause severe irritation with corneal injury which may result in permanent impairment of vision, even blindness. Chemical burns may occur.
- **Skin Contact:** Prolonged exposure not likely to cause significant skin irritation. May cause more severe response if skin is abraded (scratched or cut).
- **Skin Absorption:** No adverse effects anticipated by skin absorption.
- **Inhalation:** No adverse effects are anticipated from inhalation. Vapors are unlikely due to physical properties.
- **Ingestion:** Very low toxicity if swallowed. Harmful effects not anticipated from swallowing small amounts.

First-aid measures

- **Eye Contact:** Wash immediately and continuously with flowing water for at least 30 minutes. Remove contact lenses after the first 5 minutes and continue washing. Obtain prompt medical consultation, preferably from an ophthalmologist. Eye wash fountain should be located in immediate work area.
- **Skin Contact:** Wash skin with plenty of water.
- **Inhalation**: Move person to fresh air; if effects occur, consult a physician.
- **Ingestion**: No emergency medical treatment necessary.

- **Notes to Physician:** No specific antidote. Treatment of exposure should be directed at the control of symptoms and the clinical condition of the patient.
- **Emergency Personnel Protection:** First Aid responders should pay attention to self-protection and use the recommended protective clothing (chemical resistant gloves, splash protection). If potential for exposure exists refer to Section 8 for specific personal protective equipment.

Accidental Release Measures

- **Steps to be taken if Material is Released or Spilled:** Contain spilled material if possible. Sweep up. Recover spilled material if possible. Collect in suitable and properly labelled containers. See Section 13, Disposal Considerations, for additional information.
- **Personal Precautions:** Evacuate area. Only trained and properly protected personnel must be involved in clean-up operations. Spilled material may cause a slipping hazard. Keep upwind of spill. Ventilate area of leak or spill. Refer to Section 7, Handling, for additional precautionary measures. Use appropriate safety equipment. For additional information, refer to Section 8, Exposure Controls and Personal Protection.
- **Environmental Precautions:** Prevent from entering into soil, ditches, sewers, waterways and/or groundwater. See Section 12, Ecological Information.

Handling and Storage:

- **General Handling:** Do not get in eyes. Wash thoroughly after handling. Keep container closed. Use with adequate ventilation. Static electricity can accumulate on dry beads. Leave room for expansion as dry resin swells upon wetting and/or changing ionic form. Equipment construction material should be compatible with feed, regenerant, ionic form and effluent of the ion exchange process. Avoid generating and breathing dust. Good housekeeping and controlling of dusts are necessary for safe handling of product.
- **Storage:** Store in a dry place. Keep container tightly closed when not in use. Preferred storage temperature is in the lower half of the range given below.

  Shelf life: Use within 24 Months; Storage temperature: 0 - 50 °C

Exposure Controls / Personal Protection

- **Eye/Face Protection:** Use chemical goggles.
- **Skin Protection:** Wear clean, body-covering clothing
- **Hand protection:** Use gloves chemically resistant to this material when prolonged or frequently repeated contact could occur. If hands are cut or scratched, use gloves

chemically resistant to this material even for brief exposures. Examples of preferred glove barrier materials include: Polyvinyl chloride ("PVC" or "vinyl").

- **Respiratory Protection:** Under intended handling conditions, no respiratory protection should be needed.
- **Ingestion:** Use good personal hygiene. Do not consume or store food in the work area. Wash hands before smoking or eating.

Engineering Controls

Ventilation: Use local exhaust ventilation, or other engineering controls to maintain airborne levels below exposure limit requirements or guidelines. If there are no applicable exposure limit requirements or guidelines, general ventilation should be sufficient for most operations.

LIQUID CHLORINE (Cl_2)

Chemical Name: Liquid Chlorine (Cl_2)

Emergency overview-

Appearance: GREENISH-YELLOW GAS, WITH PUNGENT ODOUR.

Potential Health Effects

- **Eye:** Corrosive. Pain. Blurred vision. Severe deep burns.
- **Skin:** ON CONTACT WITH LIQUID: FROSTBITE. Corrosive. Skin burns. Pain.
- **Inhalation:** Corrosive. Burning sensation. Shortness of breath. Cough. Headache. Nausea. Dizziness. Laboured breathing. Sore throat. Symptoms may be delayed (see Notes).

First Aid Measures

- **Eyes:** Immediately irrigate with copious quantities of water for 15 minutes. Eyelids to be held open. Remove clothing if contaminated and wash skin. Urgently seek medical assistance. Transport to hospital or medical centre. If in eyes wash out immediately with water. In all cases of eye contamination it is a sensible precaution to seek medical advice.
- **Skin:** : If skin or hair contact occurs, remove contaminated clothing and flush skin and hair with running water. If swelling, redness, blistering or irritation occurs seek medical assistance. For gross contamination, immediately drench with water and remove

clothing. Continue to flush skin and hair with plenty of water (and soap if material is insoluble). For skin burns, cover with a clean, dry dressing until medical help is available. If blistering occurs, do NOT break blisters. If swelling, redness, blistering, or irritation occurs seek medical assistance

- **Ingestion:** Rinse mouth with water. If swallowed, do NOT induce vomiting. Give a glass of water to drink. Never give anything by the mouth to an unconscious patient. If vomiting occurs give further water. Seek medical advice.
- **Inhalation:** Remove victim from exposure - avoid becoming a casualty. Remove contaminated clothing and loosen remaining clothing Allow patient to assume most comfortable position and keep warm. Keep at rest until fully recovered Seek medical advice if effects persist.

Accidental Release Measures

General Information: Use proper personal protective equipment as indicated in Section 8. **Small Spills/Leaks:** Wear protective equipment to prevent skin and eye contamination. Avoid inhalation of vapours or dust. Wipe up with absorbent (clean rag or paper towels). Collect and seal in properly labelled containers or drums for disposal

Large Spills:- Clear area of all unprotected personnel. Slippery when spilt. Avoid accidents, clean up immediately. Wear protective equipment to prevent skin and eye contamination and the inhalation of vapours. Work up wind or increase ventilation. Contain - prevent run off into drains and waterways. Use absorbent (soil, sand or other inert material). Collect and seal in properly labelled containers or drums for disposal. If contamination of crops, sewers or waterways has occurred advise local emergency services.

Handling and Storage

- **Handling**: Avoid eye contact and skin contact. Avoid inhalation of vapour, mist or aerosols.
- **Storage:** Store in a cool, dry, well-ventilated place and out of direct sunlight. Store away from foodstuffs. Store away from incompatible materials described in Section 10. Store away from sources of heat and/or ignition. Store locked up. Store in corrosive resistant container with a resistant inner liner. Keep containers standing up right. Keep containers closed when not in use - check regularly for leaks.

Exposure Controls, Personal Protection

Engineering Controls: Use process enclosure, local exhaust ventilation, or other engineering controls to control airborne levels below recommended exposure limits. Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower.

Personal Protective Equipment-

Eyes: Wear chemical splash goggles and face shield

Skin: Wear appropriate gloves to prevent skin exposure.

Clothing: Wear appropriate protective clothing to prevent skin exposure.

Respirators: Follow the OSHA respirator regulations found in 29 CFR 1910 134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptome are experienced.

DOWEX MAC-3 ION EXCHANGE RESIN

Product name: Dowex MAC-3 hydrogen form

First aid measures

- **General advice:** Consult a physician. Show this safety data sheet to the doctor in attendance.
- **If inhaled:** If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.
- **In case of skin contact:** Wash off with soap and plenty of water. Consult a physician.
- **In case of eye contact:** Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.
- **If swallowed:** Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

Accidental release measures

- **Personal precautions, protective equipment and emergency procedures:** Use personal protective equipment. Avoid dust formation. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Avoid breathing dust.
- **Environmental precautions**: Do not let product enter drains.

- **Methods and materials for containment and cleaning up:** Pick up and arrange disposal without creating dust. Sweep up and shovel. Keep in suitable, closed containers for disposal.

Handling and storage

- **Precautions for safe handling:** Avoid contact with skin and eyes. Avoid formation of dust and aerosols. Provide appropriate exhaust ventilation at places where dust is formed. Normal measures for preventive fire protection.
- **Conditions for safe storage, including any incompatibilities:** Store in cool place. Keep container tightly closed in a dry and well-ventilated place.

Exposure controls

- **Appropriate engineering controls**: Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

- **Eye/face protection:** Safety glasses with side-shields conforming to EN166 Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).
- **Skin protection:** Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands. The selected protective gloves have to satisfy the specifications of EU Directive 89/686/EEC and the standard EN 374 derived from it.
- **Body Protection:** impervious clothing, the type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.
- **Respiratory protection:** For nuisance exposures use type P95 (US) or type P1 (EU EN 143) particle respirator. For higher level protection use type OV/AG/P99 (US) or type ABEK-P2 (EU EN 143) respirator cartridges. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

HYDRATED LIME

Chemical Name: Hi-Cal Hydrate

Hazards identification-

Hydrate is an odorless white or grayish-white powder. Contact can cause irritation to eyes, skin, respiratory system, and gastrointestinal tract

First aid information-

- **Eyes:** Immediately flush eyes with generous amounts of water or eye wash solution If water is unavailable. Pull back eyelid while flushing to ensure that all lime dust has been washed out. Seek medical attention promptly if the initial flushing of the eyes does not remove the irritant. Do not rub eyes.
- **Skin:** Brush off or remove as much dry lime as possible Wash exposed area with large amounts of water. If irritation persists, seek medical attention promptly.
- **Inhalation:** Move victim to fresh air. Seek medical attention. If breathing has stopped, give artificial respiration.
- **Ingestion:** Do not induce vomiting. Seek medical attention immediately. Never give anything by mouth unless instructed to do so by medical personnel.

Fire fighting measures-

- **Fire Hazards:** Hydrate is not combustible or flammable. However, hydrate reacts vigorously with acids, and may release heat sufficient to ignite combustible materials in specific instances. Hydrate is not considered to be an explosion hazard, although reaction with acids or other incompatible materials may rupture containers.
- **Hazardous Combustion Products**: None
- **Extinguishing Media:** Use dry chemical fire extinguisher. Do not use water or halogenated compounds, except that large amounts of water may be used to deluge small quantities of hydrate.
- **Fire Fighting Instructions:** Keep personnel away from and upwind of fire. Avoid skin contact or inhalation of dust. Wear full fire-fighting turn-out gear (full Bunker gear), and respiratory protection (SCBA).

Accidental release measures-

- **Spill / Leak Procedures:** Do Not use water on bulk material spills. Use proper protective equipment.

- **Small Spills:** Use dry methods to collect spilled materials. Avoid generating dust. Do not clean up with compressed air. Store collected materials in dry, sealed plastic or non-aluminium metal containers. Residue on surfaces may be water washed.
- **Large Spills:** Use dry methods to collect spilled materials Evacuate area downwind of clean-up operations to minimize dust exposure. Store spilled materials in dry, sealed plastic or non-aluminium metal containers.
- **Containment:** Minimize dust generation and prevent bulk release to sewers or waterways. Clean-up: Residual amounts of material can be flushed with large amounts of water Equipment can be washed with either a mild vinegar and water solution, or detergent and water.

Handling and Storage-

- **Handling:** Keep in tightly closed plastic or non-aluminium metal containers Protect containers from physical damage. Avoid direct skin contact with the material.
- **Storage:** Store in a cool, dry, and well-ventilated location. Do not store near acids or other incompatible materials Keep away from moisture Do not store or ship in aluminium containers

Exposure controls / Personal protection-

- **Engineering Controls:** Provide ventilation adequate to maintain PELs
- **Respiratory Protection:** Use NIOSH/MSHA approved respirators if airborne concentration exceeds PELs.
- **Skin Protection:** Use appropriate gloves and footwear to prevent skin contact. Clothing should fully cover arms and legs. Should lime get inside clothing or gloves, remove the clothing and the lime promptly.
- **Eye Protection:** Use safety glasses with side shields or safety goggles. Contact lenses should not be worn when working with lime products.
- **Other:** Eye wash fountain/stations and emergency showers should be available.

STRONG BASE ANION

Chemical Name: Monoplus MP M-500

Hazards identification-

- **Emergency Overview:** not expected to produce significant adverse health effects when the recommended instructions for use are followed.

- **Routes of entry:** Dermal contact, Eye Contact
- **Medical conditions aggravated by over-exposure:** Pre-existing respiratory, skin and eye disorders and disorders involving any other target organs mentioned in this MSDS as being at risk may be aggravated by over-exposure to this product.

First aid measures-

- **Eye contact:** Check for and remove any contact lenses. In case of contact flush eyes with plenty of Luke warm water. Get medical attention if symptoms occur.
- **Skin contact:** Wash with plenty of soap and water. Get medical attention if symptoms occur. Wash clothing before reuse. Clean shoes thoroughly before reuse
- **Inhalation:** If inhaled, remove to fresh air. Get medical attention if symptoms occur
- **Ingestion:** Wash out mouth with water. Do not induce vomiting unless directed to do so by medical personnel. Get medical attention if symptoms occur.

Fire-fighting measures-

Extinguishing media

- **Suitable:** In case of fire, use water spray (fog), foam or dry chemical
- **Not suitable:** Carbon dioxide (CO_2).
- **Hazardous thermal decomposition products:** Decomposition products may include the following materials: carbon dioxide carbon monoxide halogenated compounds
- **Special protective equipment for fire-fighters:** Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Accidental release measures-

- **Personal precautions:** No action shall be taken involving any personal risk or without suitable training.
- **Spill and Leak Procedures:** Hazard of slipping on spilled product. Move containers from spill area. Prevent entry into sewers, water courses, basements or confined areas. Vacuum or sweep up material and place in a designated, labelled waste container.

Handling and storage

- **Handling:** Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking.

- **Storage:** Store in accordance with local regulations Store in original container protected from direct sunlight in a dry, cool and well-ventilated area, away from incompatible materials (see section 10) and food and drink. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabelled containers. Use appropriate containment to avoid environmental contamination. It is recommended to store ion exchange resins at temperatures above the freezing point of water. If the resin should become frozen, the resin should not be mechanically handled and should be left to thaw out gradually at ambient temperature. It must be completely thawed before handling or use. No attempt should be made to accelerate the thawing process.
- **Storage temperature:** Store between the following temperatures: -20 to 40°C

Personal protection-

- **Respiratory:** None required under normal conditions of use
- **Hands:** gloves
- **Eyes:** safety glasses with side-shields
- **Skin:** Wear work clothing with long sleeves. Suitable protective footwear.

HCL

Chemical Name: Hydrochloric Acid

Hazards Identification-

Clear, colourless solution with caustic odour.

R35 – Causes severe burns. S1/2, S26, S30, S45

Routes of Entry: Skin, eyes, inhalation and ingestion.

First aid information-

- **Inhalation:** Inhalation of mists can cause corrosive action on mucous membranes. Symptoms include burning, choking, coughing, wheezing, laryngitis, shortness of breath, headache or nausea. Move casualty to fresh air and keep at rest. Get medical attention if symptoms persist.
- **Eyes:** Contact rapidly causes severe damage. Symptoms include eye burns watering eyes. Permanent damage to cornea may result. In case of eye contact, rinse with plenty of water and seek medical attention immediately.

- **Skin:** Severe and rapid corrosion from contact. Extent of damage depends on duration of contact. Symptoms include burning, itching, redness, inflammation and/or swelling of exposed tissues. Harmful if absorbed through skin. Immediately flush with plenty of water for at least 15 minutes while removing contaminated clothing and wash using soap Get medical attention immediately.
- **Ingestion:** Do Not Induce Vomiting! Severe and rapid corrosive burns of the mouth, gullet and gastrointeetinal tract will result if swallowed. Symptoms include burning, choking, nausea, vomiting and severe pain. Wash out mouth with water and give a glass of water or milk. Get medical attention immediately.

Accidental release measures-

- **Personal precautions:** See section 8 for recommendations on the use of personal protective equipment.
- **Environmental precautions:** Clean-up personnel need personal protection from inhalation and skin/eye contact. Evacuate and ventilate the area. Prevent spillage from entering drains. Cautiously add water to spill, taking care to avoid splashing and spattering. Neutralize diluted spill with soda ash or lime. Absorb neutralized spill with vermiculite or other inert absorbent material, then place in a suitable container for disposal. Clean surfaces thoroughly with water to remove residual contamination. Any release to the environment may be subject to federal/national or local reporting requirements. Dispose of all waste or clean-up materials in accordance with local regulations. Containers, even when empty, will retain residue and vapours.

Handling and storage-

- **Normal handling:** See section 8 for recommendations on the use of personal protective equipment. Use with adequate ventilation Wash thoroughly after using. Keep container closed when not in use.
- **Storage:** Store in cool, dry well-ventilated area. Keep away from incompatible materials (see section 10 for incompatibilities). Drains for storage or use areas for this material should have retention basins for pH adjustment and dilution of spills.

Exposure controls / personal protection-

- **Ventilation:** Provide local exhaust, preferably mechanical.
- **Respiratory protection:** If necessary use an approved respirator with acid vapour cartridges.

- **Eye protection:** Wear chemical safety glasses with a face shield for splash protection.
- **Skin and body protection:** Wear neoprene or rubber gloves, apron and other protective clothing appropriate to the risk of exposure.
- **Other Recommendations:** Provide eyewash stations, quick-drench showers and washing facilities accessible to areas of use and handling. Have supplies and equipment for neutralization and running water available.

SOLID SULPHUR

Product Name: Solid Sulphur

Hazards identification:

- Highly flammable and combustible Solid.
- A nuisance dust.
- Crystalline sulphur deposits and dust are readily ignitable.
- Forms explosive mixtures with charcoal and oxidizing agents.
- Thermal decomposition will evolve with large quantities of sulphur dioxide.
- In dry state can form electrostatic charge if stirred, transported pneumatically or poured.
- Contact could cause burns to skin and eyes
- Fire could produce irritating or Sulphur dioxide (SO_2) gas.
- Eye contact: Irritation and redness. Inhalation: sore throat, coughing.

First aid information-

- **Inhalation:** Move to fresh air. Take to doctor.
- **Eyes:** IMMEDIATELY wash eyes with running water until irritation is gone. Take to doctor if necessary.
- **Skin:** Remove contaminated clothing, wash skin with soap and water or shower.
- **Ingestion:** Rinse mouth with water and do not induce vomiting. Obtain medical attention. Sulphur is not considered highly toxic.

Accidental release measures-

- **Personal precautions:** Avoid mixtures of air and sulphur dust, sparks or open flames, mixtures of sulphur and oxidizing agents in general, large accumulations of sulphur dust which become airborne in an explosion or process disruption caused by other materials. Examples of oxidizing agents are perchlorates, nitrates, chlorates, permanganates peroxides. oxygen and etc. Good housekeeping is essential to minimize fire danger.
- **Spill or Leak:** Restrict access to area. Provide adequate protective equipment, ventilation and have fire fighting equipment at hand. Remove sources of heat, flame and ignition. Avoid setting fire to spilled material. Avoid creating dust and sparks with tools. Small spills may be cleaned up with a shovel and broom. Large spills may be cleaned up with front end loaders. Personnel to thoroughly wash all exposed skin areas to prevent irritation from dust.
- **Environmental:** Do not let spillages enter drains, sewers or water courses. Any spillages into the water courses must be reported to the local regulatory body, of that area.

Handling and Storage:

Handle only with well-grounded non-sparking equipment. Dry sulphur materials may generate static electricity and sparking. Avoid handling sulphur at high velocity in air. Control dust formation. Avoid contact with eyes and dust suspect ions. Only use in well ventilated areas. Do not use near sparking equipment or open flames. Do not allow large amounts of waste to accumulate. Do not store near oxidizing materials or near hot equipment. In the presence of moisture over long periods of time, sulphur will convert to sulphuric acid which is corrosive to metals, attacks paper, concrete, wood. Store in dry place

Exposure controls / personal protection-

Personnel Protective Equipment:

- **Respiratory protection:** dust mask suitable for use of irritating dust
- **Fire:** Breathing apparatus shall be worn. Indoor use areas should have sufficient local exhaust to remove dust as it is release into the air. Eye protection must be used.
- **Clothing:** Long sleeves, long pants and gloves assist to keep sulphur off the skin of sensitive persons prone to irritation or dermatitis.
- Fire fighting tools should be readily available.
- Safety shower or eye wash fountain or bottle to be available.

CAUSTIC SODA (Alkali)

Chemical Name: Sodium Hydroxide

Hazards identification-

- **This product may be:** corrosive, toxic and a major potential hazard upon contact to skin and eyes
- **Toxicity routes of exposure:** Ingestion can cause severe burning and pain in lips, mouth, tongue, throat and stomach Death can result from ingestion.
- **Overexposure:** Causes burns and scarring. Can cause serious damage to all body tissues contacted.

First aid measures-

- **Skin:** Remove contaminated clothing and immediately wash skin for a minimum of 15 minutes Call or see a physician.
- **Eyes:** Immediately flush eyes with large amount of water, occasionally lifting the upper and lower eyelids and rotating the eyeballs. Continue flushing for a minimum of 15 minutes See a physician.
- **Inhalation:** Remove to fresh air. If breathing stops, administer artificial respiration. See a physician.
- **Ingestion:** DO NOT induce vomiting. If person is conscious, give 2 or more glasses of water. If unconscious, never give anything by mouth. See a physician immediately

Accidental release measures-

In case of spill or release: Completely contain spilled material with dikes. sandbags. etc., and prevent run off into the ground or surface waters or sewers. Recover as much caustic material as possible into containers for disposal. Add water and neutralize remaining caustic material with dilute hydrochloric acid, citric acid or another solid acidic material to a pH between 6 and 9. Collect neutralized caustic with a dry sorbent. Flush residual neutralized waste to the drain with excess water.

Handling and storage-

- **Storage Requirements:** Keep container tightly closed.
- **For small volumes:** Maybe stored in plastic jugs.
- **For large volumes:** Store in steel storage tanks
- **Incompatible materials:** Store away from acids.

Exposure controls and protection-

- Adequate ventilation needed.
- **Protective Equipment for the eyes and skin:** Goggles, respirator, disposable latex/ rubber apron, PVC rain suit, rubber boots with pant legs over boots.
- **Precautionary Hygiene/control measures:** Avoid contact with skin, eyes, and clothing. Do not breathe mist or vapour. Wash thoroughly after handling. Safety showers and eye wash fountains should be available in storage and handling area.

HYDRAZINE HYDRATE 80%

Product name: HYDRAZINE HYDRATE 80%

Health hazards : Skin corrosion - Category 1B - Danger (CLP : Skin Corr. 1B) H314 Acute toxicity, Oral - Category 3 - Danger (CLP : Acute Tox. 3) H301 Acute toxicity, Inhalation - Category 3 - Danger (CLP : Acute Tox. 3) H331 Skin sensitisation - Category 1 - Warning (CLP : Skin Sens. 1) H317 Acute toxicity, dermal - Category 3 - Danger (CLP : Acute Tox. 3) H311

First aid measures

- **Inhalation:** Specific treatment (see on this label). Immediately call a POISON CENTER or doctor. Remove to fresh air and keep at rest in a position comfortable for breathing
- **Skin contact:** Wash contaminated clothing before reuse. If skin irritation or rash occurs: Get medical advice. Specific treatment (see on this label). Immediately call a POISON CENTER or doctor. Wash with plenty of soap and water. Remove/Take off immediately all contaminated clothing.
- **Eye contact:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing Immediately call a POISON CENTER or doctor.
- **Ingestion:** Rinse mouth. Do NOT induce vomiting. Immediately call a POISON CENTER or doctor. Specific treatment (see on this label).

Surrounding fires: Use water spray or fog for cooling exposed containers.

Advice for fire-fighters

Protection against fire Do not enter fire area without proper protective equipment, including respiratory protection.

Special procedures: Exercise caution when fighting any chemical fire. Avoid (reject) fire-fighting water to enter environment.

Personal precautions, protective equipment and emergency procedures

For emergency responders: Equip clean-up crew with proper protection. Ventilate area.

Technical measures: Use special care to avoid static electric charges.

Special precautions: Remove ignition sources. No naked lights. No smoking.

For non-emergency personnel: Evacuate unnecessary personnel.

Precautions for safe handling

Handling: Handle empty containers with care because residual vapours are flammable. Take precautionary measures against static discharge. Contaminated work clothing should not be allowed out of the workplace. Use only outdoors or in a well-ventilated area. Do not breathe dust, fume, gas, mist, vapours, spray. Wash contaminated clothing before reuse. Wash thoroughly after handling. Do not eat, drink or smoke when using this product.

Technical protective measures: Provide good ventilation in process area to prevent formation of vapour. Proper grounding procedures to avoid static electricity should be followed. Use only non-sparking tools. Use explosion-proof electrical, ventilating, lighting, equipment.

Special precautions: No naked lights. No smoking.

Exposure controls/personal protection

Exposure controls

- **Personal protection**: Avoid all unnecessary exposure.
- **Respiratory protection**: In case of insufficient ventilation, wear suitable respiratory equipment.
- **Hand protection**: Wear protective gloves.
- **Skin protection**: Wear suitable protective clothing.
- **Eye protection**: Chemical goggles or face shield.
- **Others**: When using, do not eat, drink or smoke.
- **Special precautions**: Hazardous waste due to toxicity. Handle empty containers with care because residual vapours are flammable.

OZONE

Product Name: OZONE

Hazard Identification

Physical: Oxidizing Gas

Health: Skin Irritation, Eye Irritation

First Aid Measures

Skin Contact: Rinse with water

Eye Contact: Rinse with water, remove contacts

Inhalation: Remove to fresh air, provide oxygen therapy as needed

Fire Fighting Measures

Ozone itself is not flammable. As a strong oxidant it may accelerate, even initiate, combustion, or cause explosions. Use whatever extinguishing agents are indicated for the burning materials

Accidental Release Measures

Turn off the ozone generator, and ventilate the area. Evacuate until ozone levels subside to a safe level (<0.1 ppm).

Handling and Storage

Ozone must be contained within ozone-resistant tubing and pipes from the generation point to the application point.

Respiratory Protection:

Use full face self-contained breathing apperatus for entering areas with a high concentration of ozone.

Engineering control:

Use ozone destruct unit for off gassing of ozone.

SODIUM HEXAMETAPHOSPHATE (SHMP)

Product Name: Sodium Hexametaphosphate

First Aid Measures:

Eye Contact: Wash with water

Skin contact: None required

Fire-Fighting Measures:

Governed by other materials present. No special fire-fighting equipment or measures required.

Accidental Release Measures:

Sweep up spillage and recover/recycle if possible. Otherwise place in paper or plastic sacks and dispose of as industrial waste.

Handling & Storage

Handling: No special precaution required.

Storage: Hygroscopic solid. Store in tightly sealed containers in a dry cool place. Store one pallet high to avoid compaction. Protect food grade material from contamination.

TRISODIUM PHOSPHATE (TSP)

Product Name: Trisodium Phosphate (TSP)

Fire-Fighting Measures:

Governed by other materials present. No special fire-fighting equipment or measures required.

Accidental Release Measures:

Sweep up spillage and recover/recycle if possible. Otherwise place in paper or plastic sacks and dispose of as industrial waste.

Handling & Storage

Handling: Minimize dust formation.

Storage:

1. Protect from contamination
2. Store in original, unopened package in clean, cool, dry place
3. Store one pallet high to avoid compaction

4.9 Fire Fighting

4.9.1 Oxeo inert gas systems: Residue-free extinguishing

Oxeo extinguishing systems ensure a reduction of the oxygen content in the event of a fire, by introducing inert gases such as argon or nitrogen into the protected area. By displacing the oxygen, the fire is extinguished rapidly and without leaving any residue of extinguishant. Therefore, Oxeo inert gas extinguishing systems are especially suitable for the protection of high-quality systems, sensitive equipment or valuable assets that might be damaged by the use of non-gaseous extinguishant. Argon and nitrogen are natural components of the ambient air. Moreover, the gases are not harmful for people and electrically non-conductive.

4.9.2 MX 1230 chemical extinguishing systems: Efficient and compact

MX 1230 systems extinguish fires using the chemical extinguishant Novec™ 1230 by 3M™. This extinguishant is neither corrosive nor electrically conductive. It is thus especially suitable for protecting rooms containing electric and electronic equipment. MX 1230 systems, too, extinguish fires without leaving residues on the protected objects, while offering a high level of personal and environmental protection at the same time. They have the added advantage of a particularly compact extinguishant supply; this makes for an attractive solution especially for smaller and medium sized rooms.

4.9.3 Fire detection systems and suppression system controls: Optimum overview and high flexibility

Flames, smoke, a gas emission, heat – a fire that is spreading is a multi-faceted fire. Minimax has the right type of fire detectors for every kind of fire. All fire detectors transmit their signals to the FMZ 5000 fire detection control panel – taking the short route, via a loop. The FMZ 5000 panel controls alarm devices and transmits alarm notifications to a permanently staffed post and to the fire department. Moreover, it can monitor the available suppression systems continuously for proper functioning and can trigger these systems - except for sprinkler systems - electrically in the event of a fire. The FMZ 5000 also offers additional features such as communication with hazard or facility management systems or via web interfaces with Internet capable devices.

4.10 Precaution to Avoid Fire

- Fire Audit / Survey to be conducted
- Fire Risk, Load and Hazard to be identified.
- Recommended protection to be identified through TAC/NBC/IS Guide Lines.

- Preparation of drawings, calculations, Quantities, Specifications and Estimates etc to be done.
- Coal yard High hazardous area: Fire Risk: Class A Fire Best extinguishing agent is water. Automatic Extinguishing is critical and expensive Manual Protection to be Installed :Water Hydrant system
- Coal Conveyor High hazardous area: Fire Risk: Class A Fire Best extinguishing agent is water. Automatic Extinguishing to be Installed. Manual Protection to be also to be Provided: High Velocity Water Spray system as per TAC/NBC to be Installed .Detection: LHS OR QUORTZ OIDBULB Atomization: Deluge / Electrical COAL CONVEYOR
- Boiler medium hazardous area: Fire Risk: Class a Fire Best extinguishing agent is water. Automatic Extinguishing to be Installed. Manual Protection to be also to be Provided: High Velocity Water Spray system as per TAC/NBC to be Installed .Detection: LHS OR QUORTZ OID BULB Atomization: Deluge / Electrical
- TG (TURBINE GENARATOR)Turbine Medium hazardous area :Fire Risk : Class B and C Fire Best extinguishing agent is Foam / Co2 / Powder Automatic Early warning Smoke detection system to be Installed: Portable Equipment CO2 / DCP also to be Provided: Foam based Medium Velocity Water Spray system as per TAC/NBC to be Installed to lube oil tanks. Detection: QUORTZOID BULB
- Cable Gallery Medium hazardous area : Fire Risk : Class B and C Fire Best extinguishing agent is Foam / Co2 / Powder Automatic Early warning Smoke detection system to be Installed: Portable Equipment CO2 /DCP also to be Provided: High Velocity Water Spray system as per TAC/NBC to be Installed to lube oil tanks. Detection: QUORTZOID BULB Atomization: Deluge Electrical Panel Medium hazardous area . Fire Risk : Class B and C
- Fire Best extinguishing agent is Foam / Co2 / Powder Automatic Early warning Smoke detection system to be Installed: Portable Equipment CO2 / DCP also to be Provided:
- Central Control Room Light hazardous area Fire Risk : Class A and C Fire Best extinguishing agent is Co2 / FM 200 / INERGEN Automatic Early warning Smoke detection system and Clean agent Gas suppression systems to be Installed: Detection: Smoke (Cross zone/addressable analogue) Atomization: Solenoid Portable Equipment CO2 also to be

- TRANSFORMER hazardous area: Fire Risk. Class B and C Best extinguishing agent is High Velocity water. Automatic Extinguishing to be Installed: Manual Protection also to be Provided: High Velocity Water Spray system as per TAC/NBC to be Installed .Detection: LHS OR QUORTZOID BULB Atomization: Deluge / Electrical
- LDO High hazardous area: Fire Risk: Claes B Best extinguishing agent is Foam / Co2 / Powder Automatic Early warning Detection system to be Installed: Required Capacity Equipment FOAM / DCP also to be Provided: Foam based Medium Velocity Water Spray system as per TAC/NBC to be installed to lube oil tanks Detection: LHS / QUORTZOIDBULB
- TRANSFORMER hazardous area: Fire Risk: Class B and C Best extinguishing agent is High Velocity water. Automatic Extinguishing to be Installed: Water Hydrant System to be Provided for Switch yard: High Velocity Water Spray system as per TAC/NBC to be Installed for Transformer. Detection: LHS ORQUORTZOID BULB Atomization. Deluge / Electrical Portable extinguishers to be provided

COMMON FIRE PROTECTION FOR TOTAL PLANT: EARLY WARNING MANUAL CALL POINT FIRE ALARM SYSTEM PORTABLE EXTINGUISHERS WATER HYDRANT SYSTEM

4.11 Fire Detection System

4.11.1 General Description of the System

The Fire Detection and Alarm System will comprise a network of Microprocessor based Fire Alarm Control Panel, Repeater Panel, Analogue addressable Multisensory Detectors, Analogue Addressable Break Glass Box type Manual Call Points, Digital type Linear Heat Sensing cable (LHS), Addressable Control Modules, Addressable sounders, Fire Sirens, associated Cabling and the accessories required to form a network like Terminal Boxes and Junction Boxes.

Automatic Fire Detection and Alarm System detect fire / over-heating by means of the attendant phenomena of fire, such as smoke or heat. It initiates alarm and actuates pre-programmed control actions. Detection of fire at an early stage permits rapid intervention by fire fighting forces. Thus the automatic fire detection and alarm system reduces damage to property and risk to human lives

It is proposed to connect the detectors for the Main Plant area to the Microprocessor based Fire alarm control Panel located in Central control Room. A Repeater Panel shall be provided and the same will be located At FIRE Station room 6.4 Coverage Area The coverage

of the Analogue Addressable Multisensory Detectors, Heat Detectors, Sirens and Linear Heat sensor Cables will be generally as follows:

(a) 25 Sqm. per Detector for General application.

(b) 20 to 25 Sqm. per Detectors for Main Control room, Electronic Cubicle room, Computer Room, etc.

(c) Linear Heat Sensor Cables running above uppermost and along the third tray from the top in case there are 4 to 5 tiers. The cable will run above the upper tray in case there are 2 or 3 tiers.

(d) Linear Heat Sensor Cable of Fusible Fibber Optic type running along the Conveyor.

(e) Sirens- 3.2 Km (min) against the Wind direction.

4.11.2 Fire Detection and Alarm (FDA) System

The Sensors in the Fire Detection and alarm System are Automatic analogue type inherently Addressable Fire Detectors, which provides continuous surveillance in an area. All Detectors are connected in loops. The Microprocessor based Fire Alarm control Panel located in Central Control Room has the facility to process the input signals and control all the input data received from inherently addressable Analogue type Detector units at various locations of the Plant.

Microprocessor based fire Alarm Control Panel provided in Central control Room is a composite unit and the same comprises of PC, Printer, Driver Units and Microcomputer for interfacing & communicating with other Panels. Fire Detectors will be selected depending on the type of fire expected in a particular area.

4.11.3 Number, Layout Requirements and Grouping of Detectors

The number of Fire Detectors to be installed is governed by the total area to be protected, type of building construction (if indoors), air movement, air velocity, ceiling obstructions, value concentration and the sensitivity required. Under ideal conditions of smooth ceiling and average room size, one detector is recommended to protect the area as specified in clause 6.4 (a) and (b). If ducts / beams, etc. on the ceiling exceed 450 mm in depth & are more than 2.5m on centre, each area so formed by the duct / beam requires at least one separate detector. The spacing of fire detector shall be as per the IS: 2189 with all suitable multiplication factors.

All individuals inherently addreseable Detectors will be wired on a common connecting line called loop. The number and exact location of detectors to be installed in the various areas will be finalized during detailed engineering stage based on Standards as per clause.

The Fire alarm Control Panel will continuously monitor the status of the fire Detectors and the connecting loops.

Following are some of the criteria to determine layout of the Fire Detectors:

(a) Multisensory Detectors should be located where the largest concentration of combustion gas can be expected

(b) As a matter of principle, Detectors will be installed at the highest point of the ceiling and minimum coverage indicated by supplier will also be considered.

(c) The number of Detectors and their location will be so selected that complete coverage is obtained. The zones of individual Detectors will overlap and no blind zone will be left.

(d) The location of Detectors will be co-ordinated with other services like air conditioning, light fittings, cable trays and raceways, etc.

4.12 Proposed Detectors System for the Different Plant Areas

4.12.1 Analogue Addressable Detectors

(a) STG Building/AHP/CHP Control Room, Computer Room, Electronic Cubicle Room (A/C/ Non-A/c) and Battery Room. The type of fire expected in this area is that due to burning of insulation/sheath material of cables and this gives rise to smoke. Hence, Multisensory Detectors will be installed in this area. Photo Electric type analogue addressable detectors will be installed above false ceiling.

(b) Record Room & Shift-in-charge Room. The type of fire expected in these areas is either due to electrical faults or accidental fire due to burning of documents giving rise to smoke. Addressable Multisensory Detectors will be provided in these areas.

(c) Switchgear Rooms & Battery Charger Room In these areas fire may occur due to overheating of current carrying parts or failure of circuit breakers to interrupt short circuit currents. Analogue Addressable Multisensory Detectors will be provided in these rooms.

(d) Cable Vaults/ Gallery the type of the fire expected is due to burning of insulation/ sheath material of cables which gives rise to dense smoke Combination of Analogue Addressable Multisensory and photoelectric Detectors will be used. In addition, Linear Heat Sensor Cable will also be provided.

(e) Switchgear Rooms in CW/DW/SW Pump house, ESP area, Ash handling area, Ash handling control room & ESP control room, CHP MCC & Control Room extension areas of DG house. Since fire in these areas will occur mainly due to burning of cable

insulation and sheath material or overheating of current carrying parts. Analogue Addressable Multisensory Detectors are the most suitable sensors for these areas.

(f) Acid/ alkali Storage Area, DG House and Pump House In these areas fire may occur due to burning of Acid. Therefore Analogue Addressable Rate of Rise of Temperature Detectors with fixed Temperature setting element, Flame Detectors and Manual Call Points.

(g) Fuel Oil storage Tanks For foam system flame proof rate of rise of temperature detector with fixed temperature element, for MVWS system Quartzite bulb detectors shall be provided for the fuel oil tanks

(f) Infra-red detectors and LHS cables will be provided for all coal conveyors.

4.12.2 Manual Call Points

In addition to Automatic Fire Detectors, analogue Addressable Manual Call Points comprising Break Glass Box type will be provided at various locations in all zones, especially at the exit of the STG Building, STG Building Control Room, ESP Control Room, CPU & WTP Lab, Ash Electrical & Control Room, Service Building, Canteen, CHP MCC & Control Room, Transformer yard, Switchyard, Boiler Platforms, CW/SW/DW/HCSD Pump House, Chemical House, Battery Charger Room, CPU & WTP Lab, Staircases and other General Areas to actuate Fire Alarm System through remote manual intervention. Sequence of alarm and actuation scheme for Manual Call Points will be same as that for automatic Fire Detectors. The Manual Call Points will be of the wall mounted or pedestal mounted type.

4.13 Control and Supervision System

The control unit evaluates the signals received from the Detectors, Triggers visual and audio alarms, indicates the location of the fire and sets in motion Fire Fighting process. It initiates tripping of AHU for A/c system, Air washer fans in Ventilation system, Package air-conditioners, VDB's, Fire Dampers, Conveyor Motor, etc. related to the area concerned. The system initiates operation of extinguishing systems such as deluge system, sprinklers and transmits alarm and fault signals to predetermined points. The system must ensure that more number of Detectors/ Devices can be connected in a loop and there will be a facility for additional Loop Modules for future expansion.

4.13.1 The Complete system shall include, but not being limited to the following:

a) Master system CPU

b) Analog addressable Fire Detection and alarm System Panels including Alarm modules, System supervisory control modules, auxillary output control modules etc.

c) PC based monitoring station with colour graphic display terminal with programming and historical archiving facility along with laser prints

d) Power supplies, batteries and battery chargers

e) Analogue addressable type Multisensory Detectors. Analogue addressable type Heat Detectors

f) Software and Hardware as required for operation of the system

g) Non addressable type LHS cable detector/Infrared type Heat detectors and Switching devices each with its own addressable interface modules

h) Complete Writing/ Cabling including its conduits/trays/fixtures etc.

4.13.2 The system will have following self-diagnostic features:

(a) Detector cabling will be completely supervised for open circuit and short circuit.

(b) Unauthorized removal of a detector head from its base will be supervised to give a fault alarm on the connected control panel

(c) Annunciation will be provided for battery low voltage, battery earth fault, DC fuse blown and loss of main AC supply

(d) Alarm verification features

(e) Facility to transmit annunciation to Repeater Panel.

The ambient conditions around each detector are 'learned' by the system and the sensitivity is adjusted accordingly.

4.13.3 Microprocessor Based Fire Alarm Control Panel

Microprocessor based Fire Alarm Control Panels are comprise of the processor, various functional modules, adequate number of loop modules for detector loops, display devices, output modules for alarm control & interlocks, communication features required. The control system shall be analogue type.

Complete system and all equipment's such as detectors, panels, etc., shall be approved and listed by UL/FM/LPCB/VDS/TAC.

The Microprocessor based Fire Alarm Control Panel will incorporate the following features.

a) Continuous supervision of the detector connecting lines, individual detector performance/operation and disconnection/removal of Detectors. The system will automatically reset on clearance of a fault

b) Discrimination between a real fire and false fire condition by incorporating signal verification and other features

c) Individual detector has an addressing capability

d) Detection of over/under sensitive Detectors and automatic calibration by increasing or decreasing their sensitivity levels based on environmental conditions like air movement, fumes, humidity, etc.

e) Pre-alarm in case of any detector(s) requiring maintenance

f) Facility shall be provided such that for alteration or access to the stored program the relevant codes are to be entered. The system should be protected against interference by unauthorized personnel

g) Compatibility with all detectors/ devices connected to the fire alarm panel

h) Logging of alarm, time and action text on printers

i) Programmed activation of various interlocks with fire protection system and other associated system such as ventilation and air conditioning, etc.,

j) Programmed activation of sequence of events to be carried out in case of fire in any particular protective area of the plant including activation of fire alarm sounders or evacuation alert signal

k) It is possible to create zones or logical groups in fire alarm panel. Each zone may contain a number of Detectors/devices and each of these zones shall be individually addressable

l) Each of the area/building shall be considered as a zone and isolators shall be provided zone wise. In case of large building isolators shall be provided for every 20 devices.

The design of the Fire Alarm Control Panel shall be such as to incorporate the following features.

(a) The circuits shall be arranged such that a fault in the detector or an open circuit in the connecting line does not affect the operation/performance of other Detectors connected in that line and does not prevent receipt of fire alarm signals on the Fire Alarm Control Panel from other Detectors. In case of a short circuit in the connecting line, line fault isolator which is included in the base of the detector such that it will affect only the particular device

(b) For all type of Detectors, the alarm will be initiated within 15 seconds

(c) The minimum number of Detectors or devices in a circuit loop is 99. The maximum number of Detectors that can be connected of the system will be furnished during detail engineering

(d) The Fire Alarm Control Panel will have adequate number of detector circuit/loops so as to cover all the arees to be protected in the sector. Provision shall also be made in Fire alarm Control Panel to add additional detector loop modules for further expansion

(e) The Fire Alarm Control Panel will automatically and periodically (at least once in 24 hrs) compare each sensor's operating characteristics with set sensitivity and recalibrate the dual alarm limits, if necessary

(f) Fire Alarm control Panel shall have provision for repeating annunciation of (a) Fire (b) water spray on (c) deluge valve on test (d) deluge valves signals for each area to be protected (i.e., cable gallery, etc.,) by interfacing with pressure switch/test switch or auxiliary contacts from fire protection panels provided by fire protection system Vendor. Also it will generate contacts as given below for co-ordinated Fire fighting operation

(g) Necessary terminals will be made available identifying the terminals for Purchasers use.1) Two sets of contacts of local control panels of fire protection system. 2) Two sets of contacts for fire in each zone of contacts shall be generated to deluge valve control panel. 3) Two sets of contacts shall be generated for each Switchgear Room/Control Room, if any of the Detectors in that area picks up. This will be used for closing the fire dampers in the corresponding area and for switching off the supply to exhaust fans & supply air fans in that area. 4) One set of contact for each floor for detector /MCP operation for interfacing with Emergency Voice Communication system for effectively evacuating people during emergency. 5) Essential contacts for interfacing/interlocking Systems.

4.13.4 Repeater Panel

Repeater Panel will be Microprocessor based which will repeat all the annunciations, audibly and visually, from Microprocessor based Fire Alarm Control Panel.

All the control functions available in Fire Alarm Control Panel will also be made available in this Panel. The visual text displayed on Fire Alarm Control Panel shall be displayed on this Panel also. Repeater Panel will be located in Fire Station Room

4.14 General Requirement of the Fire Detection & Alarm System

The fire detection and alarm system normally operates on AC power supply. In the event of AC failure, standby no break source of power with 2x100% Nickel Cadmium battery backup automatically cut in. Float cu-boost charger trickle charges the battery when AC supply is available and the battery capacity is sufficient to deliver power to fire detection and alarm system for period not less than 48 hours of continuous load and 30 minutes of maximum alarm load. The fire detection and alarm system is such as to operate at the battery voltage without requiring additional DC/AC converters for boosting up the DC voltage. Charger will be able to boost charge a fully discharged battery sufficiently in 12 hours to supply maximum alarm load for 30 minutes.

Facility is provided on the Fire Alarm Control Panels for simulating the fire condition to enable testing of the various alarm circuits.

All the fire alarm circuits will be of modular design using electronic printed card circuits to facilitate easy replacement of faulty circuits with spare cards. All the electronic components and cards will be compatible to non-air-conditioned environment for working satisfactorily.

The system design will be such that operation/resetting of alarms for one zone/detector will not block availability of alarm for any other zone. Also the alarm/ system reseting will be by common push button and not by individual switches or different zones / Detectors.

4.15 Welding Process

A person conducting a business or undertaking has the primary duty to ensure, so far as is reasonably practicable, that workers and other persons are not exposed to health and safety risks arising from the business or undertaking.

A person conducting a business or undertaking that carries out welding activities must eliminate risks arising from welding, or if that is not reasonably practicable, minimize the risks so far as is reasonably practicable.

The WHS Regulations include more specific requirements to manage the risks of hazardous chemicals, airborne contaminants and plant, as well as other hazards associated with welding such as noise and manual tasks.

Designers, manufacturers, importers and suppliers of plant or substances used in welding must ensure, so far as is reasonably practicable, that the plant or substance is without risks to health and safety. This duty includes carrying out testing and analysis as well as providing specific information about the plant or substance.

Officers, such as company directors, have a duty to exercise due diligence to ensure that the business or undertaking complies with the WHS Act and Regulations. This includes taking reasonable steps to ensure that the business or undertaking has and uses appropriate resources and processes to eliminate or minimize risks that arise from welding.

Workers have a duty to take reasonable care for their own health and safety and must not adversely affect the health and safety of other persons. Workers must comply with any reasonable instruction and co-operate with any reasonable policy or procedure relating to health and safety at the workplace. If personal protective equipment is provided by the person conducting the business or undertaking, the worker must use it in accordance with the information, instruction and training provided.

The WHS Regulations require a person conducting a business or undertaking to 'manage risks' associated with specific hazards, including noise, hazardous chemicals, confined spaces, plant and electricity.

Regulation 32-38 In order to manage risk under the WHS Regulations, a duty holder must:

- identify reasonably foreseeable hazards that could give rise to the risk
- eliminate the risk so far as is reasonably practicable
- if it is not reasonably practicable to eliminate the risk, minimise the risk so far as is reasonably practicable by implementing control measures in accordance with the hierarchy of risk control
- maintain the implemented control measure so that it remains effective
- review, and if necessary revise all risk control measures so as to maintain, so far as is reasonably practicable, a work environment that is without risks to health and safety.

This Code provides guidance on managing the risks of welding processes by following a systematic process that involves:

- identifying the hazards
- if necessary, assessing the risks associated with these hazards
- implementing control measures, and
- Reviewing control measures.

Guidance on the general risk management process is available in the Code of Practice: How to Manage Work Health and Safety Risks.

Consulting your workers

Consultation involves sharing of information, giving workers a reasonable opportunity to express views and taking those views into account before making decisions on health and safety matters.

Section 47 A person conducting a business or undertaking must consult, so far as is reasonably practicable, with workers who carry out work for them and who are (or are likely to be) directly affected by a work health and safety matter.

Section 48 If the workers are represented by a health and safety representative, the consultation must involve that representative.

Consultation with workers and their health and safety representatives is necessary at each step of the risk management process. By drawing on the experience, knowledge and ideas of your workers you are more likely to identify all hazards and choose effective control measures.

For example, metal surfaces need to be cleaned prior to welding to remove debris and hazardous materials. When considering how to safely prepare metal using chemical treatments,

you should consult with workers to better understand the work practices they use and the potential hazards they face.

Consultation with workers can help you select appropriate control measures, including any personal protective equipment they may require.

Consulting, co-operating and co-ordinating activities with other duty holders

Section 46 A person conducting a business or undertaking must consult, co-operate and co-ordinate activities with all other persons who have a work health or safety duty in relation to the same matter, so far as is reasonably practicable.

Sometimes you may share responsibility for a health and safety matter with other business operators who are involved in the same activities or who share the same workplace. In these situations, you should exchange information to find out who is doing what and work together in a co-operative and co-ordinated way so that all risks are eliminated or minimised as far as reasonably practicable.

For example, if you hire a welder to repair an item of machinery at your workplace you should work together with the welder to plan the work, discuss any safety issues that may arise and how the risks associated with the welding processes, such as exposure to fumes and noise will be controlled.

Further guidance on consultation is available in the *Code of Practice: Work Health and Safety Consultation, Co-operation and Co-ordination.*

Information, training, instruction and supervision

Section 19 A person conducting a business or undertaking must ensure, so far as is reasonably practicable, the provision of any information training, instruction, and supervision that is necessary to protect all persons from risks to their health and safety arising from work carried out.

Regulation 39 A person conducting a business or undertaking must ensure that information, training and instruction provided to a worker is suitable and adequate having regard to:

the nature of the work carried out by the worker the nature of the risks associated with the work at the time of the information, training and instruction, and the control measures implemented.

The person must also ensure, so far as is reasonably practicable, that the information, training and instruction is provided in a way that is readily understandable to whom it is provided

The information, training, and instruction that is provided to workers who carry out welding should include:

- the proper use, wearing, storage and maintenance of personal protective equipment (PPE)
- how to work safely in hazardous environments, such as a confined space
- first aid and emergency procedures
- how to access safety data sheets (SDS) for hazardous chemicals
- The nature of, and reasons for, any health monitoring if required.

4.16 Improving Tank Farm Safety

The Risk

Inadequate storage tank grounding in tank farms compromises critical protection and safety systems, leaving the tanks and nearby structures vulnerable to potentially catastrophic lightning strikes. This significantly increases the risk for infrastructure damage, personnel injury and related legal and financial liabilities.
How can these risks be managed?

Evaluating Existing Grounding Systems

The first step towards a solution is to audit existing tank farm grounding systems to assess:

- The state of the grounding system, focusing on corroded elements. Corrosion degrades the ability of the system to respond to lightning events;
- The integrity and performance of the grounding system as a whole, including nearby grounding systems. Independent grounding systems in close proximity to each other can actually work against each other, causing dangerous ground loop currents;
- Conformance to current grounding practices and regulations;
- A review of grounding system advances, including new technologies and materials.

Towards a Solution

With a clear grasp of the weaknesses and deficiencies in existing grounding systems, action can be initiated to upgrade tank grounding and lightning protection systems with new technologies that provide better safety margins and improved performance over a longer life.

An innovator in advanced grounding and cathodic protection materials and services for the oil and gas sector, SAE Inc. offers engineered solutions specific to tank farm grounding and lightning protection that incorporate modern design techniques and advanced materials developed and manufactured in-house

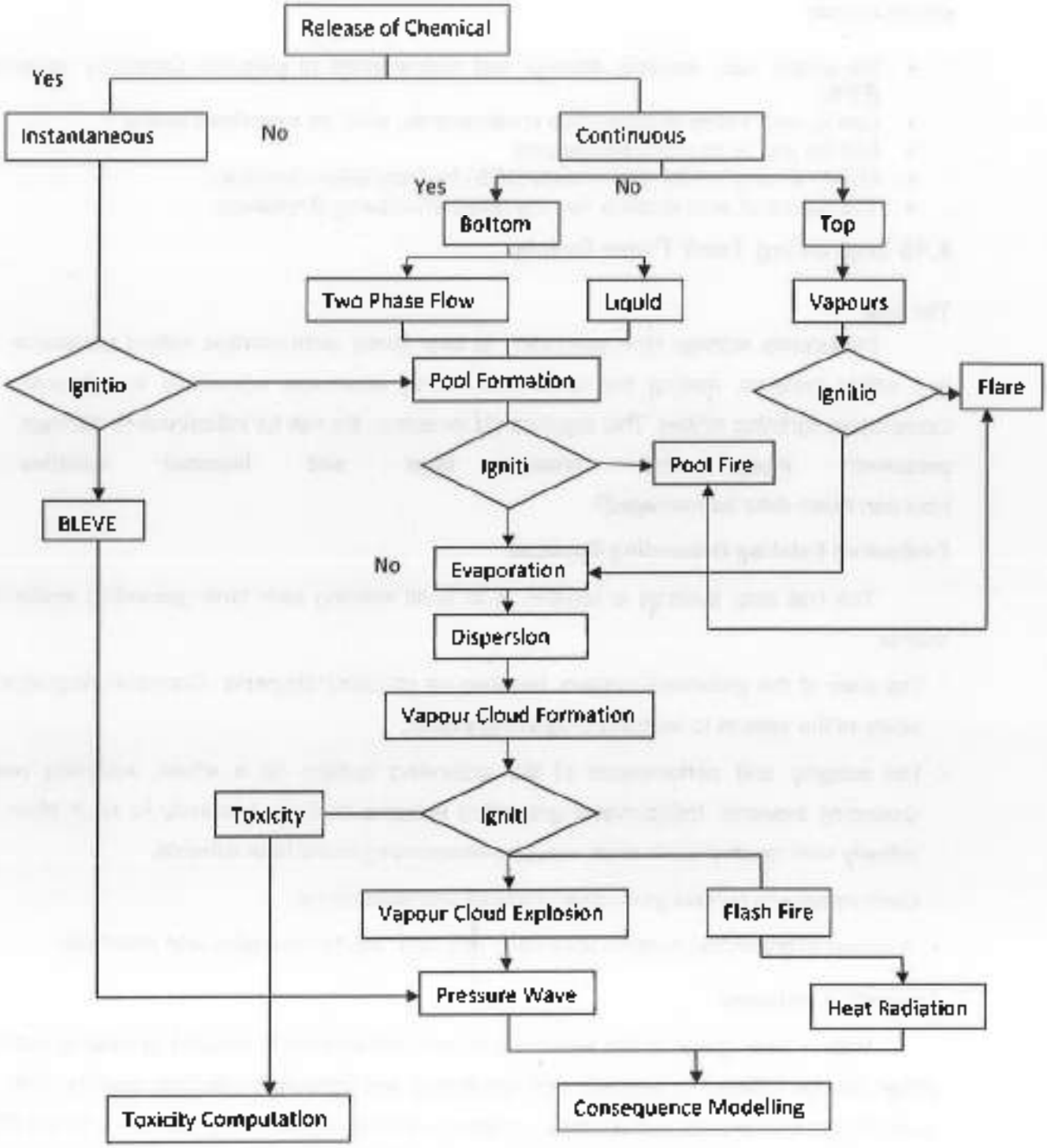


Figure 4.2 - Accidental Release of Chemicals

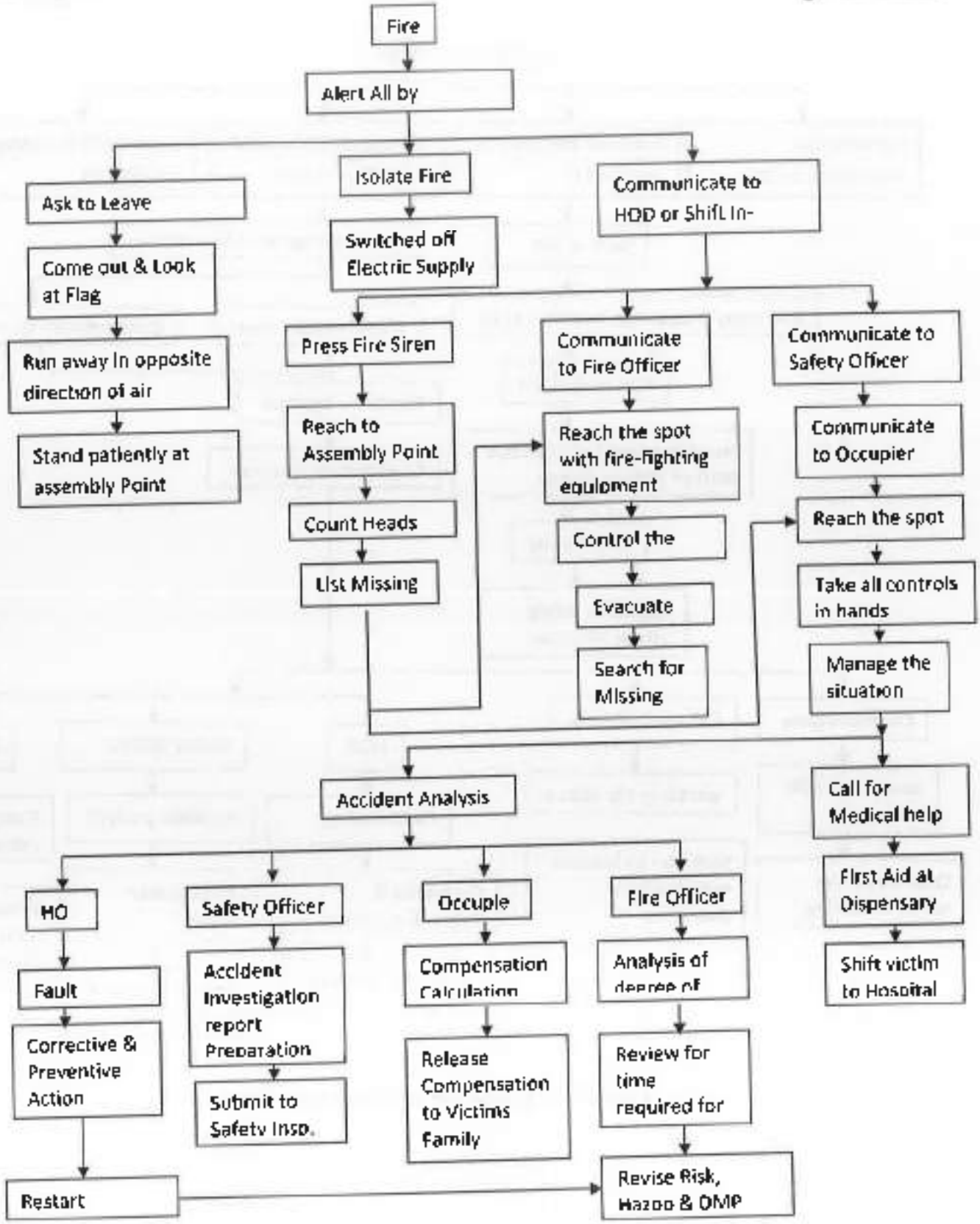


Figure 4.3 - Response to Fire Event

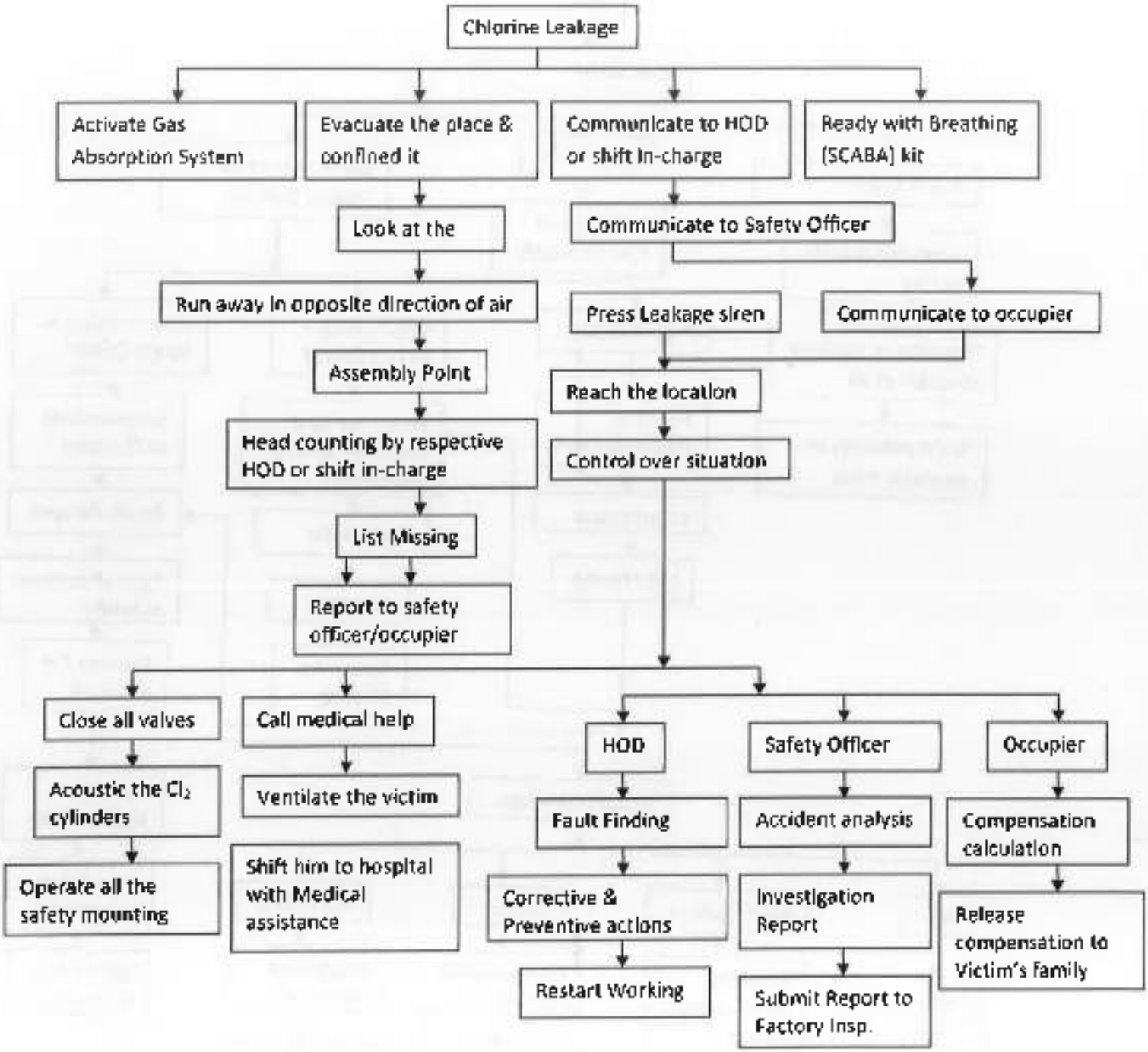


Figure 4.4- Response to Chlorine Leakage

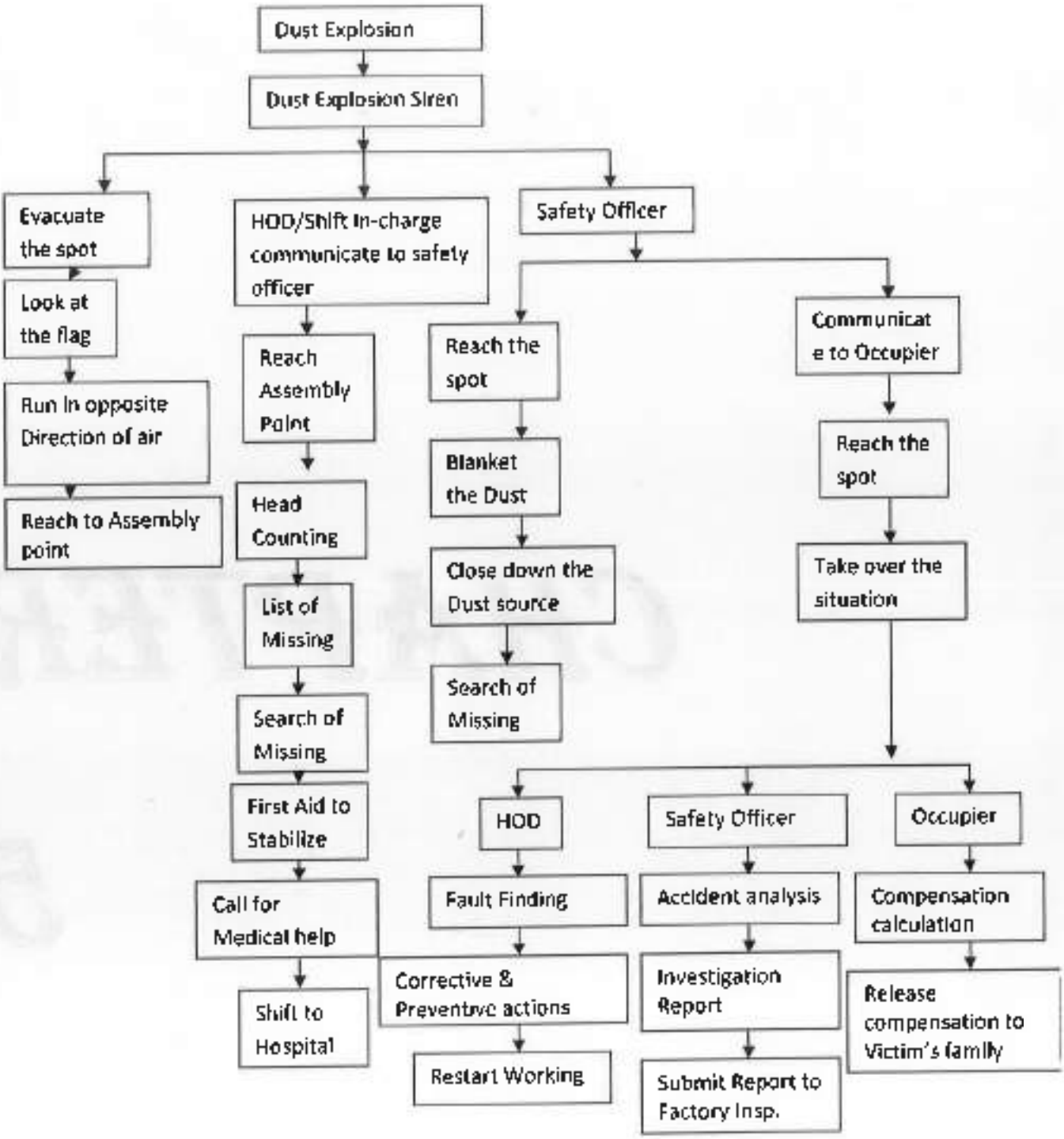


Figure 4.5- Response to Dust Explosion

CHAPTER 5

Chapter V

Emergency Responses & Facilities

5.0 Fire and Toxicity control arrangement Facilities

- One full-fledged fire station manned by qualified and experienced fire service personnel including 2 fire officers.
- Fixed fire-fighting installations viz. Electrical driven, Horizontal shaft, Centrifugal and Diesel driven, Centrifugal (Hydrant), Centrifugal (Spray), etc.
- Portable fire extinguishers, trailer / trolley mounted extinguishers as well as monitors (water / foam)
- Reservoirs / storage of fire water for carrying out fire fighting operations (at a stretch) for 9 hr. Dedicated fire pumps are installed at two separate locations to feed / convey this water through the net-work of pressurized fire water mains / headers protecting the plants / complex
- Adequate inventories of other special extinguishing media viz. Foam concentrates / DCPs
- Fire fighting and first aid trainings are attained by employees
- Availability of adequate emergency escape sets, special PPEs & emergency tool kits.

5.1 Medical Services

Following are considered essential to meet the emergency situation.

- Specialized training of doctors related to chemical hazards and Industrial Hygiene to be done.
- Medical Centre to be equipped with facilities to treat injured persons/burns cases
- Planning of additional capacity (beds) in the hospitals in case of larger number of casualties

MAHAGENCO's Medical Services are headed by Chief Medical Officer (CMO) and manned with qualified doctors and well trained and experienced paramedical staff.

First Aiders and Ambulance drivers shall be available in all shifts to give first aid treatment to any injured. Industrial Physician carries out medical treatment to injured person and also certifies whether he is fit for duty or not. In case of serious injuries then the injured is immediately transferred to Rural Hospital or Government Medical Collage & Hospital depending upon the injury.

With reference to Factories Acts 1948, the health monitoring of the employees, working in the Coal Handling Plant, Ash Handling Plant shall be carried out every six months.

5.2 Facilities Available

A qualified Doctor and five Para Medical Staff should be present at occupational Health Centre round the clock.

In addition, in General Shift

- Doctor (03 No.)
- Female Nurse (01 No.)
- Medical Assistant (02 Nos.)
- Pharmacist (03 Nos)
- Peon (03 Nos.)
- Sweeper (04 Nos.)

5.3 Emergency Treatment

(i) Emergency Medical Kits

- Observation ward
- Ambulance No. 1
- Ambulance No. 2
- Doctors Bag

(ii) Observation Ward

5 bedded emergency medicines / infusions.

(iii) medical check-up done by DISH is as follows:

a) pulmonary function
b) X-ray test
c) Blood test
d) Lipid profile

5.4 Ambulance Services

- 2 Nos. with Emergency Medical Kit, Medicines etc.
- 1 No. Ambulance Van - for internal transfer of patients to Medical Centre

5.5 Investigation Facility

It is recommended to have following facilities for better health services:

(I) Pathology Laboratory
- Blood Cell Counter
  - Hb gm. %, RBC, WBC, Platelets Exam.
- Kodak Auto analyzer : All Bio-Chemical Tests
  - Sugar, Cholesterol & Liquid Profile
  - Liver, Kidney Function Tests
  - Cardiac Profile
- Gas Chromatography - for urinary phenol estimation of employees handling benzene and other toxic chemicals

(II) X-ray Unit - Siemens 160 MA Machine

(III) Audio Meter - Hearing Test

(IV) Titmus Vision Tester, Charts - Near / Distant / Colour Vision

(V) E.C.G

(VI) Spirometry - For Lung Function Test

5.6 Medical Centre at Township and Neighbourhood

Mahagenco, Koradi, Nagpur has set up a Medical Dispensary at Township to provide medical facilities to employees and also to their family members. It is needed to established Medical Centre inside the Plant which will work round the clock with qualified medical professionals as the dispensary is around 10 Km away from the plant.

The objective of establishing medical services is to prevent diseases to reduce and eliminate physical ailment and to give first or necessary treatment to accidentee who sustain injuries on the job or off the job

In emergencies resources at Township Medical Dispensary can be utilized.

5.7 Transport and Evacuation Arrangements

In view of any major emergency, administration and security departments are equipped with the necessary transportation and evacuation facilities. Their roles during the emergency are already well defined. In major emergency it may be necessary to evacuate personnel from affected areas and, as a precautionary measure, to further evacuate non-essential personnel from areas likely to be affected should the emergency escalate. For evacuation all personnel will be directed to safe assembly point. Administration dept. will arrange the transportation and Security Key persons will control evacuation movement to the assembly point Arrangement details for transport.

5.8 Other Arrangements

It includes Central Engineering Services (CES W/S, CES Stores) & Central Technical Services (CTS).

Central Engineering Services Department consists of Engineering Workshops, Electrical, Civil & Instrument Workshops, Inspection & Corrosion Wing, Housing/Township Maintenance Wing, General Stores and Project Stores. Engineering Services play a vital role in Emergency situation to control the gravity of the incident. Engineering Workshop has various infrastructure facilities such as fabrication - shop with latest equipment, milling machines, mobile equipment, such as forklifts, shovel loaders, trucks, cranes etc. with competent operating personnel

Moreover, all the plant mechanical maintenance groups are also equipped with various material handling devices such as chain pulley blocks, rope puller, battery operated trucks etc. All the compressor houses have the facility of EOT cranes in the building for repair jobs.

Central Technical Services looks for the major modifications to be implemented at the plant with the safe operating procedure and minimum harm to the environment. The competent engineers monitor the process parameters on a daily basis for trouble shooting of the plant conditions

These can also be used for control measures in the emergency situations.

5.9 Safety Services

Central Safety Services department is adequately manned with qualified safety personnel who can manage the affairs of safety in MAHAGENCO Koradi. It is headed by Chief Engineer. There is reporting to Chief Engineer who is also in charge of Factory, through Deputy Chief Engineer.

Head of Health, Safety, Environment & Fire Department	03
Chief Engineer (O & M)	01
Deputy Chief Engineer (Admin.)	01
Deputy Chief Engineer (Technical)	01
Superintending Engineer (Safety, FF/Coal Environment)	03
Executive Engineers (Safety)	01
Executive Engineers & HOD	26
Fire Station In-charge	01

Safety appliances procurement, planning, placement at vulnerable locations, inspections & maintenance is looked after by safety personnel. Stock of safely appliances should be adequate enough to handle any kind of emergency in Mahagenco, Koradi, Nagpur.

5.9.1 List of appliances which should be available with MAHAGENCO, Koradi, Nagpur to response any type of emergency

a) **Portable Monitoring Instruments**
- Explosimeters
- Oxygen Meters
- Combustible & Oxygen Meters (Crowcon make Multi Gas Detector)
- HNU Meter (for PPM level detection)
- Dragger Tubes with sampling pump set
- Dosimeter for Radioactivity
- Noise Level Measuring Elements
- Static Charge Meter

b) **Respiratory Personnel Protective Appliances**
- On-line Breathing Apparatus Sets, Self Contained Breathing Air Set, Escape Set, Canisters of all kinds
- Dust Masks, Dust Respirators

c) **Non - Respiratory Personnel Protective Appliances**
- Helmets, PVC Goggles, Panoramic Goggles, Safety Shoes, Ear Plugs, Ear Muffs, Face Shield, Hand Gloves, Gumboots, Aprons, PVC Suits. Asbestos Suit, Fire Proxy Suit, Safety Belts, Safety Showers.

5.10 Communication System

After preparation of Emergency organization to control the emergency, the next step is to make ready the communication system it is a crucial factor in handling an emergency.

Under section 41 - B of Factories Act, now the disclosure of information to the workers, general public, local authority & the chief Inspector of Factories is made compulsory. Such advance communication is for the purpose of On-site & Off-site emergency plan. We should have quick & effective communication system to make the emergency known to everybody concerned.

- Inside the factory
- To key personnel outside after normal working hours
- To the outside emergency services & authorities
- To neighbouring factories & public in vicinity

The communication system beginning with raising the alarm, declaring the major emergency and procedure to make it known to others is explained below in briefs.

5.11 Raising the Alarm Making the Emergency Known

5.11.1 Detection of an Emergency

All the plants/departments are provided with Manual Call Points (MCP), Internal Telephones / External telephones, all the plants are provided with Public Announcement system with talkback facilities. In all plant control room, separate communication system (special speaker) called Emergency Communication System is provided, which can be operated at the time of emergency depending on the level of emergency from ECC.

Field Operators of the plants or any other employee or contract employee, while taking round of the plant or working in plant, when notice fire or chemical/gas leak or spill shall break the nearest MCP to call the Fire and Medical help. He will immediately inform the concerned plant control room. Trained personnel will act to control the incident as per the instructions.

Site Incident Controller will immediately rush to the site to assess the situation and take immediate action required to control. He will communicate the required information to the Site Main Controller who is responsible for declaring the emergency.

Internal and external telephones are placed in control rooms of each plant and in the offices of the complex. The list of telephone Nos. is shown in **Table 5.1**.

Siren

Emergency sirens are installed in each plant in PA system with the different modes of tone for different kinds of emergency. Onsite emergency siren tone is given in **Table 5.4**.

5.11.2 Nature / On-site Emergency

The emergency is perceived to be a kind of situation arising due to an incident which is confined to a smaller area and does not pose an immediate threat to life and property and which can be handled with the resource available within the premises.

Only affected plant will sound the emergency siren

5.11.3 Nature / Level - II

The emergency is perceived to be a kind of situation arising out of an incident which poses threat to human lives or/and property, having potential to affect large area within the factory premises. This kind of situation is beyond control with the internal resources and requires mobilization of additional resources from other sections/departments and also helps from outside (neighbouring industries under mutual aid, etc.). The situation may require declaration of on-site emergency or major emergency. All affected plants will sound the siren. The alarm is audible in all plants area in the complex.

5.12 Declaring the Major Emergency

In case of major emergency, many agencies will be on action at emergency location and the Emergency Control Centre. Field Command Post to be established near the site of emergency from where spill containment and counter measures operations may be conducted. Chief Coordinator and other coordinators will assemble at the Primary command Post (ECC). Chief Coordinator will command.

The Primary Command Post is fully equipped with all relevant data, information, equipment including emergency power and communication means. Respective key persons will rush to the Field Command Post and establish communication with the Primary Command Post. Chief Coordinator (Site Main Controller) and his team will be in contact with the developing scenario. Chief Coordinator will decide the appropriate response strategy specific to the situation prevailing.

Establish procedures for assuring health and safety of response personnel operating at hazardous material incidents as per guideline. Because of the scale of activity, which will be activated after the declaration of a major emergency, it is advisable to restrict the authority to declare it. However, it is not necessary to limit this authority to the Incident Controller and his

appointed Deputy. The need is to have a declaration as early as possible and other responsible persons, particularly on large complex, may be closer to the incident when it occurs and capable of making the necessary judgments.

For the communication, the list of contact numbers of Site Main Controller and other coordinator who take the joint decision to declare the major emergency is listed in Table 5.2.

5.13 Communication of Emergency

(a) Inside the Factory Premises:

All the areas of the factory are practically covered under PA system with talkback facility. All call facility from the Emergency Control Centre can be used to communicate the emergency in form of different audible siren as and when followed by specific instruction throughout the complex or factory.

(b) Key Personnel and Essential workers (Coordinators and Key Personnel) not on duty and outside during normal working hours:

All the Key Personnel and essential workers (Coordinators and Key Personnel) are on duty round the clock in each shift. Also out of them important personnel are having their mobile phone numbers and resident phone numbers. So, can be called in case of they are required at the site of incident.

(c) Outside Emergency Services and the Government Authorities

Mutual aid services will be contacted on hotline or by telephone listed in the Emergency Instruction Booklet (Flip Chart) in case of Mutual Aid is required to fight or mitigate the on-site emergency. At the same time as per the statutory rules and regulation Police station, Inspectorate of Factories, Other Inspectorates and District Authorities will be informed by the telephone after the declaration of the major emergency.

(d) Neighbouring Firms and the General Public

All neighbouring firms' phone numbers are listed in this chapter as well in the Emergency Institution Booklet (Flip Chart). In case of the evacuation or situation of off-site emergency may arise the neighbouring firms and general public will be informed as per the instruction of District Collector i.e. as per the plan of District Off-site Emergency Plan. The vehicles mounted with PAS system are available in the company round the clock. Major hazards of the company are communicated to the general public in the Community Awareness Programs. The representatives of the nearby villages visit the plant and they are made aware

about the hazards and precautions taken as well as the emergency preparedness of the company

All the details of the Major Accident Hazards and On-site emergency plan are already communicated to the government authorities.

5.14 On-site Emergency Actions

Emergency Actions are required to be initiated and individual roles to be performed by each member of the emergency response agencies, groups and crews against the following scenarios have been clearly defined in the On-site Emergency Plan. Which, in turn, is required to be coordinated (if situation warrants) with the Off-site Emergency Plan for 3X660 MW Koradi Zone, under the District Contingency Plan for Nagpur District.

These plans contain primary actions to be taken for implementing speedy and effective control measures in a systematic (step by step approach) manner. The Action Plans that have been developed against the emergency scenarios identified/considered will be coordinated with On-site & Off-site Emergency Plans.

Moreover, the design basis for fire protection arrangements in the complex is in consideration of the above scenarios (worst cases). Accordingly, the increased fire protection arrangements include

(i) Construction of Fire Station # 2,
(ii) Recruitment of additional manpower,
(iii) Setting up of Fire Pump House # II,
(iv) Stocking of additional quantity of AFFF,
(v) Acquisition of two new Foam Tenders and one Emergency Cum Rescue Tender,
(vi) Acquisition of four Long Range Water / Foam Monitors,
(vii) Acquisition of Air Compressor for re-charging of air cylinder for SCBA,
(viii) Acquisition of additional quantities of SCBA Sets & Emergency Escape Sets,
(ix) Formulation of fire tenders turn out philosophy, and
(x) Preparation of Emergency Cum Evacuation Plan exclusively for the unit 8, 9 & 10 Complexes.

5.15 Action Plan for Various Emergencies

5.15.1 Types of Emergencies

Emergencies that may arise at MAHAGENCO 3X660 MW Koradi, Nagpur are broadly classified into two categories:

- Nature I Emergency or On-site Emergency
- Nature II emergency or Off-site Emergency

Nature I - On-site Emergency

It is sub divided into two levels-

1. **Nature I, Level - I**

The emergency is perceived to be a kind of situation arising due to an incident which is confined to a smaller area and does not pose an immediate threat to life and property and which can be handled with the resources available within the premises.

2. **Nature I, Level - II**

The emergency is perceived to be a kind of situation arising out of an incident which poses threat to human lives or/and property, having potential to affect large area within the factory premises. These kinds of situation are beyond the control with the internal resources and required mobilization of additional resources from other sections/departments and also help from outside (neighbouring industries under mutual aid, etc.). The situation may require declaration of On-site emergency.

a. **Events Involving Flammable Materials**

- Major fires with no danger of explosion : Hazards from high levels of thermal radiation and smoke, e.g. tank fires containing flammable liquid hydrocerbons
- Explosion The most serious emergencies that can be envisaged are the liquefied pressurized gases vapour cloud explosion like LPG, Ethylene, Ethylene oxide, Propane. VCM and C4-hydrocarbons

b. **Events Involving Toxic Materials**

Release of toxic material like Chlorine, Hydrochloric Acid, Sulphuric Acid, Ammonia, and Sodium Hydro-oxide etc.

Nature II - Off-site Emergency

Off-site Emergency is a catastrophic situation and is a result of sudden occurrence of chain of unforeseen events or calamity due to natural causes which affects normal working within the factory premises and also in the vicinity and causes serious injuries, loss of lives and extensive damage to the property The day-to-day pattern of life is, in many instances suddenly disrupted and the people are plunged into helplessness and sufferings; and as a result need protection, clothing and shelter, medical and social care and other necessities of life.

The emergency is perceived to be a kind of situation out of an incident having potential threat (with suddenness) to human lives, property, within MAHAGENCO complex as well as in surrounding neighboring areas and the environment. It may not be possible to control such situations with the resources available within the MAHAGENCO complex The situation may thus demand prompt response of multiple emergency response groups/teams as have been recognized under the District Emergency/Contingency plan for Nagpur District. Similar emergency situations in neighbouring industry that may affect MAHAGENCO complex are also included in this category.

5.15.2 Strategy for Developing the Action Plan

Emergency situation can develop due to various factors beyond the control of the plant procedures/systems or ineffectiveness of it. Development of emergency situation takes place through following stages:

1. **Symptomatic Stage**

Abnormal process parameters, vibrations of machineries, leakage of hazardous material etc

2. **Fire Attack Stage**

Control measures such as first aid fire fighting, cooling isolation, barrication, suppression etc., will control the emergency and prevent the escalation of the emergency. The response time between detection of emergency and attack on incident will decide the fate of the emergency.

3. **Emergency Containment Stage**

Lack of response at Stage 2 will lead to containment stage where incident is contained and escalation to nearby plants/area is prevented by multifaceted approach. Utilization of mutual aid and local statutory bodies resources are must.

5.15.3 Action Plan

1. **Actions to be taken before the emergency (i.e. planning and preparedness)**

Adequacy of planning and preparedness to prevent the emergency are discussed above. Some of the sallent features are as below:

- Identification of emergencies
- Assessment of damage distances
- Strict implementation of Safety Work Permit Procedures and Preventive Maintenance schedules
- Training of AFS members and Fire Staff
- Keeping abreast on the latest development in fire detection and firefighting techniques
- Preparation of plant level emergency plans
- Rehearsal of emergency plans

2. **Actions during the Emergency Situation**

Each and every emergency is unique in its respect .No two emergency are similar in nature. The pertinent guidelines for a particular category of the emergency situations are detailed as below

- Fire Emergencies
  - Action Plan for fire emergencies in plant area, storage tank/sphere area.
  - Action Plan for Explosion/Vapour cloud explosion/physical explosion Emergencies in plant area/storage/sphere area.
- Non Fire Emergencies
  - Action Plan for major leakage of flammable liquid/gas or toxic gas release.
  - Action Plan for release of process material in process drain/storm water drain system.

5.15.4 Post Emergency Actions

After the ALL CLEAR signal from the Site Main Controller, Post Emergency activities should be started keeping following consideration in view:

- Structural parts or building parts which can collapse shall be demolished on priority

- Debris shall be segregated on broad classification like building material, piping & equipment, insulation materials etc.
- Photographs or video shooting should be taken if required by the appointed Inquiry Committee
- Drainage cleaning
- Absorption of left out materials by sorbent pads, sand or neutralization material shall be done before cleaning activities
- Post emergency crew to be deputed as standby
- Suspension of vehicular traffic within/near the effected process plant

5.16 Action Plan for Fire / Explosion Emergencies

Action Plan for Fire Emergencies In Plan Area, Storage Tank / Sphere Area

In order to envisage the different types of fire emergency situations and prepare plant level emergency action plan by the respective plants, following guidelines are furnished below:

- Activities having potential for release of flammable material
- Sources of Ignition
- Types of Fire
- Guidelines for emergency actions

A. Activities having potential for release of flammable material

- Dechoking operation
- Inadvertant opening of pipeline flanges, drain valves due to improper identification
- Failure of LPD, HPV due to corrosion, impact etc.
- Flange joint leakage during start-up operation due to wrong gasket or inadequate testing before start -up
- Impact during material handling job e g. crane operation
- Flying missiles from a failure incident
- Failure of pipe elbow due to erosion/corrosion
- Mal-operation during start-up - drain/vents not closed
- Deinventorying process during shut down
- Bursting of pipeline connected to reciprocating machine

- Over filling of tanks/receivers
- Loading / unloading operations - over filling of tank lorry, failure of hose connection

B. Sources of Ignition

- Flame & hot surfaces
- Welding and cutting operations, grinding operations
- Mechanical sparks - friction, misaligned bearings, jammed bearings/machines, broken or bent equipment, hammering
- Chemical energy : Pyrophoric Chemicals, runaway reaction
- Static Electricity : accumulation of static charge
- Auto ignition due to inherent process temperature
- Self-heating : insulation fire, oil soaked clothing, rags, waste and combustible refuge
- Electrical equipment's : Faulty electrical equipment's, use of non-flame proof equipment
- Smoking : discarded cigarette butts
- Vehicles : exhaust sparks, IC engines
- Arson

C. Types of Fires

Fire takes different form depending upon source of leakage, containment of fuel and properties of fuel.

- Ordinary combustible material fire
- Flash back fire - spillage over floor and open drain system
- Closed sewage fire
- Flaring fire (flange joint)
- Insulation fire
- Pool fire (dyked area)
- Smouldering fire (smoking fire)
- Burning fire (inferno) burning liquid droplets falling down the floors

D. Guidelines for Emergency Actions

Appropriate action shall be taken keeping in view the prevailing situation

5.16.1 Action by Production Group

- First aid free fighting and operation of in-build fire protection system
- Isolation/shut down of the section as per SOP
- Co-ordination with other sections/plants
- AHU stoppage and monitoring control room environment
- Wind direction and announcement of the same
- Evacuation of non-essential persons
- Assigning responsibility for fire water spray system operation
- Monitoring flooding of drainage system and water logging on the floor
- AFS calling for help
- Co-ordination with SSM and decision to declared the level of emergency
- Use of respiratory protection appliances and other PPEs
- Do not take decision in haste. Think fail safe and consequences of your actions
- Jet flame fire from pressurized ruptured vessel will impinge on surrounding vessels/structures. Do not enter the area. Carry out fire fighting from safe distance
- Probability of domino effect due to flying splinters/fragments

5.16.2 Actions by Emergency Teams

- Decide strategy to attack the fire
- Initiate actions as per the decided strategies such as
  - Foam pouring on/into the process sewage/storm water
  - Decide cool zone, warm zone and hot zone
  - Cooling of neighbouring structures/storage tanks from the radiant heat
  - Search for causalities and rescue operation
- Decide to seek help from Mutual Aid Members
- Establish communication between Field Command Post, Control Room and ECC
- Traffic Control by Security Team

- Medical Management by OHC Team

5.16.3 Action by Non-Essential Personnel

The Mahagenco 3X 660 MW Koradi, Nagpur employees, contractor's employees, visitors etc. (other than emergency response personnel) present at the incident site who are not required to be present at the incident site during the emergency at the site. They shall quickly assemble at the safe assembly point of the plant/area and shall respond as instructed by the Site Incident Controller. Instruction to the Non-Essential Personnel:

- Do not panic. Ensure that persons in your immediate vicinity are warned
- Remain alert for announcement from the Control Room, such as "Proceed to Safe Assembly Point" and act accordingly
- Do not rush to the scene to be a spectator
- Await instructions at the Assembly Point, report your presence to the superiors/or the Site Incident Controller, inform him whereabouts of your colleagues if they have not arrived
- Do not engage telephone/talk back system and other communication channels, unnecessarily
- Do not approach Control Centres without urgent/or important reasons
- If you are not assigned any specific role, move away as directed
- Do not offer non-authentic information/unconfirmed facts/or conjecture

5.17 Action Plan for Explosion Emergencies

5.17.1 Introduction

Preventing the development of explosive mixture is the best defence against explosion. Equipment for handling and storing of flammable material should be designed, constructed, inspected and maintained so that danger of leakage and formation of explosive mixture is reduced to minimum.

The degree of confinement or bursting pressure of the vessel or building determines the nature of the blast wave, which is generated, and the damage pattern.

An explosion occurs in the atmosphere if energy is released over a sufficiently a short time and in a sufficiently small volume so as to generate a pressure wave that is audible and of finite amplitude travelling away from the source.

5.17.2 Types of Explosion

a. Physical Explosion: Simple pressure vessel failures with no combustion e.g. steam drum, air receiver, inert gas storage etc.

b. Deflagration: It is a combustion reaction which propagates through an unburned flammable gas mixture at rate from 0 to 400 m/s

c. Detonation: It is a combustion reaction which propagates through an unburned flammable gas mixture at rate from 2000-3000 m/s

d Runaway Chemical reaction or continued explosion which includes the possibility of hat addition due to reaction, resulting into bursting of the vessel

e. Explosion in Buildings : An equipment explodes or a delayed ignition takes place in released gas producing a blast wave inside the building

f. BLEVE: It occurs when a liquefied fuel under pressure is heated intensively by external fire following an accident until it vents and burn as a torch. Damage is severe from the fireball formed by massive burning of the vessel contents in the air Fragmentation is extensive in such explosions

g. Unconfined Vapour Cloud Explosions: It involves a massive release of a combustible fuel and reasonable delay to ignition (30 seconds to 30 min.)

h. The Domino Effects: Blasts and missiles from an explosion can affect the integrity of other plants containing flammable and toxic materials, thereby causing escalation of the disaster. This is known as the domino effect

5.17.3 Guidelines for Actions

Explosion effects are immediate and do not give any time to restrict the primary damage due to initial explosion.

The domino effects which can be secondary fires or the toxic gas release due to fracture caused by the landed fragments within the plant or the nearby plants, it can be controlled by the prompt actions by the production group and the emergency teams.

5.18 Action Plan for Non-Fire Emergencies

5.18.1 Action Plan for Major Leakage of Flammable Liquid/Gas or Toxic Gas Release

Activities having potential for releases of flammable liquid/gas or toxic geses are discussed with respect to Consequence analysis and Risk evaluated.

In absence of source of ignition or timely actions, fire incident gets averted or toxic gases gets dispersed. Guidelines to handle such situations are mentioned below:

- Identify the source of leakage and decide material by odour, colour, identification marks etc.
- Do not carry out any activity, which can cause spark. Suspend all hot work permits
- Never use non-flame proof torches for identifying the source of leakage
- Barricade the area. do not allow anybody or vehicle to enter the area
- Check the wind direction and decide safe approach towards incident site
- Operation of deluge water spray system as per the requirement
- Actions to reduce the quantity of leakage such as depressurization, closing isolation valves, application of vacuum to hold the content etc.
- Actions for safe disposal of leaking material such as bunding on floor use of sorbents, channelling spill into ISBL effluent pit, neutralization, blockage of drain channel etc.
- Actions for safe dispersion of vapour/gas such as steam curtain. knocking down the escaping vapours by water spray, steam/nitrogen application by hoses etc.
- Evacuation of non-essential personnel
- Delayed ignition is dangerous. Do not enter in vapour cloud
- Never try to approach toxic gas release incident site without wearing SCBA set
- Monitor overloading of drainage system and water logging in the area
- Switch off any electrically operating machines from substation only
- Use of foam to cover the liquid pool to reduce vapour generation
- Hazards of static charge and possibility of spark should be recognized in case of any method of spill collection is applied
- Drifting of vapour cloud towards any furnace/heaters should be prevented by erection of water curtains
- Shut off the furnaces, if necessary
- Keep check on possibility of overflowing spill contaminated water into storm water drainage system.

5.18.2 Action Plan to deal with Major Release of Flammable/Toxic Chemicals into Process Sewer and/or Storm Water Drain Systems

The Mahagenco 3X660 MW Koradi. Nagpur Complex is housing a number of process plants. The each process plant is having a network of process sewers that are commonly connected to ISBL Effluent sump. The effluents that accumulate in such sump(s) are treated primarily and then directly pumped (upon consent of the In-Charge of the ETPS) to Effluent Treatment Plants.

Also, the entire complex has been covered with network of storm drains. The overflow of effluents sump under critical conditions such as stoppage of effluent pumps ultimately goes to storm water drains.

The effluents that likely to find their way (accidentally) into either process sewers or the storm water drains have the potential to catch fire. Also, storm water drains causes water pollution by way of contaminating water body. This pollution will not only cause loss of marine life but will also violate the statutory provisions/norms.

In order to prevent pollution and the violation of statutory provision/norms and also the destructive potential of the fire involving the process sewers and storm water drains the following "Defence In-depth Philosophy" is required to be complied with strictly.

- Spill prevention
- Spill control at source
- Containment of the effluents and profusely spilled hydrocarbons
- Prompt recovery of the effluents and the spilled hydrocarbons and Fire Prevention
- Fire control including exposure protection and confinement
- Spill Clean-up

The existing arrangements in the complex viz-a-viz the above elements of the philosophy have been reviewed and accordingly it is found that element "a" of the philosophy has been complied with (to some extent) by way of provision of the following arrangements:

- Underflow baffles
- Overflow baffles
- Blocking gates

The baffles and blocking gates have been provided in the storm water drains at various strategic locations/points in the complex. Whereas, much scope is left there to comply with the

elements "b", "c", "d", "e" & "f" of the philosophy. And to do so the following action plan is prepared.

- Actions to be taken before occurrence of spillage/overflow of effluents into process sewers and/or storm water drains (i.e. planning and preparedness)
  - Spill prevention
  - Identification of locations/points on the process sewers and storm water drains to set up temporary/auxiliary blockages during emergency
  - Constitution of emergency response crews
  - Acquisition of suitable equipment's and stocking of other items
- Prompt recovery of effluents and these spilled hydrocarbons from the sewers and storm water drains and Fire Prevention
  - Spill control at source
  - Emergency Actions for recovery
  - Additional Fire Preventive measures
- Fire control including exposure protection and confinement
  - Emergency Actions for suppression/control of fire
  - Additional measures for exposure protection and confinement
- Spill Clean-up
  - Emergency Spill Clean-up Actions

The foregoing Actions Plans are detailed as follows:

(A) Spill Recovery & Fire Prevention

Prompt recovery of effluents and these spilled hydrocarbons from the sewers and storm water drains and Fire Prevention.

- Spill control at source
  - The plant personnel including emergency response crews will promptly resort to emergency shut down or isolation of the section(s) of the equipment/pipeline discharging chemicals/products/effluents
  - They will also confine the spillage to the affected section or point of the equipment/pipeline discharging chemicals / products / effluents

- Fire control room will be duly alarmed by actuating nearest Manual Call Points followed by telephonic communication

◆ Emergency Actions for recovery

The plant personnel, including emergency response crews will promptly initiate the and carry out the following actions:

- Hot jobs in the affected areas to be suspended forthwith (by making announcement through PA system)
- Power supply in the affected areas to be isolated
- The recovery of the spilled liquid/product (in large quantity) form process sewer/storm water drains with the help of gulley sucker/vacuum tanker In case it is not possible to channelize the spillage to ISBL effluent sump(s)/pit(s) (for primary treatment) & further to ETPs
- In absence of gulley sucker/vacuum tanker, the spilled liquid/product should be recovered with the help of buckets and pneumatic pumps and the same be decanted into empty barrels/drums and further to ISBL effluent sump(s)/pits(s) (for primary treatment) and to be finally pumped to ETPs
- Sufficient manpower (contract labours provided with PPEs) to carry out the above tasks to be arranged and deployed at site
- The Shift Fire Officer will maintain post fire security standby till all the spill clean-up actions are completed

◆ Additional Fire Preventive Measures

- The Emergency Response Crews will immediately set up temporary/auxiliary blockages in the affected sewers/drains with the help of sand bags, which are found handy along the sewers/drains at the points identified in advance
- The Security Personnel will suspend the vehicular traffic falling within the vicinity of the affected process sewer/storm water drains
- The Fire Services Personnel will - if necessary - will introduce foam into the affected process sewer/storm water drain for suppression of flammable vapours.

(B) Fire Control Including Exposure Protection and Confinement

- Emergency Actions for suppression/control of fire
  - The Fire Service Personnel will strategically apply/introduce suitable fire extinguishing media on to the fire for the purpose of fire control and extinguishment
- Additional measures for exposure protections and confinement
  - The fire posing exposure hazard to the equipment falling within the vicinity of affected areas will be fully protected by the fire service personnel in co-ordination with the AFS members and plant personnel
  - The Shift Fire Officer will maintain post fire security standby till the spill clean-up action is completed.

(C) Spill Clean-up

- Emergency Spill Clean-up Actions
  - Once all the actions involving spill control, spill recovery and fire extinguishment are completed; the plant personnel will initiate necessary actions to carry out clean up of the affected areas. To do so, appropriate equipment and resources that have been made available in the complex as a part of planning and preparedness under this plan will be utilized appropriately. If required, all the resources available with the "spill clean-up contractors", (if engaged) for clean-up services will be pressed into action without any delay.

5.19 Organizing Mock Drill

The frequency of mock drill shall be fixed as per the company policy. According to the legal requirements as per Factories Act 1948 and MFR 1963 at least two Mock (Evacuation) drills shall be conducted each year and involve all occupants.

Special arrangement with special rescue Expert team for those with medical conditions, pregnant women and Disabled persons to be brought out at assembly area safety

Procedure

- All personnel present in the factory premises shall participate in evacuation drills
- Special SOPs shall be considered for personnel handling cash/valuable high security or confidential documents, conduct of laboratory experiments or operating sensitive processes
- In conducting evacuation drills involving large numbers of people it may be necessary to seek assistance from security force in crowd control and directing of traffic in the area
- The management of the factory shall get involved in the mock drill and shall inform the report of conduction of Mock Drill to the competent authority
- Procedure of evacuation shall be updated as and when find necessary. Speed is not only the main objective in evacuation drill but also familiarization of evacuation procedure and maintaining process order are important points to consider
- It is important to have institutionalized system of keeping records of Medical conditions, handicap, disabled, pregnant women in the factory. This record would come in handy during drills and emergencies. In such cases, an evacuation team of two persons can be included to use a fire lift to evacuate these people if there are only one or two such persons. If there are more such persons then more teams will need to be identified to bring them outside at assembly area. Using staircases if they are at upstairs
- If evacuation of such persons is done using the fire lift, it be done expeditiously in order not to delay the operations of the Fire Fighting Team. Evacuation Teams must remain contactable at all times (24 x 7)
- The evacuation procedures for the persons with disabilities and the teams identified shall be tested at least once a year. The 3X660 MW Koradi, Mahagenco Management shall ensure that the staff designated to help persons with disabilities in the event of emergency, are fully trained to execute the planned evacuation procedure
- Accountability of the occupants in the factory premises is of prime importance. Safety and fire department must devise a plan to account for the occupants who has yet to be evacuated as those occupants may potentially be trapped in the building / premises registers shall be kept updated as for as possible. However, for places where the occupants are transient and cannot be accounted for information counters may be setup who wishes to report on missing people
- In some sections, usually semi-transient people where they will move from one section to another. Using documents such as their movement register, contact number,

attendance and sitting arrangement allocation plan, the safety and Fire Department will be able to affirm the evacuation status of the occupants.

❖ **Maintain year-round visual checks of work areas**

The duties and responsibilities of the floor in-charge include a daily visual check of the floor area and to report any hazards to the coordinator or his assistant

- Fire doors blocked/ slucked or open
- Exit lights out
- Firsts aid or fire fighting equipment's inoperative or obstructed
- Obvious fire hazards-accumulation of combustible oily rags
- Defective or unsafe use of temporary or necked electrical wirings

It is the responsibility of Safety Department & Committee Members.

❖ **Emergency Response Team (ERT)**

The safety officer is the head and appoints the Emergency Response Team within the factory premises.

The CERT comprises minimum 06 persons

- Site Main Controller – 01
- Site incident Controller – 01
- Response Team Members – 04

The team members shall be trained adequately to provide initial response to emergencies such as fire and Hazmat incidents in their initial steges before arrival of rescue team. The ERT members shall not be appointed from, but not limted to the process personnel's.

❖ **Building Plans**

Detailed plans of the building should be drawn up, the purpose of which is to:

- Give an understanding of the buildings structure, nature of occupancies, hazards and protection systems available in the building
- Help formulate evacuation plans
- Provide plans should include 3 types of plan:

i) Site Plan

Site plan shows the location of the building, roads around the building, Assembly Area/s, alternate assembly and adjacent building etc.

ii) Elevation plan

Elevation Plan shows the façade of a building usually this is to shows the height of the building, Fireman's Access Panel, etc.

iii) Floor plan

Floor Plan shows the layout of each floor, for the buildings floor plan, the following details are expected:

- Escape and alternative escape routes, including exit staircase. Arrows or shaded areas shall be included to in the drawings.
- Locations of fire extinguishers, hose reels, dry risers, fire alarm panels and manual call points
- Fire resisting walls, floors, ceilings and doors, lifts (differentiating firemen's lifts) and staircases
- Indication of difference usage for each partition or compartment, e g. office shop production area, toilet, store, corridor, passageway, Assembly Area, smoke stop lobby, fire fighting lobby etc.
- Fire Engine Access way / road
- Fireman's access panel 8
- Processes and equipment introducing a particular hazard or requiring special protection against fire, water or smoke damage e.g. kitchen, transformer rooms, computer rooms and telephone exchanges
- The rooms protected by Gaseous Systems.1

The preparation and conduct of evacuation drill is usually carried out in 3 stages:

Stage 1

- Determine evacuation drill date, time and assembly area/s
- Educate and distribute ERP and guide books to everyone
- Nominate all the key personnel for the evacuation drill
- Conduct briefings and meetings to all key personnel
- Prepare and distribute the following items for the drill such as:
  - Identification helmets/ caps
  - General instruction files
  - Arm bands
  - Floe registers
  - List of nominated personnel with contact numbers
  - Logistical needs
  - Signage's
  - Evacuation drill status board

- System testing

- Prepare distribute all necessary notices and circulars
- Conduct a table top exercise to ensure the committee understand their roles
- Nominate fire safety committee to assess the fire evacuation drill.

Stage 2

Before activation of alarm, ensure the following:

- Revise with the key personnel makes sure they are familiar with their functions
- Reporting and support centres are set-up
- Monitoring stations and relevant authorities notified
- Announcement messages prepared.

When evacuation starts, monitor the following:

- Floor evacuation status
- Assembly area evacuation status
- Fire situation status
- Support centres status

For disaster situation

- Implement recovery plan
- Determine command and control centre
- Determine a press release centre
- Expansion of support centres to include enquiry post

Stage 3

Immediately after the evacuation drill, conduct meetings with fire & safety committees

- Conduct debris/ meeting with key personnel
- Prepare comments to all floor in-charge
- Send letter of thanks to all parties concerned
- Prepare evacuation drill report to include the following topics:
  - Scenario of the fire drill
  - Management response
  - Evacuation procedures
  - Occupant participation, total number of occupants and the number of participations
  - Evacuation time

- 3X660 MW Koradi, Nagpur, Mahagenco Management Comments (if any)
- Fire & Safety Committees comments
- Conclusion (Compare Previous drills
- Attachments such as Evacuation drill status records, record sheet, participating names.

Table 5.1

Coordinators and the Key Personnel for Various Disciplines / Services

Sr. No.	Emergency Service	Coordinator (E.E)	Key Personnel (Additional E.E)	EPBX (Office)
1	Boiler Maintenance	8411958603	8411958620	6250
2	Turbine Maintenance	9423961134	9545526077	6278
3	Electrical Maintenance	8411957727	8411957746	6213
4	Water Treatment Plant	8408889321	8411009237	6700
5	Operations	9823795805	8411957411	6060
6	PCR	8411957418 8411957410 8411031510	-	6800 6900 6100
7	Ash Handling Plant (O&M)	8411957878	8411045613	6311
8	Fire Fighting	8411958634	9960849066	6801
9	Security	8411958594	8411956076	6620
10	Safety 'office	9503579812	---	
11	Civil	8411883215	8411957772	6351
12	ISO	8411880437	8411004580	6050
13	Ash Utilization	9923795805	8793709673	6014
14	Major Store	8411867132	8411957791	6500
15	FQAD	8411880437	9284967208	6050
16	I&C	8411957402	8411880286	6230
17	IT/MIS	8411958591	8411958628	6098
18	MPD	9823053295	9822109675	6042
19	TSC	8411880437	9975635807	6091
20	POG	9420479495	9923474769	6080

Table 5.2

The Coordinators and the Key Personnel

Emergency Services	Co-ordinators	
	Main	Alternative
Chief Co-ordinator (Site Main Controller)	C.E.	Dy. CE
Plant operations	Shift In-charge	PCR In-charge
Security	Sr. Security Manager	Dy. Manager Security
Medical	Medical Superintendent	Hospital Administrative
Communication	Dy. CE Admin	Dy. CE II
Electrical services	Exe. Engineer EMT	Addi. Exe. Engineer EMT
Materials/Stores	Exe. Engineer Major Stores	Additional Exe. Engineer Major Stores
Power & Utilities	Exe. Engineer EM	Additional Exe. Engineer EM
Transport	Exe. Engg. CHP-VM	Additional Exe. Engg. CHP-VM
Welfare & Canteen/IR	WO	AWO
Finance	Sr. Manager (Finance)	Dy. Manager (Finance)
Purchase & Contracts	Exe. Engg (RP)	Additional EE (RP)
Media/Public Relation	Dy. CE (Admin)	

Table 5.3

Medical Facilities in Neighbourhood

Sr. No.	Name of Hospital	Distance from MAHAGENCO Koradi 3X660 MW	Telephone No
1.	Primary Health Centre Gumathi	02 Km	
2.	Government Medical Collage and Hospital	12 Km	0712-2743588
3.	Alexis Multispecialty Hospital	02 Km	0712-7120000

Table 5.4

Emergency Siren Tone Corresponding to Events

Events	Emergency Siren Tone
Fire	Intermittent Wailing tone - 10 seconds ON, 5 seconds OFF repeated for 8 times
Gas leak	Intermittent Wailing tone - 20 seconds ON, 5 seconds OFF repeated for 6 times
Air raid warning	Intermittent Wailing tone - 30 seconds ON, 5 seconds OFF repeated for 10 times
All clear	Continuous tone for two minutes
Testing	Continuous tone for two minutes. (Every Monday at 10:00 hr)

Table 5.5

Telephone No. of Chief Coordinator

Discipline / Services	Position	Telephone		
		Exten./Direct	Res.	Mobile
Chief Co-ordinator (Site Main Controller)	C.E. (O&M)	6001	-	8411957710

Table 5.6

Probable Explosion Potential Situations

Sr. No.	Area and Type of Explosion	Probable Situation
1.	Process Plants Internal Explosion	• During shutdown process, possibility of formation of explosive mixture inside tower / vessel • Run away reactions • Loss of cooling in exothermic reactions • Formation of flammable mixture in firing chest of boiler, vaporiser etc. • Oxidation process • Polymerisation reaction • Vent stacks & flare stacks • Closed sewage system
2.	Storage Tanks & Sphere Area	• Formation of explosive mixture during conversion of the tank or during planned shutdown for repair • Possibility of BLEVE with pressurized liquid storage sphere
3.	Unconfined Vapour Cloud Formation	• Total failure of inter plant piping • Heavy release of high temperature hydrocarbon material
4.	Physical Explosion	• Material failure of air receiver, steam drums, super heater etc.

Table 5.7

Identified Probable Transport Emergency Scenarios

Sr. No.	Scenario
1.	**Non Fire** ♦ Spillage and leakage of hazardous chemicals from the tanker ♦ Tank Lorry turning turtile ♦ or going off-road into ditch along the highway ♦ Major break-down of the tank lorry as a result of (i) head on collision with other vehicle or with tree or other stationery object along the highway and (ii) dashing of the tank lorry by other vehicles from rear ♦ Sudden surge in temp. and pressure of the tanker
2.	**Fire / Explosion** ♦ Spillage and leakage of hazardous chemicals from the tanker followed by instant fire/explosion ♦ Tank Lorry turning turtile or going off-road into ditch along the highway followed by instant fire/explosion ♦ Major break-down of the tank lorry as a result of (i) head on collision with other vehicle or with tree or other stationery object along the highway and (ii) dashing of the tank lorry by other vehicles from rear followed by instant fire/explosion ♦ Sudden surge in temp. and pressure of the tanker followed by instant fire/ explosion

CHAPTER 6

Chapter VI

Natural Calamities/ Disasters

6.0 Introduction

A natural disaster is the effect of a natural hazard that affects the environment, and leads to financial. environmental, Industrial and/or human losses. Calamitous event that seriously disrupts the functioning of a community or society and causes human, material, and economic or environmental losses that exceed the community's or society's ability to cope using its own resources. Though often caused by nature, disasters can have human origins.

Natural Disaster means

- event of a natural cause with high death rate or extensive destruction
- event of a natural cause that has a negative impact on the environment
- event of a natural cause with low death rate but occurring often
- a natural trend that has negative long-term consequences

Following are some examples of natural calamities.

- **Earthquake**
- **Collapse of structure**
- **Flood**
- **Terrorist Attack**
- **Bomb at premises**

Effects of Natural Disasters

- Natural disasters kill, destroy, cost (prevention, relief efforts and rebuilding)
- Costs have increased exponentially over last 50 years
- The gap between losses and insured losses increases

Natural Disasters and Human Interaction

- Humans can mitigate disaster risks (e.g. build EQ proof houses; build strong retaining walls)
- Humans can increase disaster risks (e.g. build along EQ faults; build on foot of unstable slope)

- Humans can enhance effects of natural disasters (e.g. building wrong flood control channels enhances a flood, emission of CO2 and pollutants enhances climate change)
- Humans can trigger natural disasters (e.g. inappropriate drainage can trigger landslides, mining can trigger earthquakes)

The Need to Understand Natural Disasters

- Need to understand process involved
- Improve identification of risks
- Improve prevention of losses (lives and structures)
- Improve forecast and evacuations
- Increase effectiveness of disaster relief (fight rising costs)

6.1 Emergency planning during Natural Disaster

6.1.1 Earthquake

An earthquake is the result of a sudden release of energy in the Earth's crust that creates seismic waves. At the Earth's surface, earthquakes manifest themselves by vibration, shaking, and sometimes displacement of the ground. Earthquakes are caused by slippage within geological faults. The underground point of origin of the earthquake is called the seismic focus. The point directly above the focus on the surface is called the epicentre. Earthquakes by themselves rarely kill people or wildlife. It is usually the secondary events that they trigger such as building collapse, fires, tsunamis (seismic sea waves) and volcanoes. Many of these could possibly be avoided by better construction, safety systems, early warning and planning.

Introduction:

This Emergency Action Plan (EAP) outlines the appropriate actions that employees and visitors at Mahagenco should take before, during, and after an earthquake.

Preparing for an Earthquake:

Earthquakes cannot be predicted. The following are best practices to prepare for earthquakes.

- Consider maintaining an emergency supply kit for your office.
- Store heavy or breakable objects in closed cabinets, as low as possible.
- Secure refrigerators, book shelves, appliances, bookcases and other heavy items to prevent them from falling during an earthquake

- Evaluate where hanging objects are placed. Mirrors, pictures, or other hangings near seating or sleeping areas could fall and cause injury. Arrange these items so they do not pose a fall hazard to those below

Procedures during an Earthquake:

If inside when the shaking starts

- Move under a sturdy table, desk, or bed and stay there.
- Protect your head and face with any available material.
- Stay there
- Drop, cover, and hold on Move as little as possible
- Stay away from windows to avoid being injured by shattered glass.
- Stay indoors until the shaking stops and you are sure it is safe to exit. If you must leave the building after the shaking stops, use stairs rather than an elevator in case there are aftershocks, power outages, or other damage.

If outside when the shaking starts:

- Stay there
- Move away from tall buildings, structures, and trees
- Stay away from fallen power lines, as they may appear to be "dead" but may suddenly re-energize as automatic restoration of power is attempted
- Do not lift or raise any power lines
- Find a clear spot and drop to the ground. Stay there until the shaking stops (away from buildings, power lines, trees, streetlights).
- If you are in a vehicle pull over to a clear location and stop. Avoid bridges, overpasses and power lines, if possible. Stay in your vehicle until the shaking stops. Then, drive carefully, avoiding bridges and ramps that may have been damaged.

After the Earthquake:

Once the earthquake has stopped:

- Exit the building if safe to do so and move to the designated assembly area.
- If the building loses power during the earthquake and you are unable to safely navigate your way out of the building due to low visibility; remain in place and notify Fire Department from a phone of your location.

- Move to the designated assembly area and take account of your co-workers and visitors report missing persons to Time office.
- Do not re-enter any building until it is cleared by Safety department, Physical Plant, emergency response personnel, Fire department & other department of Mahagenco.
- The Mahagenco will assess buildings for damages, chemical and physical hazards, and utility failures prior to authorizing re-occupancy of buildings.
- Never re-enter a building that appears to have structural damage.

Consider the following after an earthquake:

- Limit cell phone usage to text messaging only to allow emergency response communications to function properly.
- Remain aware of the potential for aftershocks to occur in the days or weeks following the initial earthquake. Aftershocks are typically less severe than the initial earthquake but can still result in significant damage.
- Buildings, parking structures, and roadways may remain closed for a period of time following an earthquake while damage assessments and repairs are conducted.
- Be aware that utilities such as gas, power, and water lines may be damaged. If you are aware of a gas leak, power outage, utility failure, or other building damage, report the issue to respective department.

6.1.2 Flood

A flood is an overflow of water that 'submerges' land. In the sense of 'flowing water', the word may also be applied to the inflow of the tides. Flooding may result from the volume of water within a body of water, such as a river or lake, which overflows, causing some of the water to escape its usual boundaries. While the size of a lake or other body of water will vary with seasonal changes in precipitation and snow melt, it is not a significant flood unless the water covers land used by man, like a village, city or other inhabited area, roads, expanses of farmland, etc.

Identify Your Risks

The first step to being prepared is to identify and understand your risks.

- Are your facilities located in flood zones?
- When planning on building a new location, review potential sites for flood risk.

- If building in a flood zone is necessary, be sure to locate key electrical and mechanical equipment above grade level, with additional flood protection such as pitched drains and sump pumps

Create a Plan

Once you have identified that a property is at risk for flooding, a Flood Emergency Response Plan (FERP) should be developed. The plan should:

- Designate a person in charge. The FERP Coordinator should have authority to initiate the plan and to direct resources before, during and after the emergency.
- Identify key personnel who have FERP responsibilities.
- Develop a communication method (such as a phone chain) to alert employees of incoming storms or impending floods. The communications should also alert key personnel to be on stand-by for flood preparation actions.
- Create procedures to shut down equipment and processes in a safe manner.

Preparing - Before the Flood

Mitigate damage and protect your property by taking the following pre-flood precautions:

- The FERP coordinator should closely monitor storms to asesss the need and appropriate timing to activate the plan.
- Notify key employees when potential storms are being tracked to ensure their availability
- Assemble key materials and supplies.
- Fill all fuel tanks, such as vehicles, emergency generators and fire pumps.

Actions - During the Flood

The safety of all employees who remain on-site must be top priority:

- Do not attempt to move or service wet electrical equipment.
- Do not go outside in periods of heavy rain, lightning or during other hazardous conditions. Floods are often accompanied by high winds so be aware of falling trees and flying debris.
- Shelter in-place within the building, above the grade level, and in an internal room with no windows.
- If authorities order evacuation, leave the facility immediately. DO NOT STAY under any circumstance.

Recovery – After the Flood

Once flood waters subside and the site is safe, the company should begin to assess damage and start salvage efforts. The following steps should be considered:

- Be aware of downed power lines or other hazards caused by the storm. Report any outages or damage to the utility companies.
- Repair damaged fire protection equipment.
- Communicate with contractors regarding repair work as their services may be in short supply following a major storm event.
- Clean drains and roofs of debris.

6.1.3 Collapse of structure

INTRODUCTION

This procedure establishes a standard structure and guideline for all fire department personnel operating at incidents involving structural collapse rescue operations. The procedure outlines responsibilities for first-responders, Command Officers, and other fire department personnel responding to such incidents. All other Department procedures shall apply to structural collapse rescue operations where applicable.

PURPOSE

The purpose of this procedure is to establish guidelines for the response of fire department personnel and equipment to structural collapse rescue incidents. Because structural collapse rescue operations present a significant danger to fire department personnel, the safe and effective management of these operations require special considerations. This procedure identifies some of the critical issues which must be included in managing these incidents

A phased approach to structural collapse rescue operations which include; Arrival, Pre-rescue operations, Rescue operations, and Termination, can be utilized to safely and effectively miligate these high-risk / low-frequency events.

PHASE I ARRIVAL

During the Arrival phase of a structural collapse incident. Command must take strong control of the incident to prevent the situation from quickly deteriorating into a chaotic event. A structural collapse incident is likely to have unorganized, volunteer rescue efforts being conducted by civilian personnel which creates an unsafe situation for the volunteers as well as rescuers. Command must focus attention early on building a strong Command structure that will ensure the safety of rescue personnel and support this complex campaign operation.

I. ESTABLISH COMMAND

A. First arriving company officer shall assume Command and begin an immediate size up of the situation.

B. First arriving Mahagenco Company Officer should be assigned Rescue Sector. The Mahagenco Company Officer aesigned as Rescue Sector should remain with his crew. Rescue Sector responsibilities include:

- Assuming technical rescue operations control.
- Identifying hazards and critical factors.
- Developing a rescue plan and back-up plan
- Communicating with and directing Mahagenco resources assigned to Rescue Sector.
- Informing Command of conditions, actions, and needs during all phases of the rescue operation.

C. Designate a Safety Officer. Considerations for Safety Officer include:

- One of the Regional Special Operations qualified Safety Officers.
- Any experienced Mahagenco Company Officer assigned to the incident.

D. Following the transfer of Command to a Command Officer, a Technical Advisor should be assigned to join the Command Team at their location to assist in managing personnel and resources engaged in the technical aspects of the incident. The Technical Advisor is responsible for ensuring that the rescue plan developed by Rescue Sector and communicated to Command is a sound plan in terms of the safety and welfare of both victim(s) and rescuers. Considerations for the Technical Advisor include,

- A Special Operations qualified Chief.
- One of the Regional Special Operations qualified Safety Officers.
- Any experienced Mahagenco Company Officer assigned to the incident.

II. Size-Up

A. Spot apparatus outside of any potential secondary collapse zone.

B. Secure a witness or responsible party to assist in gathering information to determine exactly what happened. If no witnesses are present, Command may have to look for clues on the scene to determine what happened.

C. Assess the immediate and potential hazards to the rescuers. Hazards associated with structural collapse include:

- Secondary collapse.
- Explosion and fire.
- Broken gas and water lines.
- Energized electrical lines.
- Falling debris.

D. Isolate immediate hazard area, secure the scene, and deny entry for all non-rescue personnel.

E. Assess on-scene capabilities and determine the need for additional resources. Consider establishing Level 2 staging and calling for heavy machinery and equipment such as cranes and front-end loaders.

PHASE II PRE-RESCUE OPERATIONS

The team involving in pre-rescue operation is highly trained and equipped to respond to incidents involving structural collapse. Consideration should be given to utilize the personnel and equipment from this task force for incidents involving structural collapse

I. MAKE THE GENERAL AREA SAFE

A. Establish a hazard zone perimeter around the collapse area.

- Keep all non-essential rescue personnel out of the hazard zone.
- Remove all non-essential civilian personnel at least 150 feet away from the hazard zone perimeter.

II. MAKE THE RESCUE AREA SAFE

A. Secure all hazards. If it is not possible to secure all hazards, rescue personnel operating in the area must be made aware of the hazard(s)

B. Establish a Lobby Sector Command should establish a Lobby Sector to control the flow and maintain personnel accountability of rescue personnel in the collapse area.

C. Establish a Treatment Sector. Command should establish a Treatment Sector to identify and set-up a triage and treatment area a safe distance from the collapse area for the treatment and transportation of victims.

D. Establish a Building Triage team. Rescue Sector should establish a Building Triage team which shall consist of a Technical Rescue Technician trained and knowledgeable in structural collapse shoring techniques, a structural engineer, and a Hazardous Materials

Technician. This team will assess the structural integrity and hazardous conditions of the building(s) involved and will utilize a building marking system to indicate their findings Consider establishing additional Building Triage teams if the area of collapse is widespread and involves numerous buildings

E. Establish a Search team. Rescue Sector should establish a Search team to search the collapse area and locate victims. A Search team shall consist of personnel trained in the use of specialized search equipment, and search canines with their handlers (if available). Consider establishing additional Search teams if the area of collapse is widespread and involves numerous buildings

F. Establish a Rescue team. A Rescue Team shall consist of Safety personnel trained in the use of specialized rescue equipment and techniques Consider establishing additional Rescue teams if the area of collapse is widespread and involves numerous buildings.

G. Establish a transportation corridor. Command shall ensure roadways are clear in and out of the collapse site so that apparatus and other heavy equipment and machinery have access to the site. Consider establishing a liaison with the Police Department to accomplish this function.

PHASE III RESCUE OPERATIONS

I. RESCUE SECTOR

Rescue Sector responsibilities shall include the following:

- Ensure that all personnel operating in Rescue Sector are accounted for and wearing appropriate PPE.
- Develop a rescue plan and a back-up plan.
- Ensure the plan and a back-up plan, which include emergency procedures, are communicated to all personnel operating on the incident

II. THE RESCUE PLAN

Rescue operations should be conducted with as little risk to the rescuers as necessary to affect the rescue. Low-risk operations may not always be possible but should be considered first. The rescue plan shall be developed through consultation with Rescue Sector, Safety, Command, and the Technical Advisor. The plan and a back-up plan, which include emergency procedures, shall be communicated to all personnel operating on the incident.

III. THE RESCUE

A. Remove surface victims. First responders should be assigned to remove victims and the "walking wounded" from the surface of the collapse area. Rescuers shall use extreme caution during the early stages of rescue operations due to significant hazards which have not yet been identified. Following the removal of surface victims and the "walking wounded", all rescue personnel should be removed from the collapse area and a personnel accountability report (PAR) shall be obtained. This will allow for a re-grouping of rescue personnel and the implementation of a detailed search and rescue plan to locate and remove any other victims from the collapse area.

B. Building Triage. Assign the Building Triage team to identify, select, and prioritize the building(s) with the highest probability of success with respect to finding and rescuing live victims. Additionally the Building Triage team shall be responsible for using a building marking system to indicate structural conditions and hazards present to search and rescue personnel.

C. Locate victims. Following the structural and hazard assessment by the Building Triage team, the Search team(s) shall be assigned to locate entrapped victims by utilizing search canines (if available), and specialty search equipment such as search cameras and acoustic listening devices. Search teams shall not enter buildings which have been determined to be structurally unsafe until appropriate shoring and stabilization measures have been taken.

D. Extricate entrapped victims. Once the Search team has located an entrapped victim, the Rescue team(s) shall be responsible for utilizing their specialized rescue equipment and techniques to extricate victims from the collapse area. The breaking and breaching of walls, floors and roofs, will typically be associated with shoring and other methods of stabilization which make these operations manpower and resource intensive. Consider calling for additional resources and establishing a Resource Sector. Rescue teams shall not enter buildings which have been determined to be structurally unsafe until appropriate shoring and stabilization measures have been taken.

E. Selected debris removal. If the Search teams have not been able to locate victims through other methods, or if a victim location is known, either by credible witness or search team verification, debris may be selectively removed to gain access to the victim and/or otherwise unsearchable locations within the collapse area. Special care must be exercised while removing debris to avoid a secondary collapse. Heavy equipment such as a crane may be necessary to accomplish selected debris removal.

The selected debris removal process should be stopped periodically to conduct search operations for additional victims. Once the debris has been removed and search operations determine that there are no other victims in the area, rescue personnel shall be accounted for and removed from the area.

F. General debris removal. Once it has been determined that no other live victims can be located in the collapse area, a general debris removal operation may be started Removal crews shall be alert to possible deceased victims and/or victim body parts and the coroner and/or other investigative personnel shall be notified to handle the removal of the remains. As debris is removed, each load should be marked as to the general location found and final location of the debris to aid in the investigative process. Command may elect to turn general debris removal over to the responsible party (RP) for final disposition of the building.

IV. TREATMENT

A. Conduct a primary survey upon reaching the victim.
B. Initiate C-spine precautions as soon as possible.
C. Conduct a secondary survey and correct any life threatening conditions.
D. Consider removing the victim from danger prior to providing definitive care.
E. Provide ALS level treatment and transportation to a hospital as indicated.

6.1.4 Procedure In Case Of Risk of Terrorist Attack

INTRODUCTION

The consequence of a terrorist attack may be a considerable number of victims, damage to buildings, disruptions in the supply of electricity, water and gas, no telephone communication and the Internet, limited availability of medical care and finally the suspension of the operation of public transport. For this reason, it is very important to be prepared properly for the consequences of the attack

Terrorism is one of the major challenges in the context of ensuring safety both from the global perspective, as well as from regional or domestic point of view. As an international threat it goes beyond the traditionally understood conflicts and crisis situations.

The variability of methods used by terrorists causes the need for us to have adequate instruments for proper diagnosis and assessing risks, and effective prevention of possible incidents. In the event of a terrorist attack, we must be prepared to take immediate and adequate response measures, and remove its effects. Achieving these objectives

requires close and comprehensive cooperation of all departments, local Authority bodies and institutions involved in the broadly understood counter-terrorism.

Threat of terrorism is related to the use of weapons of mass destruction (WMD). While no direct actions in Poland associated with attempts to acquire on a large-scale or use of chemical, biological, radiological and nuclear components (CBRN) for terrorist activities have not been disclosed so far, it should be noted, however, that terrorist organisations are trying to gain access to substances and materials which when used in an attack would cause the greatest explosive power and cause the most severe losses. Similarly, with the threat of terrorist attacks, the penetration of the activities of terrorist organizations and organized criminal groups in Poland is purely potential. However, this kind of cooperation, in particular the smuggling of people, illegal acquisition of weapons, ammunition and explosives and precursors for their production, as well as transfer of funds, may become the future interest of terrorist organisations.

- **Notifying and alarming**

  If necessary, pedestrians and drivers may be used as connection.

- **Evacuation Terms and scope**

  Evacuation is moving people or property (possessions) from the areas (objects) at risk. The decision on the evacuation of people and/or equipment is made by the EMT Team Leader. The decision may be taken after obtaining opinions of the Team members or at the request of the head of the specialised forces and resources – if any were used. Evacuation is directed by the EMT Team Leader, in consultation with the person in charge of specialized forces. The scope of evacuation depends on the seriousness of the risk. Complete evacuation (all people and equipment) or partial evacuation is possible. It should be remembered that evacuated people must leave the rooms and turn off all receivers from power sources and, in the case of a threat of use of explosives, additionally all windows must be left open. Persons leaving the room should only take their own belongings (bags, briefcases, bags, backpacks). Any items left will be objects of interest for antiterrorists searching the room afterwards.

Pay attention in your immediate surroundings to the following:

- Persons who for a longer time are watching, photographing or filming objects that may become the target of the attack
- Frequent meetings of unusually behaving people organised in rented flats

- Unusual behaviour of colleagues, e.g. unjustified attempts to get plans of facilities or taking out documents or materials which may be used in activities

Note:

If you notice or hear something disturbing, report it to the Police, Internal Security Agency

Signs indicating imminent threat of a terrorist attack:

- suspiciously or strangely behaving people
- object left unattended in public places such as briefcases, parcels and packages,
- suspicious content of a package without the sender's information and address or from a sender or place from where a package is not expected;
- vehicles, especially vans parked outside specified places

Note:

Watch your surroundings closely, pay attention to untypical behaviour of people or to objects left unattended in public places!

If you notice something disturbing, do not undertake any activity. Follow the rules below:

- if you have any suspicion inform the security staff of the facility or its administration manager, the Police, Fire Services
- do not spread information about your suspicion to avoid panic;
- do not try to overpower suspects (but observe them discretely and try to remember as many details about their appearance and behaviour);
- do not ignore or neglect information on a threat of a bomb incident;
- a bomb attack does not discriminate between 'our' and 'other' , whereas weapon is aimed by a terrorist or a criminal at a specific person;
- do not accept any packages from unknown people;
- do not leave own baggage unattended.
- any object with protruding cables, producing gas, liquid, smell, sound, powder, or left /which is visible/ by a quickly retreating person, thrown into a room or a vehicle must be considered as suspicious;
- Do not touch or worse, do not move any suspicious packages.

6.1.5 Complaints / Reporting a Threat

When reporting a threat, you should provide the following information:

- your name and telephone number;
- type of threat and premises for the threat (suspicious persons. unattended package. information from another person);
- Address of facility under threat, possibly the most detailed description of the place and suspicious persons, objects or phenomena (e.g. suddenly occurring eye and respiratory tract irritation).

If you can see 'a bomb' it can 'see' you, which means that you're in its field of fire

- Do not use mobile phone, radio wave receivers, etc. nearby;
- Keep calm;
- Inform everyone nearby about the threat and try not to cause panic;
- Inform the relevant authorities of the incident and losses (e g. the Police, Security, authorities responsible for the safety of the facility);
- Secure the place under threat if possible until the arrival of the Police, maintain the basic safety precautions. do not expose yourself or others to danger;
- Follow orders of Security officers after their arrival to the bomb incident.

In case of a suspicious package pay attention to the following:

- untypical size and weight;
- too much weight for its size;
- deformed surface;
- the fact of sending it directly to the office manager (supervisor, head, rector, etc.) with the annotation 'for the attention of';
- a note to be opened by the addressee;
- a too high price of postage stamps;
- unknown sender;
- strong packaging.
- a metallic sound heard when moving the letter; greasy spots on the envelope or packaging; smell of almonds, marzipan, mice, chemicals; small openings /holes/ in the envelopes or packaging; protruding cables or clips; a damaged package.

6.1.6 BOMB AT PREMISES

If you were informed e.g. by telephone that there is a bomb at your Premises, immediately inform the police/Security and until their arrival:

- do not step on the entrance door threshold or the doormat;
- do not touch the any electrical switch
- Switch off all electrical devices
- do not turn on the light;
- do not start or check alarm systems;
- do not step on carpets, flooring which are so-called passage in the Industry,
- do not use the radio, TV, or landline telephone/Mobile or internet;
- do not turn on any electric or gas equipment;
- leave the area as soon as possible;
- Try to inform possibly the largest number of neighbours.

Table 6.1

BASIC INSTRUCTION FOR EVACUATION

Evacuation from home	Evacuation from institution/company	Evacuation from public places
Take only the most necessary things (documents, supply of water and food, necessary medications, change of clothing, basic toiletries, a flashlight, possibly a light blanket, a sleeping bag and a foam sleep pad);	Take only the most necessary personal things;	Pay attention to location of staircases and emergency exits;
Cut off water, gas and electricity before evacuating;	Cut off electricity and gas and safely remove all flammable materials;	Think how to evacuate the building, train station or other crowded places in a hurry;
Do not use lifts;	Do not use lifts;	Do not use lifts;
Move as instructed by the evacuating party.	Move as instructed by the evacuating party;	Move as instructed by the evacuating party;
	Find out whether returning home is possible or whether the evacuated persons will be directed to other places;	Find out whether returning home is possible or whether the evacuated persons will be directed to other places

Activities after explosion of a bomb:

- remember about your own safety, the nearest and co-workers;
- start action, i.e. evacuation and provide assistance to the injured and in shock;
- do not touch or move objects which cause your anxiety;
- Follow the instructions of the rescue services after their arrival.

IT HAPPENS THAT ORDINARY PEOPLE, DESPITE FOLLOWING SAFETY RULES, BECOME HOSTAGES OF TERRORISTS.

THE FOLLOWING RULES SHOULD BE FOLLOWED:

- if you heard shots in the place where you are, do not run away, if possible, lay down behind the nearest cover;
- try to avoid a prolonged eye contact with the terrorist which arouses aggression; do not turn your back to the terrorist;
- follow the instructions of terrorists, do not argue with them, respond after a longer thought; do not resist;
- do not perform instructions of terrorists suddenly;
- try to turn the attackers' attention to the fact that they deal with specific people – a man /personification/;
- try to stay calm, find a medium attitude between aggression, passivity and submission;

PROCEDURE IN CASE OF RISK OF TERRORIST ATTACK

Do not attract terrorists' attention to yourself /discussion, many questions, rapid movements, insults, verbal abuse/;

- always ask for permission e.g. to go to the toilet, to stand up, or to open your bag;
- give them your personal belongings at terrorists' command;
- if possible, remove /discard/ unnoticeably any signs of your professional position which may cause terrorists' aggression;
- set small goals /e.g. to get water or a meal, wound dressing, possibility to use the toilet, give help to someone else from terrorists/, achieve them and set new ones;
- set future goals to be achieved after the release to justify your will to survive;

- try to stay physically and mentally fit – think positive;
- try to take care of your personal hygiene;
- remember that among hostages there may be a person cooperating with terrorists, do not show your fears and other weak points, control your reactions; do not block the escape for terrorists;
- Try to remember possibly the highest number of details about abductors and the environment which may help law enforcement authorities in further activities.

PROCEDURE DURING ANTI-TERRORIST OPERATION

- do not escape from the site, do not perform sudden movements as you may be regarded as a terrorist;
- lay on the floor, try to find the nearest cover. hold your arms with open hands preferably at your head level;
- do not try to help. do not attack terrorists;
- follow instructions and commands of the anti-terrorist group, submit to their activities even if they are violent, and do not waste time by asking questions or discussions;
- do not rub your eyes in case of tear gas grenades;
- leave the room as soon as possible after the command to leave, do not stop to collect personal belongings, for example:
- Answer questions of an officer /introduce yourself and describe how you were found at the place of attack/, but be prepared to be treated as a potential terrorist until your identity is confirmed.

BIOLOGICAL, CHEMICAL AND RADIOLOGICAL HAZARDS

If you are inside of a building, and the danger is outside:

- remain inside;
- let pedestrians in danger inside;
- close and seal doors and windows by e.g. wet cloth;
- inform other persons in the building about the danger;
- turn off air-conditioning, ventilation. air vents:
- Turn on the radio or TV /preferably local stations/.

If you inside of a building and the danger is inside;

You received a parcel.

If the parcel seems suspicious — DO NOT OPEN

- place it in a thick plastic bag and close it tightly — tape or tie;
- place the bag in a second-thick plastic bag, and also close it tightly;
- do not move the parcel, leave it as it is;
- wash your hands thoroughly;
- Inform the Security and follow their instructions.

If the room was contaminated with e.g. aerosols:

- turn off the air-conditioning and ventilators, air vents in the room;
- leave the room and close the door;
- cause air-conditioning in the building be turned off;
- do not eat, do not drink, do not smoke

If you are outdoors

- find the nearest inhabited building;
- protect respiratory tract /cover your mouth and nose with a handkerchief/; or Nose Mask
- in case of contact with dangerous substances, leave outer clothing and shoes in front of the building;
- when inside, wash your face, hair and hands, and preferably wash yourself thoroughly in a shower

6.1.7 Civil Disorder

The riots in Industry and around area of the industry (for various other reasons) are a glimpse into what could happen if things were to really turn sour. Preparing for such unrest and crises is done much the same way we prepare for snow storms or hurricanes or other natural disasters. We prepare now – today – before the storm hits.

It might not be possible to leave your plant, due to any number of situations, but its best option to reach in colony as soon as possible. If you do stay in Plant you should have at *least* a 72-hour supply of food and water. If you've been prepping for natural disasters, you should already be well on your way to being comfortable during a season of unrest. But just in case, here are a few things you should consider stocking up on:

1. **30-day food and supply**

This should include easy-to-make food, such as freeze-dried meals, that don't require much effort or energy. As for water, having a water filter can keep you supplied with water for months, and it only takes up a little bit of space on your shelf.

2. **Warm clothing/blankets**

This includes winter jackets, sleeping bags, gloves, warm hats, and other necessities that you would want if you were forced outside in the winter.

3. **Power sources**

Hopefully the power will still be on, but you never know what might happen. Make sure you have some alternate sources of power so you can charge your phone and other devices.

4. **Light**

Again, if the power goes out, you'll need some sort of light. Flashlights are an obvious choice, but consider getting different kinds of stationary lighting that you don't have to hold on to.

5. **And of course, toilet paper**

I think this one is pretty self-explanatory, but let me just say...being stuck inside your plant without it could just add to the pleasantries.

CHAPTER

7

Chapter VII

RECOMMENDATION

Department wise Recommendations

A) WTP

1. Weakly fitness checklist for Acid & alkali tank. Safely department shall also prepared own checklist & check fortnightly and external agency half yearly
2. Iron support structure and staircase are corrode , RCC structure is highly recommended
3. Redesign of dike its necessary with reference to you provision accident
4. Maintenance of pre coating liner in the dike area shall be done
5. Storage of acid in poly plastic tank is not at all recommended for a minute but it was told that from two years this practice is going on its highly recommended transfer this acid in tank of required MOC
6. Level indicator shall be installed and maintained at working condition
7. RCC structure of dike is not maintained it has very big hole
8. Storm drain and spill drain are available in dike but totally chock with mud the purpose of this drains are not meaning full as there is hole in the dike wall
9. Relocation of eye washer shall be done and it shall be situated hardal free area
10. Level indicator of all tanks shall be in working condition with regularly calibration
11. Tanks manhole at DM plant shall be provided with proper platform
12. Chemical storage area shall be facilitated with fume absorbed followed by wet scrubber
13. It is observed at so many places in WTP, especially in TTWR in insertion of naked wired in electrical switch board
14. The observed unsafe action i.e. jumping from clarifier to filter level window shall stopped immediately

B) Hydrogen Storage Area

1. Hydrogen storage are shall be equipped with leak detection system, Gas absorber, Flame & Smoke detector shall be provided and also those system shall be interlock with Automatic fire fighting/ hydrant system
2. Resins are highly flammable hence shall be remove from hydrogen storage are instantly

3. Emergency exit doors present in the area shall be fork for movement & making path shall be marked on floor with reference to all exit gel with self-illuminating material (Radioactive material shall be avoided)
4. Fire hydrant present outside of hydrogen storage area is for namesake fencing shall be removed or fire hydrents monitor shall be relocated with reference to wind flow
5. Wind shock shall be provided at hydrogen storage area, chemical storage and WTP area.

C) PCR 8, 9 & 10

1. Fire fighting hose pipes in PCR 8,9 & 10 shall be placed at its location
2. Alternate exit path's housekeeping shall be done regularly & exit path must be free from hurdles

D) Major Stores

1. The office of major store has occupancy of 30 persons & only one exit is present its highly recommend to provide exit gate with assembly point
2. MSDS in local language of flammable material like shall be displaced at their storage area & even handover every time to end users.

E) Service building

1. Escape chute is recommend at 4th floor from where emergency evacuation may be possible for the personal sitting at 4th floor at suitable location

E) Oil Handling Plant

1. Tanks Dike shall be maintained storm drain and spill drain shall be free from chocking
2. Flame/Smoke detectors shall be installed at top priority
3. Level indicator and Pressure Indicator shall be calibrated and maintained

F) Coal Handling Plant

1. Water shower for dust suppression shall be maintain
2. Dust absorption system shall be interlock with wagon tippler evacuation mode
3. Safety control system present in the area shall be maintained and put in the working condition
4. Helmet with head light shall be provided to the working personals at minus level (confined space)
5. Civil maintenance of stare case at minus level shall be at top priority

6. Illumination shall be enhanced in the whole stare case area at minus level
7. Oxygen level available shall be monitor at least quarterly Availability to oxygen will reduce fatigue of working personal
8. Drinking water quality shall be matching the portability condition as per the requirement of IS 10500. To achieve these RO filters shall be installed and maintained regularly
9. Work instruction board in local or national language shall be displays wherever requirement
10. PPE's like Nose mask, Ear puffs, Goggles, Safety shoes and Helmets with headlights shall mandatory before entering the CHP area

G) Coal sampling preparation lab

1. PPE's like Face mask, Goggles shall be mandatory in the working area
2. Illumination shall be maintained at par IS 3646:1992. LED focuses shall not be provided because it produced glare and damaged eyesight
3. Turbo ventilation, Cross Ventilation and dust suppression system shall be provided in the Coal sampling preparation lab
4. Drinking water quality shall be matching the portability condition as per the requirement of IS 10500. To achieve these RO filters shall be installed and maintained regularly

H) NDCT

1. Lightening arrestors shall be earth properly and earth pit shall be maintained
2. Aviation light shall be maintained as per the schedule and Sensor shall be provided to on light with respect natural illumination intensity

I) CW Pump House

1. Illumination shall be enhanced in the whole stare case area at minus level
2. Helmet with head light shall be provided to the working personals at minus level (confined space)

Special Recommendations

1. Well-equipped Medical Emergency room with all facilities to cope up with emergencies shall be provided within plant boundary
2. Medical Emergency room shall be headed either by medico-professional or qualified paramedical staff round the clock

3. Disaster management room / Emergency control room shall be provided within plant boundary and it should be equidistant from all department
4. Emergency Control Room shall be well- equipped with the following equipment's given in table below
5. Disaster management room shall be attended by safety professional round the clock
6. Approach road to assembly points shall be clear from all obstacles
7. Qualified man power shall be provided with ambulance
8. MSDS in local language of hydrazine hydrate and chlorine shall be displaced at storage area
9. Emergency Siren with different specification for different emergencies shall be installed
10. Gas absorbers, leak detectors, Flame & smoke detectors, heat & thermal arrestors should be installed whenever necessary
11. Housekeeping of cable racks, oil transfer pipeline from rail tank unloading to tank farm and all associated pipe racks should be done on regular basis
12. Hydrogen storage area shall be well ventilated and illuminated with fire proof electric fittings
13. Storage tanks of Acid & Alkali with associated pipeline shall be replaced with new at Top priority
14. Safety valves and overpressure vents installed on boiler shall be maintained regularly at top priority
15. Department wise Personal Protective Equipment (PPEs) Matrix should be established, displayed and maintained as per the requirement of The Maharashtra Factories Rules, 1963, Rule 57 & Factories Act 1948 Section 21 (2)
16. Working personals in the industry should be encourage for use of PPEs
17. Job Safety Analysis Studies shall be carried out for hazardous jobs as per the requirement of The Maharashtra Factories Rules, 1963; Rule 73-H & Factories Act 1948 Section 41-C
18. Ventilation Studies shall be carried out for dense populated and congested area all over the industry as per the requirement of The Maharashtra Factories Rules, 1963; Rule 22A & Factories Act 1948 Section 13
19. Dust Explosion Studies shall be carried out for CHP, Coal Crusher, Coal yard, ESP and AHP area
20. Noise Level Survey as per the requirement of The Maharashtra Factories Rules, 1963; Schedule XXIV

Table 7.1: Emergency Control Room Equipment List

Sr. No.	Particulars	Image
1.	Life Buoy	
2.	Life Jacket	
3.	Face Mask	
4.	Gas Mask	

Sr. No.	Particulars	Image
5.	Hand Glove	
6.	Gum Boot	
7.	Safety Shoe	
8.	Helmet	

Sr. No.	Particulars	Image
9.	Dragon Light	
10.	Emergency Light	
11.	Rappelling Rope	
12.	Climbing Rope	

Sr. No.	Particulars	Image
13.	Descenders	
14.	Ascenders	
15.	Water Jell Blanket	

Sr. No.	Particulars	Image
16.	Harness	
17.	Safety Net	
18.	Hand Tool Set	
19.	Safety Jacket	

Sr. No.	Particulars	Image
20.	Pickaxe	
21.	Spade	
22.	Mega Phone	
23.	PA System	

Sr. No.	Particulars	Image
24.	Power Tool	
25.	Folding Shovel	
26.	Spine Board Sketcher	
27.	Emergency Basket Skelcher	

Sr. No.	Particulars	Image
28.	Barricade Tape	
29.	SCABA	

ANNEXURE

Annexure

Head Count

Service Building

Sr. No.	Room	No. of Heads	No. of Exit	Remark
	4th Floor			
1.	C.E.	15	03	Emergency Exit 01 01 gate Block
2.	Dy. C. E.	06	01	During Emergency Glass wall may break
3.	S.E (Maintenance SM & TM)	06	01	No alternative Exit
4.	S.E. (Operations)	06	01	No alternative Exit
5.	S.E. (Electrical & IT)	06	01	During Emergency Glass wall may break
6.	S.E. (MPD)	06	01	During Emergency Glass wall may break
7.	Waiting Hall	06	01	
8.	Executive Engineer (Ramteke)	03	01	No alternative Exit
9.	Adjacent Room	04	01	No alternative Exit
10.	Toilet	04	01	No alternative Exit
11.	Conference hall 01	50	02	
12.	Conference hall 02	50	02	
13.	Video Conferencing Room	07	01	No alternative Exit
	3rd floor			
14.	ISO Cell	04	01	No alternative Exit
15.	POG Section	25	01	No alternative Exit

16.	Dispatch	02	01	No alternative Exit
17.	OS Store	06	01	No alternative Exit
18.	IT Server Room	04	01	No alternative Exit
19.	Toilet	04	01	No alternative Exit
20.	FOAD	25	01	No alternative Exit
21.	MPD	20	01	No alternative Exit
22.	Operation Service 01	15	01	No alternative Exit
23.	Operation Service 02	15	01	No alternative Exit
	2nd Floor			
24.	Control & Instrumentation Staff Room	22	01	No alternative Exit
25.	Control & Instrumentation E.E. Room	06	01	No alternative Exit
26.	Lab	02	01	No alternative Exit
27.	Store	06	01	No alternative Exit
28.	Turbine Testing	15	01	No alternative Exit
29.	C & I Store	04	01	No alternative Exit
30.	EM & T Store	07	01	No alternative Exit
31.	Electrical Maintenance 01	10	01	No alternative Exit
32.	Electrical Maintenance 02	30	01	No alternative Exit
	1st floor			
33.	AHP	16	01	No alternative Exit
34.	Turbine maintenance	10	01	No alternative Exit

35.	Technician Room	10	01	No alternative Exit
36.	TM Store	08	01	No alternative Exit
37.	TM Executive Engg	02	01	No alternative Exit
38.	BM A. E.	18	01	No alternative Exit
39.	BM Store	12	01	No alternative Exit
40.	AHP Store	11	01	No alternative Exit
	Ground Floor			
41.	Security	03	04	
42.	Movement	03	04	

Seva Sadan

Sr. No.	Room	No. of Heads	No. of Exit	Remark
1.	Safety Section	12	01	
2.	Civil 660	10	01	
3.	Civil 210	03	01	
4.	Training Hall	12	01	
5	Industrial Relationship Officer	01	01	
6.	Security Officer	03	01	
7.	Door Security	04	01	
8.	Mahagems	03	01	
9.	Mahagems outside	07	01	
10.	ISO Section	04	01	
11.	Fire Section	07	01	
12.	Coal Testing	15	02	

Urja Bhavan

Sr. No.	Room	No. of Heads	No. of Exit	Remark
	Ground Floor			
1.	Technical Committee hall	12	01	
2.	Purchase section	25	02	
3.	EE Purchase	03	01	
4.	SE Admin	03	01	
5.	General Manager (F & A)	06	01	
6.	F&A Section	5	02	
7.	Manager (F&A)	05	01	
8.	Manager (F&A)	05	01	
9.	Manager (F&A)	05	01	
10.	Sr. Manager (F & A)	05	01	
11.	Manager (F&A)	05	01	
	1st floor			
12.	C.E. room	12	01	
13.	PA room	04	01	
14.	Dy C.E.	04	01	
15.	Dy. C. E (O&M)	04	01	
16.	Waiting room	05	01	
17.	Dy. E.E. co-ordination	06	01	
18.	Security	05		
19.	HR section	90	01	
20.	Medical	04	01	

Unit 8: Number of Fire Extinguisher

Sr. No	F/P NO	Location Name	Type Of Fire Extinguishers										
			9 lit M/F	50 lit M/F	9 lit WATER	4.5 kg CO2	6.5 kg CO2	9 kg CO2	Co2 22.5 kg	2 kg DCP	5 kg DCP	10 kg DCP	25 kg DCP
1	23	PCR /PCR Panel Room				5	4	5	1			8	1
2	22	Turbine Floor	12	2		3	3					8	1
3	21	Below Turbine Floor	15	1		2	2	1			1	4	2
4	20	Turbine Basement	13	1		3	2	1				5	1
5	42	Firing Floor	4		5	1	2					1	
6	25	S.T. SWGR Room 3.5 mtr				3	3	3	1		5	7	4
7	26	S.T. SWGR Room 9 mtr				2	2	1	1		2	1	
8	28	S.T. SWGR Room 12.5 mtr				2	2	3	1		2	1	1
9	30	Boiler MCC Room U# 8,9				2	2	2			3	2	

Sr. No	F/P NO	Location Name	Type Of Fire Extinguishers										
			9 lit M/F	50 lit M/F	9 lit WATER	4.5 kg CO2	6.5 kg CO2	9 kg CO2	Co2 22.5 kg	2 kg DCP	5 kg DCP	10 kg DCP	25 kg DCP
10	41	Boiler Basement			2						2		
11	58	ESP Control Room				6		1			2	6	1
12	15	Service Building '0' mtr				2	1	1			1	1	
13	16	Service Building 1'st Floor			2	1	1	1					
14	17	Service Building 2'nd Floor			1	1	1	1		1			
15	18	Service Building 3'rd Floor				1	1	1		7			
16	19	Service Building 4'th Floor				2	1	1					
17		IT Server Room											
18	31	Bloor Room U# 8,9				1						3	

Sr. No	F/P NO	Location Name	Type Of Fire Extinguishers										
			9 lit M/F	50 lit M/F	9 lit WATER	4.5 kg CO2	6.5 kg CO2	9 kg CO2	Co2 22.5 kg	2 kg DCP	5 kg DCP	10 kg DCP	25 kg DCP
19	10	DG Comp cont. Room (MCC Room)				1		1			2	2	
20	11	DG SET				1	1				1	1	
21	14	HVAC Chiller Plant				2					2		
22	12	CUP Lab				2							
23	13	CT Makeup Pump				1					2		
24	7	Canteen			2		1	1					
25	6	Time Office				2							
		TOTAL	44	4	12	46	29	24	4	8	25	50	11

Unit 9: Number of Fire Extinguisher

Sr. No	F/P No	Location Name	Type Of Fire Extinguishers									
			9 lit M/F	50 lit M/F	9 lit Water	4.5 kg Co2	6.5 kg Co2	9 kg Co2	22.5 kg Co2	5 kg DCP	10 kg DCP	25 kg DCP
1	29	Turbine Floor	12	2		3	3				8	1
2	27	Below Turbine Floor	15	1		2	2	1		1	3	2
3	24	Turbine Basement	13	1		1	2	1			4	1
4	47	Firing Floor	5		5	2					2	
5	43	Boiler Basement			2					2		
6	45	Battery Room				1	1	1		1	2	
7	59	ESP Control Room				6		1		3	6	1
8	46	Swash Lab U= 8,9			2	2				2		
9	44	Booster P/H				1	1				3	
10	53	ESP(RCP)32mlt U=6	3					2			3	
11	54	ESP(RCP32 mit U=9	3					2			3	
12	55	ESP(RCP)32mit U=10	3					2			3	
		TOTAL	54	4	9	18	9	10		9	37	5

Unit 10: Number of Fire Extinguisher

Sr. No	F/P No	Location Name	Type Of Fire Extinguishers								
			9 lit M/F	50 lit M/F	9 lit Water	4.5 kg Co2	6.5 kg Co2	9 kg Co2	22.5 kg Co2	5 kg DCP	10 kg DCP
1	38	PCR/PCR Pannel Room				2	2	3	1	3	2
2	37	Turbine Floor	12	2		3	3				6
3	35	Below Turbine Floor	15	2		2	2	1		1	3
4	32	Turbine Basement	13	1		3	2	1			9
5	51	Firing Floor	3		5						1
6	33	S.T. SWGR Room 3.5 mtr				2	2	1	1	3	4
7	34	S.T. SWGR Room 9 mtr				1	2	1	1	3	1
8	36	S.T. SWGR Room 12.5 mtr				1	2	1	1	2	4
9	39	Boiler MCC Room U# 8,9 (24 mtr)				2	1	1	1	3	2
10	48	Boiler Basement			2					2	
11	60	ESP Control Room				6		1		2	6
12	49	Battery Room				1		2		1	1
13	50	Swash Lab			2	3				2	
14	40	Bloor Room				1					3
15		Chlorine Dozing				1					1
		TOTAL	43	5	9	28	16	12	5	22	45

CHP Area: Number of Fire Extinguisher

Sr. No	F/P No	Location Name	Type Of Fire Extinguish					
			9 lit M/F	9 lit Water	4.5 kg Co2	6.5 kg Co2	9 kg Co2	22.5 kg Co2
1	76	CHP Control Room			4		1	1
2	72	Wagon Tippler Control Room 1 & 2			2			
3	73	Wagon Tippler Control Room 3 & 4			2			
4	74	Wagon Tippler MCC Room			3		1	
5	9	TP- 7 MCC Room			1		1	
6	75	TP- 3		1	1			
7	78	TP- 4		2				
8	79	TP- 5		2	1			
9	80	Lanco Office CHP		3			1	
10	81	TP- 6		2	1			
11	77	Crusher House		1				
12		Dozer Room	1					
13	82	T/P- 7		1				
14	83	Bunker		6				

Sr.No	F/P No	Location Name	Type Of Fire Extinguish					
			9 llt M/F	9 lit Water	4.5 kg Co2	6.5 kg Co2	9 kg Co2	22.5 kg Co2
15	84	B/M STORE		2				
16	85	Diesel Pump	2					
		TOTAL	3	20	15		4	1

Out Door Area: Number of Fire Extinguisher

Sr.No	F/P No	Location Name	Type Of Fire Extinguishers						
			9 lit M/F	50 lit M/F	9 lit Water	4.5 kg Co2	6.5 kg Co2	9 kg Co2	22.5 kg Co2
1	64	Fire Fighting Pump House				3	2		
2		Ozone Plant				1			
3	69	DM Plant Area				3	1	2	
4	70	ETP				1			
5	57	CHP Pump House	9	1		2			
6	62	C W Pump House				3			
7	63	C W Pump House P/Room						1	
8	65	CHP-660MW (Unlod.area)	8	2		2	1		
9	52	AHP Control/MCC Room				5		1	1
10	6	Major Store	4		16	5		1	
11	5	Service Bldg.Project (ED off)			8		4		
12	3	Chief Engineer office (Est)			4		2		
13	56	Syllow Panel Room	1			2	1	1	
14	71	WTP Lab			4	4			
15	68	H2 Plant			3	1	1	1	
16	4	Project office			2		1		

Sr.No	F/P No	Location Name	Type Of Fire Extinguishers						
			9 lit M/F	50 lit M/F	9 lit Water	4.5 kg Co2	6.6 kg Co2	9 kg Co2	22.5 kg Co2
17	2	Security office							
18	1	L & T office			5	4			
19		Central coal lab							
20	61	Air Comp. Room U=10				2			
21	66	Row Water Pump House				1			
22	67	Chemical Godown			2	1			
		TOTAL	**22**	**3**	**44**	**40**	**13**	**7**	

Fire Extinguisher Summary

Location	9 lit M/F	50 lit M/F	9 lit Water	4.5 kg Co2	6.5 kg Co2	9 kg Co2	Co2 22.5 kg	2 kg DCP	5 kg DCP	10 kg DCP	25 kg DCP	50 kg DCP	75 kg DCP
U=8	44	4	12	46	29	24	4	8	25	50	11	3	1
U=9	54	4	9	18	9	10			9	37	5	2	1
U=10	43	5	9	28	16	12	5		22	45	9	2	1
CHP	3		20	15		4	1		8	16	1		
Out Door	22	3	44	40	13	7	1		39	31			
	166	16	94	147	67	57	11	8	103	179	26	7	3

MAHAGENCO
Maharashtra State Power Generation Co. Ltd.

2021

Surya Envirotech (OPC) Pvt. Ltd.
237, Hanuman Nagar, Nagpur
www.suryaenviro.com

Annexure-17(a)

MAHARASHTRA STATE POWER GENERATION COMPANY LIMITED
CIVIL CONSTRUCTION CIRCLE, KORADI.

Ref No. Dy.CE(C)/CCC/KRD/Tech/ 00720 Date : 19 JUN 2020

OFFICE NOTE

Sub. :- **Koradi T.P.S. 3 x 660 MW Expn. Project** :- Work of providing Piezometer wells at Koradi and Khasara Ash Bund of 3x660 MW Expansion Project, Koradi.
-- Administrative approval for taking up the work thereof.

Ref. :- 1. B.R. No. MSPGCL/CS/BM 188/188 27, Dt. 18/02/2020
2. MoM of 32nd Meeting of EAC on EIA for 2x660 MW Koradi Expansion Project.

1.00 The 2x660 MW Expansion Project is proposed at 210 MW old Koradi Thermal Power Station. The Board of Director has accorded the approval for implementation of 2x660 MW Coal based Supercritical Thermal Power Project at Koradi TPS with estimated cost of Rs. 9881.60 Cr. vide B.R. under reference (1).

2.00 The 32nd meeting at the constituted Expert Appraisal Committee (EAC) (Thermal Power) was held on 23rd August 2019 in the Ministry of Environment Forest and Climate Change at Indus Meeting Hall, Ground Floor, Jai Wing, Indira Paryavaran Bhawan, Jor Bag Road, Aliganj, New Delhi under the Chairmanship of Dr. Navin Chandra. The main agenda for the meeting was for Environmental Impact Assessment of Thermal Power Project. The Minutes of the 32nd Meeting is enclosed for ready reference.

3.00 As per above MoM, Point No. 32.9 – Proposed 2x660 MW Supercritical Thermal Power Project (Expansion) within the premises of 2400 MW Koradi Power Plant at village Koradi, Tahsil Kamptee, Dist. Nagpur, Maharashtra State by Power Generation Company Limited (Mahagenco) Reg. – (Internal discussion on site visit report. It was mentioned at Point No. 32.9.5(x), that No piezowells have been installed at the periphery of ash ponds for monitoring the ground water quality. As present no piezowells are installed at Koradi and Khasara ash bund for 3x660 MW Koradi TPS. It is necessary to install piezowell at Koradi and Khasara ash bund to

y the point of environmental clearance for (2x660 MW Koradi Expansion oject and MOEF points. During review meeting (V.C.) on Dt. 29.05.2020 on environmental aspects of 3x660MW, the Executive Director (Project) directed to forward the estimate of providing and installation of piezometer wells at Koradi and Khasara ash bund at the earliest for administrative approval to comply the MOEF points.

4.00 In view of the above, this office prepared the estimate for the work of providing and installation Piezometer wells at Koradi and Kahasara ash bund. The estimated amount works out to Rs. 26,03,385.54 (Excluding GST) and Rs. 30,71,994.93 (Including GST). The estimate for civil work is based on PWD CSR 2019-20, GSDA CSR for the year 2018 and for piezometer on the market rate. The quotation collected from PESC for the rate of Piezometer wells, as the rate of piezometer wells are not available in CSR.

5.00 If approved the work will be taken up by inviting E-Tender by following PQR as per CVC guidelines.

Pre-qualifying No. 1 :- Average annual financial turn over during the last 3 years ending 31st March of the previous financial year, should be at least 30% of the estimated cost.

Pre-qualifying No. 2 :- Experience of having successfully completed Similar work during last 7 years ending last day of month previous to the one in which application are invited should be either of the following.

a. Three Similar completed works costing not less than the amount equal to 40% of the estimated cost.

Or

b. Two Similar completed works costing not less than the amount equal to 50% of the estimated cost.

Or

c. One Similar completed work costing not less than the amount equal to 80% of the estimated cost.

t-

1) Similar works defined as any type installation of Automatic water level recorder with Telemetry (Piezometer) having experience certificate of Govt./Semi-Govt./Public under taking.

6.00 As per DOP, Page No. 31, Sr No 1.1 for administrative approval under Preconstruction and Construction Activities' Executive Director in consultation with CGM (F&A) is the Competent Authority to accord the administrative approval upto Rs. 50.00 Lakh..

7.00 The Budget Provision is taken from proposed 2x660 MW Expansion Project, Koradi as the work required MOEF expansion clearance of proposed 2x660 MW Expansion Project, Koradi.

It is requested to process the proposal for approval to take up the said work.

Sr. Manager (F&A),
Civil Construction Circle,
M.S.P.G.C.L., Koradi.

Dy. Chief Engineer (C),
Civil Construction Circle,
M.S.P.G.C.L., Koradi.

Chief Engineer (Civil) – II,
M.S.P.G.C.L., Koradi.

Chief Engineer (Civil) – I,
M.S.P.G.C.L., Mumbai.

Annexure-18(a)

Upto date Details of Tree Plantation for KTPS Koradi.- Annexure A

No	Particulars	Details	Remarks
1	Total progressive nos. of trees planted before 01.04.2019.	5,68,227	
2	No. of Tree planted in the period **1st April 2020 to 31st March 2021.**	16700	100% survive
3	Total progressive nos. of trees planted upto 31.03.2021.(1+2)	5,84,927	
4	Total progressive nos. of trees survived upto 31.03.2021.	3,89,860	
5	Target of tree plantation for the period of F.Y 2021-22	9000	
6	Species of trees planted in the period April 2020 to March 2021	Various Bamboo species supplied by M/s NEERI, Nagpur.	
7	Available open land area(in Hect.)	400.44	
8	Total area covered under plantation so far(in Hect.)	268.22	
9	Percentage of area covered under plantation (%).	66.98%	

Superintending. Engineer(C)
3x660MW, TPS, Koradi.

Annexure-18(b)

ANNEXURE 1

Company
NATIONAL ENVIR ENGG RESEARCH INSTITUTE
NEHRU MARG NAGPUR 440 020
440020 NAGPUR
INDIA

Purchase Order	
Description:	civil-660 development of geen belt
PO Number:	4550001477
Date:	17.09.2019
Version:	2
Contact Person:	MAHAGENCO
Phone:	022-26474211
Fax:	022-26476749
E-Mail:	

Goods Recipient:
KTPS Group A
Mr SHASHIKANT VELE
KTPS Group A
KORADI THERMAL POWER STATION
441111 NAGPUR

Ship-To/Service Location:
Company
Koradi Thermal Power Station
441111 NAGPUR-KORADI
INDIA

Performance From: 01.10.2019

Payment Terms: Z03690% ad against proforma. invoice & 10% agnst SES/GR

Incoterms: CIF koradi

The purchase order was already output on 05.09.2019

DESCRIPTION :

Subject:- Development of green belt by providing Bamboo plantation for dust suppression at Koradi thermal power premises using Eco-Rejuvenation Technology at MAHAGENCO land area for controlling the pollution for Fodder Farm no-4, 5, 6 at 3x660MW, TPS, Koradi

REF.:- KTPS/PUR/19-20/CIVIL-660/RFX-E-2712

Attachments:
RFxResp 3400006695 NATIONAL ENVIR ENGG RESEARCH INSTITUTE
Digital Signature
Spec
Proposal
ANNEXC

Item	Product Number	Revision Level	Description	Supplier Product Number
Delivery Date/ Performance Period	Quantity	Unit	Price per Unit	Net Value
1		Bamboo plants for dust suppression		
2	W078060010110001		TREE PLANTATION MAINT OF TREE PLANTATION	
From 01.10.2019	1.00	MON	9,570,000.00 INR/1 MON	9,570,000.00 INR

Total Value(Net):9,570,000.00 INR
Total Tax: 1,722,600.00 INR

ANNEXURE 1

Sheet no.

Company
NATIONAL ENVIR ENGG RESEARCH INSTITUTE
NEHRU MARG NAGPUR 440 020
440020 NAGPUR
INDIA

Purchase Order	
Description:	civil-660 devolpment of geen bell
PO Number:	4550001478
Date:	17.08.2019
Version:	2
Contact Person:	MAHAGENCO
Phone:	022-26474211
Fax:	022-26476749
E-Mail:	

(3)

Goods Recipient:
KTPS Group A
Mr SHASHIKANT VELE
KTPS Group A
KORADI THERMAL POWER STATION
441111 NAGPUR

Ship-To/Service Location:
Company
Koradi Thermal Power Station
441111 NAGPUR-KORADI
INDIA

Performance From: 14.10.2019

Payment Terms: Z03890% ad against proforma, invoice &10% agnst SES/GR

Incoterms: CIF koradi

The purchase order was already output on 12.09.2019

DESCRIPTION :
SUB.:- Development of green belt by providing Bamboo plantation for dust suppression at Koradi thermal power premises using Eco-Rejuvenation Technology at MAHAGENCO land area for controlling the pollution for Fodder Farm no-7 & 8 at 3x660MW, TPS, Koradi.

REF.:- KTPS/PUR/19-20/CIVIL-660/RFX-E-2713

Attachments:
RFxResp 3400008668 NATIONAL ENVIR ENGG RESEARCH INSTITUTE
Digital Signature
Spec
Proposal
ANNEXC

Item	Product Number	Revision Level	Description	Supplier Product Number
Delivery Date/ Performance Period	Quantity	Unit	Price per Unit	Net Value
1		Bamboo plant fodder farm 7&8		
2	W078050010110001		TREE PLANTATION MAINT OF TREE PLANTATION	
From 14.10.2019	1.00	MON	6,380,000.00 INR/1 MON	6,380,000.00 INR

Total Value(Net):6,380,000.00 INR
Total Tax: 1,148,400.00 INR

PURCHASE ORDER

Maharashtra State Power Generation Company Limited
CHIEF ENGINEER
KORADI THERMAL POWER STATION
KORADI, DIST: NAGPUR,
MAHARASHTRA. 441111

T:07109-262106,262109,262141-262146,FAX.262127,262847,262864
cegenkoradi@mahagenco.in
MSPGCL GSTIN . 27AAECM2935R1ZV

PO NO.: KTPS/4500104439 PO Date : 18.04.2019

To,
VENDOR CODE: 50971
GST No. :
NATIONAL ENVIR ENGG RESEARCH INSTI
NEHRU MARG NAGPUR 440 020
NAGPUR 440020
Maharashtra India
Telephone: 0712 2249879 Telefax: 0712 2249896
E-Mail:ds_ramteke@neeri.res.in
ATTN:

Our reference:

Your reference.

Procurement Type : Single Enquiry Govt

Please arrange to provide the goods / services described below strictly as per terms and conditions mentioned in this Purchase Order and its enclosure/s listed below

GENERAL DESCRIPTION	CURRENCY	TOTAL VALUE (PRICE)
Name of Work: Development of green belt by providing Bamboo plantation for dust suppression at Koradi thermal power premises using Eco-Rejuvenation Technology at MAHAGENCO land area for controlling the pollution for Fodder Farm no-1, 2, 3 at 3x660MW, TPS, Koradi. Ref:- KTPS/PUR/18-19/CIVIL-660/e_82035	INR	11,292,600.00 One Crore Twelve Lakh Ninety Two Thousand Six Hundred only.

Please send all your correspondence regarding this order in duplicate. All terms and conditions below and on the reverse are to be strictly complied with.

DESPATCH DETAILS: For details refer enclosures.
Destination(Place, State): Koradi Thermal Power Station District Koradi Nagpur 441111 Maharashtra India

DOCUMENTATION : Please send us Commercial Invoice (One Original + Two Duplicate, duly signed), three copies of Delivery Challan, work completion certificate & LR immediately after dispatch of consignment.

BILLING : For details refer enclosures. Bills submitted against this Purchase Order must contain Purchase Order No. & Date, Purchase Order Item No. and Vendor code

PRICING & TAXATION:
Please refer details in Annexure I.

PAYMENT TERMS:
Please refer details in Annexure II.

For MSPGCL

Approved Through System

Sheet N

MAHAGENCO
Maharashtra State Power Generation Co. Ltd

PURCHASE ORDER

Maharashtra State Power Generation Company Limited
CHIEF ENGINEER,
KORADI THERMAL POWER STATION
KORADI, DIST. NAGPUR,
MAHARASHTRA 441111

[illegible] 262 [illegible] FAX: 262127, [illegible]
cegenkoradi@mahagenco.in
MSPGCL GSTIN 27AAECM2935R1ZV

PO NO.: KTPS/4500104439 PO Date : 18.04.2019

To, VENDOR CODE: 50021 GST No.: NATIONAL ENVIR ENGG RESEARCH INSTI NEHRU MARG NAGPUR 440 020 NAGPUR [illegible] Maharashtra India Telephone: 0712 22 [illegible] / Telefax: 0712 2249[illegible] E-Mail: [illegible] ATTN:	Our reference: Your reference: Procurement Type : Single Enquiry [illegible]

Please arrange to provide the goods / services described below strictly as per terms and conditions mentioned in this Purchase Order and enclosures listed below.

GENERAL DESCRIPTION	CURRENCY	TOTAL VALUE (PRICE)
Name of Work: Development of green belt by providing Bamboo plantation for dust suppression at Koradi thermal power premises using Eco-Rejuvenation Technology at MAHAGENCO land area for controlling the pollution for Fodder Farm no 1, 2, 3 at 3x660MW, TPS, Koradi Ref: KTPS/PUR/18-19/CIVIL-S60 [illegible]	INR	11,292,[illegible] One Crore Twelve Lakh Ninety Two Thousand [illegible] Hundred only

Please send all your correspondence regarding this order in duplicate. All terms and conditions below and on the reverse are to be strictly complied with.

DESPATCH DETAILS: For details refer enclosures.
Destination(Place, State): Koradi Thermal Power Station District Koradi Nagpur 441111 Maharashtra India

DOCUMENTATION : Please send us Commercial Invoice (One Original + Two Duplicate, duly signed), three copies of Delivery Challan, work completion certificate & LR immediately after dispatch of the consignment.

BILLING : For details refer enclosures. Bills submitted against this Purchase Order must contain Purchase Order No. & Date, Purchase Order Item No. and Vendor code.

PRICING & TAXATION: Please refer details in Annexure I. **PAYMENT TERMS:** Please refer details in Annexure II	For MSPGCL

(3)

Approved Through System

Sheet no (57)

MAHAGENCO

Maharashtra State Power Generation Company Limited
CHIEF ENGINEER
KORADI THERMAL POWER STATION
KORADI, DIST. NAGPUR
MAHARASHTRA

PURCHASE ORDER

PO NO.: KTPS/4500091073 PO Date : 21.02.2018

To,
VENDOR CODE : 50071
NATIONAL ENVIRONMENTAL ENGINEERING RESEARCH INSTITUTE
NEHRU MARG NAGPUR
NAGPUR
Maharashtra India

Our reference

Your reference

No - 2546 21.02.2018

GENERAL DESCRIPTION	CURRENCY	TOTAL VALUE (PRICE)
Services for development of first phase ... BAMBOO DIVERSITY green belt for dust suppression ... Technology at peripheral area ... with periodic monitoring ... KTPS, MSPGCL, Koradi	INR	[illegible]

DESPATCH DETAILS:
Destination Place, State: Koradi Thermal Power Station, District Koradi, Nagpur, Maharashtra India

DOCUMENTATION : Please send us Commercial Invoice in the Original + Two Duplicate, duly signed, three copies of Delivery Challan, work completion certificate & ...

BILLING : ... Bills submitted against this Purchase Order must contain Purchase Order No. & Date, Purchase Order Item No. and ...

PRICING & TAXATION:
Please refer details in Annexure I

PAYMENT TERMS:
Please refer details in Annexure II

For MSPGCL

CHIEF ENGINEER (O&M)
KORADI, KTPS

Annexure-19(a)

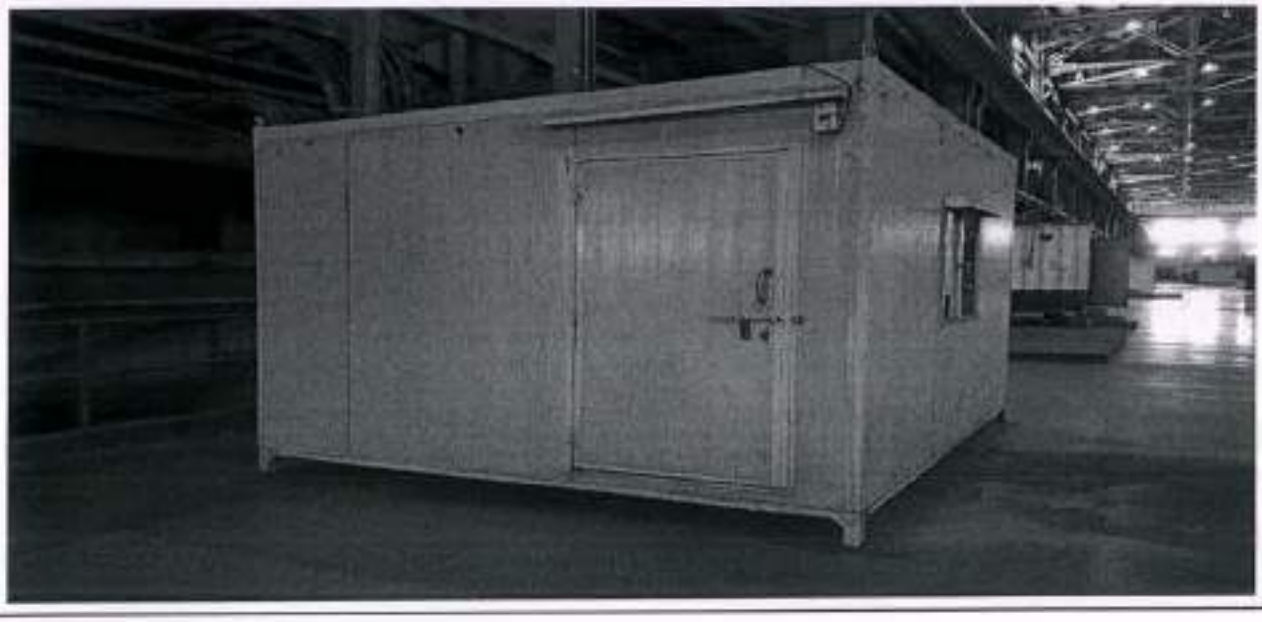
Koradi Thermal Power Station, 3X660 MW

Noise Monitoring Report for FY 2020- 2021 (JANUARY- 2021 DAY TIME)

UNIT # 8				UNIT # 9				UNIT # 10			
Sr. No.	Location	Parameter Lmax dB(A)	Parameter Lmin	Sr. No.	Location	Parameter Lmax	Parameter Lmin	Sr. No.	Location	Parameter Lmax	Parameter Lmin
1	Turbine Floor	89.1	85.8	1	Turbine Floor	88.4	85.3	1	Turbine Floor	87.6	85.3
2	PCR Unit No 8	59.8	57.4	2	PCR Unit No 9	64.7	61.2	2	PCR Unit No 10	55.4	53.2
3	Compressor Unit No.8	84.9	82.4	3	FD Fan Unit No 9 (RHS)	97.5	94.2	3	FD Fan Unit No 10 (RHS)	91.5	88.7
4	FD Fan Unit No 8 (RHS)	93.4	90.2	4	FD Fan Unit No 9 (LHS)	95.2	93.4	4	FD Fan Unit No 10 (LHS)	92.2	89.1
5	FD Fan Unit No 8 (LHS)	94.2	91.3	5	ID Fan Unit No 9 (RHS)	76.5	74.2	5	ID Fan Unit No 10 (RHS)	74.4	72.1
6	ID Fan Unit No 8 (RHS)	88.2	84.7	6	ID Fan Unit No 9 (LHS)	75.8	73.8	6	ID Fan Unit No 10 (LHS)	75.7	73.2
7	ID Fan Unit No 8 (LHS)	82.0	80.2	7	PA Fan Unit No 9 (RHS)	100.3	98.5	7	PA Fan Unit No 10 (RHS)	96.5	93.2
8	PA Fan Unit No 8 (RHS)	100.0	98.4	8	PA Fan Unit No 9 (LHS)	98.8	96.3	8	PA Fan Unit No 10 (LHS)	97.8	94.1
9	PA Fan Unit No 8 (LHS)	98.2	96.4	9	FD & ID Fan UNIT 9 Operater Cabin	70.7	68.3	9	FD & ID Fan UNIT 10 Operater Cabin	65.7	62.4
10	FD & ID Fan UNIT 8 Operater Cabin	74.6	72.0	10	Turbine Basement Unit No 9	90.4	88.2	10	AHP Pump House Unit No 10	86.8	84.4
11	AHP Pump House Unit No 8	88.2	85.4	11	Firing Floor Unit No 9	85.5	83.1	11	Turbine Basement Unit No 10	88.8	86.4
12	Turbine Basement Unit No 8	94.3	92.7	12	Bunker Level Unit No 9	84.3	82.7	12	Firing Floor Unit No 10	82.2	78.5
13	Firing Floor Unit No 8	89.4	87.2	13	Firing Floor Cabin	68.2	65.9	13	Bunker Level Unit No 10	77.2	75.1
14	Bunker Level Unit No 8	85.2	83.4	14	Compressor Cabin Unit No 8 & 9	64.7	62.5	14	Compressor Room Unit No 10	88.4	84.2
15	TTWR Pump House	82.4	80.2	15	TDBFP Unit No 9	90.2	86.4	15	Compressor Cabin Unit No 10	61.6	59.3
16	RWP	89.9	65.1	16	PA Fan UNIT 9 Operater Cabin	71.2	66.2	16	Switch Gear Unit 10 Operator Cabin	61.2	58.4
17	Disc Filtration	64.5	62.4	17	DG Set Unit No 9	96.6	92.3	17	Swas Lab Unit No 10	84.5	81.4
18	Canteen	84.2	82.1	18	Wagon Tippler- 3	83.4	80.2	18	TDBFP Unit No 10	89.4	85.1
19	Firing Floor Cabin	71.3	70.2	19	25 KLD STP	83.2	80.4	19	PA Fan UNIT 10 Operater Cabin	72.4	69.2
20	Switch Gear 8 & 9 Operator Cabin	61.3	59.4	20	DM Plant	70.8	68.4	20	DG Set Unit No 10	95.8	93.4
21	Swas Lab Unit 8 & 9	63.4	60.2	21	PTP	69.3	65.4	21	ETP Pump House	89.4	85.2
22	TTWR Cabin	58.2	56.4	22	Crusher House- 1	81.3	78.4	22	Crusher House- 2	78.2	75.4
23	TDBFP Unit 8	93.9	92.1	23	CPU	60.1	58.9	23	ETP CMB Pump House	83.5	78.2
24	PA Fan Unit No 8 Operator Cabin	74.6	72.4	24	Main Gate	64.2	61.4				
25	DG Set spare	89.4	86.3								

Air Compressor Operator Cabin

Turbine Floor Operator Cabin



Annexure-20

Mahabal Enviro Engineers Pvt. Ltd.

Engineers, Consultants, Environmental Monitoring Laboratory & Contractors
Plot Nos. 13,14,17,18, Grampanchayat Bokhara, 8 km from Nagpur City,
Opp. Patel Petrol Pump, Chhindwara Road, Koradi, Dist.Nagapur-441111
Phone : 91-712-2612162 **T/Fax:** 91-712-2612212 **Email:** nagpur@mahabal.com

Ref. No. : **MEEPL/KTPS/2020-21/02**

Date : 08th June,2021

To,
THE CHIEF ENGINEER (Gen. O&M),
M. S. POWER GENERATION CO. Ltd.,
Koradi Thermal Power Station (3X660MW)
Koradi, Dist. Nagpur

Kind Atten.: Executive Chemist (WTP)

Sub.: Ground Level Concentration study at 3 X 660 MW KTPS Koradi.

Ref.: Your PO No. KTPS/4550005523/0951 Date. 24.09.2020

Dear Sir,
Refernce to above, herewith we are submitting 2 copies of Ground Level Concentration study report for the month of **March -2021.**

We hope you will find the same in order.

Thanking you and assuring you of our the best and prompt services at all the time, we remain.

For **Mahabal Enviro Engineers Pvt. Ltd.**

Nitin Chavan
BRANCH MANAGER

Encl. : Detail Report

Plot No. P-7, Road No. 21, MIDC Wagle Estate, Thane West - 400604, Maharashtra
(600 m from Hotel Rukhmini Palace Turn Opp Toyota Show Room. Next to Ashida Electrical - near J B Sawant Bus Stop)
Phone: 2582 0658/ 3139/ 1663/ 3154 Fax: 91-22-25823543 thane@mahabal.com

GROUND LEVEL CONCENTRATION STUDY

This Study report is prepared to know 'Ground Level Concentration of Particulate Matter, Sulphur Dioxide & Nitrogen Dioxide in Ambient Air Quality' being carried out for 3 X 660 MW, Koradi Thermal Power Station.

The objective of preparing this study is to provide a conceptual information regarding concentration of pollutant in the 10 kms radius surrounding area of the industry. The common methodology is used for collecting the information for the study.

As such methodology framework has been designed considering specific objectives and available infrastructure, resources, technical know-how, time frame, etc.

Content

1. Introduction

Koradi Thermal Power Station 660 MW of Maharashtra has the power generation capacity of 1980 MW with three units of 660 MW each using super critical technology parameters. The super critical technology is more environment-friendly. KTPS 660 MW TPS is located at about 11 Km to the north of Nagpur city on National Highway 69. Its North latitude is 21º 24' 36.85º and East longitude is 79º 09'97.14º.

Nagpur is mineral rich district with a moderate forest spread over 31.5% of total land. Based on available minerals and abundant water, industries have been set up within and in the surrounding of Nagpur. KTPS 660 MW is located near old 210 MW TPS units. General slope is township SW from SE. Saoner, Sillewara, Walani, Bhanegaon, Singroli and other coal mines are located towards north of KTPS 660 MW and also North-East side. The mined coal is supplied to Koradi Thermal Power Station. From various source of WCL, MCL, SECL and foreign origin to KTPS by rail. All WCL mines generally produce coal of E & F grade. Urban environmental concerns in the district are air pollution due to coal burning industries and auto-exhaust. Municipal solid waste, bio-medical waste, untreated domestic sewage and also the urban sanitation area other issues of concern.

Topographical feature of core and buffer zones (5 km, 10km and 25 km radius respectively) are given in the **Table 1.1.**

Map1.1: Topographical feature

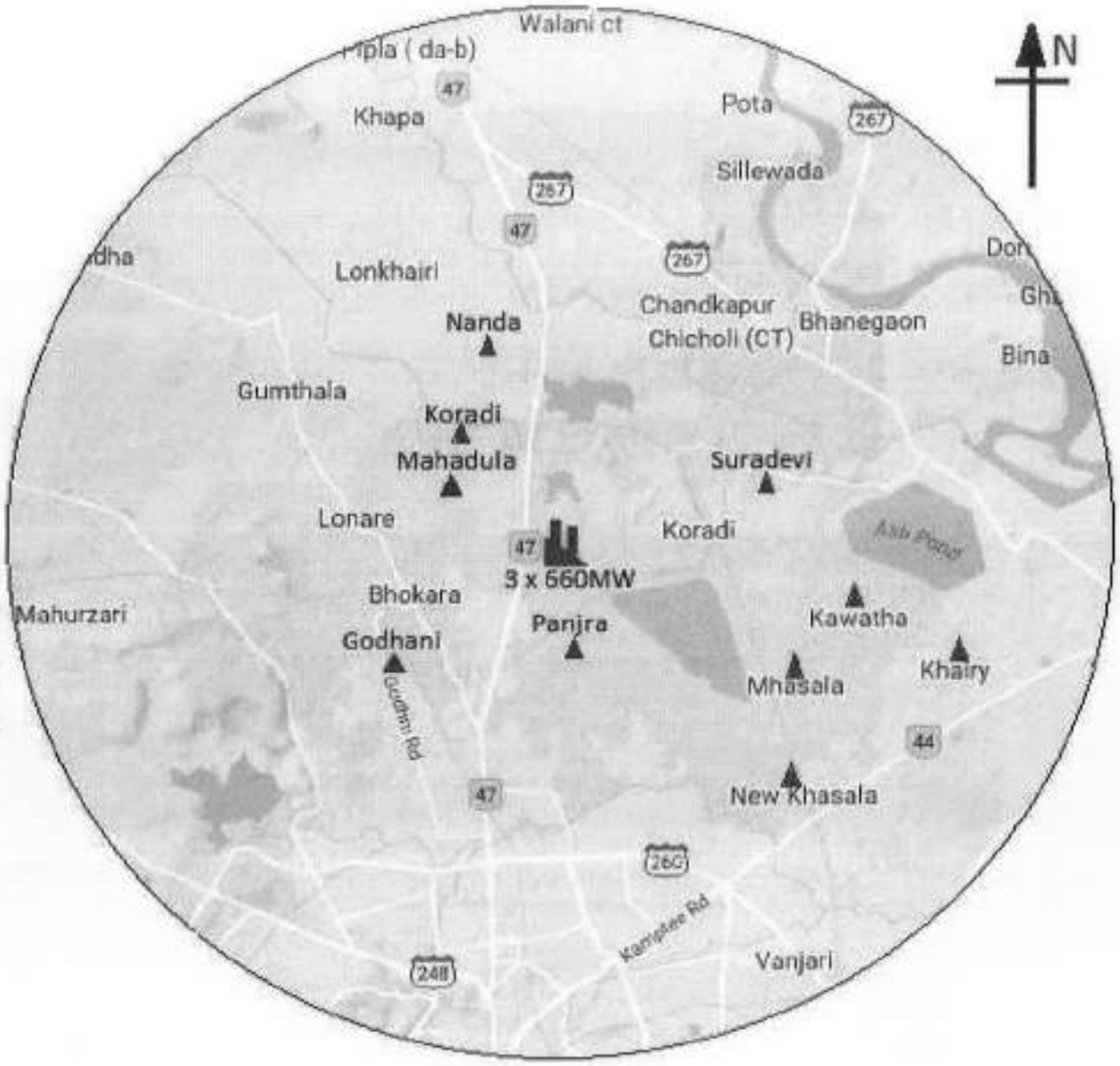


Table 1.1: Topographical feature of core buffer zones

Area 5 Km	Villages	: Mahadula,Koradi,Panjra.Nanda.Suradevi,Kavtha. Mhasala,Khairi,Khasala,Ghogli,Godhani,Bhokara,Lonara. Gumthi,Gumthla,Chankapur. Chicholi, Bhanegaon, Kawatha, Lonkhairi,Sillewara. Pota, etc.
	Surface Drains	: Kolar river
	Water body	: Koradi Lake (Pond no. 3)
	Others Features	: Coal mines at Sillewara, Bhanegaon, Singori, Roadway-Nagpur-Chhindwara Road
10 Km	Villages	: Walani. Pardi, Khandala, Rohana, Tamaswadi, Ttagaon, Bigalwadi. Hingana, Dorli, Ghatrohana, Khairi. Yerkheda. Khasala, Gharpad, Pawangaon, Mankapur, Wadi. Chicholi, Fetari, Mahurzari, Brohmwada, Walani, Sawarmendha, Champa, Dahegaon, Tandurwani, Itangoti, Patansawangi, Yetur, Kamptee, etc.
	Surface Drains	: Kanhan river & Kolar river
	Water body	: As above
	Others Features	: Roadway-Nagpur-Chhindwara Road
25 Km	Villages	: Dahagaon, Chicholi, Wabholi, Kirnapur, Karanbhad, Bhagimaheri, Amgaon, Parseoni, Gundhali, Chichbhuwan, Palora, Nilkund, Khandala, Mahadi, Dumarikala, Mandgaon, Nimkheda, Borada, Tekodi, Gondegaon, Hiwara, Kanhan, Kandri, Junikamptee, Khandala, Sihora, Kalmana, Lihigaon, Kodali. Kapsi, Bhartwada, Pardi, Khapri,Mahalgaon, Dighori, Bidgaon, Tarodi kh, Manewada, Khamla, Khapri, Hingna, Sonegaon, Gondkheri, Yerla, Khadgon, Ashti, Kalmeshwar, Bamhani, Zunki, Khairi(Lakhmaji), Sindi, Sonapur, Dhapewada, Sillod, Adasa, Kadoli, Borgaon, Kusumbi, Takli, Manegaon, Bhendala, Saoner, Waki, wakodi, etc.
	Surface Drains	: Kolar river, Kanhan river
	Others Features	: Roadway-Nagpur-Chhindwara Road
	Water body	: Gorewada lake, Amabazari lake & Koradi lake (Pond No. 3) etc.
	Others Features	: In addition to above Malu Paper Mills Ltd. and number of coal mines exist within this area.

Koradi Thermal Power Station burns large amount of coal every year which results in generation of ash. This ash is collected as bottom ash and some is arrested by electrostatic precipitator (ESP). The remaining ash escapes through stacks.
Coal burned results in the production of carbon monoxide, particulates, sulphur dioxide, hydrocarbons and oxides of nitrogen. All these pollutants of varying composition are thrown into the atmosphere in the form of gases. Thus the combustion of coal, which forms the major operations in power generation, results in the emissions that comprises of these pollutants in the form of flue gases.

Whenever any toxic gases are released in to the atmosphere, they mix with air and get diluted. The prevailing winds transport the gases and disperse, thus diluting the concentration and reducing the toxicity. The ground level concentration of a location is the concentration of particular pollutants at that location. The amount of concentration at a site is cumulative of the stack and other indicated sources. These sources include traffic on the highway and agricultural fields.

2. PROPERTIES OF THE POLLUTANTS

The emissions from the stack are composed of particulate matter, sulphur dioxide and oxides of nitrogen. The emission may also contain hydrocarbon & carbon monoxide which arise due to the incomplete combustion of fossil fuel products. The plant under consideration i.e. uses fuel only for the initial firing of a boiler and hence emissions such as hydrocarbons are not of much concern.
The particulate matter has physical characteristics like size, mode of formation, setting characteristics and optical properties. They also possess chemical characteristics of organic nature and biological properties as well. Emissions from KTPS 660 MW stacks comprises of finally divided non-combustible particles in the flue gas after the combustion of coal. Inherent minerals and metallic substances in coal are normally expected in stack emissions. Once emitted, they will settle depending upon their sizes and tendency for agglomeration.

2.1 PARTICULATE MATTER:

"Particulate matter," also known as particle pollution or PM, is a complex mixture of extremely small particles and liquid droplets. Particle pollution is made up of a number of components, including acids (such as nitrates and sulphates), organic chemicals, metals, and soil or dust particles. Some particles, such as dust, dirt, soot, or smoke, are large or dark enough to be seen with the naked eye. Others are so small they can only be detected using an electron microscope.

Particle pollution includes "inhalable coarse particles," with diameters larger than 2.5 micrometres and smaller than 10 micrometres and "fine particles," with diameters that are 2.5 micrometres and smaller. How small is 2.5 micrometres? Think about a single hair from your head. The average human hair is about 70 micrometres in diameter – making it 30 times larger than the largest fine particle.

These particles come in many sizes and shapes and can be made up of hundreds of different chemicals. Some particles, known as primary particles are emitted directly from a source, such as power plant, industries, construction sites, coal handling, unpaved roads, fields, smokestacks or fires. Others form in complicated reactions in the atmosphere of chemicals such as sulfur dioxides and nitrogen oxides that are emitted from power plants, industries and automobiles. These particles, known as secondary particles, make up most of the fine particle pollution in the country.

The size of particles is directly linked to their potential for causing health problems. Small particles less than 10 micrometers in diameter pose the greatest problems, because they can get deep into your lungs, and some may even get into your bloodstream.

Exposure to such particles can affect both your lungs and your heart. Small particles of concern include "inhalable coarse particles" (such as those found near roadways and dusty industries), which are larger than 2.5 micrometers and smaller than 10 micrometers in diameter; and "fine particles" (such as those found in smoke and haze), which are 2.5 micrometers in diameter and smaller.

The Air Act requires EPA to set air quality standards to protect both public health and the public welfare (e.g. visibility, crops and vegetation). Particle pollution affects both.

2.1.1 Health Effects:

Particle pollution - especially fine particles - contains microscopic solids or liquid droplets that are so small that they can get deep into the lungs and cause serious

health problems. Numerous scientific studies have linked particle pollution exposure to a variety of problems, including:

- premature death in people with heart or lung disease,
- nonfatal heart attacks,
- irregular heartbeat,
- aggravated asthma,
- decreased lung function, and
- Increased respiratory symptoms, such as irritation of the airways, coughing or difficulty breathing.

People with heart or lung diseases, children and older adults are the most likely to be affected by particle pollution exposure. However, even if you are healthy, you may experience temporary symptoms from exposure to elevated levels of particle pollution.

2.1.2 Environmental Effects:

Visibility impairment

Fine particles ($PM_{2.5}$) are the main cause of reduced visibility (haze) in parts of the environment, including many of our treasured national parks and wilderness areas.

Environmental damage

Particles can be carried over long distances by wind and then settle on ground or water. The effects of this settling include: making lakes and streams acidic; changing the nutrient balance in coastal waters and large river basins; depleting the nutrients in soil; damaging sensitive forests and farm crops; and affecting the diversity of ecosystems.

Aesthetic damage

Particle pollution can stain and damage stone and other materials, including culturally important objects such as statues and monuments.

2.2 SULPHUR DIOXIDES:

Sulphur dioxide (SO_2) is one of a group of highly reactive gasses known as "oxides of sulphur." The largest sources of SO_2 emissions are from fossil fuel combustion at power plants (73%) and other industrial facilities (20%). Smaller sources of SO_2 emissions include industrial processes such as extracting metal from ore, and the burning of high sulphur containing fuels by locomotives, large ships, and non-road equipment. SO_2 is linked with a number of adverse effects on the respiratory system.

Current scientific evidence links short-term exposures to SO_2, ranging from 5 minutes to 24 hours, with an array of adverse respiratory effects including

bronchoconstriction and increased asthma symptoms. These effects are particularly important for asthmatics at elevated ventilation rates (e.g., while exercising or playing.)

Studies also show a connection between short-term exposure and increased visits to emergency departments and hospital admissions for respiratory illnesses, particularly in at-risk populations including children, the elderly, and asthmatics.

National Ambient Air Quality Standard for SO_2 is designed to protect against exposure to the entire group of sulfur oxides (SOx). SO_2 is the component of greatest concern and is used as the indicator for the larger group of gaseous sulphur oxides (SOx). Other gaseous sulphur oxides (e.g. SO_3) are found in the atmosphere at concentrations much lower than SO_2.

Emissions that lead to high concentrations of SO_2 generally also lead to the formation of other SOx. Control measures that reduce SO_2 can generally be expected to reduce people's exposures to all gaseous SOx. This may have the important co-benefit of reducing the formation of fine sulphate particles, which pose significant public health threats.

SOx can react with other compounds in the atmosphere to form small particles. These particles penetrate deeply into sensitive parts of the lungs and can cause or worsen respiratory disease, such as emphysema and bronchitis, and can aggravate existing heart disease, leading to increased hospital admissions and premature death.

As alone the SPM emission is hazardous but the effect of SPM together with Sulphur dioxide has more significance e.g. 200 $\mu g/m^3$ of SO_2 (24 hr average) will impair the health of the workers which intern will increase absenteeism. Normally, hairs in the nose remove all SPM over 10 µm. If the sizes vary from 2 to 10 µm then particles are carried from wind pipes to mouth from where they are swallowed. This cause suffocation and aggravation of asthma and chronic bronchitis. This leads to a condition known as "pneumoconiosis".

2.3 NITROGEN DIOXIDES:

Nitrogen dioxide (NO_2) is one of a group of highly reactive gasses known as "oxides of nitrogen," or "nitrogen oxides (NOx)." Other nitrogen oxides include nitrous acid and nitric acid. National Ambient Air Quality Standard uses NO_2 as the indicator for the larger group of nitrogen oxides. NO_2 forms quickly from emissions from cars, trucks and buses, power plants, and off-road equipment. In addition to

contributing to the formation of ground-level ozone, and fine particle pollution, NO_2 is linked with a number of adverse effects on the respiratory system.

Current scientific evidence links short-term NO_2 exposures, ranging from 30 minutes to 24 hours, with adverse respiratory effects including airway inflammation in healthy people and increased respiratory symptoms in people with asthma.

NO_2 concentrations in vehicles and near roadways are appreciably higher than those measured at monitors in the current network. In fact, in-vehicle concentrations can be 2-3 times higher than measured at nearby area-wide monitors. Near-roadway (within about 50 meters) concentrations of NO_2 have been measured to be approximately 30 to 100% higher than concentrations away from roadways.

NO_2 exposure concentrations near roadways are of particular concern for susceptible individuals, including people with asthma asthmatics, children, and the elderly

The sum of nitric oxide (NO) and NO_2 is commonly called nitrogen oxides or NOx. Other oxides of nitrogen including nitrous acid and nitric acid are part of the nitrogen oxide family. NO_2 is the component of greatest interest and the indicator for the larger group of nitrogen oxides.

NOx react with ammonia, moisture, and other compounds to form small particles. These small particles penetrate deeply into sensitive parts of the lungs and can cause or worsen respiratory disease, such as emphysema and bronchitis, and can aggravate existing heart disease, leading to increased hospital admissions and premature death.

Ozone is formed when NOx and volatile organic compounds react in the presence of heat and sunlight. Children, the elderly, people with lung diseases such as asthma, and people who work or exercise outside are at risk for adverse effects from ozone. These include reduction in lung function and increased respiratory symptoms as well as respiratory-related emergency department visits, hospital admissions, and possibly premature deaths.

Emissions that lead to the formation of NO_2 generally also lead to the formation of other NOx. Emissions control measures leading to reductions in NO_2 can generally be expected to reduce population exposures to all gaseous NOx. This may have the important co-benefit of reducing the formation of ozone and fine particles both of which pose significant public health threats.

Table 2.3: Characteristics of some important air pollutants and their effects on human beings and animals

Pollutant	Characteristics	Effects
Particulate matter	Solid particle or liquid droplets including fumes, smoke, dusts. Solid particular can adsorb various chemicals.	Respiratory diseases, toxicity from metallic dusts, silicosis and asbestosis from the specific dusts. Damage of DNA in the lungs.
Oxides of Sulphur (SOx)	SOx comprise of SO_2 (97-99%) & SO_3 (1-3%). It is colourless, heavy & water soluble gas. Rapidly diffusing, acid forming oxidizing agent. Reacts with water forming sulphuric acid.	Absorbs quickly and irritates the upper respiratory tract. The sulphuric acid formed lowers pH. Leads to bronchial spasms breathlessness and increased susceptibility for infection. Irritation of throat and eyes.
Oxides of Nitrogen (NOx)	NOx comprises of NO, NO_2 & N_2O. NO is colourless and slightly soluble in water. NO_2 can travel in the respiratory systems. It is also involved in the formation of Ozone in the atmosphere.	Forms bonds with haemoglobin and reduce the efficiency of oxygen transport. Respiratory irritation, headache, impairment of lung defences, loss of appetite and corrosion of teeth.

3. AIR QUALITY MANAGEMENT

Environmental concerns for large scale of operation of KTPS 660MW make it mandatory to monitor the pollution from power plant on regular basis. Three pollutants are being monitored to meet the statutory requirement of MPCB namely SPM, SO_2 and NOx. There are two methods for measurement of SPM viz. (i) Settleable particulates by dust fall and (ii) suspended particulates by high volume sampler.

As far as air pollution is concerned, KTPS 660MW is having a very sound air quality management which believes in keeping the atmosphere free from any hazardous emissions from their site. MPCB have laid down limits for the stack emission monitoring at KTPS 660MW of **50 mg/Nm^3** for SPM. Whereas, National ambient air quality standards prescribed are given in **Table 3.1.**

To keep a check on the emissions, KTPS 660MW undertaken a routine monitoring of the stacks. They are maintaining monthly reports of all the data regarding the amount of pollutants emitted from the stack.

Regular surveillance is being carried out by KTPS 660 MW and records so generated have been used in this report to find out the relation between meteorology and natural purification factors like temperature, lapse rate, stability, pressure, wind speed, wind direction, humidity etc.

Table 3.1: The National Ambient Air Quality Standards (2009) for 24 Hrs Avg

Pollutants	Time Weighted Average	Concentration in Ambient Air		Methods of Measurement
		Industrial, Residential, Rural and other Areas	Ecologically, Sensitive Area (Notified by Central Government)	
Sulphur Dioxide (SO_2), µg/m³	Annual * 24 Hours **	50 80	20 80	- Improved West and Gaeke Method - Ultra violet Fluorescence
Nitrogen Dioxide (NO_2), µg/m³	Annual * 24 Hours **	40 80	30 80	- Jacob & Hochheiser modified (NaOH-NaAsO2) Method - Gas Phase Chemiluminescence
Particulate Matter (Size less than 10µm) or PM_{10}, µg/m³	Annual * 24 Hours **	60 100	60 100	- Gravimetric - TEOM - Beta attenuation
Particulate Matter (Size less than 2.5 µm) or PM2.5, µg/m³	Annual * 24 Hours **	40 60	40 60	- Gravimetric - TEOM - Beta attenuation

*Annual Arithmetic mean of minimum 104 measurements in a year at a particular site taken twice a week 24 hourly at uniform intervals.

**24 hourly or 8 hourly or 1 hourly monitored values, as applicable, shall be complied with 98 % of the time in a year. 2% of the time, they may exceed the limits but not on two consecutive days of monitoring.

NOTE: Whenever and her ever monitoring results on two consecutive days of monitoring exceed the limits specified above for the respective category; it shall be considered adequate reason to institute regular or continuous monitoring and further investigations.

3.2 Vehicular Emissions:

The total length in Nagpur District is 12589 km road length; within the municipal areas is about 1073 km. Many more different types of vehicles are run in Nagpur districts. MSRTC is running the public transport in the district (like buses). The contribution of these buses in the vehicular emissions in Nagpur has not been estimated so far the based on modified emission factors and the conditions of buses.

Many more different types of Vehicles play on Nagpur-Chhindwara & Nagpur-Jabalpur roads per hours. These two routes closely touch the Koradi Thermal Power Station 660 MW. The main pollutants from automobile exhaust are particulate matter, hydrocarbons, carbon monoxide, NOx and some amount of SO_2.

3.3 Coal Handling:

There are few coal depot mines on Nagpur- Saoner highway. These depots are responsible for the generation of the large coal dust emissions leading to deterioration of air quality due to suspended particulate matter in those areas. The families living in these areas are dependent on the coal as a fuel for their cooking.

The coal is easily available in Nagpur and its surrounding villages as the coal mines are covered this large area. It is generally observed that this coal is used as cheap alternative to the other fuel sources. It is mainly used in the villages nearer the coal mines and also in the slum areas for cooking and also for water heating purposes. It is reported that a household using coal uses approximately 7 to 8 kg of coal for domestic purposes. Further it is regularly used by hotels and dhabas on Nagpur-Chhindwara road. This burning of hard coal is major source of air emission periods. This is one of the important reasons for the appearance of a smog-blanket in Koradi and in all the villages where coal is cheaply available. The emissions from this activity contribute significantly to the local air pollution and resultant health problems.

4. FACTORS AFFECTING GROUND LEVEL CONCENTRATIONS

The main factors governing the Ground Level Concentration of a location is the meteorological condition prevailing in and around KTPS 660 MW TPS. Climatically

Nagpur is the hottest place in Maharashtra. Atmosphere is dump and humid/ sultry. Mean daily temperature in November is 19° - 39° C. Rainy season is between middle June to Middle October. SW monsoon - is the main source. Total rainfall is about 600-1000 mm/year. February is windy. The wind direction which is the important aspects as far as GLC is concerned is mainly between West and South-west. In summer the winds are basically concentrated between North-West to South-West directions with the intensity being light to moderate with some increase in speed. During the monsoon season winds are mostly in South-West direction. The winter season is from December to February. In winter, the winds are basically concentrated between North-West and North-East directions.

As wind play a role in dispersion the air pollutants, another factors i.e. temperature inversion can be neglected. Temperature inversion plays an important role in the dispersion of the air pollutants in the atmosphere. Generally temperature decreases with height, the rate of such decrease of temperature is about 6 °C to 10 °C per km at the adiabatic lapse rate at a given point may be less than 6 °C per km or even reversed (i.e. temperature may increase instead of decreasing with height). For some times of the day or nights, especially during the colder months of December, January & February in India, the air tends to stagnate.

In fact relatively stable layers of air occur at lap's rates (less than 1.8°C per Km). These layers become increasingly stable and finally full inversion condition is attained. As far as central part of India is concerned, the inversion/stable layers extending from ground level at 100 meters to 300 meters or so are considered important for air pollution point of view. Keeping in view the effect of Inversion the stack for the some industrial and Thermal Power Plant are required to be design to overcome the pollution problem.

The Inversion phenomenon in India is rather favourable. The inversion do not last more than a few hrs at a time and thus the build-up pollutant concentration is not very intense. As far as Nagpur area concerned the Inversion layers are experienced in winter on some occasions but normally the skies are clear and emissions disperse over wide range. The thick layers of Inversion are normally observed within the range of 200 meter and small percentage of inversion extends beyond 600 meters.

Inversion data collected in the past at Nagpur meteorological station. The diffusion profile of the stack emission mainly depends on the stability of the atmosphere. The condition around the stack at KTPS 660 MW TPS experiences a super-adiabatic lapse rate predominantly is summer. In such a situation the atmosphere is set to

be in an unstable equilibrium. It is under such condition when the pollutants are rapidly dispersed due to considerable vertical mixing of air. At this point the mentioned regarding plume behaviour is inevitable. When super-adiabatic lapse rate occurs "looping plumes" are observed resulting in bringing high concentration of plume gases to the ground for short period.

When inversion persists then dispersion of pollutants is at minimum and a "fanning" plume can be seen at Nagpur during cloudy days in the downwind direction. If inversions were too frequent at Nagpur then increasing the stack heights would be justified. Low GLC values are possible if the inversion conditions exist below the stack heights, resulting in "lofting" plume. Such a plume has minimum downward mixing and pollutants are dispersed downwind without any significant GLC.

"Fumigating" plume at Nagpur will occur only in winter in the early hours at the time when morning sun breaks up radiation inversion. This accounts for high GLC during relatively short periods in the morning. A plume can be trapped if inversion layer prevail above and below the stack.

The climatic condition around KTPS 660 MW TPS is predominantly clear with light winds blowing from north-west to south-east in summer. This condition ensures good dispersion of the pollutants released from the stacks.

4.1 PURPOSE OF PRESENT WORK:

The main purpose of this study is to forecast the ground level concentration of the pollutants including SPM, SO_2 and NOx emitted from KTPS 660 MW TPS in the area surrounding the power station. The study will give a clear idea about the relation between the emission from the stacks and their impact on the surrounding region.

4.2 Climate:

The Climate of this region can be classified as tropical hot climate with high range of temperature throughout the year primarily, there two prominent seasons in the district – The very hot summer and moderate winter. The summer months are very hot and prolonged while winter is short and mild. The monsoon season starts immediately after summer till late September. The southwest monsoon brings lot of rainfall during rainy season and there is no draught prone area in this district.

The temperature starts decreasing from the month of October. The daily mean temperature starts rising from the month of February and May is the peak summer month when mean maximum temperature goes up to 45^{0}C and minimum temperature is 28^{0}C to 29^{0}C. In severe hot conditions temperature raises up to 46^{0}C. However temperature starts reducing after May due to on-set of monsoon, which last from June to September when it is hot and humid. During the month of March-2021 maximum temperature recorded is 39.9 ^{0}C and minimum temperature is 19.0 ^{0}C as mention in **table 4.3**.

The annual rainfall is about 775.7 mm. The rainfall recorded during the **March 2021** is 14.9 mm. From April 20 to March 21 rainfall recorded is **712.2 mm**. Average numbers of rainy days is 60 to 65 throughout the region. The relative humidity is very high during monsoon season, which exceeds 90%, but after winter season it falls down rapidly and in summer it is only 10%. The Maximum Humidity recorded in the month of March 2021 is 94 % and minimum humidity is 27 %.

Table 4.3: Monthly Average meteorological data

DATE	Ambient Temperature (°C)		Relative Humidity (%)		Prominent Wind Direction	Avg.Wind Speed (m/sec)	RainFall (mm)	Atmospheric Pressure (mm)
	Max	Min	Max	Min				
1-Mar-21	35.2	19.8	58	33	NW	1.1	0.0	733
2-Mar-21	34.8	19.0	63	27	NW	1.3	0.0	731
3-Mar-21	29.1	26.3	94	76	SW	1.1	0.0	729
4-Mar-21	37.1	19.4	62	28	W	0.8	0.0	732
5-Mar-21	36.9	20.2	55	30	NW	1.0	0.0	729
6-Mar-21	36.6	19.7	60	27	SE	1.1	0.0	730
7-Mar-21	36.9	20.1	58	28	SE	0.8	0.0	731
8-Mar-21	37.2	21.4	60	31	E	0.7	0.0	732
9-Mar-21	37.8	22.9	58	32	NW	2.8	0.0	732
10-Mar-21	37.6	22.3	61	32	W	1.4	0.0	723
11-Mar-21	36.4	22.9	66	34	E	0.5	0.1	732
12-Mar-21	35.6	21.5	64	34	E	0.5	5.3	732
13-Mar-21	33.2	21.9	66	40	E	1.1	0.0	731
14-Mar-21	35.1	21.4	72	38	NW	0.7	0.0	731
15-Mar-21	30.4	22.5	67	34	NW	1.8	0.0	724
16-Mar-21	36.4	22.9	67	35	NW	0.7	0.0	729
17-Mar-21	35.9	23.5	63	35	E	1.6	0.0	721
18-Mar-21	31.4	24.1	63	46	E	1.2	0.0	732
19-Mar-21	30.6	21.1	81	49	NW	0.4	7.2	732
20-Mar-21	35.3	21.2	84	39	NW	1.0	1.8	732
21-Mar-21	36.9	22.0	72	36	NW	1.1	0.0	733
22-Mar-21	31.8	23.8	67	40	W	0.8	3.5	735
23-Mar-21	25.6	23.2	77	57	NW	0.4	0.3	736
24-Mar-21	36.5	20.9	77	36	NW	1.2	0.0	736
25-Mar-21	31.7	25.3	87	57	W	0.5	0.0	737
26-Mar-21	37.3	22.9	58	30	NW	0.4	0.0	737
27-Mar-21	38.1	21.9	54	29	NW	1.2	0.0	733
28-Mar-21	39.3	24.7	84	61	NW	1.5	0.0	730
29-Mar-21	33.6	22.5	76	53	NW	0.7	0.0	732
30-Mar-21	34.2	24.4	92	54	NW	1.2	0.0	733
31-Mar-21	35.1	25.9	76	53	W	0.7	0.0	730
Average	**33.3**	**19.0**	**14**	**27**	**NW**	**1.0**	**14.9**	**731**

WIND ROSE DIGRAM
KORADI THARMAL POWER STATION
MAHARASTRA STATE POWER GENERATION CO. LTD.

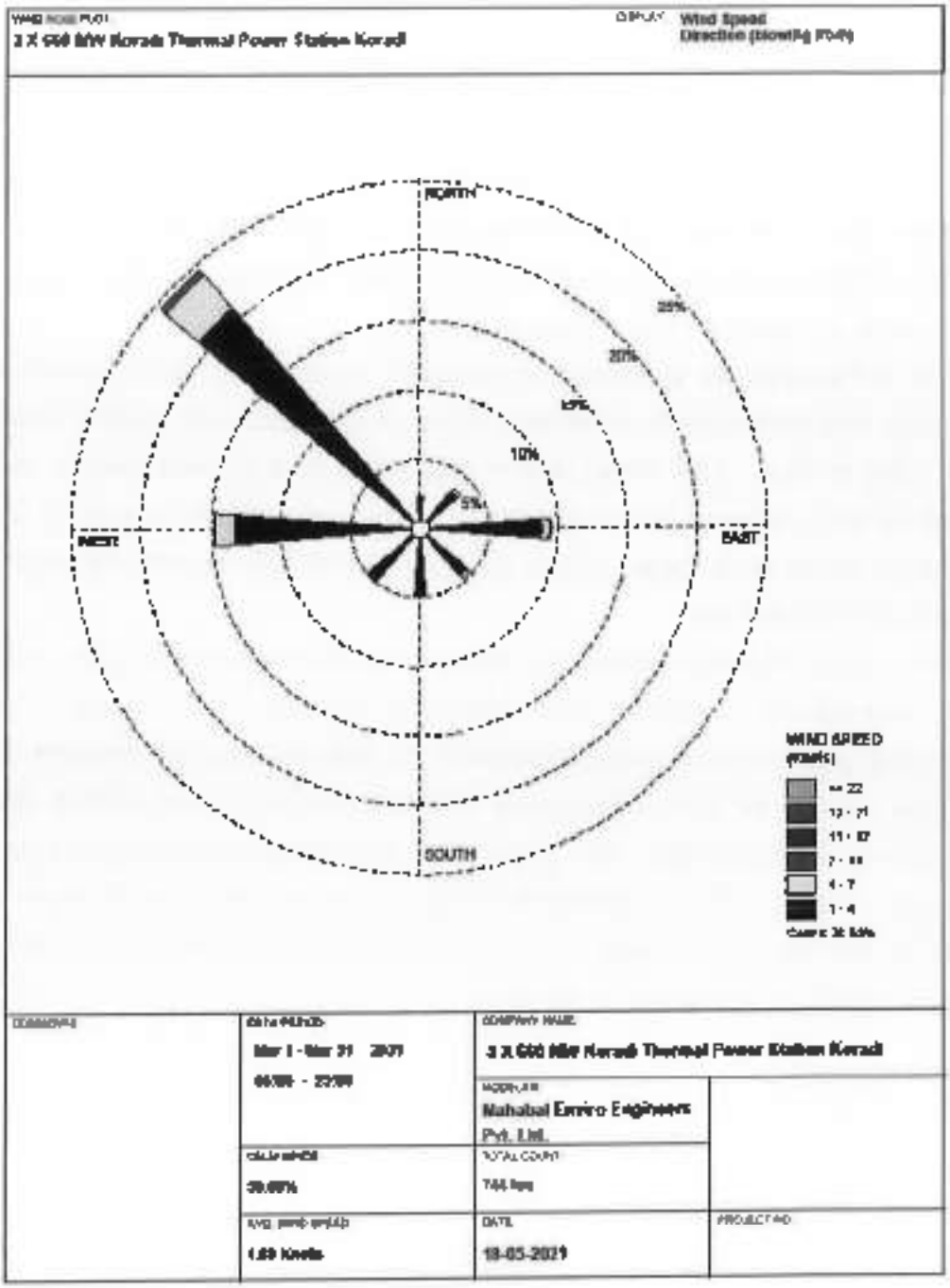


Fig.4.3: Wind Rose Diagram of KTPS 660 MW Koradi

5. ESTIMATION OF GLC

Major pollution loads from KTPS 660 MW are due to gaseous & particulate emissions. Impacts of these would be respectively on air, water bodies and the soil. Magnitude and significance of these impacts depend on the chemical nature of these pollutants.

Air pollutants released from stationery, mobile as fugitive sources within KTPS 660 MW area are transported due to atmospheric dispassion process. Stack emissions and fugitive emissions have more significance than mobile sources at KTPS 660 MW. Pollutants form these sources will be dispersed into atmosphere. Dispersion depends on stack emission parameters like flue gas composition, quantity, temperature, velocity and meteorological conditions viz. ambient temperature & wind speed, severity of impact on receptor depends on the concentration of pollutant, its duration and nature of receptors.

Wind is the primary atmospheric transport mechanism. Wind pattern varies with season and atmospheric condition. Wind speed varies with height which is known as 'wind shears'. Wind shear within CHP which is at ground level is different than that at stack height. Hence dispersion pattern of SPM from ground and elevated sources would be different due to varying wind shears at stack heights of units 8,9 & 10 at KTPS 660 MW.

Atmospheric stability is related to the rise and falling volumes of air. It is a function of temperature gradient, atmospheric turbulence, wind speed, isolation etc. Thermal gradient varies with location of the industry and the gradient indicates the actual region of the atmosphere where emissions from stacks and ambient parameters intermingle. This is confined to mixing layer. Mixing layer is at that height or regions of the atmosphere which is capped by warm air layer which would inhibit any movement past it in the upward direction. Height of mixing layer in a region affects the dispassion process.

5.1 ESTIMATION OF GLC AT DOWN WIND DISTANCE

In order to assess the anticipated ground level concentration of various pollutants namely SPM, SO_2 and NOx, efforts have been made to work out the concentration, using appropriate atmospheric dispersion models. The model used in the study is ISCST3 from USEPA and it has been widely accepted and validated for Indian conditions.

Forecasting requires information on maximum mixing depth (MMD). This is estimated by plotting maximum surface temperature and drawing a line parallel to the dry adiabatic temperature to the point at which the line intersects the ambient lapse rate for early morning period.

5.2. Dispersion Modelling

Dispersion of pollutants have been estimated using USEPA's dispersion model namely Industrial Source Complex (ISCST3) Dispersion Model. . The geography and setting of co-ordinates are taken by assigning origin (0.0) at stack Unit No.1. The settings are detailed in **Fig 5.1** showing aerial view of KTPS 660 MW along with stack co-ordinates. Meteorological data was collected during the month of March 2021 and used for modeling. Stack emission rates in terms of g/sec and stack dimensions were obtained from KTPS 660 MW. ISCST3 model was run using rural terrain and since height of all stacks are much above the buildings around downwash has not been considered for the purpose of GLC calculations. The details of stacks considered in the modeling are shown in **Table 5.1** and emission rates of SO_2, NOx and SPM are reported in **Table 5.2**. The ground level concentration has been predicted in the radius of 10 km. The results obtained using ISCST3 for 24 hr average concentrations at various locations are reported in **Table 5.3, 5.4 and 5.5** for SO_2, NOx and SPM respectively. The angles in first column of **Table 5.3 - 5.5** are starting from x-axis and in clockwise direction as referred in **Fig 5.1**.

Fig 5.1: Ariel view of three stacks at Koradi Thermal Power Station (660MW).

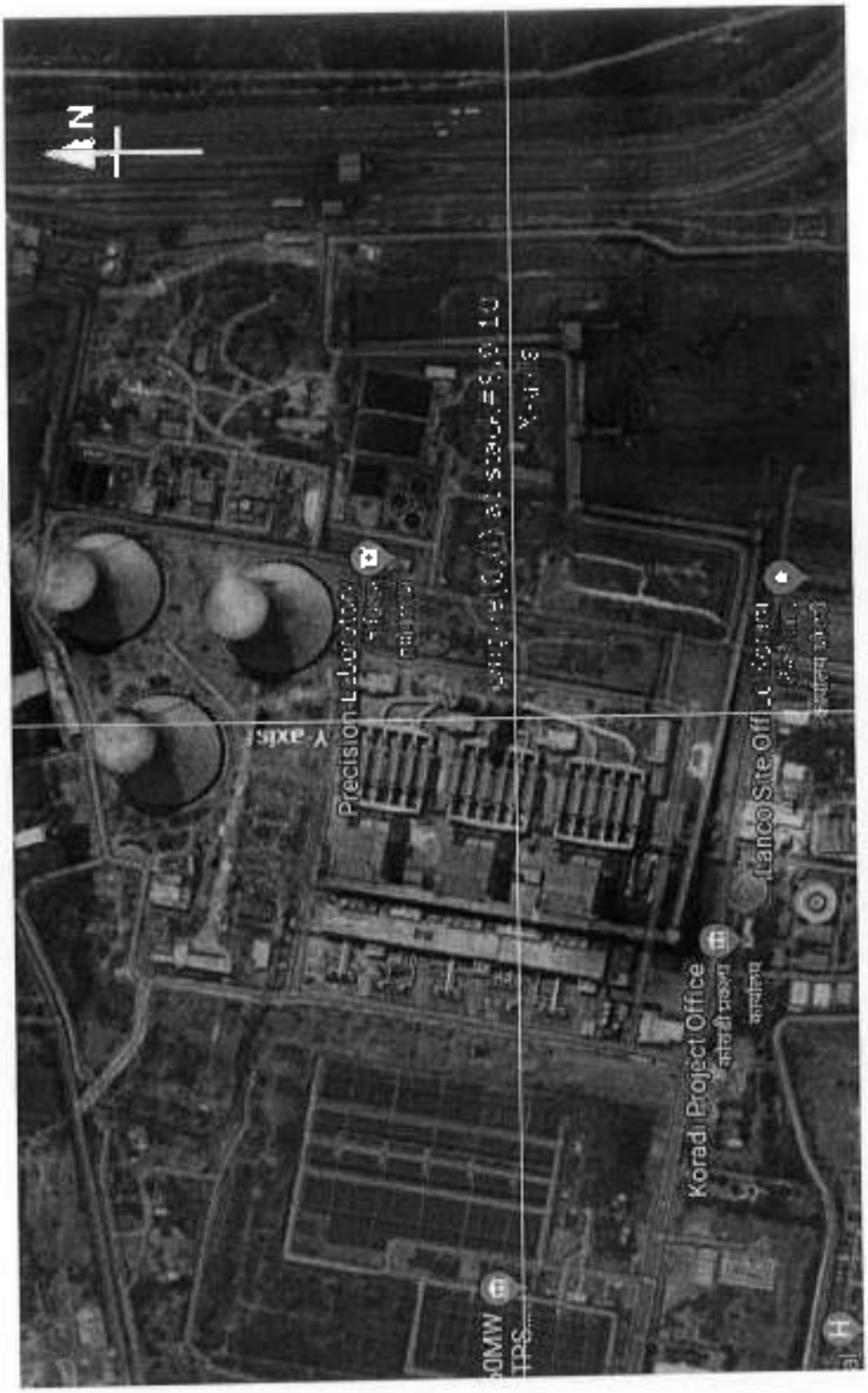


Table 5.1 Details of Stack Emission at 3 X 660 MW KTPS Koradi

Source	Stack height (m)	Stack temp (°C)	Average exit velocity (m/sec)	Stack Top Diameter internal (m)
STACK -8	275	115	24.5	7
STACK -9	275	111	23.5	7
STACK -10	275	114	23.6	7

Table 5.2: Emission rates from each stack

(March 2021)

Source	Average Emission rates (gm/sec)		
	SPM	SO_2	NOx
STACK -8	47.1	1507.8	285.5
STACK -9	43.4	1454.4	283.8
STACK -10	37.2	1477.9	276.0

Table 5.3: 744-hr Average ground level concentrations of SO_2 predicted at various locations in 10 km radius, units of concentration µg/m³

DIRECTION (DEGREES)	DISTANCE(METERS)								
	200	400	600	1000	2000	3000	5000	8000	10000
10	0.00	0.00	0.0'	0.30	1.48	1.03	0.63	0 39	0.31
20	0.00	0 00	0.00	0.10	0.63	0.33	0 14	0.06	0.04
30	0.00	0.00	0.00	0.01	0.14	0.04	0.01	0.00	0.00
40	0.00	0.00	0.00	0.00	0.02	0.10	0.24	0.21	0.16
50	0.00	0.00	0.00	0.00	0.10	0.1!	0.24	0 21	0.16
60	0.00	0.00	0.01	0.19	0.99	0.29	0.07	0.02	0.01
70	0.00	0.00	0.14	1.67	4.87	2.59	1.14	0.52	0.35
80	0.00	0.00	0.62	4.91	'2.21	8.88	5.74	3.59	2.84
90	0.00	0.00	0.96	6 81	16.51	13.33	9.83	6.82	5.67
100	0.00	0.00	0.62	4.93	12.35	8.90	5.74	3.60	2.84
110	0.00	0.00	0.18	2 11	5.98	3.06	1.30	0.58	0.39
120	0.00	0.00	0.29	2 27	5.24	3.11	1.69	0.92	0.68
130	0.00	0.00	0.70	4.11	8.24	6.90	5.60	4.26	3.62
140	0.00	0.00	0.70	4.11	8.15	6.89	5.60	4.26	3.62
150	0.00	0.00	0.28	2.09	4.25	2.82	1.63	0.90	0.67
160	0.00	0.00	0.03	0.44	1.12	0.47	0.16	0.06	0.03
170	0.00	0.00	0.00	0.02	0.13	0.03	0.00	0.00	0.00
180	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
190	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
200	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
210	0 00	0.00	0.00	0.00	0.00	0.00	0 00	0.00	0.00
220	0 00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
230	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00
240	0.00	0.00	0.00	0.03	0.30	0.09	0.02	0.00	0.00
250	0.00	0.00	0.01	0.29	1.43	0.76	0.34	0.15	0.10
260	0.00	0.00	0.04	0.87	3.45	2.67	1.94	1.24	0.98
270	0.00	0.00	0.06	1.20	4.61	4.14	3.77	2.84	2.37
280	0.00	0.00	0.04	0.87	3.50	2.68	1.94	1.24	0.98
290	0.00	0.00	0.01	0.45	1.88	0.95	0.41	0 18	0.12
300	0.00	0.00	0.06	0.78	2.07	1.18	0.60	0.32	0.24
310	0.00	0.00	0.16	1.47	3.37	2.45	1.60	1.06	0.87
320	0.00	0.00	0.16	1.47	3.36	2.45	1.60	1.06	0.87
330	0.00	0.00	0 06	0.76	1.91	1.14	0.59	0.32	0.24
340	0.00	0.00	0.01	0 26	1.09	0.52	0.20	0.09	0.06
350	0.00	0.00	0.01	0.31	'.53	1.04	0.63	0.39	0.3'
360	0.00	0.00	0.02	0 42	1.94	1.49	1.02	0.70	0.56

Table5.3A: The summary of 744-hr average ground level concentrations of SO_2

Particulars	Average Concentration (µg/m3)	Direction (Degrees)	Distance (meter)
1ST HIGHEST VALUE	**16.51**	90	2000
2ND HIGHEST VALUE	**13.33**	90	3000
3RD HIGHEST VALUE	**12.35**	100	2000
4TH HIGHEST VALUE	**12.21**	80	2000
5TH HIGHEST VALUE	**9.83**	90	5000
6TH HIGHEST VALUE	**8.90**	100	3000
7TH HIGHEST VALUE	**8.68**	80	3000
8TH HIGHEST VALUE	**8.24**	130	2000
9TH HIGHEST VALUE	**8.15**	140	2000
10TH HIGHEST VALUE	**6.90**	140	3000

Table 5.4: 744-hr Average ground level concentrations of NOx predicted at various locations in 10 km radius, units of concentration µg/m³

DIRECTION (DEGREES)	DISTANCE(METERS)								
	200	400	800	1000	2000	3000	5000	8000	10000
10	0.00	0.00	0.00	0.06	0.28	0.20	0.12	0.07	0.06
20	0.00	0.00	0.00	0.02	0.12	0.06	0.03	0.01	0.01
30	0.00	0.00	0.00	0.00	0.03	0.01	0.00	0.00	0.00
40	0.00	0.00	0.00	0.00	0.00	0.02	0.05	0.04	0.03
50	0.00	0.00	0.00	0.00	0.02	0.02	0.05	0.04	0.03
60	0.00	0.00	0.00	0.04	0.19	0.06	0.01	0.00	0.00
70	0.00	0.00	0.03	0.32	0.93	0.49	0.22	0.10	0.07
80	0.00	0.00	0.12	0.94	2.33	1.69	1.09	0.69	0.54
90	0.00	0.00	0.18	1.30	**3.15**	2.54	1.87	1.30	1.08
100	0.00	0.00	0.12	0.94	2.35	1.70	1.10	0.69	0.54
110	0.00	0.00	0.03	0.40	1.14	0.56	0.25	0.11	0.07
120	0.00	0.00	0.06	0.43	1.00	0.59	0.32	0.17	0.13
130	0.00	0.00	0.13	0.78	1.57	1.32	1.07	0.81	0.69
140	0.00	0.00	0.13	0.78	1.55	1.31	1.07	0.81	0.69
150	0.00	0.00	0.05	0.40	0.81	0.54	0.31	0.17	0.13
160	0.00	0.00	0.01	0.06	0.21	0.09	0.03	0.01	0.01
170	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00
180	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
190	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
200	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
210	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
220	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
230	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00
240	0.00	0.00	0.00	0.01	0.06	0.02	0.00	0.00	0.00
250	0.00	0.00	0.00	0.06	0.27	0.15	0.07	0.03	0.02
260	0.00	0.00	0.01	0.17	0.66	0.51	0.37	0.24	0.19
270	0.00	0.00	0.01	0.23	0.88	0.79	0.72	0.54	0.45
280	0.00	0.00	0.01	0.17	0.67	0.51	0.37	0.24	0.19
290	0.00	0.00	0.00	0.09	0.36	0.18	0.08	0.03	0.02
300	0.00	0.00	0.01	0.15	0.40	0.23	0.11	0.06	0.05
310	0.00	0.00	0.03	0.28	0.64	0.47	0.30	0.20	0.17
320	0.00	0.00	0.03	0.28	0.64	0.47	0.30	0.20	0.17
330	0.00	0.00	0.01	0.14	0.36	0.22	0.11	0.06	0.05
340	0.00	0.00	0.00	0.05	0.21	0.10	0.04	0.02	0.01
350	0.00	0.00	0.00	0.06	0.29	0.20	0.12	0.07	0.06
360	0.00	0.00	0.00	0.08	0.37	0.28	0.19	0.13	0.11

Table5.4A: The summary of 744-hr average ground level concentrations of No2

Particulars	Average Concentration (ug/m3)	Direction (Degrees)	Distance (meter)
1ST HIGHEST VALUE	3.15	90	2000
2ND HIGHEST VALUE	2.54	90	3000
3RD HIGHEST VALUE	2.35	100	2000
4TH HIGHEST VALUE	2.33	80	2000
5TH HIGHEST VALUE	1.87	90	5000
6TH HIGHEST VALUE	1.70	100	3000
7TH HIGHEST VALUE	1.69	80	3000
8TH HIGHEST VALUE	1.57	130	2000
9TH HIGHEST VALUE	1.55	140	2000
10TH HIGHEST VALUE	1.32	140	3000

Table 5.5: 744-hr Average ground level concentrations of SPM predicted at various locations in 10 km radius. units of concentration µg/m³

DIRECTION (DEGREES)	DISTANCE(METERS)								
	200	400	600	1000	2000	3000	5000	8000	10000
10	0.00	0.00	0.00	0.01	0.04	0.03	0.02	0.01	0.01
20	0.00	0.00	0.00	0.00	0.02	0.01	0.00	0.00	0.00
30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
40	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00
50	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00
60	0.00	0.00	0.00	0.01	0.03	0.02	0.00	0.00	0.00
70	0.00	0.00	0.00	0.05	0.14	0.07	0.03	0.01	0.01
80	0.00	0.00	0.02	0.14	0.35	0.25	0.16	0.10	0.08
90	0.00	0.00	0.03	0.20	0.47	0.38	0.28	0.20	0.16
100	0.00	0.00	0.02	0.14	0.35	0.26	0.16	0.10	0.08
110	0.00	0.00	0.01	0.06	0.17	0.09	0.04	0.02	0.01
120	0.00	0.00	0.01	0.07	0.15	0.09	0.05	0.03	0.02
130	0.00	0.00	0.02	0.12	0.24	0.20	0.16	0.12	0.10
140	0.00	0.00	0.02	0.12	0.23	0.20	0.16	0.12	0.10
150	0.00	0.00	0.01	0.06	0.12	0.08	0.05	0.03	0.02
160	0.00	0.00	0.00	0.01	0.03	0.01	0.00	0.00	0.00
170	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
180	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
190	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
200	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
210	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
220	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
230	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
240	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00
250	0.00	0.00	0.00	0.01	0.04	0.02	0.01	0.00	0.00
260	0.00	0.00	0.00	0.03	0.10	0.08	0.06	0.04	0.03
270	0.00	0.00	0.00	0.03	0.13	0.12	0.11	0.08	0.07
280	0.00	0.00	0.00	0.03	0.10	0.08	0.06	0.04	0.03
290	0.00	0.00	0.00	0.01	0.05	0.03	0.01	0.01	0.00
300	0.00	0.00	0.00	0.02	0.06	0.03	0.02	0.01	0.01
310	0.00	0.00	0.00	0.04	0.10	0.07	0.05	0.03	0.03
320	0.00	0.00	0.00	0.04	0.10	0.07	0.05	0.03	0.03
330	0.00	0.00	0.00	0.02	0.05	0.03	0.02	0.01	0.01
340	0.00	0.00	0.00	0.01	0.03	0.01	0.01	0.00	0.00
350	0.00	0.00	0.00	0.01	0.04	0.03	0.02	0.01	0.01
360	0.00	0.00	0.00	0.01	0.06	0.04	0.03	0.02	0.02

Table5.5A: The summary of 744-hr average ground level concentrations of SPM

Particulars	Average Concentration (µg/m3)	Direction (Degrees)	Distance (meter)
1ST HIGHEST VALUE	**0.47**	90	2000
2ND HIGHEST VALUE	**0.38**	90	3000
3RD HIGHEST VALUE	**0.35**	100	2000
4TH HIGHEST VALUE	**0.35**	00	2000
5TH HIGHEST VALUE	**0.28**	90	5000
6TH HIGHEST VALUE	**0.26**	100	3000
7TH HIGHEST VALUE	**0.25**	80	3000
8TH HIGHEST VALUE	**0.24**	130	2000
9TH HIGHEST VALUE	**0.23**	140	2000
10TH HIGHEST VALUE	**0.20**	140	3000

6.0 Observations

It may be observed from the **Table 5.3** that the maximum Ground level concentration of SO_2, 1st highest value is **16.51** and 2nd highest value is **13.33 µg/m³** occurs at distance of 2 km & 3 km in the direction 90 degree i.e. East direction of the plant. In **Table 5.4 & 5.5** the maximum GLC for NOx 1st highest value is **3.15** and 2nd highest value is **2.54 µg/m³** and SPM 1st highest value is **0.47** and 2nd highest value is **0.38 µg/m³** respectively, occurs at the same place as 1st and 2nd highest concentration of SO_2.

The graphical presentation in contour and surface plot of concentration in 10 km radius for SO_2, NOx and PM are predicted in **Fig No. 5.3 A&B, 5.4 A&B and 5.5 A&B** respectively.

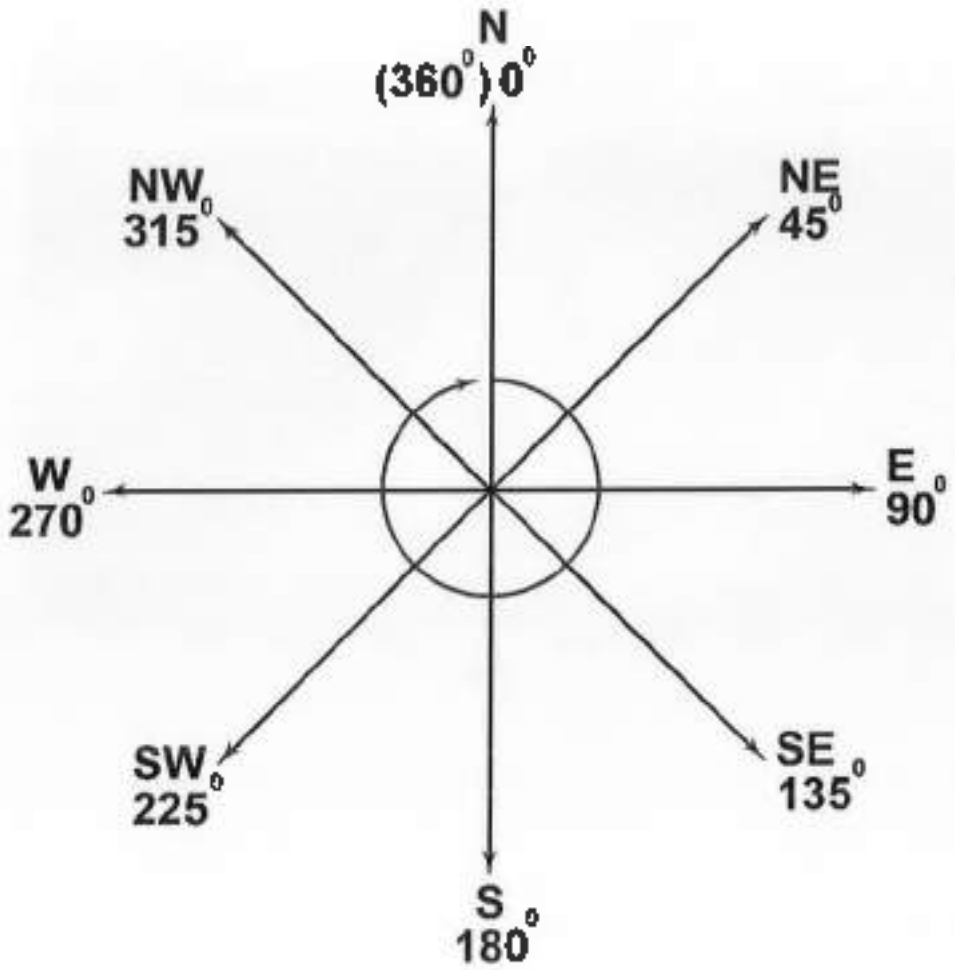
Mostly the concentrations of these pollutants are higher in the West and North direction with prevailing meteorological conditions during the month of March 2021.

The ground level concentrations with respect to ambient air quality monitoring have been monitored at various places around Koradi 660 MW TPS and same reported in **Table No. 5.10**.

Table 5.10: GLC monitored at various AAQ locations around KTPS 660MW during March 2021

Sr. No	Location	Dist. From KTPS (660 MW) TPS (km)	Direction w. r. t. KTPS (660 MW) TPS	Ambient Air Quality Concentration		
				PM_{10} ($\mu g/m^3$)	SO_2 ($\mu g/m^3$)	NO_2 ($\mu g/m^3$)
1	Mhasala Village	4.9	SW	72	14	16
2	Khairi Village	6.7	E	64	12	15
3	Kawatha Village	5.0	E	59	16	14
4	Khasala Village	6.6	SW	78	16	18
5	Godhani Village	6.0	W	59	10	14
6	Suradevi Village	2.3	E	64	16	18
7	Nanda Village	3.0	NW	62	14	18
8	Koradi Village	1.7	NW	59	12	16
9	Mahadulla	2.0	W	61	12	13
10	Panjra Village	2.3	SW	76	19	21

Directions with respect to Degrees



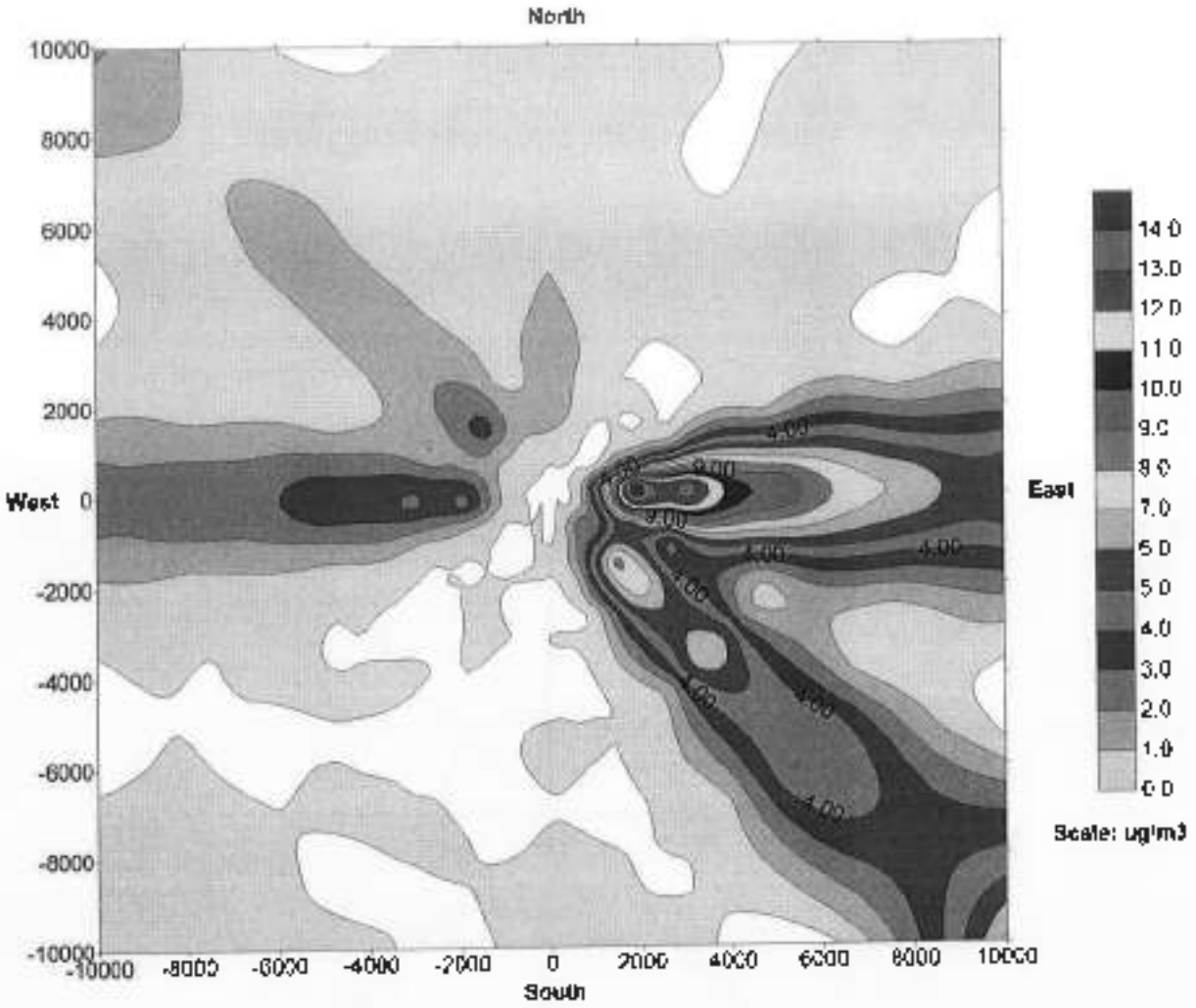


Fig. 5.3 A: Contour plot showing ground level concentration of SO_2 ($\mu g/m^3$) in 10 km radius

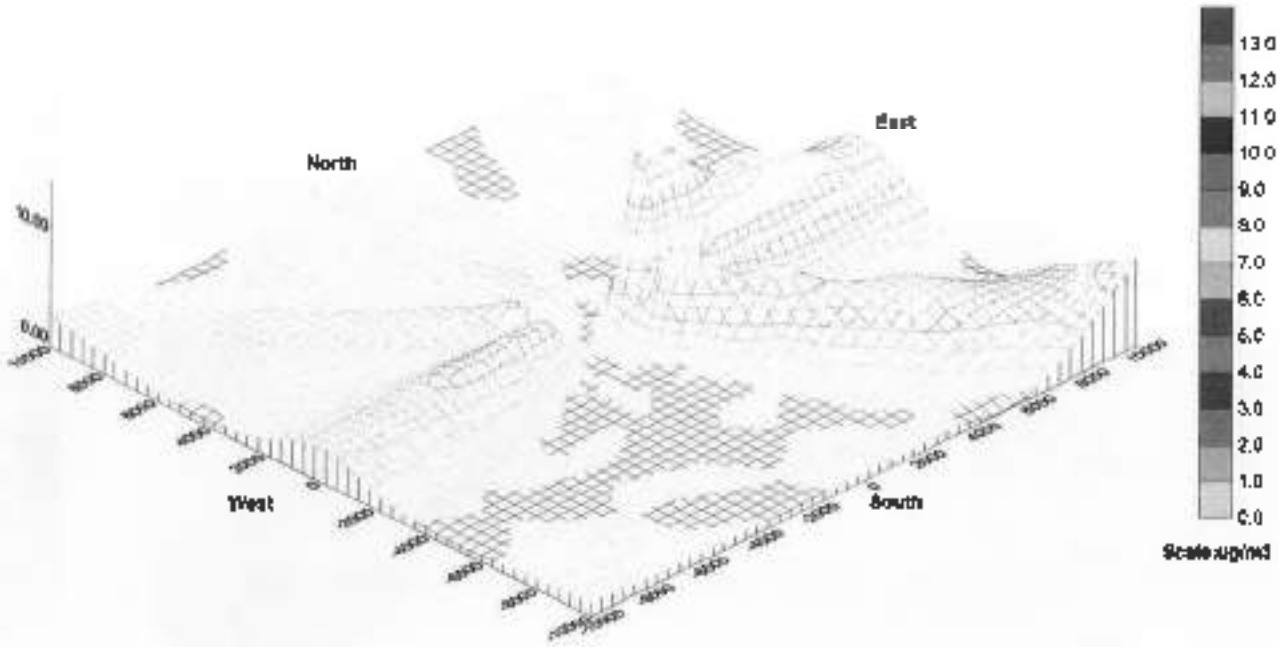


Fig. 5.3 B: Surface plot showing ground level concentration of SO_2 ($\mu g/m^3$) in 10 km radius

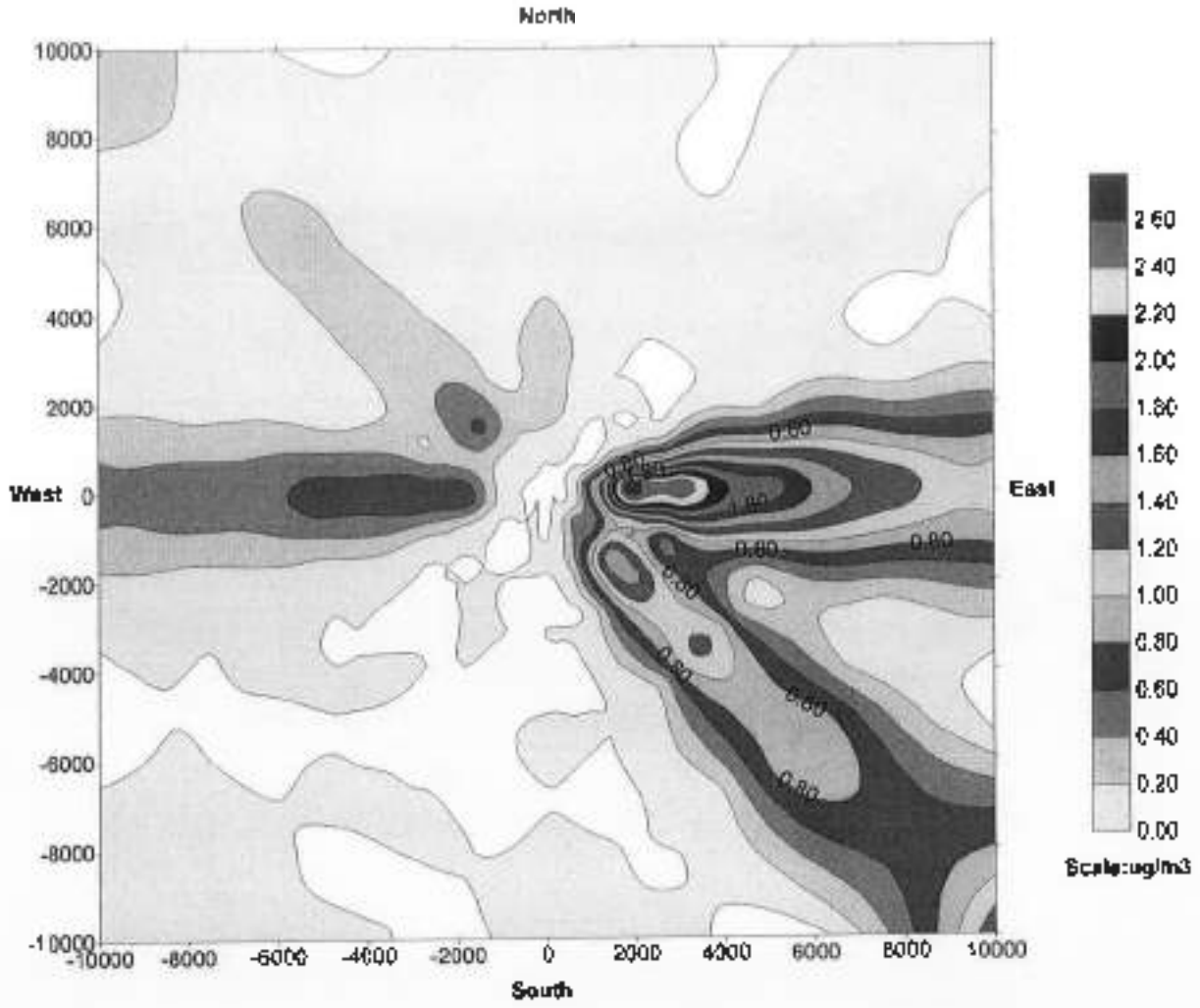


Fig. 5.4A: Contour plot showing ground level concentration of NOx (µg/m³) n 10 km radius

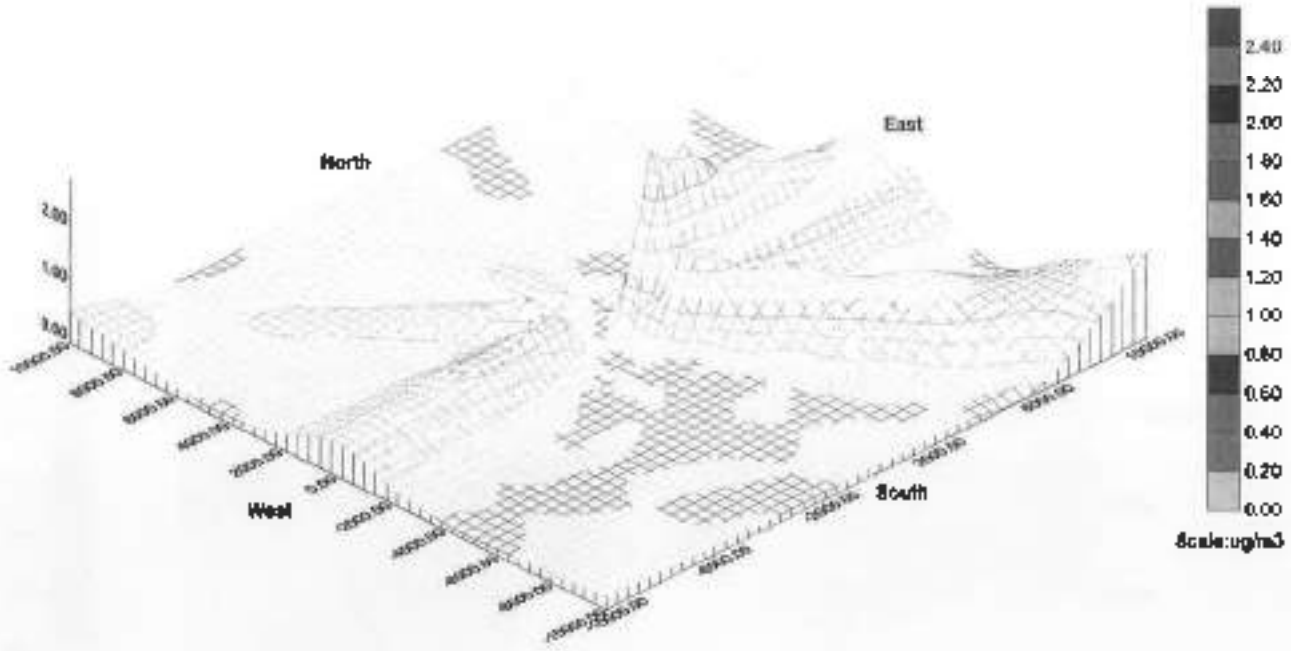


Fig. 5.48: Surface plot showing ground level concentration of NOx (µg/m³) In 10 km radius

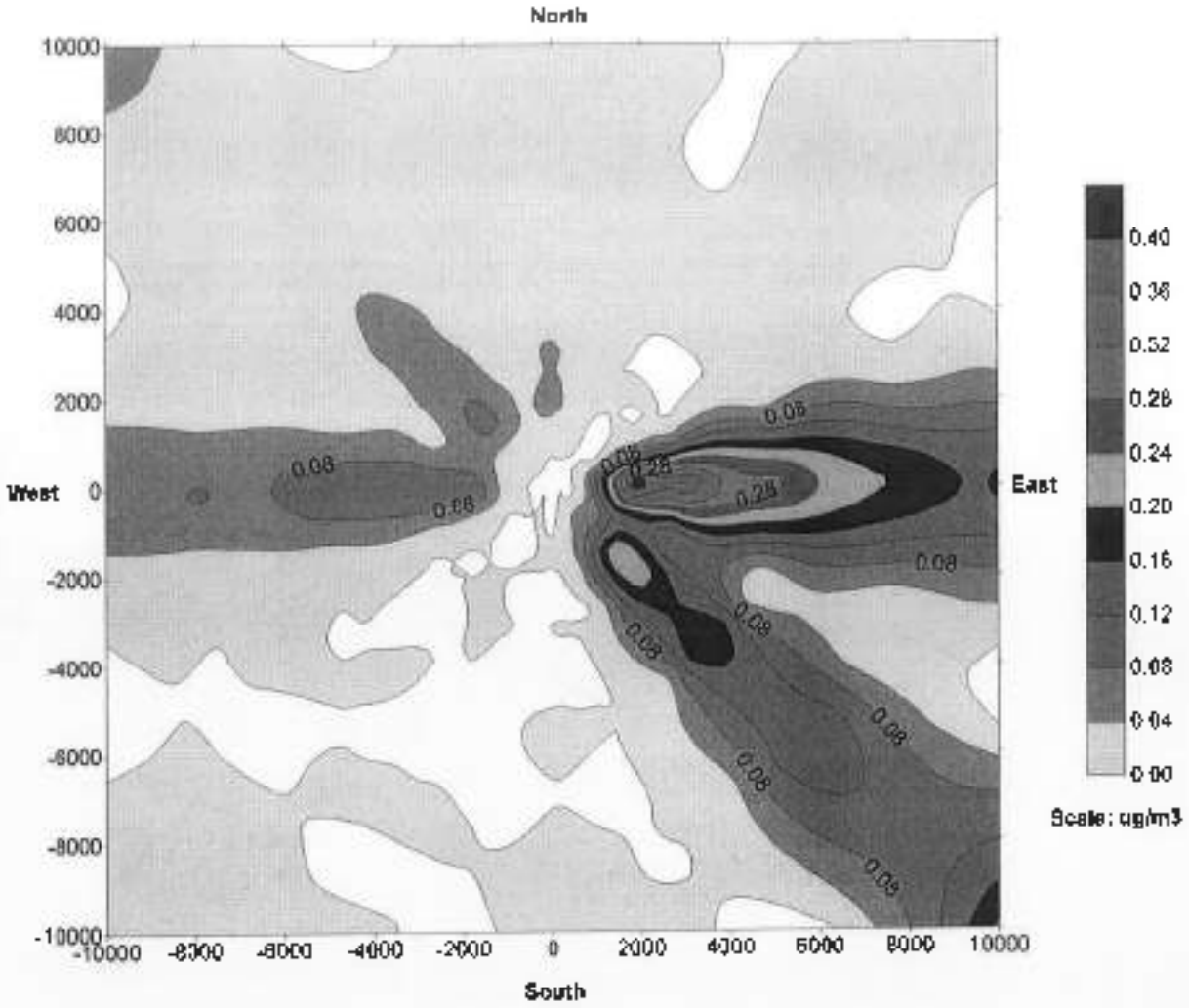


Fig.5.5A: Contour plot showing ground level concentration of PM (µg/m³) in 10 km radius

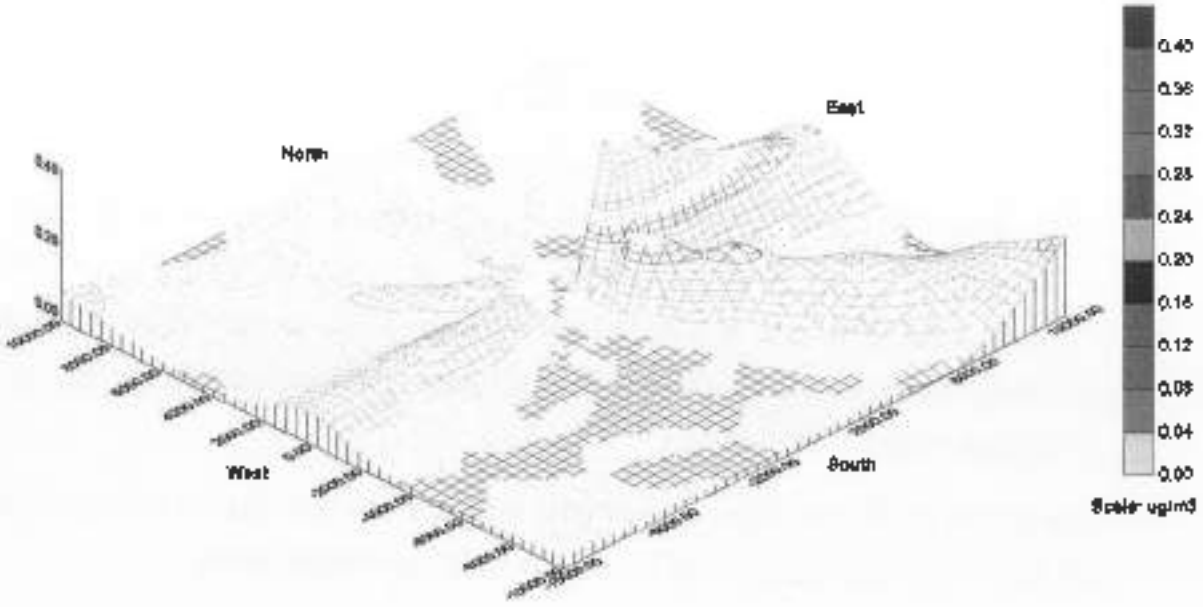


Fig.5.5B: Surface plot showing ground level concentration of PM [µg/m^3] in 10 km radius

7.0 CONCLUSION

The concentrations of pollutants predicted by Industrial Source Complex (ISCST3) Dispersion Model at various locations are well within permissible limits.

During the period March predominant wind directions was NW. The highest ground level concentrations are appearing at locations from West and within distance of about 5 kms.

The locations near the source are vulnerable to pollutants up to 10 km area surrounding the source. Depending upon the wind upon the wind direction from Meteorological data, surrounding area gets affected. Mostly the concentrations of these pollutants are higher in the East and South-East of the plant with prevailing meteorological conditions. However the concentrations are in within permissible limits.

Agricultural fields and tree plantation reduced the severity of concentration of pollutants. Thus concentrations are well within permissible limits.

Annexure - 21

EXECUTIVE SUMMARY

- Maharashtra State Electricity Generation Co. Ltd (MAHAGENCO) is the largest producer of thermal power in Maharashtra.
- One of the oldest power stations viz. Koradi Thermal Power Station (KTPS) is located at Koradi ,about 16-18 km to the north of Nagpur. Installed capacity of KTPS was 1100 MW. It occupies 1458 ha area. Existing KTPS has seven operational units. Their capacities are 4 x 120, 2 x 210 & 1 x 200 MW units.
- MAHAGENCO had earlier proposed 2 x 800 MW units at KTPS in lieu of 4 x 120 MW de-rated units and as a part of government's policy to augment electricity generation in order to partially fulfill the shortage.
- Terms of reference (TOR) for 2 x 800 MW units were received following a presentation at EAC meeting of MOEF.
- Subsequently, MAHAGENCO had to alter the configuration to 3 x 660 MW in view of State Government decision on power plants and ready availability of units. MAHAGENCO had informed MOEF accordingly.
- MoEF vide its letter dated J-13012/87/2007-IA-II(T) dated 12th May, 2008 communicated that the earlier TOR for 2 x 800 MW units would be applicable to 3 x 660 MW also. It had further permitted judicious utilization of environmental related data collected by NEERI in the year Nov. 2005 – Feb. 2006. MAHAGENCO has since continued to monitor environment quality within 10 km radius of KTPS in order to keep itself abreast of latest environment quality.
- Present EIA report has been prepared as per the TOR for 3 x 660 MW coal based thermal power plant within premises of existing Koradi Thermal Power Station (KTPS). The report includes progressive data since 2005 to date and also the summary of proceedings of public hearing held at Nagpur on March 25, 2009 under auspices of MPCB.

- Performance of the older 4 x 120 MW units has been studied in detail and has revealed that they need to be phased out since they have outlived their normal operational efficiencies.

THE TECHNOLOGY:

- Three super critical units of 660 MW each have been selected.
- Coal consumption will be @ 30,638 TPD @ 0.6447 kg/kWh and will be supplied from allotted coal field to MAHAGENCO at Machhakuta in Orissa. Only washed coal will be used.
- Water requirement
    - **Fresh water** @ 7968 m^3/d (for boiler make-up & domestic)
    - **Treated sewage @ 1, 68, 000** m^3/d (for cooling water make-up & ash handling).
    - MAHAGENCO will manage fresh water requirement within permitted quota (Water Resources Dept.) for the existing plant.
    - Nagpur Municipal Corporation (NMC) & MAHAGENCO will jointly execute a project to deliver secondary treated sewage from Nagpur to KTPS. This sewage will be treated further to meet cooling water quality criteria.
- Three stacks each 275 m high would be located in one chimney.

BASELINE ENVIRONMENT:

- Environment within 10 km radius has been monitored.
- Twelve air quality, twenty-four water quality, two soil, seven noise monitoring stations were selected to examine baseline environment during the operational phase of KTPS .
- Present activities in the study area are power generation by KTPS, the Khaperkheda TPS, use of coal for domestic fuel, traffic on NH 69 etc.

AMBIENT AIR QUALITY (AAQ):

- Average AAQ within 10 km radius was

	$\mu g/m^3$
- SPM	145.3 to 237.2
- RSPM	43.4 to 121.6
- SO_2	6.0 to 18.3
- NOx	9.7 to 26.6

- Predominant wind direction is NW → SE.
- Control at KTPS. Emissions from the present KTPS are being controlled by ESPs, EPIC II controllers and ammonia injection in units. Also bag-filters have been installed in newer units.
- First four units were commissioned during 1974 and 1976 period were designed as per the then norms and suffer from constraints to update control equipment.

Water:

- Water quality in all the 24 examined sources is acceptable for even drinking purposes after disinfection.
- Wastewater from KTPS is being recycled after treatment @30,455 m^3/d for ash handling, plantation etc.
- It is proposed to curtail fresh water requirement for ash handling in present units and wastewater from the new units will be used.

Land:

- Land use in 10 km radius is mainly for power plants, agriculture and habitations at Koradi, Khaparkheda, Mahadula villages. Some mining also is being practiced.
- These uses will not be hampered because plant will be located within the KTPS premises.

ANNEXURE 1

No. J-13012/87/2007-IA.II(T)
Government of India
Ministry of Environment & Forests

Paryavaran Bhavan,
C.G.O. Complex, Lodi Road,
New Delhi-110003.

Telefax.: 2436 2434

Dated the 12th July, 2007

To

The Chief General Manager (CEHSU)
Maharashtra State Power Generation Co. Ltd.
Corporate Environment Health & Safety Unit,
Prakashgad Building, 2nd Floor,
G-9, Prof. Anant Kanekar Marg,
Bandra (East), Mumbai-400 051.

Sub: 2x800 MW (super-critical) Koradi Thermal Power Station Expansion Project at Koradi, District Nagpur, Maharashtra by M/s MAHAGENCO - Prescribing of TOR - Regarding.

Sir,

The undersigned is directed to refer to your communication no. C.G.M./CEHSU/2x800MW proj/Koradi Expn./187 dated 7.4.2007 regarding the subject mentioned above.

2. The proposal is for setting up of a 2x800 MW coal based power plant as an expansion of the existing power plant at Koradi. The proposed unit will be accommodated in the existing 160 ha of available land. The existing 4x120 MW unit will be stopped after commissioning of the new units and their resources will be diverted for new units. The new units will be based on super critical technology and low NOx burners. No additional water allocation would be required for the proposed expansion unit. It was stated by the proponent that the baseline air quality data has already been collected during November, 2005 – February, 2006.

3. The Expert Appraisal Committee for environmental appraisal of Thermal Power and Coal Mine projects considered the project during its meeting held on June 11-13,

2007. Based on the consideration of the documents submitted and the presentation made by the project proponent, the Committee prescribed the following Terms of Reference for preparing draft EIA report for the above mentioned project:

(i) Schedule of decommissioning of the existing 4x120 MW units along with details how the existing resources from the units to be decommissioned will be utilized for the proposed new units.
(ii) Coordinates of the plant site as well as ash pond with toposheet.
(iii) The study area should cover an area of 10 km radius around the proposed site.
(iv) Land use of the study area as well as the project area shall be given.
(v) Location of any National Park, Sanctuary, Elephant / Tiger Reserve (existing as well as proposed), migratory routes, if any, within 10 km of the project site shall be specified and marked on the map.
(vi) Land requirement for the project to be optimized. Item wise break up of land requirement and its availability to be furnished. The location of the proposed units vis-à-vis the existing units on the site location map should be given.
(vii) Topography of the area should be given clearly indicating whether the site requires any filling. If so, details of filling, quantity of fill material required, its source, transportation etc. should be given.
(viii) Impact on drainage of the area and the surroundings.
(ix) Information regarding surface hydrology and water regime.
(x) One season site-specific meteorological data shall be provided.
(xi) One season AAQ data (except monsoon) to be given. The monitoring stations should take into account the pre-dominant wind direction, population zone and sensitive receptors including reserved forests. The already collected baseline AAQ data during November, 2005 to February, 2006 could be utilized.
(xii) Impact of the project on the AAQ of the area. Details of the model used and the input data used for modeling should also be provided. The air quality contours may be plotted on a location map showing the location of project site, habitation nearby, sensitive receptors, if any. The wind roses may also be shown on this map.
(xiii) Fuel analysis to be provided.
(xiv) Quantity of fuel required, its source and transportation.
(xv) Source of water and its availability. Commitment regarding availability of requisite quantity of water from the competent authority.
(xvi) Details of rainwater harvesting and how it will be used in the plant.
(xvii) Examine the feasibility of zero discharge. In case of any proposed discharge, its quantity, quality and point of discharge, users downstream etc. should be provided.
(xviii) Optimization of COC for water conservation. Other water conservation measures proposed in the project should also be given.
(xix) Details of water balance taking into account reuse and re-circulation of effluents.

(xx) Details of greenbelt i.e. land with not less than 1500 trees per ha giving details of species, width of plantation, planning schedule etc.

(xxi) Detailed plan of ash utilization / management.

(xxii) Details of evacuation of ash.

(xxiii) Details regarding ash pond impermeability and whether it would be lined, if so details of the lining etc.

(xxiv) Details of flora and fauna duly authenticated should be provided. In case of any scheduled fauna, conservation plan should be provided.

(xxv) Details regarding infrastructure facilities such as sanitation, fuel, restroom etc. to be provided to the labour force during construction as well as to the casual workers including truck drivers during operation phase.

(xxvi) Public hearing points raised and commitment of the project proponent on the same.

(xxvii) Measures of socio economic influence to the local community proposed to be provided by project proponent. As far as possible, quantitative dimension to be given.

(xxviii) Impact of the project on local infrastructure of the area such as road network and whether any additional infrastructure would need to be constructed and the agency responsible for the same with time frame.

(xxix) EMP to mitigate the adverse impacts due to the project.

(xxx) Risk assessment to be undertaken. Based on the same, proposed safeguard measures should be provided.

(xxxi) Any litigation pending against the project and /or any direction /order passed by any Court of Law against the project, if so, details thereof.

4. Besides the above, the following general points will be followed:-

a) All documents to be properly referenced with index, page numbers and continuous page numbering.

b) Where data is presented in the report especially in table, the period in which the data was collected and the source should invariably be indicated.

c) Where the documents provided are in a language other than English, an English translation should be provided.

In addition to the above, information on the following may also be incorporated in the EIA report.

1. Is the project intended to have CDM-intent?

(i) If not, then why?

(ii) If yes, then

(a) Has PIN (Project Idea Note) (or PCN (Project Concept Note)) submitted to the 'NCA' (National CDM Authority) in the MoEF?
(b) If not, then by when is that expected?
(c) Has PDD (Project Design Document) been prepared?
(d) What is the "Carbon Intensity" from your electricity generation projected (i.e. CO2 Tons/MWH or Kg/KWH)
(e) Amount of CO_2 in Tons/year expected to be reduced from the baseline data available on the CEA's web-site (www.cea.nic.in)

2. Notwithstanding 1(i) above, data on (d) & (e) above to be worked out and reported.

5. It is requested that the draft EIA report may be prepared in accordance with the above-mentioned TORs and thereafter further necessary action including conduct of public consultation may be taken for obtaining environmental clearance in accordance with the procedure prescribed under the EIA Notification, 2006.

Yours faithfully,

(Dr. S.K. Aggarwal)
Director

Copy to:-

1. The Secretary, Department of Environment, Govt. of Maharashtra, Mantralaya, Mumbai.
2. The Chairman, Maharashtra Pollution Control Board, Kalpatru Point, Sion Circle, Sion (East), Mumbai-400 022, Maharashtra.
3. The Chief Conservator of Forests (C), Regional Office (WZ), Ministry of Environment & Forests, Kendriya Paryavaran Bhawan, Link Road No.-3, E-5, Arera Colony, Bhopal – 462 016.
4. Guard File.

(Dr. S.K. Aggarwal)
Director

ANNEXURE 2

No. J- 13012/87/2007-IA-II (T)
Government of India
Ministry of Environment & Forests

Paryavaran Bhawan
CGO Complex, Lodi Road
New Delhi-110003

Dated: 12th May, 2008

To
M/s Maharashtra State Power Generation Co. Ltd
Corporate Environment Health & safety Unit
Prakashgad Building, 2nd Floor
G-9, Prof Anant Kanekar Marg
Bandra (East), Mumbai 400 051

Subject: Change in unit size from 2x800 MW to 3x660 MW Koradi TPS, District Nagpur, Maharashtra by M/s MAHAGENCO - Prescribing of Terms of Reference (TOR) reg.

Sir,

Reference is invited to your communication no.DG/KRD-Expn.Proj./3X660 MW/0024 dated 1st Jan, 2008 on the above mentioned subject.

2. The contents of the above referred letter have been examined and the proposal contained therein has been considered by the Expert Appraisal Committee for Thermal Power and Coal Mine Projects. Based on the presentation made and discussions held, the Committee reiterated the TORs prescribed earlier.

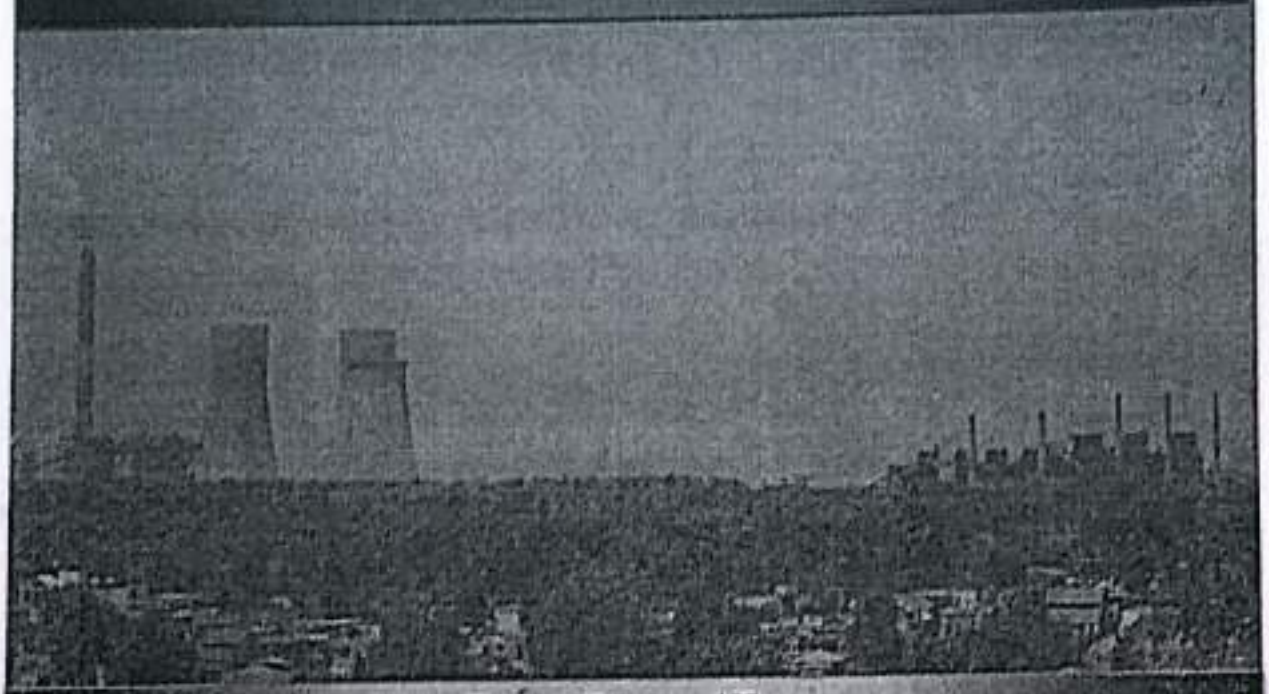
3. On the recommendation of the Expert Appraisal Committee (EAC), Ministry of Environment and Forests hereby reiterate the TORs prescribed earlier vide letter of even no. dated 12th July, 2008. After preparing the EIA report, further necessary action for obtaining environmental clearance as per the procedure prescribed under the EIA Notification including conduct of public hearing should be taken.

This issues with approval of Competent Authority.

(OM PRAKASH)
DEPUTY DIRECTOR

Annexure-22(o)

Impact Assessment of Implementation of Corporate Social Responsibility Action Plan for Adjoining Villages of 3 X 660 MW Coal Based Thermal Power Plant; Koradi Dist. Nagpur.



Report Prepared For
MAHAGENCO Koradi Expansion Project; Nagpur

Report Prepared By

Surya Envirotech

237, Hanuman Nagar, Nagpur.

July 2016

Impact Assessment of Implementation of Corporate Social Responsibility Action Plan for Adjoining Villages of 3X660 MW Coal Based Thermal Power Plant, Koradi, Dist. Nagpur

REPORT PREPARED BY

Surya Envirotech, 237 Hanuman Nagar, Nagpur

REPORT PREPARED FOR

Maharashtra State Power Generation Company Ltd. [MAHAGENCO]

MAHAGENCO

Maharashtra State Power Generation Co. Ltd.

July 2016

INDEX

Executive Summary

1.1 Recommissioning

Maharashtra State Power Generation Company Ltd. has expanded 3X660MW Thermal Power Plant, village Kondli, Taluka Kamptee, District Nagpur, Maharashtra State. The expanded project had been erected near the existing plant with investment of Rs. 11600 crores. This, about 10km away from Nagpur. The plant capacity is 3X660 MW. The expanded, site of MAHAGENCO is located in eastern side of Maharashtra state spread between Latitude 21°24'09" N and Longitude 79°09'09" E.

The study of socio economic status of the people in the area is an integral part of Corporate Social Responsibility (CSR). Demographic structure, infrastructure resource base, health status of the community and economic attributes such as employment, industrial development and sustainability of the project in financial terms has been incorporated to assess the impact of Corporate Social Responsibility (CSR) through study of Quality of Life of villages in study area.

1.2 Objectives of the study

- To prepare a demographic profile of the project affected villages
- To assesses Existing Socio-Economic status of Project Affected Persons (PAP)
- To identify and quantify nature of employment existing and future opportunities
- To assesses Quality of Life of Project Affected Persons in the study area
- To evaluate of Nature of Land use Pattern
- To evaluate infrastructure resource base, viz. medical, education, water resources, power supply
- To evaluate economic resource base, viz. agriculture, industries, forest, trade and commerce
- To evaluate health Status, viz. morbidity pattern with reference to prominent and endemic disease (e.g. fluorosis, malaria, filaria)
- To evaluate cultural and aesthetic attributes in the study area including places of historical/ archaeological importance
- To evaluate occupational pattern, employment status and income category of Project Affected Persons
- Quantification of economic resources, Health status, Cultural and Aesthetic attributes etc.
- To carryout impact assessment of CSR plan of the project affected people

1.3 The study area

The expended, site of MAHAGENCO is located in eastern side of Maharashtra state spread between Latitude 21 24' 09" N and Longitude 79 09' 99" E. The Average annual rain fall is 1166.3 mm/year and relative humidity is in the range of 80 % to 24 %. Entire study area predominantly depends upon primary or secondary employment from Thermal Power Plant of Koradi and Khaparkheda, MAHAGENCO.

The present study area of 5 Kms radial aerial distance around the expanded project site which comprises of twelve villages. The villages are from Kamptee Taluka of Nagpur District namely Koradi, Nanda, Khasala, Mahadula, Panjra, Mhasala, Kewtha, Khairi, Lonkhairi, Waregaon and Suradevi whereas Bokhara, is in Nagpur Taluka.

1.4 Corporate Social Responsibility (CSR) Policy

Our vision is – "To remain a responsible corporate entity mindful of its social responsibilities and actively contribute to the social and economic development of the communities in which we operate. In so doing build a better, sustainable way of life for the weaker sections of society and raise the country's human development index."

POLICY:

"Corporate Social Responsibilities Policy of MAHAGENCO is to integrate social and environmental concerns into the business operations in interaction with stakeholders (employee, customers, suppliers, shareholders, investors, local communities and government) on a voluntary basis".

ACTIVITIES UNDER CORPORATE SOCIAL RESPONSIBILITY OF MAHAGENCO

- Education
- Health care
- Community Development/Infrastructure Development
- Environment care
- Cultural Development
- Other activities

2.1 The Significant Demographic Features of Villages are:

Total population of the region as per 2011 census is 49,237 out of which 25,538 are male a 23,699 are female.

- Total number of households in the region about 11344
- Sex ratio (number of male per thousand female) in the region is 928 this shows that m population is higher in the region as compared to the female population
- Out of the total population Scheduled Caste and Scheduled Tribe population is about 25.4 and 6.62% respectively
- Total main worker population is about 32.70%, 5.68% comes under marginal worker catego and 61.65% belongs to non-workers category
- Literacy rate of the population in the study area is about 78.31%

3.1 Socio-Economic Survey

The study areas consist of Twelve villages, adjacent to the expanded TPS activity, are identifi for the survey: - Panjra, Koradi, Nanda, Mhasala, Kawtha, Khasala, Khairi, Suradevi, Waregaon Lonkhairi, Mahadula, Bokhara. All these villages are within 5 Km from expanded TPS 3X660 M project. As per the survey, the main language in the study area is Marathi.

The salient observations recorded during survey in the study area:

- Majority of the respondents are engaged in activities other than agriculture while near about % of the population are engaged in agricultural and its allied activities. The main crop grown in th study area is soybean, cotton, bajra, wheat etc.
- Sanitation facilities in the study area were not proper. There are open drains from where th domestic waste water is disposed. People are not at all aware and careful about hygiene an cleanliness, this has resulted in increase of health problems in the area
- Power supply facility is available in all the villages and town in the study area mostly f domestic purpose and few for agriculture also
- Drinking water sources is mostly from overhead tanks constructed by MAHAGENCO. As regar to the drinking water facility people expressed that the quality of water is portable.
- A medical facility in terms of primary health center is available in Gumthi village, but it is far fro

other villages. Doctors and nurses visits the villages for providing medical treatment as per their scheduled time

- Transportation facility was found satisfactory in the study area and road conditions are good. Frequency of public transport facility however remains deficient
- Almost all the people use LPG as a main source of fuel and very few people use kerosene and wood for cooking purpose
- Sufficient communication facility is available in the study area
- Educational facilities are available in the form of primary and middle schools. In some villages, it is extended up to high school. For higher studies people avail the facility from the nearest town.

3.2 The average Quality of Life Index values in the study area are estimated as:

QoL (s) = 0.59

QoL (o) = 0.62

QoL (c) = 0.60

3.3 Socio - Economic Impacts

Socio - Economic Impacts

Setting up of 3X660 MW Coal Based Thermal Power Plant within area would create certain impacts with beneficial as well as adverse effects on the socio-economic environment. Some of these impacts would be more effective for the immediate vicinity with short term effects whereas the others would be of higher order or of long term in nature.

It is necessary to identify the extent of these impacts for further planning of control measures leading to mitigation of the adverse impacts.

The impacts of TPS on parameters of human interest have been assessed in terms of:

- The impact due to acquisition of land needed to set up the plant buildings and other support facilities

- The potential impacts due to unavoidable releases fly ash as pollutants from the power be reaching to the public domain.

Beneficial Impacts

The impacts identified as beneficial support for existing project activities. They are:

- Job opportunities for the local people as well as for those from the nearby surrounding ar would increase due to operation and construction of 3X660 MW Coal Based Thermal Pow Plant
- Due to influx in population, the trade, business opportunity for the local people would increa raising the economic status of the people around the study area
- Establishment of township as well as the influx of working people within the study area wo lead to favorable changes in the existing infrastructure facilities, which may further improve quality of life of the study concerned area
- There would be local participation in supply of materials and services for construction township and other infrastructure such as access roads, fresh water pipeline and warehouses
- The proposed 3X660 MW Coal Based Thermal Power Plant, Koradi would help partially bridging the gap between the demand and inadequate supply of electricity within the country general, and the region in particular
- The electricity generated by 3X660 MW Coal Based Thermal Power Plant will result electrification of villages, development of irrigation facilities, drinking water supply, developme of industries etc.
- Due to proposed 3X660 MW Coal Based Thermal Power Plant there would be an ove development of the area and job opportunities, which may improve the quality of life of the are

Adverse Impacts

The impact identified as adverse would go against the project activities. These impacts can minimized by proper follow up of Corporate Social Responsibility Plan. These impacts are:

- Influx of workers during the project construction and operation phases would impose str strain on the existing basic amenities within the study area.
- The project activities may disturb the fishing activity. If appropriate measures for disposal of ash near the vicinity of river are not taken.

- For meeting various demands in the power plant, fresh water would be drawn from dam constructed on river Kolar, which may affect the drinking water & agricultural needs of the local population. However the impacts may be insignificant
- Health problems can increase due to nearby industries
- It may increase environmental pollution and social hygiene.

It is anticipated that the adverse impacts on parameters of human interest could be mitigated by proper follow-up of the measures indicated in the Corporate Social Responsibility Plan.

4.1 Implemented Activities under Corporate Social Responsibility of MAHAGENCO, Koradi

i. Water Supply
ii. Tree Plantation
iii. Road
iv. Educational Facility
v. Highmast Light
vi. Community Hall
vii. Commertial complex
viii. Temple
ix. Sitting benches
x. Hospital
xi. Sanitation and Drainage
xii. Library
xiii. Cremation or Burial Ground.

5.1 Proposed Activities of CSR

Sr. No.	Name of Village	Proposed Activity
1	Koradi	Digging and renovation of pond No. 3, Renovation of school building, Guest houses renovation
2	Khairy	Drinking water supply scheme is in progress (Khairi)
3	Mahadula	Shopping complex, construction of playground, stadium and their compound wall,
		I.T.I Training for students of standard 8th and giving stipend to them
		Construction of Anganwadi building
		Provide funeral procession van
		Use of high pressure van for cleaning of Sanitation or waste material.
		Give the employment of I.T.I holders around the Koradi project area.
		Greenbelt of 20-50 m width shall also be developed around the ash pond over and above the green belt around the plant boundary. It is planned to plant 50,000 trees in the year 2016-17 in power house and nearby premises.
		Separate arrangement is made for drinking water nearby village
4	Nanda	Construction of playground, stadium and its compound wall
5	Loankhairi, Ghumtho, Chicholi	Compensation for agricultural products spoilage due to fly ash of MAHAGENCO

6.1 Existing Quality of Life of the Villages in Study Area Comparative Table (2008- 2016)

Sr. No.	Name of the villages	QoL(o) (2005)	QoL(c) (2015)
1	Pethni	0.57	0.69
2	Kotedi	0.62	0.73
3	Nanda	0.67	0.65
4	Mhasala	0.50	0.52
5	Kawatha	0.50	0.53
6	Khasala	0.50	0.61
7	Khairy	0.50	0.56
8	Suradevi	0.57	0.61
9	Waregaon	0.52	0.56
10	Lonkhairy	0.52	0.61
11	Mahadula	0.62	0.70
12	Bokhara	0.50	0.52
	Total	**0.54**	**0.60**

QoL(s) = Subjective Quality of Life
QoL(o) = Objective Quality of Life
QoL(c) = Cumulative Quality of Life

Recommendations:

Project authority of MAHAGENCO may consider to implement following recommendations in second phase of Corporate Social Responsibility Action Plan,:

- Implementation of Scheme described in Annexure I for Poverty Elevation
- Tree plantation with tree guards and maintenance as per green belt development guideline – CPCB.
- Common sewage treatment plant for the study area.
- Rain water harvesting scheme with storm water drainage and ground water recharge structures
- Provide facility to study centre (Library Koradi) such as; Books, Internet, e- library and R.O for drinking water.
- Consideration of Youth development in the study area with the help of different schemes described in Annexure II
- School bus facility should be provide from the villages to Koradi colony schools
- Furniture facility for Z.P. school at Panjra and Nanda
- Computers for all Z. P. school so as to improve the educational level
- Mobile hospital for the study area.
- Provide Garbage disposal with ghanta-gadi for all the villages to improve the environment as well as health status
- Implementation of Different schemes for women empowerment in the study area (Refer Annexure III)
- Consideration for solar street lamps in villages.

Annexure - 22(b)

STATUS OF WORK UNDER CORPORATE SOCIAL RESPONSIBILITY (C.S.R.)

A] List of works completed as on 02.08.2017.

Sr. No.	Name of Work	Actual expenditure (Rs. In Lakhs)	Remarks.
1	**20 Bedded Hospital.** Renovation of existing school building for conversion into 20 bedded Hospital building at Koradi.	100.59	Work completed and Orange City Hospital, Nagpur has started the Hospital w.e.f. 03.02.2014.
2 A) ii)	**Drinking Water Supply.** Additional fund for Koradi & Nanda. (Deposit work to MJP)	112.00	Work completed.
B) i)	Panjara.	82.43	Work completed.
ii), v)	Waregaon, Suradevi & Bokhara.	392.10	Work completed.
iii)	Khairy.	97.86	Work completed.
iv)	Kaotha, Masala.	76.53	Work completed.
vi)	Mahadulla.	33.62	Work completed.
3	**Tree Plantation of 5000 trees with tree guards.**	44.65	Work completed. (New Koradi, Panjara, Nanda, Bokhara & Nara)
4	**Junior college.**	176.75	Work completed.
5 i)	**Approach Road and internal roads.** Strengthening and asphalting of balance road from Devi Mandir/ (Kaotha Village) to Canal and Khasara Village.	34.25	Work completed.
ii)	Strengthening and asphalting of balance road in Nanda and Koradi rehabilitated Villages	35.30	Work completed.
iii)	Construction of WBM road and asphalting of road from Dakhole field to Suradevi Pandhan.	87.72	Work completed.
iv)	Construction of WBM road from Khairy pandhan to Waregaon ash bund and Khairy in Kaotha village.	86.70	Work completed.

Sr. No.	Name of Work	Actual expenditure (Rs. In Lakhs)	Remarks.
v)	Construction of WBM road & strengthening and asphalting of road at Masala toli.	22.33	Work completed.
vi)	Providing and filling pot holes and patch repair to road from Khasara ash recovery pump house to Masala Rly Crossing.	2.98	As per directives of Hon'ble Minister. Work is completed.
vii)	Asphalting of road from Dakhole field to Suradevi Pandhan.	34.51	Work completed.
viii)	Providing & laying asphalting to WBM road from Khairy Pandhan to Waregaon ash bund to Kaotha village junction.	32.08	Work completed.
6 i)	**Crematorium.** Koradi & Nanda (Visarjan otta, condolence shed, buming shed including toilet, retaining wall & library room)	70.09	Work completed.
ii)	Khasara (Internal road with development & cremation shed and compound wall)	26.81	Work completed.
iii)	Koradi & Nanda Crematorium Compound wall.	12.50	As per directives of Hon'ble Minister. Work is completed.
7	High Mast Lighting at Koradi, Nanda and Khasara.	58.78	Work completed.
8	Sewage Disposal Scheme for Koradi, Nanda, Khasara, Panjara and Mahadulla. (Work executed for Mahadulla only)	50.00	Deposit work to PWD and work completed upto M.S.P.G.C.L., boundary wall.
9 a)	Shopping complex, Sports Complex & Community Hall at Koradi & Mahadulla (combined complex)	44.55	Work completed.
b) i)	Samaj Bhawan at Nanda, Khasara, Panjara and Mahadulla	101.59	Work completed.
ii)	Construction of Samaj Bhawan at Suradevi.	29.82	Work completed.(The work is taken up against the provision of crematorium at Suradevi)

Sr. No.	Name of Work	Actual expenditure (Rs. In Lakhs)	Remarks.
10	**Other works (Misc. In CSR).**	53.26	Work completed.
i)	Construction of compound wall around Z.P. School at Nanda village.		
ii)	Construction of compound wall around Z.P. School at Khasara village.		
iii)	Providing & fixing RCC benches in the various villages.		
iv)	Supplying furniture for library room at budhha vihar Koradi.		
v)	Providing & fixing informatory board in various CSR work site.		
vi)	Work of construction of UCR masonry boundary wall for isolation of Bazar otta land at Mahadulla village is proposed.	37.63	Work completed.
vii)	Drinking water supply to Suradevi and Bokhara Village.	10.07	Work completed.
viii)	Providing water Proofing treatment to old terrace slab at Vidya Mandir School at Koradi Colony.	2.97	Work completed.
ix)	Miscellaneous works such as providing M.S. Gate at Z.P. School and Samaj Bhawan work at Nanda.	4.53	Work completed.
x)	Said fund is utilized for puchase of poclian machine which is used for Jalyukta Shivar Abhiyan / Pandhan road development scheme.	45.00	Work completed.
	Total (List-A).....Rs.	**2000.00**	**Lakhs.**

20 Bed Hospital

Public Library

20 Bed Hospital

Public Lavatory

Crematorium

Crematorium

Annexure - 22(d)

MAHAGENCO
Maharashtra State Power Generation Co. Ltd.
CIN: U40100MH2005SGC153648

MAHARASHTRA STATE POWER GENERATION CO. LTD.
KORADI THERMAL POWER STATION
ISO 9001:2008, ISO 14001:2004 & ISO 18001:2007)
Office of. Chief Engineer (O & M), T.P.S., Koradi, Dist. Nagpur, PIN - 441111
Phone: (07109) 262141 to 262145,262106, 262109 FAX: 262127(O/M)
Email –cegenkoradi@mahagenco.in

क.कोऔविकें / मुअ (संवसु) / मासं / सामान्य / ९३३९ दिनांक 18 NOV 2021

:: कार्यालयीन टिप्पणी ::

प्रति,
कार्यकारी रसायनशास्त्रज्ञ,
औ.वि.केंद्र,कोराडी 3x660MW

विषय :– सामाजिक उत्तरदायीत्व योजनेसाठी **वार्षिक** ४ कोटी रु. निधीची माहीती कळविण्याबाबत.

संदर्भ :– आपली कार्यालयीन टिप्पणी दि. ६७.११.२०२१

उपरोक्त विषयास अनुसरून कळविण्यात येत कि, आपण मागितलेली माहीती या कार्यालयीन टिप्पणी सोबत जोडुन आपल्या माहीतीस्तव पाठविण्यात येत आहे.

18/11/2021
उप Sr. Manager (HR)
MAHAGENCO : KTPS, Koradi.

MONTHLY PAYMENT STATEMENT OF CSR CANDIDATES FINANCIAL YEAR 2020 TO 2021		
FINANCIAL YEAR	**MONTH**	**AMOUNT (RS)**
2020 - 2021	APRIL	RS.2574709.00
	MAY	RS.2700658.00
	JUNE	RS.2345000.00
	JULY	RS.2676412.00
	AUGUST	RS.2477632.00
	SEPTEMBER	RS.2473317.00
	OCTOMBER	RS.2635809.00
	NOVEMBER	RS.2508834.00
	DECEMBER	RS.2507479.00
	JANUARY	RS.2794512.00
	FEBRUARY	RS.2511453.00
	MARCH	RS.2634110.00
	TOTAL AMT.	**RS.30839925.00**
FINANCIAL YEAR	**MONTH**	**AMOUNT (RS)**
2021 - 2022	APRIL	RS.2403721.00
	MAY	RS.2550468.00
	JUNE	RS.2511100.00
	JULY	RS.2506098.00
	AUGUST	RS.2496451.00
	SEPTEMBER	RS.2350884.00
	OCTOMBER	RS.2444758.00
	TOTAL AMT.	**RS.17263480.00**

PURCHASE ORDER

Maharashtra State Power Generation Company Limited
CHIEF ENGINEER,
KORADI THERMAL POWER STATION
KORADI DIST: NAGPUR
MAHARASHTRA. 441111

PP7109-262106,262109,262141-262146,FAX:262127,262847,262864
cegenkoradi@mahagenco.in
MSPGCL GSTIN : 27AAECM2935R1ZV

PO NO.: KTPS/4500103304 PO Date : 05.04.2019

To,
VENDOR CODE: 70575
GST No. : 27AASFS2731C1Z6
SHRI: JAGDAMBA CONSTRUCTION CO
PLOT NO. 28 A, NEW KORADITAH
KAMPTEE,DIST. NAGPUR
NAGPUR 441111
Maharashtra India
Telephone: 9107109264334 Telefax:
E-Mail:jagdamba.company@rediff.com

Our reference

Your reference

Procurement Type : Open Tender PO

Please arrange to provide the goods / services described below strictly as per terms and conditions mentioned in this Purchase Order and its enclosure/s listed below

GENERAL DESCRIPTION	CURRENCY	TOTAL VALUE (PRICE)
SUBJECT:- Providing land Development compound wall / wire fencing on the periphery of the proposed area, bore well, pumping machinery, pipeline network & electric supply, financial aid or support to Bachat gat members for maintaining the plants, supervisor for development of green belt of Bamboo plantation on MAHAGENCO land for Fodder Farm no-3 at 3x660MW, TPS, Koradi. Ref.: KTPS/PL/R/2018-19/CIVIL-660/ eT-81451	INR	10,321,814.00 One Crore Three Lakh Twenty One Thousand Eight Hundred Fourteen only.

Please send all your correspondence regarding this order in Duplicate. All terms and conditions below and on the reverse are to be strictly complied with.

DESPATCH DETAILS: For details refer enclosures.
Destination(Place, State): Koradi Thermal Power Station District Koradi Nagpur 441111 Maharashtra India

DOCUMENTATION : Please send us Commercial Invoice (One Original + Two Duplicate, duly signed), three copies of Delivery Challan, work completion certificate & LR immediately after dispatch of the consignment

BILLING : For details refer enclosures Bills submitted against this Purchase Order must contain Purchase Order No. & Date, Purchase Order Item No. and Vendor code

PRICING & TAXATION:
Please refer details in Annexure I

PAYMENT TERMS:
Please refer details in Annexure II.

For MSPGCL

Approved Through System

Annexure-23(a)

PURCHASE ORDER

Maharashtra State Power Generation Company Limited
CHIEF ENGINEER,
KORADI THERMAL POWER STATION
KORADI, DIST NAGPUR,
MAHARASHTRA 441111

T:07109-262106,262109,262141-262146,FAX:262127,262847,262884
cegenkoradi@mahagenco.in
MSPGCL GSTIN : 27AAHCM2935R1ZV

PO NO.: KTPS/4500103313 PO Date : 05.04.2019

To,	Our reference:
VENDOR CODE: 50656 GST No : 27AAQPB5762Q3ZW J. D. BARDE CONSTRUCTION, OT NO 134 NEW NANDA KORADI COLONY V KORADI 441111 Maharashtra India Telephone: 7709262762 Telefax: E-Mail:jdbarde004@gmail.com	Your reference: Procurement Type Open Tender PO

Please arrange to provide the goods / services described below strictly as per terms and conditions mentioned in this Purchase Order and its enclosure/s listed below.

GENERAL DESCRIPTION	CURRENCY	TOTAL VALUE (PRICE)
SUBJECT:- Providing land Development compound wall / wire fencing on the periphery of the proposed area, bore well, pumping machinery, pipeline network & electric supply, financial aid or support to Bachat gat members for maintaining the plants, supervisor for development of green belt of Bamboo plantation on MAHAGENCO land for Fodder Farm no-1 at 3x660MW, TPS, Koradi. Ref. : KTPS/PUR/2018-19/CIVIL-660/eT-81458	INR	10,292,293.00 One Crore Two Lakh Ninety Two Thousand Two Hundred Ninety Three only

Please send all your correspondence regarding this order in duplicate. All terms and conditions below and on the reverse are to be strictly complied with.

DESPATCH DETAILS: For details refer enclosures.
Destination(Place, State): Koradi Thermal Power Station District Koradi Nagpur 441111 Maharashtra India

DOCUMENTATION : Please send us Commercial Invoice (One Original + Two Duplicate, duly signed), three copies of Delivery Challan, work completion certificate & LR immediately after dispatch of the consignment.

BILLING : For details refer enclosures. Bills submitted against this Purchase Order must contain Purchase Order No. & Date, Purchase Order Item No. and Vendor code

PRICING & TAXATION:
Please refer details in Annexure I.

PAYMENT TERMS:
Please refer details in Annexure II

For MSPGCL

Approved Through System

PURCHASE ORDER

Maharashtra State Power Generation Company Limited
CHIEF ENGINEER,
KORADI THERMAL POWER STATION
KORADI, DIST. NAGPUR,
MAHARASHTRA. 441111

T07109-262106,262109,262141-262146,FAX:262127,262847,262864
cegenkoradi@mahagenco.in
MSPGCL GSTIN : 27AAECM2995R1ZV

PO NO.: KTPS/4500103315 PO Date : 05.04.2019

To,
VENDOR CODE: 50656
GST No. : 27AAQPB5762Q3ZW
J. D. BARDE CONSTRUCTION,
OT NO. 134 NEW NANDA KORADI COLONY
Y
KORADI 441111
Maharashtra India
Telephone: 7109262762 Telefax:
E-Mail:jdbarde004@gmail.com

Our reference:

Your reference.

Procurement Type : Open Tender PO

Please arrange to provide the goods / services described below strictly as per terms and conditions mentioned in this Purchase Order and its enclosure/s listed below.

GENERAL DESCRIPTION	CURRENCY	TOTAL VALUE (PRICE)
SUBJECT – Providing land Development compound wall / wire fencing on the periphery of the proposed area, bore well, pumping machinery, pipeline network & electric supply, financial aid or support to Bachat gat members for maintaining the plants, supervisor for development of green belt of Bamboo plantation on MAHAGENCO land for Fodder Farm no-8 at 2x660MW, TPS, Koradi. Ref. - KTPS/PUR/2018-19/CIVIL-660/eT-8:407	INR	10,331,652.00 One Crore Three Lakh Thirty One Thousand Six Hundred Fifty Two only.

Please send all your correspondence regarding this order in duplicate. All terms and conditions below and on the reverse are to be strictly complied with.

DESPATCH DETAILS: For details refer enclosures.
Destination(Place, State): Koradi Thermal Power Station District Koradi Nagpur 441111 Maharashtra India

DOCUMENTATION : Please send us Commercial Invoice (One Original + Two Duplicate, duly signed), three copies of Delivery Challan, work completion certificate & LR immediately after dispatch of the consignment

BILLING : For details refer enclosures. Bills submitted against this Purchase Order must contain Purchase Order No. & Date, Purchase Order Item No. and Vendor code

PRICING & TAXATION:
Please refer details in Annexure I.

PAYMENT TERMS:
Please refer details in Annexure II

For MSPGCL

Approved Through System

PURCHASE ORDER

Maharashtra State Power Generation Company Limited
CHIEF ENGINEER,
KORADI THERMAL POWER STATION
KORADI DIST: NAGPUR,
MAHARASHTRA. 441111

T:07109-262106,262109,262141-262146,FAX.262127,262887,262864
cegenkoradi@mahagenco.in
MSPGCL GSTIN : 27AALCM2935R1ZV

PO NO.: KTPS/4500103318 PO Date : 05.04.2019

To,	Our reference:
VENDOR CODE: 70933 **GST No :** 27AOHPB6674G1ZU P R BULAKE PLOT NO 49,WARD NO: 1,NEW KORADI NEAR WANJARI BHAWAN NAGPUR 441111 Maharashtra India Telephone: Telefax E-Mail:davebulake@gmail.com ATTN:	Your reference: Procurement Type : Open Tender PO

Please arrange to provide the goods / services described below strictly as per terms and conditions mentioned in this Purchase Order and its enclosure/s listed below.

GENERAL DESCRIPTION	CURRENCY	TOTAL VALUE (PRICE)
SUBJECT:– Providing land Development compound wall / wire fencing on the periphery of the proposed area, bore well, pumping machinery, pipeline network & electric supply, financial aid or support to Bachat gat members for maintaining the plants, supervisor for development of green belt of Bamboo plantation on MAHAGENCO land for Fodder Farm no-4 at 3x660MW, TPS, Koradi. Ref.:- KTPS/PL/R/2018-19/CIVIL-660/ eT-81462	INR	10,252,935.00 One Crore Two Lakh Fifty Two Thousand Nine Hundred Thirty Five only

Please send all your correspondence regarding this order in duplicate. All terms and conditions below and on the reverse are to be strictly complied with.

DESPATCH DETAILS: For details refer enclosures.
Destination(Place, State): Koradi Thermal Power Station District Koradi Nagpur 441111 Maharashtra India

DOCUMENTATION : Please send us Commercial Invoice (One Original + Two Duplicate, duly signed), three copies of Delivery Challan, work completion certificate & LR immediately after dispatch of the consignment.

BILLING : For details refer enclosures. Bills submitted against this Purchase Order must contain Purchase Order No. & Date, Purchase Order Item No. and Vendor code.

PRICING & TAXATION:
Please refer details in Annexure I.

PAYMENT TERMS:
Please refer details in Annexure II.

For MSPGCL

Approved Through System

PURCHASE ORDER

Maharashtra State Power Generation Company Limited
CHIEF ENGINEER,
KORADI THERMAL POWER STATION
KORADI, DIST: NAGPUR,
MAHARASHTRA 441111

T:07109-262106,262109,262141-262146,FAX:262127,262847,262864
cegenkoradi@mahagenco.in
MSPGCL GSTIN : 27AAECM2935R1ZV

PO NO.: KTPS/4500103304 PO Date : 05.04.2019

To,	Our reference:
VENDOR CODE: 70575 GST No. : 27AASFS2731C1Z6 SHREE JAGDAMBA CONSTRUCTION CO PLOT NO. 28 A, NEW KORADITAH KAMPTEE,DIST. NAGPUR NAGPUR 441111 Maharashtra India Telephone: 9107109264314 Telefax E-Mail:jagdamba.company@rediff.com	Your reference: Procurement Type : Open Tender PO

Please arrange to provide the goods / services described below strictly as per terms and conditions mentioned in this Purchase Order and its enclosure/s listed below

GENERAL DESCRIPTION	CURRENCY	TOTAL VALUE (PRICE)
SUBJECT:-- Providing land Development compound wall / wire fencing on the periphery of the proposed area, bore well, pumping machinery, pipeline network & electric supply, financial aid or support to Bachat gat members for maintaining the plants, supervisor for development of green belt of Bamboo plantation on MAHAGENCO land for Fodder Farm no-3 at 3x660MW, TPS, Koradi. Ref.:- KTPS/PLR/2018-19/CIVIL 660/ eT-81461	INR	10,421,814.00 One Crore Three Lakh Twenty One Thousand Eight Hundred Fourteen only.

Please send all your correspondence regarding this order in duplicate. All terms and conditions below and on the reverse are to be strictly complied with.

DESPATCH DETAILS: For details refer enclosures.
Destination(Place, State): Koradi Thermal Power Station District Koradi Nagpur 441111 Maharashtra India

DOCUMENTATION : Please send us Commercial Invoice (One Original + Two Duplicate, duly signed), three copies of Delivery Challan, work completion certificate & LR immediately after dispatch of the consignment.

BILLING : For details refer enclosures. Bills submitted against this Purchase Order must contain Purchase Order No. & Date, Purchase Order Item No. and Vendor code

PRICING & TAXATION:
Please refer details in Annexure I

PAYMENT TERMS:
Please refer details in Annexure II

For MSPGCL

Approved Through System

PURCHASE ORDER

Maharashtra State Power Generation Company Limited
CHIEF ENGINEER,
KORADI THERMAL POWER STATION
KORADI, DIST. NAGPUR,
MAHARASHTRA. 441111

T:07109-262106,262109,262141-262146,FAX 262127,262847,262864
cegenkoradi@mahagenco.in
MSPGCL GSTIN : 27AAECM2935R1ZV

PO NO.: KTPS/4500102869 PO Date : 05.04.2019

To,
VENDOR CODE: 52980
GST No. 27ABKPL6682N1ZT
RAJ ENGINEERING WORKS
MAIN ROAD KHAPERKHEDA
NAGPUR 441102
Maharashtra India
Telephone: 7112268592 Telefax:
E-Mail:lonarer @yahoo.com
ATTN:

Our reference:

Your reference

Procurement Type : Open Tender PO

Please arrange to provide the goods / services described below strictly as per terms and conditions mentioned in this Purchase Order and its enclosure/s listed below.

GENERAL DESCRIPTION	CURRENCY	TOTAL VALUE (PRICE)
SUBJECT:-- Providing land Development compound wall / wire fencing on the periphery of the proposed area, bore well, pumping machinery, pipeline network & electric supply, financial aid or support on Bachat gat members for maintaining the plants, supervisor for development of green belt of Bamboo plantation on MAHAGENCO land for Fodder Farm no-6 at 2x660MW, TPS, Koradi. Ref:- KTPS/PUR/2018-19/CIVIL 660/ eT-81455	INR	19,302,133.00 One Crore Three Lakh Two Thousand One Hundred Thirty Three only

Please send all your correspondence regarding this order in duplicate. All terms and conditions below and on the reverse are to be strictly complied with.

DESPATCH DETAILS: For details refer enclosures
Destination(Place, State): Koradi Thermal Power Station District Koradi Nagpur 441111 Maharashtra India

DOCUMENTATION : Please send us Commercial Invoice (One Original + Two Duplicate, duly signed), three copies of Delivery Challan, work completion certificate & LR immediately after dispatch of the consignment.

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PRICING & TAXATION:
Please refer details in Annexure I

PAYMENT TERMS:
Please refer details in Annexure II

For MSPGCL

Approved Through System

PURCHASE ORDER

Maharashtra State Power Generation Company Limited
CHIEF ENGINEER,
KORADI THERMAL POWER STATION
KORADI, DIST: NAGPUR,
MAHARASHTRA. 441111

T:07109-262106,262109,262141-262146,FAX:262127,262847,262864
cegenkoradi@mahagenco.in
MSPGCL GSTIN : 27AAECM2933K1ZV

PO NO.: KTPS/4500102872 PO Date : 05.04.2019

To,
VENDOR CODE: 72818
GST No. 27ACKFS7774F1ZJ
S N DIONE
280-B, NEW KORADI TAH. KAMPTEE,
DIST. NAGPUR
NAGPUR 441111
Maharashtra India
Telephone: 07109-262266 Telefax
E-Mail:sndhone2013@gmail.com

Our reference:

Your reference:

Procurement Type : Open Tender PO

Please arrange to provide the goods / services described below strictly as per terms and conditions mentioned in this Purchase Order and its enclosure/s listed below

GENERAL DESCRIPTION	CURRENCY	TOTAL VALUE (PRICE)
Subject:Providing land Development compound wall / wire fencing on the periphery of the proposed area, bore well, pumping machinery, pipeline network & electric supply, financial aid or support to Bachat gat members for maintaining the plants, supervisor for development of green belt of Bamboo plantation on MAHAGENCO land for Fodder Farm no-7 at 3x660MW, TPS, Koradi. Ref.:- KTPS/PUR/2018-19/CIVIL-660/eT-81460	INR	10,252,948.00 One Crore Two Lakh Fifty Two Thousand Nine Hundred Forty Eight only.

Please send all your correspondence regarding this order in duplicate. All terms and conditions below and on the reverse are to be strictly complied with.

DESPATCH DETAILS: For details refer enclosures.
Destination(Place, State): Koradi Thermal Power Station District Koradi Nagpur 441111 Maharashtra India

DOCUMENTATION : Please send us Commercial Invoice (One Original + Two Duplicate, duly signed), three copies of Delivery Challan, work completion certificate & LR immediately after dispatch of the consignment.

BILLING : For details refer enclosures. Bills submitted against this Purchase Order must contain Purchase Order No. & Date, Purchase Order Item No. and Vendor code.

PRICING & TAXATION:
Please refer details in Annexure I.

PAYMENT TERMS:
Please refer details in Annexure II.

For MSPGCL

Approved Through System

Annexure-23(b)

12/5/2021

Bachat Gat Mahila working at Bamboo Fodder Farm

Annexure-24

ANNEXURE 2

कार्यालय ग्रामपंचायत कोराडी

पंचायत समिती कामठी, त. कामठी, जि. नागपूर.

❖ सरपंच ❖	❖ कार्यालय फोन ❖	❖ सरपंच ❖
सौ. अनुराधा शेखर अमिन	९५७१०९-२६११९८	श्री. श्रीरंग यादव
मो. ९९६०९११०४७		मो. ९३२५६२८७६७

जावक क्र. [redacted]

[redacted]

[redacted]

विषय :- मे.महाराष्ट्र राज्य विद्युत उत्पादन कंपनी लि. (महाजेनको) यांचे कोराडी औष्णिक विद्युत केंद्र कोराडी नागपूर येथील प्रस्तावित ३ x ६६० मेगावॅट क्षमतेचे कोळशावर आधारित ३ संच उभारणीला नाहरकत देणे बाबत.

संदर्भ :- मुख्य महाव्यवस्थापक (नि.म.व.सु.) कोराडी यांचे पत्र क्र.को.औ.वि.कें/मु.मह. (प.र.सु)/कोराडी प्रकल्प/नं १०५० दिनांक ११/३/०९.

महोदय,

मे. महाराष्ट्र राज्य विद्युत उत्पादन कंपनी लि (महाजेनको) यांचे कोराडी औष्णिक विद्युत केंद्र, कोराडी नागपूर येथील प्रस्तावित ६६० मेगावॅट क्षमतेचे कोळशावर आधारित ३ संच उभारणीकरिता खालील अटीस अधीन राहुन नाहरकत देण्यात येत आहे.

१) ग्रामपंचायत चे मालकीचे असलेल्या जमिनी जर विद्युत निर्मिती कंपनी करीता संपादन केल्या व ग्रामपंचायतला त्याचा मोबदला मिळाला नाही तो मिळणे आवश्यक राहील.

२) महाराष्ट्र शासनाचे महसूल व वन विभाग, मंत्रालय, मुंबई यांचे पत्र क्र. आर पीए-२/प्र.क्र. ५२६/र-१ दि २८/११/२००८ या आदेशाचे पालन करुन प्रकल्प बाधीत नागरिकांना संबंधीत नागरी सुविधा पुर्ण कराव्या लागतील

३) स्थानिक प्रकल्प प्रभावित लोकांवर नोकरीत प्राधान्य द्यावे लागेल

४) प्र.द. चे मालकीचे व महसुल विभागाचे जागेवरील ग्रा प चे परिसरातुन वाहने, राखेने उध्वस्त झाले ते दुरुस्त करावे लागेल.

५) या ग्रा पं. अंतर्गत रस्ता याची प्रकल्पामुळे हानी होईल त्या दुरुस्ती करावी लागेल

६) परिसरात शुध्द पाणी पुरवठा व तीरसिंचन कंपनीने व्यवस्था करावे

(मागे पहा)

कार्यालय ग्रामपंचायत कोराडी

पंचायत समिती कामठी, ता. कामठी, जि. नागपूर.

❖ सरपंच ❖
सौ. अनुराधा शेखर अमिन
मो. ९९६०९९१०५७

❖ कार्यालय फोन ❖
९५७१०९-२६१२१८

❖ सरपंच ❖
श्री. श्रीरंग यादव
मो. ९३२५५६२८७६१

जावक क्र.

दिनांक : १२/७/०९

७) या ग्रा.पं. अंतर्गत बांधकाम केलेले असलेल्या इमारती व प्रकल्पाचे (सर्व बाबी) यांचे एकूण क्षेत्रफळावर मुंबई ग्रा.पं. अधिनियम १९५८ प्रमाणे कर आकारणी बंधनकारक राहील.

८) परिसरातील हवा, ध्वनी, पाणी, प्रदुषीत होणार नाही याची हमी घ्यावी.

९) परिसरातील रस्ते, बांधकाम करणे, रस्त्यावरील लाईट लावणे, व देखभाल दुरुस्ती करणे इत्यादी बाबी कंपनीला कराव्या लागतील.

१०) प्रकल्पाचा नकाशा ग्रा.पं. कडून मंजुर करावा लागेल.

११) राखेचे प्रदुषण होणार नाही याची हमी द्यावी लागेल.

१२) फेज नं ३ मधील खोलीकरण व दोन्ही बाजुने भिंती बांधकाम करुन होणारी नुकसानी थांबवावी लागेल.

१३) शेतक-यांच्या उर्वरीत शेतजमिनी ह्या अॅशबंड चे बाजुने आहे. तेथील अप्रोच रस्ते कंपनीला बांधावे लागेल.

१४) कोराडी देवी मंदीर परिसरात म.रा.वि.म. कडून सोडण्यात आलेले पाणी नाली भरे लिय पाईप टाकुन पी.डब्ल्यु.डी. ३ पर्यंत जोडावे व परिसरात दलदल निर्माण झाल्यामुळे ह्या स्थळ सपाटीकरण करावा.

१५) ग्रा.पं. कोराडी मधील प्रकल्पग्रस्त व रहिवासी करीता काढलेली स्मशानभुमीला पैलतीर नदी कडून रिटेनिंग वॉल बांधावी.

१६) कोराडी देवी मंदिर परिसरातील संरक्षण विभागाचे व ग्रा.पं. चे मालकीचे जागेवर बांधकाम करण्यात आलेली म्युझीयम इमारत ग्रा.पं. ला हस्तांतरण करावी. सर्वे नं १६४.

१७) कोराडी देवी मंदीर परिसरात कंपनीचे गेस्ट हाऊस करीता ग्रा.पं.चे व संरक्षण विभागाचे जागेवर बांधकाम करण्यात आलेले ते अतिक्रमण रद्द करावे.

१८) मौजा कोराडी कॉलनीमध्ये बुले पडल्याने व सांडपाणी सोडल्यामुळे दलदल निर्माण झाली त्यामुळे ते अखंड नाली बांधकाम करुन, निवारण करावा.

१९) मौजा कोराडी, मौजा महादुला व परिसरात असणारे महसुली व ग्रा.पं.चे मालकीचे नाल्यात विद्युत विहार कॉलनीचे पुले गटर व मलमुत्र सोडण्यात आले ते नाले बाराही महिने प्रदुषण निर्माण करते. त्याचे पाणी दुषित असल्याने त्यामुळे उघडे सोडलेले गटर व पाणी बंद करावे व प्रदुषण टाळावे.

कार्यालय ग्रामपंचायत कोराडी

पंचायत समिती कामठी, त. कामठी, जि. नागपूर.

❖ सरपंच ❖
सौ. अनुराधा शेखर अमिन
मो. ९९६०९९९०५७

❖ कार्यालय फोन ❖
९५७१०९-२६२२९८

❖ सरपंच ❖
श्री. श्रीरंग यादव
मो. ९३२५६२८७६७

जावक क्र. दिनांक : ११/०३/०९

३०) कोराडी ग्रा.पं. चे भागातुन जाणारे ४० टक्के व ६० टक्के हॉट वाटर कॅनाल सिपेज होऊन गावात दलदल निर्माण करतात त्यामुळे कालवे दुरुस्ती करणे व प्रदुषण टाळावे.

३१) कोराडी ब वर्ग राज्यस्तरीय यात्रा स्थळ व 'ब' वर्ग पर्यटन शासनाने जाहीर केल्यामुळे पाँड नं १ व पर्यटन विभाग व ग्रा.पं. अश्या करार करुन, पाँड नं ३ चा खोलीकरण, रुंदीकरण व सौंदर्यीकरण करुन पर्यटन करीता उपलब्ध करावे. पाणी विज कंपनीने उचलावे पाण्यावर आपला हक्क राहणार नाही.

३२) [illegible] महालक्ष्मी सर्वे नं ६६/२ व ग्रा.पं. मालकीचे जमीन वीज कंपनीने फुकट मोबदला न देता आपल्या ताब्यात घेतली त्या जागा परत करावी किंवा मोबदला द्यावा.

वरील प्रमाणे अटीस अधीन राहुन ग्रामपंचायतचे विशेष सभा दि.१२/०३/०९ ठराव क्र.१ नुसार प्रस्तावित १ X ६६० मेगावॅट चे विद्युत प्रकल्पास नाहरकत देण्यात येत आहे.

Anuradha Amin

Annexure - 25 (a)

MAHARASHTRA STATE POWER GENERATION CO. LTD.
KORADI THERMAL POWER STATION
(ISO 9001:2008, ISO 14001:2004 & ISO 18001:2007)
Office of Chief Engineer (O & M), T.P.S., Koradi, Nagpur, PIN – 441111
Phone: (07109) 262141 to 262146, 262108, 262109 FAX: 262127(Off)
Email – cegenkoradi@mahagenco.in
CIN: U40100MH2005SGC153648

Ref. No: CE (O&M)/KTPS/660MW/Env.Cell./FL-10/ MD 3406

Date: 30 NOV 2021

CIRCULAR

Sub.: Formation of Environment Management Cell for Koradi TPS, 3X660 MW.

Ref.: MoEF Letter No. J-13012/87/2007-IA. II (T) dtd. 27.03.2015.

Ministry of Environment, Forest and Climate Change, GoI has issued Environment Clearance vide letter under reference. According to the condition no. 28 of this Environment Clearance "A separate Environment Management Cell with qualified staff shall be set up for implementation of the stipulated environmental safeguards."

In view of above, Environment Management Cell is here formed at Koradi TPS, 3X660 MW comprising of following officers.

Sr. No.	Name	Designation
1	S. S. Sonpethkar	Dy. C. E.
2	S. P. Degwekar	Supt. Engineer (Op)
3	S. R. Bharadhwaj	Exe. Engineer (Civil)
4	Y. N. Geranj	Exe. Chemist (Chem. Div.)
5	P. N. Madavi	Exe. Engineer (AHP)
6	R. M. Meshram	Exe. Engineer (B/M)
7	V. M. Joshi	Exe. Engineer (C&I)
8	R. Chaudhari	Exe. Engineer (CHP)
9	N. V. Mohod	Exe. Engineer (MS)
10	A. A. Bahate	Sr. Chemist (Env.)
11	S. G. Kanade	Add. Exe. Engineer (OS)
12	Priyanka Ahire	Add. Exe. Engineer (Safety)

For information to all concerned.

Chief Engineer
Koradi TPS, 3X660 MW

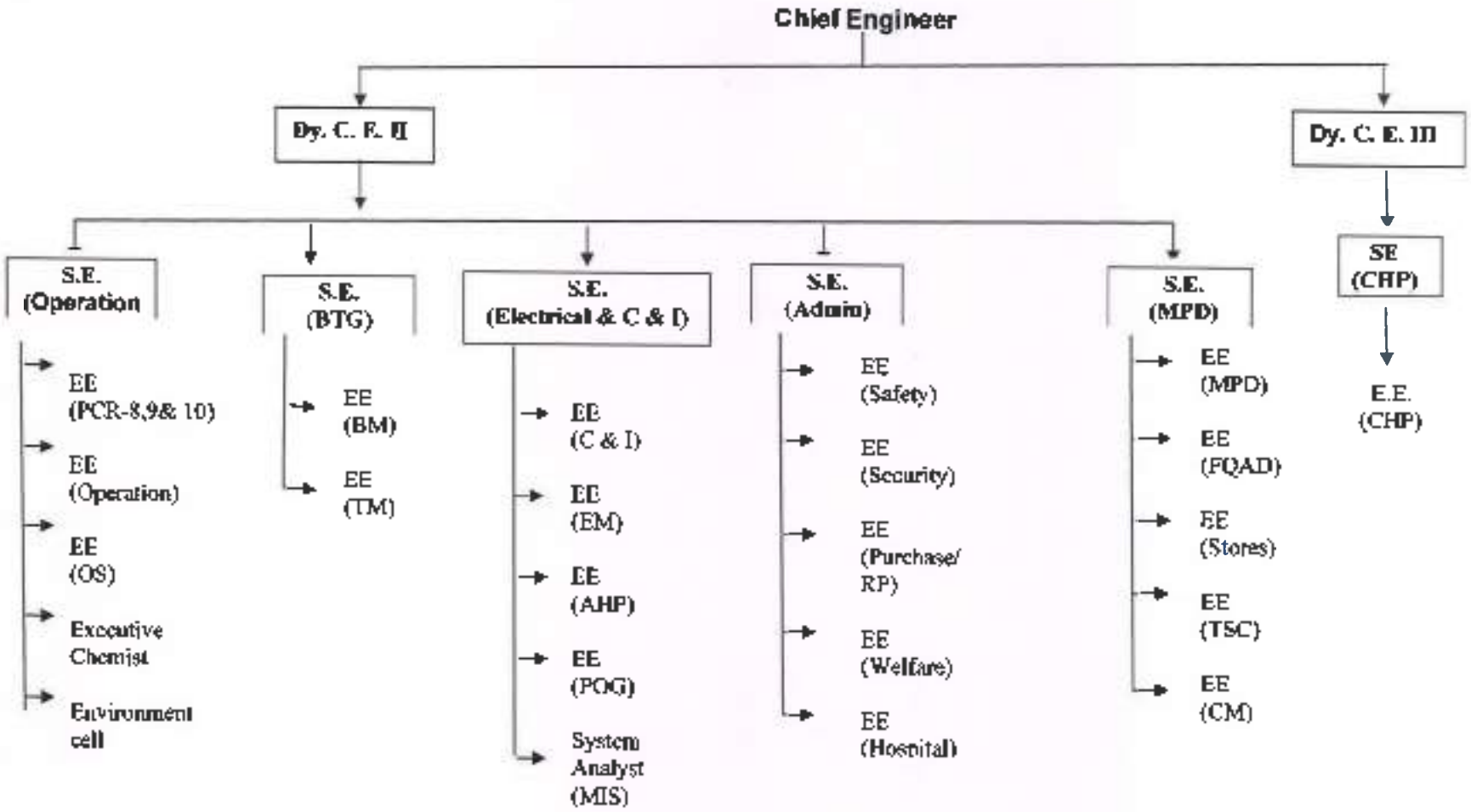
Copy f.w.cs. to:

Chief General Manager (CEHSU), 4th Floor, HDIL Tower, Mahagenco, Bandra (E), Mumbai-400051

Copy to:

1. Dy. Chief Engineer (Op), Koradi TPS, 3X660 MW.
2. Supt. Engineer (O&M/ Civil), Koradi TPS, 3X660 MW.
3. Sr. No. 1 to 12 through Section In-charge.

Koradi TPS, 3X660 MW



Annexure-25(b)

 Annexure - 26(a)

Compliance Status of Environmental Clearance condition for 3x660 MW coal based Thermal Power Plant at Koradi

Chief Engineer - Koradi TPS <cegenkoradi@mahagenco.in>

Thu 7/22/2021 11:28 AM

To: apccfcentral_ngp_mef@gov.in <apccfcentral_ngp_mef@gov.in>

Cc: edens <edens@mahagenco.in>; RO Nagpur <ronagpur@mpcb.gov.in>

1 attachments (3 MB)

Compliance Status of Environmental Clearance condition for 3x660 MW coal based Thermal Power Plant at Koradi.pdf;

Sir,

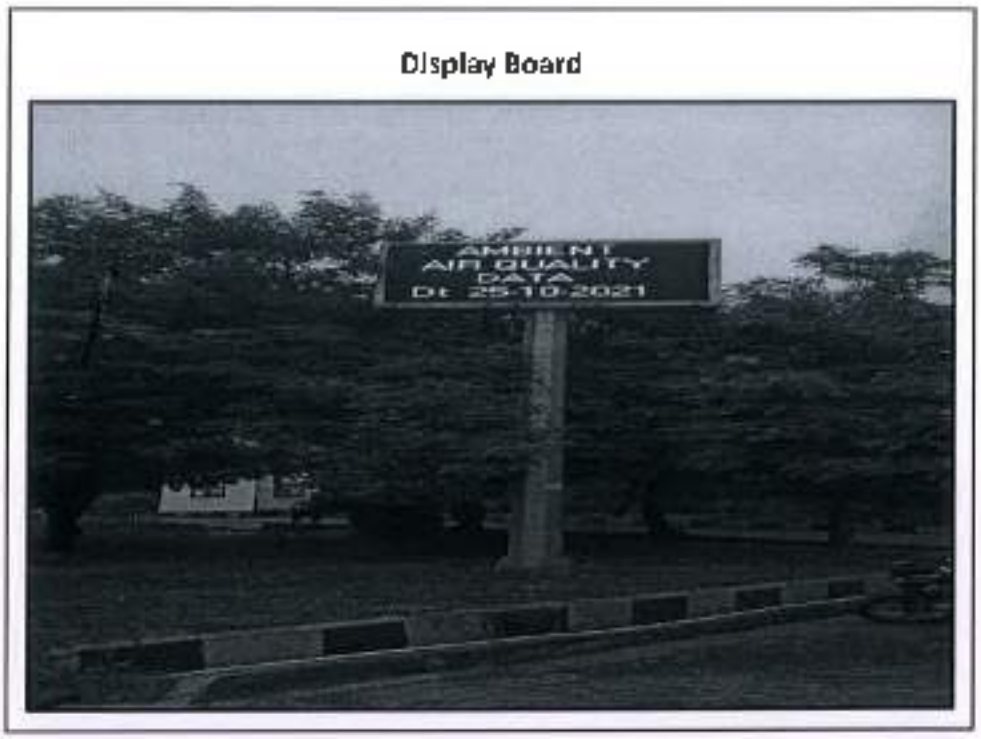
Compliance Status of Environmental Clearance condition for 3x660 MW coal based Thermal Power Plant at Koradi is attached.

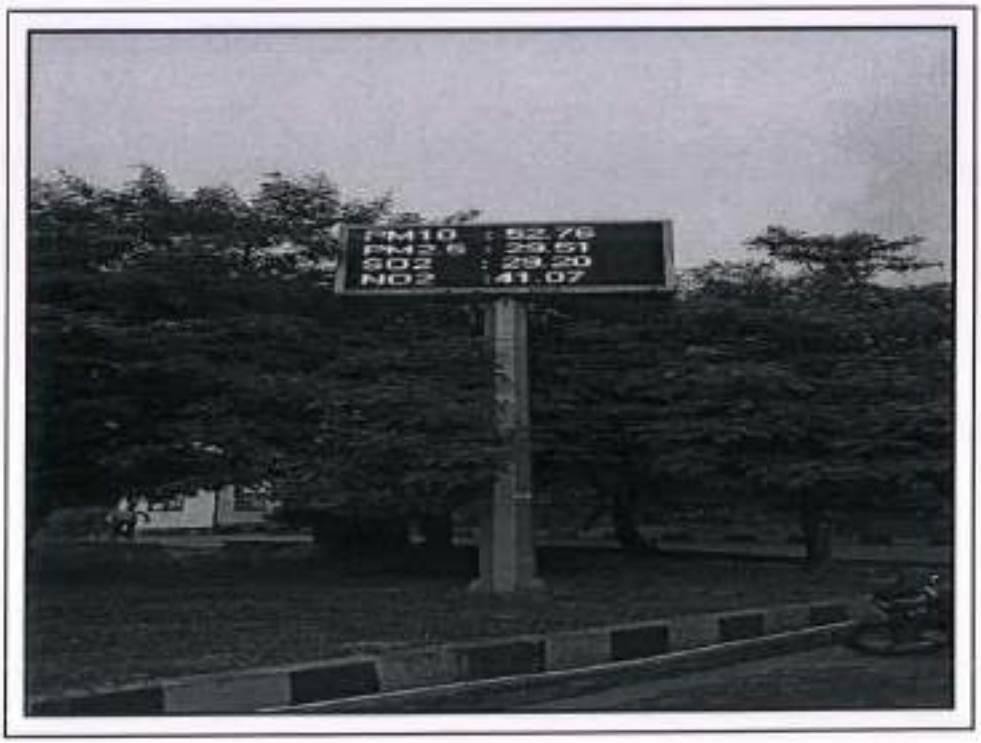
With Regards,
O/o Chief Engineer (O&M),
Koradi Thermal Power Station,
Koradi, Nagpur. (MS)

Annexure - 26(b)

12/5/2021

Display Board





Annexure- 26(c)

Fw: [EXTERNAL] - Station Processed - CPCB

Chief Engineer - Koradi TPS <cegenkoradi@mahagenco.in>
Mon 7/19/2021 4:20 PM
To: wtp210ktps <wtp210ktps@mahagenco.in>; chemicaldivision660ktps <chemicaldivision660ktps@mahagenco.in>; envcell210ktps <envcell210ktps@mahagenco.in>

With Regards,
O/o Chief Engineer (O&M),
Koradi Thermal Power Station,
Koradi, Nagpur. (MS)

From: CCR Team <cpcb.india.gov@gmail.com>
Sent: Monday, July 19, 2021 2:49 PM
To: Chief Engineer - Koradi TPS <cegenkoradi@mahagenco.in>; aditya.cpcb@gov.in <aditya.cpcb@gov.in>; anurag.cpcb@gov.in <anurag.cpcb@gov.in>; caaqms.cpcb@gov.in <caaqms.cpcb@gov.in>
Subject: [EXTERNAL] - Station Processed - CPCB

CAUTION: This email originated from outside of the organization. Do not click links or open attachments unless you recognize the sender and know the content is safe.

Welcome to
CPCB Industrial AQMS Portal

Dear sir/Madam,

Your station has been Processed and is under Integration.

Thanks & Regards:
CPCB Industrial AQMS Team
For any technical assistance, kindly mail to caaqms.cpcb@gov.in

Annexure - 27

Maharashtra Pollution Control Board

महाराष्ट्र प्रदूषण नियंत्रण मंडळ

FORM V

(See Rule 14)

Environmental Audit Report for the financial Year ending the 31st March 2021

Unique Application Number	*Submitted Date*
MPCB-ENVIRONMENT_STATEMENT-0000032791	24-06-2021

PART A

Company Information

Company Name	*Application UAN number*
MAHAGENCO, 3X660 MW, KORADI THERMAL POWER STATION	Format 1.0/CAC/UAN No. 0000076926/CR-2007000590 Dtd. 08.07.2020

Address

O/O CHIEF ENGINEER (O&M), 3X660 MW, KTPS, KORADI, NAGPUR

Plot no	*Taluka*	*Village*
KHASARA NO. 188-189	KAMPTEE	KORADI
Capital Investment (in lakhs)	***Scale***	***City***
1454072.67118	LSI	NAGPUR
Pincode	***Person Name***	***Designation***
441111	R. A. PATIL	CHIEF ENGINEER
Telephone Number	***Fax Number***	***Email***
9411957710	07109262127	cegenkoradi@mahagenco.in
Region	***Industry Category***	***Industry Type***
SRO-Nagpur I	Red	R48 Thermal Power Plants
Last Environmental statement submitted online	***Consent Number***	***Consent Issue Date***
yes	Format 1.0/CAC/UAN No. 0000076926/CR-2007000590	08.07.2020
Consent Valid Upto	***Establishment Year***	***Date of last environment statement submitted***
31.08.2021	2015	Jul 29 2020 12:00:00.000AM

Industry Category Primary (STC Code) & Secondary (STC Code)

Coal based power plant

Product Information

Product Name	*Consent Quantity*	*Actual Quantity*	*UOM*
ELECTRICITY	3X660 MW	7964669	Mwh

By-product Information

By Product Name	*Consent Quantity*	*Actual Quantity*	*UOM*
FLY ASH	10000000	5719871	
BOTTOM ASH	2400000	1429968	

Part-B (Water & Raw Material Consumption)

1) Water Consumption in m3/day

Water Consumption for	Consent Quantity in m3/day	Actual Quantity in m3/day
Process	NA	NA
Cooling	92501	79471
Domestic	942.59	1259
All others	90	25
Total	93533.59	80755

2) Effluent Generation in CMD / MLD

Particulars	Consent Quantity	Actual Quantity	UOM
TRADE EFFLUENT FROM ETP	10739	3210 19	CMD

2) Product Wise Process Water Consumption (cubic meter of process water per unit of product)

Name of Products (Production)	During the Previous Financial Year	During the current Financial year	UOM
ELECTRICITY	4.271	3.642	CMD

3) Raw Material Consumption (Consumption of raw material per unit of product)

Name of Raw Materials	During the Previous Financial Year	During the current Financial year	UOM
FURNACE OIL	0.00205	0.00145	
WATER	3.592	3 642	
COAL	0.740	0.786	MT/MWH

4) Fuel Consumption

Fuel Name	Consent quantity	Actual Quantity	UOM
COAL	10950000	6258955	Ton/Y
FURNACE OIL & LDO	NA	13337.66	KL/A

Part-C

Pollution discharged to environment/unit of output (Parameter as specified in the consent issued)

[A] Water

Pollutants Detail	Quantity of Pollutants discharged (kL/day)	Concentration of Pollutants discharged(Mg/Lit) Except PH,Temp,Colour	Percentage of variation from prescribed standards with reasons		
	Quantity	Concentration	%variation	Standard	Reason
SUSPENDED SOLID	62.60	19.5	0	100	NIL
BOD	29.53	9.2	0	30	NIL
COD	101.76	31.7	0	250	NIL

[B] Air (Stack)

Pollutants Detail	Quantity of Pollutants discharged (kL/day)	Concentration of Pollutants discharged(Mg/NM3)	Percentage of variation from prescribed standards with reasons		
	Quantity	Concentration	%variation	Standard	Reason

PM U# 8	2502.78	46	0	50	NIL
SO2 U #8	79980.3	1470	0	200	FGD installation proposal is under process at HO.
NO2 U #8	15032.8	291	0	450	NIL
PM U #9	2423.04	45	0	50	NIL
SO2 U #9	79476.06	1476	0	200	FGD Installation proposal is under process at HO.
NO2 U #9	15399.83	286	0	450	NIL
PM U #10	2350.52	44	0	50	NIL
SO2 U #10	76765.64	1437	0	200	FGD installation proposal is under process at HO.
NO2 U #10	15492.03	290	0	450	NIL

Part-D

HAZARDOUS WASTES

1) From Process

Hazardous Waste Type	Total During Previous Financial year	Total During Current Financial year	UOM
5.1 Used or spent oil	NIL	NIL	Ton/Y
Other Hazardous Waste	3.020	NIL	MT/A
Other Hazardous Waste	3.87	4.180	MT/A

2) From Pollution Control Facilities

Hazardous Waste Type	Total During Previous Financial year	Total During Current Financial year	UOM
Other Hazardous Waste	3.020	NIL	MT/A
Other Hazardous Waste	3.87	4.180	MT/A

Part-E

SOLID WASTES

1) From Process

Non Hazardous Waste Type	Total During Previous Financial year	Total During Current Financial year	UOM
FLY ASH	2095568	2087753	MT/A
BOTTOM ASH	523892	521938	MT/A

2) From Pollution Control Facilities

Non Hazardous Waste Type	Total During Previous Financial year	Total During Current Financial year	UOM
Same as I	same as I	same as I	MT/A

3) Quantity Recycled or Re-utilized within the unit

Waste Type	Total During Previous Financial year	Total During Current Financial year	UOM
29.1 Process wastes or residues	439836	1116596	MT/A

Part-F

Please specify the characteristics(in terms of concentration and quantum) of hazardous as well as solid wastes and indicate disposal practice adopted for both these categories of wastes.

1) Hazardous Waste

Type of Hazardous Waste Generated	*Qty of Hazardous Waste*	*UOM*	*Concentration of Hazardous Waste*
5.1 Used or spent oil	NIL	KL/A	As per schedule V of H.W. Rules
5.2 Wastes or residues containing oil	NIL	KL/A	As per schedule II of H.W. Rules
Other Hazardous Waste	NIL	MT/A	As per schedule II of H.W. Rules
Other Hazardous Waste	4.180	MT/A	As per schedule II of H.W. Rules

2) Solid Waste

Type of Solid Waste Generated	*Qty of Solid Waste*	*UOM*	*Concentration of Solid Waste*
FLY ASH	2087753	MT/A	As per schedule II of H.W. Rules
BOTTOM ASH	521938	MT/A	As per schedule II of H.W. Rules

Part-G

Impact of the pollution Control measures taken on conservation of natural resources and consequently on the cost of production.

Description	*Reduction in Water Consumption (M3/day)*	*Reduction in Fuel & Solvent Consumption (KL/day)*	*Reduction in Raw Material (Kg)*	*Reduction in Power Consumption (KWH)*	*Capital Investment(in Lacs)*	*Reduction in Maintenance(in Lacs)*
Recovered Water from ETP used for ash disposal	3210.19	NA	NA	NA	NA	NA

Part-H

Additional measures/investment proposal for environmental protection abatement of pollution, prevention of pollution.

(A) Investment made during the period of Environmental Statement

Detail of measures for Environmental Protection	*Environmental Protection Measures*	*Capital Investment (Lacks)*
ESP maint . & procurement of spares for ESP maint.	---	89.29306
Bag filters maint. at ash silo and Ash handling	---	915.39349
Procurement of various pumps, spares, maint. of pipelines, coal dust control	---	25.00000
Housekeeping, cleaning and hazardous waste handling	---	353.57619
Plantation and civil work	---	176.28941
MPCB JVS MONITORING	---	0.0
OCEMS AMC, CEMS AMC for online connectivity, AMC of knowledge lens	---	38.67804
Environmental monitoring and O&M of ETP/STP, CAAQMS	---	176.89673
Procurement of hoses & fore fighting nozzles	---	6.00000

(B) Investment Proposed for next Year

Detail of measures for Environmental Protection	*Environmental Protection Measures*	*Capital Investment (Lacks)*
ESP and bag filters at ash silo maint . & procurement of spares for ESP maint.	---	914.09534
Housekeeping, cleaning and hazardous waste handling	---	354.31822
OCEMS AMC, CEMS AMC for online connectivity, AMC of knowledge lens	---	37.40000
Environmental monitoring and O&M of ETP/STP, CAAQMS	---	195.50000
Procurement of various pumps, spares, maint. of pipelines, coal dust control, etc.	---	27.70000

Plantation and civil work	---	308.99328
Procurement of hoses & fore fighting nozzles	---	7.00000

Part-I

Any other particulars for improving the quality of the environment.

Particulars

Installation of three CAAQMS completed and online connectivity of same is established on MPCB server. FGD installation proposal is under process at HO.

Name & Designation

Mr. R. A. Patil , Chief Engineer (O&M), KTPS, 3X660MW, Koradi

CAN No:

MPCB-ENVIRONMENT_STATEMENT-0000032791

Submitted On:

24-06-2021

Annexure- 28

Koradi Thermal Power Station, 3X660 MW

Environmental Expenditure For April- 2020 to March- 2021

Sr No.	Section	Particulars	F. Y 2020-21 (In Lakhs)	F Y. 2021-22 (In Lakhs)
1	C&I	AMC for OCEMS, AMC of CEMS analysers for remote calibration and online connectivity. AMC of Knowledge Lens software data transmission support of ETP/STP to CPCB/MPCB server.	36.67604	37.40000
2	OS	Housekeeping, cleaning and hazardous waste handling	353 57819	354 31822
3	AHP	ESP mainte. & procurement of spares for ESP mainte.	69.69826	132 36224
		Procurement of bag filters and mainte. At Ash Handling	915 39349	747.13310
4	TM	Maintenance of pipelines and procurement of fume absorber for acid tank	25.00000	34.70000
5	Civil	Plantation of plants & its maintenance	176 26941	308 99328
6	Env. Cell	O&M of ETP/STP & CAAQMS; online connectivity of CAAQMS stations, Environmental Monitoring by mobile van. HW disposal	185 30423	252.22110
7	Major Stores	Nil	0	0
8	FAU	Nil	0	0
9	Env. Cell	MPCB JVS monitoring	Not Received	Not Received
10	IT	Nil	0	0
11	BM	Nil	0	0
12	EM	Spares and maintenance of ESP pass and rapper system, ESP control system	19.59960	34.60000
13	CHP	Flexible hoses, SS fire fighting nozzle, magnetic plate	6.00000	7.00000
		Total	**1789.54142**	**1908.72764**

Annexure-29(a)

DPR for Roof Top Solar PV Plant At KTPS Capacity: - 3300 kWp

Address: At Various Buildings of
Koradi Thermal Power Station, (KTPS)
& Colony, Koradi, Nagpur

MAHAGENCO
Maharashtra State Power Generation Co. Ltd.

Prepared and Submitted BY

PPS Energy Solutions

Regd. Off: B-403, Bharti Vihar, S. No-78,
Bharti Vidyapith Campus, Katraj,
Pune – 411046 Ph:+91-20-2523 2858, 6400 0643

Contents :

INTRODUCTION

The solar energy has a great potential as future source of energy. With its availability in large quantity almost in every corner of the country, solar power has the distinctive advantage of generating power at local and decentralized levels and being one of the prime factors for empowering people at grassroots level. The solar mission, which is part of the National Action Plan on Climate change has been set up to promote the development and use of solar energy for power generation and other uses with the ultimate objective of making solar energy competitive with fossil-based energy options. The solar photovoltaic device systems for power generation had been deployed in the various parts in the country for electrification where the grid connectivity is either not feasible or not cost effective as also some times in conjunction with diesel based generating stations in isolated places, communication transmitters at remote locations. With the downward trend in the cost of solar energy and appreciation for the need for development of solar power, solar power projects have recently been implemented. A significant part of the large potential of solar energy in the country could be developed by promoting solar photovoltaic power systems of varying sizes as per the need and affordability coupled with ensuring adequate return on investment.

BENEFITS OF SOLAR ENERGY

a. Power from the sun is clean, silent, limitless and free.

b. Photovoltaic process releases no CO2, SO2, or NO2 gases which are normally associated with burning finite fossil fuel reserves and don't contribute to global warming.

c. Photovoltaic are now a proven technology which is inherently safe as opposed to other fossil fuel based electricity generating technologies.

d. Solar power shall augment the needs of peak power needs.

e. provides a potential revenue source in a diverse energy portfolio

f. Assists in meeting renewable portfolio standards goals.

This proposal is prepared for design, engineering, procurement / manufacture and installation of solar power generating system. The grid-tie solar photovoltaic power generation system is mainly composed of PV array, String Inverter, and PV mounting structure.

It also consists of supporting devices like AC / DC switchgears, Lighting Arrestor, Earth Electrodes, AC / DC cables. As there is no any battery, it's maintenance cost is negligible and initial investment per KW is very low.

OBJECTIVE

- Provide reliable, clean, regulated, un-interrupted power on demand to the pre-identified critical loads
- System to provide low life cycle cost and maximize savings to the beneficiaries.
- To save diesel in institutions and other commercial establishments including industry facing huge power cuts especially during daytime.

DESIGN ASSUMPTIONS

General

a. The Solar Radiation Data's are based on standard books & simulation software as NASA and Meteonorm. The Mean Hourly Radiation Data is considered.

b. The module rating considered is tentative. The exact module sizing and rating will depend on the availability of cell grade and site suitability.

c. Solar Panels are roof/ground mounted in one location. Environmentally protected, closed, ventilated, inverter room at minimum distance from PV modules.

d. Application: Self consumption, captive grid or NET metering.

e. Emergency Backup: Generator or any other source in absence of Grid.

SYSTEM DESCRIPTION :

Solar Power Plant comprises of the main equipment and components listed below:

1. Solar PV Modules
2. String Inverter with MPPT
3. Module mounting system
4. Monitoring system
5. Cables & connectors

Each of the sub systems has been described for the functionality and operation modes. The physical construction of the system follows a modular approach, which is field-tested and is regularly used for delivery of power systems.

1) SOLAR PV MODULE (ELECTRICAL FEATURES)

The PV modules convert the light reaching them into DC power. The amount of power they produce is roughly proportional to the intensity and the angle of the light reaching them. They are therefore required to be positioned to take maximum advantage of available sunlight within sitting constraints.

2) SOLAR PV MODULE (MECHNICAL FEATURES)

Solar Module design will conform to following Mechanical requirements

- Toughened,
- low iron content,
- High transmissivity from glass.
- Anodized Aluminum Frame.
- Ethyl Vinyl Acetate (EVA) encapsulating.
- Tedlar/Polyester trilaminate back surface.
- ABS plastic terminal box for the module output termination with gasket to prevent water & moisture.
- Resistant to water, abrasion hall impact, humidity & other environment f actors for the worst situation at site.

3) MODULE MOUNTING STRUCTURE

The structure shall be designed to allow easy replacement of any module and shall be in line with site requirement. Structure shall be designed for simple mechanical and electrical installation. It shall support SPV modules at a given orientation, absorb and transfer the mechanical loads to the ground properly There shall be no requirement of welding or complex machinery at site. The array structure shall have tilt arrangement to adjust the plane of the solar array for optimum tilt.

4) JUNCTION BOX

The junction boxes shall be dust, vermin and waterproof and made of FRP/ABS Plastic with IP65 protection. The terminals shall be connected to copper bus bar arrangement of proper sizes. The junction boxes shall have suitable cable entry points fitted with cable glands of appropriate sizes for both incoming and outgoing cables. Suitable marking shall

be provided on the bus bar for easy identification and cable ferrules shall be fitted at the cable termination points for identification.

5) STRING INVERTER

The STRING INVERTER is a combination of Solar Charger (MPPT), Inverter and synchronization unit for two different AC supplies, all housed in a single unit. Maximum power point tracker (MPPT) shall be integrated into it to maximize energy drawn from the solar array. The Inverter converts the DC available from the array into an AC output. The output of the inverter is filtered to reduce the harmonics to an acceptable level (less than 5%). MPPT shall be microprocessor/micro controller based to minimize power losses and maximize energy utilization. The efficiency of MPPT shall not be less than 90% and shall be designed to meet the solar PV Array capacity.

6) AC /DC CABLES

We use DC & AC cables of Lap, Apar, Polycab, Havels, Finolex or equivalent make to ensure minimum losses in transmission

In order to complete the energy study that leads to the construction of a photovoltaic installation, hourly series of global horizontal irradiation values for a complete year are used, which resume the irradiation and other meteorological parameters behavior over a long term. We use PVsyst. Software to workout optimum power production at site with minimum loses.

7) GROUNDING AND LIGHTING PROTECTION

- A protective earth (PE) connection ensures that all exposed conductive surfaces are at the same electrical potential as the surface of the Earth, to avoid the risk of electrical shock. It ensures that in the case of an insulation fault (a "short circuit"), a very high current flows, which will trigger an over current protection device as fuses and circuit breakers that disconnects the power supply.
- A functional earth connection serves a purpose other than providing protection against electrical shock. In contrast to a protective earth connection, a functional earth connection may carry a current during the normal operation of a device.
- Lightning protection is a very specialized form of grounding used in an attempt to divert the huge currents from lightning strikes. A ground conductor on a lightning arrester system is used to dissipate the strike into the earth.
- Lightning ground conductors must carry heavy currents for a short period of time. To limit inductance and the resulting voltage due to the fast pulse nature of lightning currents, lightning ground conductors may be wide flat strips of metal, usually run as directly as possible to electrodes in contact with the earth
- In proposal, the entire system is fully provided with the required lighting and grounding protection.

Koradi Thermal Power Station 210MW, Koradi, Nagpur

SOLAR PV LOCATIONS

Buildings Considered for Solar Power Installation

1. Service Building
2. WTP-2
3. Turbine 6 & 7 Terrace
4. Turbine Building
5. CTPL Building
6. Club-2 (Colony)
7. Hospital (Colony)
8. Powerhouse Building
9. DG Building

10. Compressor Building

11. CT Pump House

12. A.W. Pump House

13. ESP Control Room

14. CW Pump House

15. ACW Pump House

16. DM Plant

17. HCSD

18. FOPH Building

19. Fire Station Building

20. TTW & FW Pump House

21. CPU Refrigeration Building

22. Chemical house of PT Plant

23. Time Office

24. Air Washer

25. Central Purchase Store

26. New Cycle Stand

1. CTPL Building Terrace Down Portion

55ft. x 30 ft. (Shaded Area)

2. Turbine 6 & 7 Building Terrace
270 ft. x 100 ft.

3. WTP -2 Building Terrace (Zigzag Top)

A– 140 ft. x 130 ft. & B– 160 ft. x 80 ft.

4. Club-2 Building at Colony (Taper Top)

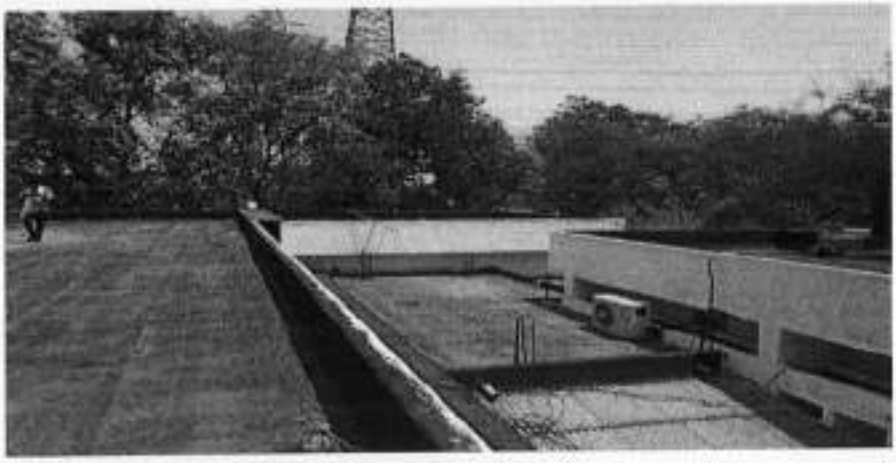
80 ft. x 30 ft.

5. Hospital Building Part-A at Colony

65 ft. x 20 ft.

6. Hospital Building Part-B at Colony

70 ft. x 20 ft.



7. Hospital Building Part-C at Colony

40 ft. x 20 ft.

8. Power House Building Terrace

80 ft. x 1000 ft.

9. DG Building Terrace

120 ft. x 150 ft.

10. Compressor Building Terrace

40 ft. x 90 ft.

11. CT Pump House Terrace

80 ft. x 15 ft.

12. ESP Control Room

40 ft. x 140 ft.

13. CW Pump House Terrace

60 ft. x 200 ft.

14. ACW Pump House Terrace

60 ft. x 30 ft.

15. DM Plant Terrace

150 ft. x 80 ft.

16. HCSD

50 ft. x 30 ft.

17. FOPH Building Terrace

80 ft. x 60 ft.

18. Fire Station Building Terrace

60 ft. x 40 ft.

19. TTW & FW Pump House Terrace

300 ft. x 30 ft.

20. CPU Regeneration Building Terrace

120 ft. x 40 ft.

21. Chemical House of PT Plant

90 ft. x 70 ft.

22. Time Office Terrace

30 ft. x 30 ft.

23. Air Washer Terrace

60 ft. x 30 ft.

Summary of Various Buildings at KTPS:

Average Unit Consumption / year for only Lighting Load of Various KTPS Buildings are **1154568** Units. For 210MW Plant & 5977386 Units for 3 x 660MW (Ref. EA & DPR Report)

Sr. No.	Name of Building	Length (ft.)	Width (ft.)	Area (Sq. ft.)	Plant Installed (kW)
1	Urja Bhavan Building Terrace Portion 1	100	60	6000	75
2	Urja Bhavan Building Terrace Portion 2	90	35	3150	39
3	CTPL Building Terrace Down Portion	55	30	1650	20 (Not Feasible due to shaded

Sr. No.	Name of Building	Length (ft.)	Width (ft.)	Area (Sq. ft.)	Plant Installed (kW)
					area)
4	CTPL Building Terrace Upper Portion	85	30	2550	30
5	Turbine Building Terrace	200	30	6000	75
6	Service Building Terrace	100	55	5500	70
7	WTP 2 Terrace (Zigzag Top) Portion 1	140	130	18200	225
8	WTP -2 Terrace (Zigzag Top) Portion 2	160	80	12800	160
9	Turbine 6 & 7 Terrace	270	100	27000	235 (70% of actual capacity)
10	Club-2 Building at Colony	80	30	2400	30
11	Hospital Building Part-A at Colony	65	20	1300	15
12	Hospital Building Part-B at Colony	70	25	1750	20
13	Hospital Building Part-C at Colony	40	20	800	10
14	Power House Building Terrace	80	1000	80000	1000
15	DG Building Terrace	120	150	18000	225
16	Compressor Building Terrace	40	90	3600	45
17	CT Pump House Terrace	80	15	1200	15
18	A.W. Pump House Terrace	70	230	16100	200
19	ESP Control Room Terrace	40	140	5600	70
20	CW Pump House Terrace	60	200	12000	150
21	ACW Pump House Terrace	60	30	1800	20
22	DM Plant Terrace	150	80	12000	150
23	HCSD Terrace	50	30	1500	18
24	FOPH Building Terrace	80	60	4800	60
25	Fire Station Building Terrace	60	40	2400	30
26	TTW & FW Pump House Terrace	300	30	9000	110
27	CPU Regeneration Building Terrace	120	40	4800	60
28	Chemical House of PT Plant	90	70	6300	78

Sr. No.	Name of Building	Length (ft.)	Width (ft.)	Area (Sq. ft.)	Plant Installed (kW)
	Terrace				
29	Time Office Terrace	30	30	900	10
30	Air Washer Terrace	60	30	1800	20
31	Central Purchase Store Terrace	80	30	2400	30
32	New Cycle Stand	1200	10	12000	30
				285300	**3325**

Total Area = 285300 Sq. Ft. & As per available shadow free Area maximum 3325 kW Plant can be installed on various buildings as per details mentioned in above table.

Note: As per available shadow free space KTPS can install maximum 3300-3325 kWp Solar Photovoltaic Power Plant on various buildings.

CAPACITY EVALUATION

Calculation for Required Solar Capacity plant to fulfill In-house Requirement

Sr. No.	Details	Value	Unit
1	Average electrical consumption per year considering both plants (210MW & 3 x 660 MW)	7131954	kWh
2	Units generated per day per kWp	4.5	kWh/kWp/day
3	Units generated per Year per kWp (330 days / Year)	1485	kWh/kWp/Year
4	Solar KW capacity for 7131954 kWh consumption / year	4802	kWp

As per electrical consumption (Building Lighting Load), capacity of Solar Power Plant required is 4802 kWp., After considering Plant Lighting Load Solar requirement may increase. As per shadow free space available on Various Buildings at KTPS maximum 3300 - 3325 kWp plant can be installed which covers full Building Lighting Load & partial requirement from Plant Lighting Load also.

The SPV power plant with proposed capacity of 3300 kWp would be connected to the main electrical distribution panel. The system would meet partial load requirement of the connected load during the day. Advance control mechanism in the Power Conditioning Unit will ensure that the maximum power generated by PV modules will be utilized first and the balance requirement of power will be met by either grid or DG set.

The 3300 kWp SPV Power Plant is estimated to afford annual energy feed around 4900500 kWh/year (After considering all losses) considering efficiency of the solar module as 15.16%, Power Conditioning Unit (PCU) efficiency as 98.3% and losses in the DC and AC system as 3%.

BUDGETARY ESTIMATION OF THE PROJECT

Details	Value	Unit
Shadow free space required for approx 1 KWp Solar Plant	80	Sq.Ft
Shadow free space available on Various Buildings at KTPS	285300	Sq.Ft
Solar Plant capacity to be installed on Various Buildings	3566	kWp
Solar Plant Round off capacity to be installed on Various Buildings at different area	3300	kWp
Installation Cost Per kWp Solar Plant	0.40	Rs. In Lakh
Gross Estimated System cost (For 3300 kWp Grid Connected Solar Plant)	1320	Rs. In Lakh
Unit generated per day per kWp Solar Plant	4.5	kWh
Electricity generation per day for 3300 kWp Grid Connected Solar Plant	14850	kWh/day
Electricity generation per year for 3300 kWp Grid Connected Solar Plant (330 days / year)	4900500	kWh/year
Average Electricity Unit Cost	6.00	Rs./kWh
Electricity cost saved per year	294.03	Rs. In Lakh
Simple payback period	4.49	Years

For PPS Energy Solutions Pvt. Ltd. Pune

PPS ENERGY SOLUTIONS PVT. LTD. PPS

Nilesh S. Saraf
(Sr. Manager)

Annexure - 29(b)

MAHAGENCO
CIN: U40100MH2005SGC153648

MAHARASHTRA STATE POWER GENERATION CO. LTD.
KORADI THERMAL POWER STATION
(ISO 9001:2015, ISO 14001:2015 & ISO 45001:2018)
Office of: Chief Engineer (O & M), T.P.S., Koradi, Dist. Nagpur, PIN - 441111
Phone: (07109) 252141 to 252146,252106, 252109 FAX: 252127(Off)
Email –cegenkoradi@mahagenco.in

Ref. No : KTPS/210MW/EM-II / No 1182 **DT.** 08 NOV 2019

To,
Chief Engineer (SPGD)
4th Floor, HDIL Tower,
Bandra (E), Mumbai – 51

Subject:- DPR for Roof Top Solar PV Plant at KTPS Plant and Colony Buildings – Submission of Project Report reg.

With reference to above, please find enclosed herewith the detailed project report for installation of Roof Top Solar PV plant at KTPS 210 MW plant and KTPS colony.

This is for your further needful please.

Enclo. –
1) DPR copy.

Chief Engineer (O & M)
210 MW,KTPS,KORADI

Copy s.w.r.to:
ED (CPE), Prakashgad, Mumbai

Copy to:
General Manager (MEDA)
Dugdha Vikas Karmachari Gruhnirman Sahakari Sanstha
2nd Floor, Palm Road, Civil Lines, Nagpur-440001

MAHAGENCO
Maharashtra State Power Generation Co. Ltd.
CIN: U40100MH2005SGC153449

MAHARASHTRA STATE POWER GENERATION CO. LTD.
KORADI THERMAL POWER STATION
(ISO 9001:2015, ISO 14001:2015 & ISO 45001:2018)
Office of: Chief Engineer (O & M), T.P.S., Koradi, Dist. Nagpur, PIN – 441111
Phone: (07109) 262141 to 262146,262105, 262100 FAX: 262127(Off)
Email –cegeekoradi@mahagenco.in

Ref. No : KTPS/210MW/EM-II / 05957 DT. 18 JUN 2021

To,
Chief Engineer (SPGD)
4th Floor, HDIL Tower,
Bandra (E), Mumbai – 51

Subject:- DPR for Roof Top Solar PV Plant at KTPS Plant and Colony Buildings – Submission of Project Report reg.

Reference:- 1) T.O.Letter No. KTPS/210 MW/EM-II/1182 dtd.08.11.2019
2) DPR for Roof Top Solar PV plant at KTPS capacity 3300 KWp

With reference to above, the detailed project report for installation of Roof Top Solar PV plant at KTPS 210 MW plant and KTPS colony was sent for further process vide letter no.1182 referred at (1).

Please convey the current status of the proposal for further correspondence.

Encls. –
1) Ltr. Under ref.(1)
2) DPR copy.

Chief Engineer (O & M)
210 MW,KTPS,KORADI

Copy s.w.r.to:
ED (CPE), Prakashgad, Mumbai

Copy to:
General Manager (MEDA)
Dugdha Vikas Karmachari Gruhnirman Sahakari Sanstha
2nd Floor, Palm Road, Civil Lines, Nagpur-440001

Annexure - 30

GOVERNMENT OF INDIA
DEPARTMENT OF ATOMIC ENERGY
BOARD OF RADIATION & ISOTOPE TECHNOLOGY
RADIOACTIVITY TEST CERTIFICATE

RADIOANALYTICAL LABORATORY

Ref: BRIT/RAL/D/467-82/MISC/368-83/19-20

SEP 04, 2019

TO
M/S. KORADI THERMAL POWER STATION
OFFICE OF :CHIEF ENGINEER (O&M),
T.P.S. KORADI, NAGPUR, PIN – 441111.

This is regarding the "COAL, FLY ASH, BOTTOM ASH & ASH BUND" samples sent by you vide letter no KTPS/660/CO/B-41/02096 dated 28.08.2019 for radioactivity analysis with the following details:

SAMPLE DESCRIPTION :
1. COAL
2. FLY ASH
3. BOTTOM ASH
4. ASH BUND

The samples were analysed for U-238, Th-232, Ra-226 & K-40 radioactivity content and the values obtained are as follows:

SR. NO.	SAMPLE DESCRIPTION	U-238 (Bq/Kg)	Th-232 (Bq/Kg)	Ra-226 (Bq/Kg)	K-40 (Bq/Kg)
1	COAL	28.9 ± 6.2	40.4 ± 7.4	MDL 1.23	86.3 ± 9.4
2	FLY ASH	61.6 ± 7.9	101.5 ± 10.7	MDL 1.23	308 ± 16.1
3	BOTTOM ASH	51.1 ± 7.6	101.1 ± 13.9	65.3 ± 8.2	291.7 ± 8.9
4	ASH BUND	70.4 ± 8.4	88.6 ± 9.9	7.2 ± 2.7	348.1 ± 14.8

Date of receipt of sample: 28.08.2019 Date of completion of test: 03.09.2019

The measurement values are below the clearance level for radionuclides of natural origin in bulk solid materials, as per AERB directive 01/2010 (table-3) dated 26/11/2010.

Note: (i)The report pertains to the given sample only. (ii)The sample will be retained in this laboratory for a period of one month from certificate date and thereafter it will be disposed off. (iii)This report shall not be reproduced except in full, without written approval of the laboratory. (iv) The sampling is not done by this laboratory.

checked by:
(AJAY. N. THAMKE)

Authorized Signatory 04/09/19

अजय एन. ठमके / Ajay N. Thamke
वैज्ञानिक अधिकारी / Scientific Officer
रेडियोवैश्लेषक प्रयोगशाला / Radioanalytical Laboratory
विकिरण एवं आइसोटोप प्रौद्योगिकी बोर्ड
Board of Radiation & Isotope Technology
सेक्टर–20/ Sector-20, वाशी संकुल / Vashi Complex
नवी मुंबई / Navi Mumbai-400 703.

End of Report

Annexure- 31

महाराष्ट्र MAHARASHTRA ◑ 2020 ◑

NAGPUR TREASURY
AW 740767
15 SEP 2020
Stamp Head Clerk / Sr. Clerk

UNDERTAKING

Ref No:- KTPS/CE (O & M) /DFA/Permission Letter/IRSHAD/2021/219 SEP Date: 22-09-2020

To,

Koradi Thermal Power Station, Koradi,
Maharashtra State Power Generation Co. Ltd.
Dist :- Nagpur-441111.

Subject :- Undertaking for Usages of Fly Ash in cement/Construction/or other ash-based Product/Industry for own or others ash based industry.

Ref No:- KTPS/CE (O& M) /DFA/Permission Letter /IRSHAD/2021/ 219EP20

Dear Sir,

This is to certify that we M/s. Irshad Enterprises, the applicant for the Fly Ash from Koradi Thermal Power Station koradi, against Award of Contract/Sale order of Dry fly ash/EOI of fly ash/lifting of pond ash from ash bund, allocated vide order no KTPS/CE (O & M) /DFA/Permission Letter/IRSHAD/2021,to us, shall be used at our Industry or others Industry for Brick manufacturing/~~Cement manufacturing/Construction~~/or other ash based products and shall not be used for Agriculture purpose of mine void filling as per Koradi TPS, MSPGCL policy.

Thanking you,

FOR IRSHAD ENTERPRISES

भारतीय गैर न्यायिक

भारत INDIA

रु. 500 FIVE HUNDRED RUPEES

पाँच सौ रुपये Rs. 500

INDIA NON JUDICIAL

महाराष्ट्र MAHARASHTRA © 2020 ©

NAGPUR TREASURY

BB 517937

14 JUL 2021

Stamp Head Clerk / Sr. Cl

ANNEXURE – A

Undertaking

Ref No. RCCPL/BTBR/Fly-Ash/Koradi TPS/01 Date: 05.07.2021

To,

Koradi Thermal Power Station, Koradi,
Maharashtra State Power Generation Co. Ltd.,
Dist. Nagpur – 441111.

Subject: Undertaking for Usage of Fly Ash in Cement Industry for own and regarding Transportation Cost.

Dear Sir,

This is to certify that we **M/s. RCCPL Private Limited, Butibori Dist. Nagpur** the applicant for the Fly Ash from **Koradi Thermal Power Station,** against sale order of Dry fly ash allocated vide order no. KTPS/3x660 MW/FAU/FL-55/No. 01784 dt. 05.07.2021 to us, **shall be used at our industry** for cement manufacturing and shall not be used for Agriculture Purpose or mine void filling as per Koradi TPS, MSPGCL Policy.

Transportation Cost towards fly ash from Koradi Thermal Power Station shall be borne by us.

Thanking You.

Seal & Stamp of Bidder

RCCPL Private Limited

महाराष्ट्र MAHARASHTRA ◐ 2020 ◐

NAGPUR TREASURY
BB 517937
14 JUL 2021
Stamp Head Clerk / Sr. Cl

ANNEXURE – A

Undertaking

Ref No. RCCPL/BTBR/Fly-Ash/Koradi TPS/01 **Date: 05.07.2021**

To,
Koradi Thermal Power Station, Koradi,
Maharashtra State Power Generation Co. Ltd.,
Dist. Nagpur – 441111.

Subject: Undertaking for Usage of Fly Ash in Cement Industry for own and regarding Transportation Cost.

Dear Sir

This is to certify that we **M/s. RCCPL Private Limited, Butibori Dist. Nagpur** the applicant for the Fly Ash from **Koradi Thermal Power Station,** against sale order of **Dry** fly ash allocated **vide** order no. KTPS/3x660 MW/FAU/FL-55/No. 01784 dt. 05.07.2021 to us, **shall be used at our industry** for cement manufacturing **and** shall **not** be used for Agriculture Purpose or mine void filling as per Koradi TPS, MSPGCL Policy.

Transportation Cost towards fly ash from Koradi Thermal Power Station shall be borne by us.

Thanking You.

Seal & Stamp of Bidder

RCCPL Private Limited
A Cement Company

महाराष्ट्र MAHARASHTRA © 2020 ©

NAGPUR TREASURY
BB 517937
14 JUL 2021
Head Clerk / Sr.Cl

ANNEXURE – A

Undertaking

Ref No. RCCPL/BTBR/Fly-Ash/Koradi TPS/01 Date: 05.07.2021

To,
Koradi Thermal Power Station, Koradi,
Maharashtra State Power Generation Co. Ltd.,
Dist. Nagpur – 441111.

Subject: Undertaking for Usage of Fly Ash in Cement Industry for own and regarding Transportation Cost.

Dear Sir

This is to certify that we M/s. RCCPL Private Limited, Butibori Dist. Nagpur the applicant for the Fly Ash from Koradi Thermal Power Station, against sale order of Dry fly ash allocated vide order no. KTPS/3x660 MW/FAU/FL-55/No. 01784 dt. 05.07.2021 to us, shall be used at our industry for cement manufacturing and shall not be used for Agriculture Purpose or mine void filling as per Koradi TPS, MSPGCL Policy.

Transportation Cost towards fly ash from Koradi Thermal Power Station shall be borne by us.

Thanking You.

Seal & Stamp of Bidder

RCCPL Private Limited
A Cement Company

महाराष्ट्र MAHARASHTRA ◑ 2020 ◑ AY 318584

22 DEC 2020

Sub Treasury Officer Saoner

Date : 29/12/2020

UNDERTAKING

Ref No. SC/KPKD/175/20

To,

Chief Engineer (O & M)

2 X 210 MW, Koradhi Thermal Power Station,

Koradhi, Dist – Nagpur - 441111

Sub : Undertaking for Usage of Fly Ash In Cement / Construction / or other ash based Product / Industry **for own or others ash-based Industry** and regarding Transporation cost.

Dear Sir,

This is to certify that we **M/s Shri Sai Construction**, the applicant for the Fly Ash from from Koradhi **Thermal Power Station**, against Award of Contract / Sale Order of Dry fly ash / EOI of fly ash / lifting of pond ash from ash bund, allocated vide order No. **KTPS/CE(O&M)/Bund ash / Sale order / 2020-21/1478 dtd 21.11.2020** to us. **Shall be used at our industry** for bricks manufacturing / cement manufacturing / construction / or other ash based products and shall not be used for Agriculture purpose or mine void filling as per Koradi TPS, MSPGCL, policy.

Transporation cost towards fly ash from Koradi Thermal Power Station shall be borne by us.

Thanking you

SHRI SAI CONSTRUCTION

Proprietor

Seal and Stamp of Bidder

022

महाराष्ट्र MAHARASHTRA ◑ 2020 ◑ AW 705797

25 AUG

Sub Treasury Officer Sonegaon

ANNEXURE-A

UNDERTAKING

Ref.No. Date: 09/09/2020

To,

KORADI THERMAL POWER STATION,KORADI,
MAHARASHTRA STATE POWER GENERATION CO.LTD.
DIST. NAGPUR- 441111,

Subject : Undertaking for Usage of Fly Ash in Cement/Construction/ or other ash based Product/Industry for own or others ash based Industry.

Dear Sir,

This is to certify that we M/s. SINGH METAL WORKS the applicant for the Fly Ash from Koradi Thermal Power Station Koradi,against Sale order of Dry Fly Ash/lifting of pond ash from ash bund, allocated vide order no KTPS/CE(O&M)/Bund ash/Sale order/2020-21/ 0766 dtd.on 04.09.2020 to us, shall be used at our industry or others industry for Cement manufecturing/Construction/or other ash based products and shall not be used for Agriculture

..2..

ANNEXURE – A
TREE PLANTATION LIST

Year	Nos. of trees	Location	Area covered	Nos. of species	Nos. of trees survived in 2017 (in Nos.)	No. of trees survived in 2018 (in Nos.)	Remarks
2016	5000	Tree plantation in between area of Khasara ash water recovery pump house to Masala railway crossing parallel to railway crossing	2.00 Hectors	Kadunimb, Gulmohar, Karanji, Pipal, Mango, Sisam, etc.	--	4100	
2016	5000	Between Koradi and Khasara ash water recovery pump house.	2.00 Hectors	Kadunimb, Gulmohar, Karanji, Pipal, Mango, Sisam, etc.	--	4300	
2016	5000	Near Masala Railway crossing (Koradi ash bund)	2.00 Hectors	Kadunimb, Gulmohar, Karanji, Pipal, Mango, Sisam, etc.	--	3900	
2016	5000	Near Masala Railway crossing / adjacent to Masala road (Koradi ash bund)	2.00 Hectors	Kadunimb, Gulmohar, Karanji, Pipal, Mango, Sisam, etc.	--	4000	
2016	2804	Area between coal settling pond and stacker re-claimer	1.20 Hectors	Kadunimb, Gulmohar, Karanji, Pipal, Mango, Sisam, etc.	--	2523	
2016	3500	Near Sunil Hi-Tech structural yard	1.40 Hectors	Kadunimb, Gulmohar, Karanji, Pipal, Mango, Sisam, etc.	--	3500	
2016	3500	Near Bokhara Gate Colony	1.40 Hectors	Kadunimb, Gulmohar, Karanji, Pipal, Mango, Sisam, etc.	--	3150	
2016	8000 2000	1) From railway crossing to Koradi ash bund. 2) Adjacent to Masala road near railway crossing.	2.00 Hectors	Kadunimb, Gulmohar, Karanji, Pipal, Mango, Sisam, etc.	--	7000 1800	
2016	3500	Bokhara gate, Gas godown and C-Type quarter in TPS Koradi	1.40 Hectors	Kadunimb, Gulmohar, Karanji, Pipal, Mango, Sisam, etc.	--	3150	
2016	5000	Infront of E-Type building 45 – 48.	2.00 Hectors	Kadunimb, Gulmohar, Karanji, Pipal, Mango, Sisam, etc.	--	4500	
2016	8000	Near STP KTPS Colony Koradi.	3.20 Hectors	Kadunimb, Gulmohar, Karanji, Pipal, Mango, Sisam, etc.	--	7200	
2016	3500	600 MW plant switch yard and CW pump road.	2.00 Hectors	Babuniya, silver oke	--	2970	
Total	59804					52093	

ANNEXURE – A
TREE PLANTATION LIST

Yr	Nos. of trees	Location	Area covered	Nos. of species	Nos. of trees survived in 2017 (in Nos.)	No. of trees survived in 2018 (in Nos.)	Remarks
16	5000	Tree plantation in between area of Khasara ash water recovery pump house to Masala railway crossing parallel to railway crossing	2.00 Hectors	Kadunimb, Gulmohar, Karanji, Pipal, Mango, Sisam, etc.	--	4100	
16	5000	Between Koradi and Khasara ash water recovery pump house.	2.00 Hectors	Kadunimb, Gulmohar, Karanji, Pipal, Mango, Sisam, etc.	--	4300	
16	5000	Near Masala Railway crossing (Koradi ash bund)	2.00 Hectors	Kadunimb, Gulmohar, Karanji, Pipal, Mango, Sisam, etc.	--	3900	
16	5000	Near Masala Railway crossing / adjacent to Masala road (Koradi ash bund)	2.00 Hectors	Kadunimb, Gulmohar, Karanji, Pipal, Mango, Sisam, etc.	--	4000	
16	2804	Area between coal settling pond and stacker re-claimer	1.20 Hectors	Kadunimb, Gulmohar, Karanji, Pipal, Mango, Sisam, etc.	--	2523	
16	3500	Near Sunil Hi-Tech structural yard	1.40 Hectors	Kadunimb, Gulmohar, Karanji, Pipal, Mango, Sisam, etc.	--	3500	
16	3500	Near Bokhara Gate Colony	1.40 Hectors	Kadunimb, Gulmohar, Karanji, Pipal, Mango, Sisam, etc.	--	3150	
16	8000 2000	1) From railway crossing to Koradi ash bund. 2) Adjacent to Masala road near railway crossing.	2.00 Hectors	Kadunimb, Gulmohar, Karanji, Pipal, Mango, Sisam, etc.	--	7000 1800	
16	3500	Bokhara gate, Gas godown and C-Type quarter in TPS Koradi	1.40 Hectors	Kadunimb, Gulmohar, Karanji, Pipal, Mango, Sisam, etc.	--	3150	
16	5000	Infront of E-Type building 46 – 48.	2.00 Hectors	Kadunimb, Gulmohar, Karanji, Pipal, Mango, Sisam, etc.	--	4500	
16	8000	Near STP KTPS Colony Koradi.	3.20 Hectors	Kadunimb, Gulmohar, Karanji, Pipal, Mango, Sisam, etc.	--	7200	
al	56304					49123	

Executive Engineer (C)
CSR Cell

Annexure - 33

MAHAGENCO
Maharashtra State Power Generation Co. Ltd.

MAHARASHTRA STATE POWER GENERATION CO. LTD.
KORADI THERMAL POWER STATION
(ISO 9001:2008, ISO 14001:2004 & ISO 18001:2007)
Office of Chief Engineer (O & M), T.P.S., Koradi, Nagpur, PIN - 441111
Phone: (07109) 262141 to 262146, 262106, 262109 FAX: 262127 (Off)
Email – cegenkoradi@mahagenco.in

CIN: U40100MH2005SGC153448

Ref. No: CE (O&M)/KTPS/660MW/Env.Cell./PL-10/ 03405

Date: 30 NOV 2021

CIRCULAR

Sub.: Formation of Environment Cell for Koradi TPS, 3X660 MW.
Ref.: 1. MoEF Letter No. J-13012/87/2007-IA. II (T) dtd. 27.03.2015.
2. CGM/E&S/Env/IA/All Power Station/967/14621 dtd. 12.12.2017.

Ministry of Environment, Forest and Climate Change, GoI has issued Environment Clearance vide letter under reference. According to the condition no. 42 of this Environment Clearance "An Environment cell comprising of at least one expert in Environment Science/Engineering, Ecology, Occupational Health and Social Science, shall be created preferably at the project site itself and shall be headed by an officer of appropriate seniority and qualification. It shall be ensured that the head of the cell shall directly report to Head of the plant who would be accountable for implementation of Environmental regulations and social impact improvement/mitigation measures."

In view of above, please find below name of employees for Environment Monitoring team constituted at Koradi TPS, 3X660 MW.

Sr. No.	Name	Designation	Qualification
1	A. H. Bhagat	Supt. Engineer (Adm.)	B. E. (Computer)
2	Y. N. Gorenj	Exe. Chemist and in-charge of Env. Cell.	B. Tech. (Chemical)
3	Dr. Amit Dalal	Asst Medical Officer	M.B.B.S.
4	A. A. Bahale	Sr. Chemist (Env.)	M.Sc. (Organic Chemistry)
5	Priyanka Ahire	Add. Exe. Engineer (Safety officer)	B. E. (Electrical), Advanced Diploma in Industrial Safety
6	N. A. Dhage	Dy. Exe. Engineer (Civil)	B. E. (Civil)
7	M. P. Dharmadhikari	Lab Chemist (Env. & Chem. Div.)	M.Sc. (Env), MIRPM, DBM, Certified L.A. for QMS, EMS, OHSAS, NABL

For information to all concerned.

Chief Engineer
Koradi TPS, 3X660 MW

Copy f.w.cs. to:
Chief General Manager (CEHSU), 4th Floor, HDIL Tower, Mahagenco, Bandra (E), Mumbai-400051

Copy to:
1. Dy. Chief Engineer (Op), Koradi TPS, 3X660 MW.
2. Supt. Engineer (O/M/E/Adm/CHP), Koradi TPS, 3X660 MW.
3. Sr. No. 1 to 7 through Section In-charge.

Annexure- 34

2017

Environmental Safeguard and Responsibility Framework

for

MSPGCL

Submitted By:

EEPL – SINE - IITB

(Incubated Firm)

CM-02, SINE, 3rd Floor, CSRE Building

IIT Bombay, Mumbai - 400076

Under supervision and guidance of

Prof. A. K. Dikshit

Indian Institute of Technology, Bombay

Mumbai-400076

Annexure - 34

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Abbreviations

Abbreviation	Full Form
AGM	Assistant General Manager
BoP	Balance of Plant
CDM	Clean Development Mechanism
CE	Chief Engineer
CEA	Central Electricity Authority
CEHSU	Central Environmental Health and Safety Unit
CGM	Chief General Manager
CMD	Chairman cum Managing Director
COO	Chief Operating Officer
CPA	Central Purchase Agency
CPCB	Central Pollution Control Board
dB	Decibel
Dy. CE	Deputy Chief Engineer
Dy. EE	Deputy Executive Engineer
EA	Environmental Assessment
ED	Executive Director
EE	Executive Engineer
EIA	Environmental Impact Assessment
EMP	Environmental Management Process
EP	Environmental Policy
ESRF	Environmental Safeguard and Responsibility Framework
FMC	Fuel Management Cell
GM	General Manager
GoI	Government of India
GoM	Government of Maharashtra
MoEFCC	Ministry of Environment, Forests, and Climate Change
MPCB	Maharashtra Pollution Control Board
MSEB	Maharashtra State Electricity Board
MSPGCL	Maharashtra State Power Generation Corporation Limited
MW	Megawatt
O&M	Operation and Maintenance
OP	Operational Policy
P&P	Project and Planning
PMG	Project Monitoring group
QA	Quality Assurance
R&D	Research and Development
SAR	Specific Absorption Rate
SE	Superintending Engineer
SPGD	Solar Power Generation Department
SPM	Suspended Particulate Matter

1 Introduction

Growth and development in any developing country depends on the sustainability of natural resources, its regular supplies at affordable price along with clean energy. On the other hand, pollution, climate change, habitat destruction and over-exploitation of natural resources such as fresh water, minerals and ores are harmful for human development, growth, and well-being. This also risks the growth and robustness of the economy on long-term.

Climate change risks the development and growth of countries. Stringent policies to address climate change needs to be prepared by industries and institutions, both private and public to address sustainability and growth in an era of climate change. Sustainable growth of the industry relies on the availability of clean and affordable energy, along with a continuous supply of natural resources. It is crucial that economic development should occur without affecting natural resources and environment. Consumption of natural resources in a sustaining way will lead to growth and development without compromising on the quality of life.

Economic growth and development depends on the facilities and infrastructure provided to improve quality of life for people and provide growth opportunities. Infrastructure and growth opportunities are usually funded by international investors, which aims for social upliftment for developing countries. These agencies have strict policies and frameworks for funding infrastructural projects aiming to protect environment during project implementation. Institutions and government offices working in association with funding agencies are bound to implement the rules and framework policies set by latter for protecting the environment.

Various environment and social obligations are to be implemented, some of which are environment impact assessment, rehabilitation of displaced population and other project impacts. Various financial agencies have laid down environmental safeguards to mitigate the impact of the growth and development.

1.1 ESRF for MSPGCL

Environmental safeguards are meant to regulate the environmental sustainability and soundness of projects. Safeguard policy that ensures environmental concerns are taken care during project conceptualization. Environmental safeguard and requirement frameworks require the executioner to identify project impacts and assess their significance, examine alternatives, prepare, implement and monitor environment management plans. Under this framework, it is requisite to assess environmental and social issues including the biodiversity and habitat which might be affected. A detailed study and public notice should be made available during conceptualization of project.

1.1.1 Relevance of ESRF

MSPGCL implements and invests in power plants projects for generating electricity to meet the power demand. Projects initiated are long term involving large investment with several stakeholder and liabilities and along with it comes environmental issues.

Safeguard responsibilities are defined on the various project phases like planning, construction, operations, and maintenance. Various risks and environmental challenges define the working and sustainability as well as the life of the power plant project. E.g.: A hydel project may inflict environmental issues which has to be addressed while the project is conceptualised. Important areas that need to be considered while drafting framework are:

- Project operations
- Organizational role of the institution

Projects initiated by MSPGCL are new power plant projects, maintenance, and renovation of existing plants. Various project activities create diverse environmental impacts which needs to be regulated by environmental policies and regulations. Environmental risk associated with different projects in general are as follows:

i. Change in topography, hydrology etc.
ii. Change in land use pattern
iii. Disturbing the ecosystem
iv. May affect nearby eco-sensitive or biological environmental zones
v. Generation of hazardous waste posing a threat to the environment
vi. Environmental pollution like noise pollution and air pollution
vii. Displacement of the local population
viii. Disturbing the biodiversity in the area
ix. Impact on communities
x. Coastal pollution

In absence of adequate policies and regulations to control the environment impacts it may lead to following damages and issues:

i. Protests and project obstruction by communities, Non-governmental organizations, and others, leading to legal cases
ii. High economic costs to be borne by the organization, in case of environmental damage repair and clean-up, penalties, and compensation to be paid
iii. Non-compliance with the rules and regulations set by regulatory bodies and authorities, which may invite legal actions from the authorities
iv. Actions such as fine and punishment may be charged on the institution in case of non-compliance of laws and regulations
v. Above mentioned issues will lead to delay in the project and invite financial implications
vi. Negative image of the organization and generate reputational risks

Due to above mentioned issues it is important for the institution to check and comply with the regulations and policies from the initiation of the project. Proactively, taking steps to check compliance and taking steps for management during implementation and operation would avoid risk associated with non-compliance.

If financial institutions are funding projects, then the environmental and social framework laid by them needs to be complied with. Funding agencies like Asian Development Bank (ADB), World Bank, Equator Principles Financial Institutions (EPFI) have safeguards/regulations on environment, health, and safety (EHSS) which must be observed for funding approvals.

Besides the banks, regulation mandate from the government, state policies and inter-state laws also effect the framework and environmental responsibilities of the organization. ESRF policy framed with respect to the institution modality and financial institutions and authorities will be effective from the initial stages of the project to ensure sustainable project implementation.

1.1.2 Environmental and International community

International communities have prioritised environmental issues during the development so as to maintain a bilateral growth and development. Henceforth, international agencies have clubbed

environmental provisions with fund sanctions of proposed projects. Institutions and agencies have formulated guidelines to ensure that the projects are designed and implemented in an environmentally and economically sound fashion.

Few International Funding Organizations with environmental regulations are:

- World Bank
- Asian Development Bank (ADB)
- African Development Bank (AfDB)
- Canadian International Development Agency (CIDA)
- Economic Commission for Europe
- European Economic Community
- European Investment Bank
- Inter-American Development Bank (IADB)
- United Nations Environmental Program (UNEP)
- United States Agency for International Development (USAID)

1.1.3 Environmental Awareness

From the time of project conceptualisation, environmental impact of all stages of project development should be considered. Knowledge on evaluation of environmental impact and measures to mitigate the same during project development should be available with the stakeholders of the project. Proactive approach has to be taken by the authorities as precautionary steps to protect environment and integrate the project development with environment sustainability. Environmental Impact Assessment can act as a benchmark and stimulant for sustainable development by increasing environmental awareness and knowledge. It can also be used during implementation of environmental management plan as a part of Environmental Safeguard and Regulatory Framework (ESRF).

1.1.4 Objective for ESRF

Objective of ESRF policy is to develop a generic environmental management plan and framework to address environmental issues arising during planning, design, construction, operation and maintenance phase of any project. ESRF will be used to establish criteria to identify the level of study in environment impact assessment for the project. It will also establish standard for the processes involved in the project, their sequence to conduct the studies for different phase of power plant project development including their legal requirements and implications. Understanding the level of assessment will be useful for the institution in scrutiny of external agency for consultancy services and also defining the conditions for such study. E.g: Planning Consultant at planning and design stage, environment assessment agency during conceptualization stage. Several consultants are available which can perform environmental risk analysis and define parameter which are crucial for implementing ESRF policy associated with a particular project, but ultimately the duty of timely implementation lies with the institution i.e. MSPGCL. Hence, it is important that the organization strengthens its capacity to deal with environmental issues while project implementation.

ESRF document will be useful as a tool to suggest mechanisms for operationalization / implementation of environmental management plan, appropriate mechanisms and specific training / capacity building needs and environmental guidelines to prepare a work plan. For better understanding of the policy, it has been divided as follows:

1. Policies and regulatory framework
   ESRF will be used to establish criteria to identify the level of environmental studies/ environment related clearances required for the project and processes involved, their sequences to conduct the studies for various components/phases of power plant projects including the legal requirement and implications. Comprehending the level of studies will help the organization in assessing the requirement of an external agency in the form of consultancy services and also stage the exact requirement of the consultant.
2. Institutionalisation of ESRF
   This defines the implementation procedure for the regulatory framework and policy. Implementation and execution of the environmental policy within the organisation. Steps and the methodologies for the implementation of screening policy for different projects are defined. Ease of execution as well as defined guidelines for incorporation of the regulatory framework is laid within the section. These guidelines have been prepared to provide an outlook and practical methods to counter the problems faced in environmental assessment and management by engineers in designing and executing the project components. Based on these generic guidelines/measures, a specific action plan needs to be worked out for the project such that any environmental issues arising due to the intervention can be countered.
3. Capacity building and training
   An important part of this capacity building is to ensure that people have the skills and necessary training to understand the linkages between project development and environmental consequences. Through this program, suggestions of suitable mechanisms for the operationalization/implementation of environmental management plan, appropriate institutional mechanisms and specific training/capacity building needs and environmental guidelines to prepare a work plan are provided.

2 MSPGCL operations and study attributes

Maharashtra State Power Generation Co Ltd. (MSPGCL) also referred to as Mahagenco, has been incorporated under Indian Companies Act 1956 pursuant to decision of Govt. of Maharashtra to reorganize erstwhile Maharashtra State Electricity Board (MSEB). Mahagenco has been incorporated on 31.5.2005 with The Registrar of Companies, Maharashtra, Mumbai. Mahagenco is the second largest power generation organisation (~10000MW) in the country and is engaged in the business of new power projects and their operations in Maharashtra. The company is led by its Chairman and Managing Director, supported by various functional heads at the Corporate office, generation plants and project sites.

Mahagenco has plants operational at nine locations in Maharashtra and various other projects are at various stages of development. MSEB after re-organisation was re-grouped into four companies of which Mahagenco is one.

Duties of Mahagenco

Mahagenco is a generating company prescribed with following duties:

1. To establish, operate and maintain generating stations, tie-lines, sub-stations and dedicated transmission lines connected therewith in accordance with the provisions of the Act or the rules and regulations made there under
2. Supply electricity to any licensee as per rules and regulations of the Act and supply electricity to any consumer subject to the regulations
3. Submit technical details regarding its generating stations to the appropriate commission and the authority
4. Co-ordinate with the Central Transmission Utility or the State Transmission Utility, as the case may be, for transmission of the electricity generated by it

2.1 MSPGCL Business mode

Mahagenco is responsible for generation of adequate power for Maharashtra on a sustainable basis in a socially responsible manner. In order to attain its vision to generate adequate power, it operates with a mission to:

- Endeavour to fully meet the future energy needs of the state and also create sufficient spinning reserves through organic value enhancing growth initiatives
- Diversify the energy portfolio to include solar, wind, gas, hydro-electric and responsible fossil consumption directed towards shrinking our carbon footprints
- Commit to affordable energy rates through cost minimization and consistent operational excellence and energy efficiency
- Strive to improve the quality of life for the people who live and work the operational territory of the firm and the power plant vicinity

MSPGCL engages in implementing power projects and generation of electricity through their operations. The main phases of the power plants are:

i. Initial Project Planning
ii. Design and development
iii. Procurement

iv. Manufacture of equipment
v. Construction and installation
vi. Commissioning
vii. Operation

Mahagenco fulfils its role for power generation for the state of Maharashtra through installation of new power plants and operation of the existing plants. Office of Mahagenco performs its functions through a management hierarchy

Different departments coordinate together for implementation and operation of power plant. Departments such as projects, civil, operation, finance and HR department coordinate for achieving the objective of Mahagenco. Project department heads the project implementation of different fossil based projects while a sub-division called Solar Power Generation Department (SPGD) looks into renewable sourced projects.

Operation and maintenance of the functional projects (power plants) are handled by operations department. Details of the project flow and management system will be discussed in the following sections.

Power is generated using several technologies except nuclear at Mahagenco. Present installed capacity is 9737 MW and 5959 MW capacity of power plants are under construction. Nine power stations are located across Maharashtra.

Table 2-1 Details of projects operated by Mahagenco

S. No.	Power Station	Units and Capacity (MW)	Installed Capacity (MW)
Hydro Power Stations			
1.	Koyna St. I & II	4 x 70 + 4 x 80	600
2.	Koyna St III	4 x 80	320
3.	Koyna St IV	4 x 250	1000
4.	KDPH	2 x 18	36
5.	Vaitarna	1 x 60	60
6.	Bhatgar	1 x 16	16
7.	Tillari	1 x 66	66
8.	Bhira T. R.	2 x 40	40
9.	Yeldari	3 x 7.5	22.5
10.	Ghatghar	2 x 125	250
11.	Radhanagari	4 x 1.2	4.8
12.	Paithan	1 x 12	12
13.	Vaitarna D. T	1 x 1.5	1.5
14.	Pawna	1 x 10	10
15.	Panshet	1 x 8	8
16.	Kanher	1 x 4	4
17.	Varasgaon	1 x 8	8
18.	Bhatsa	1 x 15	15
19.	Dhom	2 x 1	2
20.	Ujani	1 12	12
21.	Mandkdoh	1 x 6	6
22.	Dimbhe	1 x 5	5
23.	Surya	1 x 6	6
24.	Warna	2 x 8	16
25.	Terwanmedhe	1 x 0.2	0.2
26.	Dudhganga	2 x 12	24
		Total Hydro	2585
Thermal Power Station			

S. No.	Power Station	Units and Capacity (MW)	Installed Capacity (MW)
1.	Koradi	200+420+1320+660	2600
2.	Nasik	3 x 210	630
3	Bhusawal	2 x 210 + 2 x 500	1420
4.	Paras Ext	2 x 250	500
5.	Parli	2 x 210 + 3 x 250	1170
6.	K'kheda	4 x 210 + 1 x 500	1340
7.	CSTPS	2 x 210 x 500	2920
		MSPGCL Thermal Total	**10580**
Gas Turbine Power Station			
1.	Uran G. T.	4 x 108	432
2.	W.H.R.	2 x 120	240
		MSPGCL Gas Total	**672**
Solar Power			
1.	Chandrapur	1 x 1 + 2 x 2	5
2	Shivajinagar, Sakri	5 x 25	125
3.	Shirsufal	36 + 14	50
		MSPGCL Solar Total	180
		Mahagenco Total	14017
Other Projects Planned			
1.	Bhusawal TPS		660
2.	Nashik replacement		660
3.	Joint Venture Project with M/s Tata Power Co., Dherand		660
4.	Uran (Block I & Block II)	660 + 814	1220

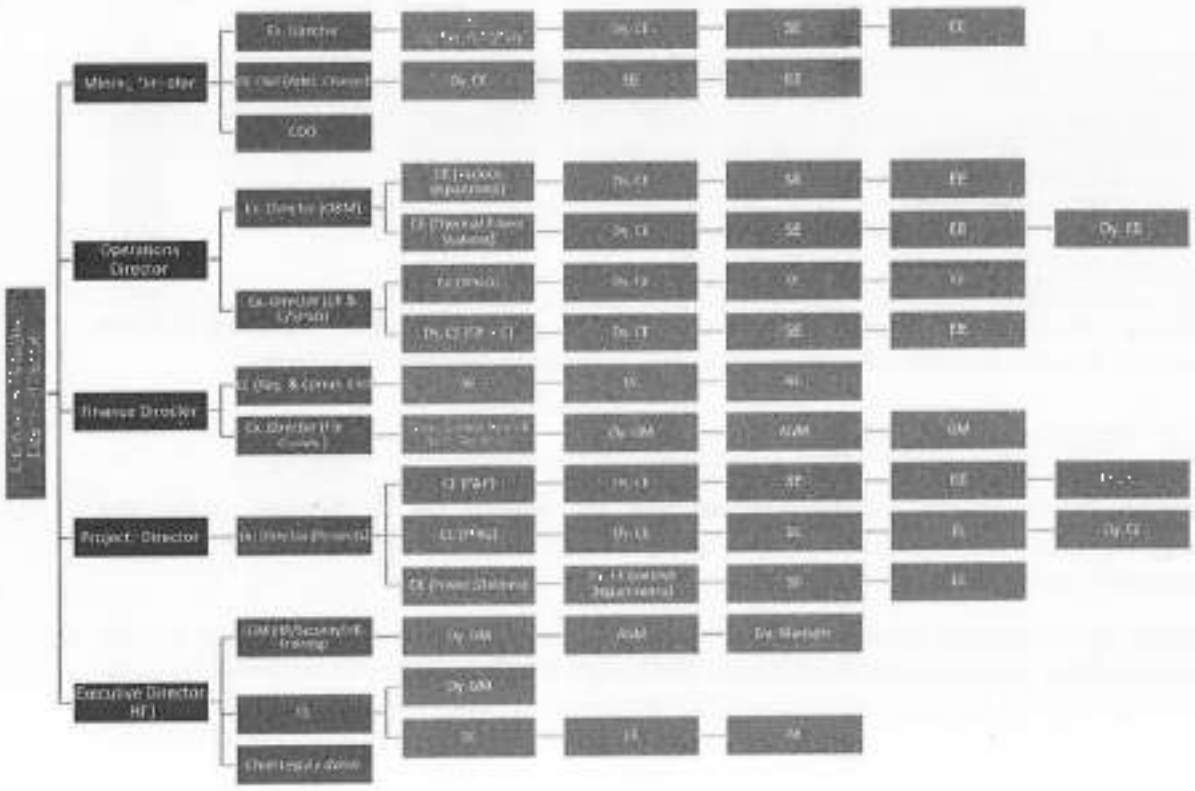
Mining is another sector in which Mahagenco deals. They own a mining yard in Chhattisgarh which will soon be under operation after obtaining clearances from the concerned department.

2.2 Organizational structure

MSPGCL has a defined organizational structure for carrying out its functions. Roles and responsibilities of the organization includes setting of power plants and operation and functioning of the existing power plants.

Organizational structure includes a defined hierarchy for managing different aspects of the project, hence defining a precise methodology as well as scrutiny for the projects. The company is presided over by a board of directors, headed by a chairman cum managing director (CMD). CMD acts as the final point for the decision on the future as well as current actions and projects of the company. Departmental organization includes finance, projects, operations, and mining, with each department headed by a director. Further hierarchy ensures fool proof implementation of projects on field as well as regular operations in an effective manner. Below the director under each department, there lies a hierarchy which includes executive director, chief engineer, chief general manager, deputy chief engineer, executive engineer, associate engineer, and junior engineer in descending order of hierarchy.

Figure 2-1 Organizational structure of Mahagenco



2.3 Financial Management

Mahagenco utilizes its financial resources tactfully and through regularised management with a mandate to fulfil the organization's objective. Through budgetary layouts, the finance department efficiently manages proper planning and sets out funds for different activities. Funding sources include direct bills and other through financial loans from funding institutions. Different funding institutions are approached for different kinds of funds for the organization. Direct billing includes earning through sale of electricity to the distribution department.

Figure 2-2 Financial funding of projects

Project Name	Name of Institution
Parli Unit-7 (250 MW)	PFC
Paras Unit-4 (250 MW)	PFC
Khaperkheda (500 MW)	PFC
Bhusawal (2 x 500 MW)	REC
Koradi (3 x 660 MW)	PFC
Koradi (3 x 660 MW)	Canara bank
Chandrapur (2 x 500 MW)	REC
Parli replacement (250 MW)	REC
Bhusawal Replacement	PFC
Koradi Unit 6 R & M	World Bank
Nashik Unit 3 R & M	KFW
Renewable Energy (Solar) 1 MW	PFC
Renewable Energy (Solar) 4 MW	IREDA
Renewable Energy (Solar) 150 MW	KFW

PFC – Power Finance Corporation, RCC – Rural Electrification Corporation, KfW – KfW German Bank
IREDA – Indian Renewable Energy Development Agency

2.4 Environmental policy of MSPGCL

Concrete environment policy at present does not form a part of the corporate policy for MSPGCL. Chief engineer, CEHSU and his team are responsible for obtaining environmental management for all the projects that are associated with Mahagenco. A consultant is hired by Mahagenco for obtaining environmental clearance from various government agencies. Consultant is entrusted to prepare all the documents required for obtaining the clearance and apply for the same at the concerned government offices. CE (CEHSU) coordinates with different organizations like MoEFCC, MPCB, CPCB and CEA etc. for environment related issues. Application is made to MPCB for Consent to Establish and Public Hearing and to MoEFCC for Environmental Clearance.

Clean Development Mechanism (CDM) projects involve preparation of project design document (PDD) by the executive engineer and gets approved from the host government. After approval, the project is implemented and the performance parameters are measured and recorded. Fly ash disposal are considered as per regulations set by MoEFCC.

Environmental policy is not an integral part of corporate policies as of now. Mahagenco lacks the presence of a direct environmental safeguard policy as such.

2.5 Project Study Aspects

Work distribution in the organisational structure of Mahagenco is followed for ease of working. Synchronisation and process management in different departments and groups ensures process flow. Projects from their onset regulates through a process flow cycling through various departments. Common procedures for project processes are discussed in the following sections along with different departments that are involved in the process flow.

2.5.1 Project flows and modalities

Management processes needed to achieve the mission and objectives of Mahagenco during various phases of power plants activities are given below

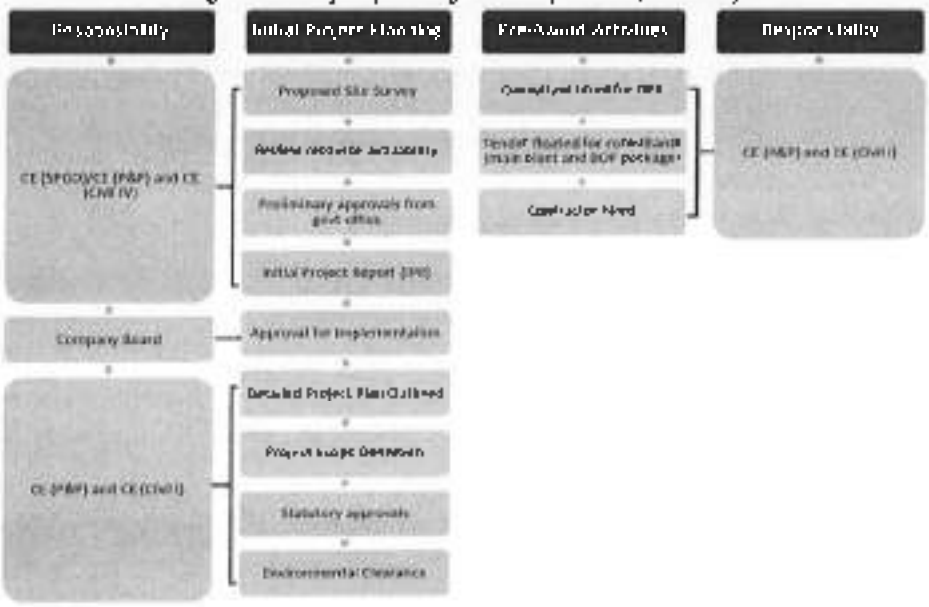
1. Planning
2. Design, Development, and Engineering
3. Purchasing
4. Projects (Construction)
5. Commissioning
6. Operations
7. Quality Assurance

Processes are planned, developed, implemented, assessed, and continually improved. Each step of the project process is assessed, by thorough monitoring of the objectives achieved and their effectiveness and taking corrective measures wherever required. Power generation plants are large sites and require several control parameters including environmental monitoring. Work flow and project management is done through various sections of Mahagenco. Sections and roles in the project initiation and planning is discussed in the forthcoming sections.

2.5.1.1 Project Planning

Projects and planning (P&P) section under projects department along with Civil department handles initial project planning for new power projects.

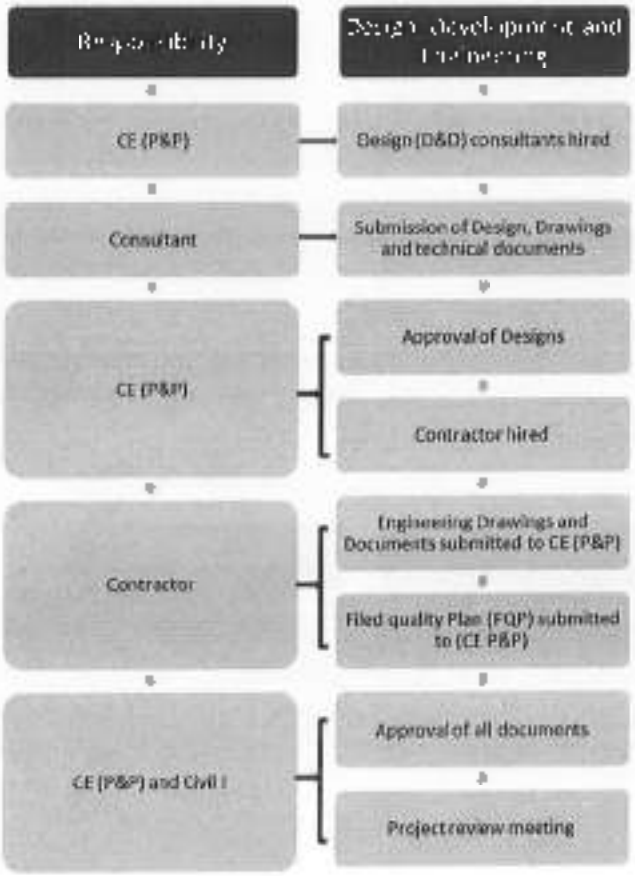
Figure 2-3 Project planning hierarchy and responsibility



2.5.1.2 Project Design, Development, and Engineering

Design consultants are hired for design and development for thermal and hydroelectric power stations and is monitored and approved by P&P section of Mahagenco. Drawing and design formed by the consultant is submitted to concerned department for approval before initiating the construction process. Plants based on non-conventional energy sources is handled by SPGD planning group. Consultants are responsible for supply of complete itinerary of documents and supporting drawings, quality manuals etc. for the concerned project to Mahagenco. While Mahagenco analysis the documents submitted by the consultants and give the final consent for the same. Consultancy contracts are handled and awarded by the projects department.

Figure 2-4 Project design, development and engineering hierarchy and responsibility



2.5.1.3 Project Purchasing

New projects involve setting up of a new power plant from base. Development of new site involves engineering, procurement, construction, and commissioning; purchases for these heads is taken care by the contractor. Other requirements at site, are managed by project and construction groups at site.

Operation and maintenance related purchases are made through Central Purchase Agency (CPA) based at head office

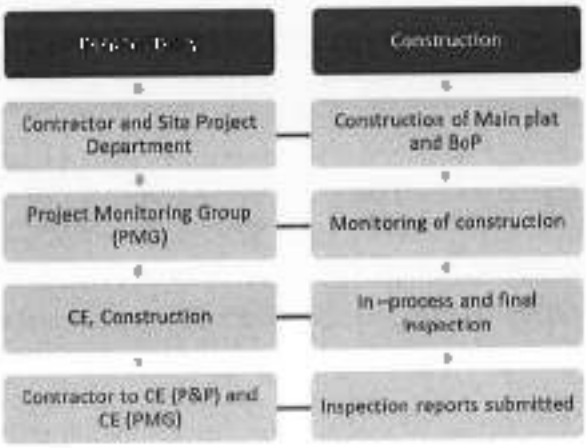
Coal and gas purchase for the power stations are handled by the Fuel Management Cell (FMC). Construction, purchase, commissioning and quality control is ensured by project construction group at site through a defined quality assurance manual approved by Project Department.

Figure 2-5 Project purchasing hierarchy and responsibility

2.5.1.4 Projects Construction

Construction activity is carried out by the contractor at the site. The activity is carried out in coordination with projects department at site, under supervision of Project Management Group (PMG) of corporate office.

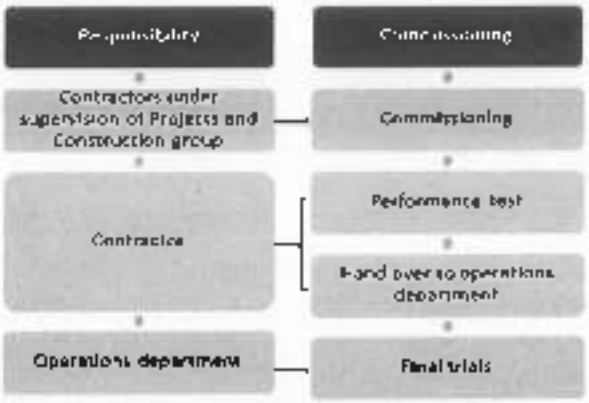
Figure 2-6 Project construction hierarchy and responsibility



2.5.1.5 Commissioning

After completion of civil engineering work and installation of equipment, commissioning is carried out by the contractor under the supervision of projects and construction group at plant site. After the necessary tests are completed, the project is taken over by the Operations department. At this stage trials are carried out to check the installation and the performance of the equipment by the contractor after which operations department take over the project.

Figure 2-7 Project commissioning Hierarchy and responsibility



2.5.1.6 *Project Operation and Maintenance*

A dedicated operations and maintenance (O&M) section at each power plant ensures management and operation of the plants. O&M section is backed by the operations department from the head office. Operational activities are supported through Operations and Maintenance Manuals and Procedures to ensure optimal functioning of plant.

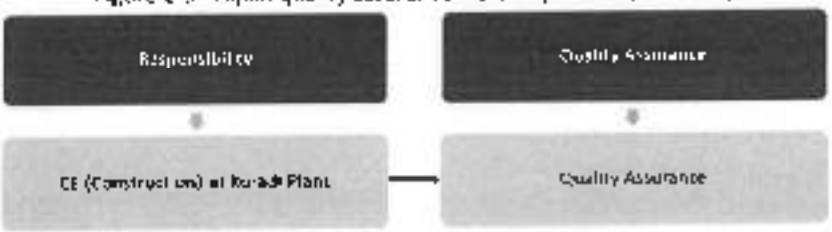
Environmental management is performed by CE (CEHSU) from the corporate office, who ensures compliance to rules and regulations stated by the regulating authorities.

Figure 2-8 Project operation and maintenance hierarchy and responsibility

2.5.1.7 *Quality Assurance*

Quality assurance inspection for different projects is the responsibility of CE Construction at Koradi Plant. Guiding documents for this purpose are engineering drawings, product specifications and approved QAPs. Records for each inspection and maintenance activities are maintained. Documents for different activities are maintained as per the procedure for control of records.

Figure 2-9 Project quality assurance hierarchy and responsibility



3 Policies and regulatory framework

Government of India and Government of Maharashtra laws, regulations, policies, and guidelines along with policies and procedures of the financing agencies will govern the projects implementation based on the location, design, and operation. For each category of the project, an environment management plan will be prepared by MSPGCL, following applicable national environmental laws and regulations.

3.1 Environmental Laws and Regulations

Many of project activities and their locations are regulated and governed under environmental legal requirements in India. Legal requirements thus may be imposed by the central government or state laws. Thus, it is necessary to ensure that all activities pertaining to a proposed project is consistent with all relevant applicable laws, regulations, and notifications. It is the responsibility of the various project implementing sections and environmental team to ensure compliance to the regulatory framework, whether national, state or municipal/local.

3.1.1 National Regulations

Environmental laws that are applicable as per Mahagenco' s mandate is listed below (not limited to these):

i. The Electricity Act, 2003
ii. The Water (Prevention and Control of Pollution) Act, 1974, amended 1988
iii. The Water (Prevention and Control of Pollution) Rules, 1975
iv. The Air (Prevention and Control of Pollution) Act 1981, amended 1987
v. The Air (Prevention and Control of Pollution) Rules, 1982
vi. The Environment (Protection) Act, 1986, amended 1991 and including the following Rules/Notification issued under this Act:
    - The Environment (Protection) Rules, 1986, including amendments
    - Solid Waste Management Rules, 2016
    - Hazardous and other wastes (Management and Transboundary Movement) Rules, 2016
    - Bio-Medical Waste Management Rules, 2016
    - Construction and Demolition Waste Management Rules, 2016
    - E-Waste (Management) Rules, 2016
    - Plastic Waste Management Rules, 2016
    - Noise Pollution (Regulation and Control) Rules, 2000,
    - Wild Life (Protection) Amendment Act, 2002
    - Ozone Depleting Substances (Regulation & Control) Rules, 2000.
    - The Biological Diversity Act, 2002 and Rules, 2004;
    - The Environment Impact Assessment Notification, 1994; amended up to 2009;
    - Batteries (Management & Handling) Rules, 2001 (amended in 2010)
    - The Environmental Clearance Notification, 1994
vii. The Indian Wildlife (Protection) Act, 1972, amended 1993
viii. The Wildlife (Protection) Rules, 1995
ix. Wildlife Conservation Strategy, 2002, amended in 2006
x. Coastal Regulation Zone (CRZ) Notification, 2011
xi. The Indian Forest Act, 1927
xii. Forest (Conservation) Act, 1980, amended 1988 (National Forest Policy,1988)
xiii. Forest (Conservation) Rules, 1981 amended 1992 and 2004

xiv. Guidelines for diversion of forest lands for non-forest purpose under the Forest (Conservation) Act, 1980
xv. The National Environmental Appellate Authority Act, 1997
xvi. The National Green Tribunal Act, 2010
xvii. The National Green Tribunal (Practices and Procedures) Rules, 2011
xviii. Central Motor Vehicle Act 1988 & Rules 1989
xix. The National Environment Tribunal Act, 1995
xx. The Public Liability Insurance Rules,1991, amended 1993

3.1.2 State regulations (includes interstate regulations)

- The Maharashtra Felling of Trees (Regulation) Act, 1964 and amendments thereon
- The Maharashtra (Urban Areas) Protection & Preservation of Trees Act, 1975
- Eco-sensitive zone limitations

3.1.3 International Regulations

International regulations of the funding agencies must be followed by Mahagenco. As per records of the projects owned and operated by Mahagenco most of the projects are funded by the national financial institutions. However, couple of projects were funded by international funding agencies like World Bank and KfW development bank. Funding agencies have defined criteria for funding various category of projects, formulated as a part of their operational policy.

3.1.3.1 World Bank

The World Bank has various safeguard policies; the details and applicability of the operational/safeguard policies to the Project are provided in the Table 3-1

Environmental requirements of the World Bank are specified in detail in its Operational Policy (OP) 4.01 and other related Operation Policies. The instances in which the procedural and regulatory requirements differ, the more stringent policies apply. The World Bank environmental requirements are based on a three-part classification system.

- *Category A*-requires a full Environmental Assessment (EA)
- *Category B*-projects require a lesser level of environmental investigation
- *Category C*-projects require no environmental analysis

Table 3-1 World bank safeguard policies

World Bank Safeguard Policy	Subject Category	Reason for its Applicability
OP 4.01	Environmental assessment	Umbrella policy
OP 4.04	Natural habitats	Eco-sensitive-forestry and wildlife related issues
OP 4.36	Forestry	Forest land acquisition
OP 4.09	Pest management	Pest management
OP 4.30	Involuntary resettlement	Road widening may lead to loss of livelihoods, loss of land and buildings etc.
OP 4.20	Indigenous people	
OP 4.11	Cultural property	Declared cultural property

3.1.3.2 KfW Development Bank

KfW bank supports energy related projects which ensure sustainable supply of energy. The bank is concerned for both environmental and climate protection as well as secure energy supply. KfW supports thermal fired projects to a limited extent. KfW focusses on financing highly efficient new power plants as well as their modernisation. Criteria for financing coal based projects are strictly

regulated especially for coal fired power facilities. Following criteria is applicable for funding facilities on a cumulative basis.

- Projects will only be pursued in countries which have a national climate mitigation policy and strategy which is supported by a targeted policy to expand renewables and/or to enhance energy efficiency. The projects must be compatible with this climate change mitigation policy
- The best available techniques (BAT) must be deployed in line with the current version of the European Industrial Emissions Directive (IED-RL 2010/75/EU)
- Financing for new coal-fired power plants is only possible if
    - In the case of facilities with unit sizes > 500 MW_e at least technologies with a planned electrical efficiency of 43% (lignite) and 44% (hard coal) are used, or if
    - facilities with unit sizes < 500 MW_e achieve a relative improvement of efficiency compared with the regional average and rank amongst the best 25% of the regional power plant portfolio in this size category.
    - and the technical and spatial preconditions are examined with a view to possible subsequent carbon capture and storage (CCS)
- In case of new coal-fired facilities which cogenerate heat and power or generate heat, a planned fuel efficiency of at least 75% must be attained
- In case of improvements or modernisations of existing coal-fired power plants, the measures funded must result in substantial improvement in the environmental footprint of the power plant
- In case of all the projects, the national rules on preventing and minimising any negative environmental and social effects and risks must also be strictly complied with
- Financing in countries which are not EU or OECD members must also be subjected to an environmental and social impact assessment which - in addition to the relevant national rules - must at least be based on internationally recognised standards (e.g. of the World Bank Group or the EU)

3.2 Screening/ Categorisation – Operational /Safeguard Policies

Ministry of Environment, Forest and Climate Change (MoEFCC) lays down the classification of projects and sub-projects into different categories under the GoI Environment Impact Assessment 2006 rules. As per the rules the projects can be categorised into two major categories which are:

Category A: A project is classified under Category A, if it is likely to produce significant negative impacts and is listed under the category A of the schedule under EIA notification, 2006. Such kind of projects require detailed Environment Impact Assessment (EIA) to be undertaken in addition to Environmental Clearance from MoEFCC.

Category B: Projects which are likely to have fewer negative impacts are listed under category B of the EIA notification. These are further classified as B1 and B2 projects. Projects likely to create certain environmental impact falls under category B1 which would need Environmental Clearance from State Environment Impact Assessment Authority (SEIAA), thus would need EIA study to be conducted. Category B2 class of projects do not require EIA study as the potential environmental impact of these projects are minimal. These projects do not require further study but needs approval from SEIAA.

MoEFCC has constituted SEIAA and State Level Expert Appraisal Committee (SEAC) for the state of Maharashtra in October 2013. These authorities are responsible for providing environmental clearance for category B projects in Maharashtra. For projects in a different state, their respective SEIAA and SEAC has to be approached. Category B projects which can be approved and cleared by SEIAA and SEAC are: mining up to 50 ha area; hydroelectric power projects up to 50MW; thermal power plants up to 500MW; state highways up to 30km of length and state highway and national highway widening projects up to 20 m of width; construction projects up to 20,000 m^2 (<1,50,000 $m^2$of built up area); township projects up to 50 ha (>1,50,00 m^2 of built up area), etc. Clearance from forests department is required in all cases where project is constructed on forest land or requires cutting of any forest tree/trees or passes through buffer zone of a sanctuary and/or national park. In addition, The Maharashtra Felling of Trees (Regulation) Act, 1964 has to be complied with while felling of tree/trees in a rural or urban region.

4 ESRF for MSPGCL

Mahagenco has adapted this environmental safeguard policy to ensure compliance with government regulations with respect to environment. Environmental safeguard for various projects has to be ensured and incorporated from the initial stages of the project. The safeguards hereby adapted by the company ensures that the project undertaken is environment friendly and sustainable. Pollution mitigation and waste management also forms an integral part of the environment safeguard policy. The aim of the policy is to reduce the environment footprint of the project.

4.1 Corporate Environmental Policy

Corporate environmental policy is hereby adapted by MSPGCL to develop eco-friendly and sustainable power generating plants and their infrastructure. Corporate policy shall cater to the needs of policies and regulations besides promoting a healthy environment of growth and development. Environmental sustenance would be the crux of corporate environmental policy.

MSPGCL is focussed to adapt the following as a part of corporate policy -

- To generate sensitivity towards environmental issues and conduct the activities accordingly
- Follow an Integrated Environment Management and Practices
- To utilize natural resources efficiently
- Conservation of natural resources and developing green zones
- Pollution mitigation practices and its eco-friendly management
- Train and sensitize human resource of the company towards environmental issues
- Adapting policies for sustainable environmental practices within the organization
- Promoting vendors and stakeholders associated with the company to adapt sustainable practices for environmental protection

MSPGCL Environmental Policy (EP) is founded on the concept of Sustainable Development and thereby recognizes Environmental and Social (E&S) considerations in its business operations to add value, minimize impacts and risks to increase effectiveness of development projects for the benefit of the state.

MSPGCL is committed to comply with its Environment Policy, applicable environmental laws of the land and be responsive to existing and emerging global environmental concerns on a proactive basis.

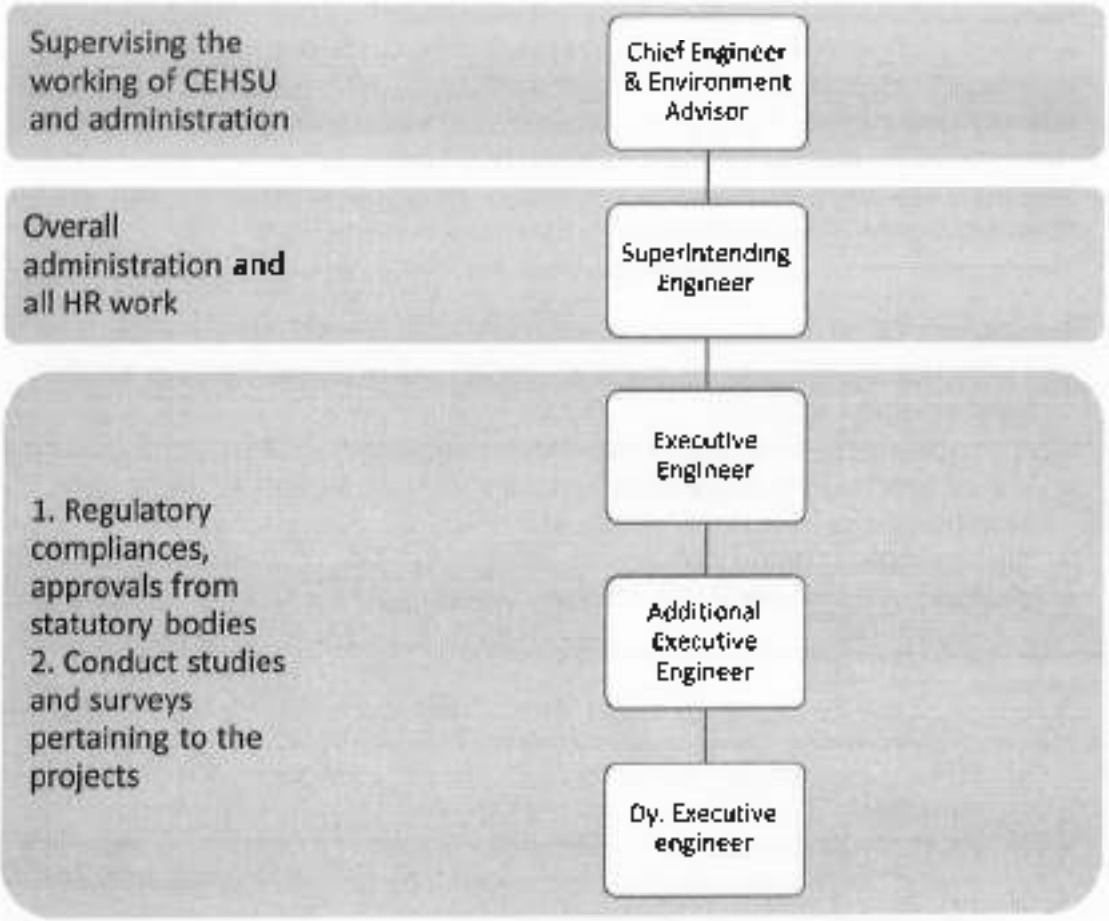
4.2 MSPGCL Environmental Department

Mahagenco has a dedicated department for environment, health and safety namely as Corporate Environment Health & Safety Unit (CEHSU). This department is responsible for implementation and integration of various environment rules and regulations within different projects taken up by Mahagenco as a part of its work. CEHSU department also co-ordinates with various environment related authorities both at state and national level to maintain environment friendly project development and maintenance. This unit also ensures environment laws are strictly adhered to even during operation and maintenance of power plants, thus maintaining sustainable development. Environmental department are on their way to adapt an environmental safeguard policy for even better efficient mode of environment safeguard and protection.

4.2.1 Hierarchy of Roles and Responsibilities

CEHSU department has a well-defined hierarchy of roles for execution of different requirements during various project stages. Current hierarchy and their roles are discussed in the Figure 4-1.

Figure 4-1 Existing hierarchical roles and responsibility of CEHSU department



The department is well structured with several positions for executing different responsibilities concerned with projects. Executive engineer in association with additional executive engineer and Dy. executive engineer is responsible for coordinating with various government organizations viz. MPCB, MoEFCC, CPCB and other organization and ministry for approvals and clearances for a new or existing project. They are also responsible for hiring third parties for conducting pre – feasibility, feasibility, EIA studies. They also consider other areas such as compliances, proposals, approvals and appraisals and safety. Waste management and disposal are also the concern of this team.

Suggested Modifications:

Organizational structure should be developed at corporate and site level to aid effective implementation of the environmental safeguards framework and responsibilities. Therefore, roles and responsibilities will be defined at each level to ensure compliance and implementation.

Roles and responsibilities:

Roles and responsibilities at the corporate and site office are defined as follows:

1. Corporate level (CEHSU department)

- Coordinating environmental initiatives with various agencies, financial institutional requirements and regulatory authorities
- Coordination of all environmental activities related to a project from conceptualisation to operation and maintenance
- Advising and coordinating Site offices to carry out environmental surveys for new projects
- Assisting Site offices to finalize renovation of power plants considering environmental and social factors that could arise due to project activities
- Follow-up with the state forest offices and other state departments in expediting forest clearances and the land acquisition process of various projects
- Providing a focal point for interaction with MoEFCC for expediting forest clearances and follow-ups with the Ministry of Railway on environmental and social issues
- Training of Site officials on environment issues and their management plan

2. Site level
    - Conduct surveys on environmental and social aspects to finalize the route for the transportation
    - Conduct surveys on sites being considered for land acquisition
    - Interact with the Forest Departments to develop the forest proposal and follow up for MoEFCC clearance
    - Implementation of EIA and EMP
    - Monitoring and producing periodic reports

Specific roles of different executives at Mahagenco are defined for efficient execution of ESRF and it implementation.

A) The role of Environmental Advisor in implementation of ESRF will be to:
    a. Act as an independent advisor on environmental management and regulatory compliances
    b. Establish and implement ESRF in Mahagenco
    c. Engage environmental consultants and specialists for conducting various studies (if Mahagenco lacks sufficient resources/manpower)
    d. Monitoring all environmental initiatives related to a project from conceptualisation to operation and maintenance
    e. Act as s focal point for all ESRF activities related to different projects in Mahagenco
    f. Periodically review ESRF implementation in different projects as well as the level of implementation
    g. Ensure periodic review and update of ESRF policies as per requirement
    h. Prepare annual environmental performance reports for Mahagenco
    i. Report implementation level of ESRF policies in Mahagenco
    j. Ensure training sessions for Mahagenco' s staff about the ESRF and environmental management practices

B) The role of Superintending Engineer in implementation of ESRF will be to
    a. Assist Environmental Advisor in fulfilling his role
    b. Review project details and documents for undertaking the environmental risk assessment
    c. Issue Terms of Reference (ToR) for conduct of EIA, review the EIA report and highlight areas of intervention.

d. Ensure the important environmental concerns associated with the project are taken into consideration
e. Organize and review required documentation in different project stages for assessment of environmental risks
f. Develop risk rating for projects and establish monitoring levels
g. Identify new risk and develop management strategies during project execution and operation
h. Update risk management strategy in case of any project modifications or change in activities
i. Highlight relevant environmental concerns for contractual agreements and tenders
j. Develop risk management plan and its execution on field
k. Allocate responsibilities to the team for effective implementation of risk management
l. Suggest corrective measures for the action plans with regular review and update
m. Monitoring implementation of action plans periodically and report the same to environmental advisor
n. Organize training sessions for Mahagenco staff regularly
o. Prepare annual environmental performance reports for Mahagenco along with Environmental Advisor
p. Follow-up with the state forest offices and other state departments in expediting forest clearances and the land acquisition process of various projects
q. Providing a focal point for interaction with MoEFCC for expediting forest clearances and follow-ups with the Ministry of Railway on environmental and social issues
r. Assisting Site offices to finalize renovation of power plants considering environmental and social factors that could arise due to project activities
s. Coordination of all environmental activities related to a project from conceptualisation to operation and maintenance

C) The role Executive Engineer(s) and other Engineer(s) (with lower ranks) will be to
a. Conduct surveys on environmental and social aspects to finalize the route for the transportation
b. Conduct preliminary site surveys and identify the potential environmental impacts
c. Collate details of the project and forward the same accompanied with project documents to the Environmental Engineer/ Consultant
d. Implementation of action plan on field as prepared and forwarded by the Environmental Advisor
e. Reporting any environmental risk/concern observed during implementation which was not covered under risk management strategy
f. Assist consultants/contractors to carry out EIA studies
g. Implement EMP associated with different projects
h. Ensure proper on site operation of environment risk mitigation plans
i. Identify the major environmental factors which will be affected by the project during initial stages of the project
j. Update the status of the action plan and forward to the Environmental Advisor
k. Procure the monthly/ quarterly site monitoring report on environmental aspects from the Project Management Consultant and forward to the Environmental Engineer
l. Inform the Environmental Advisor in case of any modifications in the project

m. Contact the concerned authorities for obtaining clearance and operation consent
n. Developing the application format for obtaining clearances and approval from different authorities
o. Train consultants and other site officers on ESRF policy and its implementation
p. Ensure implementation of ESRF on field
q. Reporting to Environmental Advisor/Superintending Engineer for any new/undesirable environmental issues from the project activity

5 Institutionalisation of ESRF

Environment Safeguard and Responsibility framework is one such policy of Mahagenco which would ascertain environment friendly practices and sustainable development. Projects or sub-projects when developed in accord with the ESRF will lead to compliance of rules and regulations of GoI and the lending institutions. Institutionalisation of ESRF involves several steps during various phases of project development. Incorporation procedure and other considerations in ESRF have been discussed in detail in the following sections.

5.1 Implementation Steps

Environmental Safeguard and Responsibility Framework (ESRF) establishes the criteria to identify the mandatory requirements related to environment and the processes involved, their sequence to conduct EA studies for various components/phases of power projects including their legal requirements and implications. These environmental management practices have to be adapted as a part of ESRF policy. These practices would include various activities during different stages of the project. The activities and their respective stages are enlisted in the table 5-1.

Table 5-1 Environmental management regulatory procedure for a project

S. No.	Activities	Stage
1	Site Selection, environmental screening, initial assessment, scoping of significant issues	Pre-feasibility
2	Detailed assessment of significant impacts, identification of mitigation needs, input to decision analysis	Feasibility
3	Detailed design of mitigation and compensation measures	Design and engineering
4	Implementation of mitigation measures and environmental management strategy	Implementation
5	Monitoring and post-auditing (lessons for future projects, EIA verification, compliance)	Monitoring and evaluation

5.2 Environmental Management Procedures

Environment Management Procedure defines requirements of the project which will help Mahagenco in assessing the requirement of an external agency for consultancy services and other requirements like Planning consultant, Design and Development consultant during development stage, Construction consultant during construction, defining the roles of operation and maintenance team. It also helps in defining the role of environmental consultants appointed for environmental impact study

During the initial stage after the project is conceptualised and enters the planning phase, process of environmental management comes into picture. The first step is the screening of the project to ascertain the category of Environmental Assessment/clearance required. Different steps of the environment management procedures are discussed as follows.

Step 1: Mandatory Requirements/ Initial Clearance

Two stages are incorporated in the initial clearance and along with few mandatory requirements.

Pre-feasibility:

Even before the preparation of initial Project report, mandatory initial level clearances are taken from various government offices, e.g.: land and water availability etc. This includes a thorough assessment of the resources available for setting up a power station. Assessment and evaluation of the impacts a new project might cause on location of the project, land availability, transport, power sector, biodiversity, coastal regions, eco-sensitive zones, tourist destination, flora and fauna has to be done. The initial assessment carried out would mark all the relevant environment effects that the project might cause during the implementation and post-commissioning. Environmental team of the organization will collect all the basic information of the project and will conduct a site survey to understand the impacts on the site in question. These details will be incorporated in the initial project report.

If a consultant is hired for the above purpose, he shall be responsible for conducting a pre-feasibility study at site, which would include a detailed site visit. Pre-feasibility report as prepared by the consultant should be submitted to CEHSU department, who will be responsible to review the study report critically and ensure all the components of environmental impact are incorporated in it.

Feasibility:

Based on the pre-feasibility study report submitted, the company board will give its consent for the implementation of the project. Beyond approval, detailed study will be undertaken by the CEHSU department. CEHSU department will be responsible for taking the approvals from the required agencies, MoEFCC, CEA etc. A detailed project report will be prepared. For detailed project report, the company will hire a consultant, who will carry out a detailed study of the project area and analyse the environmental impacts of the project development. During this phase, environmental clearance from MPCB, MoEFCC and other departments like Civil Aviation/ AAI, Water Resource department, forest department, Ministry of architecture will be taken. A proposal has to be prepared during application for all kind of clearance. Exceptions to obtaining environmental assessment are solar power plants which are not covered under EIA 2006 notification.

Step 2: Funding Agency Requirement

Environmental requirements of the funding agencies relevant to Mahagenco are World Bank (WB) Operational Policies (O.P) 4.00 - Piloting the use of Borrower Systems to Address Environmental and Social Safeguards Issues in Bank Supported Projects; KfW Development Bank: KfW Group guidelines on the financing of coal fired power plants. Different banks have their particular operational and funding guidelines. If Mahagenco approaches any other bank besides the above mentioned, they need to adhere to the funding guidelines before approaching the bank. For e.g.. Asian Development Bank (ADB). Operations Manuals (OM) F1/BP; Japan bank for International Cooperation (JBIC): Environmental Guidelines. Funding agencies procedures for environmental assessment of different development projects are outlined in these guidelines.

As per these guidelines developmental projects are classified in three categories – A, B and C based on the probable social and environmental impacts the projects might lead to. World bank has an additional category FI – applicable to projects involving a credit line through a financial intermediary.

Category A: Projects having significant adverse environmental impacts that are sensitive, diverse, or unprecedented. These projects require a detailed EIA to address significant impacts.

Category B: Projects having some adverse impacts that are not as significant as of Category-A projects. These impacts are generally site specific and addressed through carefully designed mitigating measures. These projects do not require full EIA but would normally require an environmental review through Initial Environmental Assessment (World Bank) guidelines or Environmental and Social Impact Assessment (ESIA; KfW Development Bank).

Category C: Projects having minimal or no adverse environmental impacts. No EIA or environmental review is required for such projects.

Power plant projects fall under different category depending on the type of technology being taken up. Based on the impact the project, it is categorised into the above-mentioned categories for assessment. Due to the size of the investment as well as the long-term impact, most of the projects require environmental assessment studies. It is suggested to take up the study in the initial stages of the project cycle and concomitantly along with other activities of the project. Additionally, Mahagenco should take pro-active measures to prevent, minimize, mitigate, or compensate for adverse impact and improve environmental performance.

Step 3: Legislative Work Requirement

This section involves applicable legislations, relevant policies and the implementing agencies. Various legislations and factors need to be considered by Mahagenco and included during implementation. Various policies and rules that will be applicable are discussed below.

1. Pollution Prevention and Control
   India initiated legislation and set up pollution control institutions to regulate pollution generated from almost every day to day activity including the industries. As a result, air emission, water effluent standards, noise pollution limits and various other limits were determined for various activities. Pollution Control Boards (PCBs) were set up under these laws to control emissions, sewage, and industrial effluent by approving, rejecting, or conditioning applications for "Consent to Establish" and "Consent to Operate".
   Mahagenco sets up power generation plants based on conventional and renewable sources of energy. Renewable sources of energy mostly fall under the clean sources, not contributing to major pollution. Few polluting sources at the non-conventional energy plant (Solar energy plant) is water pollution, noise pollution. Conventional fuels based power plant are comparatively more polluting and requires permission, consent to operate and consent to establish from State pollution control boards (SPCB) (here Maharashtra Pollution Control Board (MPCB)).
   Mahagenco has to follow the rules and notifications under the Environment (Protection) Act 1986, which prescribes the standards for various environmental pollutants with respect to water, air, soil, noise, solid waste, hazardous waste etc. and functions within permissible levels as prescribed by Indian and International standards.
2. Resource Conservation
   Mahagenco while implementing different power projects needs to conserve natural resources and avoid ecologically sensitive areas, eco-sensitive zones, forests, sanctuaries, national parks, tiger / biosphere reserves, and CRZ covered coastal areas, as far as possible. In case traversing forest land is unavoidable, clearance from the forest authorities is obtained under the Forest (Conservation) Act, 1980. Other relevant laws and/or regulations

(not limited to these) relating to natural resources that have to be looked into by Mahagenco are:

- Indian Forest Act 1927;
- Wildlife (Protection) Act, 1972.
- Coastal Regulation Zone (CRZ) Notifications, 1991 & 2008
- Regulatory Framework for Conservation of Wetlands, 2008 (Draft)
- National Forest Policy, 1988,
- National Conservation Strategy and Policy Statement on Environment and Development, 1992,
- Policy Statement for Abatement of Pollution, 1992
- Wildlife Conservation Strategy 2002-15,
- National Environment Policy (NEP), 2006.

Under special cases where natural resources have to be used e.g.: In hydro based power plants, it should be ascertained that the natural resource is conserved and if any forest or ecological specific species are being disturbed, it must be ensured that they are relocated and rehabilitated in a similar ecological habitat.

3. Implementing agencies

   MoEFCC is the central nodal agency for planning, promoting and coordinating environmental programmes. Mahagenco has to approach the MoEFCC at central and regional levels. Central Pollution Control Board (CPCB) is accountable for prevention and control of all forms of pollution. State level departments for CPCB are established which are responsible for monitoring pollution levels at the state level. Power generation using conventional fuels is associated with different forms of pollutants, it needs to be approved by the SPCB, here MPCB. For both conventional and non-conventional source of power plants environmental impacts need to be assessed. MoEFCC will be the concerned agency which will be approached for environment clearances and approvals to set up the power plant projects. These permissions are also to be attained during renovation and maintenance projects.

Step 4: Health and Safety Requirements

Mahagenco will maintain safety as a priority for the workers and staff associated with the Mahagenco power plant projects including the contractors. This would include the rules and regulation set by the GoI which would include The Factories Act, 1948, The Mines Act, 1952 etc.

Step 5: Environment Assessment Procedure

Environment Assessment is required in the initial stages of the project. Assessment is required for the project category A and category B1. Different steps of the environmental assessment are discussed below.

A. Screening

   Process of screening involves assessment of the project to gather basic information to validate the type and level of the EIA required based on the environmental impacts. Screening involves three step process for identification of the environmental impacts and categorisation of the project for the type of EIA to be taken up.

1. Preliminary Study: Collect the basic information of the project at the site and plan a methodology to be adapted to carry out EA study. This step would include data collection and detailed review of the collected data for defining EIA better. This would also include review of literature and previous studies conducted at site.
2. Site Survey: First-hand information collection from the project area will be the main objective of this activity. Data collected through literature and other means during preliminary study will also be verified at site. Assessing the likely impacts, identifying the major/main issues and other activities like preparing the methodology for detailed investigation will be carried out during this stage.
3. Final Screening: Compilation of the primary and secondary data collected during above stages. After evaluation of the project impacts and comparison with the State and National Environment policies along with the supporting international financial Institutions legal framework, category or requirement of the Environment Assessment is finalised. Possible outcomes of this step are:
    a. Where significant concerns exist or where there is a lot that is unknown about project impacts, a full EIA study is necessary
    b. If environmental impacts of a project are known and can be easily mitigated, a limited environmental study and mitigation plan may be all that is necessary
    c. If screening identifies no concerns, further environmental analysis is unnecessary, and the project may proceed without an EIA study

Environmental Assessment (EA) process incorporates several defining steps. Based on the categorization of EIA require as screened above, EIA cycle (if required) has been discussed in the section to follow. Mahagenco can define the Terms of Reference (TOR) for EIA study based on screening outcomes.

B. Environmental Assessment

Assessment process constitutes a systematic approach for the evaluation of a project with respect to natural, regulatory and environment of the area where the project development has been proposed.

i. Quality Assurance: Detailed methodology is prepared at the initial stages of planning of EIA for any project. The methodology along with a schedule is prepared for effective and on-time execution of Environmental Assessment. Methodology prepared will be based on the preliminary study, site survey and experience of previous projects.

ii. Scoping: Scoping involves defining the different project activities and their possible impacts on the environment. This will also define the natural, regulatory and environment of the proposed project site which will directly or indirectly be impacted during the project development. Scoping is completed during early stages of the project to prioritize issues with highest environmental impact during the entire project development.

iii. Environment Impact Assessment (EIA)

Data from different sections which includes legislative requirements, engineering, environmental and socio-economic data will be analysed at length to ensure the impacts associated with different activities are considered. The study would include different step which are as follows.

a. Study the existing environmental conditions to define the baseline for the environmental status. This would include collection of primary data at site for different parameters like environmental parameters, socio-economic status etc.
b. Assessment of the policies and regulations applicable at the nation and state level besides the requirements of the financial institutions
c. Prediction of the likely impact of the project development is the most challenging part of EIA. Prediction methods used are verified by the organization before using them for prediction and judgement
d. Alternatives of the project impact to be analysed. Impact will be analysed using an appropriate technique
e. Consultation with stakeholders (both primary and secondary) at different levels of the project development

iv. Risk Assessment

Environmental risk assessment is critical to the selection of any project components which is installed or proposed. Different critical issues which might come up during different stages of the project will be assessed. Based on the identification of critical issues, Mahagenco is responsible to ensure:

- Design engineers/consultant understand the project risk
- Potential identification of environmental concerns
- Development of alternatives to ensure environment impact mitigation in consultation with consultants/design engineers

v. Environment Impact Identification

Potential impact will be identified based on the baseline data collected as per previous steps. This impact identification along with the previous data collected will form the part of EIA document.

Table 5-2 Possible environmental impacts during project execution

Project Activity	Planning & Design Phase	Pre-construction phase		Construction Phase					Operation	Indirect effect of operation and maintenance
Environment Component	Land Acquisition	Removal of structure	Removal of trees and vegetation	Earth works including quarrying	Laying of railway line	Vehicle & machine O&M	Concrete & crusher plants	Sanitation & waste (labour camps)	Project operation	
Air		Dust generation during dismantling	Reduced buffering of air and noise pollution, hotter, drier microclimate	Dust generation	Dust due to aggregated	Dust pollution and gaseous emissions	Soot, odour, dust pollution	Odour, smoke	Dust, soot, gaseous emissions,	Other pollution, poor air quality
Land	Loss of productive land	Generation of debris	Erosion and loss of top soil	Erosion and loss of quality soil, increased dust generation		Land contamination and compaction, loss of fertility	Contamination and compaction of land	Contamination of land	Dust deposition, accidents may lead to spill hazards, dumps of fly ash contaminating soil	Land use pattern changes
Water	Water resource re-allocated or used, leading to loss	Siltation due to loose earth	Siltation	Changed in water flow, stagnant water pools in quarries	Reduction of ground water recharge area	Pollution by fuel, lubricants, seeping of construction oil, silting	Contamination by leakage of fuel	Contamination by sewage water seeping, through waste water discharge	Spill contamination by fuel, lubricants	Increased ground water contamination
Noise	-	Noise Pollution	Noise pollution due to machinery	Noise pollution	Noise pollution during construction and	Noise Pollution	Noise pollution due to machinery	-	Noise pollution due to machinery	Increased Noise pollution in the area, disturbing the

Project Activity	Planning & Design Phase	Pre-construction phase		Construction Phase					Operation	Indirect effect of operation and maintenance
Environment Component	Land Acquisition	Removal of structure	Removal of trees and vegetation	Earth works including quarrying	Laying of railway line	Vehicle & machine O&M	Concrete & crusher plants	Sanitation & waste (labour camps)	Project operation	
					operation					surrounding ecosystem
Vibration	-	-	-	Vibration	-	-	Vibration	-	Vibration level increases	Blight impact the surrounding structures or ecosystem
Flora	-	Loss of biomass	Loss of vegetation and different species	Loss of soil fertility	Vegetation removed, loss of biomass	Vegetation removed, soil becomes infertile	Vegetation cleared	Felling of trees for fuel	Lowered vegetation leading to pollution, land productivity decreases	
Fauna	-	-	Loss of habitat	Disturbs the habitat and life cycle	Disturbs the habitat	Disturbance	Disturbance	Poaching	Disturbed pathways	Disturbance of the habitat
Agricultural land	Change in land process	Economic value of land lost, land becomes infertile	Loss of standing crops	Lost of productive land	Land use pattern changed	Disturbs the fertility and productivity of soil	Reduces productivity of land	Land contamination	Change of land use pattern	Land becomes unfit for cultivation
Built-up Structures	-	Loss of property and changed landscape	-	Disturbs the neighbouring infrastructure		Disturbs the neighbouring infrastructure or vegetation	Dust accumulation on the neighbouring land and	New structures for temporary housing of labourers	Changes land use	Generates vibration and noise

Project Activity	Planning & Design Phase	Pre-construction phase		Construction Phase					Operation	Indirect effect of operation and maintenance
Environment Component	Land Acquisition	Removal of structure	Removal of trees and vegetation	Earth works including quarrying	Laying of railway line	Vehicle & machine O&M	Concrete & crusher plants	Sanitation & waste (labour camps)	Project operation	
		es		ure or vegetation			Infrastructure			
Cultural Assets	-	Loss of culturally significant structures	Loss of sacred trees	Noise, vibration damages structure	-	Damage from vibration and air pollution	-	-	Damage from vibration and air pollution	-
Utilities and amenities	-	Interruption in supply	-	-	Disturbs the existing infrastructure	Damage to utility and amenities	Dust accumulation on water bodies	Increased pressure on existing amenities		
Labour's health and safety				Increase of stagnant water and chances	Odour and dust accumulation might affect the local population	Collisions with vehicles, pedestrian and livestock	Impact on health due to inhale of dust	Increase in communicable diseases	Collision pedestrians and livestock, loss of life	

vi. Mitigation and Monitoring Plan

Measures to mitigate the potential environmental impacts will be considered along with identification of impacts. Impacts of different project activities can be categorised as per their environmental impacts varying form catastrophic to positive as per the Table 5-3. Activities having severe impact should be identified and analysed to find alternative measures to reduce the intensity of impact.

Table 5-3 Impact categories and rankings

Impact Category	Definition
Catastrophic	Most severe, alternatives to the activity to be sought
Major	Severe, alternatives/avoidance to be suggested
Moderate	Little severe, measures to minimise impact
Minor	Less severe, mitigation measures suggested
Negligible	Least severe, mitigation and enhancement measures proposed
Non	No impact, enhancement measures proposed
Positive	Positive impact

Potential impact mitigation program will include

- Habitat compensation program
- Species specific management program
- Adapting alternative methods to achieve the objective
- Customised engineering designs
- Stakeholders participation in finalizing mitigation measures
- Construction practice, including labour welfare measures
- Operation control procedures
- Management systems

Step 6: Environmental Management Process (EMP)

EMP has to be installed for impacts identified with severe consequences for their mitigation. Management plans include measures to reduce or eliminate the severity of any predicted adverse environmental effects. This will also result in the overall improvement in environmental performance of the project and acceptability of the project. The order of priority to reduce the environmental impact for a specific activity for which mitigation measures are to be taken are as follows:

1. Eliminate or avoid adverse effects, where reasonably possible
2. Reduce adverse effects to the lowest reasonably achievable level
3. Regulate adverse effects to an acceptable level
4. Create other beneficial effects to substitute the adverse effects partially or fully.

Step 7: Bid Document

Bid documents to be prepared for all the projects will include the environmental management plan. Cost of the environmental issues are considered within the bid document. Besides EMP, environmental construction guidelines are also to be included. The organization, Mahagenco, will also ensure that EMP and mitigation measures for all the adverse activities identified through EIA are incorporated in the bid document.

Bid document for any of the project like power plants or mining will include environmental compliances and in case of compliance failure penalty will be implied to them.

Step 8: Implementation

Implementation of the Environment Management plan is crucial to ensure Environmental Safeguards for the project activities are in place. This also ensures that the negative impact of the project activities is mitigated.

Step 9: Monitoring and Review

Environmental management plan has to be implemented along with the projects. During the implementation, it is the responsibility of the company to ensure that mitigation measures are installed and the negative impact from the project activities is avoided. Effective monitoring programme will be also a part of the project which is designed and carried out. The monitoring and review programme ensures implementation of the EMP, mitigating environmental plans.

Monitoring programme objective for power plants and mining activity will be as follows:

- Evaluation of the performance of mitigation measures proposed in the EMP
- Review and suggest improvements in the management plans
- To satisfy the regulatory obligations, both state and national, for the operation of the project

Review of the performance indicators, reporting the performance indicators and necessary budget will be a part of monitoring and review plans.

Table 5-4 Different pollutant parameters associated with different project types

Project type / Parameters	Thermal power plant	Gas turbine power plant	Hydro Power Plants	Solar Power Plants	Mining
Air Quality	✓	✓	✓	✓	✓
Noise Quality	✓	✓	✓	✓	✓
Water Quality	✓	✓	✓	✓	✓
Soil Quality	✓	✓	✓	✓	✓
Solid waste	✓	✓	✓	✓	✓
Hazardous Waste	✓	✓	✓	✓	✓

Monitoring plans include different environmental components which needs to be continually monitored along with the location of the monitoring sites and duration of the monitoring sites. Monitoring plans specifies the applicable standards which are to be complied for each of the environmental parameter. Monitoring plan of environmental indicators of the different projects during construction and operation stages are discussed under Table 5-5. Monitoring plan included the conditions required to obtain the NOC or consent for plant site operation and maintenance.

Table 5-5 Environmental indicators monitoring plan

Environmental Indicator	Parameter	Special Guidance	Standards	Duration
Air	CO, NO_x, SPM, RPM and SO_2	High volume samples to be used. Use CPCB specified methodology for analysis	Air (Prevention and Control of Pollution Rules, CPCB, 1994)	24 hours sampling
Water	All essential characteristics and some of desirable characteristics as decided by the Environmental Specialist	Grab sample collected from source and analyse as per Standard Method for Examination of Water and Wastewater	Indian Standards for Inland Surface Water	Grab Sampling
Noise	Noise levels on dB (A) scale	Equivalent noise levels using an integrated noise level meter kept at a dis of 15m from edge of pavement	MoEFCC Noise Rules, 2000	Leq in dB (A) of day time and night time
Soil	Monitoring of Pb, SAR and Oil & grease	Sample of soil collected to acidified and analysed using absorption spectrophotometer	Threshold for each contaminant set by IRIS database of USEPA until national standards are promulgated	Grab sampling

Step 10: Capacity Building and Training Program

Effective implementation of ESRF policy depends on the preparedness and understanding of ESRF policies and regulations. Detailed capacity building and training program for effective implementation of ESRF policy will be discussed in the upcoming section.

5.3 Risk Evaluation and Management

Different projects will have different retention time for the environmental impact inflicted by different activities. It is therefore crucial to formulate a risk evaluation and management scheme. Risks involved with different projects vary with the activities of the projects during different stages. Risk identification and management are two stage process, which involves risk identification followed by the management strategies.

5.3.1 Evaluation

Risk rating and impacts associated with a project are identified based on the

a) Environmental risks
b) Project Scope and finances

Risk involved is identified based on the several factors and considerations. This process involves following assessment and review

i. Review project details during different phases and assessing the prospective impact on the different project activities on the environment
ii. Assessing the project type and the components involved which risk the environmental as well as social communities in the project area
iii. Screening risks of different activities, environmental sensitivity with applicable regulations and compliances on development

As discussed above environmental risk will depend on the location of the plant along with the type of project and applicable regulations for the location as well the project. Different regulations that should be considered (not limited to these) while developing a power plant and mining site are following

a. Archaeological sites
b. Coastal areas
c. Densely populated areas
d. Eco-Sensitive areas
e. Environmental Impact Assessment Notification, 2006
f. Important bird areas
g. Mangrove forests/ wetlands
h. Protected Areas (National Park, Wildlife Sanctuary, Biosphere reserve)
i. Reserve Forest and Protected Forests
j. Residential locations
k. Water scarce/drought prone areas
l. Western Ghats

5.3.2 Risk Management

Risk management is an integral part of the environmental safeguard policy, which helps in decision making. Environmental risks and their associated management are a part of the project development cycle. All the aspects of environment and their mitigation plans are incorporated into the planning, design, construction, operation, and maintenance of the projects during early planning stages of the project. The motive is to ensure minimal environmental impact and promote safeguard of the environment due to different project activities. Management and incorporation promotes positive sustainable environmental outcomes through sensitized planning and implementation of environmental management measures. These steps are essential to avoid, minimize and mitigate anticipated impacts.

1. Risk management policies to be incorporated in the project development cycle to avoid, minimize and/or mitigate the adverse environmental impacts that may arise due to a project
2. Evaluation of environmental risks associated with the project in the initial stages
3. Procedures that need to be incorporated during planning, design and implementation cycle of the project are also enlisted
4. Applicable rules and regulations are filtered and applied to the project design
5. Enlist risk mitigation/control measures for effectively managing identified risks, through defined procedures in the project development cycle
6. Roles and responsibilities of CEHSU department to be defined for managing and monitoring environmental risks
7. Risk management can be improvised through regular monitoring and updating the management policy as per requirement

8. On -site data collection of the new risks and developing an immediate mitigation plan through discussion and brain storming, thereby ensuring minimal environmental impact
9. Training and capacity building for staff working on -site to ensure risk mitigation is needed to ensure successful implementation of environmental safeguard

5.4 Capacity Building Plan

Effective implementation of environmental safeguard policy depends on the understanding and preparedness of the engineers, especially the Environmental team. It is important to train and sensitize the staff on management of environmental issues. Training would include environmental issues, guidance on risks and the encourage to build resources to implement rules and regulation as prescribed by concerned authorities.

5.4.1 Training program

As per new ESRF policy, comprehensive training program has to be developed for the staff of Mahagenco. Before commencing training program, it should be ensured that the environmental management system have been defined. Duties and responsibilities of the staff has to be defined for careful execution of ESRF policy. A training program is not meant to be one-time event, instead it is a continuous process which is important to strengthen capacity and be sustainable within the organization. ESRF policies should be introduced to new staff as and when employed.

Comprehensive training programme should be planned for the project to address the components of the project. Mahagenco will define the role/responsibility of its staff to manage the environment components and compliances involved in the project. Training programme should be defined for all contractor, supervisors and others involved in the project. It is crucial to incorporate awareness among the stakeholders to ensure effective implementation of ESRF for the projects. Training components involved can be divided into following categories

- Principles and policies for environmental mitigation in development projects
- Legal and institutional aspects; project mandates
- Probable (natural and social) environmental impacts and losses in development and renovation projects and mining processes
- The EMP will consist of
    - The construction stage environmental concerns
    - The environmental designs and implementation plans
    - The project environmental safeguard framework
    - Operational and maintenance environmental risks and hazards
- Monitoring, evaluation and reporting methods and mechanisms

5.5 Periodic Review and Updates

The Environmental head and advisor will conduct regular review and update of the safeguard policies. This will ensure continued compliance and implementation of the ESRF policies by the concerned staff. Review and monitoring will be regularly updated in a prescribed format and stored for future reference.

Internal review will be defined based on the following objective:

1. Periodic review of the ESRF document to ensure compliance with the new laws, rules and regulation laid down by the government and authorities

2. Assessing the level of execution of the ESRF policy for the existing and upcoming projects (both power plants and mining)
3. Assessment of Engineers of both corporate office and site office for their knowledge on the environment safeguard policies and the application of ESRF as linked to their functions
4. Review the projects for the risk assessment and management, along with other documents to determine the impact of the various project activities
5. Ensure implementation of EMP in the different project stages for the new projects as well as completed projects
6. Review and ensure implementation of additional requirements to fulfil any shortcomings in the environmental management system of any project

Regular annual periodic review and update for the ESRF policy will be conducted based on the operational experience and review from site incorporating changes in the policy. With changes in the environmental regulatory requirements of the GoI or GoM further changes may be required in the corporate policy too. It will be the responsibility of the environmental advisor to ensure the update of legal and regulatory checklist based on the amendments and notifications as and when issued by the GoI.

Annexure I - Risk Assessment and Management Plan

S. No.	Environmental Attribute	Potential Impacts	Nature of Impacts	Magnitude of Impact			Management Plan	Sub-Project Phase
				Low	Medium	High		
A.	Physical Resources							
1.	Topography	Change in the surface features and present	Direct/local/ irreversible			✓	Greenbelt surrounding the power plant area to improve aesthetics	Construction
2.	Climate	Impact on the climatic condition	Indirect/local/ irreversible	✓			No visible impact	Construction
			Indirect/local/ irreversible		✓		Due to stack emissions	Operation
		Monitoring of SF6 gas from electrical equipment	Direct/local/ irreversible			✓	Switchgear equipment	Operation
B.	Environmental Resources							
1.	Air Quality	Impact on air quality during the construction period due to increase in the dust emission	Direct/local/ reversible			✓	Watering at construction site, limited burn soils, maintenance of project vehicles etc.	Construction
		Stack emission control and monitoring is required.	Direct/local/ reversible			✓	Stack emission monitoring	Operations
2.	Noise	Noise due to general construction activities	Direct/local/ reversible		✓		Restriction of noise generating activities at night and use of personal protective equipment like ear plugs, mufflers etc.	Construction
		Noise arising from operation of gas engines and compressors	Direct/local/ reversible			✓	Proper maintenance of equipment/ machineries so the ambient noise standard is met	Operation
3.	Surface and ground water quality	Wastewater from the construction site	Direct/local/ reversible			✓	Domestic waste treatment at construction site required using septic tanks	Construction
		Oil Spillage	Indirect/local/ reversible	✓			Containment structures, oil water separation, adopting good practices for oil	Construction and Operation

S. No.	Environmental Attribute	Potential Impacts	Nature of Impacts	Magnitude of Impact			Management Plan	Sub-Project Phase
				Low	Medium	High		
							handling and maintenance works	
		Oil contamination during maintenance	Indirect/local/ reversible		✓		Oil trap installation for separation of oil from water	During operation
		Water treatment for make-up water for radiators	Direct/local/ reversible	✓			Water drained out is minimal as all of it is evaporated in the radiators	Operation
4.	Soils and Geology	Digging and pile foundation for engines, generator compressors etc.	Direct/local/ reversible	✓			Avoiding sites, which are prone to the soil erosion. Levelling of construction sites.	Construction
		Improper debris removal/accumulation	Direct/local/ reversible		✓		Proper planning for debris removal from power plant area so by stored temporarily/used for site reclamation	Design and construction
		Damage due to seismic activity	Direct/regional/ reversible		✓		Site selection and design considering the geological conditions and seismicity	Construction/ Operation
C.	Ecological Resources							
1.	Terrestrial Ecology	Loss of vegetation	Direct/local/ irreversible	✓			Location of power plant in thinly vegetated area and waste lands	Construction
2.	Terrestrial Fauna	Disturbance to the local fauna during construction	Direct/local/ reversible	✓			Some wildlife species are reported to be seen about 4 km away from the plant.	Construction
	Avifauna	Disturbance to the local fauna during operation	Direct/local/ reversible	✓			Hot effluent gases from the stack will harm avifauna in the area	Operation
3.	Aquatic Ecology	Disturbance to fish	Direct/local/ reversible			✓	Runoff from construction site from construction material and spillage oil etc.	Construction
			Direct/local/ reversible		✓		Effluent water laced with oil and chemicals during wastewater discharge	Operation
D.	Human Environment							
1.	Fire Safety	Fires, explosion, and other accidents at the power generation plant site	Indirect/local	✓			Use of personal protective equipment during construction and maintenance. Prepare and implement safety and emergency manual at plant site. Regular inspection of equipment for faults prone to accidents.	Construction
			Direct/local	✓				Operation

S. No.	Environmental Attribute	Potential Impacts	Nature of Impacts	Magnitude of Impact			Management Plan	Sub-Project Phase
				Low	Medium	High		
2.	Health and Safety	Exposure to electromagnetic fields	Direct/local/ Continuous	✓			Manpower at site of operation. No houses near the plant.	Operation
3.	Agriculture	Permanent and temporary loss of agricultural land	Direct/local/ reversible	✓			No agricultural land used for construction	Construction
4.	Socio-economics	Beneficial impacts job opportunities	Direct/regional	✓			Hiring for temporary construction jobs	Construction
			Direct/regional	✓			Hiring for temporary construction jobs	Operation
5.	Resettlement	Resettlement of any household	Direct/local/ reversible	✓				Construction/ Operation
6.	Cultural Sites	Archaeological, historical, or cultural important sites are affected by the construction of gas based generation plant	Direct/local/ reversible	✓			No mitigation required	Design
7.	Traffic and Transportation	Traffic congestion due to movement of construction vehicles	Direct/local/ reversible	✓			Avoid high density areas, proper traffic signs at the construction site, ensuring proper access roads	Construction
8.	Solid Waste generation	Probability of surface and ground water pollution	Direct/local/ reversible		✓		Spillage of Oil from dismantling of equipment	Construction
			Direct/local/ reversible		✓		The oil sludge should be separately stored in the containers. Used oil to be collected and reclaimed by contractors through the Office of Stores and Purchase. Separated oily waste and scrap will be collected and disposed of in compliance with the Environmental Protection Act, 1986, and applicable regulations and rules	Operation
		Probability of soil contamination	Direct/local/ Irreversible			✓	Fly ash generated should be managed and disposed off as per standards described by MoEFCC	Operation

Annexure II – National Environmental Regulation and Legislations

S. No.	Act/Rules	Purpose	Applicability	Authority
1	Environment Protection Act 1986	Protect and improve overall environment	The project activities should maintain emission standards	MoEF&CC, GD, CPCB, and SPCB
2	Environmental Impact Assessment Notification	To provide environmental clearance to new development activities following environmental impact assessment	Based on the category of the project taken up by Mahagenco. EIA has to be conducted	MoEF&CC
3	Notification for use of fly ash	Reuse large quantity of fly ash discharged from thermal power plant to minimize land use for disposal	Possibility of use of fly ash shall be explored in engg designs or sale to other industries	MoEF&CC
4	Coastal Regulation Zone (CRZ) Notification 2002	Protection of fragile coastal belt	Plants should not be set up in such areas	MoEF&CC
5	National Environment Appellate Authority Act (NEAA) 1997	Address Grievances regarding the process of environmental clearance	Grievances may be addresses and maximum social issues to be addressed in the initial stages	NEAA
6	The Land Acquisition Act 1894, 1989	Set out rule for acquisition of land by government	Land Acquisition procedure has to be followed strictly and clearance from forest department, regional offices has to be obtained	Revenue department, state government and empowered regional offices
7	MoEF&CC Circular on Marginal Land Acquisitions and Bypasses 1999	Defining "marginal land" acquisition relating to the 1997 Notification	Marginal land has to be approved for acquisition	MoEF&CC
8	The Forest (Conservation) Act 1927 The Forest (Conservation) Act 1980 The Forest (conversion) Rules 1981	To check deforestation by restricting conversion of forested areas into non-forested areas	Forest land is involved in the project	Forest Department
9	MoEF&CC circular (1998) on linear Plantation on roadside canals and railway lines modifying the applicability of provisions of forest (Conservation) Act to linear Plantation	Protection / planting roadside strips as avenue/strip plantations as these are declared protected forest areas.	Applicability of forest conservation act	MoEF&CC
10	Wild Life Protection Act 1972	To protect wildlife through certain pr	No wild life Sanctuary or National	Chief Conservator Wildlife, Wildlife

		National Parks and Sanctuaries	pars should be involved in the project	Wing, Forest Department, State Government
11	Air (Prevention and Control of Pollution) Act, 1981	To control air pollution	Emissions from construction machinery and vehicle should be checked regularly	SPCB
12	Water Prevention and Control of Pollution) Act 1974	To control water pollution by controlling discharge of pollutants as per the prescribed standards	Various parameters in Effluents from construction sites and workshops are to be kept below the prescribed standards	SPCB
13	Noise Pollution (Regulation and Control Act) 1990	The standards for noise for day and night have been promulgated by the MoEFCC for various land uses.	DG sets at construction sites and workshops should be provided with acoustics or closures	SPCB
14	Ancient Monuments and Archaeological Sites and Remains Act 1958 and its amendment up to 1992	Conservation of cultural and historical remains found in India	Archaeological sites should be away from the impact of the power plant	Archaeological Dept. Gol, Indian Heritage
15	Public Liability and Insurance Act 1991	Protection from hazardous materials and accidents	Shall be taken as per requirements	SPCB
16	Explosive Act 1984	Safe transportation, storage and use of explosive material	Respective Authorization shall be obtained from CCE	Chief Controller
17	Minor Mineral and concession Rules	For opening new quarry.	Quarry licenses shall be obtained by Contractors	District Collector
18	Central Motor Vehicle Act 1988 and Central Motor Vehicle Rules1989	To check vehicular air and noise pollution.	All vehicles in use shall obtain Pollution Control Check certificates	Motor Vehicle Department
19	National Forest Policy1952 National Forest Policy (Revised) 1988	To maintain ecological stability through preservation and restoration of balance of diversity.	Forest land is involved in the project.	Forest Department, Gol and Odisha
20	The Mining Act	The mining act has been modified for safe and sound mining activity.	Quarry Licenses shall be obtained by Contractors	Department of mining, Gol and State Governments
21	Railway (Amendment) Act, 2008	Land acquisition for special railway project	Applicable for thermal power plants	Gol

Annexure III – Environment Assessment Template: Hydropower plants

Note: This is a template for environment assessment of hydropower plant. On the same lines, further templates can be developed for quick environmental assessment of various power plants and mining projects. This template helps in quick identification of the environmental risk and impact of the project activities.

Template

Project Title

Sector/Division

A. Project design data

1. Dam Height
2. Surface area of reservoir (ha)
3. Estimated number of people to be displaced
4. Rated power output (MW)
5. Water storage type

_____ reservoir _____ run of river _____ pumped storage

6. River diversion scheme

_____ Trans-basin diversion _____ in-stream flow regulation _____ in-stream diversion

7. Type of power demand to address

_____ Peak load _____ Base load

Screening Questions	Yes	No	Remarks
B Project Location			
Is the dam and /or project facilities adjacent to or within any of the following areas?			
Unregulated river			
Undammed river tributaries below the proposed dam			
Unique or aesthetically valuable land or water form			
Special area for protecting biodiversity			
Protected Area			
Buffer zone of protected area			
Primary forest			
Range of endangered or threatened animals			
Area used by indigenous peoples			
Cultural heritage site			
Wetland			
Mangrove			
Estuary			
C. Potential Environmental Impacts			
Will the Project cause...			

Screening Questions	Yes	No	Remarks
short-term construction impacts such as soil erosion, deterioration of water and air quality, noise, and vibration from construction equipment?			
disturbance of large areas due to material quarrying?			
disposal of large quantities of construction spoils?			
clearing of large forested area for ancillary facilities and access road?			
impounding of a long river stretch?			
dryness (less than 50% of dry season mean flow) over a long downstream river stretch?			
construction of permanent access road near or through forests?			
creation of barriers for migratory land animals			
loss of precious ecological values due to flooding of agricultural/forest areas, and wild lands and wildlife habitat; destruction of fish spawning/breeding and nursery grounds?			
deterioration of downstream water quality due to anoxic water from the reservoir and sediments due to soil erosion?			
significant diversion of water from one basin to another?			
alternating dry and wet downstream conditions due to peaking operation of powerhouse?			
peaking operation of powerhouse?			
significant modification of annual flood cycle affecting downstream ecosystem, people's sustenance, and livelihoods?			
loss or destruction of unique or aesthetically valuable land or water forms?			
proliferation of aquatic weeds in reservoir and downstream impairing dam discharge, irrigation systems, navigation, and fisheries, and increasing water loss through transpiration?			
scouring of riverbed below dam?			
downstream erosion of recipient river in trans-basin diversion?			
increased flooding risk of recipient river in trans-basin diversion?			
decreased groundwater recharge of downstream areas?			
draining of downstream wetlands and riparian areas?			
decline or change in fisheries below the dam due to reduced peak flows and floods, submersion of river stretches and resultant destruction of fish breeding and nursery grounds, and water quality changes?			
loss of migratory fish species due to barrier imposed by the dam?			
formation of sediment deposits at reservoir entrance, creating backwater effect and flooding and waterlogging upstream?			
significant disruption of river sediment transport downstream due to trapping in reservoir?			
environmental risk due to potential toxicity of sediments trapped behind the dams?			
increased saltwater intrusion in estuary and low lands due to reduced river flows?			

Screening Questions	Yes	No	Remarks
significant induced seismicity due to large reservoir size and potential environmental hazard from catastrophic failure of the dam?			
cumulative effects due to its role as part of a cascade of dams/ reservoirs?			
depletion of dissolved oxygen by large quantities of decaying plant material, fish mortality due to reduced dissolved oxygen content in water, algal blooms causing successive and temporary eutrophication, growth, and proliferation of aquatic weeds?			
risks and vulnerabilities related to occupational health and safety due to physical, chemical, biological, and radiological hazards during project construction and operation?			
large population influx during project construction and operation that causes increased burden on social infrastructure and services (such as water supply and sanitation systems)?			
creation of community slums following construction of the hydropower plant and its facilities?			
social conflicts if workers from other regions or countries are hired?			
uncontrolled human migration into the area, made possible by access roads and transmission lines?			
disproportionate impacts on the poor, women, children, or other vulnerable groups?			
community health and safety risks due to the transport, storage, and use and/or disposal of materials likely to create physical, chemical, and biological hazards?			
risks to community safety due to both accidental and natural hazards, especially where the structural elements or components of the project (e.g., dams) are accessible to members of the affected community or where their failure could result in injury to the community throughout project construction, operation, and decommissioning?			

Annexure IV – Outline of Environmental Impact Assessment Report

An environmental assessment report is required for all environment category A and B1 projects. Its level of detail and comprehensiveness corresponds with the significance of potential environmental impacts and risks. A typical EIA report contains the following major elements. The substantive aspects of this outline will guide the preparation of environmental impact assessment reports [not necessarily in the order shown].

A. Executive Summary

This section describes concisely the critical facts, significant findings, and recommended actions.

B. Policy, Legal, and Administrative Framework

This section discusses the national and regional legal and institutional regulations within which the environmental assessment is to be carried out. It also identifies project-relevant international environmental agreements to which the country is a party. And also identifies funding agencies requirements for the specific projects.

C. Description of the Project

This section deals with the project itself; its major components; its geographic, ecological, social, and temporal context, including any associated facility required by and for the project (for example, access roads, power plants, water supply, quarries and borrow pits, and soil disposal). It normally includes drawings and maps showing the project's layout and components, the project site, and the project's area of influence. Highlights the surrounding location, drawing and changes in the area that are likely to occur.

D. Description of the Environment (Baseline Data)

This section describes relevant physical, biological, and socio-economic conditions within the project study area as defined in the project description. It reviews the current and proposed developmental activities within the project's area of influence, including those not directly connected to the project.

E. Anticipated Environmental Impacts and Mitigation Measures

This section predicts and assesses the project's likely positive and negative direct and indirect impacts to physical, biological, socio-economic, and physical cultural resources in the project's area of influence, in both quantitative as well as qualitative terms to the extent possible. It identifies mitigation measures and any residual negative impacts that cannot be mitigated. Further it explores opportunities for enhancement; identifies and estimates the extent and quality of available data, key data gaps, and uncertainties associated with predictions. It also specifies topics that do not require further attention; and examines global, transboundary, and cumulative impacts as appropriate for the project development.

F. Information Disclosure, Consultation, and Participation

This section:

(i) describes the process undertaken during project design and preparation for engaging stakeholders, including information disclosure and consultation with affected people and other stakeholders;

(ii) summarizes comments and concerns received from affected people and other stakeholders and how the problems have been addressed in project design and mitigation measures

(iii) describes the planned information disclosure measures facilitating the participation of the affected during project implementation.

G. Grievance Redress Mechanism

This section describes the grievance redress framework, by defining the time frame and mechanisms for resolving complaints about environmental impacts.

I. Environmental Management Plan

This section deals with the set of mitigation and management measures to be taken during project implementation to avoid, reduce, mitigate, or compensate for adverse environmental impacts. It includes the following key components:

(i) Mitigation:
   a) identifies and summarizes anticipated significant adverse environmental impacts and risks;
   b) describes each mitigation measure with technical details,
   c) provides links to any other mitigation plans required for the project.

(ii) Monitoring:
   a) describes monitoring measures with technical details, and
   b) describes monitoring and reporting procedures and document the progress and results of mitigation.

(iii) Implementation arrangements:
   a) specifies the implementation schedule
   b) describes institutional or organizational arrangements for environmental management and monitoring and
   c) estimates capital and recurrent costs and describes sources of funds for implementing the environmental management plan.

(iv) Performance indicators: describes the desired outcomes

J. Conclusion and Recommendation

This section provides the conclusions drawn from the assessment and provides recommendations.

Annexure V – Template for Basic Project Information

Basic information of the Project to be obtained ta site the Engineer in charge

Project Site: Basic information collection template	
Date:	
Project No.	
Project Name	
Name of Engineer In-charge	
Date of Information collection	
Type of Project	**Select (options)**
Hydro Power	
Thermal	
Gas turbine	
Solar Power	
Mining	
Funding agency	
National	
International	
Financial Institution name	
Project development cycle	**Phase**
Planning	
Design, Development and Engineering	
Purchasing	
Construction	
Commissioning	
Operations	
Quality Assurance	
Executing agency	
Name	
Contract Period	
Role	
Project stake (in Million INR)	
Timeframe for Project	**Time (months)**
Planning	
Design, Development, and Engineering	

Project Site: Basic information collection template	
Purchasing	
Construction	
Commissioning	
Operations	
Quality Assurance	
Location details of the place (Attach map)	
District	
City	
Town	
Village	
Detailed Scope of the Project	
Land use Pattern in the surroundings of the Project	
(Attach map of the land use)	
Status of Legal Clearance/Approvals applicable to the project	
Clearances	**Status**
Environmental Clearance	
CRZ clearance	
Consent to Establish and Operate	
Wildlife Clearance	
Forest Clearance	
Land Acquisition	
Water use permission	

Project Site: Basic information collection template	
Mining certificates	
Others	
Is there any tribal population affected?	
Is there any regional ecosystem affected?	
Is there change in the topography?	
Is there displacement or major change in the neighbouring region?	
Are precautions/measures are being taken to mitigate environmental impacts?	
Are local people being employed in the project?	
Is there an on-site availability of environment monitoring team?	
Remarks	
Documents to be attached (hard copies)	
1. Land use pattern of the surrounding region	
2. Clearance obtained from the different departments	
3. Project planning and design document	
Reviewed by	
Name	
Position	
Signature	
Date	

Annexure- 35

भारतीय गैर न्यायिक

भारत INDIA

रु. 500 FIVE HUNDRED RUPEES

पाँच सौ रुपये Rs. 500

INDIA NON JUDICIAL

महाराष्ट्र MAHARASHTRA ◑ 2020 ◑

NAGPUR TREASURY
AY 316505
02 DEC 2020
Stamp Head Clerk / Sr. Clerk

CONTRACT AGREEMENT

CONTRACT FOR BENEFICIATION OF 17.58MMT RoM/RAW COAL AND DELIVERY OF BENEFICIATED COAL TO VARIOUS THERMAL POWER STATIONS OF MAHAGENCO

This coal beneficiation and delivery contract (the "Contract") is made on 10th day of December, 2020 at Mumbai between Maharashtra State Power Generation Co. Ltd., a company registered under Indian Companies Act, 1956 and having its registered office at 2nd Floor, Prakashgad, plot No. G9, Prof. AK Marg, Bandra (East) Mumbai, India (hereinafter called and referred to as "**MAHAGENCO**" which expression shall unless excluded by or repugnant to the context include its successors and assignees) of the one part and Maharashtra State Mining Corporation, a company registered under Indian Companies Act, 1956 and having its registered office at Khanikarm Bhavan, Plot

Dy. Chief Engineer-III (FM)
Mahagenco, Nagpur.

P. Y. TEMBHARE
Agent/G. M. (Operations),
M.S.M.C. Ltd., Nagpur

13. **CONTRACT OPERATING AUTHORITY:**
This contract will be operated by the Dy.CE-III(FM), Vidyut Bhavan, Katol Road, Nagpur440013 in all matters related to this contract.

IN WITNESS whereof the parties hereto have caused this Contract to be executed in accordance with their respective laws the day and year first above written.

FOR MAHARASHTRA STATE POWER GENERATION CO. LTD.,

Name: Sharad R. Bhagat

Designation: Deputy Chief Engineer (FM-III)

In the presence of

Name: Vijay Barange

Designation: S.E. (coal)

Address: VidyutBhavan, Katol Road, Nagpur-440013

FOR THE MAHARASHTRA STATE MINING CORPORATION LIMITED

Name: Shri Premchand. Y. Tembhare

Designation: General Manager (CP)

In the presence of

Name: Abhishek Verma

Designation: Legal Consultant

Address: Khanikarm Bhavan, Plot No.7, Ajni Square, Wardha Road, Nagpur

Dy. Chief Engineer-III (FM)
Mahagenco, Nagpur.

P. Y. TEMBHARE
Agent/G. M. (Operations),
M.S.M.C. Ltd., Nagpur

1.28 **"ROM Coal"** shall means Run of mine coal

1.29 **"SECL"** shall means South Eastern Coalfields Ltd.

1.30 **"Surveillance Agency [SA]"** shall means the agency carrying out simultaneous Sampling and Analysis of coal at TPS end and at Washery end on as and when directed basis randomly and independently to cross check the sampling & analysis by carried out by IIA.IIA will be appointed by Mahagenco through open tender.

1.31 **"Tripartite agreement"** shall means An Agreement between coal company, CIMFR and/or designated agency appointed by Mahagenco & Mahagenco for sampling and analysis of raw coal at loading end

1.32 **"Washery"** shall means Infrastructure facilities of Coal beneficiation plant

1.33 **"WCL"** shall means Western Coalfields Ltd

GENERAL TERMS & CONDITIONS

1. DETAILED SCOPE OF WORK:

The scope of work includes taking delivery of RoM/raw coal from mine authority (WCL, SECL, MCL) on behalf of Mahagenco, transporting raw coal to Washery, processing/ beneficiation of the RoM/raw coal to obtain specified parameters, transportation of beneficiated coal to railway siding, loading of beneficiated coal into railway wagons for dispatch to designated Thermal Power Station on completing all documentation as required by Mine authorities (WCL,SECL,MCL), Railways and Mahagenco. MSMC shall be responsible for treatment and disposal of Rejects.

Importance of beneficiated/ washed coal: As the beneficiated/ washed coal with improved quality (GCV and Ash content) is utilized to mitigate the shortfall in quality of RoM/ raw coal and fulfill the demand of generation of state within MOD (Merit Order Dispatch) concept, the failure on account of quantity and quality has adverse effect on generation of electricity. Therefore, the MSMC shall deliver the beneficiated coal strictly as per technical specification and delivery schedule in accordance with the terms and conditions of the contract, failing which penalties as specified herein shall be recovered from the MSMC..

a) MSMC shall deliver Mahagenco beneficiated coal of 14.15 MMT Per Annum during the contract period of 5 year from WCL, MCL & SECL command area against raw coal quantity of 17.58 MMT Per Annum and as per standard coal company wise normative yield.

Coal Company	WCL	SECL	MCL	Total
Raw coal quantity (80 % of 21.98 MMT)	8	5.6	3.98	17.58
Normative yield (%)	85	80	72	
Wash coa quantity (MMT)	6.8	4.48	2.87	14.15

However, Mahagenco reserves the right to increase or decrease/ Varied/ allocation of quantity depending on the availability of raw coal from Coal Companies SLC (ST) Linkages, requirement of coal to different TPS of Mahagenco considering MoD and performance of MSMC and MSMC is bound by the same

Dy. Chief Engineer-III (PM)
Mahagenco, Nagpur.

P. Y. TEMBHARE
Agent/G. M. (Operations),
M.S.M.C. Ltd., Nagpur

Annexure-36(a)

MAHARASHTRA POLLUTION CONTROL BOARD

Phone : 4010437/4020781 /4037124/4035273
Fax : 24044532/4024068 /4023516
Email : cac-cell@mpcb.gov.in
Visit At : http://mpcb.gov.in

Kalpataru Point, 3rd & 4th floor, Sion- Matunga Scheme Road No. 6, Opp. Cine Planet Cinema, Near Sion Circle, Sion (E), Mumbai - 400 022

Consent No: Format 1.0/ BO/CAC-Cell/UAN No. 0000054679/CAC - 1908000444 Date: 16/08/2019

To,
M/s. Maharashtra State Power Generation Co. Ltd.,
[Coal based Thermal Power Plant]
At- Koradi, Tal: Kamptee, Dist: Nagpur.

Kora

Subject: Consent to Establish for expansion.i.e. Construction of closed pipe conveyor system under RED Category.

Ref: 1. Consent to operate granted by the Board vide no. BO/CAC-Cell/UAN no.30152/CAC-1906000774 dated 17.06.2019.
2. Minutes of CAC meeting held on dated 03.04.2019.

Your application: MPCB-Consent-0000054679 Dated: 16.08.2018.

For: Consent to Establish for expansion. i.e. i.e. Construction of closed pipe conveyor system with increase in capital investment

under Section 25 of the Water (Prevention & Control of Pollution) Act, 1974 & under Section 21 of the Air (Prevention & Control of Pollution) Act, 1981 and Authorization under Rule 5 of the Hazardous and Other Wastes (M & T M) Rules 2016 is considered and the consent is hereby granted subject to the following terms and conditions and as detailed in the schedule I, II, III & IV annexed to this order:

1. The consent to Establish is granted for a period up to commissioning of the unit or 5 years period whichever is earlier.

2. The actual capital investment of the proposed activity of thermal power plant is Rs.179.07 Crores as per certificate issued by Chartered Accountant.

3. The Consent to establish is valid for –

Sr. No.	Activity
1	The Construction of Transportation route of raw coal by constructing 16.1 Km cross country Pipe conveyor system on 2.79 ha from Gondegaon & Bhanegaon Mine of Western Coalfield Ltd via Khaperkheda Thermal Power Plant to existing 3 x 660 MW Koradi Thermal Power Plant at Mouza - Koradi, Tehsil - Kamptee, District – Nagpur.

Maharashtra Pollution Control Board

5. Conditions under Water (P&CP), 1974 Act for discharge of effluent:

Sr. no.	Description	Permitted quantity of discharge (CMD)	Standards to be achieved	Disposal
1.	Trade effluent	---	As per Schedule –I	---
2.	Domestic Effluent	---	As per Schedule –I	---

6. Conditions under Air (P& CP) Act, 1981 for air emissions:

Sr. No.	Description of stack / source	Number of Stack	Standards to be achieved
--	---	---	As per Schedule –II

7. Conditions about Non Hazardous Wastes :

Sr. no.	Type Of Waste	Quantity & UoM	Treatment	Disposal
–	–	–	–	–

8. Conditions under Hazardous Waste (MH & TM) Rules, 2008 for treatment and disposal of hazardous waste:

Sr. No.	Type Of Waste	Category	Quantity	UOM	Treatment	Disposal
–	---	–	–	–	--	–

9. The Board reserves the right to review, amend, suspend, revoke etc. this consent and the same shall be binding on the Industry.

10. Industry shall promote adoption of clean coal (with ash content less than 34%) and clean power generation technologies and comply with the notification issued by MoEF for utilization of fly ash from coal or lignite based thermal power plants dated 14th September, 1999 and as amended on 3rd November, 2009 & amendment dated 02nd January 2014.

11. The applicant shall comply with the recommendations of the task force for implementation of CREP recommendations for Thermal Power Plants.

12. Project Proponent shall comply conditions stipulated in Environmental Clearance granted by Ministry of Environment , Forest and Climate Change vide letter dated J-13012/87/2007-IA-II(T) dated 29.05.2018.

13. This consent should not be construed as exemption from obtaining necessary NOC/permission from any other Government authorities.

For and on behalf of the
Maharashtra Pollution Control Board

(E. Ravendiran, IAS)
Member Secretary

Received Consent fee of –

Sr. No.	Amount (Rs.)	D.D. No.	Date	Drawn On
1.	Rs.3,58,140/-	L-7616323	31.10.2018	Canara Bank

Copy to:

1.Regional Officer, MPCB, Nagpur /Sub-Regional Officer –Nagpur-I, MPCB, Nagpur.
- They are directed to ensure the compliance of the consent conditions.
2.Chief Accounts Officer, MPCB, Mumbai.
3.CC/CAC desk - for record & website updation purposes.

Schedule-I

Terms & conditions for compliance of Water Pollution Control:

1) A] Industrial Effluent generation: Nil.
   B] Industrial Effluent treatment: N.A.
   C] Industrial Effluent disposal: N.A.

2) A] Domestic Effluent generation: Nil.
   B] Domestic Effluent treatment: N.A.
   C] Domestic Effluent disposal: N.A.

3) The Board reserves its rights to review plans, specifications or other data relating to plant setup for the treatment of waterworks for the purification thereof & the system for the disposal of sewage or trade effluent or in connection with the grant of any consent conditions. The Applicant shall obtain prior consent of the Board to take steps to establish the unit or establish any treatment and disposal system or and extension or addition thereto.

4) The Industry shall ensure replacement of pollution control system or its parts after expiry of its expected life as defined by manufacturer so as to ensure the compliance of standards and safety of the operation thereof.

5) The Applicant shall comply with the provisions of the Water (Prevention & Control of Pollution) Cess Act, 1977 and provisions as contained in the said Act.

Sr. No.	Purpose for water consumed	Water consumption quantity (CMD)
1.	Industrial Cooling, spraying in mine pits or boiler feed	---
2.	Domestic purpose	---
3.	Processing whereby water gets polluted & pollutants are easily biodegradable	---
4.	Processing whereby water gets polluted & pollutants are easily biodegradable and are toxic	---

6) The Applicant shall provide Specific Water Pollution control system as per the conditions of EP Act, 1986 and rule made there under Environmental Clearance / CREP guidelines.

Schedule-II

Terms & conditions for compliance of Air Pollution Control:

1. As per your application, you have provided the Air pollution control (APC)system and also erected following stack (s) and to observe the following fuel pattern-

Sr. No.	Stack Attached To	APC System	Height in Mtrs.	Type of Fuel	Quantity & UoM	S %	SO_2 Kg/Day
—	—	—	—	—	—	—	—

2. The Applicant shall provide Specific Air Pollution control equipments as per the conditions of EP Act, 1986 and rule made there under from time to time / Environmental Clearance / CREP guidelines. (Concern section shall mention specific control equipments)

3. The applicant shall operate and maintain above mentioned air pollution control system, so as to achieve the level of pollutants to the following standards:

1	Particulate Matter	Not to exceed	100 mg/ Nm³

4. The Applicant shall obtain necessary prior permission for providing additional control equipment with necessary specifications and operation thereof, alteration, or replacement alteration well before its life come to an end or erection of new pollution control equipment.

5. The Board reserves its rights to vary all or any of the condition in the consent, if due to any technological improvement or otherwise such variation (including the change of any control equipment, other in whole or in part is necessary).

6. The Industry shall achieve the National Ambient Air Quality standards prescribed vide Government of India, Notification dated 16.11.2009 as amended.

7. Control Equipment's:-----

Schedule-III

Details of Bank Guarantees

BG Regime:

Sr. No.	Consent	Amt. of BG Imposed in Rs.	Submission Period	Purpose of BG	Compliance Period	Validity Date
1	Consent to Establish	Rs. 5.0 lakhs	15 Day	Towards compliances of the consent conditions	Continuous	31.12.2024.

Note:

(1) The above bank guarantees shall be submitted by the applicant at the respective regional Office within 15 days.

(2) Project proponent shall extend period of bank guarantee for a period up to: Validity of consent + 4 months period.

Schedule-IV

General Conditions:

1) The applicant shall provide facility for collection of environmental samples and samples of trade and sewage effluents, air emissions and hazardous waste to the Board staff at the terminal or designated points and shall pay to the Board for the services rendered in this behalf.
2) Industry should monitor effluent quality, stack emissions and ambient air quality monthly/quarterly.
3) The applicant shall provide ports in the chimney/(s) and facilities such as ladder, platform etc. for monitoring the air emissions and the same shall be open for inspection to/and for use of the Board's Staff. The chimney(s) vents attached to various sources of emission shall be designated by numbers such as S-1, S-2, etc. and these shall be painted/ displayed to facilitate identification.
4) Whenever due to any accident or other unforeseen act or even, such emissions occur or is apprehended to occur in excess of standards laid down, such information shall be forthwith Reported to Board, concerned Police Station, office of Directorate of Health Services, Department of Explosives, Inspectorate of Factories and Local Body. In case of failure of pollution control equipments, the production process connected to it shall be stopped.
5) The applicant shall provide an alternate electric power source sufficient to operate all pollution control facilities installed to maintain compliance with the terms and conditions of the consent. In the absence, the applicant shall stop, reduce or otherwise, control production to abide by term and conditions of this consent.
6) The firm shall submit to this office, the 30th day of September every year, the Environmental Statement Report for the financial year ending 31st March in the prescribed Form-V as per the provisions of rule 14 of the Environment (Protection) (Second Amendment) Rules, 1992.
7) The industry shall send used oil to reprocess/re refiners authorized by MPCB & the Hazardous Waste to CHWTSDF Butibori, Nagpur as per the provision contain in the HW & Other Waste (M & TM) Rules, 2016.
8) The industry should comply with the HW & Other Waste (M & TM) Rules, 2016 and submit the Annual Returns as per Rule 5(6) & 22(2) of Hazardous Waste (M,H & TM) Rules, 2016 for the preceding year April to March in Form-IV by 30th June of every year.
9) An inspection book shall be opened and made available to the Board's officers during their visit to the applicant.
10) The applicant shall obtain Consent to Operate from Maharashtra Pollution Control Board before actual commencement of the Unit/ Activity for proposed other units (In case of Consent to establish).
11) The applicant shall make an application for renewal of the consent at least 60 days before the date of the expiry of the consent.
12) Industry shall strictly comply with the Water (P&CP) Act, 1974, Air (P&CP) Act,1981 and Environmental Protection Act,1986 and industry specific standard under EP Rules 1986 which are available on MPCB website(www.mpcb.gov.in).
13) The industry shall constitute an Environmental cell with qualified staff/personnel/agency to see the day to day compliance of consent condition towards Environment Protection.
14) Separate drainage system shall be provided for collection of trade and sewage effluents. Terminal manholes shall be provided at the end of the collection system with arrangement for measuring the flow. No effluent shall be admitted in the pipes/sewers downstream of the terminal manholes. No effluent shall find its way other than in designed and provided collection system.
15) Neither storm water nor discharge from other premises shall be allowed to mix with the effluents from the factory.
16) The applicant shall install a separate meter showing the consumption of energy for operation of domestic and industrial effluent treatment plants and air pollution control system. A register showing consumption of chemicals used for treatment shall be maintained.
17) Conditions for D.G. Set

a) Noise from the D.G. Set should be controlled by providing an acoustic enclosure or by treating the room acoustically.

b) Industry should provide acoustic enclosure for control of noise. The acoustic enclosure/ acoustic treatment of the room should be designed for minimum 25 dB (A) insertion loss or for meeting the ambient noise standards, whichever is on higher side. A suitable exhaust muffler with insertion loss of 25 dB (A) shall also be provided. The measurement of insertion loss will be done at different points at 0.5 meters from acoustic enclosure/room and then average.

c) Industry should make efforts to bring down noise level due to DG set, outside industrial premises, within ambient noise requirements by proper sitting and control measures.

d) Installation of DG Set must be strictly in compliance with recommendations of DG Set manufacturer.

e) A proper routine and preventive maintenance procedure for DG set should be set and followed in consultation with the DG manufacturer which would help to prevent noise levels of DG set from deteriorating with use

f) D.G. Set shall be operated only in case of power failure.

g) The applicant should not cause any nuisance in the surrounding area due to operation of D.G. Set.

h) The applicant shall comply with the notification of MoEF dated 17.05.2002 regarding noise limit for generator sets run with diesel

18) The industry should not cause any nuisance in surrounding area.

19) The industry shall take adequate measures for control of noise levels from its own sources within the premises so as to maintain ambient air quality standard in respect of noise to less than 75 dB (A) during day time and 70 dB (A) during night time. Day time is reckoned in between 6 a.m. and 10 p.m. and night time is reckoned between 10 p.m. and 6 a.m.

20) The applicant shall maintain good housekeeping.

21) The applicant shall bring minimum 33% of the available open land under green coverage/plantation. The applicant shall submit a statement on available open plot area, number of trees surviving as on 31st March of the year and number of trees planted by September end, with the Environment Statement.

22) The non-hazardous solid waste arising in the factory premises, sweepings, etc. be disposed of scientifically so as not to cause any nuisance / pollution. The applicant shall take necessary permissions from civic authorities for disposal of solid waste.

23) The applicant shall not change or alter the quantity, quality, the rate of discharge, temperature or the mode of the effluent/emissions or hazardous wastes or control equipments provided for without previous written permission of the Board. The industry will not carry out any activity, for which this consent has not been granted/without prior consent of the Board.

24) The industry shall ensure that fugitive emissions from the activity are controlled so as to maintain clean and safe environment in and around the factory premises.

25) The industry shall submit quarterly statement in respect of industries' obligation towards consent and pollution control compliance's duly supported with documentary evidences [format can be downloaded from MPCB official site].

26) The industry shall submit official e-mail address and any change will be duly informed to the MPCB.

27) The industry shall achieve the National Ambient Air Quality standards prescribed vide Government of India, Notification dt. 16.11.2009 as amended.

28) The industry shall comply with the notification issued by MoEF for utilization of fly ash from coal or lignite based thermal power plants dated 14th September, 1999 and as amended on 3rd November, 2009.

29) Industry shall provide dry fly ash handling & collection system and utilize the fly ash as per the fly ash notification of the Govt. of India.

30) The use of beneficiated coal as per GOI Notification shall be implemented. Transportation of coal to site by seaways at portland further transportation of coal shall be carried out through trucks by covering tarpaulin properly till the railway facility from Nardana Railway station to the factory site provided. Fly ash shall be by transported through bunker having closed system, truck by covering tarpaulin properly and coal carrying conveyor belt shall be covered from all side with provision of water springing/spraying system properly.

31) The applicant shall Operate three continuous automatic ambient air and micrometeorological monitoring station at location indicated by MPC Board to be set up and operate at its own cost for measurement of SO2, NOx and particulate matter. These CAAQMS shall also have necessary provision of networking to the Air Quality Monitoring network of MPCB.

32) They shall promote adoption of clean coal and clean power generation technologies.

33) The coal handling system shall be covered with proper hooding and ventilation arrangements connected to dust suppress agent so as not to allow any fugitive emissions.

34) If due to any technological improvements or otherwise this Board is of opinion that all or any of the conditions referred above require variation (including the change of any control equipment either in whole or in part), this Board shall after giving the applicant an opportunity of being heard vary all or any of such conditions and thereupon the applicant shall be bound to comply with the conditions so varied.

Annexure - 36 (b)

12/5/2021

Coal Pipe Conveyor System