

BEFORE THE HON'BLE NATIONAL GREEN
TRIBUNAL, WESTERN ZONE BENCH, PUNE

Appeal No. 166/2024(WZ)

APPELLANTS: MRS PRACHI AMIT MAHURKAR & 3
OTHERS

VERSUS

RESPONDENTS: UNION OF INDIA & 8 OTHERS

INDEX

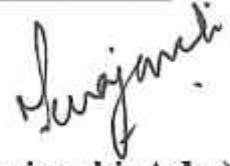
| Sr. No. | Particulars | Page Nos. |
|---------|----------------------------------------------------------------------------------------------------------------------------------|-----------|
| 1. | Counter affidavit of Respondent No. 4 Maharashtra State Power Generation Co. Ltd. | 1058-1113 |
| 2. | Annexure-R-4/A Copy of the Radio Activity Test Certificate issued by Department of Atomic Energy dated 14.12.2024. | 1114 |
| 3. | Annexure-R-4/B | 1115-1129 |

| | | |
|----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| | Copies of replies given by Koradi Thermal Power Station to the show cause notices dated 07.12.2021, 01.02.2022 and 20.07.2022 .(Coll) | |
| 4. | <u>Annexure-R-4/C</u> Copy carbon footprint study through SINE IIT Bombay Company for its Koradi Power Station | 1130-1215 |
| 5. | <u>Annexure- R-4/D</u> Copies of Test reports dated 06.06.2025 for bore wells as well as dug wells of villages Panjra, Mahadula, Koradi, Nanda, Suradevi, Kawtha, Khasala and Mhasala. | 1216-1270 |
| 6. | <u>Annexure-R-4/E</u> Copy of detailed action plan prepared by the answering Respondent for maximum ash utilisation dated 31.05.2025. | 1271-1273 |
| 7. | <u>Annexure-R-4/F</u> | 1274-1275 |

| | | |
|--|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| | Copy of Copy of Notification issued by Respondent No. 1, wherein the time line for installation of FGD for Thermal Power Plants is extended for three years, i.e. up to 31.12.2027 for Koradi Thermal Power Station. | |
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Pune

Date : 04/09/2025



(M.P. Khajanchi, Adv.)

Counsel for Respondent No. 4

1058

**BEFORE THE HON'BLE NATIONAL GREEN
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REPLY ON BEHALF OF THE RESPONDENT NO. 4

The Respondent No. 4 begs to submit as under:-

**PRELIMINARY OBJECTIONS TO THE TENABILITY OF THE
APPEAL**

1. The Appellants have invoked the Appellate jurisdiction of this Hon'ble Tribunal under Section 16 of National Green Tribunal Act, 2010 to challenge the Environmental Clearance dated 19.09.2024 granted to the answering Respondent by the Respondent No. 1 for the 2X660 MW Coal based Supercritical Thermal Power Plant within the existing premises of 2190 MW Koradi Power Plant at Koradi, Tah. Kamptee, District Nagpur, Maharashtra. The



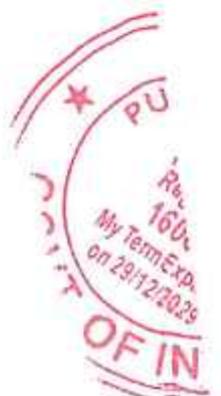
1059

answering Respondent submits that the present Appeal under Section 16 of National Green Tribunal Act, 2010 is not maintainable.

2. The answering Respondent submits that the Appellants have not shown as to how they are “persons aggrieved” within the meaning of “any person aggrieved” under Sections 16 and 18 of National Green tribunal Act, 2010.

3. The answering Respondent submits that the Appellants do not live in the vicinity of Koradi Thermal Power Station. They have not participated in the Public Hearing. They have not even claimed in the Appeal that they sought hearing during the public consultation but were not given such opportunity. In such circumstances, it is crystal clear from record that the Appellants are not the “persons aggrieved” and they have no authority under law to invoke the jurisdiction of this Hon’ble tribunal under Section 16 of National Green Tribunal Act, 2010.

4. It is pertinent to note that none of the persons who reside in the vicinity of Koradi Thermal Power Station have filed Appeal. The Appellants have not shown any credentials and bonafides in filing the Appeal before this Hon’ble Tribunal. The Appellants have not



1060

disclosed the source of documents, source of funding etc. In such circumstances the Appellants have no *locus standi* to prefer the present Appeal.

5. Even otherwise, perusal of the Environmental Clearance dated 19.09.2024 would demonstrate that the same is granted on various conditions including that answering Respondent shall abide by all orders and judicial pronouncements made from time to time by the Hon'ble High Court of Judicature at Bombay, Bench at Nagpur in Public Interest Litigation (PIL) No. 51/2023 and Original Application (OA) No. 62/2021 filed before this Hon'ble Tribunal. In the humble submission of the answering Respondent, when the issues in question sought to be raised by Appellants are already being looked in to by Hon'ble High Court and this Hon'ble Tribunal in two separate proceedings, the Appellants should not and could not have invoked the Appellate jurisdiction of this Hon'ble Tribunal by raising identical subject matters and similar grievances. Resultantly, the answering Respondent submits that the Appeal as framed and filed by the Appellants before this Hon'ble Tribunal is not maintainable.



1061

6. Absolutely without prejudice to the above raised preliminary objections, the answering Respondent submits that even on merits, the Appellants have not made out any case whatsoever to seek indulgence from this Hon'ble Tribunal. The answering Respondent denies each and every adverse allegation made against the answering Respondent by the Appellants, as if each of such adverse allegation is specifically denied and traversed. The answering Respondent is submitting parawise reply as under:-

Reply to Para 1:

7. As already submitted the Appellants cannot be said to be "persons aggrieved" by the Environmental Clearance dated 19.09.2024 issued by Respondent No. 1 in favour of the answering Respondent. The answering Respondent denies that the Appellants are aggrieved by the said Environmental Clearance dated 19.09.2024. It is denied that the Appellants are not associated with any political party and it is further denied that they are not interested/influenced by any political decision. It is denied that grave illegalities, as alleged or otherwise, are committed by the Respondent No. 1 while granting Environmental Clearance to the answering Respondent.



1062

Reply to Para 2:

8. Needs no reply.

Reply to Para 3:

9. Needs no reply.

Reply to Para 4 (i) & (ii):

10. On Appellants' own showing, the Respondent No. 1 had issued the Terms of Reference (TOR) on 26.06.2020. Perusal of the said Terms of Reference (TOR) would validate that it's a detailed reference containing several terms and it was published on the website of the Respondent No. 1. The Appellants have also annexed the same with the Memo of Appeal. However, the Appellants did not raise any grievances or objections to the said Terms of Reference (TOR). It is crystal clear that the Appellants, when were not aggrieved by the said Terms of Reference (TOR), there is no question of they being aggrieved by the impugned Environmental Clearance 19.09.2024 granted by the Respondent No. 1 in favour of the answering Respondent. Had the Appellants really been serious about the alleged grievances raised by them in the present Appeal, they would have



1063

very well challenged the Terms of Reference (TOR) dated 26.06.2020. Having failed to do so, the Appellants are estopped from challenging the impugned Environmental Clearance dated 19.09.2024 by way of present Appeal.

Reply to Para 4 (iii):

11.Appellants have themselves pleaded that the Maharashtra Electricity Regulatory Commission (MERC) had granted approval for the proposed expansion of the project in Case No. 230/2019 dated 04.09.2019. The Appellants did not challenge the said order dated 04.09.2019 passed by MERC. The said conduct not only shows the casual approach of the Appellants but it also demonstrates that there is no cause of action made out by the Appellants in the present Appeal for redressal of their alleged grievances before this Hon'ble Tribunal.

Reply to Para 4 (iv) to (xii):

12.Needs no reply.

Reply to Para 4 (xiii):



1064

13. All the allegations made in this para are denied. The answering Respondent had properly addressed all the objections raised during the public hearing held on 23.05.2009 in respect of 3x660 MW Koradi Project and the proposal was submitted to MOEF & CC for recommendation of EC. Further, EC in respect of 3x660 MW Koradi Project was granted MOEF & CC on 04.01.2010.

Reply to Para 4 (xiv):

14. It is denied that the ash is being released from the Ash Bund in the River Kanhan which is the main water source of drinking water in Nagpur City. The Appellants are put to strict proof of the same.

Reply to Para 4 (xv):

15. Needs no reply.

Reply to Para 4 (xvi):

16. Needs no reply.

Reply to Para 4 (xvii):

17. It is denied that the answering Respondent has not complied with the terms of the EC dated 04.01.2010 for 3x660 MW Plant and that



1065

the environment is being continuously degraded as alleged and it is further denied that the same is resulting in serious health hazard to the life of the Citizens in Nagpur and surrounding areas, as alleged or otherwise. The Appellants are put to strict proof of the same.

Reply to Para 4 (xviii) to (xxiv):

18. Needs no reply.

Reply to Para 4 (xxv):

19. It is denied that the important directions issued by this Hon'ble Tribunal are still not followed by Respondents and it is further denied that health of citizens of Vidarbha Region is at serious risk.

Reply to Para 4 (xxvi):

20. The answering Respondent submits that the EC specifically lays down condition directing the answering Respondent to abide by all orders in the said two ongoing legal proceedings. It is denied that existence of these legal challenges directly questions the validity of the EC.



1066

21. It is denied that granting the EC while show cause notices are pending is a clear violation of the precautionary principle as alleged or otherwise. As the said three show cause notices have been duly replied by the answering Respondent. The Environmental Clearance (EC) dated 19.09.2024 has also dealt with the same.

22. The Gorewada International Zoo is not a notified national park, sanctuary, or protected forest under said the Act. Hence, the observation in the EC to the effect that there are no such areas within a 10 km radius is factually and legally correct.

Reply to Para 4 (xxvii) & (xxviii):

23. Needs no reply.

Reply to Para 4 (xxix):

24. It is denied that in the years following the EC and NGT order, several compliance issues have emerged. The installation of FGD system is in progress. Koradi TPS has achieved an average ash utilization of 65% in past 3 years. Efforts are being taken to achieve 100% ash utilization. It is denied that this Hon'ble Tribunal's



1067

directions regarding studies on Nuclear Radiations have not been followed. The Appellants are put to strict proof of the same. The answering Respondent submits that as per the radio activity test certificate issued by Department of Atomic Energy, the values are below the clearance level. Copy of the said Radio Activity Test Certificate dated 14.12.2024 issued by Department of Atomic Energy is annexed herewith and marked as Annexure-R-4/A.

Reply to Para 4 (xxx):

25. It is denied that the Koradi Thermal Power Plant has been operational for 7-8 years without compliance with EC conditions and NGT directives. It is denied that this situation has raised concerns about any environmental degradation and potential health hazards in the Nagpur area. The Appellants are put to strict proof of the same.

Reply to Para 4 (xxxi):

26. It is denied that that answering Respondent deliberately closed down all units of the power plant during this visit of sub-committee to conceal the actual pollution levels, as alleged or otherwise.



Reply to Para 4 (xxxii):

27. It is denied that alleged issues at the Koradi Thermal Power Plant highlight the challenges in balancing industrial development with environmental protection and/or public health concerns. It is denied that they underscore the need for more stringent enforcement of environmental norms and regulations in India's Power sector. In the humble submissions of answering Respondent, these submissions made by the Appellants have no factual bearing and are based upon assumptions and presumptions only. Answering respondent submits that, Hon'ble Supreme Court of India vide its judgement dated 10.05.2022 in matter of M/s Arawali Power Co Pvt Ltd (Civil Appeal nos. 1692-1693 of 2020) has set aside the NGT order dated 12.02.2020 in the matter of OA 117/2014.

Reply to Para 4 (xxxiii):

28. In respect of the show cause notices dated 03.12.2021, 27.01.2022 and 18.07.2022, the Koradi Thermal Power Station of the answering Respondent had suitably replied to them on 07.12.2021, 01.02.2022 and 20.07.2022 respectively, copies



1069

whereof are annexed hereto and marked as **Annexure-R-4/B** **(Collectively)**. But, the show cause notice dated 21.07.2023 referred by the Appellants does not pertain to the Koradi Thermal Power Station in question. The issuance of show cause notices regarding certain violations is an ongoing process and the Respondent No. 3 regularly takes follow up of the Industries including that of the subject Power Plant to keep a check and for compliance with the environmental protection and pollution control norms. Therefore, the Appellants cannot take any advantage by placing reliance upon the show cause notices. The answering Respondent submits that it has duly complied with the show causes notices issued by the Respondent No. 3 from time to time. Issuance of the show cause notices itself validates that the Respondent No. 3 is taking appropriate action whenever required and no interference is called for at the behest of Appellants. The answering Respondent submits that whatever discrepancies have been pointed out, the same have been duly corrected. The demand and supply of power in the State of Maharashtra is the major concern of the answering Respondent. Whenever any discrepancies occur, the same are immediately corrected. This is



1070

not a case where the directions issued by Authorities including MPCB have not been complied with by the answering Respondent.

Reply to Para 4 (xxxiv):

29. It is denied that the answering Respondent has not complied with all the terms of the EC dated 04.01.2010 for 3x660 MW Plant. There are few conditions partially complied with and other compliance is in progress. The status of the same has been already appraised to MoEF&CC.

Reply to Para 4 (xxxv):

30. Needs no reply.

Reply to Para 4 (xxxvi):

31. It is denied that that answering Respondent deliberately closed down all units of the power plant during this visit of sub-committee to conceal the actual pollution levels, as alleged or otherwise. The Appellants have made wild allegations in this para without substantiating the same. The pleadings in this para are false, frivolous, scandalous and vexatious without any iota of



1071

material. Such pleadings deserve to be struck off and appropriate action deserve to be taken against the Appellants.

Reply to Para 4 (xxxvii):

32. It is denied that the answering Respondent has not complied with all the terms of the EC dated 04.01.2010 for 3x660 MW Plant. There are few conditions partially complied with and other compliance is in progress. The status of the same has been already appraised to MoEF&CC.

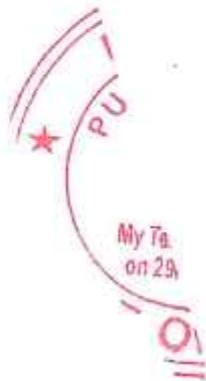
Reply to Para 4 (xxxviii):

33. Needs no reply.

Reply to Para 4 (xli):

34. The answering Respondent submits that the public hearing was conducted in accordance with the provisions of Environment (Protection) Act, 1986 and EIA Notification, 2006 (as amended from time to time). The procedure for conducting public hearing, as enshrined in EIA Notification, 2006 was duly complied with.

Reply to Para 4 (xlii):



1072

35. It is denied that the project's resource requirements and environmental impacts warrant closer scrutiny. It is denied that the massive coal requirement of 7.18 MMTPA raises concerns about the environmental consequences of coal transportation and storage. It is denied that the plan to use treated sewage water from Nagpur Municipal Corporation as the primary water source needs careful examination for its long-term sustainability and reliability. It is denied that the presence of three Schedule I species in the study area, with a Wildlife Conservation Plan still under process and/or indicates potential risks to local biodiversity that have not been adequately addressed, as alleged or otherwise. It is denied that the cumulative environmental impact of the proposed expansion in conjunction with the existing 2190 MW plant, may not have been comprehensively assessed, concerning air quality in the already polluted airshed of Nagpur, as alleged or otherwise.

Reply to Para 4 (xliii):

36. It is denied that critical issues related to project implementation and compliance also merit attention. It is denied that the timeline and adequacy of the action plan to address



1073

concerns raised during the public hearing require thorough evaluation. It is denied that Project's ability to achieve 100% fly ash utilization and effectively manage legacy ash from the existing plant is questionable given past performance. It is denied that there is any delay in installing Flue Gas Desulfurization (FGD) systems for existing units and it anyway casts doubt on the likelihood of timely compliance for the new units. All these submissions are based upon assumptions and presumptions only. The answering Respondent submits that the process of installation of Flue Gas Desulfurization (FGD) systems is in progress. It is denied that the land use change for the expansion project within the existing premises may have unforeseen environmental consequences that warrant further investigation.

Reply to Para 4 (xliv):

37. The answering Respondent submits that perusal of the impugned Environmental Clearance (EC) dated 19.09.2024 itself would demonstrate that all relevant factors have duly been considered while granting the EC.

Reply to Para 4 (xlv):



1074

38. It is denied that comprehensive review of the Project's environmental impacts, compliance history, and mitigation measures is necessary to ensure that the expansion does not come at the cost of irreversible damage to the local environment and community health. It is denied that there is any need to scrutinize the clearance process, paying particular attention to the cumulative impacts of the expanded power plant, the adequacy of proposed environmental safeguards, and the project's alignment with India's commitments to reducing carbon emissions and promoting sustainable development. All these submissions are based upon assumptions and presumptions only. Even if there is any adverse impact as alleged, the same can be corrected but these submissions of the Appellants are al premature and not worthy of consideration at this juncture.



REPLY TO THE GROUNDS OF APPEAL

Reply to ground (i):

1075

39. It is denied that the Environmental Clearance (EC) granted to the Project is fundamentally flawed due to its alleged failure to provide a comprehensive assessment of the Project's contribution to climate change. It is denied that the EC does not include any evaluation of the Project's Greenhouse gas emissions and/or its carbon footprint. It is denied that there is no assessment of how the Project aligns with India's Nationally Determined Contributions (NDCs) under the Paris Agreement and it is further denied that it is critical for ensuring that India meets its International climate commitments. It is denied that there is failure and that it is a violation of India's obligations under International law and contravenes the National Green Tribunal (NGT) Act, 2010, which mandates the consideration of environmental impacts in line with sustainable development principles. It is denied that there is any absence of evaluation and that it renders the EC invalid and/or in violation of India's International and/or Domestic Environmental obligations. The Appellants have no authority under law to raise such unfounded objection in respect of the subject EC. The Appellants are not the environmental experts, so as to enable them to raise such issues in the present Appeal. The expert body has



1076

already taken into consideration all the relevant aspects while granting EC.

40. The answering Respondent submits that it is fully vigilant about the environmental concerns and is committed to mitigate carbon emission generated from the Power Station. The answering Respondent has conducted carbon footprint study through SINE IIT Bombay Company in December 2022 for its Koradi Power Station and the said report is annexed herewith and marked as **Annexure-R-4/C.**

41. The answering Respondent submits that it shall implement the mitigation measures suggested, such as biomass co-firing with coal, use of beneficiated coal to reduce ash percentage, green belt development, installation of solar power plant etc.

42. The answering Respondent submits that in the proposed 2x660 MW Project, the answering Respondent is checking feasibility for 240 TPH biomass handling along with 2400 TPH coal handling system.



1077

43. The answering Respondent submits that total green belt area in 215 HA land (including existing 103 HA land) will be developed at Koradi Thermal Power Station, in tune with the EC conditions.
44. The answering Respondent submits that Koradi Thermal Power Station is already using washed coal for its existing Thermal Power Station to substantially reduce the ash percentage.
45. The said units will be established on existing land within the premises of Koradi TPS by demolishing old units. As such, there is no question of any deforestation.
46. The proposed project will be in line with sustainable development principles with following systems to reduce the pollutants well within the prescribed limits of MPCB/CPCB:-
- a) Highly efficient (99.94%) Electro Static Precipitator will be installed;
 - b) Flu Gas Desulphurisation (FGD) Plant will be installed;
47. Additionally, the Environmental Clearance (EC) dated 19.09.2024 also contemplates monitoring of carbon emissions



1078

from the existing Power Plant as well as for the proposed Power Project which is required to be mandatorily carried out annually from a reputed Institute and report is required to be submitted to the Regional Office of Respondent No. 1.

48. In such circumstances there are absolutely no merits in the allegations made in ground (i) and no interference is called for in the Appellate jurisdiction of this Hon'ble Tribunal.

Reply to ground (ii):

49. It is denied that the EC process anyway failed to account for the cumulative environmental impact of the existing 2,190 MW power plant along with the proposed 1,320 MW expansion. It is denied that there is any violation of Rule 4 of the Environment (Protection) Rules, 1986 and/or the Environmental Impact Assessment (EIA) Notification, 2006. It is denied that the proposed expansion, which would increase the Plant's total capacity to 3,510 MW, significantly exacerbates environmental risks related to air quality and/or water resources and/or ash management, as alleged or otherwise. It is denied that on account of failure to assess, the alleged combined impacts has caused the



1079

EC to be in alleged violation of the law and that the same cannot be sustained.

50. The answering Respondent submits that the Environmental Clearance (EC) process undertaken for the proposed 1,320 MW expansion project has duly considered the requirements under the Environment (Protection) Rules, 1986, and the EIA Notification, 2006. The Terms of Reference (ToR) granted by the Expert Appraisal Committee (EAC) specifically required assessment of the baseline environmental conditions, including the influence of the existing 2,190 (1 x 210 + 3 x 660) MW power station.

51. Accordingly, the EIA study included monitoring of ambient air quality, surface and ground water quality, soil, and noise within a 10 km radius of the project site, which already reflects the cumulative contribution of the operating plant. Predictive modelling of emissions and water usage was carried out using established CPCB/MoEF&CC guidelines, factoring in the existing facility's impact along with the proposed expansion. This ensures that the combined effect of both operations has been taken into account.



1080

52. Furthermore, the project has committed to robust mitigation measures such as 100% dry fly ash utilization, high-efficiency ESPs, adoption of FGD for SO₂ control, advanced dust suppression systems, zero liquid discharge concept, and greenbelt development. These measures will ensure that even with the expanded capacity, the environmental parameters remain within the prescribed standards.

Reply to ground (iii):

53. Though the EC was granted in spite of two ongoing legal proceedings: (i) Public Interest Litigation (PIL) No. 51/2023 pending before the Bombay High Court, challenging the legality of the public hearing conducted for the project, and (ii) Original Application (OA) No. 62/2021 pending before this Hon'ble Tribunal, but the said EC specifically lays down condition directing the answering Respondent to abide by all orders in the said two ongoing legal proceedings. It is denied that existence of these legal challenges directly questions the validity of the EC. It is denied that granting clearance in the face of these alleged unresolved legal issues undermines the principles of natural justice



1081

and/or due process. It is denied that issuing an EC in the midst of ongoing litigations concerning alleged environmental concerns of the same project site undermines the legal process and/or prejudices the Applicants' rights.

Reply to ground (iv):

54. It is denied that granting the EC while show cause notices are pending is a clear violation of the precautionary principle as alleged or otherwise. As already submitted the said three show cause notices have been duly replied by the answering Respondent. The Environmental Clearance (EC) dated 19.09.2024 has also dealt with the same. In such circumstances, there is no question of EC being issued in violation of any principles, as alleged or otherwise.

Reply to ground (v):

55. As regards ground raised by the Appellants is concerned, the answering Respondent submits that the said public hearing was conducted in accordance with the provisions of Environment (Protection) Act, 1986 and EIA Notification, 2006 (as amended



1082

from time to time). The procedure for conducting public hearing, as enshrined in EIA Notification, 2006 was duly complied with.

Reply to ground (vi):

56. As regards challenge to EC, the answering Respondent submits that the same is granted in accordance with the Environment (Protection) Act, 1986 and substantial conditions have been imposed in the said EC itself.
57. The answering Respondent submits that the stack height provided to the existing units is 275 meters, which evacuates the Flue Gas well above the 275 meters, due to the Flue Gas column created by its positive pressure.
58. High efficiency Electrostatic Precipitators (ESP) are installed to the existing 3x660 MW units with removal efficiency of 99.94% and design Particulate Matter (PM) limit of less than 50 mg/Nm³. Ammonia for Flue Gas System is also installed in site with ESP of existing units for control of Particulate Matter.



1083

59. Over Fire Air System is installed to control NO_x emissions and at present NO_x values are consistently within the prescribed limit of 450 mg/Nm³.
60. FGD has been installed for 210 MW Koradi Thermal Power Station for control of So₂ emissions. The said FGD unit has commissioned and the system is in service.
61. Total four continuous Ambient Air Monitoring Systems have been installed in the vicinity of Koradi Thermal Power Station and are connected online to the server of Respondent No. 3. AAQ data is regularly monitored by Respondent No. 3 as well as the answering Respondent.
62. Bag filters are provided to silos used for collection of Dry Fly Ash and water is sprinkled periodically on approach roads and power plant area to suppress fugitive dust. Water fogs are provided near coal storage/coal stack yard.
63. Arrangement has been made for disbursement of Dry Fly Ash utilisation from intermediate/HCSO Silo No. 1. Provision of 3 remote silos is also made for completely dust free loading of ash



1084

in bunkers. Unutilised ash is disposed by High Concentration Slurry Disposal (HCSD) System in Khasara Ash Bund.

64. Coal Handling Plant conveying system at the Koradi Thermal Power Station is closed type and released fugitive emission in the atmosphere is avoided. Trucks transporting coal and ash are fully covered with tarpaulin.
65. Tree plantation is carried out in available open areas with specific species and Bamboo plantation to maintain greenery and as a part of CO₂ sequestration measures. Almost 69.65% of open land is covered with greenery. Work of plantation of 10000 trees along the road from Koradi Thermal Power Station Gate No. 6 to Suradevi village has been carried out by the answering Respondent during October 2023 to April 2024. Total progressive numbers of trees survived up to 31.03.2025 is 4,12,988.
66. Additionally, for effective performance of ESP's, following measures are continuously being carried out:-
- a) Inspection of collecting plates and emission electrodes during shut down of units;



1085

- b) Maintain optimum values of voltage and current;
- c) Ensuring healthiness of rectifiers;
- d) Timely evacuation of ash;
- e) Ensuring healthiness of rapper motors;

67. The answering Respondent submits that new proposed 2x660 MW units will be in-line with the existing 3x660 MW Units for the above mentioned points and full adequate measures will be duly ensured to safeguard the air pollution.

68. Moreover, the EC granted to the answering Respondent has already imposed detailed conditions including general conditions for control of pollution for air quality, water quality, noise pollution, waste management, human health environment, risk mitigation etc. The statutory compliances under the EC granted to the answering Respondent specifically mentions, "Emission standards for Thermal Power Plants as per Ministry's Notification dated 07.12.2015, GSR dated 28.06.2018 and as amended from time to time shall be complied".



1086

69. In such circumstances the grounds raised regarding disregard to environmental protection and public health are absolutely without any substance.

Reply to ground (vii):

70. It is denied that the EC approved the usage of 95,040 KLD of treated sewage water for the project, without adequately assessing the reliability of this water source and/or its potential impact on other users. It is denied that in absence of alleged robust evaluation regarding the long-term sustainability of this water resource raises serious concerns as alleged. It is denied that the EC does not impose a zero liquid discharge (ZLD) requirement which is a critical measure for preventing water pollution. It is denied that any failure violates the Water (Prevention and Control of Pollution) Act, 1974, and/or the principles laid down by the Hon'ble Supreme Court in catena of judgements as alleged.



71. All the above allegations are false. The answering respondent submits that following measures have been taken to ensure Zero Liquid Discharge at existing Thermal Power Station of Koradi:-

1087

- a) Effluent Treatment Plant of capacity 14400 m³/day has been provided to treat trade effluents and treated effluents utilised for ash disposal.
 - b) Ash water recovery scheme is provided at the outlet of Khasara Ash Pond, wherein the supernatant water out flowing from Khasara Ash Pond is recycled and reused for ash handling.
 - c) Three decanting tanks have been constructed in the Plant's premises and the said decanted water is treated in effluent treatment plant;
 - d) The recovered water from ash pond is used for ash disposal inside the Plant's premises;
 - e) 35 Kilolitres per day Sewage Treatment Plant(STP) has been provided at 3x660 MW units to treat sewage and treated sewage water is used and re-utilised for gardening and plantation;
72. Ground water sampling is being taken by the answering Respondent from bore wells as well as dug wells from villages in the periphery of the Koradi Thermal Power Station and complete



1088

chemical testing is being done regularly. Test reports dated 06.06.2025 for bore wells as well as dug wells of villages Panjra, Mahadula, Koradi, Nanda, Suradevi, Kawtha, Khasala and Mhasala are annexed herewith and marked as Annexure- R-4/D (Collectively).

73. Moreover, in the EC granted to answering Respondent, there is specific condition to the effect that “Effluent of 28800 KLD will be treated through Effluent Treatment Plant. As committed by the project proponent, Zero Liquid Discharge shall be adopted”.
74. Further, the EC also specifically mentions that ,water source shall be tertiary treated water of Nagpur Municipal Corporation. Answering respondent has entered into an agreement with Nagpur Municipal Corporation for long-term supply of treated water.
75. Resultantly, the grounds regarding water pollution are without any substance.

Reply to ground (viii):

76. It is denied that alleged existing Plant's history of non-compliance with ash handling norms the EC fails to impose



1089

stringent conditions for ash management in the proposed new units. It is denied that any alleged oversight violates the Fly Ash Notification, 1999 (as amended) and/or the directions issued by this Hon'ble Tribunal in Shantanu Sharma v. Union of India, OA No. 117/2014. It is denied that the lack of proper ash management conditions in the EC raises serious environmental and/or public health concerns especially given the scale of the expansion as alleged or otherwise.

77. Answering Respondent submits that a detailed action plan has been prepared by the answering Respondent dated 31.05.2025 for maximizing ash utilisation, copy whereof is annexed herewith and marked as Annexure-R-4/E. In line with this action plan of maximum ash utilisation for the existing units, the same shall be implemented even for proposed 2x660 MW units. Additional transportation of ash will be undertaken by Railway Wagons directly from ash silos by providing separate railway line from Kalamna Railway Station site of South Eastern Central Railway to Godhani Railway Station Site of Central Railway.



1090

78. The construction of railway over bridge on the back side of Koradi Thermal Power Station is proposed under 2x660 MW project for transportation of ash and coal instead of existing transportation from the front side of the Koradi Thermal Power Station through Koradi, Mahadula and Nanda villages. It will considerably restrict the air pollution and chances of accidents will be negated by avoiding transportation through villages.

79. Moreover, the EC granted to the answering Respondent lays down a specific condition that” MOEF and CC Notifications on ash utilisation dated 31.12.2021 as amended from time to time shall be complied”. Even there is another condition to the effect that “Fly ash shall be collected in dry form and ash generated shall be used in phased manner as per provisions of the Notification on fly ash utilisation issued by the Ministry dated 31.12.2021, 30.12.2021 and 01.01.2024 and amended thereto”.

80. It is thus crystal clear that the ground regarding lack of proper ash management are wholly without substance.

Reply to ground (ix):



1091

81. It is denied that the EC fails to impose strict timelines for FGD installation in the new units in alleged violation of the MOEF & CC's notification dated 07.12.2015 or any other notification. It is denied that alleged failure to ensure timely implementation of pollution control technologies further compounds the environmental risk associated with the project.
82. The answering Respondent has already commenced the procedure for installation of FGD plant. Moreover, it has already installed FGD to 1x210 MW unit at Koradi Thermal Power Station.
83. In any event, the EC granted to answering Respondent itself includes the condition of installation of FGD to existing 3x660 MW units and the conditions states that, "Project Proponent shall install and commission the FGD for the existing 3x660 MW and 1x210 MW on (or) before 31st December, 2026 and report in this regard shall be submitted to RO, MOEF and CC".
84. Thereafter, the Respondent No. 2 held its meeting on 30.10.2024 to discuss on extension of time lines for complying with SO₂ norms, considering the challenges involved in



1092

installation of FGD system. In the said meeting, the Respondent No. 2 proposed to extend the time line for further three years. Accordingly, the Respondent No. 1 has issued a Notification dated 30.12.2024, wherein the time line for installation of FGD for Thermal Power Plants is extended for three years, i.e. up to 31.12.2027 for Koradi Thermal Power Station. Copy of Notification dated 30.12.2024 issued by Respondent No. 1 is annexed herewith and marked as Annexure-R-4/F.

85. In addition, the EC granted to answering Respondent includes condition for installation of FGD to proposed 2x660 MW Koradi Project, which condition reads that, "FGD system shall be installed based on lime/ammonia dosing to capture sulphur in the flu gasses to meet the SO₂ emission standard as per GSR dated 31.03.2021 read with GSR dated 05.09.2022 and amended from time to time".

86. In such circumstances, the grounds raised by Appellants regarding alleged failure to ensure timely implementation of pollution control technologies are untenable in the eyes of law.

Reply to ground (x):



1093

87. It is denied that the EC process did not explore alternative energy sources and/or project locations in violation of Section 20 of the National Green Tribunal Act, 2010 or any other provisions of law. It is denied that there is any breach of the sustainable development principle, as alleged or otherwise.
88. The answering Respondent is well aware of green power scenario of power generation from non-conventional energy sources and it has clear vision for providing green power to the consumers of Maharashtra. Accordingly, to fulfil renewable power obligation of Power Distribution Companies in Maharashtra, the answering Respondent has commissioned 428.16 MW Solar Power Project till date.
89. The answering Respondent is committed to expand the power generation capacity to meet the ever growing power supply need of Maharashtra. As a matter of fact, the answering Respondent submits that it is an eco-friendly Power Generating Company and has received certification under ISO:14001 and ISO:18001.
90. The answering Respondent's mission is to diversify the energy portfolio to include solar, wind and hydro power pump storage



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units. Bio-mass pellets are also being considered to co-fire with coal in Thermal Power Plants.

91. However, Solar Power is not available during night hours and in cloudy and rainy weather conditions, which creates a sudden drop in power generation. In such a situation, to maintain grid stability and reliability, it is essential to adopt thermal as well as gas Power Plants to cater the minimum based power load. Looking to the power demand throughout the length and breadth of Maharashtra, it is extremely essential that the proposed 2x660 units at Koradi are commissioned as replacement units after dismantling of the old units.

92. Hence, the grounds regarding alleged non-adequacy of alternative energy sources are untenable.

Reply to ground (xi):

93. It is denied that granting the EC despite the alleged project proponent's history of non-compliance and/or the existence of pending legal issues, the MOEF & CC has violated the precautionary principle and/or a fundamental tenet of



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environmental law. It is denied that the precautionary principle requires that in cases of scientific uncertainty or potential environmental harm, precautionary measures must be taken to prevent irreversible damage. It is denied that the EC's approval in this case demonstrates alleged disregard for this principle and that warrants its revocation, as alleged or otherwise.

Reply to ground (xii):

94. It is denied that there is any violation of the provisions under the Environment Impact Assessment (EIA) Notification, 2006, which mandates that no activity related to the construction or establishment of a project can commence before receiving an EC. Answering respondent submits that there were no activities related construction carried out prior obtaining EC or consent to Establish. The tender process is complex and time consuming. Only because the tender process was initiated, it does not violate any of the provisions, as alleged or otherwise.

Reply to ground (xiii):



1096

95. It is denied that premature tendering process raises serious concerns regarding the project's legality and/or undermines the purpose of environmental assessment, which is to ensure that all environmental concerns are addressed prior to any decision-making related to financial investment or construction. The Respondents have not committed any procedural violation that renders the entire clearance process void, as alleged and it is further denied that it defeats the objective of the precautionary principle enshrined in environmental law.

96. The answering Respondent submits that all the environmental concerns are being ensured for incorporation in the tender and will be ensured for implementation during construction without fail. The tender process is complex and time consuming. Only because the tender process was initiated, it does not violate any of the provisions, as alleged or otherwise. However, the answering Respondent submits that no contract was awarded before the grant of EC.

Reply to ground (xiv) & (xv):



97. It is denied that the cumulative environmental impact of the existing coal mines in proximity to the proposed project has not been adequately assessed in the Environmental Impact Assessment (EIA) Report.
98. The answering Respondent submits that the Environmental Impact Assessment (EIA) for the proposed 1,320 MW expansion project has been conducted in accordance with the Terms of Reference (ToR) prescribed by the Expert Appraisal Committee (EAC) of MoEF&CC, which specifically requires consideration of the regional environmental setting, including other industrial and mining activities in the study area.
99. Dispersion modelling for air quality prediction was undertaken by incorporating existing background concentrations along with the projected incremental emissions from the proposed expansion. This scientific approach allows for a realistic understanding of cumulative impacts, rather than a simple aggregation of individual activities

Reply to ground (xvi):



1098

100. It is denied that the project area is experiencing depletion of groundwater resources and/or contamination due to both industrial activity and/or over-extraction. It is denied that according to the Geological Survey of India (GSI) report or otherwise, the groundwater table in the region has been depleted and/or the water quality is compromised making it unsuitable for domestic or/or agricultural use.

101. As a matter of fact, the answering Respondent submits that it did not extract ground water for existing units. The answering Respondent further submits that it will never extract ground water even for the proposed units at Koradi Thermal Power Station. The water requirement for the proposed units shall be fulfilled by treating the sewage water of Nagpur Municipal Corporation.

102. The fresh water required from the balancing reservoir, i.e. pond No. 3, is only for drinking purpose. The said pond No. 3 is fed by water from Pench and filled up between RL 290.5 to RL 291.5 M. This water is available in pond No. 3 throughout the year and recharges the ground water of the nearby villages in the vicinity of Koradi Thermal Power Station. Hence, ground water



table is always maintained by the answering Respondent and there is no question of depletion due to the proposed project.

Reply to ground (xvii):

103. It is denied that the proposed project, for any reasons as alleged will exacerbate the water crisis in the area. It is denied that the EAC's recommendation failed to address the current state of groundwater and/or its capacity to sustain additional industrial demand. It is denied that any oversight is there and that it goes against the principles of intergenerational equity and/or violates the right of the local population to safe and/or sufficient water.

104. The answering Respondent submits that the source of water for the proposed project will be tertiary treated water from Nagpur Municipal Corporation. Fresh water from the Pench Dam will be only be utilised for domestic purpose. As such, in fact, there will be saving of fresh water and there is no question of any exacerbation of the fresh water crisis in the area due to the proposed project, as alleged or otherwise.

Reply to ground (xviii):



1100 :

105. The answering Respondent is stringently taking continuous efforts to maintain the pollution limits by maintaining ESP, dust suppression and evacuation system, precautions for coal/ash transportation by trucks, water sprinklers and spraying systems etc. In fact, the answering Respondent maintains transparency by sharing online air quality and emission data of existing plant continuously with the Respondent No. 3 and even the Central Pollution Control Board for Monitoring. Had the Appellants taken efforts to gather such data from MPCP or CPCB, they would have been duly satisfied with the fact that there is no question of pollution as alleged and they would not have even filed the present Appeal.

106. The answering Respondent submits that there are many causes for air pollution such as rapid urbanisation and vehicular traffic. Resultantly, the grounds related to pollution fail to satisfy the test of reasonable grounds to be worth consideration by this Hon'ble Tribunal.

Reply to ground (xxxv):



1101

107. It is denied that only the modernization of Units No. 6 of Koradi TPS has commenced, as alleged. It is denied that any alleged lack of progress raises questions about the real intent behind the current expansion proposal at Koradi and that whether it is a genuine expansion or effectively a new project under the guise of modernization.

Reply to ground (xxxvi):

108. It is denied that the project is misrepresented as an expansion. It is denied that closing several units across Maharashtra and that establishing new units at Koradi makes this a new project rather than a modernization or expansion and/or in violation of the procedures laid down for environmental approvals.

Reply to ground (xxxvii):

109. It is denied that the proposed project is located in close proximity to several educational institutions, including schools and colleges, which are situated merely 2-3 kilometres from the project site. It is denied that there is any risk to the health and/or well-being of students, faculty, and residents in these areas,



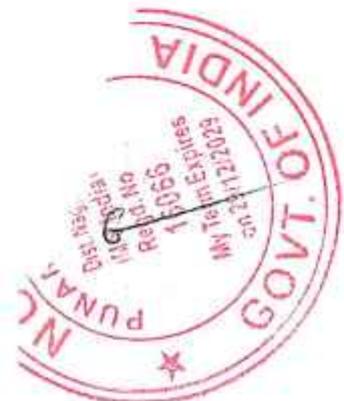
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particularly given the potential air and water pollution associated with Thermal Power Plants. It is denied that the alleged establishment of a large-scale Thermal Power Project alleged close proximity to alleged densely populated residential and/or educational zones contradicts principles of environmental sustainability and/or public safety. Predictive air quality modelling undertaken as part of the EIA indicates that, even under worst-case operational scenarios, the ground-level concentrations of pollutants such as PM₁₀, PM_{2.5}, SO₂, and NO_x will remain well within the National Ambient Air Quality Standards (NAAQS).

110. Regarding Public Health Safeguards:

Advanced pollution control technologies are being adopted, including:

- a) Flue Gas Desulphurization (FGD) for SO₂ control,
- b) High-efficiency Electrostatic Precipitators (ESPs) with >99.9% efficiency for particulate matter removal,
- c) Low-NO_x burners to limit NO_x formation,
- d) 100% ash utilization strategy to prevent fugitive dust emissions, and



1103

e) Zero Liquid Discharge (ZLD) system to ensure no wastewater is released outside the plant premises.

These measures ensure that there is no adverse impact on ambient air or water quality that could affect nearby institutions or residents.

111. **Regarding Greenbelt Development:**

Greenbelt will serve as a natural buffer for dust and noise attenuation, further reducing any potential environmental impact on surrounding communities

Reply to ground (xxxviii):

112. It is denied that the proximity of the project to these sensitive receptors increases the potential for adverse environmental impacts as alleged in this para. Each and every point adverse to the answering Respondent is denied in toto.

113. **Mitigation measures that will be implemented in proposed project are as follows: -**

Air Quality Deterioration:



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- *Advanced pollution control technologies, including Flue Gas Desulphurization (FGD), high-efficiency ESPs (>99.9%), and low-NOx burners, will be employed to minimize emissions.*

Noise Pollution:

- *Major noise-generating equipment will be equipped with acoustic enclosures and silencers.*
- *Plant layout has been designed to ensure that noise levels at the boundary remain below CPCB-prescribed limits for industrial-residential interfaces.*
- *The greenbelt will also act as a noise attenuator, reducing the impact on surrounding educational institutions and residential colonies.*

Water Contamination and Depletion:

- *The project is designed on a Zero Liquid Discharge (ZLD) concept, ensuring that no untreated wastewater is discharged outside plant premises.*



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- *Treated wastewater from Nagpur Municipal Corporation will be utilized, thereby eliminating the need for fresh groundwater extraction and avoiding stress on local aquifers.*
- *Robust wastewater treatment and recycling systems (including cooling tower blowdown treatment, ash water recirculation, and effluent recycling) are being adopted.*

Reply to ground (xxxix):

114. It is denied that locating the project in alleged vulnerable zone and that without taking into account the presence of educational institutions and/or residential complexes is in alleged violation of the principles of environmental justice and/or the precautionary principle and/or the right to a clean and/or safe environment. It is denied that project's potential cause irreparable harm to the health and/or safety of children, students and/or local residents necessitates a thorough reconsideration of its environmental clearance.

Reply to ground (xl) & (xli):



1106

115. It is denied that the Environmental Clearance (EC) granted to the project incorrectly asserts that there are no national parks, wildlife sanctuaries, or protected forests within a 10 km radius, while the same EC acknowledges that the Gorewada International Zoo, housing endangered species, is located just 5.28 km from the project site. It is denied that alleged conflicting information demonstrates the inadequacy of the environmental impact assessment and/or neglects the importance of nearby ecological resources, which are critical for biodiversity conservation.

116. As per the provisions of the Wildlife (Protection) Act, 1972 and the MoEF&CC Notification, 2006, “eco-sensitive areas” requiring mandatory clearance disclosure include notified national parks, wildlife sanctuaries, biosphere reserves, and reserved/protected forests within 10 km of the project site.

117. The Gorewada International Zoo is not a notified national park, sanctuary, or protected forest under the said Act. Hence, the observation in the EC to the effect that there are no such areas within a 10 km radius is factually and legally correct.

Reply to ground (xlii):



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118. Environmental Impact Assessment (EIA) conducted for the proposed 1,320 MW expansion has duly considered water bodies, forested patches, and ecological corridors within the 10 km study area, and the allegation of non-consideration is not correct.

119. Assessment of Water Bodies:

- All major rivers (Kanhan, Kolar Nadi, Pili Nadi, Pench River)in the 10 km radius were identified and assessed during the baseline study.
- Water quality monitoring was carried out at representative locations to evaluate existing conditions, including the influence of surrounding anthropogenic activities.
- The project adopts a Zero Liquid Discharge (ZLD) system and will utilize treated sewage water from Nagpur Municipal Corporation, ensuring that no impact occurs on natural water bodies.

120. Forested Regions and Ecological Corridors:



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- The EIA included land use and land cover (LULC) mapping, which identified forest patches and scrublands in the region.
- Study area does not include any forest area. No National Park, Sanctuary, Elephant or Tiger Reserve is situated within 10 km radius area surveyed around the project site.
- Baseline ecological surveys (flora, fauna, and avifauna) were conducted in both core and buffer zones. No Schedule-I species were recorded within the plant site itself; however, their possible occurrence in the wider buffer area was considered.

Reply to ground (xliii):

121. Needs no reply.

Reply to ground (xliv):



122. It is denied that despite alleged efforts made by local residents and/or NGOs to highlight the alleged serious environmental and/or health concerns associated with the project, the Respondents have ignored these issues and proceeded to grant premature Environmental Clearance (EC). It is denied that the Respondents have failed to adequately consider the adverse impacts on both the health of the local population and the surrounding flora and fauna. It is denied that alleged concerns were reported in various newspaper articles and that the Respondents have not taken any meaningful steps to address them. It is denied that alleged disregard for public health and/or environmental protection raises questions about the transparency and/or legitimacy of the EC process.

Reply to ground (xlv):

123. It is denied that Respondents' indifference to public outcry, backed by credible media reports and/or evidence of the health hazards faced by the local communities, illustrates a failure to prioritize the welfare of the citizens and the environment. It is



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denied that alleged omission violates the precautionary principle, as alleged or otherwise.

Reply to ground (xlv):

124. It is denied that the petitioner enquired about the same, the petitioner was informed by a few others present at the meeting that a register was being circulated amongst locals by a representative of MAHAGENCO, and that such register never reached the petitioner. In this regard, the answering Respondent submits that it had no role to play in the public hearing organised by the Authorities.

REPLY TO OTHER UNDERTAKINGS:

125. It is denied that any cause of action arose to file the present Appeal. It is denied that the Applicant has not filed any other petition or proceedings either in this Hon'ble Court or in any other Court including Hon'ble Apex Court touching the subject matter of this Application, except the present Application.

REPLY TO LIMITATION/CAUSE OF ACTION



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126. It is denied that that the Appellants are aggrieved by the action of the MOEF who has arbitrarily issued the Environmental Clearance on 19.09.2024 which was published in the Hitavada" on 24.09.2024 by which the Appellants learnt about the Environmental Clearance, as alleged or otherwise. It is denied that any cause of action arose at any time. It is denied that Appeal is in within limitation.

REPLY TO PRAYER CLAUSE:

127. The Appellants are not entitled to seek any relief whatsoever in the present Appeal.

REPLY TO INTERIM PRAYER:

128. For all the above stated reasons, the Appellants are not entitled for grant of any interim relief.

129. The answering Respondent submits that the Appellants are not entitled for any reliefs whatsoever. The Thermal Power Stations being run by the answering Respondent are the lifeline throughout the State of Maharashtra. Taking into consideration the continuous and ever growing demand of power in the State, it is the need of

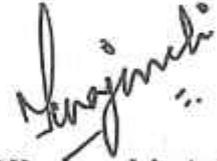


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the hour to expand the existing power plant with the state of art power plant. The answering Respondent submits that coal fired power plants are a must to meet the huge demand of power in the State and there is no other way to generate the power. No interference is called for in the Appellate jurisdiction of this Hon'ble Tribunal at the behest of Appellant, that too on the strength of imaginary allegations. The Appeal deserves to be dismissed with heavy compensatory costs, which may kindly be quantified and saddled upon the Appellants.

Pune

Date : 04/09/2025



(M.P. Khajanchi, Adv.)

Counsel for Respondent No. 4

SOLEMN AFFIRMATION

I, Narayan A. Rathod, aged about 49 years, Dy. Chief Engineer, Koradi Project Office, Maharashtra State Power Generation Co. Ltd., duly authorised by the Respondent No. 4 herein, do hereby take oath and state on solemn affirmation that the above reply has been drafted by the counsel as per the instructions issued on behalf of the office of



1113

the Respondent No. 4 and the contents made therein are true and correct to the information received from office records and believed by me to be true. The facts stated in the reply, which runs into paragraph Nos.1 to 129 are true to the office records and believed by me to be true, whereas legal submissions have been made as per the legal advice received and believed by me to be true.

Hence, solemnly affirmed and signed at Nagpur on this 4th day of September, 2025.

I know and identify the deponent

M.P. Khajanchi
Advocate
(M.P. Khajanchi)

Narayan A. Rathod
DEPONENT

Deputy Chief Engineer
3x660MW, Koradi Exn. Project,
MSPGCL, KORADI.

SWORN/SOLEMNLy AFFIRMED
BY Narayan A. Rathod

WHO IS PERSONALLY/KNOWN
TO ME /IDENTIFIED BY M.P. Khajanchi (Adv)
BEFORE ME THIS THE 04th
DAY OF Sept 2025 AT NAGPUR

Punam
PUNAM P. MOON
NOTARY
NAGPUR DIST. (M.S. INDIA)



भारत सरकार
परमाणु ऊर्जा विभाग
विकिरण एवं आइसोटोप प्रौद्योगिकी बोर्ड



Government of India
Department of Atomic Energy
Board of Radiation & Isotope Technology

प्रमाणपत्र ट्रैकिंग आईडी/Certificate Tracking ID : 2404556
जारी करने की तिथि/Date of Issue : 14-Dec-2024
प्रमाणपत्र क्रमांक/Certificate Sr.No.: ULR-TC1170324000004064F



Radioanalytical Laboratory

RADIOACTIVITY TEST CERTIFICATE

Ref : BRIT/RAL/DOM/1277-1292/MISC/1020-1035/24-25

To :
KORADI THERMAL POWER STATION
D/o CHIEF ENGINEER (O&M),
K.T.P.S., KORADI, NAGPUR, PIN-441111. MAHARASHTRA.

This is regarding the sample of "COAL & ASH" sent for radioactivity analysis vide your letter Ref. NO.: KTPS/660/CD/Env. Cell/OFFICE NOTE/FL/03878 dated 30.10.2024 which as per above letter is drawn from consignment with the following markings, as shown in italics:

SAMPLE DESCRIPTION : COAL & ASH
SOURCE OF SAMPLE : KORADI THERMAL POWER STATION, 3 X 660 MW, KORADI

DATE OF RECEIPT OF SAMPLE: 01.11.2024 **DATE OF COMPLETION OF TEST:** 07.11.2024

The samples were analysed for U-238, Ra-226, Th-232 and K-40 radioactivity content by HPGe gamma spectrometry and the values obtained are as follows:

| Sr. No | NAME OF THE PRODUCT | U-238 (Bq/Kg) | Ra-226 (Bq/Kg) | Th-232 (Bq/Kg) | K-40 (Bq/Kg) |
|--------|---------------------|---------------|----------------|----------------|--------------|
| 1 | COAL SAMPLE | 49.9 ± 3.7 | 22.8 ± 3.8 | 86.4 ± 5.5 | 131 ± 9.5 |
| 2 | FLY ASH | 106 ± 4.5 | 91.1 ± 9.0 | 156 ± 3.5 | 539 ± 26.4 |
| 3 | BOTTOM ASH | 115 ± 4.9 | 76.1 ± 9.4 | 193 ± 8.3 | 565 ± 30.8 |
| 4 | ASH BUND | 115 ± 3.9 | 118 ± 10.0 | 180 ± 6.4 | 470 ± 23.4 |

Opinion: 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 3 months 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:
GANPAT B NAKTI
Assistant

Authorized Signatory:
AJAY NANA THAMKE
OIC, RAL

***** End of Report *****

1/1

The authenticity of this certificate is verifiable. Please scan the QR code using a QR scanning application on any mobile devices. Upon redirection you must enter the necessary information in landing page <https://portal.britatom.gov.in>. We will then revert you back with a digital copy of the certificate in your verified e-mail ID. In accordance to IT Act 2000 (21 of 2000), this document is generated electronically through a validated s/w and need no physical/ digital signature(s).



विद्यार्थी/ बीएआरसी परिसर, सेक्टर २०, नवी मुंबई - ४०० ७०२ (महाराष्ट्र)
BRIT/ BARC Vashi Complex, Sector 20, Navi Mumbai - 400 703 (Maharashtra)

वेबसाइट, Website: www.britatom.gov.in; फ़ोन, 022 2788 7002/ 7006





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 - ce@mahagenco.in



CIN: U40100MH2005SGC153648

Ref No: CE (O&M)/KTPS/660MW/Env Cell./FL-01

NO 03507

Date: 7 DEC 2021

To,
 Joint Director
 Air Pollution Control
 2nd-4th floor, Kalpataru Point,
 Opp. PVR Cinema, New Sion Circle,
 Sion (E), Mumbai- 400022.

Sub.: Show Cause Notice for the violation of consent conditions granted under water (Prevention & Control of Pollution) act, 1974 & air (Prevention & Control of Pollution) act, 1981- compliance thereof

Ref.: Your Ltr. No. BO/JD(APC)/TB.2/SCN/B-0158 Dtd. 03.12.2021.

Dear Sir,

With reference to above subject, this office is in receipt of show cause notice vide letter cited under reference based on the visit of MPCB Board official on 26.10.2021 for checking of compliance of consent conditions. The point wise clarification and compliance to the show cause notice is submitted as below for your perusal.

Point No 1: Industry is failed to achieve consented emission standards in respect of particulate matter, NOx & SO2 emission.

Compliance: To achieve the consented emission standards at present ESP are provided with 99.94% collection efficiency to each unit of 660 MW. The particulate matter concentration at each ESP outlet is < 50 mg/NM3. Sometimes, due to operational changes particulate emission exceeds. The healthiness of ESP fields is being monitored regularly and replacement of plates/electrodes if any is carried out during AOH/COH of the units. Also, tangentially fired low NOx burners are installed for each unit to control the NOx emissions and are maintained within prescribed limits. However, sulphur di-oxide concentration is not meeting the norms of notification DT: 07/12/2015. For control of Sulphur di-oxide emissions, FGD is proposed and shall be installed as per directions issued under stipulated time. At present tenderization process is completed and work order will be placed shortly. Koradi TPS is regularly monitoring the source emissions from MoEF recognised laboratory.

Point No 2: The online meter reading, which are connected to MPCB/CPCB server for the unit 8&10 Dtd. 28.11.2021 shows average TPM emissions for the Unit No. 10- PM 91.1mg/Nm3, SO2-1508.5 mg/Nm3 & NOx-343.7 mg/Nm3. O&M of existing air pollution arrangements is not satisfactory, which needs urgent up-gradation.

Compliance: Online data for NOx emission for both units are well within limit. PM value for unit 10 is showing value on higher side as some of the ESP fields were under voltage. This office is planning for maintenance work of Unit 10 in next week, during which complete maintenance of ESP fields of Unit 10 will be taken up. However, as mentioned in Point No. 1 compliance, Koradi TPS units are provided with ESP with 99.94% collection efficiency. Sometimes, due to operational changes particulate emission exceeds. The healthiness of ESP fields is being monitored regularly and replacement of plates/electrodes, if any, is carried out during AOH/COH of the units. In addition to this Koradi TPS will also takes the work of stitching of electrode collecting plate which will increase the strength of plate and availability. Vent line modification will be taken up so that hopper evacuation will enhance. ESP door closing system is employed for proper sealing. To control the sulphur di-oxide emission installation of FGD is proposed.

Point No 3: Industry has failed to achieve 100% fly ash utilisation as per the consent conditions. It is reported that only 58% fly is utilised from April-21 to October-21.

Compliance: For 100% fly ash utilisation the action plan is as follows:

- Tie up with Birla Cement is in progress.

- Fly ash transportation by rail mode, tender for construction of ramp is in progress. Compliance to mandatory 100 % Fly Ash Utilization is enclosed as Annexure-I.

Point No 4: Industry has not provided adequate dry fly ash storage facility. Dry fly ash utilisation is very poor. For the year 2020-21, it was only 0.55%. For period April-2021 to October-2021, dry fly ash utilisation is only 2.8%.

Compliance: It is to mention here that total ash utilisation of Koradi TPS is increasing year by year. TPS is taking all out efforts for the same. To increase the dry fly ash utilization, as a promotional activity, regularly advertisement are published in various News-papers for 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 Koradi TPS, 3X660 MW. Koradi TPS has issued the sale orders. Details are as Annexure-I.

Koradi TPS has provided temporary arrangement at three intermediate silo each with storage capacity 1125MT for ash bulker loading. There is provision of three remote silo (Each with capacity 1125MT) for ash utilization & permanent arrangement for bulker loading. Total capacity of three remote silo would become 3375 MT. Erection work of one remote silo is completed & trial work is in progress. It will be handed over to O&M within a month as per project.

Point No 5: Industry has not submitted BG as per the consent conditions of Schedule-III,4. Industry has not provided HDPE/ LDPE lining at ash bund area.

Compliance: On account of slowdown in economy due to the pandemic, and as per Gol, Ministry of Finance, Department of Expenditure office Memorandum No. F.9/4/2020-PPd, dtd. 12.11.2020, Mahagenco HO has requested to grant the relief in Bank guarantee imposed vide Schedule-III against Consent To Operate condition issued vide Ltr. No. MAHAGENCO/CGM/E&S/MPCB/BG/158 dtd. 18.03.2021. As per Minutes of 5th Consent Appraisal Committee Meeting of 2021-2022 held on 03.08.2021, 17.08.2021 & 20.08.2021 conducted through video conferencing, MPCB has decided not to consider the request of Koradi TPS about relief in the amount of Bank Guarantee stipulated in the consent. Hence, Bank guarantees are processed there-after and shall be submitted within a month.

The ash bund is live, the work of HDPE/ LDPE lining cannot be taken up in hand, but all precautionary measures are taken to avoid breaching of bund. Three drain wells are maintained inside the bund and water is recovered through waste weir. The decanted water is being recycled and utilised again in plant. As a precautionary measure bund height is increased from 305.2 ML to 312.0 ML.

Point No 6: Adequate capacity dust extraction system not provided at Fly ash handling area.

Compliance: Bag filters are provided at fly ash handling system. To arrest the ash in ash handling plant following actions are taken:

- Ensure 100% availability of vent fans
- Monthly cleaning of ash filter bags
- Ensuring optimum efficiency of filter bags purging system through regular routine check.
- Quarterly replacement of filter bags in each intermediate silo.
- Attending fly ash conveying pipelines leakage on priority and replacement of wear out portion of pipelines.
- Regular water sprinkling on nearby roads is carried out periodically.

Point No 7: Industry has not completed ash bund overflow effluent recycling system, resulting of which industry is failed to recover ash bund effluent.

Compliance: Water from ash bund is again utilised for ash disposal through AWR pump house. For recycling of Ash Water Recovery three pumps with capacity of 500 m³/hr each are installed. Settling tank is provided from where bund effluent is pumped to TPS. Commissioning of 2 Nos. of recovery lines from Khasara AWR to



CIN: U40100MH2005SGC153648

1117
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
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Email - cejenkoradi@mahagenco.in



AHP of KTPS, 3X660 MW was proposed. Out of two lines, one line is commissioned and in service. However, second line will be commissioned by April-2022 by Koradi project.

Koradi TPS is already initiated measures as below:

- Utilisation of Tertiary treated water from Bhandewadi STP for secondary purpose like cooling thereby reducing the reservation of fresh raw water.
- The work of closed coal pipe conveyor from nearby mines is in progress to reduce fugitive dust emission during transportation of coal by road.
- Use of new technology such as HCSD for disposal of ash to conserve water.
- Proposal is initiated for AAQ monitoring by mobile van in surrounding villages and sensitive locations.
- To enhance the ash utilisation, rail transport, bulk consuming industries and brick cluster project are under way.

Koradi TPS is taking all out efforts to meet the norms as per Water (Prevention & Control of Pollution) act, 1974 & Air (Prevention & Control of Pollution) act, 1981 and Hazardous waste (Management, Handling & Transboundary movement) Rules, 2008. As Koradi TPS has already initiated aforesaid measures, it is requested not to forfeit Bank Guarantees. Koradi TPS, 3X660MW will remain adhere to consented conditions. As such it is requested to consider the compliance of Koradi TPS 3X660 MW sympathetically and shall not initiate any action against Koradi TPS, 3X660 MW.

Thanking You.

End.: As stated above.

Yours Faithfully,


Chief Engineer
Koradi TPS, 3X660 MW

Copy s.w.rs.to:

- 1) Executive Director (E&S), 4th floor, HDIL Tower, Bandra (E), Mumbai- 51.
- 2) Regional Officer, MPCB, Udyog Bhavan, 5th floor, Civil Lines, Nagpur- 440001.

Copy f.w.rs.to:

- 1) Sub Regional Officer-I, MPCB, Udyog Bhavan, 5th floor, Civil Lines, Nagpur- 440001.
- 2) Supdt. Chemist, Prakashgad, 3rd Floor, Bandra (East), Mumbai- 400051



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Annexure - 1

Action plan for Fly Ash Utilisation

Koradi Thermal 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), Dhariwal TPP(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, who are 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 is gradually improving as per details shown in table below:

Station Ash Utilization (210 MW and 660 MW)

| Sr.No | Year | Coal Consumed | Ash Generation | Total Ash Utilization | % 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 till Nov-21 | 4877126 | 1796745 | 1133461 | 63.08% * |

- Due to Corona Pandemic,
- In Monsoon season ash utilization reduces drastically,
Lot of efforts are being taken to achieve 100 % ash utilization target.

1) Dry Fly Ash Utilization :-

To increase the dry fly ash utilization, as a promotional activity, regularly advertisement are published in various Newspapers for 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.

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.

Total 18 nos. of sale order are issued under 80% quota for lifting of DFA from 2018 to till date.

Total 6 nos. of sale Order are issued under 20% Quota (SSI Units such as brick manufacturer) from 2018 to till date.

2) Pond Ash Utilization: -

a) Ash Dyke Raising:

Pond ash from Khasara ash bund is utilised for ash dyke raising started from November-2019 & to till continued. Till date 16, 63,128 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 sale order is issued at Free of Cost with site using charges.

c) Khasara Ash Pond:

For ash utilization from Khasara Ash Pond of 3 x 660 MW sale order is issued at Free of Cost with site using charges per day.

3) Remote Silo: -

At present, remote silo with separate approach road is under commissioning stage. This work is executed by Project Department and commissioning of 1st remote silo shall be completed by end of Nov-2021 and 2nd & 3rd silo by end of



Dec-2021. However, Koradi TPS has made temporary arrangement from HSCD silo no. 1 for disbursement of Dry fly ash to 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 under civil 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/FL-60/2586 dtd 10.09.2021 & KTPS/3X660 MW/ FAU/FL-60/605 dtd 27.02.2021) given to M/s Shree Cement Ltd.

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 dtd 29.07.2020. (b) M/s Dalmia cement works, Chandrapur vide letter



CIN : U40100MH2005GC153648

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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 maximize utilization 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 concern 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, Dhoiwasa OC, NaveenKunada OC. These mines are situated in Chandrapur district and are not near by Koradi 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 ash lifting vehicle for maximizing ash utilization.

Continuous efforts will be taken to achieve the target of dry fly ash utilization.



1123

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 Email - ceponkoradi@mahagenco.in



CIN: U40100MH2005SGC153648

Ref No: CE (O&M) / KTPS / 660MW / Env Cell /FL-01/

Date:-

NO 00329

1 FEB 2022

To,
 The Regional Officer
 Maharashtra Pollution Control Board
 5th floor, Udyog Bhavan,
 Civil Lines, Nagpur-440001

Sub. Prosecution Notice under section 15 of Environment (Protection) Act 1986- Reply thereof

- Ref.:**
- 1) Notice No. MPCB/PN/154/2022 Dtd. 27.01.2022
 - 2) T. O letter no. CE (O&M)/KTPS/660MW/Env Cell./FL-01/3178 Dtd. 11.11.2021
 - 3) T. O letter no. CE (O&M)/KTPS/660MW/Env Cell./FL-01/3501 Dtd. 07.12.2021
 - 4) T. O letter no. CE (O&M)/KTPS/660MW/Env Cell./FL-01/00150 Dtd. 13.01.2022

Dear Sir,

At the outset it is to inform that this office is in receipt of Prosecution notice cited under reference (1) received to this office on DT: 27/01/2022 and called upon for show cause to reply to the observations made by your office regarding noncompliance's of consent conditions, various complaints received by stakeholders and inferences from the personal Hearing conducted on DT: 08/12/2021.

In this context, this office would like to submit as below:

- 3 x 660 MW & 1 x 210 MW KTPS Koradi has been operating under consent to operate conditions issued by MPCB and as a mandatory part of compliance has provided adequate water and air pollution control arrangement so as to achieve prescribed standards. The details of which are elaborated in reply to the show cause mentioned under reference (3). Apparently this office had also informed about the steps taken for Environmental protection by replying to the directions vide reference (2).
- Subsequently this office had also replied to the minutes of personal hearing conducted at MPCB HQ Mumbai on DT: 08/12/2021 vide reference (4). The action plan to mitigate the impact caused due to operations of power plant was submitted along with time line. Photocopy of letter attached herewith for reference.
- Accordingly this office is implementing the action plan to execute the measures for environment improvement within designated time frame. To monitor the action plan and execute the works effectively, a task force has been formed inclusive of Sub regional officer-I MPCB Nagpur. The progress of the work will be communicated to your office in due course of time.
- **3 x 660 MW:** At present one ash water recovery line is commissioned whereas second line has also started recovery of effluent from last fortnight. Photographs attached herewith for reference. Also to have uniform distribution of water in ash bund, third ash water recovery line is diverted to Koradi ash bund from Khasara ash bund so that the outflow of water from Khasala ash bund can be optimized. TPS will install and commission three new pumps along with pipeline at Ash bund and will construct a new sump to increase storage capacity. Also one additional tank near TTWR for decantation of waste water from 3 x 660 MW premises is being constructed in-house for which excavation work has started and expected to be completed within Two months. As such 3 x 660 MW Koradi has already initiated the steps to implement the said action plan.

1 X 210 MW: Replacement and Re-routing of Ash water recovery lines for increasing ash water recovery are being done. At 210MW Koradi TPS one settling tank in reject coal yard is provided for settling of suspended solids from the influents. Thereafter, chemical treatment will be applied and clear water shall be reused

01 FEB 2022

राज्य मंत्रालय, नागपूर.

पर्यावरण विभाग, नागपूर.



1124

MAHARASHTRA STATE POWER GENERATION CO. LTD.
KORADI THERMAL POWER STATION



(ISO 9001:2008, ISO 14001:2004 & ISO 18001:2007)

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Email - ce@mahagenco.m

CIN: U40100MH2005SGC153648

Further, as a long term measure 210 MW Koradi TPS will install one additional tank and two stone filters on toe drain of Koradi Ash bund to restrict the flow of ash & coal particle outside plant premises and avoid water pollution.

- **3 x 660 MW:** ESP is provided with 99.94% collection efficiency to each unit of 660 MW with design particulate matter concentration at each ESP outlet is < 50 mg/NM3. Sometimes, due to partial load operation depending upon grid availability, particulate matter emission exceeds. However, the healthiness of ESP fields is being monitored regularly and replacement of plates/electrodes if any is carried out during AOH/COH of the units. Koradi TPS has also taken the maintenance work of ESP fields in hand and prepared the schedule for ESP field stitch welding of CE panels & their allied internal rectification works. The details of work and expected period of completion is as below.

| Unit No | ESP Pass | Expected completion date |
|---------|----------|--------------------------|
| 8 | A Pass | 01/05/2022 |
| | C Pass | 01/06/2022 |
| 9 | B Pass | 28/02/2022 |
| | D Pass | 01/03/2022 |
| | E Pass | 01/04/2022 |
| | F Pass | 01/07/2022 |
| 10 | A Pass | 25/02/2022 |
| | B Pass | 27/02/2022 |
| | C Pass | 29/06/2022 |
| | E Pass | 29/03/2022 |
| | F Pass | 29/07/2022 |

- However, 3 x 660 MW has initiated process to install Ammonia Flue gas conditioning system to control particulate emission till the installation of FGD system is completed. The installation of AFGC system shall be taken up for Unit-10 in month of Feb-2022 whereas for Unit-9 it shall be taken up in the month of June- 2022. Unit-8 shall undergo installation of FGD system in the Month of Nov-2022 during its AOH.
- At 3 x 660 MW Tangentially fired low NOx burners are installed for each unit to control the NOx emissions and are maintained within prescribed limits. However, sulphur di-oxide concentration is not meeting the norms of notification DT: 07/12/2015. For control of Sulphur di-oxide emissions, FGD is proposed and GoM has sought clarification and further concurrence from GoM is awaited. Eventually, Feasibility study will be carried out for supply of limestone quantity required and M/s Mercadus is deputed for said work.



1125

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Email: ce@genkoradi@mahagenco.in



CIN: U40100MH2005SGC153648

This Feasibility study shall also include aspects for Gypsum storage and transportation. Contract agreement for supply of limestone and storage/ transportation of Gypsum shall have to be done. As such time limit for installation of FGD shall require another 30 months. These are few constraints which shall be responsible in case of delay for installation of FGD.

- **1 X 210 MW:** For air emission control, 210 MW, Koradi Unit 6 has been installed with high capacity ESP with outlet concentration of less than 70 mg/Nm³. Installation of Ammonia Flue Gas Conditioning System at ESP inlet is in process to reduce the PM level. Wind box & burner assembly is provided for NOx control during R&M of Unit-6. The NOx level is within limit. Whereas, to control SO₂ emission installation of dry sorbent FGD system is proposed for Unit-6 of Koradi TPS. LoA will be place after MERC approval.
- Koradi TPS is regularly monitoring the Air emission and water discharges from MoEF & CC recognized laboratory and the environmental impact assessed is minimal. Regarding various complaints received from NGO, it is to state that such reports/ complaints may be biased as they do not consider other environmental aspects surrounding TPS responsible for Environmental degradation. Apparently, six vintage Units at Koradi have been decommissioned thereby decreasing the Environmental load in the form of Air emission & water discharges. Hence, any incremental values in ambient air and ground water parameters are not envisaged.
- Koradi TPS has also initiated the actions towards 100% ash utilization and use of legacy ash in ponds by means construction of railway siding Platform for rail mode transportation of Fly ash, follow up with various entrepreneurs for use of fly ash on bulk basis such as NHAI, MSRDC, M/s Birla Corporation Limited, M/s Reliance Cement Company Private Limited, and M/s. Dalmia Cements (Bharat) Ltd, EOI for Bulk fly ash transportation by railway, Bulk transportation of Fly ash through railway wagons and Establishment of ash based Industries like cement industries on fly ash cluster.
- As per the recent Minutes of Meeting vide no. MPCB/ JD (APC)/ TB/B-0695 Dtd. 24.01.2022 Hon. Chairman, MPCB directed MAHAGENCO & Coal India Company to immediately start using abandoned mines for back filling with legacy ash, MAHAGENCO shall follow with District Collector for identifying Stone quarries near to TPS. Mahagenco shall hold meeting with MOIL for utilisation of bund ash. Accordingly, Koradi TPS has communicated & keeping follow up of the matter with Hon. District Collector, Nagpur and MOIL. Photo copies of the letter are attached herewith for reference.
- Whereas your kind attention is drawn to the new notification of the MoEF & CC no: S.O 5481 (E) DT: 31/12/2021 wherein as per section A (5) the applicability of notification shall be from 01/04/2022 and as per section B (3), it shall be obligatory on all mines located within 300 kilometres radius of thermal power plant to undertake backfilling of ash in mine voids or mixing of ash with external overburden dumps under extended producer responsibility. The thermal power plant has to utilize 100 percent ash generated during that year, however in no case shall utilization fall below 80 percent in any year and the thermal power plant shall achieve average ash utilization of 100 percent in three year cycle. Considering this the TPS have a period of three years from April 2022 to achieve the utilization target.

Whereas, it is to inform that a case has been filed in NGT (Western Bench) regarding Environmental Non compliances against EC Conditions issued to Koradi TPS, 3X660 MW. As respondents in the case this office shall be submitting comprehensive submission for the steps taken for Environmental Protection and Pollution Control in front of Hon. NGT. As such our organisation are not knowingly or wilfully violating the provisions laid down in Water (P&CP) Act 1974 & Air (P&CP) Act 1982. This office also refutes the charges of being habitual defaulter as we have been consistently putting all out efforts for complying with the conditions granted under Consent to Operate & Environmental Clearance.

As, it is a known fact that the mitigation measures for Environment Protection proposed in the action plan submitted involves techno-commercial viability, the execution of proposed measures shall take substantial time for completion. The proposed Action plan with time frame has been communicated to your office on Dtd. 27.01.2022. However, photocopy of the same is enclosed herewith for your perusal. From the above facts mentioned thereto it is demonstrated that our organisation which a state Government undertaking has exercised all due diligence to prevent the commission of any offence. And the above mentioned things are done or intended to be done in good faith in pursuance of Acts & Rules made thereof.

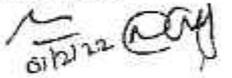
This is for your kind consideration and with request for not to file any criminal complaints against our organization in any court of law.

Thanking You.

Encl: as stated above

Yours Faithfully


Chief Engineer (O&M)
3x660MW, KTPS, Koradi


01/2/22

Copy s. w. r to --

- 1) Director (Operations) 2nd Floor Prakashgad Bandra (E) Mumbai-51
- 2) Joint Director (APC) MPCB, Kalpataru Point Sion (E) Mumbai-39
- 3) Executive Director (E&S), 4th floor, HDIL Tower, Bandra (E), Mumbai-51
- 4) Sub Regional Officer-I, MPCB, 5th Floor, Udyog Bhavan, Civil Lines, Nagpur-01.



1127
MAHARASHTRA STATE POWER GENERATION CO. LTD.
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Email - t.egenkoradi@mahagenco.in



CIN: U40100MH2005SGC153648

Ref: CE(O&M)/KTP5/660MW/Env.Cell/FL-01

NO 024241

Date: 20 JUL 2022

To,
Regional Officer
Maharashtra Pollution Control Board
5th Floor, Udyog Bhavan,
Civil Lines, Nagpur- 440001

Sub: Prosecution notice under section 15 of Environment (protection) Act 1986- Reply thereof

Ref: Your letter No. MPCB/PN/746/2022 Dtd. 18.07.2022

Dear Sir,

This has reference to the receipt of Prosecution Notice under reference (1) on Dtd. 19.07.2022 through mail and it is state that to reply suitably to the observations made by your office regarding incidence of Khasala ash bund bursting on date 16.07.2022, its implications and water pollution through ash bund. In this context this office would like to submit the compliance as below:

- Koradi TPS, 3X660 MW has been operating under the consent to operate issued by MPCB and complied to Water & Air (P&CP) acts and achieves the prescribed standards time to time. This office suitably replied to the Directions and Notices issued by Board timely.
- This office has prepared the action plan to comply with the statutory obligation and meeting the imposed norms and execute the action plan accordingly within designated time frame. For effective implementation Koradi TPS has prepared the Committee with nearby village Sarpanch and NGO representatives.
- As a part of Action part, in last few months Koradi TPS has completed the various works for arresting the effluent flow from plant activities and bund overflow. Koradi TPS has taken up the work of deepening of toe drain of Khasala ash bund and Nalha upto Khairi village. Also arrange for stone filters for arresting the suspended solids and diverted the flow of ash bund to plant for its recycling. Koradi TPS has exhaustively completed the tasks before monsoon to avoid undue incidences.
- The Khasala ash bund having total area of 314.00 Ha is used for ash deposition of 3X660MW units, KTPS, Koradi. The 2nd raising of Khasala ash bund from TBL 308.50 to 312.00 is in progress through O/o Chief Engineer, (CCC), Koradi Project, Koradi. The 2nd raising work has been completed in limb portion of H-I-J-K-L-A-B-C-D-weir area of ash bund. As such Koradi TPS has taken efforts before rainy season for avoiding breach of bund.
- There was a heavy rainfall during the last week in Koradi area which is about 316.8 mm from day 10.07.2022 to 15.07.2022. Due to sudden rise on 16th July-2022 Rain water level rises upto 1st raising of Khasala ash bund and overtopped. Due to overtopping of water, ash bund dyke wall eroded & cut was created @ 17 mtr. in ash dyke wall within very short span of time, through which bund water is released on dtd. 16.07.2022 @ 11:40 hrs.



1128
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CIN: U40100MH2005SGC153648

- Koradi TPS management along with maintenance staff immediately reached at site, the restoration work of ash dyke wall is started by deploying the two JCB, four poklanes, tractors, required manpower and required material same is restored and flowing water is arrested by 06.00 am on 17.07.2022. TPS management has taken immediate action to avoid further catastrophic situation due to accidental unfortunate incidence. Photographs after restoration work are enclosed.
- Apparently, Koradi TPS would like to draw your attention to the fact that Koradi TPS, 3X660 MW is using Khasala ash bund since its commissioning which was active bund and disposal is made through slurry lines. Prior getting Environment clearance, Mahagenco has submitted Environment Impact assessment for Proposed 3X660 MW Koradi Expansion project. Wherein it is mentioned that TPS is going to use existing Khasala ash bund for newly commissioned units. As per EIA Clause No. 5.7.2, Point No. 3 'Ash bund construction is as per the directives of the Central Design Division of Civil Engineering Department of Mahagenco, Mumbai. There is a provision for a stable embankment around ash bund area and also for raising dykes by a specified height to enhance storage capacity'. Also as per Clause 5.7.3 "Details regarding ash pond, impermeability etc" provision for raising the bund from RL 305.2 to 312 m in two stages is mentioned, hence no separate EC is required for the same as already been cleared while issuing EC based on EIA report submitted. Copies of same are enclosed.
- Accordingly, as a necessity arose due to operation of new three units of Koradi TPS, 3X660 MW, Khasala ash bund height was subsequently increased to accommodate the generated ash. Prior starting the work of ash bund raising approval from CDO Nashik for enhancing the capacity of bund has been taken.
- Whereas your kind attention is drawn that Mahagenco has issued the Environmental clearance on Dtd. 04.01.2010 and afterwards Amended EC has been issued as per applications made by Mahagenco in 2017 and 2018 for change in coal source and for work of pipe conveyor system.
- As an immediate measure TPS has arrested the bund flow by construction of dam wall. Work of lifting of ash from natural drains, bund toe drain, ash water recovery sump and spreaded ash from nearby area. As per request of nearby village Sarpanch demand and request, TPS has started the supply of drinking water through tankers. Koradi TPS has requested to Chief Engineer, (CCC), Koradi Project, Koradi to complete the balance work of bund raising immediately.

Koradi TPS is bound to follow provisions of Water (Prevention & Control of Pollution) Act, 1974 and the Air (Prevention & Control of Pollution) Act 1981 and Hazardous Waste (Management and Transboundary Movement) Rules, 2016. TPS has also made an Action plan for implementation and continuously mitigating the said Acts. Sometimes implementation of Action plans involves the techno-commercial viability and substantial time for implementation. TPS has taken immediate steps all the time for protection of environment and to avoid the cause of pollution on nearby villages.



1129
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: 262117 (Off)

Email - regenkoradi@mahagenco.in



CIN: U40100MH2005SGC153648

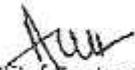
With the above facts mentioned, it is demonstrated that our organisation which is State Government utility has exercised all due diligence to prevent the commission of any offence. And the above mentioned things are done or intended to be done in good faith in pursuance of Acts & rules made thereof. It is requested to consider the reply and request to not file any criminal complaint against organisation in any court of law.

This is for information, please.

Thanking You.

Encl: As Above

Yours Faithfully


Chief Engineer

KTPS, 3X660MW, Koradi

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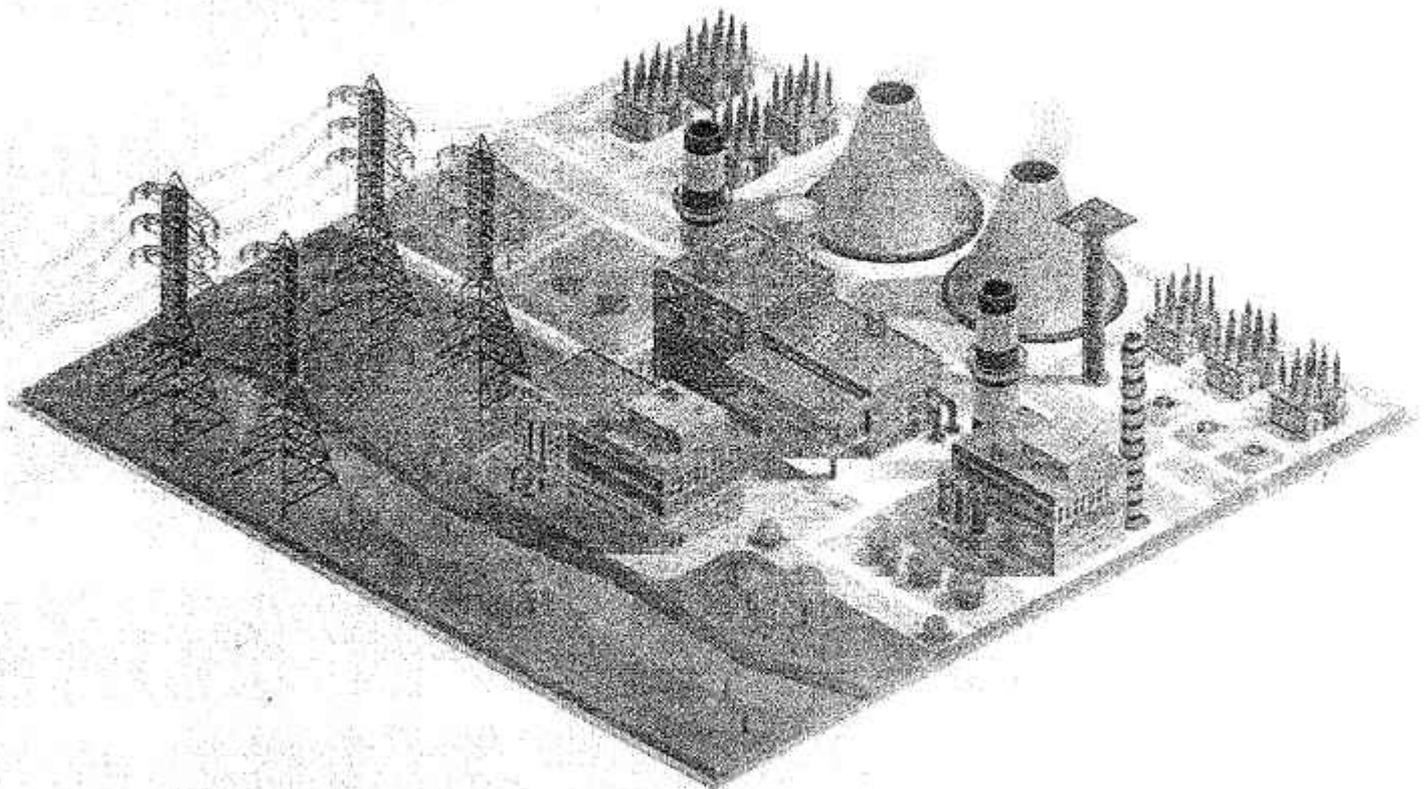
- 1) Director (Operations), MSPGCL, Prakashgadh, Bandra (E), Mumbai
- 2) Joint Director (APC), MPCB, Mumbai
- 3) Executive Director (E&S), 4th Floor, HDIL Tower, Bandra(E), Mumbai- 51
- 4) Law Officer-2, Policy & Law Division, MPC Board, Mumbai
- 5) Sub Regional Officer, MPCB, Udyog Bhavan, 5th Floor, Civil Lines, Nagpur-440001

Annexure R-4C

- 1130 -

3x660 MW Koradi (U. 2011)
MSPGCL, Koradi.

Carbon Footprint Study for Koradi Thermal Power Station Nagpur, Maharashtra



December 2022

By:



EMERGY

SINE IIT Bombay Company (EEPL)

CM-02, SINE, CSRE Building, 3rd Floor, IIT Bombay, Powai

Executive Summary

In recent decades, the earth's atmosphere has degraded at an unprecedented rate due to anthropogenic activities such as burning of fossil fuels for power generation which has resulted in severe impacts on the environment. Anthropogenic activities lead to climate change, which is a major environmental problem world is facing today. Climate change is primarily caused due to the emission of greenhouse gases (GHG), especially carbon dioxide (CO₂), methane (CH₄) and nitrous oxide (N₂O). Climate change leads to rise in temperature and sea levels, wildfires triggered by extreme heat and moisture loss, occurrence of severe storms, floods and droughts, loss of biodiversity, increased food scarcity and associated health risks.

The total global CO₂ emissions were estimated to be 46 Gt, out of which around 36 Gt (78 % of the total CO₂ emissions) was contributed only by the energy sector. Coal-based energy sectors contributes around 15 Gt (30 %) of total global GHG emissions. The GHG emissions are expressed in terms of CO₂e (carbon dioxide equivalent), which is also known as carbon footprint. In India, the coal-based power generation contributes nearly 1.1 Gt CO₂ emissions, which is about 50 per cent of the total fuel-related CO₂ emissions (Trivedi, 2020). The electricity generation is one of the key factors for any country to grow its socioeconomic system quickly and sustainably. However, the fossil fuel based thermal power plants are responsible for significant amount of CO₂ emission in the environment. India has also pledged to reduce its emissions intensity by 45% till 2030 (PIB, 2022) and ultimately achieve net-zero emissions by 2070.

In the present study, Maharashtra State Power Generation Company (MAHAGENCO) has engaged EMERGY Enviro Private Limited (A SINE IIT Bombay company) to assess the overall carbon footprint of the Koradi Thermal Power Station (Koradi TPS). This study will enable the industry to evaluate their total carbon footprint and total carbon emissions per MW of electricity generation, and to check the reduction potential of control measures that can be adopted to reduce their GHG emission.

Objective and Scope

The overall objective of the study is to quantify the carbon emissions from various activities to assess the total carbon footprint of the organization and to suggest mitigation measures to minimize carbon emission. The objective and scope of the study includes:

- Area wise identification of carbon emitting activities in 1 X 210 MW unit, and 3 X 660 MW unit of Koradi TPS
- Categorization of carbon emitting activities into direct (scope 1) and indirect (scope 2) emission sources
- Preparation of GHG emission inventory and quantification of carbon footprint of the industry
- Recommendations based on the study for reduction of carbon footprint of the plant

Greenhouse Gas Emission Inventory

In the present study, the greenhouse gas (GHG) emission inventory was prepared to theoretically quantify the total GHG emission from the Koradi TPS to assess its carbon footprint. The present assessment was carried out for the financial year (FY) 2021-22 i.e., April 2021 to March 2022. The emission inventory was prepared using emission factors developed by Intergovernmental Panel on

Climate Change (IPCC), United States Environment Protection Agency (USEPA) and other relevant literatures. The greenhouse gas (GHG) emission inventory was prepared only for the activities carried out inside the Koradi TPS compound boundary. The inventory does not include the GHG emissions from township, ash pond area.

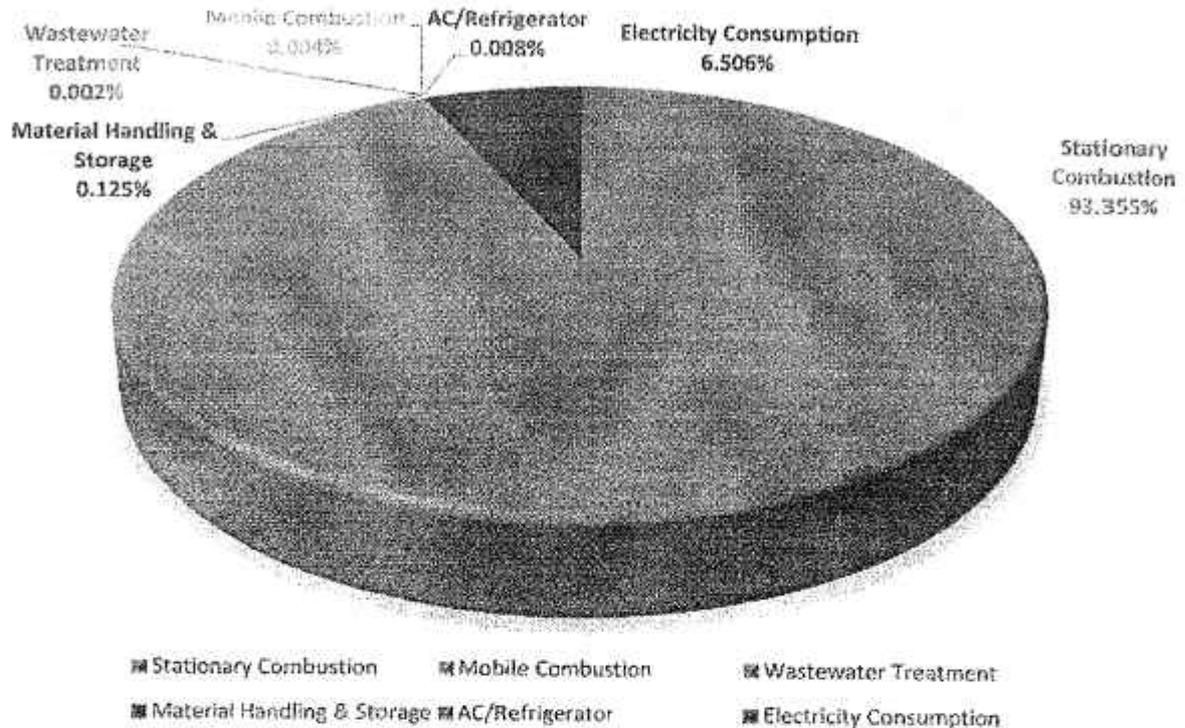
Total Greenhouse Gas Emissions of Koradi TPS

The total GHG emissions as well as direct & indirect emissions in terms of CO₂e from Koradi TPS are summarized in the below table.

| Sr. No. | Category | Source | CO ₂ e (MT/year) | | |
|-----------------------------------------------------------|-----------------------|-------------------------------|-----------------------------|-----------------|-------------|
| | | | 1 X 210 MW unit | 3 X 660 MW unit | Total |
| 1 | Direct (Scope 1) | Stationary Combustion | 908724.14 | 9650162.28 | 10558886.42 |
| 2 | | Mobile Combustion | 132.05 | 324.15 | 456.20 |
| 3 | | Wastewater Treatment | 0 | 175.36 | 175.36 |
| 4 | | Material Handling and Storage | 1242.34 | 12907.48 | 14149.83 |
| 5 | | AC/Refrigerator | 510.84 | 443.72 | 954.56 |
| Direct Emissions- Total CO ₂ e | | | 910609.38 | 9664012.99 | 10574622.36 |
| 6 | Indirect (Scope 2) | Electricity Consumption | 90891.87 | 645097.41 | 735989.28 |
| Indirect Emissions- Total CO ₂ e | | | 90891.87 | 645097.41 | 735989.28 |
| Total CO ₂ e from Koradi TPS in the FY 2021-22 | | | 1001501.25 | 10309110.40 | 11310611.64 |

It can be observed from the above table that for the FY 2021-22, the total GHG emissions in terms of CO₂e from Koradi TPS was 1,13,106,011.64 MT. Out of the total GHG emissions, contribution of 1 X 210 MW and 3 X 660 MW unit was 10,01,501.25 MT (8.85 %) and 1,03,09,110.40 MT (91.15 %), respectively.

To understand the % contribution of each source in total GHG emissions in terms of CO₂e, a graphical representation is shown in figure.



It can be observed from the figure that total GHG emissions in terms of CO₂e from Koradi TPS was 1,13,10,611.64 MT/year, out of which 93.355 % is contributed by stationary combustion source alone i.e., due to the fuel combustion in boiler. The second highest contribution in GHG emissions is due to auxiliary electricity consumption (6.506 %), while the remaining sources of Koradi TPS have significantly low contribution.

GHG Emission in Terms of CO₂e Per Unit of Electricity Generation

The greenhouse gas emission in terms of CO₂e per unit of electricity generation is given in below table for 1 X 210 MW unit and 3 X 660 MW unit.

| Unit | Electricity generation (MWh/year) | Total CO ₂ e (MT/year) | CO ₂ e/MW (MT/MWh) |
|-----------------------------|-----------------------------------|-----------------------------------|-------------------------------|
| 1 X 210 MW (Unit 6) | 838353.24 | 1001501.25 | 1.19 |
| 3 X 660 MW (Unit 8, 9 & 10) | 12552350.00 | 10309110.40 | 0.82 |
| Koradi TPS | 13390703.24 | 11310611.64 | 0.84 |

It can be observed from Table 2-32 that 1 MWh electricity generation emits 1.19 MT and 0.82 MT GHG emission in terms of CO₂e from 1 X 210 MW unit (sub-critical technology) and 3 X 660 MW unit (super-critical technology) respectively. Thus, it was found that the GHG emissions from 1 X 210 MW unit were 45.45 % higher than that from 3 X 660 MW unit.

Carbon Sequestration

The industry has planted a total of 5,93,927 number of trees in 3 X 660 MW unit, 1 X 210 MW unit and TPS township. There are a total 27 identified tree species in the study area, out of which the carbon sequestration potential per tree was found to be highest for trees belonging to species Ficus religiosa (Pimpal) followed by Eucalyptus globulus (Nilgiri), and Syzygium cumini (Jambhul). Furthermore, the

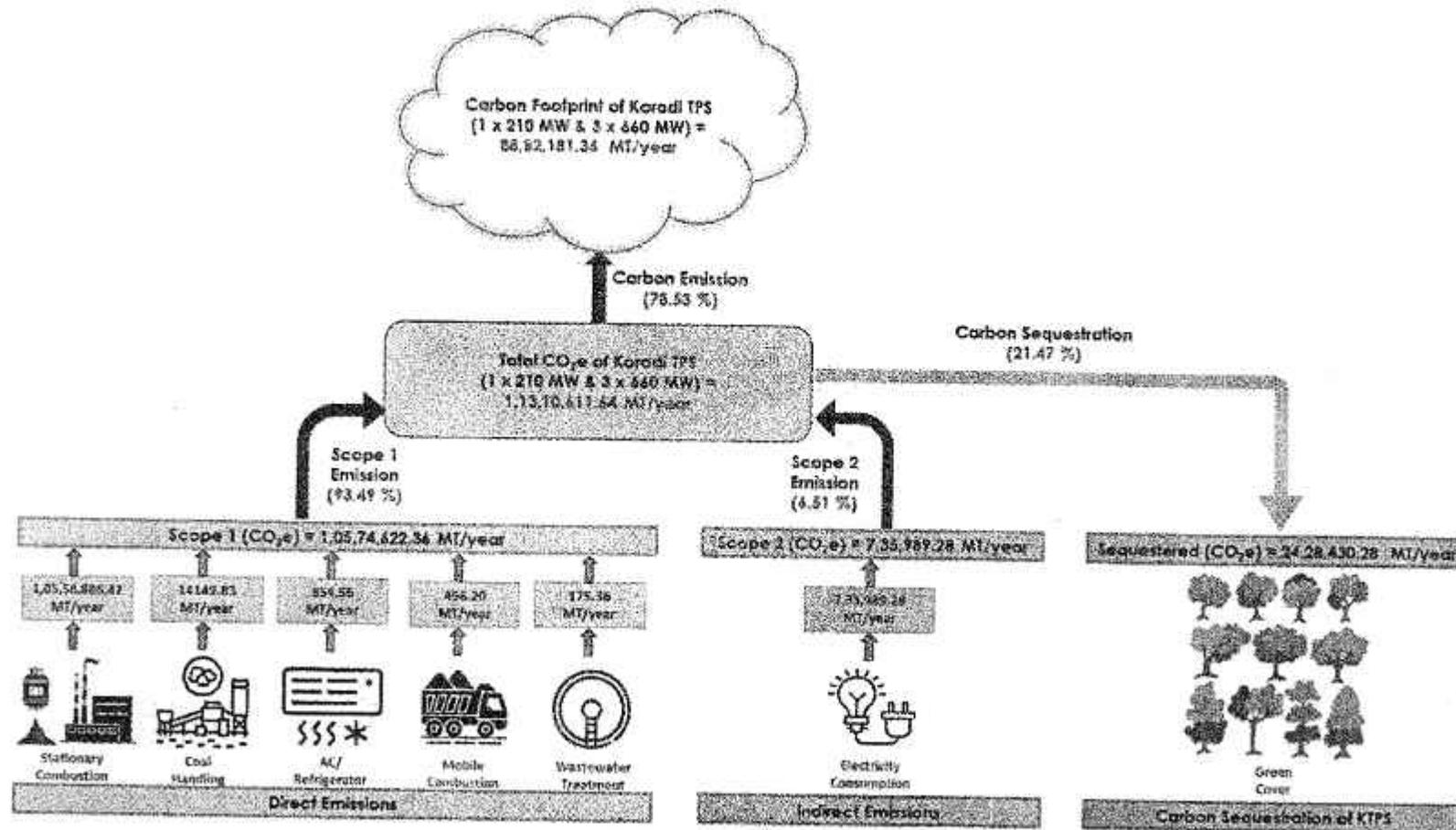
carbon sequestration potential of trees depends on their DBH, for instance, the trees belonging to specie *Ficus religiosa* planted in 3 X 660 MW unit (with 7.5 cm diameter) has a sequestration potential of 23.26 CO₂e/tree (kg/year), however same specie planted in 1 X 210 MW unit (with 150 cm diameter) has a sequestration potential of 28778.02 CO₂e/tree (kg/year).

Based on the assessment, it was observed that the trees planted in 1 X 210 MW unit and TPS township are older and thus have larger DBH, consequently having higher carbon sequestration potential, while as 3 X 660 MW unit is recently commissioned, the trees planted in 660 MW plant have smaller DBH and thus have low carbon sequestration potential.

The total carbon sequestration potential of the vegetation cover provided by Koradi TPS was found to be 24,28,578.96 MT CO₂e per year, which is around 21.47 % of the total GHG emissions (1,13,10,611.64 MT CO₂e per year) from Koradi TPS.

Total Carbon Footprint of Koradi TPS

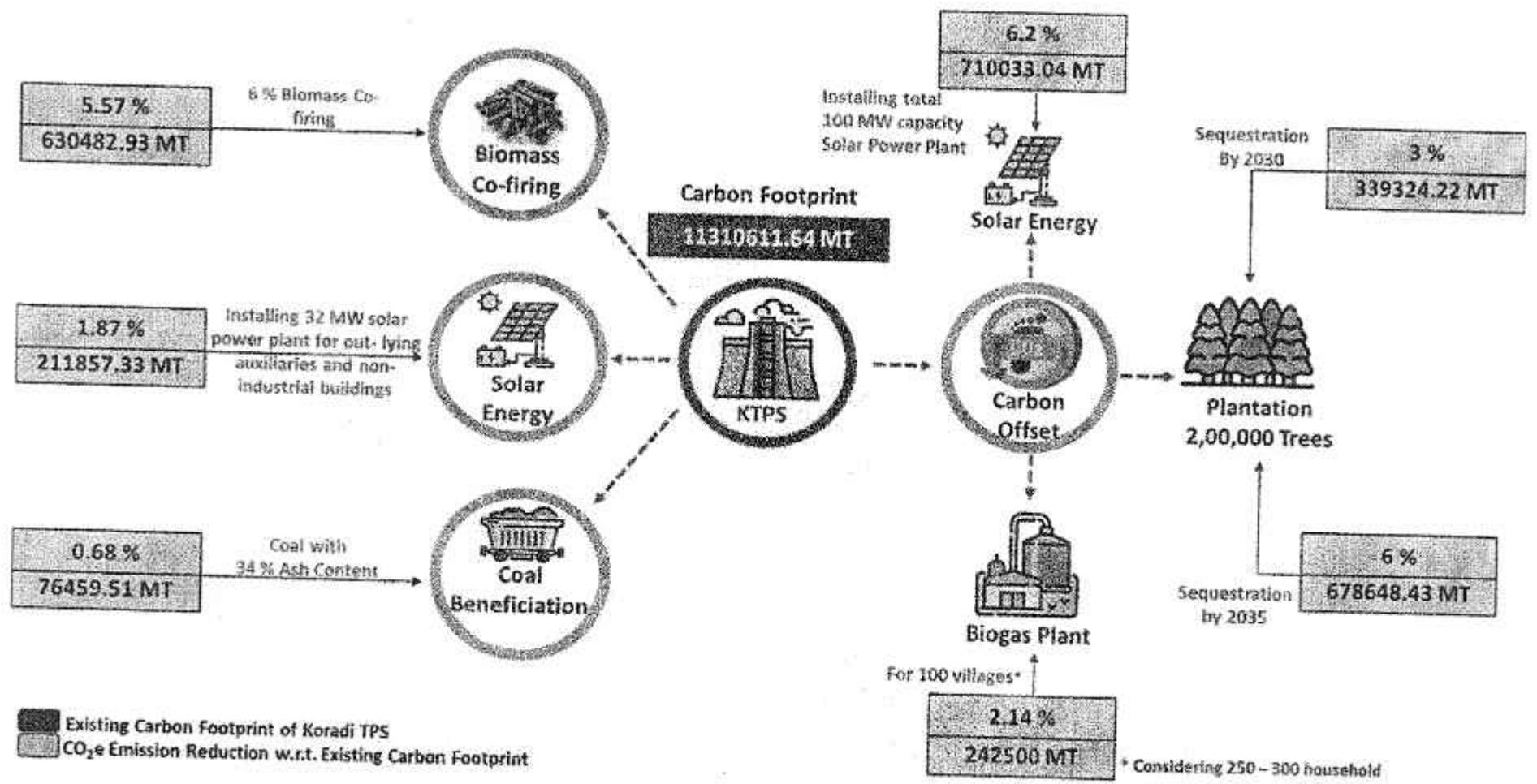
For the FY 2021-22, the total CO₂e emission from Koradi TPS was found to be 1,13,10,611.64 MT CO₂e per year, while the vegetation cover provided by the industry has a total carbon sequestration of 24,28,430.28 MT CO₂e per year. Thus, total carbon footprint of the Koradi TPS was found to be 88,82,181.36 CO₂e per year which is shown in below figure.

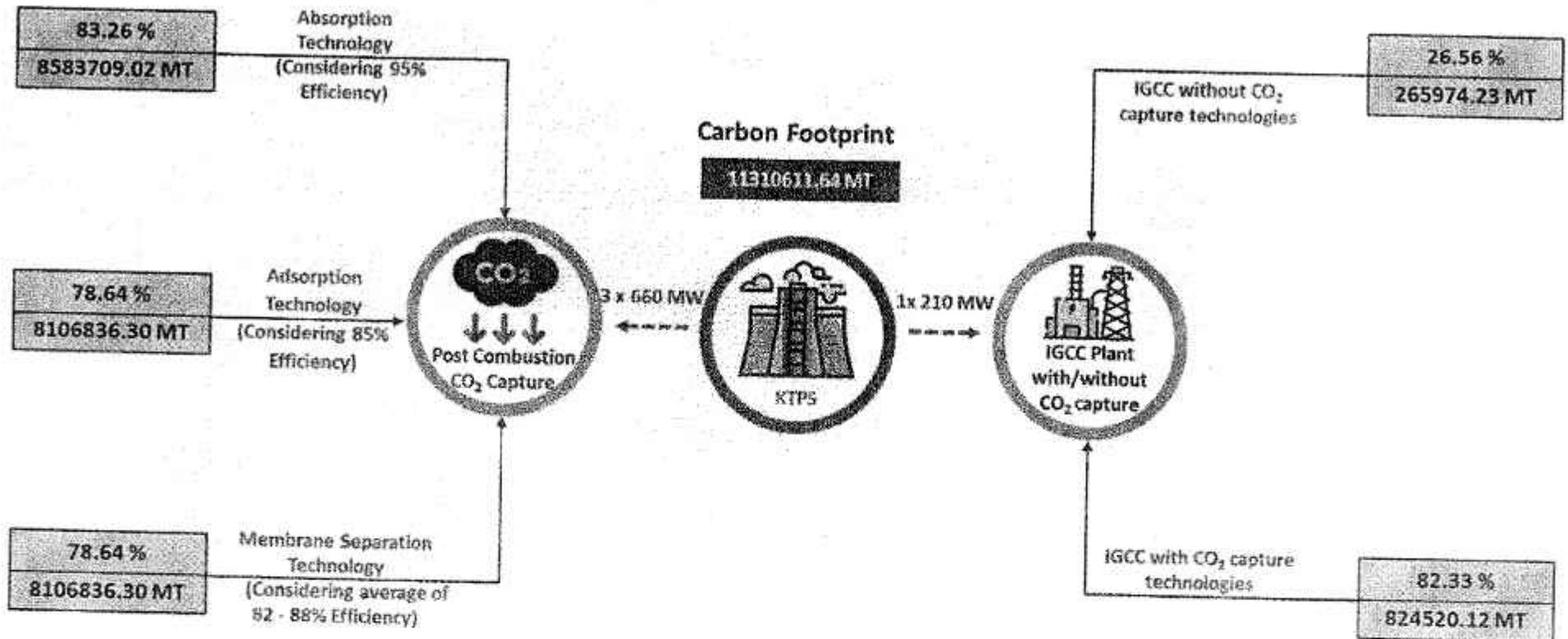


Control Scenarios to Reduce Carbon Footprint

In order to control the carbon emission from the TPS, four control scenarios are generated to reduce CO₂ emissions. The theoretical calculations were carried out to predict the percentage reduction in CO₂ emission if these control strategies are adopted. The percentage reduction in the carbon footprint of the Koradi TPS on implementing these control scenarios are summarised in below table.

| Control Scenarios | Existing and Proposed Practice | % Reduction in CO ₂ e | | |
|----------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|----------------------------------|------------|----------|
| | | 1 X 210 MW | 3 X 660 MW | Total |
| Control Scenario I- Biomass Co-firing | Considering 6 % biomass co-firing | -5.35 % | -5.60 % | -5.57 % |
| Control Scenario II- Solar Technology | Considering installation of 32 MW solar power plant for out-lying auxiliaries and non-industrial buildings | -2.80 % | -1.78 % | -1.87 % |
| Control Scenario III: Carbon Offsetting | | | | |
| <i>Case I- Solar Energy</i> | Considering Installation of 100 MW (1X100 MW or 4X 25 MW or 10X 10 MW) capacity solar power plant in phases | - | - | -6.2 % |
| <i>Case II- Biogas Technology</i> | Considering installation of biogas plants for 100 villages (assuming 250-300 households in each village) | - | - | -2.14 % |
| <i>Case III- Tree Plantation</i> | Considering plantation of 2,00,000 trees for next 4 year (planting 50,000 trees per year) | - | - | - |
| <i>Case III- A- Sequestration by 2030</i> | | - | - | -3 % |
| <i>Case III- B- Sequestration by 2035</i> | | - | - | -6 % |
| Control Scenario IV - Coal Beneficiation | Use of washed (beneficiated) coal with A % = 34 % | -4.06 % | -0.35 % | -0.68 % |
| Control Scenario V: Post Combustion CO₂ Capture | | | | |
| <i>Case I- Post combustion CO₂ capture using absorption technology</i> | Considering the CO ₂ capture efficiency of absorption technology to be 90 % | -79.67 % | -83.26 % | -82.95 % |
| <i>Case II- Post combustion CO₂ capture using adsorption technology</i> | Considering the CO ₂ capture efficiency of adsorption technology to be 85 % | -75.25 % | -78.64 % | -78.34 % |
| <i>Case III- Post combustion CO₂ capture using membrane separation technology</i> | Considering the CO ₂ capture efficiency of membrane technology to be 85 % | -75.25 % | -78.64 % | -78.34 % |
| Control Scenario VI: IGCC with and without Pre-Combustion CO₂ Capture | | | | |
| <i>Case I – IGCC without CO₂ capture technologies</i> | Considering up to 30% and 17 % CO ₂ emission reduction for subcritical unit and super-critical unit, respectively | -26.56 % | -15.73 % | -16.69 % |
| <i>Case II – IGCC with Pre-Combustion CO₂ Capture</i> | Considering the CO ₂ capture efficiency of absorption technology to be 90 % | -82.33 % | -84.84 % | -84.61 % |





- Existing Carbon Footprint of Koradi TPS
- CO₂e Emission Reduction w.r.t. Existing Carbon Footprint (3 x 660 MW)
- CO₂e Emission Reduction w.r.t. Existing Carbon Footprint (1 x 210 MW)

The industry is currently sequestering around 21.47% CO₂e due to their green cover. If the industry adopts Control Scenario I, II, III & IV, they can achieve around 45 % reduction in CO₂e emissions by 2035.

The Control Scenario I, II, III & IV are less capital intensive and can be implemented with immediate effect to reduce CO₂e emissions. However, to achieve near net zero carbon emission target from coal-based power plants, CCUS technologies need to be explored by the TPS.

In case of 1 X 210 MW unit, the highest % reduction of 82.33 % was observed for Control Scenario VI- Case II (IGCC with Pre-Combustion CO₂ Capture). As 1 X 210 MW unit is 40-year-old unit and near to its retirement. This necessitates its renovation and modernization. Thus, it is suggested that the industry should check the techno-economic feasibility of upgrading sub-critical to IGCC with installation of pre-combustion CO₂ capture technology, which will reduce CO₂e by 82.33 %. In addition, it will reduce the coal consumption by 30% (2,22,510 MT/year) as its combustion efficiency will be increased up to 50%.

In case of 3 X 660 MW unit, implementation of Control Scenario V (Post Combustion CO₂ Capture) is suggested for CO₂ capture. The industry should check the feasibility of adopting these post combustion CO₂ capture methods and adopt the most suitable methods. Although Control Scenario VI- Case II (IGCC with pre-combustion CO₂ capture) shows highest reduction, but implementing it might not be cost-effective, as 3 X 660 MW unit is already a supercritical technology-based unit.

Recommendations

Based on the present study, the total carbon footprint of the Koradi TPS was found to be 88,82,181.36 MT CO₂e/year for the FY 2021-22, after considering overall GHG emissions (11310611.64 MT CO₂e/year) and carbon sequestered by vegetation cover (24,28,430.28 MT CO₂e/year). Stationary combustion source (especially boilers) was found to be the maximum contributing source with 93.355 % emissions, while emissions due to auxiliary electricity was second highest contributor with 6.506 % emission. It was also found that the GHG emissions from 1 X 210 MW unit were 45.45 % higher than that from 3 X 660 MW unit. The industry needs to implement certain short term and long terms mitigation measures to gradually reduce their carbon footprint to become net zero. Some of these mitigation measures are discussed in this section.

Short Term Mitigation Measures

- *The industry shall implement biomass co-firing along with coal in boilers to reduce coal consumption and CO₂ emissions from the boilers. It is evident from the Control Scenario I (refer Section 5.1) that on adopting this measure, a reduction of 5.35 % and 5.6 % in CO₂e can be achieved from 1 X 210 MW and 3 X 660 MW units, respectively. Consequently, the total CO₂e from the Koradi TPS can be reduced by 630482.93 MT/year (5.57 % reduction). It was found that co-firing of 6% biomass can replace 504988.02 MT of coal per year which will lead to reduction of 630482.931 MT/year of CO₂e emission. This practice will also improve the energy efficiency of the industry. Biomass co-firing can be implemented using three methods viz. direct co-firing, indirect co-firing, and parallel co-firing. The industry should check the feasibility of adopting these methods and should adopt the most suitable method.*

- **The industry shall consider installation of total 32 MW capacity solar power plant to meet the energy requirement of out-lying auxiliaries and non-industrial buildings to reduce their indirect emissions.** The Koradi TPS can install the solar panels within the industry premises as per space availability. The industry can consider areas such as roof tops of non-industrial buildings, four-wheeler parking area, and open area near the cooling tower, etc. It is evident from the Control Scenario II (refer section 5.2) that if the industry adopts Control Scenario-III, a reduction of 2.80 % (28086.09 MT/year) and 1.78 % (183771.23 MT/year) in CO₂e emission from 1 X 210 MW and 3 X 660 MW units, respectively can be achieved. It was observed that **28.78% (268.17 MU/year) of total auxiliary electricity consumption has the potential to be replaced by solar energy.** Consequently, the total CO₂e emission from the Koradi TPS can be reduced by 211857.33 MT/year (1.87 % reduction).
- **The industry can reduce their carbon footprint by investing in carbon offsetting activities such as implementation of renewable energy (solar, biogas etc.) and planting trees to compensate for the GHG emissions from the industry.**
 - **The industry can take initiative to implement solar panels as a carbon offsetting activity in villages.** It was found that if industry implements Control Scenario III- Case I i.e., considering installation of 100 MW (1X100 MW or 4X25 MW or 10X10 MW) capacity solar power plant in phases, it can offset the CO₂e emissions from Koradi TPS by 710033.04MT/year (6.20 % reduction).
 - **The industry can take initiative to implement biogas plant as a carbon offsetting activity in any area or village.** It was found that if the industry implements Control Scenario III- Case II i.e., implementing biogas plant for 100 villages (considering each village has about 250 – 300 households), it can offset the CO₂e emissions from Koradi TPS by 242500.00 MT/year (2.14 % reduction).
 - **The industry can develop a green cover in barren/degraded land as a carbon offsetting activity in any area or village.** It was found that if the industry implements Control Scenario III- Case III i.e., planting 50,000 trees each year for next 4 consecutive years (considering plantation of trees belonging to species *namely Kadulimb, Wad, Pimpal, Aamba, Karanji, and Jambhul*), it can offset the CO₂e emissions from Koradi TPS by 339324.22 MT/year (3.00 % reduction) by year 2030, if plantation starts from this year and it can offset the CO₂e emissions by 678648.43 MT/year (6.00 % reduction) by year 2035.
- **The industry shall increase the quantity of beneficiated coal used in boilers such that the average ash content of the bunkered coal remains below 34% to reduce the CO₂ emissions from the boilers.** It is evident from the Control Scenario IV (refer Section 5.4) that on adopting this measure, a reduction of 4.06 % and 0.35 % in CO₂e from 1 X 210 MW and 3 X 660 MW units, respectively can be achieved. Consequently, the total CO₂e from the Koradi TPS can be reduced by 76459.51 MT/year (0.68 % reduction).
- **The industry shall increase their vegetation cover to enhance the carbon sequestration potential.** Based on the analysis of total carbon sequestration through the existing vegetation cover in the industry, it was observed that 21.47 % of total CO₂e emission could be sequestered from the Koradi TPS. It was observed that carbon sequestration potential of individual trees belonging to species *namely Ficus religiosa (Pimpal), Eucalyptus globulus*

(Nilgiri), Syzygium cumini (Jambhul), Ficus benghalensis (Wad), Chichwa, and Azadirachta indica (Kadulimb) was significantly high. Moreover, based on the present study and literature survey, there are other plant species such as Delonix regia (Gulmohar), Tamarindus indica (Chinch), Terminalia catappa (Badam), Albizia lebbeck (Shirish), Butea monosperma (Palas), Pongamia pinnata (Karanja), and Samanea saman (Gulabi Shirish), which have significant carbon sequestration potential. In addition, the industry shall consider plantation of species like Banana, Drumsticks, Nimboo, Papaya and Custard apple as these have high growth rate. **Hence, the plantation of these species would increase the CO₂ sequestration.**

- **The industry shall consider providing the electric buses for commute of employees from township to TPS.** The fossil fuel-based vehicles (petrol/diesel) release the greenhouse gases into the environment. As per the data given by industry, the two-wheeler and four-wheeler count of 3 X 660 MW unit was 219 and 915, respectively. Similarly, the two-wheeler and four-wheeler count of 1 X 210 MW unit was 48 and 446, respectively. Thus, instead of using these fossil fuel-based vehicles to commute from the township to the plant, if the industry provides electric vehicles that run on solar-based electricity, it can reduce the greenhouse gases emissions significantly (UNEP, 2022). If the Koradi TPS provide one electric bus with the seating capacity of 40 person to their employees for transportation, then a single electric bus can reduce the GHG emissions equivalent to 40 two-wheelers or 40 four-wheelers i.e., 1.25 MT/year or 5.36 MT/year, respectively from the Koradi TPS.
- To reduce scope 2 GHG emissions due to auxiliary electricity consumption from sewage treatment plants installed within the plant premises, **the industry shall modify and upgrade the existing conventional STPs to green STPs.** Based on a literature study it was found that CO₂e emissions from a conventional STP are 200 MT/year/MLD.

Long Term Mitigation Measures

- **The industry shall check the technical and financial feasibility to implement post combustion CO₂ capture technology for 3 X 660 MW unit using absorption, adsorption or membrane separation methods and accordingly shall adopt the most suitable method.** It is evident from the Control Scenario V that on adopting this measure, a reduction of 78.64 % to 83.26 % in CO₂e (depending on the separation technology) can be achieved from 3 X 660 MW unit. Implementing CCUS technologies is considered as a crucial measure in achieving near net-zero emissions from coal-based power plants. Furthermore, the industry also needs to check the feasibility of transporting the captured CO₂ to a suitable utilization facility.
- **The industry shall check the technical and financial feasibility to adopt IGCC and pre-combustion CO₂ capture technology in 1 X 210 MW unit to prevent CO₂ from getting released into atmosphere.** It is evident from the Control Scenario VI that on adopting this measure, a reduction of 82.33 % in CO₂e can be achieved from 1 X 210 MW unit. Implementation of IGCC system will also lead to reduction in coal consumption by 30% (2,22,510 MT/year) as its combustion efficiency will be increased up to 50%. Furthermore, the industry also needs to check the feasibility of transporting the captured CO₂ to a suitable utilization facility.

Table of Content

| | |
|-------------------------------------------------------------------------------------------|-----------|
| Executive Summary..... | i |
| Table of Content | xii |
| List of Tables | xiv |
| List of Figures | xvi |
| List of Abbreviations | xvii |
| List of Units | xix |
| 1 Introduction | 1 |
| 1.1 Company Overview..... | 1 |
| 1.2 Objective and Scope | 2 |
| 1.3 Study Area..... | 2 |
| 1.4 Methodology..... | 3 |
| 1.4.1 Pre-Site Visit Activities | 3 |
| 1.4.2 On-Site Activities..... | 3 |
| 1.4.3 Post Site Visit Activities..... | 4 |
| 2 Greenhouse Gas Emission Inventory | 5 |
| 2.1 Preparation of Greenhouse Gas Emission Inventory..... | 5 |
| 2.1.1 Identification and Categorization of Sources..... | 5 |
| 2.1.2 Greenhouse Gas Emission Factors and Global Warming Potential | 6 |
| 2.1.3 Data Collection..... | 7 |
| 2.2 Quantification of GHG Emissions..... | 7 |
| 2.2.1 Direct (Scope 1) Emissions..... | 7 |
| 2.2.2 Indirect (Scope 2) Emissions | 25 |
| 2.2.3 Total GHG Emissions of Koradi TPS..... | 29 |
| 2.2.4 GHG Emission in Terms of CO ₂ e Per Unit of Electricity Generation | 30 |
| 3 Carbon Sequestration | 31 |
| 3.1 Methodology..... | 31 |
| 3.2 Carbon Sequestration Potential..... | 31 |
| 4 Total Carbon Footprint of Koradi TPS | 34 |

| | | |
|-----|----------------------------------------------------------------------------------------|----|
| 5 | Control Scenario to Reduce Carbon Footprint..... | 36 |
| 5.1 | Control Scenario I: Biomass Co-firing..... | 36 |
| 5.2 | Control Scenario II: Solar Energy..... | 37 |
| 5.3 | Control Scenario III: Carbon Offsetting..... | 37 |
| 5.4 | Control Scenario IV: Coal Beneficiation..... | 39 |
| 5.5 | Control Scenario V: Post Combustion CO ₂ Capture..... | 40 |
| 5.6 | Control Scenario VI: IGCC with and without Pre-Combustion CO ₂ Capture..... | 41 |
| 5.7 | Summary of Control Scenarios..... | 42 |
| 6 | Conclusion..... | 48 |
| 7 | Recommendations..... | 52 |
| 7.1 | Short Term Mitigation Measures..... | 52 |
| 7.2 | Long Term Mitigation Measures..... | 54 |
| 8 | References..... | 55 |
| 9 | Annexure..... | 57 |

List of Tables

Table 2-1 Direct (scope 1) and indirect (scope 2) emission of Koradi TPS and their sources..... 6

Table 2-2 GHG emission sources and their references..... 6

Table 2-3 GHG and their global warming potential..... 7

Table 2-4 Stationary combustion units within the premises of Koradi TPS..... 7

Table 2-5 GHG emission factors for coal consumption in boilers..... 8

Table 2-6 GHG emission factor for furnace oil (FO) and light diesel oil (LDO) 8

Table 2-7 GHG emissions due to coal consumption in boiler attached to units 6, 8, 9 and 10..... 10

Table 2-8 GHG emissions in term of CO₂e due to coal consumption in boiler attached to units 6, 8, 9 and 10 11

Table 2-9 GHG emissions due to FO consumption in boiler attached to units 6, 8, 9 and 10 12

Table 2-10 GHG emissions in term of CO₂e due to FO consumption in boiler attached to units 6, 8, 9 and 10 13

Table 2-11 GHG emissions due to consumption of light diesel oil (LDO) in boiler attached to unit 6, 8, 9 and 10 14

Table 2-12 GHG emissions in terms of CO₂e due to consumption of light diesel oil in boiler attached to unit 6, 8, 9 and 10 15

Table 2-13 Total GHG emission in terms of CO₂e from boiler (unit 6, 8, 9 and 10) due to fuel consumption in FY 2021-22 16

Table 2-14 GHG emission in terms of CO₂e due to LDO consumption in DG sets, spare and booster pump unit in FY 2021-22..... 17

Table 2-15 GHG emission factor for LPG consumption 17

Table 2-16 GHG emissions in terms of CO₂e due to LPG consumption in canteens for FY 2021-22 17

Table 2-17 Overall GHG emissions in terms of CO₂e from all the stationary combustion sources of Koradi TPS 18

Table 2-18 Emission factors for mobile combustion 18

Table 2-19 CO₂ emissions due to the vehicular movement in 1 X 210 MW unit..... 19

Table 2-20 CO₂ emission or CO₂e due to the vehicular movement in 3 X 660 MW unit..... 19

Table 2-21 Overall GHG emissions in terms of CO₂e from mobile combustion source of Koradi TPS . 19

Table 2-22 GHG emissions and CO₂e from wastewater treatment units of Koradi TPS for FY 2021-22 22

Table 2-23 CH₄ emission factor for coal handling and storage 22

| | |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| Table 2-24 GHG emission and CO ₂ e due to coal handling and storage at Koradi TPS for the FY 2021-22 | 22 |
| Table 2-25 Refrigerant and their Global Warming Potential (GWP) | 23 |
| Table 2-26 Average refrigerant charge and annual leakage rate for AC/Refrigerator | 24 |
| Table 2-27 GHG emissions from AC/Refrigeration units of 1 X 210 MW unit | 24 |
| Table 2-28 GHG emissions from AC/Refrigeration units of 3 X 660 MW unit | 24 |
| Table 2-29 Emission factor for CO ₂ emission due to electricity consumption..... | 25 |
| Table 2-30 Indirect (Scope 2) GHG emissions for Koradi TPS in the FY 2021-22 | 27 |
| Table 2-31 Category wise total GHG emission in terms of CO ₂ e of Koradi TPS | 29 |
| Table 2-32 CO ₂ e per MWh of electricity generation..... | 30 |
| Table 3-1 Carbon sequestration potential of tree species planted in the study area in terms of CO ₂ e per tree (in kg/year) and overall CO ₂ e (MT/year)..... | 32 |
| Table 5-1 Control Scenario I and respective percentage reduction in emission of CO ₂ e | 36 |
| Table 5-2 Control Scenario II and respective percentage reduction in emissions of CO ₂ e | 37 |
| Table 5-3 Control Scenarios III and respective percentage reduction in emissions of CO ₂ e | 39 |
| Table 5-4 Control Scenario IV and respective percentage reduction in emission of CO ₂ e..... | 40 |
| Table 5-5 Control Scenario V and respective percentage reduction in emissions of CO ₂ e | 41 |
| Table 5-6 Control Scenarios VI and respective percentage reduction in emissions of CO ₂ e..... | 42 |
| Table 5-7 Control scenarios and respective percentage reduction in emission of CO ₂ e..... | 43 |

List of Figures

| | |
|-------------------------------------------------------------------------------------------------------------------------------------------------|----|
| Figure 1-1 Satellite view of study area at Koradi TPS (1 X 210 MW unit and 3 X 660 MW unit) | 3 |
| Figure 2-1 Percentage wise contribution of fuel for GHG emissions in terms of CO ₂ e from boiler attached to unit 6, 8, 9 & 10 | 16 |
| Figure 2-2 Overall CO ₂ e from mobile combustion source of Koradi TPS | 20 |
| Figure 2-3 Percentage wise bifurcation of indirect (scope 2) emission of Koradi TPS for the FY 2021-22 | 28 |
| Figure 2-4 Percentage contribution of different sources in total GHG emissions from Koradi TPS for FY 2021-22 | 29 |
| Figure 4-1 Overall carbon footprint of Koradi TPS | 35 |
| Figure 5-1 Short term control measures along with their respective percentage CO ₂ e reduction | 45 |
| Figure 5-2 Long term control measures along with their respective percentage CO ₂ e reduction | 46 |

List of Abbreviations

| | |
|-------------------|------------------------------------------------------------|
| AC | Air Conditioner |
| AGB | Above Ground Biomass |
| ALR | Annual Leakage Rate |
| AR | Assessment Report |
| BGB | Below Ground Biomass |
| CCUS | Carbon Capture, Utilization and Storage |
| CEA | Central Electricity Authority |
| CH ₄ | Methane |
| CHP | Coal Handling Plant |
| CNG | Compressed Natural Gas |
| CO | Carbon Monoxide |
| CO ₂ | Carbon Dioxide |
| CO ₂ e | Carbon Dioxide Equivalent |
| CSP | Carbon Sequestration Potential |
| CV | Calorific Value |
| DBH | Diameter at Breast Height |
| DG | Diesel Generator |
| EF | Emission Factor |
| EPA | Environmental Protection Agency |
| ETP | Effluent Treatment Plant |
| FO | Furnace Oil |
| FY | Financial Year |
| GHG | Greenhouse Gases |
| GWP | Global Warming Potential |
| H ₂ | Hydrogen |
| HDV | Heavy Duty Vehicle |
| HFC | Hydrofluorocarbon |
| IGCC | Integrated Coal Gasification Combined Cycle |
| IPCC | Intergovernmental Panel on Climate Change |
| KTPS | Koradi Thermal Power Station |
| LDO | Light Diesel Oil |
| LPG | Liquified Petroleum Gas |
| MAHAGENCO | Maharashtra State Power Generation Company |
| MBBR | Moving Bed Biofilm Reactor |
| MDV | Medium Duty Vehicle |
| MoP | Ministry of Power |
| MSETC | Maharashtra State Electricity Transmission Company Limited |
| N ₂ O | Nitrous Oxide |
| NA | Not Available |
| OE | Operational Emissions |
| PFC | Perfluorocarbon |

| | |
|--------|-------------------------------------------------------|
| STP | Sewage Treatment Plant |
| TB | Total Biomass |
| TERI | The Energy and Resources Institute |
| TOW | Total Organics in Wastewater |
| TPS | Thermal Power Station |
| UNFCCC | United Nations Framework Convention on Climate Change |
| US | United States |
| USEPA | United States Environmental Protection Agency |

List of Units

| | |
|----------------------------|----------------------------------------------|
| % | Percentage |
| °C | Degree Celsius |
| °F | Degree Fahrenheit |
| cm | Centimetre |
| g | Gram |
| GW | Gigawatt |
| kg | Kilogram |
| kg BOD/year | Kilogram Biochemical Oxygen Demand per Year |
| kg CH ₄ /year | Kilogram Methane per Year |
| kg N ₂ O/year | Kilogram Nitrous Oxide per Year |
| kg N ₂ O-N/kg N | Kilogram Nitrous Oxide per Kilogram Nitrogen |
| kg/gallon | Kilogram per Gallon |
| kWh | Kilowatt Hour |
| m | Meter |
| m ³ /tonne | Cubic Meter per Tonne |
| MLD | Million Litres per Day |
| mm | Millimetre |
| MMBtu | Metric Million British Thermal Unit |
| MT | Metric Tonne |
| MT/year | Metric Tonne per Year |
| MU | Megaunits |
| MW | Megawatt |
| t CO ₂ /MWh | Tonnes of Carbon Dioxide per Megawatt Hour |

1 Introduction

In recent decades, the earth's atmosphere has degraded at an unprecedented rate due to anthropogenic activities such as burning of fossil fuels for power generation which has resulted in severe impacts on the environment. Anthropogenic activities lead to climate change, which is a major environmental problem world is facing today. Climate change is primarily caused due to the emission of greenhouse gases (GHG), especially carbon dioxide (CO₂), methane (CH₄) and nitrous oxide (N₂O). Climate change leads to rise in temperature and sea levels, wildfires triggered by extreme heat and moisture loss, occurrence of severe storms, floods and droughts, loss of biodiversity, increased food scarcity and associated health risks.

The total global CO₂ emissions were estimated to be 46 Gt, out of which around 36 Gt (78 % of the total CO₂ emissions) was contributed only by the energy sector. Coal-based energy sectors contributes around 15 Gt (30 %) of total global GHG emissions (Trivedi, 2020). The GHG emissions are expressed in terms of CO₂e (carbon dioxide equivalent), which is also known as carbon footprint. The carbon footprint is defined as a quantitative measurement of GHG emissions caused directly or indirectly by individuals, organizations, processes, or products. Among the rising concerns of GHG emissions, various countries have taken initiatives to measure their carbon footprint to evaluate their contribution in climate change. India has also pledged to reduce its emissions intensity by 45% till 2030 (PIB, 2022) and ultimately achieve net-zero emissions by 2070.

In India, the coal-based power generation contributes nearly 1.1 Gt CO₂ emissions, which is about 50 per cent of the total fuel-related CO₂ emissions (Trivedi, 2020). The electricity generation is one of the key factors for any country to grow its socioeconomic system quickly and sustainably. However, the fossil fuel based thermal power plants are responsible for significant amount of CO₂ emission in the environment, which results in increased concentration of GHG in the atmosphere. Hence, due to pressing environmental and climate concerns, decarbonization of the coal-based power industry has become imperative.

In the present study, Maharashtra State Power Generation Company (MAHAGENCO) has engaged EMERGY Enviro Private Limited (A SINE IIT Bombay company) to assess the overall carbon footprint of the Koradi Thermal Power Station (Koradi TPS). This study focuses on both direct (Scope 1) and indirect (Scope 2) GHG emissions from the manufacturing units, transportation, coal handling activities and auxiliary electricity consumption within the boundary of Koradi TPS. It also includes estimation of the carbon sequestration potential of vegetation cover in the industry. This study will enable the industry to evaluate their total carbon footprint and total carbon emissions per MW of electricity generation, and to check the reduction potential of control measures that can be adopted to reduce their GHG emission.

1.1 Company Overview

The Maharashtra State Power Generation Company Limited (MAHAGENCO) has installed a coal-fired thermal power plant at Koradi, close to Nagpur city, Maharashtra. In 1974, first unit of 120 MW capacity was installed at Koradi thermal power station (TPS). Since its commissioning, Koradi TPS was expanded under different stages. The capacity of Koradi TPS was increased between 1975 and 1976 (under stage-I expansion) by installation of three additional units, each of 120 MW capacity. Later,

under stage II expansion, Unit 5 with a total capacity of 200 MW was installed. Furthermore between 1982 and 1983, under stage-III expansion, two units (Unit 6 and Unit 7) with a capacity of 210 MW each were erected and put into operation. At present out of all these units, only one subcritical unit (Unit-6) of 210 MW capacity is in operation.

Recently, three supercritical units (Unit 8, Unit 9, and Unit 10), each of 660 MW capacity were installed and commissioned between 2015 and 2017. At present total capacity of power generation of Koradi TPS is 2190 MW (i.e., 1 X 210 MW unit and 3 X 660 MW unit).

1.2 Objective and Scope

The overall objective of the study is to quantify the carbon emissions from various activities to assess the total carbon footprint of the organization and to suggest mitigation measures to minimize carbon emission. The objective and scope of the study includes:

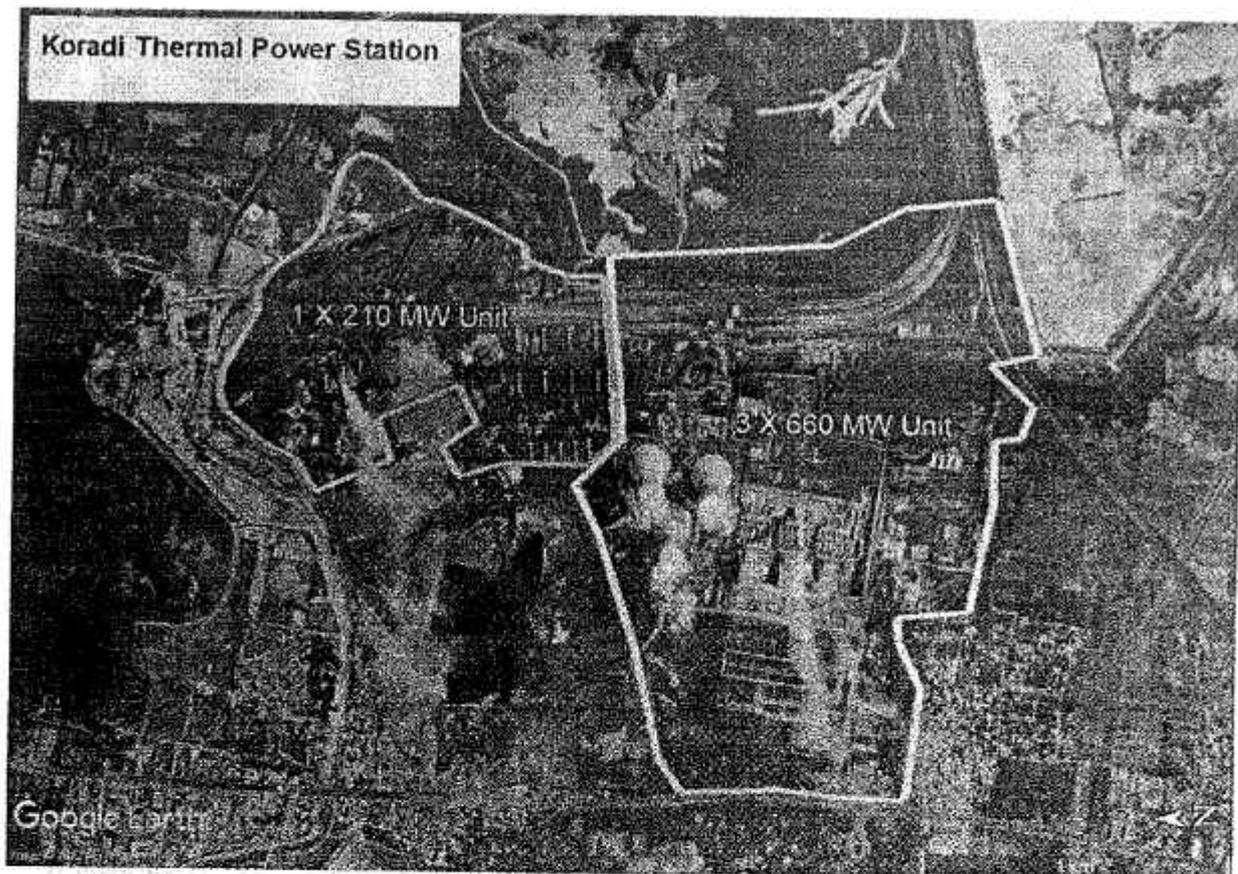
- Area wise identification of carbon emitting activities in 1 X 210 MW unit, and 3 X 660 MW unit of Koradi TPS
- Categorization of carbon emitting activities into direct (scope 1) and indirect (scope 2) emission sources
- Preparation of GHG emission inventory and quantification of carbon footprint of the industry
- Recommendations based on the study for reduction of carbon footprint of the plant.

1.3 Study Area

The Koradi TPS is situated at Koradi village, around 11 km from the Nagpur city, on National Highway No. 69. Koradi TPS consist of two electricity generation units, an old plant with electricity generation capacity of 1 X 210 MW and a new plant with generation capacity of 3 x 660 MW. The old and new plant are situated at 21°14'57" N & 79°5'53.80" E and 21°14'17.99" N & 79°5'40.74" E, respectively.

In the present study, the area within the plant compound boundary of both 1 X 210 MW and 3 x 660 MW units is considered as the study area for which total carbon footprint was estimated. It includes the units like coal handling plant, electricity generation unit, ash handling plant, water treatment section, service offices and canteens area, etc. The study area does not include the carbon emissions from TPS township, ash bund or ash pond area. The satellite view of the study area is depicted in Figure 1-1.

Figure 1-1 Satellite view of study area at Koradi TPS (1 X 210 MW unit and 3 X 660 MW unit)



1.4 Methodology

A predefined and well-planned methodology was adopted for the carbon footprint estimation of Koradi TPS. The methodology includes the following activities.

1.4.1 Pre-Site Visit Activities

A detailed questionnaire was shared with the industry to collect information/data to prepare the emission inventory for estimating theoretical emissions of greenhouse gases. The required information includes the data of fuel consumption in various activities, fuel analysis report, electricity generation, electricity consumption, transportation, wastewater treatment, material handling and storage, AC/Refrigerators, vegetation cover of the plant etc.

1.4.2 On-Site Activities

During the site visit, overall process of electricity generation was understood. All the manufacturing units were visited and the sources of greenhouse gases emission such as fuel consumption units, wastewater treatment units, material handling and storage units etc., were identified. The data requirement sheet (shared before the visit) was discussed during the site visit and remaining data was collected from the industry.

1.4.3 Post Site Visit Activities

After the site visit, a detailed analysis of the collected data/information was carried out. The collected data was processed using the standard procedures to estimate the carbon footprint from various sources such as stationary combustion, mobile combustion, wastewater treatment units, material handling and storage units, AC/refrigerants and due to electricity consumption for the operation of different units. The emission inventory was prepared using the standard emission factors. Carbon sequestration potential of vegetation cover, as per the data provided by the industry, was also carried out. Based on the outcomes of the study, certain recommendations were suggested to reduce the carbon footprint of the TPS.

2 Greenhouse Gas Emission Inventory

The emission inventory is a database that accounts for the total air pollutants discharged into the atmosphere from various sources in a defined area during a year or a period (US EPA, 2015). It also acts as a tool to identify the major contributing sources in the total emission load. Moreover, it is useful to define the future emission scenario, its possible prevention and predicting best possible control measures based on the contribution of different sources.

In the present study, the greenhouse gas (GHG) emission inventory was prepared to theoretically quantify the total GHG emission from the Koradi TPS to assess its carbon footprint. The present assessment was carried out for the financial year (FY) 2021-22 i.e., April 2021 to March 2022. The emission inventory was prepared using emission factors developed by Intergovernmental Panel on Climate Change (IPCC), United States Environment Protection Agency (USEPA) and other relevant literatures.

In the present study, the greenhouse gas (GHG) emission inventory was prepared only for the activities carried out inside the Koradi TPS compound boundary. The inventory does not include the GHG emissions from township, ash pond area.

2.1 Preparation of Greenhouse Gas Emission Inventory

The GHG emission inventory was prepared based on well-defined methodology as discussed below in detail in this section.

2.1.1 Identification and Categorization of Sources

The various sources of GHG emission were identified within the TPS that contributes to carbon emissions such as boilers, coal handling plant, vehicular movement, offices, and canteen area, etc. Furthermore, these sources were categorized in direct (scope 1) and indirect (scope 2) emissions as per the guidelines given by United States Environmental Protection Agency (EPA, 2022).

2.1.1.1 Direct (Scope 1) Emission

Direct emission are the emissions generated from the sources directly owned or controlled by the industry (EPA, 2022). Direct emissions are also called as scope 1 emission. It includes the emission due to fuel consumption activities and other associated activities which are responsible for direct GHG emissions in the environment like emissions from boilers, AC/refrigerator, or vehicle fleets. The scope 1 category includes five sources which are stationary combustion, mobile combustion, wastewater treatment, material handling & storage and AC/Refrigerator as per US EPA guidelines.

2.1.1.2 Indirect (Scope 2) Emission

Indirect emissions are those emissions which are generated due to auxiliary electricity consumption (EPA, 2022). Indirect emissions are also called scope 2 emissions. The Koradi TPS consumes the electricity provided by Maharashtra State Electricity Transmission Company Limited (MSETC) as per the information collected from the industry.

The scope 1 and scope 2 emission and their sources are shown in below Table 2-1.

Table 2-1 Direct (scope 1) and indirect (scope 2) emission of Koradi TPS and their sources

| Sr. No. | Emission Category | Source |
|---------|------------------------------|-----------------------------------|
| 1 | Direct (Scope 1) Emissions | Stationary Combustion |
| | | Mobile Combustion |
| | | Wastewater Treatment |
| | | Material Handling and Storage |
| | | AC/Refrigerator |
| 2 | Indirect (Scope 2) Emissions | Auxiliary Electricity Consumption |

2.1.2 Greenhouse Gas Emission Factors and Global Warming Potential

Emission factor is representative number which relates the quantity of pollutant emitted through the activity. It is generally expressed in terms of weight of pollutants per unit weight, volume, distance, or duration of the activity (US EPA, 2015). The emission factors for various sources are shown in Table 2-2.

Table 2-2 GHG emission sources and their references

| Sr. No. | GHG emission source | Reference for emission factor |
|---------|-------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | Stationary Combustion | US EPA: "Emission Factors for Greenhouse Gas Inventories, 2021" published by United States Environment Protection Agency (US EPA, 2021) |
| 2 | Mobile Combustion | "India Specific Road Transport Emission Factors, 2015" published by India GHG Program (Gajjar & Sheikh, 2015) |
| 3 | Wastewater Treatment | IPCC: 2019 "Refinement to the 2006 Guidelines for National Greenhouse Gas Inventories (Chapter 6: Wastewater Treatment and Discharge)" (IPCC, 2019) |
| 4 | Material Handling and Storage | IPCC: "Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories: Workbook" (IPCC, 1996) |
| 5 | AC/Refrigerator | IPCC: Climate "Change 2013: IPCC Fifth Assessment Report (AR5)" (IPCC, 2013) |
| 6 | Electricity Consumption | "Indian Electricity Generation Weighted Average Emission Factor for NEWNE Grid (North, East, West and North-East Grid)" (Central Electricity Authority, 2021) |

Furthermore, the different gases have different heat absorbing ability in the atmosphere with respect to the carbon dioxide (CO₂) and this heat trapping ability is known as Global Warming Potential (GWP). Thus, the total GHG emissions are presented in terms of carbon dioxide equivalent (CO₂e). The CO₂, CH₄ and N₂O are converted into CO₂e based on their global warming potential. As per IPCC fourth assessment, the GWP of carbon dioxide (CO₂), methane (CH₄) and nitrous oxide (N₂O) by considering time horizon of 100 years (US EPA, 2021) which is shown in below Table 2-3.

Table 2-3 GHG and their global warming potential

| Sr. No. | GHG | Global Warming Potential (GWP) |
|---------|------------------|--------------------------------|
| 1 | CO ₂ | 1 |
| 2 | CH ₄ | 25 |
| 3 | N ₂ O | 298 |

2.1.3 Data Collection

The activity or process wise material and fuel consumption data were collected for those activities which contribute to generation of greenhouse gases emission from Koradi TPS. For example, the fuel consumption (coal, furnace oil (FO) and light diesel oil (LDO)) in boiler, fuel consumption (Petrol or Diesel) in vehicles, quantity of coal handled, and type and quantity of refrigerant used in AC/Refrigerator units etc. In addition, electricity consumption data for 1 x 210 MW unit & 3 x 660 MW unit was also collected separately.

Note: The industry does not maintain segregated electricity consumption data process-wise/area-wise.

The data were collected for the FY 2021-22 (April 2021 to March 2022). These data were collected in the form of questionnaire, which was shared with the industry (Refer Annexure).

2.2 Quantification of GHG Emissions

The greenhouse gas emissions were quantified for each source of Scope-1 & Scope-2 category, based on the data given by the industry and their respective emission factors (as mentioned in Section 2.1.2). GHG emissions from all sources of Koradi TPS are discussed in following section.

2.2.1 Direct (Scope 1) Emissions

The source wise direct GHG emissions are quantified in below section.

2.2.1.1 Stationary Combustion

The stationary combustion indicates the combustion of any type of fuel associated with non-movable activities. The units like boiler, DG set, spare, booster pump & canteen are considered under stationary combustion sources. There are total four boilers and four DG sets (one in 1 X 210 MW unit and three in 3 X 660 MW unit), one spare and one booster pump (in 3 X 660 MW unit) and two canteens (one in 1 x 210 MW unit and other in 3 X 660 MW unit) located within the plant premises. All stationary combustion sources along with the type of fuel are depicted in Table 2-4.

Table 2-4 Stationary combustion units within the premises of Koradi TPS

| Sr. No. | Source | Total count | Location of the source | Fuel used for combustion |
|---------|--------------|-------------|-----------------------------------------------------|--------------------------|
| 1 | Boiler | 4 | Unit 6 (1 X 210 MW), Unit 8, 9 & 10 (3 X 660 MW) | Coal, FO, LDO |
| 2 | DG Set | 4 | Unit 6 (1 X 210 MW), Unit 8, 9 & 10 (3 X 660 MW) | LDO |
| 3 | Spare | 1 | 3 x 660 MW Unit | LDO |
| 4 | Booster Pump | 1 | 3 x 660 MW Unit | LDO |

| Sr. No. | Source | Total count | Location of the source | Fuel used for combustion |
|---------|---------|-------------|-------------------------------|--------------------------|
| 5 | Canteen | 2 | 1 x 210 MW Unit & 660 MW Unit | LPG |

Koradi TPS majorly uses three types of fuel for power generation - coal, FO and LDO. Coal is used as primary fuel, while FO and LDO is used as auxiliary fuel or secondary fuel which provides additional support for combustion activity. Apart from the fuel used for power generation, liquified petroleum gas (LPG) is used for cooking purpose at the canteen of 3 X 660 MW unit and 1 X 210 MW unit. Consumption of coal, FO, LDO and LPG lead to generation of GHGs such as CO₂, CH₄ and N₂O.

2.2.1.1.1 GHG Emissions by Fuel Consumption in Boiler

In Koradi TPS, the coal is the primary fuel used in huge quantity for electricity generation. Furnace oil (FO) and light diesel oil (LDO) are another source of fuel which is being used in boilers for initial ignition. Consumption of coal, FO and LDO in boiler leads to the emission of CO₂, CH₄ and N₂O in the environment (US EPA, 2021).

The GHG emission from boilers due to coal consumption was quantified based on the following equation.

$$\text{Total Emission} \left(\frac{\text{kg}}{\text{month}} \right) = \text{Total Fuel Consumption} \left(\frac{\text{short ton}}{\text{month}} \right) * \text{CV} \left(\frac{\text{mmBTU}}{\text{short ton}} \right) * \text{EF} \left(\frac{\text{Kg}}{\text{mmBTU}} \right)$$

Where:

CV= Calorific value or Heat value

EF= Emission factor

GHG emission factor for bituminous coal combustion in boilers are mentioned in Table 2-5.

Table 2-5 GHG emission factors for coal consumption in boilers

| Fuel Type | Emission Factor | | |
|-----------------|--------------------------------|-------------------------------|--------------------------------|
| | CO ₂ (kg per MMBtu) | CH ₄ (g per MMBtu) | N ₂ O (g per MMBtu) |
| Bituminous Coal | 93.28 | 11 | 1.6 |

Similarly, the GHG emission from boilers due to consumption of FO and LDO was quantified based on the following equation.

$$\text{Total Emission} \left(\frac{\text{kg}}{\text{month}} \right) = \text{Total Fuel Consumption} \left(\frac{\text{gallons}}{\text{month}} \right) * \text{CV} \left(\frac{\text{mmBTU}}{\text{gallon}} \right) * \text{EF} \left(\frac{\text{Kg}}{\text{mmBTU}} \right)$$

GHG emission factor for FO and LDO combustion in boilers are mentioned in Table 2-6.

Table 2-6 GHG emission factor for furnace oil (FO) and light diesel oil (LDO)

| Fuel Type | Emission Factor | | |
|-----------|--------------------------------|-------------------------------|--------------------------------|
| | CO ₂ (kg per MMBtu) | CH ₄ (g per MMBtu) | N ₂ O (g per MMBtu) |
| FO/LDO | 74.01 | 3.00 | 0.60 |

Note: Due to unavailability of emission factor for FO and LDO, the average emission factor of residual fuel is considered for the calculation for FO and LDO.

2.2.1.1.1.1 GHG Emission due to Coal Consumption in Boiler

Currently, a total four boilers (in unit 6, 8, 9 & 10) are in operation in Koradi TPS. The boiler installed in unit 6 has a capacity of 210 MW while the boilers installed in units 8, 9 & 10 have 660 MW capacity each. As per the data provided by industry, total coal consumption in unit 6, 8, 9 & 10 was 741700 MT, 2586614 MT, 2414565 MT and 2673588 MT, respectively in the FY 2021-22.

Note: The industry did not provide the data regarding the type of coal like anthracite, bituminous, lignite etc. But during the site visit, it was conveyed by the industry that the Koradi TPS purchase coal from Madhya Pradesh, India, thus for the calculation purpose coal type is considered as bituminous coal as Madhya Pradesh has bituminous coal reserves.

The theoretical GHG emissions due to coal consumption in boilers were estimated using the data provided by the industry on coal consumption, its respective gross calorific value (Refer Annexure), and emission factor of the coal (mentioned in Table 2-5).

The GHG emissions were converted into CO₂e by using Global Warming Potential (GWP) as mentioned in Table 2-3. For the FY 2021-22, the month wise GHG emissions due to coal consumption in boilers attached to units 6, 8, 9 & 10 is depicted in Table 2-7. Also, the GHG emission in terms of CO₂e is shown in Table 2-8.

1159

Carbon Footprint Study for Korndi Thermal Power Station

Table 2-7 GHG emissions due to coal consumption in boiler attached to units 6, 8, 9 and 10

| Month | Boiler - (Unit 6) | | | Boiler - (Unit 8) | | | Boiler - (Unit 9) | | | Boiler - (Unit 10) | | |
|--------|-------------------|-----------------|------------------|-------------------|-----------------|------------------|-------------------|-----------------|------------------|--------------------|-----------------|------------------|
| | CO ₂ | CH ₄ | N ₂ O | CO ₂ | CH ₄ | N ₂ O | CO ₂ | CH ₄ | N ₂ O | CO ₂ | CH ₄ | N ₂ O |
| | MT/year | | | MT/year | | | MT/year | | | MT/year | | |
| Apr-21 | 57599.51 | 6.79 | 0.99 | 287841.59 | 33.94 | 4.94 | 189717.51 | 22.37 | 3.25 | 174300.16 | 20.55 | 2.99 |
| May-21 | 0 | 0 | 0 | 239196.87 | 28.21 | 4.1 | 247344.35 | 29.17 | 4.24 | 283432.33 | 33.42 | 4.86 |
| Jun-21 | 0 | 0 | 0 | 104768.16 | 12.35 | 1.8 | 229141.67 | 27.02 | 3.93 | 293465.19 | 34.61 | 5.03 |
| Jul-21 | 0 | 0 | 0 | 256152.84 | 30.21 | 4.39 | 218938 | 25.82 | 3.76 | 224525.72 | 26.48 | 3.85 |
| Aug-21 | 88200.45 | 10.4 | 1.51 | 291464.57 | 34.37 | 5 | 266592.48 | 31.44 | 4.57 | 281261.65 | 33.17 | 4.82 |
| Sep-21 | 71702.9 | 8.46 | 1.23 | 218016.72 | 25.71 | 3.74 | 147915.41 | 17.44 | 2.54 | 217640.38 | 25.67 | 3.73 |
| Oct-21 | 94771.83 | 11.18 | 1.63 | 318274.44 | 37.53 | 5.46 | 256073.28 | 30.2 | 4.39 | 241002.55 | 28.42 | 4.13 |
| Nov-21 | 106647.07 | 12.58 | 1.83 | 233119.19 | 27.49 | 4 | 304363.47 | 35.89 | 5.22 | 324649.55 | 38.28 | 5.57 |
| Dec-21 | 110698.6 | 13.05 | 1.9 | 305966.68 | 36.08 | 5.25 | 204529.06 | 24.12 | 3.51 | 345462.38 | 40.74 | 5.93 |
| Jan-22 | 110925.43 | 13.08 | 1.9 | 308039.55 | 36.33 | 5.28 | 320131.83 | 37.75 | 5.49 | 318148.16 | 37.52 | 5.46 |
| Feb-22 | 115933.99 | 13.67 | 1.99 | 331424.45 | 39.08 | 5.68 | 244975.7 | 28.89 | 4.2 | 304410.92 | 35.9 | 5.22 |
| Mar-22 | 130101 | 15.34 | 2.23 | 370462.62 | 43.69 | 6.35 | 358764.14 | 42.31 | 6.15 | 275940.92 | 32.54 | 4.73 |
| Total | 886580.77 | 104.55 | 15.21 | 3254727.7 | 384.39 | 56 | 2988486.9 | 352.42 | 51.26 | 3284239.9 | 387.3 | 56.33 |

It can be observed from Table 2-7 that out of three GHGs emitting from the boilers, CO₂ is the major contributing gas.

Table 2-8 GHG emissions in term of CO₂e due to coal consumption in boiler attached to units 6, 8, 9 and 10

| Month | Boiler- (Unit 6) | Boiler- (Unit 8) | Boiler- (Unit 9) | Boiler- (Unit 10) |
|-----------------------------|------------------|-------------------|-------------------|-------------------|
| CO ₂ e (MT/year) | | | | |
| Apr-21 | 58063.73 | 290161.48 | 191246.56 | 175704.95 |
| May-21 | 0 | 241124.7 | 249337.85 | 285716.68 |
| Jun-21 | 0 | 105612.55 | 230988.46 | 295830.4 |
| Jul-21 | 0 | 258217.33 | 220702.56 | 226335.31 |
| Aug-21 | 88911.31 | 293813.66 | 268741.11 | 283528.51 |
| Sep-21 | 72280.8 | 219773.84 | 149107.55 | 219394.47 |
| Oct-21 | 95535.65 | 320839.6 | 258137.13 | 242944.93 |
| Nov-21 | 107506.61 | 234998.04 | 306816.52 | 327266.1 |
| Dec-21 | 111590.79 | 308432.65 | 206177.48 | 348246.67 |
| Jan-22 | 111819.44 | 310522.23 | 322711.97 | 320712.31 |
| Feb-22 | 116868.37 | 334095.6 | 246950.1 | 306864.35 |
| Mar-22 | 131149.56 | 373448.4 | 361655.64 | 278164.9 |
| Total | 893726.26 | 3291040.09 | 3012572.92 | 3310709.58 |

It can be observed from Table 2-8 that in FY 2021-22, the GHG emissions in terms of CO₂e from boilers attached to units 6, 8, 9 & 10 was 8,93,726.26 MT/year, 32,91,040.09 MT/year, 30,12,572.92 MT/year and 33,10,709.58 MT/year, respectively, due to coal consumption. Thus, boiler attached to unit 10 was the highest contributor in GHG emissions due to coal consumption followed by boilers attached to unit 8, 9 & 6.

2.2.1.1.2 GHG Emission due to Furnace Oil and Light Diesel Oil Consumption in Boiler
Furnace oil (FO) and Light Diesel Oil (LDO) is used as an auxiliary fuel in Koradi TPS. As per the data provided by industry, total FO consumption in unit 6, 8, 9 & 10 was 4503.01 kL, 3396.07 kL, 3152.13 kL and 4365.89 kL respectively, and the total LDO consumption in unit 6, 8, 9 & 10 was 672.09 kL, 394.50 kL, 573.50 kL and 402.83 kL respectively, in the FY 2021-22.

The theoretical GHG emissions due to FO and LDO consumption were estimated using their respective emission factors (mentioned in Table 2-6) and the data provided by the industry on respective fuel consumption & calorific value (Refer Annexure). The GHG emissions were converted into CO₂ equivalent by using Global Warming Potential (GWP) as mentioned in Table 2-3.

For the FY 2021-22, the month wise GHG emissions due to FO and LDO consumption from boiler attached to unit 6, 8, 9 and 10 is shown in Table 2-9 and Table 2-11, respectively. Also, the GHG emission in terms of CO₂e due to FO and LDO consumption from boiler attached to unit 6, 8, 9 and 10 is shown in Table 2-10 and Table 2-12, respectively.

Table 2-9 GHG emissions due to FO consumption in boiler attached to units 6, 8, 9 and 10

| Month | Boiler- (Unit 6) | | | Boiler- (Unit 8) | | | Boiler- (Unit 9) | | | Boiler- (Unit 10) | | |
|--------|------------------|-----------------|------------------|------------------|-----------------|------------------|------------------|-----------------|------------------|-------------------|-----------------|------------------|
| | CO ₂ | CH ₄ | N ₂ O | CO ₂ | CH ₄ | N ₂ O | CO ₂ | CH ₄ | N ₂ O | CO ₂ | CH ₄ | N ₂ O |
| | MT/year | | | MT/year | | | MT/year | | | MT/year | | |
| Apr-21 | 462.31 | 0.02 | 0 | 614.19 | 0.02 | 0 | 1442.19 | 0.06 | 0.01 | 2835.73 | 0.11 | 0.02 |
| May-21 | 0 | 0 | 0 | 654.64 | 0.03 | 0.01 | 833.43 | 0.03 | 0.01 | 853.98 | 0.03 | 0.01 |
| Jun-21 | 0 | 0 | 0 | 1744.14 | 0.07 | 0.01 | 811.03 | 0.03 | 0.01 | 115.52 | 0 | 0 |
| Jul-21 | 0 | 0 | 0 | 1178.84 | 0.05 | 0.01 | 1680.12 | 0.07 | 0.01 | 4045.59 | 0.16 | 0.03 |
| Aug-21 | 2458.5 | 0.1 | 0.02 | 949.76 | 0.04 | 0.01 | 523.66 | 0.02 | 0 | 767.05 | 0.03 | 0.01 |
| Sep-21 | 3592.86 | 0.15 | 0.03 | 1425.7 | 0.06 | 0.01 | 669.92 | 0.03 | 0.01 | 1750.99 | 0.07 | 0.01 |
| Oct-21 | 3631.88 | 0.15 | 0.03 | 55.03 | 0 | 0 | 466.41 | 0.02 | 0 | 801.25 | 0.03 | 0.01 |
| Nov-21 | 742 | 0.03 | 0.01 | 943.46 | 0.04 | 0.01 | 502.83 | 0.02 | 0 | 48.25 | 0 | 0 |
| Dec-21 | 407.48 | 0.02 | 0 | 1253.26 | 0.05 | 0.01 | 487.1 | 0.02 | 0 | 7.39 | 0 | 0 |
| Jan-22 | 1187.23 | 0.05 | 0.01 | 582.16 | 0.02 | 0 | 634.25 | 0.03 | 0.01 | 439.11 | 0.02 | 0 |
| Feb-22 | 220.68 | 0.01 | 0 | 306.33 | 0.01 | 0 | 723.65 | 0.03 | 0.01 | 0 | 0 | 0 |
| Mar-22 | 291.99 | 0.01 | 0 | 92.98 | 0 | 0 | 321.91 | 0.01 | 0 | 934.37 | 0.04 | 0.01 |
| Total | 12994.93 | 0.53 | 0.11 | 9800.49 | 0.4 | 0.05 | 9096.5 | 0.37 | 0.07 | 12599.23 | 0.51 | 0.1 |

It can be observed from Table 2-9 that out of three GHGs emitting from the boilers, CO₂ is the major contributing gas.

Table 2-10 GHG emissions in term of CO₂e due to FO consumption in boiler attached to units 6, 8, 9 and 10

| Month | Boiler- (Unit 6) | Boiler- (Unit 8) | Boiler- (Unit 9) | Boiler- (Unit 10) |
|--------------|-----------------------------|------------------|------------------|-------------------|
| | CO ₂ e (MT/year) | | | |
| Apr-21 | 463.9 | 616.29 | 1447.14 | 2845.46 |
| May-21 | 0 | 656.89 | 836.29 | 856.9 |
| Jun-21 | 0 | 1750.12 | 813.82 | 115.92 |
| Jul-21 | 0 | 1182.88 | 1685.88 | 4059.46 |
| Aug-21 | 2466.93 | 953.01 | 525.46 | 769.68 |
| Sep-21 | 3605.18 | 1430.59 | 672.21 | 1756.99 |
| Oct-21 | 3644.33 | 55.22 | 468.01 | 804 |
| Nov-21 | 744.55 | 946.7 | 504.55 | 48.42 |
| Dec-21 | 408.88 | 1257.56 | 488.77 | 7.41 |
| Jan-22 | 1191.3 | 584.15 | 636.42 | 440.61 |
| Feb-22 | 221.44 | 307.38 | 726.13 | 0 |
| Mar-22 | 292.99 | 93.3 | 323.02 | 937.58 |
| Total | 13039.49 | 9834.09 | 9127.69 | 12642.43 |

It can be observed from Table 2-10 that in FY 2021-22, the GHG emissions in terms of CO₂e due to FO consumption from boiler attached to unit 6, 8, 9 & 10 was 13039.49 MT/year, 9834.09 MT/year, 9127.69 MT/year and 12642.43 MT/year respectively. Thus, boiler attached to unit 6 was the highest contributor in GHG emissions due to FO consumption followed by boiler attached to unit 10, 8 & 9.

1163

Carbon Footprint Study for Koradi Thermal Power Station

Table 2-11 GHG emissions due to consumption of light diesel oil (LDO) in boiler attached to unit 6, 8, 9 and 10

| Month | Boiler- (Unit 6) | | | Boiler- (Unit 8) | | | Boiler- (Unit 9) | | | Boiler- (Unit 10) | | |
|--------|------------------|-----------------|------------------|------------------|-----------------|------------------|------------------|-----------------|------------------|-------------------|-----------------|------------------|
| | CO ₂ | CH ₄ | N ₂ O | CO ₂ | CH ₄ | N ₂ O | CO ₂ | CH ₄ | N ₂ O | CO ₂ | CH ₄ | N ₂ O |
| | MT/year | | | MT/year | | | MT/year | | | MT/year | | |
| Apr-21 | 233.36 | 0.01 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 111.76 | 0 | 0 |
| May-21 | 0 | 0 | 0 | 0 | 0 | 0 | 272.73 | 0.01 | 0 | 0 | 0 | 0 |
| Jun-21 | 0 | 0 | 0 | 632.75 | 0.03 | 0.01 | 190.88 | 0.01 | 0 | 0 | 0 | 0 |
| Jul-21 | 0 | 0 | 0 | 13.41 | 0 | 0 | 96.55 | 0 | 0 | 125.84 | 0.01 | 0 |
| Aug-21 | 227.97 | 0.01 | 0 | 37.82 | 0 | 0 | 104.6 | 0 | 0 | 158.13 | 0.01 | 0 |
| Sep-21 | 808.2 | 0.03 | 0.01 | 39.61 | 0 | 0 | 183.21 | 0.01 | 0 | 40.23 | 0 | 0 |
| Oct-21 | 455.49 | 0.02 | 0 | 0 | 0 | 0 | 93.47 | 0 | 0 | 139.47 | 0.01 | 0 |
| Nov-21 | 0 | 0 | 0 | 121.6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Dec-21 | 0 | 0 | 0 | 102.72 | 0 | 0 | 364.54 | 0.01 | 0 | 0 | 0 | 0 |
| Jan-22 | 77.54 | 0 | 0 | 110.15 | 0 | 0 | 94.7 | 0 | 0 | 161.46 | 0.01 | 0 |
| Feb-22 | 0 | 0 | 0 | 0 | 0 | 0 | 137.45 | 0.01 | 0 | 0 | 0 | 0 |
| Mar-22 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 343.51 | 0.01 | 0 |
| Total | 1802.55 | 0.07 | 0.01 | 1058.07 | 0.04 | 0.01 | 1538.14 | 0.06 | 0.01 | 1080.4 | 0.04 | 0.01 |

It can be observed from Table 2-11 that out of three GHGs emitting from the boilers, CO₂ is the major contributing gas.

Table 2-12 GHG emissions in terms of CO₂e due to consumption of light diesel oil in boiler attached to unit 6, 8, 9 and 10

| Month | Boiler- (Unit 6) | Boiler- (Unit 8) | Boiler- (Unit 9) | Boiler- (Unit 10) |
|--------------|-----------------------------|------------------|------------------|-------------------|
| | CO ₂ e (MT/year) | | | |
| Apr-21 | 234.16 | 0 | 0 | 112.14 |
| May-21 | 0 | 0 | 273.67 | 0 |
| Jun-21 | 0 | 634.92 | 191.53 | 0 |
| Jul-21 | 0 | 13.46 | 96.88 | 126.27 |
| Aug-21 | 228.75 | 37.95 | 104.96 | 158.67 |
| Sep-21 | 810.97 | 39.75 | 183.84 | 40.37 |
| Oct-21 | 457.05 | 0 | 93.79 | 139.94 |
| Nov-21 | 0 | 122.02 | 0 | 0 |
| Dec-21 | 0 | 103.07 | 365.79 | 0 |
| Jan-22 | 77.8 | 110.53 | 95.03 | 162.01 |
| Feb-22 | 0 | 0 | 137.92 | 0 |
| Mar-22 | 0 | 0 | 0 | 344.69 |
| Total | 1808.74 | 1061.70 | 1543.41 | 1084.10 |

It can be observed from Table 2-12 that in FY 2021-22, the GHG emissions in terms of CO₂e due to LDO consumption from boiler attached to unit 6, 8, 9 & 10 was 1808.74 MT/year, 1061.70 MT/year, 1543.41 MT/year and 1084.10 MT/year respectively. Thus, boiler attached to unit 6 was the highest contributor in GHG emissions due to LDO consumption followed by boiler attached to unit 9, 10 & 8.

Total GHG emission from boilers due to fuel combustion

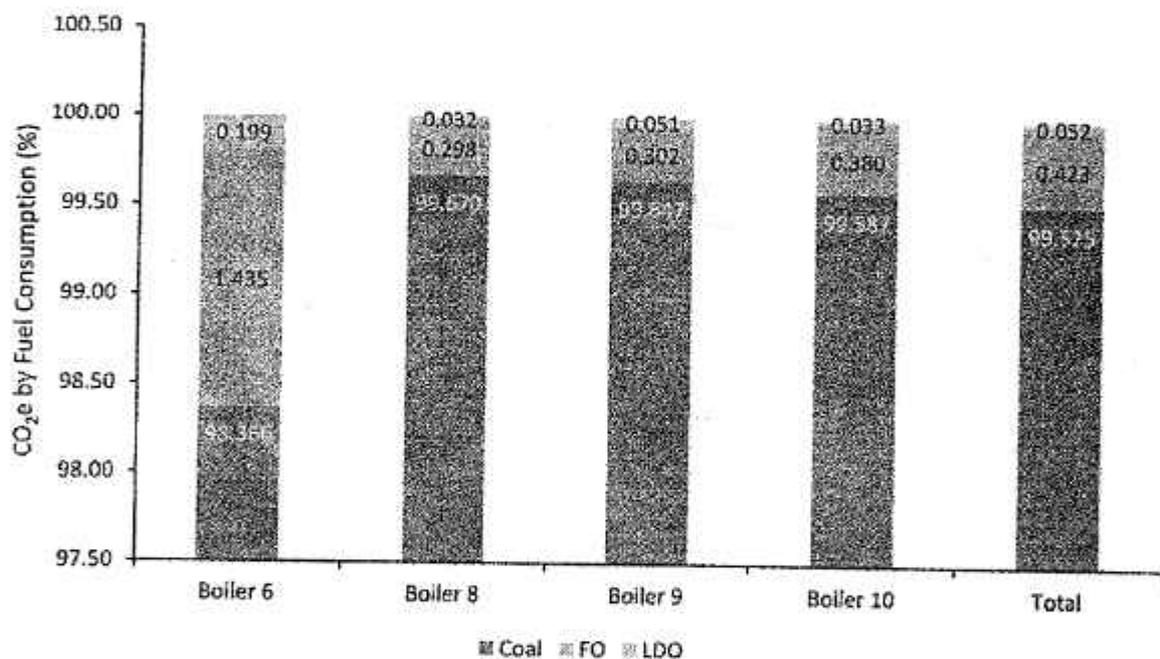
The total GHG emission from boiler attached to unit 6, 8, 9 and 10 in terms of CO₂e due to consumption of coal, FO and LDO is depicted in Table 2-13.

Table 2-13 Total GHG emission in terms of CO₂e from boiler (unit 6, 8, 9 and 10) due to fuel consumption in FY 2021-22

| Sr. No. | Source | CO ₂ e (MT/year) | | | Total |
|---------|-------------------|-----------------------------|----------|---------|-------------|
| | | Coal | FO | LDO | |
| 1 | Boiler- (Unit 6) | 893726.26 | 13039.49 | 1808.74 | 908574.49 |
| 2 | Boiler- (Unit 8) | 3291040.09 | 9834.09 | 1061.70 | 3301935.88 |
| 3 | Boiler- (Unit 9) | 3012572.92 | 9127.69 | 1543.41 | 3023244.03 |
| 4 | Boiler- (Unit 10) | 3310709.58 | 12642.43 | 1084.10 | 3324436.11 |
| | Total | 10508048.85 | 44643.70 | 5497.95 | 10558190.51 |

The graphical representation of Table 2-13 is shown in below Figure 2-1.

Figure 2-1 Percentage wise contribution of fuel for GHG emissions in terms of CO₂e from boiler attached to unit 6, 8, 9 & 10



It can be observed from Figure 2-1 that the maximum GHG emission in terms of CO₂e (>98 %) from boiler attached to unit 6, 8, 9 & 10 is due to the coal consumption.

2.2.1.1.2 GHG Emissions by Fuel Consumption in DG-Sets

In Koradi TPS, DG set (in unit 6, 8, 9 & 10), Spare (in unit 8, 9 & 10) and booster pump (in unit 8, 9 & 10) consume Light Diesel Oil (LDO) as a fuel. As per the data provided by industry, total LDO consumption in DG set- unit 6, DG set- unit 8, DG set- unit 9, DG set- unit 10, spare and booster pump was 1.80 kL, 1.50 kL, 1.40 kL, 1.75 kL, 0.75 kL and 0.30 kL, respectively in the FY 2021-22.

The industry provided the month-wise data for LDO consumption and their gross calorific values which is shown in

Annexure. The GHG emission from DG set (unit 6, 8, 9 & 10), spare and booster pump due to the consumption of LDO is estimated in same way as for calculated for boiler and is shown in Table 2-14.

Table 2-14 GHG emission in terms of CO₂e due to LDO consumption in DG sets, spare and booster pump unit in FY 2021-22

| Sr. No. | Sources | CO ₂ e (MT/year) |
|---------|-------------------|-----------------------------|
| 1 | DG Set- (Unit 6) | 4.84 |
| 2 | DG Set- (Unit 8) | 4.04 |
| 3 | DG Set- (Unit 9) | 3.76 |
| 4 | DG Set- (Unit 10) | 4.71 |
| 5 | Spare | 2.02 |
| 6 | Booster Pump | 0.81 |
| Total | | 20.18 |

2.2.1.1.3 GHG Emissions by Liquefied Petroleum Gas Consumption

There are two canteens in the Koradi TPS (one canteen in 3 x 660 MW unit and another in 1 x 210 MW unit). LPG is used for cooking purpose in canteens which causes emission of GHGs like CO₂, CH₄ and N₂O (US EPA, 2021). As per the data given by industry, the average number of cylinders used in 3 X 660 MW unit and 1 X 210 MW unit was 660 and 180 per year respectively. The quantification of GHG emission from canteens due to consumption of LPG was carried out by using emission factors given in Table 2-15.

Table 2-15 GHG emission factor for LPG consumption

| Fuel Type | Emission Factor | | |
|-----------|-----------------------------|-----------------------------|------------------------------|
| | CO ₂ (kg/gallon) | CH ₄ (kg/gallon) | N ₂ O (kg/gallon) |
| LPG | 5.680 | 0.280 | 0.060 |

The GHG emissions were converted into CO₂e by using Global Warming Potential (GWP) as (Refer Table 2-3). The GHG emissions in terms of CO₂e due to LPG consumption is shown in Table 2-16.

Table 2-16 GHG emissions in terms of CO₂e due to LPG consumption in canteens for FY 2021-22

| Sr. No. | Canteen Location | CO ₂ e (MT/year) |
|---------|------------------|-----------------------------|
| 1 | 3 X 660 MW Unit | 530.93 |
| 2 | 1 X 210 MW Unit | 144.79 |
| Total | | 675.73 |

As observed from Table 2-16, total GHG emissions in terms of CO₂e due to LPG consumption in canteen for FY 2021-22 was 675.73 MT/year.

Total GHG emission from stationary combustion sources due to fuel combustion

The overall GHG emissions in terms of CO₂e from all the stationary combustion sources of Koradi TPS for the FY 2021-22 is depicted in Table 2-17.

Table 2-17 Overall GHG emissions in terms of CO₂e from all the stationary combustion sources of Koradi TPS

| Sr. No. | Sources | Location of source | CO ₂ e (MT/year) |
|---------|--------------|-----------------------------------------------------|-----------------------------|
| 1 | Boiler | Unit 6 (1 X 210 MW), Unit 8, 9 & 10 (3 X 660 MW) | 10558190.51 |
| 2 | DG Set | Unit 6 (1 X 210 MW), Unit 8, 9 & 10 (3 X 660 MW) | 17.35 |
| 3 | Spare | 3 x 660 MW Unit | 2.02 |
| 4 | Booster Pump | 3 x 660 MW Unit | 0.81 |
| 5 | Canteen | 1 x 210 MW Unit & 660 MW Unit | 675.73 |
| Total | | | 10558886.42 |

2.2.1.2 Mobile Combustion

The mobile combustion includes the combustion of fuel associated with the movable activities. It includes the vehicular movement within the study area. The transport sector mainly uses two kinds of fuels - petrol and diesel. But these fuels are carbon intensive and contain 80-85% of carbon by weight. The combustion of these fuels lead to the emission of greenhouse gases like CO₂ (Gajjar & Sheikh, 2015).

The quantification of GHG emissions due to the vehicular movement within the plant boundary was carried out using following equation.

$$\text{Total Emission (kg)} = \text{Total Distance Travelled (km)} * \text{Emission Factor} \left(\frac{\text{Kg CO}_2}{\text{Km}} \right)$$

The vehicular movement within the plant boundary of Koradi TPS majorly include movement for the transportation of coal, raw material, fly ash, bottom ash, and mill reject, etc. It also includes movement of employee's private vehicles (two/three/four wheelers) within the plant premises. The vehicular data for FY 2021-22 was collected from the industry which is given in Annexure.

The greenhouse gas emissions were quantified by using emission factor given in "India Specific Road Transport Emission Factors, 2015" published by India GHG Program shown in Table 2-18 (Gajjar & Sheikh, 2015).

Table 2-18 Emission factors for mobile combustion

| Category of vehicle | Fuel type | Emission factor (kg CO ₂ /km) |
|---------------------------|---------------|------------------------------------------|
| Light Duty Vehicle (LDV) | Diesel | 0.3070 |
| Medium Duty Vehicle (MDV) | Diesel | 0.5928 |
| Heavy Duty Vehicle (HDV) | Diesel | 0.7375 |
| Three Wheelers | Petrol | 0.1135 |
| | Diesel | 0.1322 |
| | CNG | 0.10768 |
| Four-Wheeler | Diesel/Petrol | 0.183 |
| Two-Wheeler | Petrol | 0.0430 |

Note: The average emission factor value was considered for two and four-wheeler vehicle due to the unavailability of the data.

In the FY 2021-22, the CO₂ emissions or CO₂e due to the vehicular movement in 1 X 210 MW unit is depicted in Table 2-19.

Table 2-19 CO₂ emissions due to the vehicular movement in 1 X 210 MW unit

| Sr. No. | Category of vehicle | Classification of vehicle | Type of fuel | Number of vehicles | CO ₂ or CO ₂ e (MT/Year) |
|---------|---------------------------------------|---------------------------|----------------|--------------------|------------------------------------------------|
| 1 | Vehicles used for Coal transportation | HDV | Diesel | 10034 | 66.60 |
| 2 | Vehicles used for Bottom Ash | MDV | Diesel | 1 | 7.68 |
| 3 | Vehicles used for Mill reject | MDV | Diesel | 2 | 34.86 |
| 4 | Vehicle used for other Raw materials | MDV | Diesel | 1 | 2.28 |
| 5 | Four Wheelers | NA | Diesel/ Petrol | 48 | 6.43 |
| 6 | Three Wheelers | Auto Rickshaw | CNG | 1 | 0.22 |
| 7 | Two Wheelers | NA | Petrol | 446 | 13.99 |
| Total | | | | | 132.06 |

It can be observed from Table 2-19 that the total CO₂ emission or CO₂e due to vehicular movement in 1 X 210 MW plant for FY 2021-22 was 132.06 MT/year. The highest emission (50.43 %) was due to heavy duty vehicles used for coal transportation.

Similarly, the CO₂ emission or CO₂e due to the vehicular movement in 3 X 660 MW unit is depicted in Table 2-20.

Table 2-20 CO₂ emission or CO₂e due to the vehicular movement in 3 X 660 MW unit

| Sr. No. | Category of vehicle | Classification of vehicle | Type of fuel | Number of vehicles | CO ₂ or CO ₂ e (MT/Year) |
|---------|---------------------------------------|---------------------------|----------------|--------------------|------------------------------------------------|
| 1 | Vehicles used for Coal transportation | HDV | Diesel | 40433 | 89.46 |
| 2 | Vehicles used for Fly Ash | HDV | Diesel | 10 | 5.31 |
| 3 | Vehicle used for other Raw materials | LDV | Diesel | 2 | 1.79 |
| 4 | | MDV | Diesel | 1 | 1.73 |
| 5 | Vehicle used for mill reject | MDV | Diesel | 10 | 46.77 |
| 6 | | HDV | Diesel | 3 | 121.05 |
| 9 | Four Wheelers | NA | Diesel/ Petrol | 219 | 29.33 |
| 10 | Two Wheelers | NA | Petrol | 915 | 28.71 |
| Total | | | | | 324.15 |

It can be observed from Table 2-20 that the total CO₂ emission or CO₂e due to vehicular movement in 3 X 660 MW unit for FY 2021-22 was 324.15 MT/year. The highest emission (66.58 %) was due to heavy duty vehicles used for coal transportation.

In FY 2021-22, the total GHG emissions in terms of CO₂e from mobile combustion source of Koradi TPS was 456.20 MT/year. Details are shown in Table 2-21.

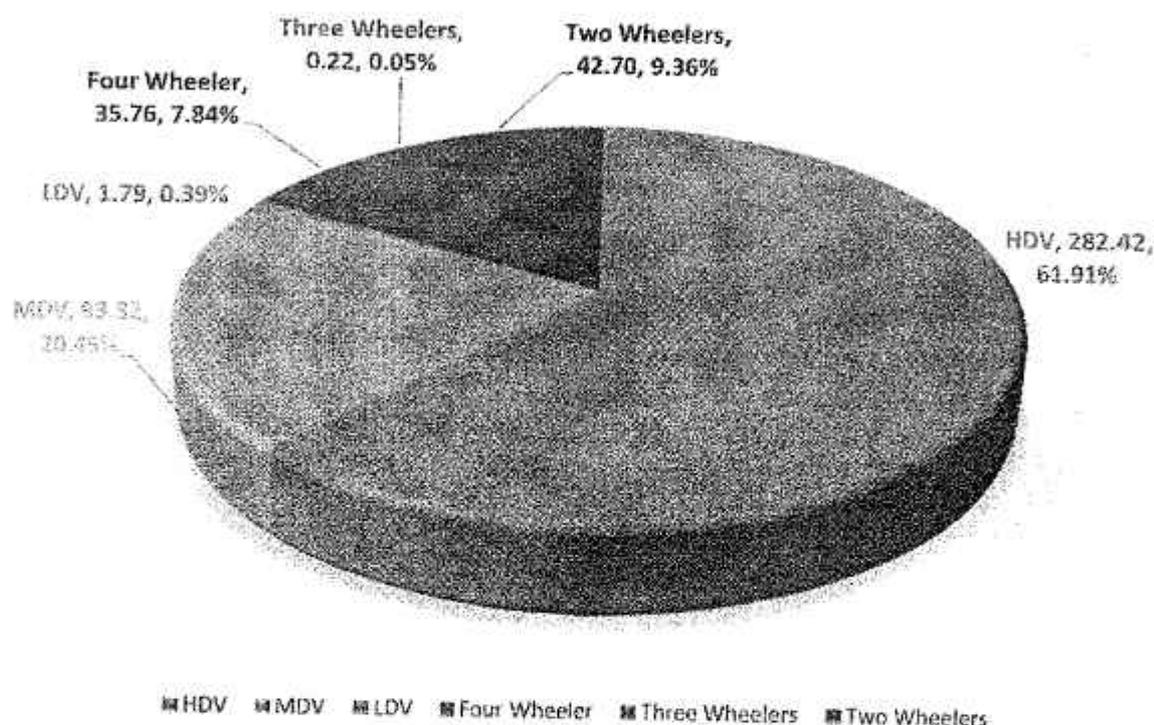
Table 2-21 Overall GHG emissions in terms of CO₂e from mobile combustion source of Koradi TPS

| Sr. No. | Category of vehicle | CO ₂ e (MT/year) |
|---------|---------------------|-----------------------------|
| 1 | HDV | 282.42 |

| Sr. No. | Category of vehicle | CO ₂ e (MT/year) |
|---------|---------------------|-----------------------------|
| 2 | MDV | 93.32 |
| 3 | LDV | 1.79 |
| 3 | Four-Wheeler | 35.76 |
| 4 | Three Wheelers | 0.22 |
| 5 | Two Wheelers | 42.70 |
| Total | | 456.21 |

The graphical representation of CO₂e from mobile combustion source of Koradi TPS is shown in Figure 2-2.

Figure 2-2 Overall CO₂e from mobile combustion source of Koradi TPS



It is evident from the above graph that CO₂e from mobile combustion sources are largely contributed by the heavy-duty vehicles (HDV). HDV account for 61.91 % of the total CO₂e followed by medium duty vehicles, two wheelers, four-wheelers.

2.2.1.3 Wastewater Treatment

The wastewater treatment unit is another source which contributes to the emission of methane (CH₄) and nitrous oxide (N₂O) gases in the environment. The CH₄ emission from wastewater treatment unit depends on the type of treatment method. Anaerobic treatment system generates significantly higher CH₄ emissions as compared to aerobic treatment system. The nitrification and denitrification process leads to the emission of N₂O gas during the treatment process (IPCC, 2019).

The Koradi TPS has installed a sewage treatment plant (STP) and two effluent treatment plants (ETP) to treat the wastewater generating inside the plant boundary. The STP treats the domestic sewage generated from the canteen and toilets of administrative buildings. The STP of 40 kLD capacity is

provided in 3 X 660 MW unit which is based on Moving Bed Biofilm Reactor (MBBR) technology (aerobic treatment). The treated water of STP is being used for gardening purpose within the industry.

Note: A STP of 25 kLD capacity was installed in 1 X 210 MW unit, but it is not considered in the present study as during the site visit it was observed to be in defunct stage.

The ETP treats the trade effluent generating from the industrial activities within Koradi TPS. The treatment capacity of ETPs installed at 3 X 660 MW unit and 1 X 210 MW unit are 14 MLD and 38.4 MLD respectively. ETP installed at 3 X 660 MW unit has both primary & secondary (aerobic) treatment systems, while ETP installed at 1 X 210 MW unit has sedimentation process (primary treatment) only and does not contain any biological units. The treated wastewater from both the ETPs was used for ash handling.

The quantification of GHG emissions from STP and ETP was carried out based on the data provided by the industry which include data regarding inlet and outlet Biochemical oxygen demand (BOD), inlet and outlet total nitrogen content (TN), type of treatment method, quantity, and method of sludge removal etc.

Quantification of CH₄ emissions from sewage treatment plant was carried out using following equations.

$$CH_4 \text{ emissions } \left(\frac{kg \text{ CH}_4}{yr} \right) = \left(TOW \left(\frac{kg \text{ BOD}}{yr} \right) - S \left(\frac{kg \text{ BOD}}{yr} \right) \right) * EF \left(\frac{kg \text{ CH}_4}{kg \text{ BOD}} \right) - R$$

Where:

CH₄ Emission= CH₄ emissions in kg CH₄/year

TOW= Organics in wastewater in kg BOD/year

S= Organic component removed from wastewater (S= 0 for no sludge removal)

EF= Emission factor in kg CH₄/kg BOD (EF= 0.018 as aerobic treatment provided)

R= Amount of CH₄ recovered in kg CH₄/year (Default value is zero)

Similarly, quantification of N₂O emissions from sewage treatment plant was carried out using following equations.

$$N_2O \left(\frac{kg \text{ N}_2O}{yr} \right) = (\Sigma(U * T * EF)) * TN * \frac{44}{28}$$

Where:

N₂O= N₂O emissions in kg N₂O/year

TN= Total nitrogen in domestic wastewater as kg N/year

U= Fraction of population

T= Degree of treatment utilization

EF= Emission factor in kg N₂O-N/kg N

The factor 44/28 is for the conversion of kg N₂O-N into kg N₂O

The GHG emissions comprising of CH₄ & N₂O and total GHG emission in terms of CO₂e was determined for wastewater units installed in the Koradi TPS, which is shown in Table 2-22.

Table 2-22 GHG emissions and CO₂e from wastewater treatment units of Koradi TPS for FY 2021-22

| Unit | CH ₄ (MT/year) | N ₂ O (MT/year) | CO ₂ e (MT/year) |
|-----------------------|---------------------------|----------------------------|-----------------------------|
| STP (3 X 660 MW Unit) | 0.170 | 0.004 | 5.36 |
| ETP (3 X 660 MW Unit) | - | 0.570 | 169.99 |
| Total | 0.170 | 0.574 | 175.36 |

The total GHG emission in terms of CO₂e from wastewater treatment units of Koradi TPS was 175.36 MT/year for the FY 2021-22.

2.2.1.4 Coal Handling and Storage

Coal is a primary fuel used for the electricity generation at the Koradi TPS and the post mining activities like coal handling, storage & transportation are responsible for methane (CH₄) emissions. Emission of CH₄ occur due to the increased surface area of the coal after mining (during handling and storage of coal) which allows methane gas to desorb (IPCC, 1996).

Coal handling and storage is the critical process of Koradi TPS where coal is unloaded from railway wagons and transferred to coal crusher and storage area through conveyers. As per the information shared by the industry, Koradi TPS was using three types of coal- Raw (India based), Imported (Indonesia based) and Washed (India based). The emission factor for CH₄ emission from post mining activities is given in Table 2-23.

Table 2-23 CH₄ emission factor for coal handling and storage

| Activities | Emission Factor (m ³ /tonne) | |
|-------------|-----------------------------------------|---------|
| | Underground | Surface |
| Post Mining | 0.9 - 4.0 | 0 - 0.2 |

In industry coal handling and storage is carried out in open space. Thus, the average emission factor of 0.1 m³/tonne for post mining surface activities is considered to quantify CH₄ emission from coal handling and storage. The CH₄ emission from the coal handling and storage is quantified based on following equation.

$$\text{Total Emission (MT)} = \text{Total Coal Handling (tonnes)} * EF \left(\frac{\text{m}^3}{\text{tonne}} \right) * CF \left(\frac{\text{MT}}{\text{m}^3} \right)$$

Where:

CF= Conversion Factor (IPCC, 1996)

The CH₄ emission and its CO₂e from coal handling activities at 1 X 210 MW unit as well as 3 X 660 MW unit is given in Table 2-24.

Table 2-24 GHG emission and CO₂e due to coal handling and storage at Koradi TPS for the FY 2021-22

| Sr. No. | Coal handling plant location | CH ₄ emissions (MT/year) | CO ₂ e (MT/year) |
|---------|------------------------------|-------------------------------------|-----------------------------|
| 1 | 1 X 210 MW Unit | 49.69 | 1242.34 |
| 2 | 3 X 660 MW Unit | 516.30 | 12907.48 |
| | Total | 565.99 | 14149.83 |

Carbon Footprint Study for Koradi Thermal Power Station

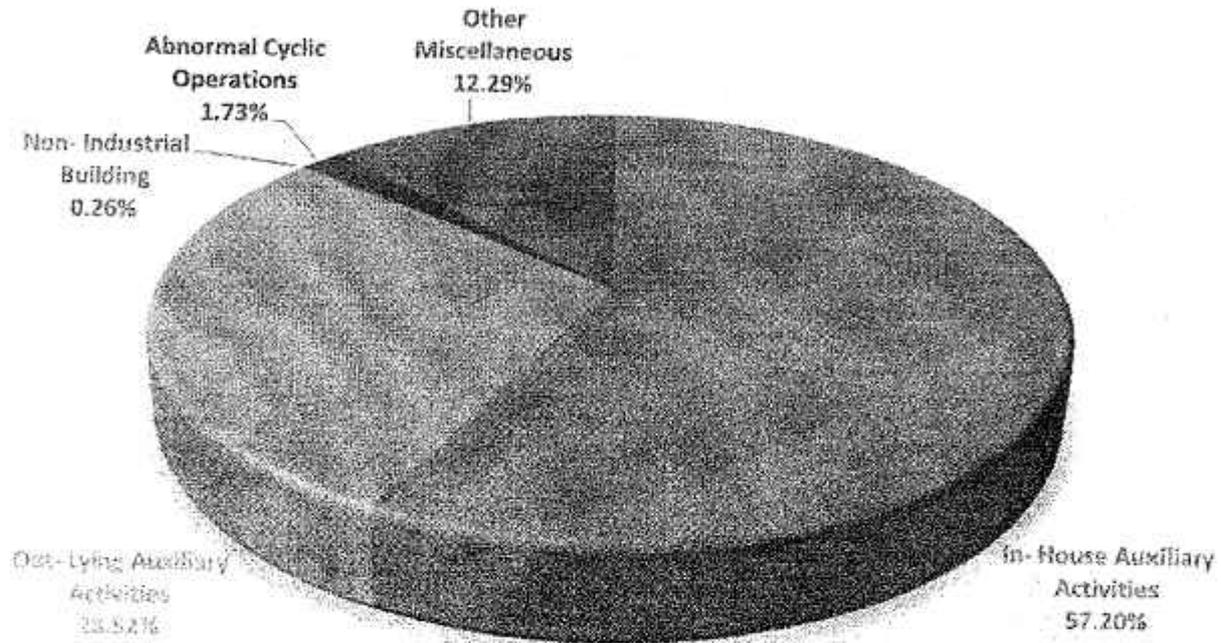
Table 2-30 Indirect (Scope 2) GHG emissions for Koradi TPS in the FY 2021-22

| Sr. No. | Activity | Required Power (MW) | 1 X 210 MW Unit | | Required Power (MW) | 3 X 660 MW Unit | | Koradi TPS Total CO ₂ emission or CO ₂ e (MT) |
|----------------------------------------|----------------------------|---------------------|------------------------------|----------------------------------------------------|---------------------|------------------------------|----------------------------------------------------|---------------------------------------------------------------------|
| | | | Electricity Consumption (MU) | CO ₂ emission or CO ₂ e (MT) | | Electricity Consumption (MU) | CO ₂ emission or CO ₂ e (MT) | |
| Industrial Activities | | | | | | | | |
| 1 | Boiler Feed Pump | 3.39 | 29.31 | 23154.66 | 24.08 | 208.02 | 164338.29 | 187492.95 |
| 2 | Condensate Extraction Pump | 0.26 | 2.29 | 1805.28 | 1.88 | 16.22 | 12812.82 | 14618.09 |
| 3 | Induced Draft Fan | 1.56 | 13.51 | 10674.69 | 11.10 | 95.90 | 75762.74 | 86437.43 |
| 4 | Forced Draft Fan | 0.37 | 3.18 | 2511.69 | 2.61 | 22.57 | 17826.53 | 20338.22 |
| 5 | PA Fan | 1.24 | 10.73 | 8476.96 | 8.81 | 76.16 | 60164.53 | 68641.49 |
| 6 | Mills | 0.77 | 6.66 | 5258.85 | 5.47 | 47.25 | 37324.29 | 42583.14 |
| 7 | Electrostatic Precipitator | 0.0001 | 0.0011 | 0.88 | 0.13 | 1.12 | 881.99 | 882.87 |
| Sub Total (In-house Auxiliary) | | 7.60 | 65.67 | 51883.03 | 54.08 | 467.23 | 369111.17 | 420994.20 |
| 8 | Coal Handling Plant | 0.29 | 2.48 | 1962.26 | 2.04 | 17.63 | 13926.97 | 15889.23 |
| 9 | Ash Handling Plant | 0.23 | 1.99 | 1569.81 | 1.63 | 14.10 | 11141.58 | 12711.39 |
| 10 | Sewage Treatment Plant | 0.01 | 0.12 | 98.31 | 0.00023 | 0.00199 | 1.57 | 99.88 |
| 11 | Effluent Treatment Plant | 0.05 | 0.39 | 308.75 | 0.01 | 0.11 | 83.05 | 391.80 |
| 12 | Water Treatment Plant | 0.13 | 1.12 | 882.35 | 0.10 | 0.89 | 705.88 | 1588.23 |
| 13 | Air Compressor | 0.10 | 0.89 | 706.41 | 0.73 | 6.35 | 5013.71 | 5720.12 |
| 14 | Cooling Tower | 2.66 | 22.95 | 18131.28 | 18.85 | 162.89 | 128685.23 | 146816.51 |
| 15 | Auxiliary Cooling Water | 0.48 | 4.17 | 3296.60 | 3.43 | 29.62 | 23397.32 | 26693.91 |
| Sub Total (Out-lying Auxiliary) | | 3.95 | 34.12 | 26955.77 | 26.80 | 231.59 | 182955.32 | 209911.08 |
| 16 | Abnormal Cyclic Operations | 0.23 | 1.99 | 1569.81 | 1.63 | 14.10 | 11141.58 | 12711.39 |
| Non-Industrial Activities | | | | | | | | |
| 17 | Non-Industrial Buildings | 0.17 | 1.43 | 1130.33 | 0.12 | 1.03 | 815.92 | 1946.24 |
| Other Activities | | | | | | | | |
| 18 | Miscellaneous | 1.37 | 11.84 | 9352.94 | 11.88 | 102.62 | 81073.43 | 90426.37 |
| Annual Total | | 13.32 | 115.05 | 90891.87 | 94.51 | 816.53 | 645097.41 | 735989.28 |

The total GHG emission in terms of CO₂e from 1 X 210 MW unit and 3 X 660 MW unit was 90891.87 MT/year and 645097.41 MT/year, respectively. Thus, the overall scope 2 emission from Koradi TPS was found to be 735989.28 MT/year for FY 2021-22.

The percentage wise bifurcation of indirect (scope 2) emission of Koradi TPS is shown in Figure 2-3.

Figure 2-3 Percentage wise bifurcation of indirect (scope 2) emission of Koradi TPS for the FY 2021-22



It can be observed from the above figure that the in-house auxiliary activities are the major contributor of scope 2 GHG emissions with around 57.20% CO₂e emission, followed by out-lying auxiliary activities, other miscellaneous, abnormal cyclic operations, and non-industrial buildings with 28.52 %, 12.29 %, 1.73 % and 0.26 % CO₂e emission, respectively.

2.2.3 Total GHG Emissions of Koradi TPS

As discussed in previous sections, GHG emission inventory was prepared for the various sources within Koradi TPS for the FY 2021-22. The total GHG emissions in terms of CO₂e from Koradi TPS is the total GHG emissions under Scope-1 & Scope-2, which are summarized in the Table 2-31.

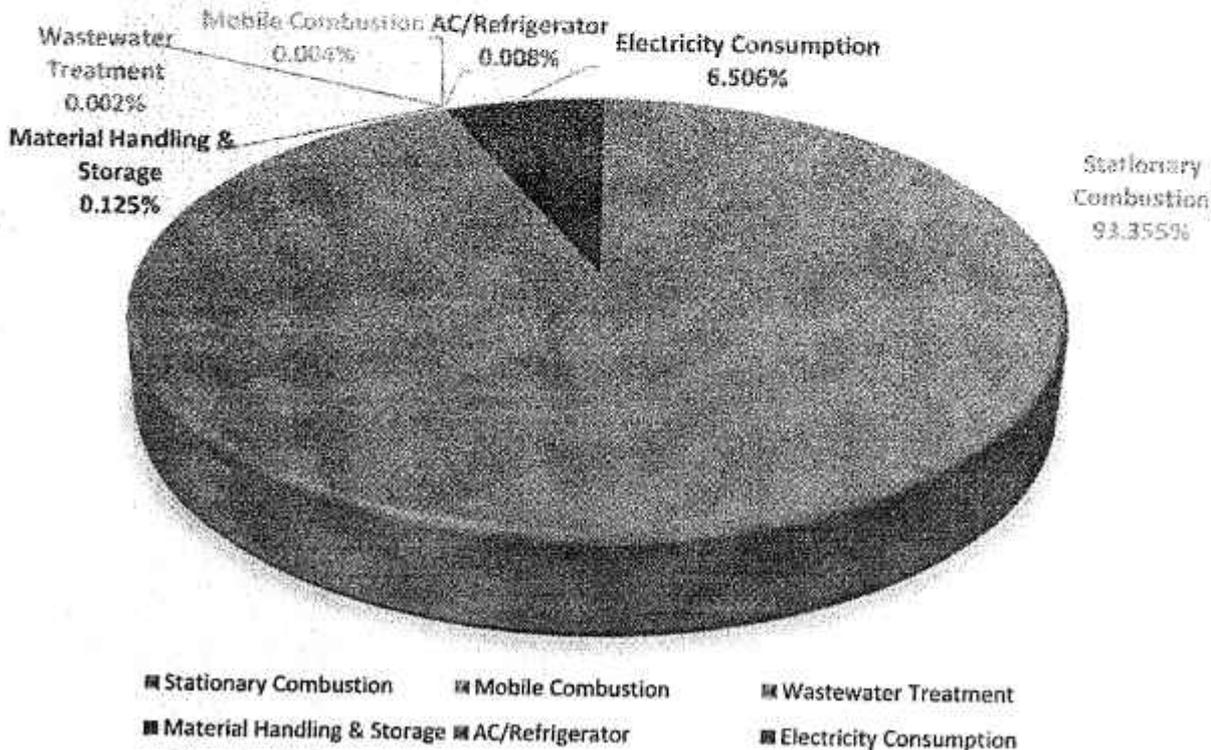
Table 2-31 Category wise total GHG emission in terms of CO₂e of Koradi TPS

| Sr. No. | Category | Source | CO ₂ e (MT/year) | | |
|-----------------------------------------------------------|----------|-------------------------------|-----------------------------|-----------------|-------------|
| | | | 1 X 210 MW unit | 3 X 660 MW unit | Total |
| 1 | Scope 1 | Stationary Combustion | 908724.14 | 9650162.28 | 10558886.42 |
| 2 | | Mobile Combustion | 132.05 | 324.15 | 456.20 |
| 3 | | Wastewater Treatment | 0 | 175.36 | 175.36 |
| 4 | | Material Handling and Storage | 1242.34 | 12907.48 | 14149.83 |
| 5 | | AC/Refrigerator | 510.84 | 443.72 | 954.56 |
| Scope 1 Emissions- Total CO ₂ e | | | 910609.38 | 9664012.99 | 10574622.36 |
| 6 | Scope 2 | Electricity Consumption | 90891.87 | 645097.41 | 735989.28 |
| Scope 2 Emissions- Total CO ₂ e | | | 90891.87 | 645097.41 | 735989.28 |
| Total CO ₂ e from Koradi TPS in the FY 2021-22 | | | 1001501.25 | 10309110.40 | 11310611.64 |

It can be observed from the above table that for the FY 2021-22, the total GHG emissions in terms of CO₂e from Koradi TPS was 1,13,106,011.64 MT. Out of the total GHG emissions, contribution of 1 X 210 MW and 3 X 660 MW unit was 10,01,501.25 MT (8.85 %) and 1,03,09,110.40 MT (91.15 %), respectively.

To understand the % contribution of each source in total GHG emissions in terms of CO₂e, a graphical representation is shown in Figure 2-4.

Figure 2-4 Percentage contribution of different sources in total GHG emissions from Koradi TPS for FY 2021-22



It can be observed from Figure 2-4 that in total GHG emissions in terms of CO₂e (1,13,10,611.64 MT/year) from Koradi TPS, 93.35 % was contributed by stationary combustion source alone i.e., due to the fuel combustion in boiler. The second highest contribution was electricity consumption (6.51 %), while the remaining sources of Koradi TPS have significantly low contribution.

2.2.4 GHG Emission in Terms of CO₂e Per Unit of Electricity Generation

In the FY 2021-22, the electricity generation by Koradi TPS was 838353.24 MWh/year and 12552350 MWh/year in 1 X 210 MW unit and 3 X 660 MW unit, respectively. The GHG emission in terms of CO₂e per MWh electricity generation from Koradi TPS was found to be 0.84 MT and bifurcation for both the units is shown in Table 2-32.

Table 2-32 CO₂e per MWh of electricity generation

| Unit | Electricity generation (MWh/year) | Total CO ₂ e (MT/year) | CO ₂ e/MW (MT/MWh) |
|--------------------------------|-----------------------------------|-----------------------------------|-------------------------------|
| 1 X 210 MW (Unit 6) | 838353.24 | 1001501.25 | 1.19 |
| 3 X 660 MW (Unit 8, 9 & 10) | 12552350.00 | 10309110.40 | 0.82 |
| Koradi TPS | 13390703.24 | 11310611.64 | 0.84 |

It can be observed from Table 2-32 that 1 MWh electricity generation emits 1.19 MT and 0.82 MT GHG emission in terms of CO₂e from 1 X 210 MW unit (sub-critical technology) and 3 X 660 MW unit (super-critical technology) respectively. Thus, it was found that the GHG emissions from 1 X 210 MW unit were 45.45 % higher than that from 3 X 660 MW unit.

The total GHG emission in terms of CO₂e due to coal handling and storage at Koradi TPS was 14149.83 MT/year for FY 2021-22.

2.2.1.5 AC/Refrigerators

Air-conditioners and refrigerators are used in Koradi TPS for various purposes like cold storage, in chiller units, industrial process refrigeration, commercial air conditioning system etc. These AC/Refrigerator units are responsible for GHG emission due to consumption of HFCs as refrigerants. The Global Warming Potential (GWP) of these HFCs varies from 140 to 11,700 times as compared to CO₂. Hence its potential impact on climate change is significant (IPCC, 2013).

AC/Refrigerators cause GHG emission during its manufacturing process, its leakage during the operational years and disposal at the end. The emission during manufacturing and disposal were not considered for the quantification of annual GHG emission from AC/Refrigerators. The GHG emissions due to leakage during operation were estimated based on the following equation.

$$OE = \sum_{i=1}^m (N_i * C_i * ALR_i * GWP * CF)$$

Where:

OE= Emissions from operation of AC/Refrigerators (CO₂ equivalent)

i= Type of AC/Refrigerators in the facility

N_{*i*}= The number of equipment of type *i* in the facility

C_{*i*}= Original refrigerant charge (kg)

ALR= The annual leakage rate from equipment (%)

GWP= The 100-year GWP of the refrigerant

CF= Conversion Factor (1 tonne= 1000 kg)

m- Number of different types of equipment produced

The Global Warming Potential (GWP) for the calculation of GHG emission from AC/ Refrigerators are taken from "IPCC: Climate Change 2013: IPCC Fifth Assessment Report (AR5)" (IPCC, 2013). The GWP of refrigerants used at Koradi TPS is depicted in Table 2-25.

Table 2-25 Refrigerant and their Global Warming Potential (GWP)

| Sr. No. | Type of refrigerant | GWP |
|---------|---------------------|-------|
| 1 | R-134a | 1,430 |
| 2 | R-22a | NA |
| 3 | R-407c | 1774 |
| 4 | R- 22 | 1810 |
| 5 | R- 32 | 675 |
| 6 | R- 410a | 2088 |
| 7 | R-404 | NA |

The data regarding type of refrigerants, their refrigerant charge (C_{*i*}) and annual leakage rate (ALR_{*i*}) was provided by the industry for most of the AC/Refrigerator, which is shown in Annexure.

For some AC/Refrigerator, these data were not available with the industry, and thus the average value of refrigerant charge and leakage rate was assumed from literature as shown in below Table 2-26.

Table 2-26 Average refrigerant charge and annual leakage rate for AC/Refrigerator

| AC/Refrigerator | Refrigerant Charge | ALR % |
|---------------------------|--------------------|-------|
| Residential/Commercial AC | 50.25 | 3 |

The GHG emissions in terms of CO₂e from 1 X 210 MW and 3 X 660 MW unit due to the refrigerant used in AC/Refrigerators is depicted in Table 2-27 and Table 2-28, respectively.

Table 2-27 GHG emissions from AC/Refrigeration units of 1 X 210 MW unit

| Sr. No. | Name of the equipment | Application | Operational units per year | Type of refrigerant | CO ₂ e (MT/year) |
|---------|-----------------------|----------------|----------------------------|---------------------|-----------------------------|
| 1 | H ₂ Dryer | Commercial AC | 2 | R-404 | NA |
| 2 | Instrument Air dryer | Commercial AC | 2 | R-134a | 0.34 |
| 3 | Various cabins | Residential AC | 47 | R-22 | 510.42 |
| 4 | Refrigerator | Commercial AC | 8 | R-134a | 0.08 |
| Total | | | | | 510.84 |

Table 2-28 GHG emissions from AC/Refrigeration units of 3 X 660 MW unit

| Sr. No. | Name of the Equipment | Application | Operational units per year | Type of refrigerant | CO ₂ e (MT/year) |
|---------|--------------------------------------|-------------------------------|----------------------------|---------------------|-----------------------------|
| 1 | SWAS Lab Chillers | NA | 3 | R-22a | NA |
| 2 | ESP PAC | NA | 9 | R-407c | 287.39 |
| 3 | CCR | Residential/ Commercial AC | 9 | R- 22 | 21.14 |
| 4 | L&T Office (Oil Lab) | | 3 | R- 22 | 8.19 |
| 5 | Coal Lab | | 2 | R- 22 | 3.75 |
| 6 | DG Set (C.H.) | | 2 | R- 22 | 5.46 |
| 7 | CUP Regeneration | | 2 | R- 22 | 5.46 |
| 8 | CW (P.H) | | 2 | R- 22 | 5.46 |
| 9 | TTWR | | 2 | R- 22 | 5.46 |
| 10 | DM Plant | | 2 | R- 22 | 5.46 |
| 11 | WTP | | 5 | R- 22 | 13.64 |
| 12 | AHP SWG | | 4 | R- 22 | 10.91 |
| 13 | FOPH One Day Tank | | 3 | R- 410a | 9.44 |
| 14 | AHP Control Room | | 5 | R- 22 | 13.64 |
| 15 | U#8 RIO Room | | 1 | R- 410a | 3.15 |
| 16 | U#9 RIO Room | | 2 | R- 22 | 5.46 |
| 17 | U#9 RIO Room | | 6 | R- 22 | 16.38 |
| 17 | Canteen | | 1 | R- 22 | 2.73 |
| 18 | ESP Rapper Room | | 6 | R- 22 | 16.37 |
| 19 | Firing Floor U9 & U10, AHP SWGR Room | Water Cooler | 3 | R-134a | 2.13 |
| 20 | Boiler Basement U9, AHP Room | Water Cooler | 2 | R-134a | 1.42 |
| 21 | Boiler Basement U10 | Water Cooler | 1 | R-134a | 0.71 |
| Total | | | | | 443.72 |

It can be observed from Table 2-27 Table 2-28 that the total GHG emission in terms of CO₂e due to use of AC/Refrigerators in 1 X 210 MW and 3 X 660 MW unit was 510.84 MT/year and 443.72 MT/year, respectively. The overall GHG emission in terms of CO₂e from AC/Refrigerators at Koradi TPS for FY 2021-22 was 954.56 MT/year.

Total Direct GHG emissions

The total direct GHG emission in terms of CO₂e from the Koradi TPS for FY 2021-22 was 1,05,74,622.36 MT/year. Out of the total GHG emissions under scope 1, GHG emission from 1 X 210 MW unit and 3 X 660 MW unit was found to be 9,10,609.38 MT and 96,64,012.99 MT, respectively.

2.2.2 Indirect (Scope 2) Emissions

The GHG emission due to auxiliary electricity consumption comes under indirect (Scope 2) emissions. The Koradi TPS consumes the electricity provided by Maharashtra State Electricity Transmission Company Limited (MSETC).

The emission factor defined for Indian electricity generation for NEWNE grid (North, East, West and North-East Grid) was considered for the quantification of GHG emissions due to the electricity consumption at Koradi TPS (Central Electricity Authority, 2021). It only includes the emission factor for CO₂ as the emissions of N₂O and CH₄ gases due to electricity consumption occurs in negligible amount. The emission factor for CO₂ emission due to electricity consumption is given in Table 2-29.

Table 2-29 Emission factor for CO₂ emission due to electricity consumption

| Activity | GHG | Emission factor | Unit |
|-------------------------|-----------------|-----------------|------------------------|
| Electricity consumption | CO ₂ | 0.79 | t CO ₂ /MWh |

As per the data provided by the industry for the FY 2021-22, the total electricity consumption in different activities at 1 X 210 MW unit and 3 X 660 MW unit were 115.05 MU and 816.58 MU, respectively.

As mentioned earlier, the industry does not maintain segregated electricity consumption data, process-wise or area-wise. According to the practice followed at the industry, the electricity consumption was monitored at only a few individual activities/ equipment's, such as at STP, ETP, ESP (1 X 210 MW unit) and at ETP, ESP (3 X 660 MW unit). Thus, for the remaining areas, theoretical electricity consumption was calculated based on the available literature.

The total auxiliary electricity consumption in Koradi TPS was bifurcated into electricity consumption in industrial, non-industrial and miscellaneous activities.

Industrial electricity consumption is calculated for electricity consumed in in-house (common) auxiliary activities, out-lying (individual) auxiliary activities, and abnormal cyclic operations. The in-house auxiliary activities include the boiler feed pump, condensate extraction pump, induced draft fan, forced draft fan, primary air fan (PA Fan), mills, and ESP's. The out-lying auxiliary activities include coal handling plant, ash handling plant, water/wastewater treatment plants (WTP/STP/ETP), air compressor, cooling tower, and auxiliary cooling water.

The (Mandi & Yaragatti, 2010) determined the auxiliary electricity consumption of 210 MW coal based thermal power plant based on various factors such as plant specific factors, grid specific factors and other external factors. This study was used as a reference study to determine the industrial electricity

consumption at 1 X 210 MW unit and 3 X 660 MW unit of Koradi TPS. The electricity consumption for WTP of both the units was determined based on the electricity consumption intensity (0.00023 kWh/l) for water treatment as per (Roorkee Water Conclave, 2020) report. The electricity consumption in STP of 3 X 660 MW unit was estimated based on actual electricity consumption in STP of 1 X 210 MW unit, as provided by the industry.

Non-industrial electricity consumption includes the electricity consumed in buildings/offices and canteen. The electricity consumption in non- industrial buildings was determined based on energy consumption factor given in (Centre for Science and Environment, 2014) report. The electricity consumption in non-industrial buildings was determined based on the total floor area of various non-industrial buildings which was provided by the industry and shown in Annexure. The energy consumption factor for building/offices and canteen were considered as 136.10 kWh/m²/year and 362.15 kWh/m²/year, respectively.

The remaining activities which consume electricity but cannot be identified are denoted as miscellaneous activities.

The total auxiliary electricity consumption and respective GHG emissions from the various activities for the FY 2021-22 are shown in Table 2-30.

Carbon Footprint Study for Koradi Thermal Power Station

Table 3-1 Carbon sequestration potential of tree species planted in the study area in terms of CO₂e per tree (in kg/year) and overall CO₂e (MT/year)

| Sr. No. | Tree Name | | Count of Trees | | | Diameter at Breast Height (DBH) in cm | | | CO ₂ e sequestered per tree (kg/year) | | | Total CO ₂ e sequestered (MT/Year) |
|---------|--------------------------|---------------|----------------|--------|----------|------------------------------------------|--------|----------|-----------------------------------------------------|----------|----------|-----------------------------------------------------|
| | Scientific Name | Common Name | 660 MW | 210 MW | Township | 660 MW | 210 MW | Township | 660 MW | 210 MW | Township | |
| 1 | Artocarpus heterophyllus | Fanas | 0 | 5 | 25 | 0 | 40 | 40 | 0 | 1615.04 | 1615.04 | 48.45 |
| 2 | Azadirachta indica | Kadulimb | 310 | 200 | 250 | 7.5 | 90 | 90 | 23.26 | 9794.31 | 9794.31 | 4414.65 |
| 3 | Bambusa balcooa | balcooa | 19000 | 0 | 0 | 6.83 | 0 | 0 | 21.31 | 0 | 0 | 404.95 |
| 4 | Bambusa bambos | katang | 19000 | 0 | 0 | 7.18 | 0 | 0 | 22.17 | 0 | 0 | 421.27 |
| 5 | Bambusa Tulda | tulda | 2000 | 0 | 0 | 5.44 | 0 | 0 | 21.26 | 0 | 0 | 42.52 |
| 6 | Bambusa vulgaris yellow | yellow bamboo | 2000 | 0 | 0 | 5.94 | 0 | 0 | 20.66 | 0 | 0 | 41.32 |
| 7 | Chakas | Chakas | 90 | 0 | 0 | 7.5 | 0 | 0 | 23.26 | 0 | 0 | 2.09 |
| 8 | Chichwa | Chichwa | 0 | 100 | 10000 | 0 | 95 | 30 | 0.00 | 10994.26 | 812.69 | 9226.36 |
| 9 | Delonix regia | Gulmohar | 390 | 0 | 0 | 7.5 | 0 | 0 | 23.26 | 0 | 0 | 9.07 |
| 10 | Eucalyptus globulus | Nilgiri | 0 | 50 | 250 | 0 | 120 | 120 | 0.00 | 18035.90 | 18035.90 | 5410.77 |
| 11 | Ficus benghalensis | Wad | 130 | 50 | 50 | 7.5 | 104 | 104 | 23.26 | 13329.21 | 13329.21 | 1335.94 |
| 12 | Ficus religiosa | Pimpal | 130 | 50 | 200 | 7.5 | 150 | 150 | 23.26 | 28778.02 | 28778.02 | 7197.53 |
| 13 | Leucaena leucocephala | Subabul | 0 | 10000 | 15000 | 0 | 25 | 25 | 0.00 | 515.71 | 515.71 | 12892.74 |
| 14 | Mangifera indica | Aamba | 90 | 150 | 150 | 7.5 | 60 | 60 | 23.26 | 4053.24 | 4053.24 | 1218.06 |
| 15 | Millettia pinnata | Karanji | 40 | 350 | 300 | 7.5 | 70 | 70 | 23.26 | 5689.09 | 5689.09 | 3698.84 |
| 16 | Mimusops elengi | Bakud | 40 | 0 | 0 | 7.5 | 0 | 0 | 23.26 | 0 | 0 | 0.93 |
| 17 | Peltophorum pterocarpum | Peltra Farm | 180 | 0 | 0 | 7.5 | 0 | 0 | 23.26 | 0 | 0 | 4.19 |
| 18 | Saraca asoca | Ashoka | 0 | 150 | 50 | 0 | 20 | 20 | 0.00 | 288.18 | 288.18 | 57.64 |
| 19 | Spathodea campanulata | Spethodia | 50 | 0 | 0 | 7.5 | 0 | 0 | 23.26 | 0 | 0 | 1.16 |
| 20 | Syzygium cumini | Jambhul | 90 | 25 | 100 | 7.5 | 110 | 110 | 23.26 | 15010.87 | 15010.87 | 1878.45 |
| 21 | Tamarindus indica | Chinch | 50 | 0 | 0 | 7.5 | 0 | 0 | 23.26 | 0 | 0 | 1.16 |
| 22 | Tectona grandis | Sagwan | 0 | 60 | 700 | 0 | 40 | 30 | 0.00 | 1615.04 | 812.69 | 665.79 |
| 23 | Terminalia arjuna | Arjun | 170 | 0 | 0 | 7.5 | 0 | 0 | 23.26 | 0.00 | 0.00 | 3.95 |
| 24 | Terminalia catappa | Badam | 40 | 150 | 250 | 7.5 | 50 | 50 | 23.26 | 2695.22 | 2695.22 | 1079.02 |
| 25 | Tibobia | Tibobia | 190 | 0 | 0 | 7.5 | 0 | 0 | 23.26 | 0.00 | 0.00 | 4.42 |
| 26 | Vachellia nilotica | Babul | 0 | 20000 | 12000 | 0 | 30 | 30 | 0 | 812.69 | 812.69 | 26006.19 |
| 27 | Ziziphus mauritiana | Bori | 0 | 1500 | 100 | 0 | 40 | 40 | 0 | 1615.04 | 1615.04 | 2584.06 |
| 28 | Unidentified species | - | 0 | 15000 | 1000 | 0 | 25 | 25 | 0 | 515.71 | 515.71 | 8251.35 |
| Total | | | 455772 | | | 66.81* | | | 5137.497 | | | 2341527.39 |
| | | | 5,93,077 | | | | | | | | | 2428430.28 |

3 Carbon Sequestration

Carbon sequestration is the process of capturing and storing atmospheric carbon dioxide. It prevents CO₂ from entering the atmosphere. Carbon sequestration can occur either through storing CO₂ in vegetation or in geological formations (rocks). Vegetation cover, particularly trees, act as a sink for CO₂ by fixing carbon during photosynthesis and storing excess carbon as biomass. The carbon stored by trees is retained as live biomass for a very long duration with little leakage into the atmosphere (Sharma, et al., 2021). The rate of carbon sequestration by trees depends on size, age, diameter, and growth rate of trees.

Koradi TPS has grown a vegetation cover having around 5,93,927 trees including various species in both the units (1 X 210 MW and 3 X 660 MW) and their township area. In this study, the carbon sequestration potential of the tree species in 3 X 660 MW unit, 1 X 210 MW unit and TPS township area is estimated to evaluate the amount of carbon sequestered annually by the existing vegetation cover.

3.1 Methodology

A predefined methodology was adopted for estimation of carbon sequestration potential of trees planted within the boundary of the study area. For this study, the trees greater than or equal to 5 cm girth at breast height (1.37 m) were considered for the estimation of carbon sequestration potential of vegetation cover (Sharma, et al., 2020).

Methodology adopted for this study is briefly described in this section.

- The data required to estimate the sequestration potential of trees was obtained from the industry. It includes the name of tree species, number of trees planted for a particular species, their average age, height, and diameter at breast height (DBH).
- Based on the data obtained from the industry, the above ground biomass (AGB) and below-ground biomass (BGB) were estimated.
- Above-ground and below-ground biomass were calculated separately using allometric equations (Sharma, et al., 2020). AGB consists of all the biomass that is above the soil and is evaluated using the DBH. BGB consists of biomass that grows below soil, it majorly comprises of live roots having diameter greater than 2 mm. Total Biomass (TB) is calculated using AGB and BGB of a given tree.
- Finally, the CO₂ sequestered by a tree annually is estimated based on the total available biomass. Generally, for any plant species, 50% of its biomass is its carbon content (Sharma, et al., 2021). Total annual carbon sequestration potential of all the trees is determined based on the number of trees of each species and its biomass.

3.2 Carbon Sequestration Potential

The carbon sequestration potential of the trees planted by Koradi TPS within 1 X 210 MW unit, 3 X 660 MW unit and township area are determined in terms of CO₂e sequestered per tree (in kg/year) and overall CO₂e sequestered (MT/year) by all the trees, which are presented in Table 3-1.

**Note: For the unidentified species, an average DBH value (average of the old species planted by the industry) was considered for the calculation purpose as the industry couldn't provide the DBH value for the same.*

*The industry has planted a total of 5,93,927 number of trees in 3 X 660 MW unit, 1 X 210 MW unit and TPS township. As observed from the Table 3-1, there are a total 27 identified tree species in the study area, out of which the carbon sequestration potential per tree was found to be highest for trees belonging to species *Ficus religiosa* (Pimpal) followed by *Eucalyptus globulus* (Nilgiri), and *Syzygium cumini* (Jambhul).*

*Furthermore, the carbon sequestration potential of trees depends on their DBH. For instance, the trees belonging to specie *Ficus religiosa* planted in 3 X 660 MW unit (with 7.5 cm diameter) has a sequestration potential of 23.26 CO₂e/tree (kg/year), however same specie planted in 1 X 210 MW unit (with 150 cm diameter) has a sequestration potential of 28778.02 CO₂e/tree (kg/year).*

Based on the assessment, it was observed that the trees planted in 1 X 210 MW unit and TPS township are older and thus have larger DBH, consequently having higher carbon sequestration potential, while as 3 X 660 MW unit is recently commissioned, the trees planted in 660 MW plant have smaller DBH and thus have low carbon sequestration potential.

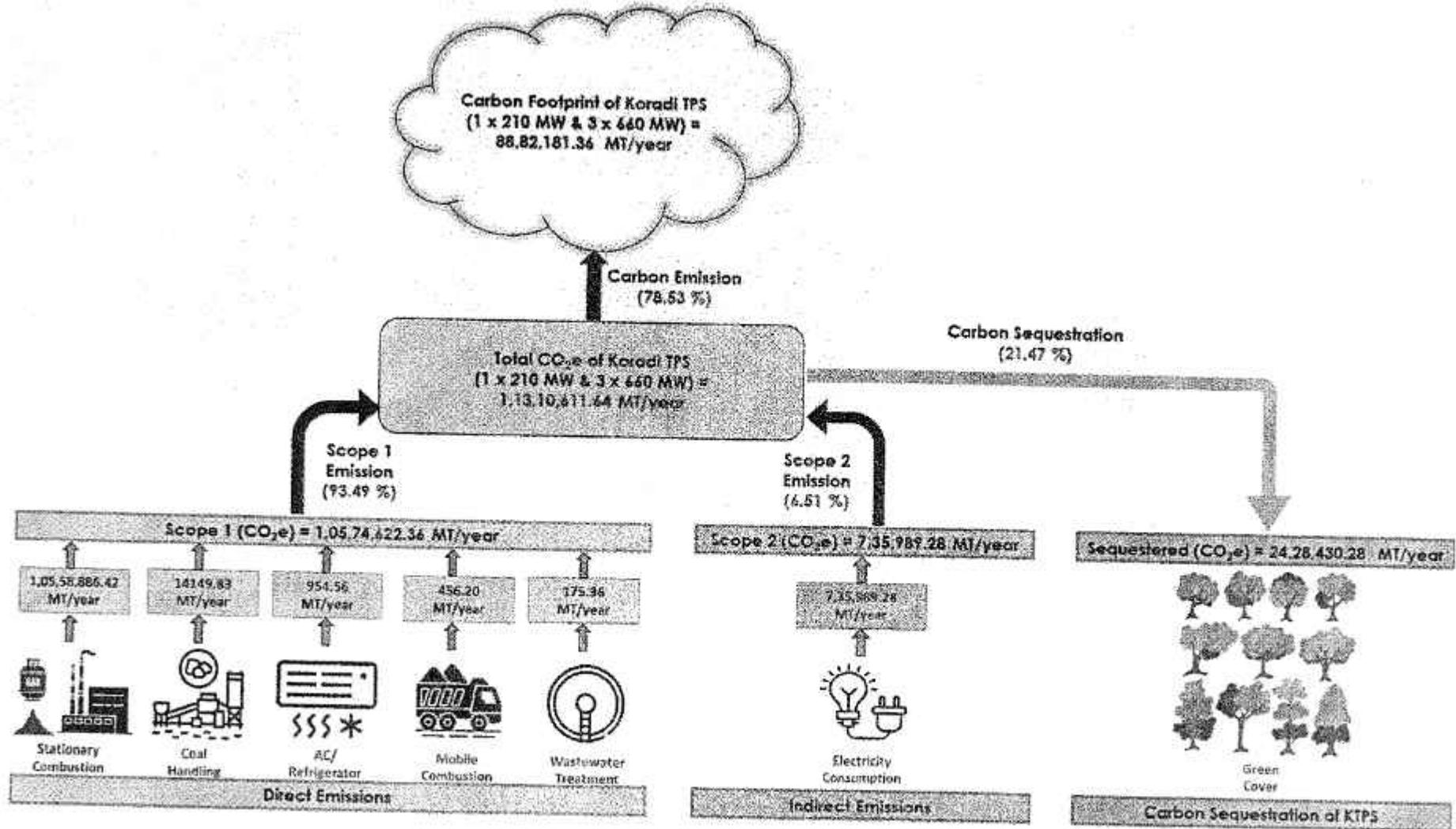
Hence, the total carbon sequestration potential of the vegetation cover provided in 1 X 210 MW unit, 3 X 660 MW unit and TPS township was found to be 2428430.28 MT CO₂e per year, which is around 21.47 % of the total GHG emissions (1,13,10,611.64 MT CO₂e per year) from Koradi TPS.

4 Total Carbon Footprint of Koradi TPS

For the FY 2021-22, the total CO₂e emission from Koradi TPS was found to be 1,13,10,611.64 MT CO₂e per year, while the vegetation cover provided by the industry has a total carbon sequestration of 24,28,430.28 MT CO₂e per year. Thus, total carbon footprint of the Koradi TPS was found to be 88,82,181.36 CO₂e per year.

The overall carbon footprint of Koradi TPS for the FY 2021-22 is shown in below Figure 4-1.

Figure 4-1 Overall carbon footprint of Koradi TPS



5 Control Scenario to Reduce Carbon Footprint

The type and quality of coal consumed, and combustion process employed are the factors that significantly govern the amount of GHG emissions from the industry. Based on the present assessment, the maximum contribution in overall carbon footprint of the industry was from stationary combustion units (especially boilers). Remaining sources such as auxiliary electricity combustion, coal handling and storage, AC and refrigerators, mobile combustion sources, and wastewater treatment systems have small contribution in overall carbon footprint of the Koradi TPS. Based on the theoretical calculations (refer Chapter 4) the overall carbon footprint (CO₂e) of the Koradi TPS was 8882181.36 MT/year after considering carbon sequestration by vegetation cover.

In the present scenario, 1 X 210 MW unit and 3 X 660 MW unit are based on the sub-critical and super-critical technologies, respectively. In order to control the carbon emission from the TPS, four control scenarios are generated to reduce CO₂ emissions. The theoretical calculations were carried out to predict the percentage reduction in CO₂ emission if these control strategies are adopted. All the control scenarios are discussed in detail in the following section.

5.1 Control Scenario I: Biomass Co-firing

Ministry of Power (MoP) is encouraging the use of biomass co-firing along with coal in thermal power plants. MoP have issued a policy "Biomass Utilization for Power Generation through co-firing in Coal-based power plants" in 2017 wherein coal based thermal power plants were advised to use 5-10 % of biomass pellets after assessing the technical feasibility. This policy was further revised in 2021 and a mandatorily use of 5-7 % of co-firing is advised to coal based thermal power plants, depending on their milling system. The information on permissible quality of agro residue- based biomass (non-torried and torried) for co-firing is provided by (Central Electricity Authority, 2018).

Co-firing of biomass with coal is a rapid and economical method for decarbonizing power plants to some extent and reduce their coal consumption. In order to reduce coal consumption and CO₂e emitted due to burning of coal in boilers, Control Scenario I is generated considering 6 % biomass co-firing along with coal. The CO₂e emitted from the Koradi TPS in the present scenario and % reduction in CO₂e after implementation of the Control Scenario I is depicted in Table 5-1.

Table 5-1 Control Scenario I and respective percentage reduction in emission of CO₂e

| Control Scenarios and respective % reduction in CO ₂ e (MT/year) | Existing and Proposed Practice | CO ₂ e (MT/year) | | |
|-----------------------------------------------------------------------------|-----------------------------------|-----------------------------|-------------|-------------|
| | | 1 X 210 MW | 3 X 660 MW | Total |
| Present Scenario | 100% Coal | 1001501.25 | 10309110.40 | 11310611.64 |
| Control Scenario I- Biomass Co-firing | Considering 6 % biomass co-firing | 947877.67 | 9732251.04 | 10680128.71 |
| Reduction in emissions w.r.t present scenario (MT) | | 53623.58 | 576859.36 | 630482.93 |
| % Reduction in emission load w.r.t present scenario | | -5.35 % | -5.60 % | -5.57 % |

It can be observed from above table that if the industry adopts Control Scenario-I, the CO₂e emitted from 1 X 210 MW and 3 X 660 MW units will reduce by 53623.58 MT/year (5.35 % reduction) and

576859.36 MT/year (5.60 % reduction), respectively. Consequently, the total CO₂e from the Koradi TPS will be reduced by 630482.93 MT/year (5.57 % reduction).

5.2 Control Scenario II: Solar Energy

Solar energy is a renewable form of energy that can be harnessed using photovoltaics, solar heating and cooling systems or by concentrating solar power. It is a green and clean energy. Solar energy has a great potential to replace conventional fossil fuels-based energy which will lead to reduction of the GHG emissions due to burning of fossil fuels.

In order to reduce GHG emission (indirect emissions) arising from the auxiliary electricity consumption, Control Scenario-II was generated considering installation of 32 MW solar power plant for out-lying auxiliaries and non-industrial buildings in Koradi TPS. In this Control Scenario, use of solar electricity instead of coal-based electricity was considered for out-lying auxiliary activities and non-industrial buildings to reduce the scope 2 GHG emissions. In the present assessment (Refer Section 2.2.2), it was observed that out-lying auxiliary activities consumes approximately 34.12 MU/year and 231.59 MU/year in 1 X 210 MW and 3 X 660 MW units, respectively. Furthermore, non-industrial buildings consume about 1.43 MU/year and 1.03 MU/year in 1 X 210 MW and 3 X 660 MW units, respectively. Thus, in total 28.78 % (268.17 MU/year) of total auxiliary electricity consumption has the potential to be replaced by solar.

Note: As per (Central Electricity Authority, 2021), around 0.79 MT of CO₂ emission per MWh can be reduced on using solar based electricity for auxiliary consumption instead of coal-based electricity.

The CO₂e emitted from the Koradi TPS in the present scenario and respective % reduction in CO₂e after implementation of the Control Scenario II is depicted in Table 5-2.

Table 5-2 Control Scenario II and respective percentage reduction in emissions of CO₂e

| Control Scenario II and respective % reduction in CO ₂ e (MT/year) | Existing and Proposed Practice | CO ₂ e (MT/year) | | |
|-------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|-----------------------------|-------------|-------------|
| | | 1 X 210 MW | 3 X 660 MW | Total |
| Present Scenario | 100% Coal | 1001501.25 | 10309110.40 | 11310611.64 |
| Control Scenario II- Solar Technology | Considering Installation of 32 MW solar power plant for out-lying auxiliaries and non-industrial buildings | 973415.16 | 10125339.16 | 11098754.32 |
| Reduction in emissions w.r.t present scenario (MT) | | 28086.09 | 183771.23 | 211857.33 |
| % Reduction in emission load w.r.t present scenario | | -2.80 | -1.78 | -1.87 |

It can be observed from above table that if the industry adopts Control Scenario-II, the CO₂e emission from 1 X 210 MW and 3 X 660 MW units will reduce by 28086.09 MT/year (2.80 % reduction) and 183771.23 MT/year (1.78 % reduction), respectively. Consequently, the total CO₂e from the Koradi TPS will be reduced by 211857.33 MT/year (1.87 % reduction).

5.3 Control Scenario III: Carbon Offsetting

Carbon offsetting is the process of reducing GHG emissions or sequestering CO₂ from atmosphere, in order to compensate for the emissions that occur elsewhere. Since climate change is not a localised

problem and GHG emitted is spread throughout the atmosphere, undertaking carbon offsetting elsewhere also helps in significant reduction of GHG emissions. Carbon offsetting is a process that can be undertaken by individuals/organisations to reduce their carbon footprint. Carbon offsetting is based on the RRC approach i.e., Replace (replacing fossil fuel by clean renewable energy), Reduce (reducing fossil fuel consumption which eventually reduces the GHG emission) & Capture (capturing emissions by using trees and any other technique) (UNFCCC, 2022). A few initiatives that can be implemented by organizations for carbon offsetting include implementation of renewable energy (such as solar technology, biogas plant), tree plantation, etc.

Solar power is a renewable source of energy, replacing coal-based electricity with solar electricity leads to the reduction of GHG emissions due to coal consumption. Similarly, biogas plant is also a renewable form of energy and have a lower or negligible carbon footprint as the amount of carbon dioxide released in biogas generation is equal to the amount of carbon dioxide fixed in biodegradable feedstock, resulting in no net increase in atmospheric carbon dioxide emissions. Installing biogas plants in villages will not only help to curb GHG emissions but will also help to manage their organic waste efficiently. Furthermore, tree plantation is another important carbon offsetting activity which help to sequester atmospheric CO₂ emissions effectively.

In order to compensate their carbon footprint, Koradi TPS can adopt abovementioned carbon offsetting activities. Control Scenario III is generated considering three different cases of adopting the carbon offsetting activities.

Case I: Installation of 100 MW (1X100 MW or 4X25 MW or 10X10 MW) capacity solar power plant in phases. It is considered that electricity supply for households in villages is fulfilled by solar energy, instead of fossil-fuel based electricity. The MSEDCL- rural electricity consumption is 2.16 kWh/day/household (MoP, 2019). It indicates that energy demand of each rural household in Maharashtra is 0.09 kW per day. As per (Central Electricity Authority, 2021), around 0.79 MT of CO₂ emission per MWh can be reduced on using solar based electricity instead of coal-based electricity.

Case II: Installation of biogas plant for 100 villages (considering 250-300 households in each village). It is considered that if a biogas plant is installed for a rural household (having 4 cattle), it will produce around 2200 m³ of biogas and 1725 kg of biogas slurry per year. This will replace 5,535 kg firewood and 4,400 kg cattle dung cake used as fuel and 119 kg of NPK fertilizer per year, which will eventually lead to the reduction of 9.7 MT/year GHG emission in terms of CO₂e (Pathak, et al., 2008). Thus, installing biogas plants in villages will help to curb GHG emissions due to fuel burning and application of chemical fertilizer.

Case III: Developing a green cover in barren/degraded land by planting 50,000 trees each year for next 4 consecutive years, i.e., overall plantation of 2,00,000 trees. Six types of tree species (having high carbon sequestration potential) were considered for plantation namely- Kadulimb, Wad, Pimpal, Aamba, Karanji, and Jambhul. Two cases - Case-III (A) and (B) were generated, i.e., the CO₂ sequestration potential by green cover in year 2030 and year 2035 respectively.

Note- In case III (A) and case III (B) plantation scenario, the CO₂ sequestered by tree species is calculated based on average DBH of that species as per the data provided by the industry. Furthermore, it is considered that the planation will start this year (2023) itself.

The CO₂e emission in the present scenario and after implementation of the Control Scenario III along with the percentage reduction in CO₂e is depicted in Table 5-3.

Table 5-3 Control Scenarios III and respective percentage reduction in emissions of CO₂e

| Control Scenario III and respective % reduction in CO ₂ e (MT/year) | Existing and Proposed Practice | Koradi TPS CO ₂ e (MT/year) |
|--------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|----------------------------------------|
| Present Scenario | | 11310611.64 |
| Case I- Solar Technology | Considering Installation of 100 MW (1X100 MW or 4X 25 MW or 10X 10 MW) capacity solar power plant in phases | 10600578.60 |
| Reduction in emission load w.r.t present scenario (MT) | | 710033.04 |
| % Reduction in emission load w.r.t present scenario | | -6.20 % |
| Case II- Biogas Technology | Considering installation of biogas plants for 100 villages (assuming 250-300 households in each village) | 11068111.64 |
| Reduction in emission load w.r.t present scenario (MT) | | 242500.00 |
| % Reduction in emission load w.r.t present scenario | | -2.14 % |
| Case III- Tree Plantation | Considering plantation of 2,00,000 trees for next 4 year (planting 50,000 trees per year) | |
| Case III (A)- Sequestration by 2030 | | 10971287.42 |
| Reduction in emission load w.r.t present scenario (MT) | | 339324.22 |
| % Reduction in emission load by 2030 w.r.t present scenario | | -3.00 % |
| Case III (B)- Sequestration by 2035 | | 10631963.21 |
| Reduction in emission load w.r.t present scenario (MT) | | 678648.43 |
| % Reduction in emission load by 2035 w.r.t present scenario | | -6.00% |

It can be observed from the above table that if industry implements Case I of Control Scenario III, the CO₂e emission from Koradi TPS will reduce by 710033.04 MT/year (6.2 % reduction). Similarly, if the industry implements Case II of Control Scenario III, the CO₂e emission from Koradi TPS will reduce by 242500.00 MT/year (2.14 % reduction). Moreover, if the industry adopts Case III, then the CO₂e emissions from Koradi TPS will reduce by 339324.22 MT/year (3.00 % reduction) and 678648.43 MT/year (6.00 % reduction) by year 2030 and year 2035, respectively.

5.4 Control Scenario IV: Coal Beneficiation

Coal with high ash content (> 30 %) leads to difficulty in pulverization, causes poor emissivity and flame temperature, low radiative transfer, and generation of excessive amounts of fly ash that contains significant amount of un-burnt carbon. This results in rise in the auxiliary power consumption and reduction in the efficiency of the power plant which ultimately leads to higher CO₂ emissions from the power plant (Trivedi, 2020). Hence, clean or upgraded (washed) coal shall be used to reduce the CO₂ emissions. Coal preparation, or coal beneficiation process is used for improving the coal quality. This process involves separating inorganic impurities from the raw mined coal, which results in its improved combustion characteristics.

Based on the theoretical calculations, in present scenario the CO₂e emitted from 1 X 210 MW and 3 X 660 MW units are 1001501.25 MT/year and 10309110.40 MT/year, respectively. The average ash content of bunkered coal in Koradi TPS was 48.68 % and 35.2 % for 1 X 210 MW and 3 X 660 MW units, respectively.

Note: The ash content in coal used in 1 X 210 MW unit is considerably higher (14.68 %) than the permissible limit (34 % ash content, as per CTO). While, in 3 X 660 MW unit, the ash content is only 1.2% higher than the consented limit.

According to (Trivedi, 2020), approximately 2–3 percent reduction can be observed in CO₂e emissions after using washed (beneficiated) coal with 34 % ash content instead of coal with 42 % ash content. In order to reduce CO₂e emitted due to higher ash content in coal, Control Scenario IV was generated considering use of washed (beneficiated) coal with 34 % ash content in boilers. The CO₂e emitted from the Koradi TPS in the present scenario and % reduction in CO₂e after implementation of the Control Scenario I is depicted in Table 5-4.

Table 5-4 Control Scenario IV and respective percentage reduction in emission of CO₂e

| Control Scenarios and respective % reduction in CO ₂ e (MT/year) | Existing and Proposed Practice | CO ₂ e (MT/year) | | |
|-----------------------------------------------------------------------------|---------------------------------------------------------------------|-----------------------------|-------------|-------------|
| | | 1 X 210 MW | 3 X 660 MW | Total |
| Present Scenario | Coal with A % = 48.68 % (1 X 210 MW), and A % = 35.2 % (3 X 660 MW) | 1001501.25 | 10309110.40 | 11310611.64 |
| Control Scenario IV - Coal Beneficiation | Use of washed (beneficiated) coal with A % = 34 % | 960807.19 | 10273344.94 | 11234152.13 |
| Reduction in emissions w.r.t present scenario (MT) | | 40694.06 | 35765.45 | 76459.51 |
| % Reduction in emissions w.r.t present scenario | | -4.06 % | -0.35 % | -0.68 % |

'A%' is the Ash content of coal

It can be observed from above table that if the industry adopts Control Scenario IV, the overall CO₂e from 1 X 210 MW and 3 X 660 MW units will reduce by 40694.06 MT/year (4.06 % reduction) and 35765.45 MT/year (0.35 % reduction), respectively. Consequently, the total CO₂e from the Koradi TPS will reduce by 76459.51 MT/year (0.68 % reduction).

5.5 Control Scenario V: Post Combustion CO₂ Capture

Based on the assessment study, it was observed that CO₂ emissions were mainly contributed by combustion processes. Carbon Capture Utilization and Storage (CCUS) technologies are being explored worldwide to capture CO₂ emissions from combustion processes. It includes carbon capture through capture technologies such as oxyfuel combustion and post-combustion CO₂ removal followed by compression of gas to form a dense fluid which ease the transport and storage of the captured CO₂. The captured CO₂ is transported to storage sites via pipelines, road trucks or ships and can reduce 85–95 % of CO₂ emissions (Dennis, et al., 2014).

To prevent CO₂ emissions from being released into atmosphere, Control Scenario-V was generated considering implementation of post combustion CO₂ capture technology. Three cases were considered for post combustion CO₂ capture using three CO₂ separation methods viz: absorption, adsorption, and membrane separation. The efficiency of absorption with MEA (Monoethanolamine) and adsorption technology (Pressure Swing Adsorption technology) is considered as 90 % and 85 % respectively, while that of membrane separation technology varies between 82 % and 88 % (Dennis, et al., 2014). The CO₂e emission in the present scenario and after implementation of the Control Scenario V along with the percentage reduction in CO₂e is depicted in Table 5-5.

Table 5-5 Control Scenario V and respective percentage reduction in emissions of CO₂e

| Control Scenario V and respective % reduction in CO ₂ e (MT/year) | Existing and Proposed Practice | CO ₂ e (MT/year) | | |
|-----------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|-----------------------------|-------------|-------------|
| | | 1 X 210 MW | 3 X 660 MW | Total |
| Present Scenario | Sub-critical (1 X 210 MW), Super-critical (3 X 660 MW), no CO ₂ capture technology | 1001501.25 | 10309110.40 | 11310611.64 |
| Case I - Post combustion CO ₂ capture using absorption technology | Considering the CO ₂ capture efficiency of absorption technology to be 90 % | 203578.55 | 1725401.38 | 1928979.93 |
| Reduction in emissions w.r.t present scenario (MT) | | 797922.70 | 8583709.02 | 9381631.71 |
| % Reduction in emission load w.r.t present scenario | | -79.67 % | -83.26 % | -82.95 % |
| Case II - Post combustion CO ₂ capture using adsorption technology | Considering the CO ₂ capture efficiency of adsorption technology to be 85 % | 247907.59 | 2202274.10 | 2450181.69 |
| Reduction in emissions w.r.t present scenario (MT) | | 753593.66 | 8106836.30 | 8860429.95 |
| % Reduction in emission load w.r.t present scenario | | -75.25 % | -78.64 % | -78.34 % |
| Case III - Post combustion CO ₂ capture using membrane separation technology | Considering the CO ₂ capture efficiency of membrane technology to be 85 % (average of 82-88 %) | 247907.59 | 2202274.10 | 2450181.69 |
| Reduction in emissions w.r.t present scenario (MT) | | 753593.66 | 8106836.30 | 8860429.95 |
| % Reduction in emission load w.r.t present scenario | | -75.25 % | -78.64 % | -78.34 % |

It is evident from above table that if industry implements Control Scenario V (Case I), the CO₂e emissions from 1 X 210 MW and 3 X 660 MW units will reduce by 797922.70 MT/year (79.67 % reduction) and 8583709.02 MT/year (83.26 % reduction), respectively. Consequently, the total CO₂e from the Koradi TPS will reduce by 9381631.71 MT/year (82.95 % reduction).

If the industry implements Case II or Case III of Control Scenario V, the CO₂e emissions from 1 X 210 MW and 3 X 660 MW units will reduce by 753593.66 MT/year (75.25 % reduction) and 8106836.30 MT/year (78.64 % reduction), respectively in both cases. Consequently, the total CO₂e from the Koradi TPS will reduce by 8860429.95MT/year (78.34 % reduction).

5.6 Control Scenario VI: IGCC with and without Pre-Combustion CO₂ Capture

In an integrated gasification combined cycle (IGCC) system, coal is partially oxidized at high temperature and pressure in the presence of oxygen or air to produce synthesis gas or syngas. Syngas majorly comprises of carbon monoxide (CO) and hydrogen (H₂). The CO in syngas is converted to CO₂ through a water-gas shift reaction. This concentrated gas stream is decarbonized using pre-combustion CO₂ capture technologies. The captured CO₂ is transported for utilization in a suitable facility or can be stored at storage sites while the H₂ gas is used as fuel for downstream applications. The combustion efficiency of IGCC technology is about 50% and this is the highest among any other coal-based technologies available so far. Furthermore, IGCC system enables the use of different fossil feedstocks such as biomass, agricultural, forestry, municipal and refinery wastes (TERI, 2015).

As discussed earlier, 1 X 210 MW and 3 X 660 MW units are based on sub-critical and super-critical technology, respectively. Sub-critical technology is an obsolete technology with efficiency varying between 35% to 38%, which is the least among all the technologies available. While the efficiency of super-critical technology varies between 42% to 43%.

To prevent CO₂ emissions from being released into atmosphere, Control Scenario VI is generated considering two cases. In Case I, implementation of IGCC without pre-combustion CO₂ capture technology is considered for both 1 X 210 MW and 3 X 660 MW units. Replacing a subcritical unit and super-critical unit with IGCC can reduce CO₂ emissions up to 30% and 17%, respectively (Trivedi, 2020). While in Case II, implementation of IGCC with pre-combustion CO₂ capture using absorption technology (with 90 % efficiency) is considered (Dennis, et al., 2014). The CO₂e emission in the present scenario and after implementation of the Control Scenario V along with the percentage reduction in CO₂e is depicted in Table 5-6.

Table 5-6 Control Scenarios VI and respective percentage reduction in emissions of CO₂e

| Control Scenario VI and respective % reduction in CO ₂ e (MT/year) | Existing and Proposed Practice | CO ₂ e (MT/year) | | |
|-------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|-----------------------------|-------------|-------------|
| | | 1 X 210 MW | 3 X 660 MW | Total |
| Present Scenario | Sub-critical (1 X 210 MW), Super-critical (3 X 660 MW), no CO ₂ capture technology | 1001501.25 | 10309110.40 | 11310611.64 |
| Case I – IGCC without CO₂ capture technologies | Considering up to 30% and 17 % CO ₂ emission reduction for subcritical unit and super-critical unit, respectively | 735527.01 | 8687743.14 | 9423270.15 |
| Reduction in emissions w.r.t present scenario (MT) | | 265974.23 | 1621367.26 | 1887341.49 |
| % Reduction in emission load w.r.t present scenario | | -26.56 % | -15.73 % | -16.69 % |
| Case II – IGCC with Pre-Combustion CO₂ capture | Considering the CO ₂ capture efficiency of absorption technology to be 90 % | 176981.13 | 1563264.65 | 1740245.78 |
| Reduction in emissions w.r.t present scenario (MT) | | 824520.12 | 8745845.75 | 9570365.86 |
| % Reduction in emission load w.r.t present scenario | | -82.33 % | -84.84 % | -84.61 % |

It can be observed from above table that if industry implements Case I of Control Scenario VI, the CO₂e emissions from 1 X 210 MW and 3 X 660 MW units will reduce by 265974.23 MT/year (26.56 % reduction) and 1621367.26 MT/year (15.73 % reduction), respectively. Consequently, the total CO₂e emission from the Koradi TPS will reduce by 1887341.49 MT/year (16.69 % reduction).

If the industry implements Case II of Control Scenario VI, the CO₂e emissions from 1 X 210 MW and 3 X 660 MW units will further reduce by 824520.12 MT/year (82.33 % reduction) and 8745845.75 MT/year (84.84 % reduction), respectively in both cases. Consequently, the total CO₂e from the Koradi TPS will reduce by 9570365.86 MT/year (84.61 % reduction).

5.7 Summary of Control Scenarios

Based on the various mitigation measures that can be adopted to reduce the carbon footprint of the Koradi TPS, the control scenarios and the respective percentage reduction in CO₂e emissions on implementing these scenarios are summarised in Table 5-7.

Table 5-7 Control scenarios and respective percentage reduction in emission of CO₂e

| Control Scenarios | Existing and Proposed Practice | % Reduction in CO ₂ e | | |
|-----------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|----------------------------------|------------|----------|
| | | 1 X 210 MW | 3 X 660 MW | Total |
| Control Scenario I- Biomass Co-firing | Considering 6 % biomass co-firing | -5.35 % | -5.60 % | -5.57 % |
| Control Scenario II- Solar Technology | Considering installation of 32 MW solar power plant for out-lying auxiliaries and non-industrial buildings | -2.80 % | -1.78 % | -1.87 % |
| Control Scenario III: Carbon Offsetting | | | | |
| <i>Case I- Solar Energy</i> | Considering installation of 100 MW (1X100 MW or 4X 25 MW or 10X 10 MW) capacity solar power plant in phases | - | - | -6.20 % |
| <i>Case II- Biogas Technology</i> | Considering installation of biogas plants for 100 villages (assuming 250-300 households in each village) | - | - | -2.14 % |
| <i>Case III- Tree Plantation</i> | Considering plantation of 2,00,000 trees for next 4 year (planting 50,000 trees per year) | - | - | -3.00 % |
| <i>Case III-A-Sequestration by 2030</i> | | - | - | -6.00 % |
| <i>Case III-B-Sequestration by 2035</i> | | - | - | - |
| Control Scenario IV - Coal Beneficiation | Use of washed (beneficiated) coal with A % = 34 % | -4.06 % | -0.35 % | -0.68 % |
| Control Scenario V: Post Combustion CO₂ Capture | | | | |
| <i>Case I - Post combustion CO₂ capture using absorption technology</i> | Considering the CO ₂ capture efficiency of absorption technology to be 90 % | -79.67 % | -83.26 % | -82.95 % |
| <i>Case II - Post combustion CO₂ capture using adsorption technology</i> | Considering the CO ₂ capture efficiency of adsorption technology to be 85 % | -75.25 % | -78.64 % | -78.34 % |
| <i>Case III - Post combustion CO₂ capture using membrane separation technology</i> | Considering the CO ₂ capture efficiency of membrane technology to be 85 % | -75.25 % | -78.64 % | -78.34 % |
| Control Scenario VI: IGCC with and without Pre-Combustion CO₂ Capture | | | | |
| <i>Case I - IGCC without CO₂ capture technologies</i> | Considering up to 30% and 17 % CO ₂ emission reduction for subcritical unit and super-critical unit, respectively | -26.56 % | -15.73 % | -16.69 % |
| <i>Case II - IGCC with Pre-Combustion CO₂ Capture</i> | Considering the CO ₂ capture efficiency of absorption technology to be 90 % | -82.33 % | -84.84 % | -84.61 % |

From the above table, it can be observed that if the industry adopts Control Scenario I, the overall CO₂e from 1 X 210 MW and 3 X 660 MW units will reduce by 5.35 % and 5.6 %, respectively. Consequently, the total CO₂e from the Koradi TPS will reduce by 5.57 %. This signifies that co-firing 6% biomass can replace 504988.02 MT of coal per year which will be equivalent to CO₂e emission reduction of 630482.93 MT/year.

On adopting Control Scenario II, the overall CO₂e from 1 X 210 MW and 3 X 660 MW units will reduce by 2.80 % and 1.78 %, respectively. Consequently, the total CO₂e from the Koradi TPS will reduce by 1.87 % (211857.33 MT/year).

It is evident from the Control Scenario III that on adopting Case-I, a reduction of 6.2 % (710033.04 MT/year) in CO₂e can be achieved from Koradi TPS. Similarly, a reduction of 2.14 % (242500.00 MT/year) in CO₂e can be achieved if the industry adopts Case-II. Moreover, on adopting Case-III, sequestration of 3.00 % (339324.22 MT/year) CO₂ can be achieved in year 2030, if plantation will start from this year and sequestration of 6.00 % (678648.43 MT/year) can be achieved in year 2035.

On adopting Control Scenario IV, the overall CO₂e from 1 X 210 MW and 3 X 660 MW units will reduce by 4.06 % and 0.35 %, respectively. Consequently, the total CO₂e from the Koradi TPS will reduce by 0.68 % (76459.51 MT/year).

It is evident from the Control Scenario V that on adopting this measure, a reduction of 75.25 % to 79.67 %, and 78.64 % to 83.26 % in CO₂e (depending on the separation technology) can be achieved from 1 X 210 MW and 3 X 660 MW unit, respectively. Among all the cases, maximum CO₂e reduction was observed in Case- I and the total CO₂e from the Koradi TPS will reduce by 82.95 % (9381631.71 MT/year).

It is evident from the Control Scenario VI that on adopting Case-I, a reduction of 26.56 % and 15.73% in CO₂e can be achieved from 1 X 210 MW and 3 x 660 MW unit. The CO₂e emissions will further reduce by 82.33 % and 84.84 % from 1 X 210 MW and 3 x 660 MW unit, respectively, if the industry adopts Case-II. Consequently, the total CO₂e from the Koradi TPS will reduce by 84.61 % (9570365.86 MT/year).

Control Scenario-I, II, III and IV can be implemented in short time and Control Scenario-V and VI can be implemented in long term based on their technical and financial feasibility. The short- and long-term carbon footprint control measures for Koradi TPS are shown in below Figure 5-1 and Figure 5-2 respectively.

Figure 5-1 Short term control measures along with their respective percentage CO₂e reduction

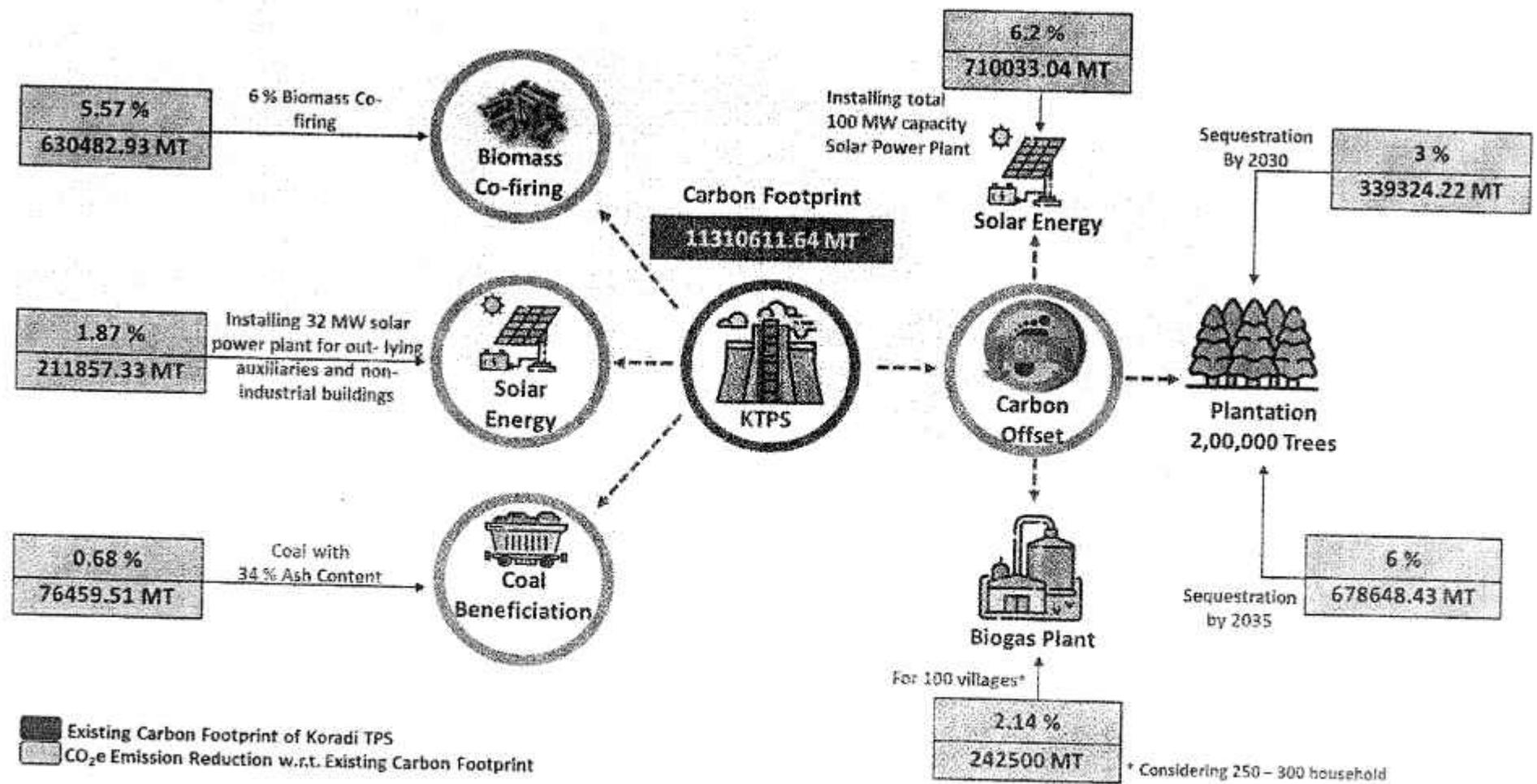
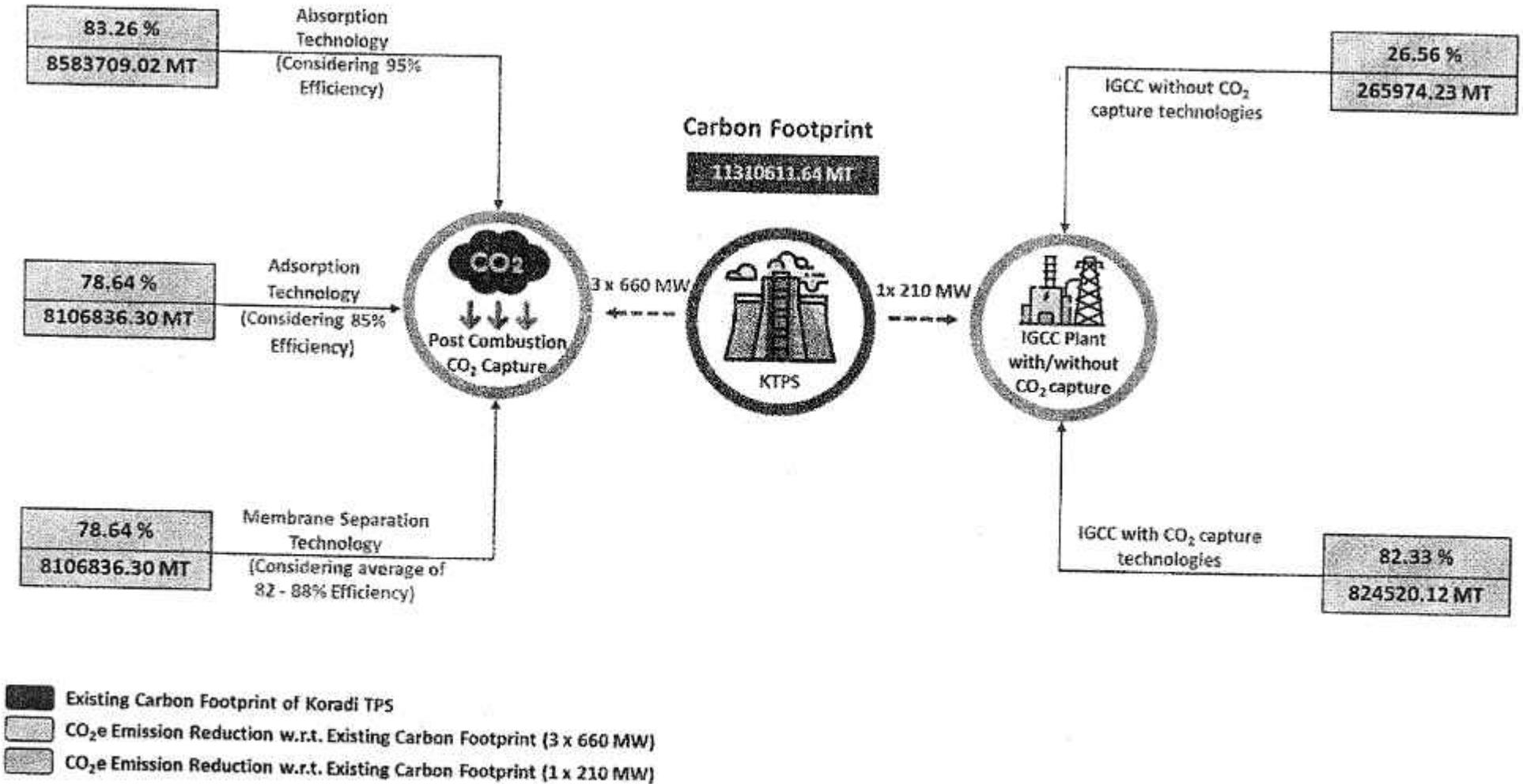


Figure 5-2 Long term control measures along with their respective percentage CO₂e reduction



Remark: The industry is currently sequestering around 21.47% CO₂e due to their green cover. If the industry adopts Control Scenario I, II, III & IV, they can achieve around 45 % reduction in CO₂e emissions by 2035.

The Control Scenario I, II, III & IV are less capital intensive and can be implemented with immediate effect to reduce CO₂e emissions. However, to achieve near net zero carbon emission target from coal-based power plants, CCUS technologies need to be explored by the TPS.

In case of 1 X 210 MW unit, the highest % reduction of 82.33 % was observed for Control Scenario VI- Case II (IGCC with Pre-Combustion CO₂ Capture). As 1 X 210 MW unit is 40-year-old unit and near to its retirement. This necessitates its renovation and modernization. Thus, it is suggested that the industry should check the techno-economic feasibility of upgrading sub-critical to IGCC with installation of pre-combustion CO₂ capture technology, which will reduce CO₂e by 82.33 %. In addition, it will reduce the coal consumption by 30% (2,22,510 MT/year) as its combustion efficiency will be increased up to 50%.

In case of 3 X 660 MW unit, implementation of Control Scenario V (Post Combustion CO₂ Capture) is suggested for CO₂ capture. The industry should check the feasibility of adopting these post combustion CO₂ capture methods and adopt the most suitable methods. Although Control Scenario VI- Case II (IGCC with pre-combustion CO₂ capture) shows highest reduction, but implementing it might not be cost-effective, as 3 X 660 MW unit is already a supercritical technology-based unit.

6 Conclusion

Based on the detailed emission inventory of scope 1 and scope 2 emissions from Koradi TPS for FY 2021-22, carbon sequestration potential of the vegetation cover developed by the industry, and the results of control scenarios developed to reduce overall carbon footprint of the industry, following conclusions can be inferred.

Greenhouse gases emission inventory

- The scope 1 emissions include the five sources which are stationary combustion, mobile combustion, wastewater treatment, material handling & storage and AC/Refrigerator.
- The total GHG emissions in terms of CO₂e from stationary combustion sources (boilers, DG sets, spare unit, booster pump and canteens) was found to be 1,05,58,886.42 MT/year. The individual contribution of these sources are as follows:
 - The total GHG emissions in terms of CO₂e from boilers attached to unit 6, 8, 9 & 10 due to consumption of coal, FO and LDO was found to be 9,08,574.49 MT/year, 33,01,935.88 MT/year, 30,23,244.03 MT/year and 33,24,436.11 MT/year, respectively. The maximum GHG emission (>98 %) from boilers was due to coal consumption.
 - The total GHG emissions in terms of CO₂e from DG sets, spare and booster pump due to consumption of LDO was found to be 20.18 MT/year.
 - The total GHG emissions in terms of CO₂e from canteen due to LPG consumption was found to be 675.73 MT/year.
- The total GHG emission in terms CO₂e from the mobile combustion sources of Koradi TPS was 456.21 MT/year. Out of which, the GHG emissions from mobile combustion sources in 1 X 210 MW unit and 3 X 660 MW unit was found to be 132.06 MT/year and 324.15 MT/year, respectively.
- The total GHG emission in terms of CO₂e from wastewater treatment units was found to be 175.36 MT/year.
- The total GHG emission in terms of CO₂e from coal handling and storage activities at Koradi TPS was 14149.83 MT/year.
- The total GHG emissions in terms of CO₂e from the AC/Refrigerator sources of Koradi TPS was 954.56 MT/year. Out of which, the GHG emissions due to use of AC/Refrigerators in 1 X 210 MW and 3 X 660 MW unit was found to be 510.84 MT/year and 443.72 MT/year, respectively.
- Thus, the total scope 1 GHG emission in terms of CO₂e from the Koradi TPS was 1,05,74,622.36 MT/year. Out of the total GHG emissions under scope 1, GHG emission from 1 X 210 MW unit and 3 X 660 MW unit was found to be 9,10,609.38 MT and 96,64,012.99 MT, respectively.
- The total auxiliary electricity consumption of 1 X 210 MW unit and 3 X 660 MW unit is 115.05 MU/year and 816.58 MU/year, respectively. The total GHG emission in terms of CO₂e of 1 X 210 MW unit and 3 X 660 MW unit are 90891.87 MT/year and 645097.41 MT/year, respectively. The overall scope 2 emission from Koradi TPS is 735989.28 MT/year for FY 2021-22.

- Out of all the activities responsible for scope- 2 emission, the in- house auxiliary activities are the major contributor of GHG emissions with around 57.20% CO₂e emission, followed by out-lying auxiliary activities, other miscellaneous, abnormal cyclic operations, and non- industrial buildings with 28.52 %, 12.29 %, 1.73 % and 0.26 % CO₂e emission, respectively.
- The total GHG emissions in terms of CO₂e from Koradi TPS was found to be 1,13,106,011.64 MT/year in which 93.35 % is contributed by stationary combustion source alone i.e., due to the fuel combustion in boilers. The second highest contribution was due to electricity consumption (6.51 %), while the remaining sources had significantly low contribution. Out of the total GHG emissions, contribution of 1 X 210 MW unit and 3 X 660 MW unit was found to be 10,01,501.25 MT/year (8.85 %) and 1,03,09,110.40 MT/year (91.15 %), respectively.

GHG emission in terms of CO₂e per unit of electricity generation

- The 1 MWh electricity generation emits 1.19 MT and 0.82 MT GHG emission in terms of CO₂e from 1 X 210 MW unit (sub-critical technology) and 3 X 660 MW unit (super-critical technology) respectively. Thus, it was found that the GHG emissions from 1 X 210 MW unit were 45.45 % higher than that from 3 X 660 MW unit.

Carbon sequestration

- The industry has total 5,93,927 number of trees planted in 3 X 660 MW unit, 1 X 210 MW unit and TPS township. There are 27 identified tree species in the study area, out of which the carbon sequestration potential per tree was found to be highest for trees belonging to species *Ficus religiosa* (Pimpal) followed by *Eucalyptus globulus* (Nilgiri), and *Syzygium cumini* (Jambhul).
- The carbon sequestration potential of trees depends on DBH (Diameter at Breast Height). For instance, carbon sequestration potential of specie *Ficus religiosa* planted in 3 X 660 MW unit (with 7.5 cm diameter) has a sequestration potential of 23.26 CO₂e/tree (kg/year), however same specie planted in 1 X 210 MW unit (with 150 cm diameter) has a sequestration potential of 28778.02 CO₂e/tree (kg/year).
- It was found that the trees planted in 1 X 210 MW unit and TPS township are older and thus have larger DBH, consequently having higher carbon sequestration potential, while as 3 X 660 MW unit is recently commissioned, the trees planted in 660 MW plant have smaller DBH and thus have low carbon sequestration potential.
- The total carbon sequestration potential of the vegetation cover provided in 1 X 210 MW unit, 3 X 660 MW unit and TPS township was found to be 24,28,430.28 MT CO₂e per year which is around 21.47 % of the total CO₂e emission (1,13,10611.64 MT CO₂e per year) from Koradi TPS.

Total carbon footprint of Koradi TPS

- For the FY 2021-22, the total CO₂e emission from Koradi TPS was found to be 1,13,10,611.64 MT CO₂e per year, while the vegetation cover provided by the industry has a total carbon sequestration of 24,28,430.28 MT CO₂e per year. Thus, total carbon footprint of the Koradi TPS was found to be 88,82,181.36 CO₂e per year.

Control scenario to reduce carbon footprint

- Based on the outcomes of Control Scenario-I (considering 6 % biomass co-firing), a reduction of 5.35 % and 5.60 % was observed in CO₂e emitted from 1 X 210 MW and 3 X 660 MW units, respectively while total 5.57 % reduction was observed from Koradi TPS with respect to present scenario.
- For Control Scenario-II (Considering installation of 32 MW solar power plant for out-lying auxiliaries and non-industrial buildings), a reduction of 2.80 % and 1.78 % was observed in CO₂e emitted from 1 X 210 MW and 3 X 660 MW units, respectively while total 1.87 % reduction was observed from Koradi TPS with respect to present scenario.
- For Control Scenario-III (carbon offsetting), for Case-I-installing 100 MW (1 X 100 MW or 4 X 25 MW or 10 X 10 MW) capacity solar power plant in phases to provide clean electricity to villages instead of fossil-fuel based electricity, a reduction of 6.2 % (710033.04 MT/year) CO₂e emissions was observed from Koradi TPS. For Case-II-installation of biogas plant for 100 villages (assuming 250 – 300 household in each village), a reduction of 2.14 % (242500.00 MT/year) CO₂e emissions can be achieved from Koradi TPS. Moreover, for Case-III-developing a green cover in barren/degraded land by plantation of 50,000 trees each year for next 4 consecutive years, i.e., overall tree plantation of 2,00,000 trees (considering plantation starting from this year), a reduction of 3.00 % (339324.22 MT/year) and 6.00 % (678648.43 MT/year) CO₂e emissions was observed by year 2030 and 2035, respectively.
- Based on the outcomes of Control Scenario-IV (use of washed (beneficiated) coal with 34 % ash content in boilers), a reduction of 4.06 % and 0.35 % was observed in CO₂e emitted from 1 X 210 MW and 3 X 660 MW units, respectively while total 0.68 % reduction was observed from Koradi TPS with respect to present scenario.
- For Control Scenario-V (considering implementation of post combustion CO₂ capture technology), for Case-I (using absorption technology), a reduction of 79.67 % and 83.26 % was observed in CO₂e emitted from 1 X 210 MW and 3 X 660 MW units, respectively while total 82.95 % reduction was observed from Koradi TPS with respect to present scenario. Similarly, for Case-II (using adsorption technology) and III (using membrane separation technology), a reduction of 75.25 % and 78.64 % was observed in CO₂e emitted from 1 X 210 MW and 3 X 660 MW units, respectively while total 78.34 % reduction was observed from Koradi TPS as compared to present scenario.
- For Control Scenario-VI (considering implementation of IGCC technology), for Case-I (without CO₂ capture), a reduction of 26.56 % and 15.73 % was observed in CO₂e emitted from 1 X 210 MW and 3 X 660 MW units, respectively while total 16.69 % reduction was observed from Koradi TPS with respect to present scenario. Similarly, for Case-II (with pre-combustion CO₂ capture), a reduction of 82.33 % and 84.84 % was observed in CO₂e emitted from 1 X 210 MW and 3 X 660 MW units, respectively while total 84.61 % reduction was observed from Koradi TPS as compared to present scenario.
- It can be concluded that, the Control Scenario I (considering 6 % biomass co-firing), Control Scenario II (solar technology) and Control Scenario III (carbon offsetting), and Control Scenario IV (use of washed (beneficiated) coal with 34 % ash content in boilers), are less capital intensive and can be implemented with immediate effect to reduce CO₂e emissions. However,

to achieve near net zero carbon emission target from coal-based power plants, CCUS technologies need to be explored by the TPS.

- In case of 1 X 210 MW unit, the highest % reduction of 82.33 % was observed for Control Scenario VI- Case II (IGCC with Pre-Combustion CO₂ Capture). As 1 X 210 MW unit is 40-year-old unit and near to its retirement. This necessitates its renovation and modernization. Thus, it is suggested that the industry should check the techno-economic feasibility of upgrading sub-critical to IGCC with installation of pre-combustion CO₂ capture technology, which will reduce CO₂e by 82.33 %. In addition, it will reduce the coal consumption by 30% (2,22,510 MT/year) as its efficiency will be increased up to 50%.
- In case of 3 X 660 MW unit, implementation of Control Scenario V (Post Combustion CO₂ Capture) is suggested for CO₂ capture. The industry should check the feasibility of adopting these post combustion CO₂ capture methods and adopt the most suitable methods. Although Control Scenario VI- Case II (IGCC with pre-combustion CO₂ capture) shows highest reduction, but implementing it might not be cost-effective, as this is already a supercritical technology-based unit.

7 Recommendations

Based on the present study, the total carbon footprint of the Koradi TPS was found to be 88,82,181.36 MT CO₂e/year for the FY 2021-22, after considering overall GHG emissions (11310611.64 MT CO₂e/year) and carbon sequestered by vegetation cover (24,28,430.28 MT CO₂e/year). Stationary combustion source (especially boilers) was found to be the maximum contributing source with 93.355 % emissions, while emissions due to auxiliary electricity was second highest contributor with 6.506 % emission. It was also found that the GHG emissions from 1 X 210 MW unit were 45.45 % higher than that from 3 X 660 MW unit. The industry needs to implement certain short term and long terms mitigation measures to gradually reduce their carbon footprint to become net zero. Some of these mitigation measures are discussed in this section.

7.1 Short Term Mitigation Measures

- **The industry shall implement biomass co-firing along with coal in boilers to reduce coal consumption and CO₂ emissions from the boilers.** It is evident from the Control Scenario I (refer Section 5.1) that on adopting this measure, a reduction of 5.35 % and 5.6 % in CO₂e can be achieved from 1 X 210 MW and 3 X 660 MW units, respectively. Consequently, the total CO₂e from the Koradi TPS can be reduced by 630482.93 MT/year (5.57 % reduction). It was found that **co-firing of 6% biomass can replace 504988.02 MT of coal per year which will lead to reduction of 630482.931 MT/year of CO₂e emission.** This practice will also improve the energy efficiency of the industry. Biomass co-firing can be implemented using three methods viz. direct co-firing, indirect co-firing, and parallel co-firing. The industry should check the feasibility of adopting these methods and should adopt the most suitable method.
- **The industry shall consider installation of total 32 MW capacity solar power plant to meet the energy requirement of out-lying auxiliaries and non-industrial buildings to reduce their indirect emissions.** The Koradi TPS can install the solar panels within the industry premises as per space availability. The industry can consider areas such as roof tops of non-industrial buildings, four-wheeler parking area, and open area near the cooling tower, etc. It is evident from the Control Scenario II (refer section 5.2) that if the industry adopts Control Scenario-III, a reduction of 2.80 % (28086.09 MT/year) and 1.78 % (183771.23 MT/year) in CO₂e emission from 1 X 210 MW and 3 X 660 MW units, respectively can be achieved. It was observed that **28.78% (268.17 MU/year) of total auxiliary electricity consumption has the potential to be replaced by solar energy.** Consequently, the total CO₂e emission from the Koradi TPS can be reduced by 211857.33 MT/year (1.87 % reduction).
- **The industry can reduce their carbon footprint by investing in carbon offsetting activities such as implementation of renewable energy (solar, biogas etc.) and planting trees to compensate for the GHG emissions from the industry.**
 - **The industry can take initiative to implement solar panels as a carbon offsetting activity in villages.** It was found that if industry implements Control Scenario III- Case I i.e., considering installation of 100 MW (1X100 MW or 4X25 MW or 10X10 MW) capacity solar power plant in phases, it can offset the CO₂e emissions from Koradi TPS by 710033.04MT/year (6.20 % reduction).

- **The industry can take initiative to implement biogas plant as a carbon offsetting activity in any area or village.** It was found that if the industry implements Control Scenario III- Case II i.e., implementing biogas plant for 100 villages (considering each village has about 250 – 300 households), it can offset the CO₂e emissions from Koradi TPS by 242500.00 MT/year (2.14 % reduction).
- **The industry can develop a green cover in barren/degraded land as a carbon offsetting activity in any area or village.** It was found that if the industry implements Control Scenario III- Case III i.e., planting 50,000 trees each year for next 4 consecutive years (considering plantation of trees belonging to species *namely Kadulimb, Wad, Pimpal, Aamba, Karanji, and Jambhul*), it can offset the CO₂e emissions from Koradi TPS by 339324.22 MT/year (3.00 % reduction) by year 2030, if plantation starts from this year and it can offset the CO₂e emissions by 678648.43 MT/year (6.00 % reduction) by year 2035.
- **The industry shall increase the quantity of beneficiated coal used in boilers such that the average ash content of the bunkered coal remains below 34% to reduce the CO₂ emissions from the boilers.** It is evident from the Control Scenario IV (refer Section 5.4) that on adopting this measure, a reduction of 4.06 % and 0.35 % in CO₂e from 1 X 210 MW and 3 X 660 MW units, respectively can be achieved. Consequently, the total CO₂e from the Koradi TPS can be reduced by 76459.51 MT/year (0.68 % reduction).
- **The industry shall increase their vegetation cover to enhance the carbon sequestration potential.** Based on the analysis of total carbon sequestration through the existing vegetation cover in the industry, it was observed that 21.47 % of total CO₂e emission could be sequestered from the Koradi TPS. It was observed that carbon sequestration potential of individual trees belonging to species *namely Ficus religiosa (Pimpal), Eucalyptus globulus (Nilgiri), Syzygium cumini (Jambhul), Ficus benghalensis (Wad), Chichwa, and Azadirachta indica (Kadulimb)* was significantly high. Moreover, based on the present study and literature survey, there are other plant species such as *Delonix regia (Gulmohar), Tamarindus indica (Chinch), Terminalia catappa (Badam), Albizia lebbeck (Shirish), Butea monosperma (Palas), Pongamia pinnata (Karanja), and Samanea saman (Gulabi Shirish)*, which have significant carbon sequestration potential. In addition, the industry shall consider plantation of species like *Banana, Drumsticks, Nimboo, Papaya and Custard apple* as these have high growth rate. **Hence, the plantation of these species would increase the CO₂ sequestration.**
- **The industry shall consider providing the electric buses for commute of employees from township to TPS.** The fossil fuel-based vehicles (petrol/diesel) release the greenhouse gases into the environment. As per the data given by industry, the two-wheeler and four-wheeler count of 3 X 660 MW unit was 219 and 915, respectively. Similarly, the two-wheeler and four-wheeler count of 1 X 210 MW unit was 48 and 446, respectively. Thus, instead of using these fossil fuel-based vehicles to commute from the township to the plant, if the industry provides electric vehicles that run on solar-based electricity, it can reduce the greenhouse gases emissions significantly (UNEP, 2022). If the Koradi TPS provide one electric bus with the seating capacity of 40 person to their employees for transportation, then a single electric bus can reduce the GHG emissions equivalent to 40 two-wheelers or 40 four-wheelers i.e., 1.25 MT/year or 5.36 MT/year, respectively from the Koradi TPS.

- To reduce scope 2 GHG emissions due to auxiliary electricity consumption from sewage treatment plants installed within the plant premises, ***the industry shall modify and upgrade the existing conventional STPs to green STPs.*** Based on a literature study it was found that CO₂e emissions from a conventional STP are 200 MT/year/MLD.

7.2 Long Term Mitigation Measures

- ***The industry shall check the technical and financial feasibility to implement post combustion CO₂ capture technology for 3 X 660 MW unit using absorption, adsorption or membrane separation methods and accordingly shall adopt the most suitable method.*** It is evident from the Control Scenario V that on adopting this measure, a reduction of 78.64 % to 83.26 % in CO₂e (depending on the separation technology) can be achieved from 3 X 660 MW unit. Implementing CCUS technologies is considered as a crucial measure in achieving near net-zero emissions from coal-based power plants. Furthermore, the industry also needs to check the feasibility of transporting the captured CO₂ to a suitable utilization facility.
- ***The industry shall check the technical and financial feasibility to adopt IGCC and pre-combustion CO₂ capture technology in 1 X 210 MW unit to prevent CO₂ from getting released into atmosphere.*** It is evident from the Control Scenario VI that on adopting this measure, a reduction of 82.33 % in CO₂e can be achieved from 1 X 210 MW unit. Implementation of IGCC system will also lead to reduction in coal consumption by 30% (2,22,510 MT/year) as its combustion efficiency will be increased up to 50%. Furthermore, the industry also needs to check the feasibility of transporting the captured CO₂ to a suitable utilization facility.

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9 Annexure

This section includes the data given by the industry for the FY 2021-22.

1 X 210 MW Unit

Electricity Generation Data

| Month | Electricity Generation | | | | |
|--------|------------------------|---------|--------|-----------------------|-----------------------|
| | Unit 5 | Unit 6 | Unit 7 | Total Generation (MU) | Total Generation (MW) |
| Apr-21 | 0 | 51.704 | 67.008 | 118.712 | 163.82 |
| May-21 | 0 | 0.000 | 0.000 | 0.000 | 0.00 |
| Jun-21 | 0 | 0.000 | 0.000 | 0.000 | 0.00 |
| Jul-21 | 0 | 0.000 | 0.000 | 0.000 | 0.00 |
| Aug-21 | 0 | 83.001 | 0.000 | 83.001 | 114.54 |
| Sep-21 | 0 | 67.910 | 0.000 | 67.910 | 93.72 |
| Oct-21 | 0 | 89.440 | 0.000 | 89.440 | 123.43 |
| Nov-21 | 0 | 102.915 | 0.000 | 102.915 | 142.02 |
| Dec-21 | 0 | 108.950 | 0.000 | 108.950 | 150.35 |
| Jan-22 | 0 | 98.830 | 0.000 | 98.830 | 136.39 |
| Feb-22 | 0 | 106.320 | 0.000 | 106.320 | 146.72 |
| Mar-22 | 0 | 123.125 | 0.000 | 123.125 | 169.91 |

Fuel Consumption Data

Unit- 8 Boiler

| Sr. No. | Total Fuel Consumption Per Month | | | |
|---------|----------------------------------|----------|-----------------------|-----------------|
| | Coal (MT) | FO (KL) | Light Diesel Oil (KL) | Other fuel (KL) |
| Apr-21 | 48704 | 160.200 | 87.010 | NA |
| May-21 | 0 | 0.000 | 0.000 | NA |
| Jun-21 | 0 | 0.000 | 0.000 | NA |
| Jul-21 | 0 | 0.000 | 0.000 | NA |
| Aug-21 | 78020 | 851.920 | 85.000 | NA |
| Sep-21 | 63158 | 1245.000 | 301.340 | NA |
| Oct-21 | 75130 | 1258.520 | 169.830 | NA |
| Nov-21 | 84445 | 257.120 | 0.000 | NA |
| Dec-21 | 86164 | 141.200 | 0.000 | NA |
| Jan-22 | 90922 | 411.400 | 28.910 | NA |
| Feb-22 | 99429 | 76.470 | 0.000 | NA |
| Mar-22 | 115728 | 101.180 | 0.000 | NA |

DG Set

| Sr. No. | Total fuel Consumption Per Month | | |
|---------|----------------------------------|---------|-----------------------|
| | Coal (MT) | FO (KL) | Light Diesel Oil (KL) |
| Apr-21 | NA | NA | 0.800 |
| May-21 | NA | NA | 0.200 |
| Jun-21 | NA | NA | 0.000 |
| Jul-21 | NA | NA | 0.000 |
| Aug-21 | NA | NA | 0.000 |
| Sep-21 | NA | NA | 0.000 |
| Oct-21 | NA | NA | 0.400 |

| Sr. No. | Total Fuel Consumption Per Month | | |
|---------|----------------------------------|---------|-----------------------|
| | Coal (MT) | FO (KL) | Light Diesel Oil (KL) |
| Nov-21 | NA | NA | 0.000 |
| Dec-21 | NA | NA | 0.000 |
| Jan-22 | NA | NA | 0.000 |
| Feb-22 | NA | NA | 0.400 |
| Mar-22 | NA | NA | 0.000 |

Electricity Consumption Data

| Month | Total Electricity Consumption (Mus) |
|--------|-------------------------------------|
| Apr-21 | 16.48 |
| May-21 | 2.325 |
| Jun-21 | 1.775 |
| Jul-21 | 1.56 |
| Aug-21 | 10.478 |
| Sep-21 | 9.086 |
| Oct-21 | 10.849 |
| Nov-21 | 11.979 |
| Dec-21 | 12.901 |
| Jan-22 | 11.704 |
| Feb-22 | 11.596 |
| Mar-22 | 14.32 |

Transportation Data

| Sr. No. | Category | Classification (LOV/MDV/HDV) | Total Number of vehicles | Type of Fuel used | Distance Travel (km/day) | No. of Round/ Month | Fuel/ Month (Lit.) |
|---------|---------------------------------------|------------------------------|--------------------------|-------------------|--------------------------|---------------------|----------------------|
| 1 | Vehicles used for Coal transportation | | 10034 per year | Diesel | | | |
| 2 | Vehicles used for Fuel (LDO/HFO) | BTPN Rake | As per requirement | Electricity | NA | Per year rounds 04 | FO-500KI LDO-40KI |
| 3 | Vehicles used for Fly Ash | NA | NA | NA | NA | NA | NA |
| 4 | Vehicles used for Bottom Ash | Tractor Trolley | 1 | Diesel | 4 to 5 (One side) | 120 | 100 Litres |
| 5 | Vehicles used for Mill reject | Tractor Trolley | 2 | Diesel | 3 to 4 (One side) | 350 | 400 Litres |
| 6 | Vehicle used for other Raw materials | Tractor Trolley | 1 | Diesel | 3 to 5 (One side) | 40 | 25 Litres |
| 7 | Four-Wheeler | | 48 | Diesel/Petrol | | | |
| 8 | Two-Wheeler | | 446 | Petrol | | | |

AC/Refrigerator Data

| Name of the equipment | Application | Number of units in operation during the year | Type of refrigerant | Refrigerant charge (kg) | Annual leakage factor (%) |
|---------------------------------------------------|----------------|----------------------------------------------|---------------------|-------------------------|---------------------------|
| H2 Dryer | Commercial AC | 2 | R-404 | 12 | 10 |
| Instrument Air dryer | Commercial AC | 2 | HFC-134a | 6 | 2 |
| Various cabins in 1 X 210 MW Unit for auxiliaries | Residential AC | 47 | R-22 | 30 | 20 |
| Refrigerator | Commercial AC | 8 | HFC-134a | 0.7 | 1 |

Coal Handling Data

| Month | Total Coal Handling (Tonnes/Month) |
|--------|------------------------------------|
| Apr-21 | 48704.00 |
| May-21 | 0 |
| Jun-21 | 0 |
| Jul-21 | 0 |
| Aug-21 | 78,020.00 |
| Sep-21 | 63,156.30 |
| Oct-21 | 75,130.00 |
| Nov-21 | 84,445.00 |
| Dec-21 | 86,164.00 |
| Jan-22 | 90,922.00 |
| Feb-22 | 99,429.00 |
| Mar-22 | 1,15,728.00 |

Plantation Data

| Sr. No. | Tree Name | | Average Count (Nos.) | Average Age (Years) | Average Height (m) | Average Diameter at Breast Height of the Tree (DBH) in m |
|---------|-----------------|-------------------------------------|----------------------|---------------------|--------------------|----------------------------------------------------------|
| | Scientific Name | Common Name | | | | |
| 1 | | Karanji | 350 | 15 | 7.0 | 0.70 |
| 2 | | Subabul | 10,000 | 13 | 5.0 | 0.25 |
| 3 | | Limb Kadu | 200 | 17 | 5.5 | 0.90 |
| 4 | | Mango | 150 | 12 | 6.0 | 0.60 |
| 5 | | Chichwa | 100 | 15 | 7.5 | 0.95 |
| 6 | | Nilgiri | 50 | 25 | 9.0 | 1.2 |
| 7 | | Pimple | 50 | 20 | 8.0 | 1.5 |
| 8 | | Wad | 50 | 35 | 8.0 | 1.04 |
| 9 | | Badam | 150 | 10 | 4.5 | 0.5 |
| 10 | | Bori | 1500 | 15 | 3.0 | 0.4 |
| 11 | | Jambul | 25 | 15 | 4.5 | 1.1 |
| 12 | | Ashoka | 150 | 10 | 3.0 | 0.2 |
| 13 | | Sagwan | 60 | 11 | 3.0 | 0.4 |
| 14 | | Fanas | 5 | 40 | 12.0 | 0.4 |
| 15 | | Babul | 20000 | 30 | 4.0 | 0.3 |
| 16 | | Extra trees which name is not known | 15000 | 25 | 3.0 | 0.25 |

| Sr. No. | Tree Name | | Average Count (Nos.) | Average Age (Years) | Average Height (m) | Average Diameter at Breast Height of the Tree (DBH) in m |
|---------|-----------------|-------------------------------------|----------------------|---------------------|--------------------|----------------------------------------------------------|
| | Scientific Name | Common Name | | | | |
| 1 | | Karanji | 300 | 15 | 8.0 | 0.7 |
| 2 | | Subabul | 15,000 | 13 | 14.0 | 0.25 |
| 3 | | Limb Kadu | 250 | 17 | 8.0 | 0.9 |
| 4 | | Mango | 150 | 12 | 6.0 | 0.6 |
| 5 | | Chichwa | 10000 | 15 | 7.5 | 0.3 |
| 6 | | Nilgiri | 250 | 25 | 9.0 | 1.2 |
| 7 | | Pimpie | 200 | 20 | 11.0 | 1.5 |
| 8 | | Wad | 50 | 35 | 12.0 | 1.04 |
| 9 | | Badam | 250 | 10 | 10.0 | 0.5 |
| 10 | | Bori | 100 | 15 | 7.0 | 0.4 |
| 11 | | Jambul | 100 | 15 | 11.0 | 1.1 |
| 12 | | Ashoka | 50 | 10 | 5.0 | 0.2 |
| 13 | | Sagwan | 700 | 11 | 15.0 | 0.3 |
| 14 | | Fanas | 25 | 40 | 12.0 | 0.4 |
| 15 | | Babul | 12000 | 30 | 4.0 | 0.3 |
| 16 | | Extra trees which name is not known | 1000 | 25 | 3.0 | 0.25 |

Non-Industrial Building

| Sr. No. | Building Name | Working Hours (hr) | Area of each floor (m ²) | No. of Floors | Total Area (m ²) |
|---------|--------------------------|--------------------|--------------------------------------|---------------|------------------------------|
| 1 | Service Building | 8 | 800.00 | 2 | 1600 |
| 2 | Civil Building | 8 | 144.00 | 1 | 144 |
| 3 | Environmental Cell | 8 | 432.00 | 2 | 864 |
| 4 | Security Office | 24 | 300.00 | 1 | 300 |
| 5 | Canteen | 12 | 155.00 | 1 | 155 |
| 6 | WTP- I Section Building | 24 | 2500.00 | 1 | 2500 |
| 7 | WTP- II Section Building | 24 | 1250.00 | 2 | 2500 |
| 8 | Time Office Building | 24 | 450.00 | 1 | 450 |
| 9 | Administrative Building | 8 | 1000.00 | 2 | 2000 |

3 X 660 MW Unit

Electricity Generation Data

| Month | Electricity Generation (MW) | | | |
|--------|-----------------------------|--------|---------|------------------|
| | Unit 8 | Unit 9 | Unit 10 | Total Generation |
| Apr-21 | 466 | 369 | 340 | 1194 |
| May-21 | 468 | 472 | 426 | 1358 |
| Jun-21 | 448 | 459 | 440 | 1344 |
| Jul-21 | 390 | 365 | 357 | 1112 |
| Aug-21 | 509 | 437 | 479 | 1424 |
| Sep-21 | 428 | 374 | 380 | 1186 |
| Oct-21 | 501 | 474 | 480 | 1459 |
| Nov-21 | 554 | 541 | 531 | 1622 |
| Dec-21 | 577 | 571 | 538 | 1678 |
| Jan-22 | 555 | 541 | 502 | 1595 |
| Feb-22 | 571 | 542 | 518 | 1631 |
| Mar-22 | 578 | 558 | 456 | 1598 |

Fuel Consumption Data

Unit- 8 Boiler

| Sr. No. | Total Fuel Consumption Per Month | | | |
|---------|----------------------------------|---------|-----------------------|-----------------|
| | Coal (MT) | FO (kl) | Light Diesel Oil (kl) | Other fuel (kg) |
| Apr-21 | 221306 | 212.829 | 0 | -- |
| May-21 | 179117 | 226.847 | 0 | -- |
| Jun-21 | 89230 | 604.379 | 235.92 | -- |
| Jul-21 | 220736 | 408.492 | 5 | -- |
| Aug-21 | 248394 | 329.11 | 14.1 | -- |
| Sep-21 | 181062 | 494.034 | 14.77 | -- |
| Oct-21 | 249241 | 19.07 | 0 | -- |
| Nov-21 | 170504 | 326.93 | 45.34 | -- |
| Dec-21 | 226916 | 434.28 | 38.3 | -- |
| Jan-22 | 248868 | 201.73 | 41.07 | -- |
| Feb-22 | 266249 | 106.15 | 0 | -- |
| Mar-22 | 284991 | 32.22 | 0 | -- |

Unit- 9 Boiler

| Sr. No. | Total Fuel Consumption Per Month | | | |
|---------|----------------------------------|---------|-----------------------|-----------------|
| | Coal (MT) | FO (kl) | Light Diesel Oil (kl) | Other fuel (kg) |
| Apr-21 | 158976 | 499.75 | 0 | -- |
| May-21 | 186718 | 288.8 | 101.69 | -- |
| Jun-21 | 192969 | 281.04 | 71.17 | -- |
| Jul-21 | 189270 | 582.195 | 36 | -- |
| Aug-21 | 229659 | 181.46 | 39 | -- |
| Sep-21 | 131661 | 232.14 | 68.31 | -- |
| Oct-21 | 204259 | 161.62 | 34.85 | -- |
| Nov-21 | 225727 | 174.24 | 0 | -- |
| Dec-21 | 152481 | 168.79 | 135.92 | -- |
| Jan-22 | 263360 | 219.78 | 35.31 | -- |
| Feb-22 | 199348 | 250.76 | 51.25 | -- |
| Mar-22 | 280137 | 111.55 | 0 | -- |

Unit- 10 Boiler

| Sr. No. | Total Fuel Consumption Per Month | | | |
|---------|----------------------------------|---------|-----------------------|-----------------|
| | Coal (MT) | FO (kl) | Light Diesel Oil (kl) | Other fuel (kg) |
| Apr-21 | 152584 | 982.64 | 41.669 | -- |
| May-21 | 227020 | 295.92 | 0 | -- |
| Jun-21 | 256404 | 40.03 | 0 | -- |
| Jul-21 | 189910 | 1401.88 | 46.92 | -- |
| Aug-21 | 234451 | 265.799 | 58.96 | -- |
| Sep-21 | 185948 | 606.754 | 15 | -- |
| Oct-21 | 188784 | 277.65 | 52 | -- |
| Nov-21 | 242770 | 16.72 | 0 | -- |
| Dec-21 | 262546 | 2.56 | 0 | -- |
| Jan-22 | 265444 | 152.16 | 60.2 | -- |
| Feb-22 | 249743 | 0 | 0 | -- |
| Mar-22 | 217984 | 323.78 | 128.08 | -- |

DG Set

| Sr. No. | Light Diesel Oil (KL) Consumption Per Month | | | | | |
|---------|---------------------------------------------|--------|---------|-------|--------------|--------------|
| | Unit-8 | Unit-9 | Unit-10 | Spare | Booster Pump | Hydrant Pump |
| Apr-21 | 0.200 | 0.200 | 0.400 | 0.400 | 0 | 0 |
| May-21 | 0 | 0 | 0 | 0 | 0 | 0 |
| Jun-21 | 0 | 0 | 0.400 | 0 | 0 | 0 |
| Jul-21 | 0.350 | 0.300 | 0 | 0.150 | 0.300 | 0 |
| Aug-21 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sep-21 | 0 | 0 | 0 | 0 | 0 | 0 |
| Oct-21 | 0.350 | 0.300 | 0.350 | 0 | 0 | 0 |
| Nov-21 | 0 | 0 | 0 | 0 | 0 | 0 |
| Dec-21 | 0.200 | 0.200 | 0.200 | 0 | 0 | 0 |
| Jan-22 | 0 | 0 | 0 | 0 | 0 | 0 |
| Feb-22 | 0.200 | 0.200 | 0.200 | 0.200 | 0 | 0 |
| Mar-22 | 0.200 | 0.200 | 0.200 | 0 | 0 | 0 |

Electricity Consumption Data

| Month | Total Electricity Consumption (Mus) |
|--------|-------------------------------------|
| Apr-21 | 65.715 |
| May-21 | 69.563 |
| Jun-21 | 60.644 |
| Jul-21 | 67.954 |
| Aug-21 | 71.522 |
| Sep-21 | 58.11 |
| Oct-21 | 67.937 |
| Nov-21 | 68.71 |
| Dec-21 | 68.297 |
| Jan-22 | 73.788 |
| Feb-22 | 66.524 |
| Mar-22 | 77.815 |

Transportation Data

| Category | Classification (LDV/MDV/HDV) | Total Number of vehicles | Type of Fuel used | Distance Travel (km/month) | No. of Round/ Month | Fuel per Month (Lit.) |
|---------------------------------------|------------------------------|--------------------------|-------------------|----------------------------|---------------------|-----------------------|
| Vehicles used for Coal transportation | HDV | 7 | Diesel | 2 | | 140 |
| Vehicles used for Fly Ash | HDV | 10 | Diesel | 2 | 30 | 9600 |
| Vehicles used for Bottom Ash | MDV | 150 | Diesel | 225000 | 30 | 90000 |
| Vehicles used for Mill reject | | | | | | |
| Vehicle used for other Raw materials | LDV | 2 | Diesel | 265 | | 35 |
| | MDV | 1 | Diesel | 225 | | 65 |
| Vehicle used for mill reject | MDV | 10 Tractor | Diesel | 8 | 1178 | |
| Vehicle used for mill reject | HDV | 1JCB | Diesel | Nil | 300 | |
| Vehicle used for mill reject | HDV | 1 Bobcat | Diesel | Nil | 210 | |
| Vehicle used for mill reject | HDV | Hydra | Diesel | Nil | 95 | |
| Four Wheelers | | 219 | Diesel/Petrol | | | |
| Two Wheelers | | 915 | Petrol | | | |

Sewage Treatment Plant

| Data related to Sewage Treatment Plant | | Values | Units |
|----------------------------------------|--------------------------------------------------------------------------|------------------------------------------------------------|----------------------|
| 1 | Total capacity of STP | 0.04 | MLD |
| 2 | Population for which STP is designed? | 3459 | Persons |
| 3 | Type of treatment method provided? | MBBR, Tube Settler, Disinfection System, Filtration System | |
| 4 | Is there any primary treatment provided? | Bar Screen Pit, Oil & Grease Chamber | |
| 5 | Inlet Flow rate (Design) | 0.000405 | m ³ /sec. |
| 6 | Inlet Flow rate (Actual) | 0.000405 | m ³ /sec. |
| 7 | Outlet Flow rate | 0.000405 | m ³ /sec. |
| 8 | Inlet BOD | 300 | mg/litre |
| 9 | Outlet BOD | ≤30 | mg/litre |
| 10 | Inlet COD | 400 | mg/litre |
| 11 | Outlet COD | ≤100 | mg/litre |
| 12 | Sludge removal | -- | kg/day or kg/month |
| 13 | Type of sludge (primary sludge/ secondary sludge/ mixed sludge) | -- | |
| 14 | Mode of disposal of treated wastewater (to river/ lakes/land/reused etc) | Reused | |
| 15 | Operational hours in a day | 24 | Hours |
| 16 | Operational days in a year | 365 | days |

| Parameter | Average Concentration (mg/l or ppm) | | | | | | | | | | | |
|-------------|-------------------------------------|------|------|------|------|------|------|-------|------|------|------|------|
| | Apr | May | June | July | Aug | Sept | Oct | Nov | Dec | Jan | Feb | Mar |
| BOD (Inlet) | 132.6 | 20.7 | 15.5 | 90.8 | 59.3 | 44.3 | 51.4 | 123.0 | 20.8 | 46.3 | 32.8 | 20.2 |

1213
Carbon Footprint Study for Koradi Thermal Power Station

| Parameter | Average Concentration (mg/l or ppm) | | | | | | | | | | | |
|----------------------------|-------------------------------------|------|------|-------|-------|-------|-------|-------|------|-------|------|------|
| | Apr | May | June | July | Aug | Sept | Oct | Nov | Dec | Jan | Feb | Mar |
| BOD (Outlet) | 7.3 | 9.9 | 6.6 | 6.9 | 5.6 | 5.9 | 8.3 | 8.7 | 5.8 | 10 | 10 | 4.9 |
| COD (Inlet) | 377.0 | 63.0 | 48.0 | 278.0 | 184.0 | 138.0 | 161.0 | 360.0 | 73.0 | 163.3 | 93.8 | 63.2 |
| COD (Outlet) | 24 | 34 | 22 | 22 | 22 | 20 | 26 | 28 | 20 | 32 | 32 | 16 |
| Sludge Removal | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Total Nitrogen (Inlet) | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Kjeldahl Nitrogen (Outlet) | 0.62 | 0.76 | 0.76 | 0.64 | 0.84 | 0.76 | 0.70 | 0.61 | 0.84 | 0.78 | 0.78 | 0.84 |
| Ammonical Nitrogen | BDL | 0.10 | 0.14 | BDL | BDL | 0.12 | BDL | BDL | 0.14 | 0.13 | 0.16 | 0.14 |

Effluent Treatment Plant

| Data related to Effluent Treatment Plant | | Values | Units |
|------------------------------------------|--------------------------------------------------------------------------|---------------------|----------------------|
| 1 | Total capacity of ETP | 14 | MLD |
| 2 | Population for which ETP is designed? | NA | Persons |
| 3 | Type of treatment method provided? | Primary & secondary | |
| 4 | Is there any primary treatment provided? | Yes | |
| 5 | Inlet Flow rate (Design) | 0.166 | m ³ /sec. |
| 6 | Inlet Flow rate (Actual) | 0.162 | m ³ /sec. |
| 7 | Outlet Flow rate | 0.162 | m ³ /sec. |
| 8 | Inlet COD | -- | mg/litre |
| 9 | Outlet COD | 28.5 | mg/litre |
| 10 | Sludge removal | -- | kg/day or kg/month |
| 11 | Type of sludge (primary sludge/ secondary sludge/ mixed sludge) | --- | |
| 12 | Mode of disposal of treated wastewater (to river/ lakes/land/reused etc) | Reused | |
| 13 | Operational hours in a day | 24 | Hours |
| 14 | Operational days in a year | 365 | days |

| Parameters | Average Concentration (mg/l or ppm) | | | | | | | | | | | |
|----------------------------|-------------------------------------|------|------|------|------|------|------|------|------|-------|-------|-------|
| | Apr | May | June | July | Aug | Sept | Oct | Nov | Dec | Jan | Feb | Mar |
| BOD (Inlet) | 15.0 | 22.5 | 16.4 | 14.5 | 15.5 | 10.3 | 17.0 | 11.7 | 13.6 | 23.3 | 15.8 | 15.0 |
| BOD (Outlet) | 8.6 | 8 | 7.3 | 8.4 | 10.4 | 8.1 | 7.3 | 8.7 | 7.0 | 12.0 | 12.0 | 8.9 |
| COD (Inlet) | 47.0 | 68.0 | 51.2 | 47.0 | 49.0 | 33.0 | 53.0 | 37.3 | 44.0 | 80.0 | 82.0 | 54.8 |
| COD (Outlet) | 28 | 26 | 24 | 28 | 24 | 26 | 24 | 28 | 24 | 36 | 36 | 28 |
| Sludge Removal | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Total Nitrogen (Inlet) | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Kjeldahl Nitrogen (Outlet) | 0.59 | 0.64 | 1.04 | 0.59 | 1.12 | 0.64 | 0.67 | 0.84 | 0.67 | 0.65 | 0.652 | 0.784 |
| Ammonical Nitrogen | BDL | 0.11 | 0.25 | 0.10 | 0.17 | 0.11 | BDL | BDL | BDL | 0.115 | 0.115 | 0.138 |

AC/Refrigerator Data

| Name of the equipment | Qt y | Type of refrigerant | Refrigerant charge (kg) | ALF (%) |
|-----------------------|---------|------------------------|----------------------------|------------|
| CHILLERS | 3 | R-134a | 30 | 0 |
| SWAS LAB CHILLERS | 3 | R-22a | 40 | 20 |
| ESP PAC | 9 | R-407c | 60 | 30 |
| CCR (SR. Dy. Mag) | 2 | - | R22 | - |
| CCR (Dy. Mag) | 1 | - | R22 | - |
| CCR (Control Room) | 4 | - | R22 | - |
| CCR | 2 | - | R32 | - |
| L&T OFFICE (Oil Lab) | 3 | - | R22 | - |

| Name of the equipment | Qty | Type of refrigerant | Refrigerant charge (kg) | ALP (%) |
|--------------------------------------------------|-----|---------------------|-------------------------|---------|
| Coal Lab | 1 | - | R32 | - |
| | 1 | - | R22 | - |
| DG SET (C.H) | 2 | - | R22 | - |
| CUP Regeneration | 2 | - | R22 | - |
| CW (P.H) | 2 | - | R22 | - |
| TTWR | 2 | - | R22 | - |
| DM Plant | 2 | - | R22 | - |
| WTP | 5 | - | R22 | - |
| AHP SWG | 4 | - | R22 | - |
| FOPH One day Tank | 3 | - | R410 a | - |
| AHP Control Room | 1 | - | R22 | - |
| | 4 | - | R22 | - |
| U#8 RIO Room | 1 | - | R410 a | - |
| | 2 | - | R22 | - |
| U#9 RIO Room | 3 | - | R22 | - |
| | 1 | - | R22 | - |
| | 2 | - | R22 | - |
| CANTEEN | 1 | - | R22 | - |
| ESP RAPPER ROOM | 6 | - | R22 | - |
| FIRING FLOOR U9, FIRING FLOOR U10, AHP SWGR ROOM | 3 | - | R134A | - |
| BOILER BASEMENT U9, AHP ROOM | 2 | - | R134A | - |
| BOILER BASEMENT U10 | 1 | - | R134A | - |

Coal Handling Data

| Month | Total Coal Handling (Tonnes/Month) |
|--------|------------------------------------|
| Apr-21 | 648661.22 |
| May-21 | 580955.41 |
| Jun-21 | 554394.15 |
| Jul-21 | 532373.7 |
| Aug-21 | 567724.14 |
| Sep-21 | 425465.8 |
| Oct-21 | 609330.34 |
| Nov-21 | 719973.49 |
| Dec-21 | 725896.54 |
| Jan-22 | 751660.9 |
| Feb-22 | 735053.37 |
| Mar-22 | 854470.85 |

Plantation Data

| Sr. No. | Tree Name | | Native Species/Exotic Species | Avg. Count | Avg. Age (Years) | Avg. Height (m) | (DBH) In cm |
|---------|-------------------------|--------------|-------------------------------|------------|------------------|-----------------|-------------|
| | Scientific Name | Common Name | | | | | |
| 1 | Bambusa bambos | katang | Native | 19000 | 2 | 10 | 7.18 |
| 2 | Bambusa balcooa | balcooa | native | 19000 | 2 | 11 | 6.83 |
| 3 | Bambusa Tulda | tulda | native | 2000 | 2 | 6 | 5.44 |
| 4 | Bambusa Wamin | wamin | native | 5000 | 2 | 3 | 4.22 |
| 5 | T. Oliveri | oliveri | native | 900 | 2 | 10 | 4.88 |
| 6 | Bambusa vulgaris yellow | yello bamboo | native | 2000 | 2 | 10 | 5.94 |
| 7 | | Gulmohar | Native | 390 | 4 | 3 | 7.5 |
| 8 | | Arjun | Native | 170 | 4 | 3 | 7.5 |
| 9 | | Chakas | Native | 90 | 4 | 3 | 7.5 |
| 10 | | Pimpal | Native | 130 | 4 | 3 | 7.5 |
| 11 | | Wad | Native | 130 | 4 | 3 | 7.5 |

Carbon Footprint Study for Koradi Thermal Power Station

| Sr. No. | Tree Name | | Native Species/Exotic Species | Avg. Count | Avg. Age (Years) | Avg. Height (m) | (DBH) in cm |
|---------|-----------------|-------------|-------------------------------|------------|------------------|-----------------|-------------|
| | Scientific Name | Common Name | | | | | |
| 12 | | Peltra Farm | Native | 180 | 4 | 3 | 7.5 |
| 13 | | Kadulimb | Native | 310 | 4 | 3 | 7.5 |
| 14 | | Tibobia | Native | 190 | 4 | 3 | 7.5 |
| 15 | | Chinch | Native | 50 | 4 | 3 | 7.5 |
| 16 | | Spethodia | Native | 50 | 4 | 3 | 7.5 |
| 17 | | Bakud | Native | 40 | 4 | 3 | 7.5 |
| 18 | | Aamba | Native | 90 | 4 | 3 | 7.5 |
| 19 | | Jambhul | Native | 90 | 4 | 3 | 7.5 |
| 20 | | Karanji | Native | 40 | 4 | 3 | 7.5 |
| 21 | | Badam | Native | 40 | 4 | 3 | 7.5 |

Bunkered Coal Data

| Unit | WEEK | Coal Consumption | AFB % TM | AFB % ASH | AFB (%VM) | AFB % FC | AFB CV by BOMB | Unburnt C % In Fly Ash | Unburnt C % in Bottom Ash |
|------|--------|------------------|----------|-----------|-----------|----------|----------------|------------------------|---------------------------|
| 10 | Apr-21 | 1,52,584.000 | 11.73 | 44.47 | 18.78 | 25.02 | 3,088 | 0.46 | 1.53 |
| | May-21 | 2,27,020.000 | 13.33 | 39.52 | 19.21 | 27.93 | 3,375 | 0.41 | 1.51 |
| | Jun-21 | 2,56,404.000 | 16.74 | 38.58 | 20.05 | 24.64 | 3,094 | 0.38 | 1.42 |
| | Jul-21 | 1,89,910.000 | 17.31 | 36.41 | 21.33 | 24.97 | 3,196 | 0.41 | 1.40 |
| | Aug-21 | 2,34,451.000 | 17.11 | 35.34 | 22.27 | 25.28 | 3,243 | 0.36 | 1.41 |
| | Sep-21 | 1,85,948.000 | 18.18 | 36.21 | 19.40 | 26.21 | 3,164 | 0.36 | 1.38 |
| | Oct-21 | 1,88,784.000 | 16.47 | 34.71 | 20.43 | 28.40 | 3,451 | 0.45 | 1.50 |
| | Nov-21 | 2,42,770.000 | 16.01 | 31.48 | 22.76 | 29.75 | 3,615 | 0.39 | 1.40 |
| | Dec-21 | 2,62,546.000 | 16.45 | 31.09 | 22.42 | 30.03 | 3,557 | 0.40 | 1.41 |
| | Jan-22 | 2,65,444.000 | 17.30 | 34.70 | 20.33 | 27.67 | 3,240 | 0.44 | 1.45 |
| | Feb-22 | 2,49,743.000 | 16.91 | 34.85 | 20.56 | 27.69 | 3,295 | 0.43 | 1.42 |
| | Mar-22 | 2,17,984.000 | 16.64 | 34.05 | 21.07 | 28.24 | 3,422 | 0.37 | 1.39 |
| 8 | Apr-21 | 2,21,306.000 | 12.16 | 39.43 | 21.51 | 26.89 | 3,516 | 0.45 | 1.48 |
| | May-21 | 1,79,117.000 | 14.06 | 36.21 | 21.53 | 28.20 | 3,610 | 0.40 | 1.46 |
| | Jun-21 | 89,230.000 | 18.09 | 35.72 | 21.19 | 25.01 | 3,174 | 0.45 | 1.40 |
| | Jul-21 | 2,20,736.000 | 17.14 | 36.83 | 21.31 | 24.72 | 3,137 | 0.40 | 1.42 |
| | Aug-21 | 2,48,394.000 | 17.09 | 36.21 | 21.48 | 25.22 | 3,172 | 0.40 | 1.40 |
| | Sep-21 | 1,81,062.000 | 18.83 | 34.37 | 20.11 | 26.69 | 3,255 | 0.32 | 1.34 |
| | Oct-21 | 2,49,241.000 | 16.66 | 34.62 | 20.40 | 28.32 | 3,452 | 0.45 | 1.49 |
| | Nov-21 | 1,70,504.000 | 15.93 | 30.97 | 23.05 | 30.05 | 3,696 | 0.38 | 1.43 |
| | Dec-21 | 2,26,916.000 | 16.29 | 30.60 | 22.63 | 30.48 | 3,645 | 0.43 | 1.43 |
| | Jan-22 | 2,48,868.000 | 17.12 | 33.89 | 21.08 | 27.91 | 3,346 | 0.42 | 1.43 |
| | Feb-22 | 2,66,249.000 | 17.23 | 34.20 | 20.63 | 27.94 | 3,365 | 0.40 | 1.38 |
| | Mar-22 | 2,84,991.000 | 16.56 | 33.36 | 21.48 | 28.60 | 3,514 | 0.37 | 1.42 |
| 9 | Apr-21 | 1,58,976.000 | 12.05 | 42.67 | 19.32 | 25.96 | 3,226 | 0.38 | 1.76 |
| | May-21 | 1,86,718.000 | 13.77 | 37.25 | 20.68 | 28.31 | 3,581 | 0.38 | 1.44 |
| | Jun-21 | 1,92,969.000 | 18.11 | 35.47 | 21.71 | 24.71 | 3,210 | 0.41 | 1.42 |
| | Jul-21 | 1,89,270.000 | 17.16 | 36.99 | 21.24 | 24.60 | 3,127 | 0.38 | 1.40 |
| | Aug-21 | 2,25,595.850 | 16.91 | 36.66 | 21.47 | 24.96 | 3,138 | 0.41 | 1.45 |
| | Sep-21 | 1,35,724.360 | 18.40 | 37.29 | 19.13 | 25.17 | 3,037 | 0.37 | 1.41 |
| | Oct-21 | 2,04,259.000 | 16.38 | 35.43 | 20.42 | 27.76 | 3,389 | 0.44 | 1.47 |
| | Nov-21 | 2,25,727.000 | 15.78 | 31.27 | 22.80 | 30.15 | 3,645 | 0.40 | 1.43 |
| | Dec-21 | 1,52,481.000 | 16.31 | 30.33 | 22.75 | 30.62 | 3,626 | 0.39 | 1.49 |
| | Jan-22 | 2,63,360.000 | 17.18 | 34.26 | 20.69 | 27.87 | 3,286 | 0.40 | 1.44 |
| | Feb-22 | 1,99,348.000 | 16.96 | 34.74 | 20.34 | 27.96 | 3,322 | 0.46 | 1.41 |
| | Mar-22 | 2,80,137.000 | 16.66 | 33.80 | 21.36 | 28.18 | 3,462 | 0.39 | 1.43 |

Annexure R-4-D -1216-



Mahabal Enviro Engineers Pvt. Ltd.

PLOT NOS. 13,14,17,18, GRAMPANCHAYAT BOKHARA, CHHINDWARA ROAD, KORADI, NAGPUR, MAHARASHTRA, INDIA

Phone: 0712-2612162/2612212 email: nagpur@mahabal.com



TEST REPORT

| | | | |
|-------------|--------------------|-------|------------|
| Report No.: | ME-1878250529 | Date: | 06.06.2025 |
| ULR No.: | TC748725000010435F | | |

| | | | |
|------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|----------------------------------------------------------------------------------------------------|
| Name and Address of Customer | THE CHIEF ENGINEER, MAHARASHTRA STATE POWER GENERATION COMPANY LIMITED, Koradi Thermal Power Station Koradi, Dist. Nagpur. (3X660MW) | | PO No.: KTPS/4550023222/01038 PO Date: 22.08.2024 |
| Sample Description / Type | Ground water | Sampling Done by | Laboratory |
| Sampling Location | Borewell Mahadula Village | Sample Quantity / Packing | 10L X 1 No. PVC Can 500 mL X 1 No. PVC Can 100 mL X 1 No. PVC Can 1L X 1 No. Glass Bottle |
| Date of Sampling | 29.05.2025 | Date of Receipt of Sample | 29.05.2025 |
| Sampling Procedure | IS: 17614; APHA 24 th Ed. 2023, 1060-B | | |
| Date of Start of Analysis | 29.05.2025 | Date of Completion of Analysis | 06.06.2025 |

| Sr. No. | Parameter | Unit | Result | Method Reference |
|---------|----------------------------------------------------------------------------------|------|----------------|----------------------------------------------------------|
| | Discipline: Chemical Testing: Product Group: Water (Ground Water) | | | |
| 1. | Temperature | °C | 28.0 | APHA 24 th Ed. 2023, 2550-B |
| 2. | pH | - | 7.5 | APHA 24 th Ed. 2023, 4500-H+B |
| 3. | Free Chlorine (Residual) | mg/L | BQL (LOQ:0.05) | APHA 24 th Ed. 2023, 4500-Cl G |
| 4. | Total Dissolved Solids | mg/L | 840 | IS 3025 (Part 16): 2023 |
| 5. | Total Suspended Solids | mg/L | 7 | APHA 24 th Ed. 2023, 2540-D |
| 6. | Chloride (as Cl) | mg/L | 126 | APHA 24 th Ed. 2023, 4500-Cl-B |
| 7. | Sulphate (as SO ₄) | mg/L | 31.0 | APHA 24 th Ed. 2023, 4500-SO ₄ -E |
| 8. | Nitrate (as NO ₃) | mg/L | 1.81 | APHA 24 th Ed. 2023, 4500-NO ₃ , B |
| 9. | Total Hardness (as CaCO ₃) | mg/L | 424 | APHA 24 th Ed. 2023, 2340-C |
| 10. | Alkalinity Total (as CaCO ₃) | mg/L | 512 | APHA 24 th Ed. 2023, 2320-B |
| 11. | Phosphate Total (as PO ₄) | mg/L | 0.490 | APHA 24 th Ed. 2023, 4500-P, E |
| 12. | Fluoride (as F) | mg/L | 0.50 | APHA 24 th Ed. 2023, 4500-F, D |
| 13. | Dissolved Oxygen | mg/L | 6.8 | APHA 24 th Ed. 2023, 4500-O, B & C |
| 14. | Biochemical Oxygen Demand (3 days 27°C) | mg/L | 5.9 | IS 3025 (Part 44): 2023 |
| 15. | Chemical Oxygen Demand | mg/L | 20 | APHA 24 th Ed. 2023, 5220-B |
| 16. | Oil and Grease | mg/L | BQL (LOQ:1) | IS 3025 (Part 39): 2021 |

Reviewed and
authorised by

Sagar Yeul

Sagar Yeul

Dy. Technical Manager
Chemical Testing

Page 1 of 2
QF/SALE/02
Issue No 03
Date 05.12.2019.
Amr 03 Date
18.07.2023



YC-1487



- 1217 -

Mahabal Enviro Engineers Pvt. Ltd.

PLOT NOS. 13,14,17,18, GRAMPANCHAYAT BOKHARA, CHHINDWARA ROAD, KORADI, NAGPUR, MAHARASHTRA, INDIA
Phone: 0712-2612162/2612212 email: nagpur@mahabal.com



TEST REPORT

| | | | |
|-------------|--------------------|-------|------------|
| Report No.: | ME-1878250529 | Date: | 06.06.2025 |
| ULR No.: | TC748725000010435F | | |

| Sr. No. | Parameter | Unit | Result | Method Reference |
|--------------------------------------------------------|----------------------------------------------------------|------|------------------|----------------------------------------------------------------------------------------------------------------------------|
| 17. | Free Ammonia | mg/L | BQL (LOQ:0.1) | Test Procedures for Water and Wastewater Maharashtra Engineering Research Institute Government of Maharashtra (MERI): 1992 |
| 18. | Total Kjeldahl Nitrogen | mg/L | 0.95 | APHA 24 th Ed. 2023, 4500 N Org-B |
| 19. | Sulphide (as S) | mg/L | BQL (LOQ:0.05) | APHA 24 th Ed. 2023, 4500-S-C, D |
| 20. | Cyanide (as CN) | mg/L | BQL (LOQ:0.001) | APHA 24 th Ed. 2023, 4500-CN, C & E |
| 21. | Phenolic Compounds (as C ₆ H ₅ OH) | mg/L | BQL (LOQ:0.001) | APHA 24 th Ed. 2023, 5530- B & C |
| 22. | Fixed Dissolved Solids | mg/L | 652 | IS 3025 (Part 18):2022 |
| Product Group: Residues in water (Ground Water) | | | | |
| 23. | Iron (as Fe) | mg/L | 0.155 | IS 3025 (Part 2) 2019 |
| 24. | Manganese (as Mn) | mg/L | BQL (LOQ:0.01) | IS 3025(Part 2): 2019 |
| 25. | Copper (as Cu) | mg/L | BQL (LOQ:0.01) | IS 3025 (Part 2) 2019 |
| 26. | Lead (as Pb) | mg/L | BQL (LOQ:0.008) | IS 3025 (Part 2) 2019 |
| 27. | Zinc (as Zn) | mg/L | 0.035 | IS 3025(Part 2): 2019 |
| 28. | Arsenic (as As) | mg/L | BQL (LOQ:0.007) | IS 3025(Part 2): 2019 |
| 29. | Nickel (as Ni) | mg/L | BQL (LOQ:0.01) | IS 3025(Part 2): 2019 |
| 30. | Mercury (as Hg) | mg/L | BQL (LOQ:0.0005) | APHA 24 th Ed. 2023, 3112-B |
| 31. | Hexavalent Chromium (as Cr ⁶⁺) | mg/L | BQL (LOQ:0.02) | APHA 24 th Ed. 2023, 3500- Cr-B |
| 32. | Chromium Total (as Cr) | mg/L | BQL (LOQ:0.01) | IS 3025 (Part 2) 2019 |
| 33. | Cadmium (as Cd) | mg/L | BQL (LOQ:0.0027) | IS 3025 (Part 2) 2019 |
| 34. | Selenium (as Se) | mg/L | BQL (LOQ:0.01) | IS 3025 (Part 2) 2019 |
| 35. | Vanadium (as V) | mg/L | BQL (LOQ:0.01) | IS 3025(Part 2): 2019 |

END OF REPORT

- Note:**
1. BQL: Below Quantification Limit.
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Page 2 of 2
QF/SALE/02
Issue No 03
Date 05.12.2019.
Amd 03 Date
18.07.2023

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authorised by


Sagar Yeul
Dy. Technical Manager
Chemical Testing



TC-2487



Mahabal Enviro Engineers Pvt. Ltd.

PLOT NOS. 13,14,17,18, GRAMPANCHAYAT BOKHARA, CHHINDWARA ROAD, KORADI, NAGPUR, MAHARASHTRA, INDIA
Phone: 0712-2612162/2612212 email: nagpur@mahabal.com

1218



TEST REPORT

| | | | |
|-------------|----------------|-------|------------|
| Report No.: | ME-1878250529N | Date: | 06.06.2025 |
| ULR No.: | - | | |

| | | | |
|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|------------------------------------------------------|
| Name and Address of Customer | THE CHIEF ENGINEER, MAHARASHTRA STATE POWER GENERATION COMPANY LIMITED, Koradi Thermal Power Station Koradi, Dist. Nagpur. (3X660MW) | | PO No.: KTPS/4550023222/01038 PO Date: 22.08.2024 |
| Sample Description / Type | Ground water | Sampling Done by | Laboratory |
| Sampling Location | Borewell Mahadula Village | Sample Quantity / Packing | 10L X 1 No. PVC Can 500 mL X 1 No. PVC Can |
| Date of Sampling | 29.05.2025 | Date of Receipt of Sample | 29.05.2025 |
| Sampling Procedure | IS: 17614; APHA 24 th Ed. 2023, 1060-B | | |
| Date of Start of Analysis | 29.05.2025 | Date of Completion of Analysis | 06.06.2025 |

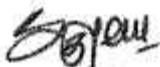
| Sr. No. | Parameter | Unit | Result | Method Reference |
|---------|----------------------------------------------------------------------------------|------|-----------------------------------------------------------------------------------------------|------------------|
| | Discipline: Chemical Testing; Product Group: Water (Ground Water) | | | |
| 1. | Bioassay test | - | Free from acute lethal toxicity (100% Survival of Fish after first 96 hours in 100% water) | IS 6582:1971 |
| 2. | Trivalent Chromium (as Cr ³⁺) | mg/L | BQL (LOQ:0.01) | WI/SAP/WW/56 |

END OF REPORT

- Note:**
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Page 1 of 1
QF/SALE/02
Issue No 03
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Dy. Technical Manager
Chemical Testing





Mahabal Enviro Engineers Pvt. Ltd.

PLOT NOS. 13,14,17,18, GRAMPANCHAYAT BOKHARA, CHHINDWARA ROAD, KORADI, NAGPUR, MAHARASHTRA, INDIA
Phone: 0712-2612162/2612212 email: nagpur@mahabal.com

TEST REPORT



| | | | |
|-------------|--------------------|-------|------------|
| Report No.: | ME-1879250529 | Date: | 06.06.2025 |
| ULR No.: | TC748725000010436F | | |

| | | | |
|------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|----------------------------------------------------------------------------------------------------|
| Name and Address of Customer | THE CHIEF ENGINEER, MAHARASHTRA STATE POWER GENERATION COMPANY LIMITED, Koradi Thermal Power Station Koradi, Dist. Nagpur. (3X660MW) | | PO No.: KTPS/4550023222/01038 PO Date: 22.08.2024 |
| Sample Description / Type | Ground water | Sampling Done by | Laboratory |
| Sampling Location | Dugwell Mahadula Village | Sample Quantity / Packing | 10L X 1 No. PVC Can 500 mL X 1 No. PVC Can 100 mL X 1 No. PVC Can 1L X 1 No. Glass Bottle |
| Date of Sampling | 29.05.2025 | Date of Receipt of Sample | 29.05.2025 |
| Sampling Procedure | IS: 17614; APHA 24 th Ed. 2023, 1060-B | | |
| Date of Start of Analysis | 29.05.2025 | Date of Completion of Analysis | 06.06.2025 |

| Sr. No. | Parameter | Unit | Result | Method Reference |
|---------|----------------------------------------------------------------------------------------------|------|----------------|----------------------------------------------------------|
| | Discipline: Chemical Testing: Product Group: Water (Ground Water) | | | |
| 1. | Temperature | °C | 27.0 | APHA 24 th Ed. 2023, 2550-B |
| 2. | pH | - | 7.6 | APHA 24 th Ed. 2023, 4500-H+B |
| 3. | Free Chlorine (Residual) | mg/L | BQL (LOQ:0.05) | APHA 24 th Ed. 2023, 4500-Cl G |
| 4. | Total Dissolved Solids | mg/L | 933 | IS 3025 (Part 16):2023 |
| 5. | Total Suspended Solids | mg/L | BQL (LOQ:5) | APHA 24 th Ed. 2023, 2540-D |
| 6. | Chloride (as Cl) | mg/L | 127 | APHA 24 th Ed. 2023, 4500-Cl-B |
| 7. | Sulphate (as SO ₄) | mg/L | 47.5 | APHA 24 th Ed. 2023, 4500-SO ₄ -E |
| 8. | Nitrate (as NO ₃) | mg/L | 34.9 | APHA 24 th Ed. 2023, 4500-NO ₃ , B |
| 9. | Total Hardness (as CaCO ₃) | mg/L | 464 | APHA 24 th Ed. 2023, 2340-C |
| 10. | Alkalinity Total (as CaCO ₃) | mg/L | 524 | APHA 24 th Ed. 2023, 2320-B |
| 11. | Phosphate Total (as PO ₄) | mg/L | 0.165 | APHA 24 th Ed. 2023, 4500-P, E |
| 12. | Fluoride (as F) | mg/L | 0.55 | APHA 24 th Ed. 2023, 4500-F, D |
| 13. | Dissolved Oxygen | mg/L | 6.7 | APHA 24 th Ed. 2023, 4500-O, B & C |
| 14. | Biochemical Oxygen Demand (3 days 27°C) | mg/L | 4.2 | IS 3025 (Part 44): 2023 |
| 15. | Chemical Oxygen Demand | mg/L | 16 | APHA 24 th Ed. 2023, 5220-B |
| 16. | Oil and Grease | mg/L | BQL (LOQ:1) | IS 3025 (Part 39): 2021 |

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Page 1 of 2
QF/SALE/02
Issue No 03
Date 05.12.2019.
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18.07.2023

Sagar Yeul
Dy. Technical Manager
Chemical Testing



1220



Mahabal Enviro Engineers Pvt. Ltd.

PLOT NOS. 13,14,17,18, GRAMPANCHAYAT BOKHARA, CHHINDWARA ROAD, KORADI, NAGPUR, MAHARASHTRA, INDIA
Phone: 0712-2612162/2612212 email: nagpur@mahabal.com

TEST REPORT



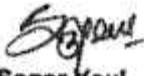
| | | | |
|-------------|--------------------|-------|------------|
| Report No.: | ME-1879250529 | Date: | 06.06.2025 |
| ULR No.: | TC748725000010436F | | |

| Sr. No. | Parameter | Unit | Result | Method Reference |
|---------|-------------------------------------------------------------|------|------------------|----------------------------------------------------------------------------------------------------------------------------------|
| 17. | Free Ammonia | mg/L | BQL (LOQ:0.1) | Test Procedures for Water and Wastewater Maharashtra Engineering Research Institute Government of Maharashtra (MERI): 1992 |
| 18. | Total Kjeldahl Nitrogen | mg/L | 1.01 | APHA 24 th Ed. 2023, 4500-N Org-B |
| 19. | Sulphide (as S) | mg/L | BQL (LOQ:0.05) | APHA 24 th Ed. 2023, 4500-S-C, D |
| 20. | Cyanide (as CN) | mg/L | BQL (LOQ:0.001) | APHA 24 th Ed. 2023, 4500-CN, C & E |
| 21. | Phenolic Compounds (as C ₆ H ₅ OH) | mg/L | BQL (LOQ:0.001) | APHA 24 th Ed. 2023, 5530-B & C |
| 22. | Fixed Dissolved Solids | mg/L | 736 | IS 3025 (Part 18):2022 |
| | Product Group: Residues in water (Ground Water) | | | |
| 23. | Iron (as Fe) | mg/L | 0.063 | IS 3025 (Part 2): 2019 |
| 24. | Manganese (as Mn) | mg/L | 0.035 | IS 3025(Part 2): 2019 |
| 25. | Copper (as Cu) | mg/L | BQL (LOQ:0.01) | IS 3025 (Part 2): 2019 |
| 26. | Lead (as Pb) | mg/L | BQL (LOQ:0.008) | IS 3025 (Part 2): 2019 |
| 27. | Zinc (as Zn) | mg/L | 0.057 | IS 3025(Part 2): 2019 |
| 28. | Arsenic (as As) | mg/L | BQL (LOQ:0.007) | IS 3025(Part 2): 2019 |
| 29. | Nickel (as Ni) | mg/L | BQL (LOQ:0.01) | IS 3025(Part 2): 2019 |
| 30. | Mercury (as Hg) | mg/L | BQL (LOQ:0.0005) | APHA 24 th Ed. 2023, 3112-B |
| 31. | Hexavalent Chromium (as Cr ⁶⁺) | mg/L | BQL (LOQ:0.02) | APHA 24 th Ed. 2023, 3500-Cr-B |
| 32. | Chromium Total (as Cr) | mg/L | BQL (LOQ:0.01) | IS 3025 (Part 2): 2019 |
| 33. | Cadmium (as Cd) | mg/L | BQL (LOQ:0.0027) | IS 3025 (Part 2): 2019 |
| 34. | Selenium (as Se) | mg/L | BQL (LOQ:0.01) | IS 3025 (Part 2): 2019 |
| 35. | Vanadium (as V) | mg/L | 0.010 | IS 3025(Part 2): 2019 |

END OF REPORT

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Page 2 of 2
QF/SALE/02
Issue No 03
Date 05.12.2019.
Amd 03 Date
18.07.2023

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Dy. Technical Manager
Chemical Testing





1221

Mahabal Enviro Engineers Pvt. Ltd.

PLOT NOS. 13,14,17,18, GRAMPANCHAYAT BOKHARA, CHHINDWARA ROAD, KORADI, NAGPUR, MAHARASHTRA, INDIA

Phone: 0712-2612162/2612212 email: nagpur@mahabal.com

TEST REPORT



| | | | |
|-------------|----------------|-------|------------|
| Report No.: | ME-1879250529N | Date: | 06.06.2025 |
| ULR No.: | - | | |

| | | | |
|------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|------------------------------------------------------|
| Name and Address of Customer | THE CHIEF ENGINEER, MAHARASHTRA STATE POWER GENERATION COMPANY LIMITED, Koradi Thermal Power Station Koradi, Dist. Nagpur. (3X660MW) | | PO No.: KTPS/4550023222/01038 PO Date: 22.08.2024 |
| Sample Description / Type | Ground water | Sampling Done by | Laboratory |
| Sampling Location | Dugwell Mahadula Village | Sample Quantity / Packing | 10L X 1 No. PVC Can 500 mL X 1 No. PVC Can |
| Date of Sampling | 29.05.2025 | Date of Receipt of Sample | 29.05.2025 |
| Sampling Procedure | IS: 17614; APHA 24 th Ed. 2023, 1060-B | | |
| Date of Start of Analysis | 29.05.2025 | Date of Completion of Analysis | 06.06.2025 |

| Sr. No. | Parameter | Unit | Result | Method Reference |
|---------|----------------------------------------------------------------------------------|------|-----------------------------------------------------------------------------------------------|------------------|
| | Discipline: Chemical Testing; Product Group: Water (Ground Water) | | | |
| 1. | Bioassay test | - | Free from acute lethal toxicity (100% Survival of Fish after first 96 hours in 100% water) | IS 6582:1971 |
| 2. | Trivalent Chromium (as Cr ³⁺) | mg/L | BQL (LOQ:0.01) | WI/SAP/WW/56 |

END OF REPORT

- Note:**
1. BQL: Below Quantification Limit.
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Page 1 of 1
QF/SALE/02
Issue No 03
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18.07.2023

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Sagar Yeul
Dy. Technical Manager
Chemical Testing





Mahabal Enviro Engineers Pvt. Ltd.

PLOT NOS. 13,14,17,18, GRAMPANCHAYAT BOKHARA, CHHINDWARA ROAD, KORADI, NAGPUR, MAHARASHTRA, INDIA
Phone: 0712-2612162/2612212 email: nagpur@mahabal.com

1222

TEST REPORT



| | | | |
|-------------|--------------------|-------|------------|
| Report No.: | ME-1881250529 | Date: | 06.06.2025 |
| ULR No.: | TC748725000010438F | | |

| | | | |
|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|----------------------------------------------------------------------------------------------------|
| Name and Address of Customer | THE CHIEF ENGINEER, MAHARASHTRA STATE POWER GENERATION COMPANY LIMITED, Koradi Thermal Power Station Koradi, Dist. Nagpur. (3X660MW) | | PO No.: KTPS/4550023222/01038 PO Date: 22.08.2024 |
| Sample Description / Type | Ground water | Sampling Done by | Laboratory |
| Sampling Location | Dugwell Koradi Village | Sample Quantity / Packing | 10L X 1 No. PVC Can 500 mL X 1 No. PVC Can 100 mL X 1 No. PVC Can 1L X 1 No. Glass Bottle |
| Date of Sampling | 29.05.2025 | Date of Receipt of Sample | 29.05.2025 |
| Sampling Procedure | IS: 17614; APHA 24 th Ed. 2023, 1060-B | | |
| Date of Start of Analysis | 29.05.2025 | Date of Completion of Analysis | 06.06.2025 |

| Sr. No. | Parameter | Unit | Result | Method Reference |
|---------|----------------------------------------------------------------------------------|------|----------------|----------------------------------------------------------|
| | Discipline: Chemical Testing; Product Group: Water (Ground Water) | | | |
| 1. | Temperature | °C | 28.0 | APHA 24 th Ed. 2023, 2550-B |
| 2. | pH | - | 7.7 | APHA 24 th Ed. 2023, 4500-H+ B |
| 3. | Free Chlorine (Residual) | mg/L | BQL (LOQ:0.05) | APHA 24 th Ed. 2023, 4500-Cl G |
| 4. | Total Dissolved Solids | mg/L | 548 | IS 3025 (Part 16):2023 |
| 5. | Total Suspended Solids | mg/L | BQL (LOQ:5) | APHA 24 th Ed. 2023, 2540-D |
| 6. | Chloride (as Cl) | mg/L | 59.5 | APHA 24 th Ed. 2023, 4500-Cl-B |
| 7. | Sulphate (as SO ₄) | mg/L | 34.6 | APHA 24 th Ed. 2023, 4500-SO ₄ -E |
| 8. | Nitrate (as NO ₃) | mg/L | 23.3 | APHA 24 th Ed. 2023, 4500-NO ₃ , B |
| 9. | Total Hardness (as CaCO ₃) | mg/L | 354 | APHA 24 th Ed. 2023, 2340-C |
| 10. | Alkalinity Total (as CaCO ₃) | mg/L | 312 | APHA 24 th Ed. 2023, 2320-B |
| 11. | Phosphate Total (as PO ₄) | mg/L | 0.707 | APHA 24 th Ed. 2023, 4500-P, E |
| 12. | Fluoride (as F) | mg/L | 0.54 | APHA 24 th Ed. 2023, 4500-F, D |
| 13. | Dissolved Oxygen | mg/L | 6.7 | APHA 24 th Ed. 2023, 4500-O, B & C |
| 14. | Biochemical Oxygen Demand (3 days 27°C) | mg/L | 5.2 | IS 3025 (Part 44): 2023 |
| 15. | Chemical Oxygen Demand | mg/L | 17 | APHA 24 th Ed. 2023, 5220-B |
| 16. | Oil and Grease | mg/L | BQL (LOQ:1) | IS 3025 (Part 39): 2021 |

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Sagar Yeul
Dy. Technical Manager
Chemical Testing

Page 1 of 2
QF/SALE/02
Issue No 03
Date 05.12.2019.
Amd 03 Date
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1223

Mahabal Enviro Engineers Pvt. Ltd.

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Phone: 0712-2612162/2612212 email: nagpur@mahabal.com

TEST REPORT



| | | | |
|-------------|--------------------|-------|------------|
| Report No.: | ME-1881250529 | Date: | 06.06.2025 |
| ULR No.: | TC748725000010438F | | |

| Sr. No. | Parameter | Unit | Result | Method Reference |
|--------------------------------------------------------|----------------------------------------------------------|------|------------------|----------------------------------------------------------------------------------------------------------------------------|
| 17. | Free Ammonia | mg/L | BQL (LOQ:0.1) | Test Procedures for Water and Wastewater Maharashtra Engineering Research Institute Government of Maharashtra (MERI): 1992 |
| 18. | Total Kjeldahl Nitrogen | mg/L | 1.40 | APHA 24 th Ed. 2023, 4500-N Org-B |
| 19. | Sulphide (as S) | mg/L | BQL (LOQ:0.05) | APHA 24 th Ed. 2023, 4500-S-C, D |
| 20. | Cyanide (as CN) | mg/L | BQL (LOQ:0.001) | APHA 24 th Ed. 2023, 4500-CN, C & E |
| 21. | Phenolic Compounds (as C ₆ H ₅ OH) | mg/L | BQL (LOQ:0.001) | APHA 24 th Ed. 2023, 5530-B & C |
| 22. | Fixed Dissolved Solids | mg/L | 422 | IS 3025 (Part 18):2022 |
| Product Group: Residues in water (Ground Water) | | | | |
| 23. | Iron (as Fe) | mg/L | 0.091 | IS 3025 (Part 2) 2019 |
| 24. | Manganese (as Mn) | mg/L | BQL (LOQ:0.01) | IS 3025(Part 2): 2019 |
| 25. | Copper (as Cu) | mg/L | 0.014 | IS 3025 (Part 2) 2019 |
| 26. | Lead (as Pb) | mg/L | BQL (LOQ:0.008) | IS 3025 (Part 2) 2019 |
| 27. | Zinc (as Zn) | mg/L | 0.031 | IS 3025(Part 2): 2019 |
| 28. | Arsenic (as As) | mg/L | BQL (LOQ:0.007) | IS 3025(Part 2): 2019 |
| 29. | Nickel (as Ni) | mg/L | BQL (LOQ:0.01) | IS 3025(Part 2): 2019 |
| 30. | Mercury (as Hg) | mg/L | BQL (LOQ:0.0005) | APHA 24 th Ed. 2023, 3112-B |
| 31. | Hexavalent Chromium (as Cr ⁶⁺) | mg/L | BQL (LOQ:0.02) | APHA 24 th Ed. 2023, 3500-Cr-B |
| 32. | Chromium Total (as Cr) | mg/L | BQL (LOQ:0.01) | IS 3025 (Part 2) 2019 |
| 33. | Cadmium (as Cd) | mg/L | BQL (LOQ:0.0027) | IS 3025 (Part 2) 2019 |
| 34. | Selenium (as Se) | mg/L | BQL (LOQ:0.01) | IS 3025 (Part 2) 2019 |
| 35. | Vanadium (as V) | mg/L | 0.012 | IS 3025(Part 2): 2019 |

END OF REPORT

- Note:**
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Page 2 of 2
QF/SALE/02
Issue No 03
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Amd 03 Date
18.07.2023

Reviewed and
authorised by

Sagar Yeul
Dy. Technical Manager
Chemical Testing





Mahabal Enviro Engineers Pvt. Ltd.

PLOT NOS. 13,14,17,18, GRAMPANCHAYAT BOKHARA, CHHINDWARA ROAD, KORADI, NAGPUR, MAHARASHTRA, INDIA
Phone: 0712-2612162/2612212 email: nagpur@mahabal.com

TEST REPORT



| | | | |
|-------------|----------------|-------|------------|
| Report No.: | ME-1881250529N | Date: | 06.06.2025 |
| ULR No.: | - | | |

| | | | |
|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|------------------------------------------------------|
| Name and Address of Customer | THE CHIEF ENGINEER, MAHARASHTRA STATE POWER GENERATION COMPANY LIMITED, Koradi Thermal Power Station Koradi, Dist. Nagpur. (3X660MW) | | PO No.: KTPS/4550023222/01038 PO Date: 22.08.2024 |
| Sample Description / Type | Ground water | Sampling Done by | Laboratory |
| Sampling Location | Dugwell Koradi Village | Sample Quantity / Packing | 10L X 1 No. PVC Can 500 mL X 1 No. PVC Can |
| Date of Sampling | 29.05.2025 | Date of Receipt of Sample | 29.05.2025 |
| Sampling Procedure | IS: 17614; APHA 24 th Ed. 2023, 1060-B | | |
| Date of Start of Analysis | 29.05.2025 | Date of Completion of Analysis | 06.06.2025 |

| Sr. No. | Parameter | Unit | Result | Method Reference |
|---------|----------------------------------------------------------------------------------|------|-----------------------------------------------------------------------------------------------|------------------|
| | Discipline: Chemical Testing; Product Group: Water (Ground Water) | | | |
| 1. | Bioassay test | - | Free from acute lethal toxicity (100% Survival of Fish after first 96 hours in 100% water) | IS 6582:1971 |
| 2. | Trivalent Chromium (as Cr ³⁺) | mg/L | BQL (LOQ:0.01) | W/SAP/WW/56 |

END OF REPORT

- Note:**
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Page 1 of 1
QF/SALE/02
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Sagar Yeul
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Chemical Testing





Mahabal Enviro Engineers Pvt. Ltd.

PLOT NOS. 13,14,17,18, GRAMPANCHAYAT BOKHARA, CHHINDWARA ROAD, KORADI, NAGPUR, MAHARASHTRA, INDIA
Phone: 0712-2612162/2612212 email: nagpur@mahabal.com

TEST REPORT



| | | | |
|-------------|--------------------|-------|------------|
| Report No.: | ME-1880250529 | Date: | 06.06.2025 |
| ULR No.: | TC748725000010437F | | |

| | | | |
|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|----------------------------------------------------------------------------------------------------|
| Name and Address of Customer | THE CHIEF ENGINEER, MAHARASHTRA STATE POWER GENERATION COMPANY LIMITED, Koradi Thermal Power Station Koradi, Dist. Nagpur. (3X660MW) | | PO No.: KTPS/4650023222/01038 PO Date: 22.08.2024 |
| Sample Description / Type | Ground water | Sampling Done by | Laboratory |
| Sampling Location | Borewell Koradi Village | Sample Quantity / Packing | 10L X 1 No. PVC Can 500 mL X 1 No. PVC Can 100 mL X 1 No. PVC Can 1L X 1 No. Glass Bottle |
| Date of Sampling | 29.05.2025 | Date of Receipt of Sample | 29.05.2025 |
| Sampling Procedure | IS: 17614; APHA 24 th Ed. 2023, 1060-B | | |
| Date of Start of Analysis | 29.05.2025 | Date of Completion of Analysis | 06.06.2025 |

| Sr. No. | Parameter | Unit | Result | Method Reference |
|---------|----------------------------------------------------------------------------------|------|----------------|---------------------------------------------------------|
| | Discipline: Chemical Testing: Product Group: Water (Ground Water) | | | |
| 1. | Temperature | °C | 29.0 | APHA 24 th Ed. 2023, 2550-B |
| 2. | pH | - | 7.7 | APHA 24 th Ed. 2023, 4500-H+B |
| 3. | Free Chlorine (Residual) | mg/L | BQL (LOQ:0.05) | APHA 24 th Ed. 2023, 4500-Cl G |
| 4. | Total Dissolved Solids | mg/L | 595 | IS 3025 (Part 16):2023 |
| 5. | Total Suspended Solids | mg/L | BQL (LOQ:5) | APHA 24 th Ed. 2023, 2540-D |
| 6. | Chloride (as Cl) | mg/L | 71.0 | APHA 24 th Ed. 2023, 4500-Cl-B |
| 7. | Sulphate (as SO ₄) | mg/L | 33.6 | APHA 24 th Ed. 2023, 4500-SO ₄ -E |
| 8. | Nitrate (as NO ₃) | mg/L | 33.3 | APHA 24 th Ed. 2023, 4500-NO ₃ B |
| 9. | Total Hardness (as CaCO ₃) | mg/L | 398 | APHA 24 th Ed. 2023, 2340-C |
| 10. | Alkalinity Total (as CaCO ₃) | mg/L | 328 | APHA 24 th Ed. 2023, 2320-B |
| 11. | Phosphate Total (as PO ₄) | mg/L | 0.376 | APHA 24 th Ed. 2023, 4500-P, E |
| 12. | Fluoride (as F) | mg/L | 0.62 | APHA 24 th Ed. 2023, 4500-F, D |
| 13. | Dissolved Oxygen | mg/L | 6.7 | APHA 24 th Ed. 2023, 4500-O, B & C |
| 14. | Biochemical Oxygen Demand (3 days 27°C) | mg/L | 4.9 | IS 3025 (Part 44): 2023 |
| 15. | Chemical Oxygen Demand | mg/L | 18 | APHA 24 th Ed. 2023, 5220-B |
| 16. | Oil and Grease | mg/L | BQL (LOQ:1) | IS 3025 (Part 39): 2021 |

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Page 1 of 2
QF/SALE/02
Issue No 03
Date 05.12.2019.
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Chemical Testing





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PLOT NOS. 13,14,17,18, GRAMPANCHAYAT BOKHARA, CHHINDWARA ROAD, KORADI, NAGPUR, MAHARASHTRA, INDIA
Phone: 0712-2612162/2612212 email: nagpur@mahabal.com

TEST REPORT



| | | | |
|-------------|--------------------|-------|------------|
| Report No.: | ME-1880250529 | Date: | 06.06.2025 |
| ULR No.: | TC748725000010437F | | |

| Sr. No. | Parameter | Unit | Result | Method Reference |
|--------------------------------------------------------|----------------------------------------------------------|------|------------------|----------------------------------------------------------------------------------------------------------------------------|
| 17. | Free Ammonia | mg/L | BQL (LOQ:0.1) | Test Procedures for Water and Wastewater Maharashtra Engineering Research Institute Government of Maharashtra (MERI): 1992 |
| 18. | Total Kjeldahl Nitrogen | mg/L | 1.06 | APHA 24 th Ed. 2023, 4500-N-Or-B |
| 19. | Sulphide (as S) | mg/L | BQL (LOQ:0.05) | APHA 24 th Ed. 2023, 4500-S-C, D |
| 20. | Cyanide (as CN) | mg/L | BQL (LOQ:0.001) | APHA 24 th Ed. 2023, 4500-CN, C & E |
| 21. | Phenolic Compounds (as C ₆ H ₅ OH) | mg/L | BQL (LOQ:0.001) | APHA 24 th Ed. 2023, 5530-B & C |
| 22. | Fixed Dissolved Solids | mg/L | 450 | IS 3025 (Part 18):2022 |
| Product Group: Residues in water (Ground Water) | | | | |
| 23. | Iron (as Fe) | mg/L | 0.071 | IS 3025 (Part 2) 2019 |
| 24. | Manganese (as Mn) | mg/L | 0.035 | IS 3025(Part 2): 2019 |
| 25. | Copper (as Cu) | mg/L | BQL (LOQ:0.01) | IS 3025 (Part 2) 2019 |
| 26. | Lead (as Pb) | mg/L | BQL (LOQ:0.008) | IS 3025 (Part 2) 2019 |
| 27. | Zinc (as Zn) | mg/L | 0.058 | IS 3025(Part 2): 2019 |
| 28. | Arsenic (as As) | mg/L | BQL (LOQ:0.007) | IS 3025(Part 2): 2019 |
| 29. | Nickel (as Ni) | mg/L | BQL (LOQ:0.01) | IS 3025(Part 2): 2019 |
| 30. | Mercury (as Hg) | mg/L | BQL (LOQ:0.0005) | APHA 24 th Ed. 2023, 3112-B |
| 31. | Hexavalent Chromium (as Cr ⁶⁺) | mg/L | BQL (LOQ:0.02) | APHA 24 th Ed. 2023, 3500-Cr-B |
| 32. | Chromium Total (as Cr) | mg/L | BQL (LOQ:0.01) | IS 3025 (Part 2) 2019 |
| 33. | Cadmium (as Cd) | mg/L | BQL (LOQ:0.0027) | IS 3025 (Part 2) 2019 |
| 34. | Selenium (as Se) | mg/L | BQL (LOQ:0.01) | IS 3025 (Part 2) 2019 |
| 35. | Vanadium (as V) | mg/L | 0.011 | IS 3025(Part 2): 2019 |

END OF REPORT

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Page 2 of 2
QF/SALE/02
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Sagar Yeul

Sagar Yeul
Dy. Technical Manager
Chemical Testing



TC-7487



1227

Mahabal Enviro Engineers Pvt. Ltd.

PLOT NOS. 13,14,17,18, GRAMPANCHAYAT BOKHARA, CHHINDWARA ROAD, KORADI, NAGPUR, MAHARASHTRA, INDIA

Phone: 0712-2612162/2612212 email: nagpur@mahabal.com

TEST REPORT



| | | | |
|-------------|----------------|-------|------------|
| Report No.: | ME-1880250529N | Date: | 06.06.2025 |
| ULR No.: | - | | |

| | | | |
|------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|------------------------------------------------------|
| Name and Address of Customer | THE CHIEF ENGINEER, MAHARASHTRA STATE POWER GENERATION COMPANY LIMITED, Koradi Thermal Power Station Koradi, Dist. Nagpur. (3X660MW) | | PO No.: KTPS/4550023222/01038 PO Date: 22.08.2024 |
| Sample Description / Type | Ground water | Sampling Done by | Laboratory |
| Sampling Location | Borewell Koradi Village | Sample Quantity / Packing | 10L X 1 No. PVC Can 500 mL X 1 No. PVC Can |
| Date of Sampling | 29.05.2025 | Date of Receipt of Sample | 29.05.2025 |
| Sampling Procedure | IS: 17614; APHA 24 th Ed. 2023, 1060-B | | |
| Date of Start of Analysis | 29.05.2025 | Date of Completion of Analysis | 06.06.2025 |

| Sr. No. | Parameter | Unit | Result | Method Reference |
|---------|----------------------------------------------------------------------------------------------|------|-----------------------------------------------------------------------------------------------|------------------|
| | Discipline: Chemical Testing: Product Group: Water (Ground Water) | | | |
| 1. | Bioassay test | - | Free from acute lethal toxicity (100% Survival of Fish after first 96 hours in 100% water) | IS 6582:1971 |
| 2. | Trivalent Chromium (as Cr ³⁺) | mg/L | BQL (LOQ:0.01) | W/SAP/WW/56 |

END OF REPORT

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Page 1 of 1
QF/SALE/02
Issue No 03
Date 05.12.2019.
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Dy. Technical Manager
Chemical Testing





1228

Mahabal Enviro Engineers Pvt. Ltd.

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Phone: 0712-2612162/2612212 email: nagpur@mahabal.com

TEST REPORT



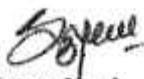
| | | | |
|-------------|--------------------|-------|------------|
| Report No.: | ME-1882250529 | Date: | 06.06.2025 |
| ULR No.: | TC748725000010439F | | |

| | | | |
|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|----------------------------------------------------------------------------------------------------|
| Name and Address of Customer | THE CHIEF ENGINEER, MAHARASHTRA STATE POWER GENERATION COMPANY LIMITED, Koradi Thermal Power Station Koradi, Dist. Nagpur. (3X660MW) | | PO No.: KTPS/4550023222/01038 PO Date: 22.08.2024 |
| Sample Description / Type | Ground water | Sampling Done by | Laboratory |
| Sampling Location | Borewell Nanda Village | Sample Quantity / Packing | 10L X 1 No. PVC Can 500 mL X 1 No. PVC Can 100 mL X 1 No. PVC Can 1L X 1 No. Glass Bottle |
| Date of Sampling | 29.05.2025 | Date of Receipt of Sample | 29.05.2025 |
| Sampling Procedure | IS: 17614; APHA 24 th Ed. 2023, 1060-B | | |
| Date of Start of Analysis | 29.05.2025 | Date of Completion of Analysis | 06.06.2025 |

| Sr. No. | Parameter | Unit | Result | Method Reference |
|---------|----------------------------------------------------------------------------------|------|----------------|--------------------------------------------------------|
| | Discipline: Chemical Testing; Product Group: Water (Ground Water) | | | |
| 1. | Temperature | °C | 30.0 | APHA 24 th Ed. 2023, 2550-B |
| 2. | pH | - | 7.4 | APHA 24 th Ed. 2023, 4500-H+ B |
| 3. | Free Chlorine (Residual) | mg/L | BQL (LOQ:0.05) | APHA 24 th Ed. 2023, 4500-Cl G |
| 4. | Total Dissolved Solids | mg/L | 666 | IS 3025 (Part 16):2023 |
| 5. | Total Suspended Solids | mg/L | BQL (LOQ:5) | APHA 24 th Ed. 2023, 2540-D |
| 6. | Chloride (as Cl) | mg/L | 114 | APHA 24 th Ed. 2023, 4500-Cl B |
| 7. | Sulphate (as SO ₄) | mg/L | 29.3 | APHA 24 th Ed. 2023, 4500-SO ₄ E |
| 8. | Nitrate (as NO ₃) | mg/L | 34.2 | APHA 24 th Ed. 2023, 4500-NO ₃ B |
| 9. | Total Hardness (as CaCO ₃) | mg/L | 504 | APHA 24 th Ed. 2023, 2340-C |
| 10. | Alkalinity Total (as CaCO ₃) | mg/L | 362 | APHA 24 th Ed. 2023, 2320-B |
| 11. | Phosphate Total (as PO ₄) | mg/L | 0.246 | APHA 24 th Ed. 2023, 4500-P, E |
| 12. | Fluoride (as F) | mg/L | 0.48 | APHA 24 th Ed. 2023, 4500-F, D |
| 13. | Dissolved Oxygen | mg/L | 6.6 | APHA 24 th Ed. 2023, 4500-O, B & C |
| 14. | Biochemical Oxygen Demand (3 days 27°C) | mg/L | 5.8 | IS 3025 (Part 44): 2023 |
| 15. | Chemical Oxygen Demand | mg/L | 21 | APHA 24 th Ed. 2023, 5220-B |
| 16. | Oil and Grease | mg/L | BQL (LOQ:1) | IS 3025 (Part 39): 2021 |

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Page 1 of 2
QF/SALE/02
Issue No 03
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Sagar Yeul
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Chemical Testing



TC 7487



1229

Mahabal Enviro Engineers Pvt. Ltd.

PLOT NOS. 13,14,17,18, GRAMPANCHAYAT BOKHARA, CHHINDWARA ROAD, KORADI, NAGPUR, MAHARASHTRA, INDIA
Phone: 0712-2612162/2612212 email: nagpur@mahabal.com

TEST REPORT



| | | | |
|-------------|--------------------|-------|------------|
| Report No.: | ME-1882250529 | Date: | 06.06.2025 |
| ULR No.: | TC748725000010439F | | |

| Sr. No. | Parameter | Unit | Result | Method Reference |
|---------|-------------------------------------------------------------|------|------------------|----------------------------------------------------------------------------------------------------------------------------------|
| 17. | Free Ammonia | mg/L | BQL (LOQ:0.1) | Test Procedures for Water and Wastewater Maharashtra Engineering Research Institute Government of Maharashtra (MERI): 1992 |
| 18. | Total Kjeldahl Nitrogen | mg/L | 2.18 | APHA 24 th Ed. 2023, 4500 N Org-B |
| 19. | Sulphide (as S) | mg/L | BQL (LOQ:0.05) | APHA 24 th Ed. 2023, 4500-S-C, D |
| 20. | Cyanide (as CN) | mg/L | BQL (LOQ:0.001) | APHA 24 th Ed. 2023, 4500-CN, C & E |
| 21. | Phenolic Compounds (as C ₆ H ₅ OH) | mg/L | BQL (LOQ:0.001) | APHA 24 th Ed. 2023, 5530-B & C |
| 22. | Fixed Dissolved Solids | mg/L | 510 | IS 3025 (Part 18):2022 |
| | Product Group: Residues in water (Ground Water) | | | |
| 23. | Iron (as Fe) | mg/L | 0.081 | IS 3025 (Part 2) 2019 |
| 24. | Manganese (as Mn) | mg/L | 0.035 | IS 3025(Part 2): 2019 |
| 25. | Copper (as Cu) | mg/L | BQL (LOQ:0.01) | IS 3025 (Part 2) 2019 |
| 26. | Lead (as Pb) | mg/L | BQL (LOQ:0.008) | IS 3025 (Part 2) 2019 |
| 27. | Zinc (as Zn) | mg/L | 0.057 | IS 3025(Part 2): 2019 |
| 28. | Arsenic (as As) | mg/L | BQL (LOQ:0.007) | IS 3025(Part 2): 2019 |
| 29. | Nickel (as Ni) | mg/L | BQL (LOQ:0.01) | IS 3025(Part 2): 2019 |
| 30. | Mercury (as Hg) | mg/L | BQL (LOQ:0.0005) | APHA 24 th Ed. 2023, 3112-B |
| 31. | Hexavalent Chromium (as Cr ⁶⁺) | mg/L | BQL (LOQ:0.02) | APHA 24 th Ed. 2023, 3500-Cr-B |
| 32. | Chromium Total (as Cr) | mg/L | BQL (LOQ:0.01) | IS 3025 (Part 2) 2019 |
| 33. | Cadmium (as Cd) | mg/L | BQL (LOQ:0.0027) | IS 3025 (Part 2) 2019 |
| 34. | Selenium (as Se) | mg/L | BQL (LOQ:0.01) | IS 3025 (Part 2) 2019 |
| 35. | Vanadium (as V) | mg/L | 0.013 | IS 3025(Part 2): 2019 |

END OF REPORT

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Page 2 of 2
QF/SALE/02
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Sagar Yeul
Dy. Technical Manager
Chemical Testing





1230

Mahabal Enviro Engineers Pvt. Ltd.

PLOT NOS. 13,14,17,18, GRAMPANCHAYAT BOKHARA, CHHINDWARA ROAD, KORADI, NAGPUR, MAHARASHTRA, INDIA
Phone: 0712-2612162/2612212 email: nagpur@mahabal.com

TEST REPORT



| | | | |
|-------------|----------------|-------|------------|
| Report No.: | ME-1882250529N | Date: | 06.06.2025 |
| ULR No.: | - | | |

| | | | |
|------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|------------------------------------------------------|
| Name and Address of Customer | THE CHIEF ENGINEER, MAHARASHTRA STATE POWER GENERATION COMPANY LIMITED, Koradi Thermal Power Station Koradi, Dist. Nagpur. (3X660MW) | | PO No.: KTPS/4550023222/01038 PO Date: 22.08.2024 |
| Sample Description / Type | Ground water | Sampling Done by | Laboratory |
| Sampling Location | Borewell Nanda Village | Sample Quantity / Packing | 10L X 1 No. PVC Can 500 mL X 1 No. PVC Can |
| Date of Sampling | 29.05.2025 | Date of Receipt of Sample | 29.05.2025 |
| Sampling Procedure | IS: 17614; APHA 24 th Ed. 2023, 1060-B | | |
| Date of Start of Analysis | 29.05.2025 | Date of Completion of Analysis | 06.06.2025 |

| Sr. No. | Parameter | Unit | Result | Method Reference |
|---------|----------------------------------------------------------------------------------------------|------|-----------------------------------------------------------------------------------------------|------------------|
| | Discipline: Chemical Testing: Product Group: Water (Ground Water) | | | |
| 1. | Bioassay test | - | Free from acute lethal toxicity (100% Survival of Fish after first 96 hours in 100% water) | IS 6582:1971 |
| 2. | Trivalent Chromium (as Cr ³⁺) | mg/L | BQL (LOQ:0.01) | WI/SAP/WW/56 |

END OF REPORT

- Note:**
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Page 1 of 1
QF/SALE/02
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Phone: 0712-2612162/2612212 email: nagpur@mahabal.com

TEST REPORT



| | | | |
|-------------|--------------------|-------|------------|
| Report No.: | ME-1883250529 | Date: | 06.06.2025 |
| ULR No.: | TC748725000010440F | | |

| | | | |
|------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|----------------------------------------------------------------------------------------------------|
| Name and Address of Customer | THE CHIEF ENGINEER, MAHARASHTRA STATE POWER GENERATION COMPANY LIMITED, Koradi Thermal Power Station Koradi, Dist. Nagpur. (3X660MW) | | PO No.: KTPS/4550023222/01038 PO Date: 22.08.2024 |
| Sample Description / Type | Ground water | Sampling Done by | Laboratory |
| Sampling Location | Dugwell Nanda Village | Sample Quantity / Packing | 10L X 1 No. PVC Can 500 mL X 1 No. PVC Can 100 mL X 1 No. PVC Can 1L X 1 No. Glass Bottle |
| Date of Sampling | 29.05.2025 | Date of Receipt of Sample | 29.05.2025 |
| Sampling Procedure | IS: 17614; APHA 24 th Ed. 2023, 1060-B | | |
| Date of Start of Analysis | 29.05.2025 | Date of Completion of Analysis | 06.06.2025 |

| Sr. No. | Parameter | Unit | Result | Method Reference |
|---------|----------------------------------------------------------------------------------------------|------|----------------|----------------------------------------------------------|
| | Discipline: Chemical Testing: Product Group: Water (Ground Water) | | | |
| 1. | Temperature | °C | 27.0 | APHA 24 th Ed. 2023, 2550-B |
| 2. | pH | - | 7.8 | APHA 24 th Ed. 2023, 4500-H+B |
| 3. | Free Chlorine (Residual) | mg/L | BQL (LOQ:0.05) | APHA 24 th Ed. 2023, 4500-Cl G |
| 4. | Total Dissolved Solids | mg/L | 632 | IS 3025 (Part 16):2023 |
| 5. | Total Suspended Solids | mg/L | BQL (LOQ:5) | APHA 24 th Ed. 2023, 2540-D |
| 6. | Chloride (as Cl) | mg/L | 97.0 | APHA 24 th Ed. 2023, 4500-Cl-B |
| 7. | Sulphate (as SO ₄) | mg/L | 24.6 | APHA 24 th Ed. 2023, 4500- SO ₄ -E |
| 8. | Nitrate (as NO ₃) | mg/L | 29.8 | APHA 24 th Ed. 2023, 4500-NO ₃ -B |
| 9. | Total Hardness (as CaCO ₃) | mg/L | 488 | APHA 24 th Ed. 2023, 2340-C |
| 10. | Alkalinity Total (as CaCO ₃) | mg/L | 354 | APHA 24 th Ed. 2023, 2320-B |
| 11. | Phosphate Total (as PO ₄) | mg/L | 0.352 | APHA 24 th Ed. 2023, 4500-P, E |
| 12. | Fluoride (as F) | mg/L | 0.56 | APHA 24 th Ed. 2023, 4500-F, D |
| 13. | Dissolved Oxygen | mg/L | 6.7 | APHA 24 th Ed. 2023, 4500-O, B & C |
| 14. | Biochemical Oxygen Demand (3 days 27°C) | mg/L | 4.1 | IS 3025 (Part 44): 2023 |
| 15. | Chemical Oxygen Demand | mg/L | 15 | APHA 24 th Ed. 2023, 5220-B |
| 16. | Oil and Grease | mg/L | BQL (LOQ:1) | IS 3025 (Part 39): 2021 |

Reviewed and authorised by

Sagar Yeul
Dy. Technical Manager
Chemical Testing

Page 1 of 2
QF/SALE/02
Issue No 03
Date 05.12.2019.
Amd 03 Date
18.07.2023





Mahabal Enviro Engineers Pvt. Ltd.

PLOT NOS. 13,14,17,18, GRAMPANCHAYAT BOKHARA, CHHINDWARA ROAD, KORADI, NAGPUR, MAHARASHTRA, INDIA
Phone: 0712-2612162/2612212 email: nagpur@mahabal.com

TEST REPORT



| | | | |
|-------------|--------------------|-------|------------|
| Report No.: | ME-1883250529 | Date: | 06.06.2025 |
| ULR No.: | TC748725000010440F | | |

| Sr. No. | Parameter | Unit | Result | Method Reference |
|---------|----------------------------------------------------------|------|------------------|----------------------------------------------------------------------------------------------------------------------------|
| 17. | Free Ammonia | mg/L | BQL (LOQ:0.1) | Test Procedures for Water and Wastewater Maharashtra Engineering Research Institute Government of Maharashtra (MERI): 1992 |
| 18. | Total Kjeldahl Nitrogen | mg/L | 1.90 | APHA 24 th Ed. 2023, 4500 N Org-B |
| 19. | Sulphide (as S) | mg/L | BQL (LOQ:0.05) | APHA 24 th Ed. 2023, 4500-S-C, D |
| 20. | Cyanide (as CN) | mg/L | BQL (LOQ:0.001) | APHA 24 th Ed. 2023, 4500-CN, C & E |
| 21. | Phenolic Compounds (as C ₆ H ₅ OH) | mg/L | BQL (LOQ:0.001) | APHA 24 th Ed. 2023, 5530- B & C |
| 22. | Fixed Dissolved Solids | mg/L | 490 | IS 3025 (Part 18):2022 |
| | Product Group: Residues in water (Ground Water) | | | |
| 23. | Iron (as Fe) | mg/L | 0.141 | IS 3025 (Part 2) 2019 |
| 24. | Manganese (as Mn) | mg/L | BQL (LOQ:0.01) | IS 3025(Part 2): 2019 |
| 25. | Copper (as Cu) | mg/L | BQL (LOQ:0.01) | IS 3025 (Part 2) 2019 |
| 26. | Lead (as Pb) | mg/L | BQL (LOQ:0.008) | IS 3025 (Part 2) 2019 |
| 27. | Zinc (as Zn) | mg/L | 0.030 | IS 3025(Part 2): 2019 |
| 28. | Arsenic (as As) | mg/L | BQL (LOQ:0.007) | IS 3025(Part 2): 2019 |
| 29. | Nickel (as Ni) | mg/L | BQL (LOQ:0.01) | IS 3025(Part 2): 2019 |
| 30. | Mercury (as Hg) | mg/L | BQL (LOQ:0.0005) | APHA 24 th Ed. 2023, 3112-B |
| 31. | Hexavalent Chromium (as Cr ⁶⁺) | mg/L | BQL (LOQ:0.02) | APHA 24 th Ed. 2023, 3500- Cr-B |
| 32. | Chromium Total (as Cr) | mg/L | BQL (LOQ:0.01) | IS 3025 (Part 2) 2019 |
| 33. | Cadmium (as Cd) | mg/L | BQL (LOQ:0.0027) | IS 3025 (Part 2) 2019 |
| 34. | Selenium (as Se) | mg/L | BQL (LOQ:0.01) | IS 3025 (Part 2) 2019 |
| 35. | Vanadium (as V) | mg/L | BQL (LOQ:0.01) | IS 3025(Part 2): 2019 |

END OF REPORT

- Note:
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Page 2 of 2
QF/SALE/02
Issue No 03
Date 05.12.2019.
Amd 03 Date
18.07.2023

Reviewed and
authorised by


Sagar Yeul
Dy. Technical Manager
Chemical Testing





1233

Mahabal Enviro Engineers Pvt. Ltd.

PLOT NOS. 13,14,17,18, GRAMPANCHAYAT BOKHARA, CHHINDWARA ROAD, KORADI, NAGPUR, MAHARASHTRA, INDIA
Phone: 0712-2612162/2612212 email: nagpur@mahabal.com

TEST REPORT



| | | | |
|-------------|----------------|-------|------------|
| Report No.: | ME-1883250529N | Date: | 06.06.2025 |
| ULR No.: | - | | |

| | | | |
|------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|------------------------------------------------------|
| Name and Address of Customer | THE CHIEF ENGINEER, MAHARASHTRA STATE POWER GENERATION COMPANY LIMITED, Koradi Thermal Power Station Koradi, Dist. Nagpur. (3X660MW) | | PO No.: KTPS/4550023222/01038 PO Date: 22.08.2024 |
| Sample Description / Type | Ground water | Sampling Done by | Laboratory |
| Sampling Location | Dugwell Nanda Village | Sample Quantity / Packing | 10L X 1 No. PVC Can 500 mL X 1 No. PVC Can |
| Date of Sampling | 29.05.2025 | Date of Receipt of Sample | 29.05.2025 |
| Sampling Procedure | IS: 17614; APHA 24 th Ed. 2023, 1060-B | | |
| Date of Start of Analysis | 29.05.2025 | Date of Completion of Analysis | 06.06.2025 |

| Sr. No. | Parameter | Unit | Result | Method Reference |
|---------|----------------------------------------------------------------------------------|------|-----------------------------------------------------------------------------------------------|------------------|
| | Discipline: Chemical Testing; Product Group: Water (Ground Water) | | | |
| 1. | Bioassay test | - | Free from acute lethal toxicity (100% Survival of Fish after first 96 hours in 100% water) | IS 6582:1971 |
| 2. | Trivalent Chromium (as Cr ³⁺) | mg/L | BQL (LOQ:0.01) | W/SAP/WW/56 |

END OF REPORT

- Note:**
1. BQL: Below Quantification Limit.
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Page 1 of 1
QF/SALE/02
Issue No 03
Date 05.12.2019.
Amd 03 Date
18.07.2023

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Sagar Yeul
Dy. Technical Manager
Chemical Testing





1234

Mahabal Enviro Engineers Pvt. Ltd.

PLOT NOS. 13,14,17,18, GRAMPANCHAYAT BOKHARA, CHHINDWARA ROAD, KORADI, NAGPUR, MAHARASHTRA, INDIA
Phone: 0712-2612162/2612212 email: nagpur@mahabaf.com

TEST REPORT



| | | | |
|-------------|--------------------|-------|------------|
| Report No.: | ME-1884250529 | Date: | 06.06.2025 |
| ULR No.: | TC748725000010441F | | |

| | | | |
|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|----------------------------------------------------------------------------------------------------|
| Name and Address of Customer | THE CHIEF ENGINEER, MAHARASHTRA STATE POWER GENERATION COMPANY LIMITED, Koradi Thermal Power Station Koradi, Dist. Nagpur. (3X660MW) | | PO No.: KTPS/4550023222/01038 PO Date: 22.08.2024 |
| Sample Description / Type | Ground water | Sampling Done by | Laboratory |
| Sampling Location | Borewell Suradevi Village | Sample Quantity / Packing | 10L X 1 No. PVC Can 500 mL X 1 No. PVC Can 100 mL X 1 No. PVC Can 1L X 1 No. Glass Bottle |
| Date of Sampling | 29.05.2025 | Date of Receipt of Sample | 29.05.2025 |
| Sampling Procedure | IS: 17614; APHA 24 th Ed. 2023, 1060-B | | |
| Date of Start of Analysis | 29.05.2025 | Date of Completion of Analysis | 06.06.2025 |

| Sr. No. | Parameter | Unit | Result | Method Reference |
|---------|----------------------------------------------------------------------------------|------|----------------|---------------------------------------------------------|
| | Discipline: Chemical Testing; Product Group: Water (Ground Water) | | | |
| 1. | Temperature | °C | 28.0 | APHA 24 th Ed. 2023, 2550-B |
| 2. | pH | - | 7.1 | APHA 24 th Ed. 2023, 4500-H+B |
| 3. | Free Chlorine (Residual) | mg/L | BQL (LOQ:0.05) | APHA 24 th Ed. 2023, 4500-Cl-G |
| 4. | Total Dissolved Solids | mg/L | 505 | IS 3025 (Part 16):2023 |
| 5. | Total Suspended Solids | mg/L | BQL (LOQ:5) | APHA 24 th Ed. 2023, 2540-D |
| 6. | Chloride (as Cl) | mg/L | 134 | APHA 24 th Ed. 2023, 4500-Cl-B |
| 7. | Sulphate (as SO ₄) | mg/L | 38.7 | APHA 24 th Ed. 2023, 4500-SO ₄ -E |
| 8. | Nitrate (as NO ₃) | mg/L | 43.5 | APHA 24 th Ed. 2023, 4500-NO ₃ -B |
| 9. | Total Hardness (as CaCO ₃) | mg/L | 316 | APHA 24 th Ed. 2023, 2340-C |
| 10. | Alkalinity Total (as CaCO ₃) | mg/L | 160 | APHA 24 th Ed. 2023, 2320-B |
| 11. | Phosphate Total (as PO ₄) | mg/L | 0.278 | APHA 24 th Ed. 2023, 4500-P, E |
| 12. | Fluoride (as F) | mg/L | 0.28 | APHA 24 th Ed. 2023, 4500-F, D |
| 13. | Dissolved Oxygen | mg/L | 6.8 | APHA 24 th Ed. 2023, 4500-O, B & C |
| 14. | Biochemical Oxygen Demand (3 days 27°C) | mg/L | 5.2 | IS 3025 (Part 44): 2023 |
| 15. | Chemical Oxygen Demand | mg/L | 18 | APHA 24 th Ed. 2023, 5220-B |
| 16. | Oil and Grease | mg/L | BQL (LOQ:1) | IS 3025 (Part 39): 2021 |

Reviewed and
authorised by

Sagar Yeul
Dy. Technical Manager
Chemical Testing

Page 1 of 2
QF/SALE/02
Issue No 03
Date 05.12.2019.
Amd 03 Date
18.07.2023



TC-7487

1235



Mahabal Enviro Engineers Pvt. Ltd.

PLOT NOS. 13,14,17,18, GRAMPANCHAYAT BOKHARA, CHHINDWARA ROAD, KORADI, NAGPUR, MAHARASHTRA, INDIA
Phone: 0712-2612162/2612212 email: nagpur@mahabal.com

TEST REPORT



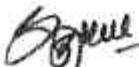
| | | | |
|-------------|--------------------|-------|------------|
| Report No.: | ME-1884250529 | Date: | 06.06.2025 |
| ULR No.: | TC748725000010441F | | |

| Sr. No. | Parameter | Unit | Result | Method Reference |
|---------|----------------------------------------------------------|------|------------------|----------------------------------------------------------------------------------------------------------------------------|
| 17. | Free Ammonia | mg/L | BQL (LOQ:0.1) | Test Procedures for Water and Wastewater Maharashtra Engineering Research Institute Government of Maharashtra (MERI): 1992 |
| 18. | Total Kjeldahl Nitrogen | mg/L | 2.20 | APHA 24 th Ed. 2023, 4500-N Org-B |
| 19. | Sulphide (as S) | mg/L | BQL (LOQ:0.05) | APHA 24 th Ed. 2023, 4500-S-C, D |
| 20. | Cyanide (as CN) | mg/L | BQL (LOQ:0.001) | APHA 24 th Ed. 2023, 4500-CN, C & E |
| 21. | Phenolic Compounds (as C ₆ H ₅ OH) | mg/L | BQL (LOQ:0.001) | APHA 24 th Ed. 2023, 5530-B & C |
| 22. | Fixed Dissolved Solids | mg/L | 400 | IS 3025 (Part 18):2022 |
| | Product Group: Residues in water (Ground Water) | | | |
| 23. | Iron (as Fe) | mg/L | 0.087 | IS 3025 (Part 2) 2019 |
| 24. | Manganese (as Mn) | mg/L | 0.037 | IS 3025(Part 2): 2019 |
| 25. | Copper (as Cu) | mg/L | BQL (LOQ:0.01) | IS 3025 (Part 2) 2019 |
| 26. | Lead (as Pb) | mg/L | BQL (LOQ:0.008) | IS 3025 (Part 2) 2019 |
| 27. | Zinc (as Zn) | mg/L | 0.060 | IS 3025(Part 2): 2019 |
| 28. | Arsenic (as As) | mg/L | BQL (LOQ:0.007) | IS 3025(Part 2): 2019 |
| 29. | Nickel (as Ni) | mg/L | BQL (LOQ:0.01) | IS 3025(Part 2): 2019 |
| 30. | Mercury (as Hg) | mg/L | BQL (LOQ:0.0005) | APHA 24 th Ed. 2023, 3112-B |
| 31. | Hexavalent Chromium (as Cr ⁺⁶) | mg/L | BQL (LOQ:0.02) | APHA 24 th Ed. 2023, 3500-Cr-B |
| 32. | Chromium Total (as Cr) | mg/L | BQL (LOQ:0.01) | IS 3025 (Part 2) 2019 |
| 33. | Cadmium (as Cd) | mg/L | BQL (LOQ:0.0027) | IS 3025 (Part 2) 2019 |
| 34. | Selenium (as Se) | mg/L | BQL (LOQ:0.01) | IS 3025 (Part 2) 2019 |
| 35. | Vanadium (as V) | mg/L | 0.014 | IS 3025(Part 2): 2019 |

END OF REPORT

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Page 2 of 2
QF/SALE/02
Issue No 03
Date 05.12.2019.
Amd 03 Date
18.07.2023

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Sagar Yeul
Dy. Technical Manager
Chemical Testing





1236

Mahabal Enviro Engineers Pvt. Ltd.

PLOT NOS. 13,14,17,18, GRAMPANCHAYAT BOKHARA, CHHINDWARA ROAD, KORADI, NAGPUR, MAHARASHTRA, INDIA
Phone: 0712-2612162/2612212 email: nagpur@mahabal.com



TEST REPORT

| | | | |
|-------------|----------------|-------|------------|
| Report No.: | ME-1884250529N | Date: | 06.06.2025 |
| ULR No.: | - | | |

| | | | |
|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|------------------------------------------------------|
| Name and Address of Customer | THE CHIEF ENGINEER, MAHARASHTRA STATE POWER GENERATION COMPANY LIMITED, Koradi Thermal Power Station Koradi, Dist. Nagpur. (3X660MW) | | PO No.: KTPS/4550023222/01038 PO Date: 22.08.2024 |
| Sample Description / Type | Ground water | Sampling Done by | Laboratory |
| Sampling Location | Borewell Suradevi Village | Sample Quantity / Packing | 10L X 1 No. PVC Can 500 mL X 1 No. PVC Can |
| Date of Sampling | 29.05.2025 | Date of Receipt of Sample | 29.05.2025 |
| Sampling Procedure | IS: 17614; APHA 24 th Ed. 2023, 1060-B | | |
| Date of Start of Analysis | 29.05.2025 | Date of Completion of Analysis | 06.06.2025 |

| Sr. No. | Parameter | Unit | Result | Method Reference |
|---------|----------------------------------------------------------------------------------|------|-----------------------------------------------------------------------------------------------|------------------|
| | Discipline: Chemical Testing: Product Group: Water (Ground Water) | | | |
| 1. | Bioassay test | - | Free from acute lethal toxicity (100% Survival of Fish after first 96 hours in 100% water) | IS 6582:1971 |
| 2. | Trivalent Chromium (as Cr ³⁺) | mg/L | BQL (LOQ:0.01) | WI/SAP/WW/56 |

END OF REPORT

- Note:**
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Page 1 of 1
QF/SALE/02
Issue No 03
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Amd 03 Date
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Sagar Yeul
Dy. Technical Manager
Chemical Testing





Mahabal Enviro Engineers Pvt. Ltd.

PLOT NOS. 13,14,17,18, GRAMPANCHAYAT BOKHARA, CHHINDWARA ROAD, KORADI, NAGPUR, MAHARASHTRA, INDIA
Phone: 0712-2612162/2612212 email: nagpur@mahabal.com

TEST REPORT



| | | | |
|-------------|--------------------|-------|------------|
| Report No.: | ME-1885250529 | Date: | 06.06.2025 |
| ULR No.: | TC748725000010442F | | |

| | | | |
|------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|----------------------------------------------------------------------------------------------------|
| Name and Address of Customer | THE CHIEF ENGINEER, MAHARASHTRA STATE POWER GENERATION COMPANY LIMITED, Koradi Thermal Power Station Koradi, Dist. Nagpur. (3X660MW) | | PO No.: KTPS/4550023222/01038 PO Date: 22.08.2024 |
| Sample Description / Type | Ground water | Sampling Done by | Laboratory |
| Sampling Location | Dugwell Suradevi Village | Sample Quantity / Packing | 10L X 1 No. PVC Can 500 mL X 1 No. PVC Can 100 mL X 1 No. PVC Can 1L X 1 No. Glass Bottle |
| Date of Sampling | 29.05.2025 | Date of Receipt of Sample | 29.05.2025 |
| Sampling Procedure | IS: 17614; APHA 24 th Ed. 2023, 1060-B | | |
| Date of Start of Analysis | 29.05.2025 | Date of Completion of Analysis | 06.06.2025 |

| Sr. No. | Parameter | Unit | Result | Method Reference |
|---------|----------------------------------------------------------------------------------|------|----------------|----------------------------------------------------------|
| | Discipline: Chemical Testing; Product Group: Water (Ground Water) | | | |
| 1. | Temperature | °C | 28.0 | APHA 24 th Ed. 2023, 2550-B |
| 2. | pH | - | 7.6 | APHA 24 th Ed. 2023, 4500-H+8 |
| 3. | Free Chlorine (Residual) | mg/L | BQL (LOQ:0.05) | APHA 24 th Ed. 2023, 4500-Cl G |
| 4. | Total Dissolved Solids | mg/L | 395 | IS 3025 (Part 16):2023 |
| 5. | Total Suspended Solids | mg/L | BQL (LOQ:5) | APHA 24 th Ed. 2023, 2540-D |
| 6. | Chloride (as Cl) | mg/L | 57.0 | APHA 24 th Ed. 2023, 4500-Cl-B |
| 7. | Sulphate (as SO ₄) | mg/L | 38.4 | APHA 24 th Ed. 2023, 4500-SO ₄ -E |
| 8. | Nitrate (as NO ₃) | mg/L | 12.7 | APHA 24 th Ed. 2023, 4500-NO ₃ , B |
| 9. | Total Hardness (as CaCO ₃) | mg/L | 238 | APHA 24 th Ed. 2023, 2340-C |
| 10. | Alkalinity Total (as CaCO ₃) | mg/L | 194 | APHA 24 th Ed. 2023, 2320-B |
| 11. | Phosphate Total (as PO ₄) | mg/L | 0.532 | APHA 24 th Ed. 2023, 4500-P, E |
| 12. | Fluoride (as F) | mg/L | 0.55 | APHA 24 th Ed. 2023, 4500-F, D |
| 13. | Dissolved Oxygen | mg/L | 6.3 | APHA 24 th Ed. 2023, 4500-O, B & C |
| 14. | Biochemical Oxygen Demand (3 days 27°C) | mg/L | 6.5 | IS 3025 (Part 44): 2023 |
| 15. | Chemical Oxygen Demand | mg/L | 22 | APHA 24 th Ed. 2023, 5220-B |
| 16. | Oil and Grease | mg/L | BQL (LOQ:1) | IS 3025 (Part 39): 2021 |

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Page 1 of 2
QF/SALE/02
Issue No 03
Date 05.12.2019.
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18.07.2023

Sagar Yeul
Dy. Technical Manager
Chemical Testing



TC-1487



Mahabal Enviro Engineers Pvt. Ltd.

PLOT NOS. 13,14,17,18, GRAMPANCHAYAT BOKHARA, CHHINDWARA ROAD, KORADI, NAGPUR, MAHARASHTRA, INDIA
Phone: 0712-2612162/2612212 email: nagpur@mahabal.com

1238

TEST REPORT



| | | | |
|-------------|--------------------|-------|------------|
| Report No.: | ME-1885250529 | Date: | 06.06.2025 |
| ULR No.: | TC748725000010442F | | |

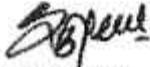
| Sr. No. | Parameter | Unit | Result | Method Reference |
|--------------------------------------------------------|-------------------------------------------------------------|------|------------------|----------------------------------------------------------------------------------------------------------------------------------|
| 17. | Free Ammonia | mg/L | BQL (LOQ:0.1) | Test Procedures for Water and Wastewater Maharashtra Engineering Research Institute Government of Maharashtra (MERI): 1992 |
| 18. | Total Kjeldahl Nitrogen | mg/L | 2.10 | APHA 24 th Ed. 2023, 4500 N Org-B |
| 19. | Sulphide (as S) | mg/L | BQL (LOQ:0.05) | APHA 24 th Ed. 2023, 4500-S-C, D |
| 20. | Cyanide (as CN) | mg/L | BQL (LOQ:0.001) | APHA 24 th Ed. 2023, 4500-CN, C & E |
| 21. | Phenolic Compounds (as C ₆ H ₅ OH) | mg/L | BQL (LOQ:0.001) | APHA 24 th Ed. 2023, 5530- B & C |
| 22. | Fixed Dissolved Solids | mg/L | 304 | IS 3025 (Part 18):2022 |
| Product Group: Residues in water (Ground Water) | | | | |
| 23. | Iron (as Fe) | mg/L | 0.146 | IS 3025 (Part 2) 2019 |
| 24. | Manganese (as Mn) | mg/L | BQL (LOQ:0.01) | IS 3025(Part 2): 2019 |
| 25. | Copper (as Cu) | mg/L | BQL (LOQ:0.01) | IS 3025 (Part 2) 2019 |
| 26. | Lead (as Pb) | mg/L | BQL (LOQ:0.008) | IS 3025 (Part 2) 2019 |
| 27. | Zinc (as Zn) | mg/L | 0.030 | IS 3025(Part 2): 2019 |
| 28. | Arsenic (as As) | mg/L | BQL (LOQ:0.007) | IS 3025(Part 2): 2019 |
| 29. | Nickel (as Ni) | mg/L | BQL (LOQ:0.01) | IS 3025(Part 2): 2019 |
| 30. | Mercury (as Hg) | mg/L | BQL (LOQ:0.0005) | APHA 24 th Ed. 2023, 3112-B |
| 31. | Hexavalent Chromium (as Cr ⁶⁺) | mg/L | BQL (LOQ:0.02) | APHA 24 th Ed. 2023, 3500- Cr-B |
| 32. | Chromium Total (as Cr) | mg/L | BQL (LOQ:0.01) | IS 3025 (Part 2) 2019 |
| 33. | Cadmium (as Cd) | mg/L | BQL (LOQ:0.0027) | IS 3025 (Part 2) 2019 |
| 34. | Selenium (as Se) | mg/L | BQL (LOQ:0.01) | IS 3025 (Part 2) 2019 |
| 35. | Vanadium (as V) | mg/L | BQL (LOQ:0.01) | IS 3025(Part 2): 2019 |

END OF REPORT

- Note:**
1. BQL: Below Quantification Limit.
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Page 2 of 2
QF/SALE/02
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Sagar Yeul
Dy. Technical Manager
Chemical Testing



TC-7487



1239

Mahabal Enviro Engineers Pvt. Ltd.

PLOT NOS. 13,14,17,18, GRAMPANCHAYAT BOKHARA, CHHINDWARA ROAD, KORADI, NAGPUR, MAHARASHTRA, INDIA

Phone: 0712-2612162/2612212 email: nagpur@mahabal.com

TEST REPORT



| | | | |
|-------------|----------------|-------|------------|
| Report No.: | ME-1885250529N | Date: | 06.06.2025 |
| ULR No.: | - | | |

| | | | |
|------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|------------------------------------------------------|
| Name and Address of Customer | THE CHIEF ENGINEER, MAHARASHTRA STATE POWER GENERATION COMPANY LIMITED, Koradi Thermal Power Station Koradi, Dist. Nagpur. (3X660MW) | | PO No.: KTPS/4550023222/01038 PO Date: 22.08.2024 |
| Sample Description / Type | Ground water | Sampling Done by | Laboratory |
| Sampling Location | Dugwell Suradevi Village | Sample Quantity / Packing | 10L X 1 No. PVC Can 500 mL X 1 No. PVC Can |
| Date of Sampling | 29.05.2025 | Date of Receipt of Sample | 29.05.2025 |
| Sampling Procedure | IS: 17614; APHA 24 th Ed. 2023, 1060-B | | |
| Date of Start of Analysis | 29.05.2025 | Date of Completion of Analysis | 06.06.2025 |

| Sr. No. | Parameter | Unit | Result | Method Reference |
|---------|----------------------------------------------------------------------------------------------|------|-----------------------------------------------------------------------------------------------|------------------|
| | Discipline: Chemical Testing: Product Group: Water (Ground Water) | | | |
| 1. | Bioassay test | - | Free from acute lethal toxicity (100% Survival of Fish after first 96 hours in 100% water) | IS 6582:1971 |
| 2. | Trivalent Chromium (as Cr ³⁺) | mg/L | BQL (LOQ:0.01) | WISAPNWW/56 |

END OF REPORT

- Note:
1. BQL: Below Quantification Limit.
 2. LOQ: Limit of Quantification.
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Page 1 of 1
QF/SALE/02
Issue No 03
Date 05.12.2019.
Amd 03 Date
18.07.2023

Reviewed and
authorised by


Sagar Yeul
Dy. Technical Manager
Chemical Testing





Mahabal Enviro Engineers Pvt. Ltd.

PLOT NOS. 13,14,17,18, GRAMPANCHAYAT BOKHARA, CHHINDWARA ROAD, KORADI, NAGPUR, MAHARASHTRA, INDIA
Phone: 0712-2612162/2612212 email: nagpur@mahabal.com

1240

TEST REPORT



| | | | |
|-------------|--------------------|-------|------------|
| Report No.: | ME-1886250529 | Date: | 06.06.2025 |
| ULR No.: | TC748725000010443F | | |

| | | | |
|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|----------------------------------------------------------------------------------------------------|
| Name and Address of Customer | THE CHIEF ENGINEER, MAHARASHTRA STATE POWER GENERATION COMPANY LIMITED, Koradi Thermal Power Station Koradi, Dist. Nagpur. (3X660MW) | | PO No.: KTPS/4550023222/01038 PO Date: 22.08.2024 |
| Sample Description / Type | Ground water | Sampling Done by | Laboratory |
| Sampling Location | Borewell Mhasala Village | Sample Quantity / Packing | 10L X 1 No. PVC Can 500 mL X 1 No. PVC Can 100 mL X 1 No. PVC Can 1L X 1 No. Glass Bottle |
| Date of Sampling | 29.05.2025 | Date of Receipt of Sample | 29.05.2025 |
| Sampling Procedure | IS: 17514; APHA 24 th Ed. 2023, 1060-B | | |
| Date of Start of Analysis | 29.05.2025 | Date of Completion of Analysis | 06.06.2025 |

| Sr. No. | Parameter | Unit | Result | Method Reference |
|---------|----------------------------------------------------------------------------------|------|----------------|---------------------------------------------------------|
| | Discipline: Chemical Testing; Product Group: Water (Ground Water) | | | |
| 1. | Temperature | °C | 28.0 | APHA 24 th Ed. 2023, 2550-B |
| 2. | pH | - | 7.5 | APHA 24 th Ed. 2023, 4500-H+B |
| 3. | Free Chlorine (Residual) | mg/L | BQL (LOQ:0.05) | APHA 24 th Ed. 2023, 4500-Cl-G |
| 4. | Total Dissolved Solids | mg/L | 1308 | IS 3025 (Part 16):2023 |
| 5. | Total Suspended Solids | mg/L | BQL (LOQ:5) | APHA 24 th Ed. 2023, 2540-D |
| 6. | Chloride (as Cl) | mg/L | 204 | APHA 24 th Ed. 2023, 4500-Cl-B |
| 7. | Sulphate (as SO ₄) | mg/L | 292 | APHA 24 th Ed. 2023, 4500-SO ₄ -E |
| 8. | Nitrate (as NO ₃) | mg/L | 44.0 | APHA 24 th Ed. 2023, 4500-NO ₃ -B |
| 9. | Total Hardness (as CaCO ₃) | mg/L | 580 | APHA 24 th Ed. 2023, 2340-C |
| 10. | Alkalinity Total (as CaCO ₃) | mg/L | 470 | APHA 24 th Ed. 2023, 2320-B |
| 11. | Phosphate Total (as PO ₄) | mg/L | 0.287 | APHA 24 th Ed. 2023, 4500-P, E |
| 12. | Fluoride (as F) | mg/L | 0.57 | APHA 24 th Ed. 2023, 4500-F, D |
| 13. | Dissolved Oxygen | mg/L | 6.4 | APHA 24 th Ed. 2023, 4500-O, B & C |
| 14. | Biochemical Oxygen Demand (3 days 27°C) | mg/L | 4.7 | IS 3025 (Part 44): 2023 |
| 15. | Chemical Oxygen Demand | mg/L | 16 | APHA 24 th Ed. 2023, 5220-B |
| 16. | Oil and Grease | mg/L | BQL (LOQ:1) | IS 3025 (Part 39): 2021 |

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Page 1 of 2
QF/SALE/02
Issue No 03
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18.07.2023

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1241

Mahabal Enviro Engineers Pvt. Ltd.

PLOT NOS. 13,14,17,18, GRAMPANCHAYAT BOKHARA, CHHINDWARA ROAD, KORADI, NAGPUR, MAHARASHTRA, INDIA

Phone: 0712-2612162/2612212 email: nagpur@mahabal.com

TEST REPORT



010-188625029

| | | | |
|-------------|--------------------|-------|------------|
| Report No.: | ME-1886250529 | Date: | 06.06.2025 |
| ULR No.: | TC748725000010443F | | |

| Sr. No. | Parameter | Unit | Result | Method Reference |
|---------|-------------------------------------------------------------|------|------------------|----------------------------------------------------------------------------------------------------------------------------------|
| 17. | Free Ammonia | mg/L | BQL (LOQ:0.1) | Test Procedures for Water and Wastewater Maharashtra Engineering Research Institute Government of Maharashtra (MERI): 1992 |
| 18. | Total Kjeldahl Nitrogen | mg/L | 1.40 | APHA 24 th Ed. 2023, 4500 N Org-B |
| 19. | Sulphide (as S) | mg/L | BQL (LOQ:0.05) | APHA 24 th Ed. 2023, 4500-S-C, D |
| 20. | Cyanide (as CN) | mg/L | BQL (LOQ:0.001) | APHA 24 th Ed. 2023, 4500-CN, C & E |
| 21. | Phenolic Compounds (as C ₆ H ₅ OH) | mg/L | BQL (LOQ:0.001) | APHA 24 th Ed. 2023, 5530-B & C |
| 22. | Fixed Dissolved Solids | mg/L | 1030 | IS 3025 (Part 18):2022 |
| | Product Group: Residues in water (Ground Water) | | | |
| 23. | Iron (as Fe) | mg/L | 0.061 | IS 3025 (Part 2): 2019 |
| 24. | Manganese (as Mn) | mg/L | 0.036 | IS 3025(Part 2): 2019 |
| 25. | Copper (as Cu) | mg/L | BQL (LOQ:0.01) | IS 3025 (Part 2) 2019 |
| 26. | Lead (as Pb) | mg/L | BQL (LOQ:0.008) | IS 3025 (Part 2) 2019 |
| 27. | Zinc (as Zn) | mg/L | 0.055 | IS 3025(Part 2): 2019 |
| 28. | Arsenic (as As) | mg/L | BQL (LOQ:0.007) | IS 3025(Part 2): 2019 |
| 29. | Nickel (as Ni) | mg/L | BQL (LOQ:0.01) | IS 3025(Part 2): 2019 |
| 30. | Mercury (as Hg) | mg/L | BQL (LOQ:0.0005) | APHA 24 th Ed. 2023, 3112-B |
| 31. | Hexavalent Chromium (as Cr ⁶⁺) | mg/L | BQL (LOQ:0.02) | APHA 24 th Ed. 2023, 3500- Cr-6 |
| 32. | Chromium Total (as Cr) | mg/L | BQL (LOQ:0.01) | IS 3025 (Part 2) 2019 |
| 33. | Cadmium (as Cd) | mg/L | BQL (LOQ:0.0027) | IS 3025 (Part 2) 2019 |
| 34. | Selenium (as Se) | mg/L | BQL (LOQ:0.01) | IS 3025 (Part 2) 2019 |
| 35. | Vanadium (as V) | mg/L | 0.013 | IS 3025(Part 2): 2019 |

END OF REPORT

- Note:**
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Page 2 of 2
QF/SALE/02
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Sagar Yeul
Dy. Technical Manager
Chemical Testing



TC 7487



Mahabal Enviro Engineers Pvt. Ltd.

PLOT NOS. 13,14,17,18, GRAMPANCHAYAT BOKHARA, CHHINDWARA ROAD, KORADI, NAGPUR, MAHARASHTRA, INDIA
Phone: 0712-2612162/2612212 email: nagpur@mahabal.com

1242

TEST REPORT



| | | | |
|-------------|----------------|-------|------------|
| Report No.: | ME-1886250529N | Date: | 06.06.2025 |
| ULR No.: | - | | |

| | | | |
|------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|------------------------------------------------------|
| Name and Address of Customer | THE CHIEF ENGINEER, MAHARASHTRA STATE POWER GENERATION COMPANY LIMITED, Koradi Thermal Power Station Koradi, Dist. Nagpur. (3X860MW) | | PO No.: KTPS/4550023222/01038 PO Date: 22.08.2024 |
| Sample Description / Type | Ground water | Sampling Done by | Laboratory |
| Sampling Location | Borewell Mhasala Village | Sample Quantity / Packing | 10L X 1 No. PVC Can 500 mL X 1 No. PVC Can |
| Date of Sampling | 29.05.2025 | Date of Receipt of Sample | 29.05.2025 |
| Sampling Procedure | IS: 17614; APHA 24 th Ed. 2023, 1060-B | | |
| Date of Start of Analysis | 29.05.2025 | Date of Completion of Analysis | 06.06.2025 |

| Sr. No. | Parameter | Unit | Result | Method Reference |
|---------|----------------------------------------------------------------------------------------------|------|-----------------------------------------------------------------------------------------------|------------------|
| | Discipline: Chemical Testing: Product Group: Water (Ground Water) | | | |
| 1. | Bioassay test | - | Free from acute lethal toxicity (100% Survival of Fish after first 96 hours in 100% water) | IS 6582:1971 |
| 2. | Trivalent Chromium (as Cr ³⁺) | mg/L | BQL (LOQ:0.01) | WWSAP/WW/56 |

END OF REPORT

- Note:
1. BQL: Below Quantification Limit.
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Page 1 of 1
QF/SALE/02
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Sagar Yeul
Dy. Technical Manager
Chemical Testing





1243

Mahabal Enviro Engineers Pvt. Ltd.

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Phone: 0712-2612162/2612212 email: nagpur@mahabal.com

TEST REPORT



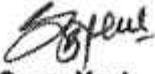
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|-------------|--------------------|-------|------------|
| Report No.: | ME-1887250529 | Date: | 06.06.2025 |
| ULR No.: | TC748725000010444F | | |

| | | | |
|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|----------------------------------------------------------------------------------------------------|
| Name and Address of Customer | THE CHIEF ENGINEER, MAHARASHTRA STATE POWER GENERATION COMPANY LIMITED, Koradi Thermal Power Station Koradi, Dist. Nagpur. (3X660MW) | | PO No.: KTPS/4550023222/01038 PO Date: 22.08.2024 |
| Sample Description / Type | Ground water | Sampling Done by | Laboratory |
| Sampling Location | Dugwell Mhasala Village | Sample Quantity / Packing | 10L X 1 No. PVC Can 500 mL X 1 No. PVC Can 100 mL X 1 No. PVC Can 1L X 1 No. Glass Bottle |
| Date of Sampling | 29.05.2025 | Date of Receipt of Sample | 29.05.2025 |
| Sampling Procedure | IS: 17614, APHA 24 th Ed. 2023, 1060-B | | |
| Date of Start of Analysis | 29.05.2025 | Date of Completion of Analysis | 06.06.2025 |

| Sr. No. | Parameter | Unit | Result | Method Reference |
|---------|----------------------------------------------------------------------------------|------|----------------|---------------------------------------------------------|
| | Discipline: Chemical Testing; Product Group: Water (Ground Water) | | | |
| 1. | Temperature | °C | 29.0 | APHA 24 th Ed. 2023, 2550-B |
| 2. | pH | - | 8.2 | APHA 24 th Ed. 2023, 4500-H-H-B |
| 3. | Free Chlorine (Residual) | mg/L | BQL (LOQ:0.05) | APHA 24 th Ed. 2023, 4500-CI-G |
| 4. | Total Dissolved Solids | mg/L | 774 | IS 3025 (Part 16):2023 |
| 5. | Total Suspended Solids | mg/L | BQL (LOQ:5) | APHA 24 th Ed. 2023, 2540-D |
| 6. | Chloride (as Cl) | mg/L | 130 | APHA 24 th Ed. 2023, 4500-CI-B |
| 7. | Sulphate (as SO ₄) | mg/L | 104 | APHA 24 th Ed. 2023, 4500-SO-E |
| 8. | Nitrate (as NO ₃) | mg/L | 9.70 | APHA 24 th Ed. 2023, 4500-NO ₃ -B |
| 9. | Total Hardness (as CaCO ₃) | mg/L | 164 | APHA 24 th Ed. 2023, 2340-C |
| 10. | Alkalinity Total (as CaCO ₃) | mg/L | 346 | APHA 24 th Ed. 2023, 2320-B |
| 11. | Phosphate Total (as PO ₄) | mg/L | 0.676 | APHA 24 th Ed. 2023, 4500-P, E |
| 12. | Fluoride (as F) | mg/L | 0.50 | APHA 24 th Ed. 2023, 4500-F, D |
| 13. | Dissolved Oxygen | mg/L | 6.2 | APHA 24 th Ed. 2023, 4500-O, B & C |
| 14. | Biochemical Oxygen Demand (3 days 27°C) | mg/L | 6.0 | IS 3025 (Part 44): 2023 |
| 15. | Chemical Oxygen Demand | mg/L | 21 | APHA 24 th Ed. 2023, 5220-B |
| 16. | Oil and Grease | mg/L | BQL (LOQ:1) | IS 3025 (Part 39): 2021 |

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Page 1 of 2
QF/SALE/02
Issue No 03
Date 05.12.2019.
Amd 03 Date
18.07.2023


Sagar Yeul
Dy. Technical Manager
Chemical Testing





Mahabal Enviro Engineers Pvt. Ltd.

PLOT NOS. 13,14,17,18, GRAMPANCHAYAT BOKHARA, CHHINDWARA ROAD, KORADI, NAGPUR, MAHARASHTRA, INDIA
Phone: 0712-2612162/2612212 email: nagpur@mahabal.com

1244

TEST REPORT



| | | | |
|-------------|--------------------|-------|------------|
| Report No.: | ME-1887250529 | Date: | 06.06.2025 |
| ULR No.: | TC748725000010444F | | |

| Sr. No. | Parameter | Unit | Result | Method Reference |
|---------|----------------------------------------------------------|------|------------------|----------------------------------------------------------------------------------------------------------------------------|
| 17. | Free Ammonia | mg/L | BQL (LOQ:0.1) | Test Procedures for Water and Wastewater Maharashtra Engineering Research Institute Government of Maharashtra (MERI): 1992 |
| 18. | Total Kjeldahl Nitrogen | mg/L | 1.20 | APHA 24 th Ed. 2023, 4500 N Org-B |
| 19. | Sulphide (as S) | mg/L | BQL (LOQ:0.05) | APHA 24 th Ed. 2023, 4500-S-C, D |
| 20. | Cyanide (as CN) | mg/L | BQL (LOQ:0.001) | APHA 24 th Ed. 2023, 4500-CN, C & E |
| 21. | Phenolic Compounds (as C ₆ H ₅ OH) | mg/L | BQL (LOQ:0.001) | APHA 24 th Ed. 2023, 5530- B & C |
| 22. | Fixed Dissolved Solids | mg/L | 610 | IS 3025 (Part 16):2022 |
| | Product Group: Residues in water (Ground Water) | | | |
| 23. | Iron (as Fe) | mg/L | 0.148 | IS 3025 (Part 2) 2019 |
| 24. | Manganese (as Mn) | mg/L | BQL (LOQ:0.01) | IS 3025(Part 2): 2019 |
| 25. | Copper (as Cu) | mg/L | BQL (LOQ:0.01) | IS 3025 (Part 2) 2019 |
| 26. | Lead (as Pb) | mg/L | BQL (LOQ:0.008) | IS 3025 (Part 2) 2019 |
| 27. | Zinc (as Zn) | mg/L | 0.031 | IS 3025(Part 2): 2019 |
| 28. | Arsenic (as As) | mg/L | BQL (LOQ:0.007) | IS 3025(Part 2): 2019 |
| 29. | Nickel (as Ni) | mg/L | BQL (LOQ:0.01) | IS 3025(Part 2): 2019 |
| 30. | Mercury (as Hg) | mg/L | BQL (LOQ:0.0005) | APHA 24 th Ed. 2023, 3112-B |
| 31. | Hexavalent Chromium (as Cr ⁶⁺) | mg/L | BQL (LOQ:0.02) | APHA 24 th Ed. 2023, 3500- Cr-B |
| 32. | Chromium Total (as Cr) | mg/L | BQL (LOQ:0.01) | IS 3025 (Part 2) 2019 |
| 33. | Cadmium (as Cd) | mg/L | BQL (LOQ:0.0027) | IS 3025 (Part 2) 2019 |
| 34. | Selenium (as Se) | mg/L | BQL (LOQ:0.01) | IS 3025 (Part 2) 2019 |
| 35. | Vanadium (as V) | mg/L | BQL (LOQ:0.01) | IS 3025(Part 2): 2019 |

END OF REPORT

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Page 2 of 2
QF/SALE/02
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Sagar Yeul

Sagar Yeul
Dy. Technical Manager
Chemical Testing





Mahabal Enviro Engineers Pvt. Ltd.

PLOT NOS. 13,14,17,18, GRAMPANCHAYAT BOKHARA, CHHINDWARA ROAD, KORADI, NAGPUR, MAHARASHTRA, INDIA
Phone: 0712-2612162/2612212 email: nagpur@mahabal.com

TEST REPORT



| | | | |
|-------------|----------------|-------|------------|
| Report No.: | ME-1887250529N | Date: | 06.06.2025 |
| ULR No.: | - | | |

| | | | |
|------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|------------------------------------------------------|
| Name and Address of Customer | THE CHIEF ENGINEER, MAHARASHTRA STATE POWER GENERATION COMPANY LIMITED, Koradi Thermal Power Station Koradi, Dist. Nagpur. (3X660MW) | | PO No.: KTPS/4550023222/01038 PO Date: 22.08.2024 |
| Sample Description / Type | Ground water | Sampling Done by | Laboratory |
| Sampling Location | Dugwell Mhasala Village | Sample Quantity / Packing | 10L X 1 No. PVC Can 500 mL X 1 No. PVC Can |
| Date of Sampling | 29.05.2025 | Date of Receipt of Sample | 29.05.2025 |
| Sampling Procedure | IS: 17614; APHA 24 th Ed. 2023, 1060-B | | |
| Date of Start of Analysis | 29.05.2025 | Date of Completion of Analysis | 06.06.2025 |

| Sr. No. | Parameter | Unit | Result | Method Reference |
|---------|----------------------------------------------------------------------------------|------|-----------------------------------------------------------------------------------------------|------------------|
| | Discipline: Chemical Testing; Product Group: Water (Ground Water) | | | |
| 1. | Bioassay test | - | Free from acute lethal toxicity (100% Survival of Fish after first 96 hours in 100% water) | IS 6582:1971 |
| 2. | Trivalent Chromium (as Cr ³⁺) | mg/L | BQL (LOQ:0.01) | WISAP/WWW/56 |

END OF REPORT

- Note:**
1. BQL: Below Quantification Limit.
 2. LOQ: Limit of Quantification.
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Page 1 of 1
QF/SALE/02
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Sagar Yeul
Dy. Technical Manager
Chemical Testing





Mahabal Enviro Engineers Pvt. Ltd.

PLOT NOS. 13,14,17,18, GRAMPANCHAYAT BOKHARA, CHHINDWARA ROAD, KORADI, NAGPUR, MAHARASHTRA, INDIA
Phone: 0712-2612162/2612212 email: nagpur@mahabal.com

1246

TEST REPORT



| | | | |
|-------------|--------------------|-------|------------|
| Report No.: | ME-1888250529 | Date: | 06.06.2025 |
| ULR No.: | TC748725000010445F | | |

| | | | |
|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|----------------------------------------------------------------------------------------------------|
| Name and Address of Customer | THE CHIEF ENGINEER, MAHARASHTRA STATE POWER GENERATION COMPANY LIMITED, Koradi Thermal Power Station Koradi, Dist. Nagpur. (3X660MW) | | PO No.: KTPS/4550023222/01038 PO Date: 22.08.2024 |
| Sample Description / Type | Ground water | Sampling Done by | Laboratory |
| Sampling Location | Borewell Khasala Village | Sample Quantity / Packing | 10L X 1 No. PVC Can 500 mL X 1 No. PVC Can 100 mL X 1 No. PVC Can 1L X 1 No. Glass Bottle |
| Date of Sampling | 29.05.2025 | Date of Receipt of Sample | 29.05.2025 |
| Sampling Procedure | IS: 17614; APHA 24 th Ed. 2023, 1060-B | | |
| Date of Start of Analysis | 29.05.2025 | Date of Completion of Analysis | 06.06.2025 |

| Sr. No. | Parameter | Unit | Result | Method Reference |
|---------|----------------------------------------------------------------------------------|------|----------------|--------------------------------------------------------|
| | Discipline: Chemical Testing; Product Group: Water (Ground Water) | | | |
| 1. | Temperature | °C | 29.0 | APHA 24 th Ed. 2023, 2550-B |
| 2. | pH | - | 7.7 | APHA 24 th Ed. 2023, 4500-H+B |
| 3. | Free Chlorine (Residual) | mg/L | BQL (LOQ:0.05) | APHA 24 th Ed. 2023, 4500-Cl G |
| 4. | Total Dissolved Solids | mg/L | 960 | IS 3025 (Part 16):2023 |
| 5. | Total Suspended Solids | mg/L | 9 | APHA 24 th Ed. 2023, 2540-D |
| 6. | Chloride (as Cl) | mg/L | 221 | APHA 24 th Ed. 2023, 4500-Cl-B |
| 7. | Sulphate (as SO ₄) | mg/L | 100 | APHA 24 th Ed. 2023, 4500-SO+E |
| 8. | Nitrate (as NO ₃) | mg/L | 28.0 | APHA 24 th Ed. 2023, 4500-NO ₃ B |
| 9. | Total Hardness (as CaCO ₃) | mg/L | 440 | APHA 24 th Ed. 2023, 2340-C |
| 10. | Alkalinity Total (as CaCO ₃) | mg/L | 380 | APHA 24 th Ed. 2023, 2320-B |
| 11. | Phosphate Total (as PO ₄) | mg/L | 0.343 | APHA 24 th Ed. 2023, 4500-P, E |
| 12. | Fluoride (as F) | mg/L | 0.51 | APHA 24 th Ed. 2023, 4500-F, D |
| 13. | Dissolved Oxygen | mg/L | 6.2 | APHA 24 th Ed. 2023, 4500-O, B & C |
| 14. | Biochemical Oxygen Demand (3 days 27°C) | mg/L | 8.5 | IS 3025 (Part 44): 2023 |
| 15. | Chemical Oxygen Demand | mg/L | 28 | APHA 24 th Ed. 2023, 5220-B |
| 16. | Oil and Grease | mg/L | BQL (LOQ: 1) | IS 3025 (Part 39): 2021 |

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Page 1 of 2
QF/SALE/02
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18.07.2023

Sagar Yeul
Dy. Technical Manager
Chemical Testing





Mahabal Enviro Engineers Pvt. Ltd.

PLOT NOS. 13,14,17,18, GRAMPANCHAYAT BOKHARA, CHHINDWARA ROAD, KORADI, NAGPUR, MAHARASHTRA, INDIA
Phone: 0712-2612162/2612212 email: nagpur@mahabal.com

TEST REPORT



| | | | |
|-------------|--------------------|-------|------------|
| Report No.: | ME-1888250529 | Date: | 06.06.2025 |
| ULR No.: | TC748725000010445F | | |

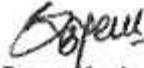
| Sr. No. | Parameter | Unit | Result | Method Reference |
|--------------------------------------------------------|----------------------------------------------------------|------|------------------|----------------------------------------------------------------------------------------------------------------------------|
| 17. | Free Ammonia | mg/L | BQL (LOQ:0.1) | Test Procedures for Water and Wastewater Maharashtra Engineering Research Institute Government of Maharashtra (MERI): 1992 |
| 18. | Total Kjeldahl Nitrogen | mg/L | 3.0 | APHA 24 th Ed. 2023, 4500 N Org-B |
| 19. | Sulphide (as S) | mg/L | BQL (LOQ:0.05) | APHA 24 th Ed. 2023, 4500-S-C, D |
| 20. | Cyanide (as CN) | mg/L | BQL (LOQ:0.001) | APHA 24 th Ed. 2023, 4500-CN, C & E |
| 21. | Phenolic Compounds (as C ₆ H ₅ OH) | mg/L | BQL (LOQ:0.001) | APHA 24 th Ed. 2023, 5530- B & C |
| 22. | Fixed Dissolved Solids | mg/L | 752 | IS 3025 (Part 18):2022 |
| Product Group: Residues in water (Ground Water) | | | | |
| 23. | Iron (as Fe) | mg/L | 0.080 | IS 3025 (Part 2) 2019 |
| 24. | Manganese (as Mn) | mg/L | 0.036 | IS 3025(Part 2): 2019 |
| 25. | Copper (as Cu) | mg/L | BQL (LOQ:0.01) | IS 3025 (Part 2) 2019 |
| 26. | Lead (as Pb) | mg/L | BQL (LOQ:0.008) | IS 3025 (Part 2) 2019 |
| 27. | Zinc (as Zn) | mg/L | 0.063 | IS 3025(Part 2): 2019 |
| 28. | Arsenic (as As) | mg/L | BQL (LOQ:0.007) | IS 3025(Part 2): 2019 |
| 29. | Nickel (as Ni) | mg/L | BQL (LOQ:0.01) | IS 3025(Part 2): 2019 |
| 30. | Mercury (as Hg) | mg/L | BQL (LOQ:0.0005) | APHA 24 th Ed. 2023, 3112-B |
| 31. | Hexavalent Chromium (as Cr ⁶⁺) | mg/L | BQL (LOQ:0.02) | APHA 24 th Ed. 2023, 3500- Cr-8 |
| 32. | Chromium Total (as Cr) | mg/L | BQL (LOQ:0.01) | IS 3025 (Part 2) 2019 |
| 33. | Cadmium (as Cd) | mg/L | BQL (LOQ:0.0027) | IS 3025 (Part 2) 2019 |
| 34. | Selenium (as Se) | mg/L | BQL (LOQ:0.01) | IS 3025 (Part 2) 2019 |
| 35. | Vanadium (as V) | mg/L | 0.015 | IS 3025(Part 2): 2019 |

END OF REPORT

- Note:**
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Page 2 of 2
QF/SALE/02
Issue No 03
Date 05.12.2019.
Amd 03 Date
18.07.2023

Reviewed and
authorised by


Sagar Yeul
Dy. Technical Manager
Chemical Testing





Mahabal Enviro Engineers Pvt. Ltd.

PLOT NOS. 13,14,17,18, GRAMPANCHAYAT BOKHARA, CHHINDWARA ROAD, KORADI, NAGPUR, MAHARASHTRA, INDIA
Phone: 0712-2612162/2612212 email: nagpur@mahabal.com

1248

TEST REPORT



| | | | |
|-------------|----------------|-------|------------|
| Report No.: | ME-1888250529N | Date: | 06.06.2025 |
| ULR No.: | - | | |

| | | | |
|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|------------------------------------------------------|
| Name and Address of Customer | THE CHIEF ENGINEER, MAHARASHTRA STATE POWER GENERATION COMPANY LIMITED, Koradi Thermal Power Station Koradi, Dist. Nagpur. (3X660MW) | | PO No.: KTPS/4550023222/01038 PO Date: 22.08.2024 |
| Sample Description / Type | Ground water | Sampling Done by | Laboratory |
| Sampling Location | Borewell Khasala Village | Sample Quantity / Packing | 10L X 1 No. PVC Can 500 mL X 1 No. PVC Can |
| Date of Sampling | 29.05.2025 | Date of Receipt of Sample | 29.05.2025 |
| Sampling Procedure | IS: 17614; APHA 24 th Ed. 2023, 1060-B | | |
| Date of Start of Analysis | 29.05.2025 | Date of Completion of Analysis | 06.06.2025 |

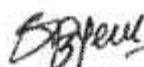
| Sr. No. | Parameter | Unit | Result | Method Reference |
|---------|----------------------------------------------------------------------------------|------|-----------------------------------------------------------------------------------------------|------------------|
| | Discipline: Chemical Testing; Product Group: Water (Ground Water) | | | |
| 1. | Bioassay test | - | Free from acute lethal toxicity (100% Survival of Fish after first 96 hours in 100% water) | IS 6582:1971 |
| 2. | Trivalent Chromium (as Cr ³⁺) | mg/L | BQL (LOQ:0.01) | WISAP/MW/56 |

END OF REPORT

- Note:**
1. BQL: Below Quantification Limit.
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Page 1 of 1
QF/SALE/02
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Sagar Yeui
Dy. Technical Manager
Chemical Testing





Mahabal Enviro Engineers Pvt. Ltd.

PLOT NOS. 13,14,17,18, GRAMPANCHAYAT BOKHARA, CHHINDWARA ROAD, KORADI, NAGPUR, MAHARASHTRA, INDIA
Phone: 0712-2612162/2612212 email: nagpur@mahabal.com

1249



TEST REPORT

| | | | |
|-------------|--------------------|-------|------------|
| Report No.: | ME-1889250529 | Date: | 06.06.2025 |
| ULR No.: | TC748725000010446F | | |

| | | | |
|------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|----------------------------------------------------------------------------------------------------|
| Name and Address of Customer | THE CHIEF ENGINEER, MAHARASHTRA STATE POWER GENERATION COMPANY LIMITED, Koradi Thermal Power Station Koradi, Dist. Nagpur. (3X660MW) | | PO No.: KTPS/4550023222/01038 PO Date: 22.08.2024 |
| Sample Description / Type | Ground water | Sampling Done by | Laboratory |
| Sampling Location | Dugwell Khasala Village | Sample Quantity / Packing | 10L X 1 No. PVC Can 500 mL X 1 No. PVC Can 100 mL X 1 No. PVC Can 1L X 1 No. Glass Bottle |
| Date of Sampling | 29.05.2025 | Date of Receipt of Sample | 29.05.2025 |
| Sampling Procedure | IS: 17614; APHA 24 th Ed. 2023, 1060-B | | |
| Date of Start of Analysis | 29.05.2025 | Date of Completion of Analysis | 06.06.2025 |

| Sr. No. | Parameter | Unit | Result | Method Reference |
|---------|----------------------------------------------------------------------------------|------|----------------|----------------------------------------------------------|
| | Discipline: Chemical Testing: Product Group: Water (Ground Water) | | | |
| 1. | Temperature | °C | 27.0 | APHA 24 th Ed. 2023, 2550-B |
| 2. | pH | - | 8.0 | APHA 24 th Ed. 2023, 4500-H+B |
| 3. | Free Chlorine (Residual) | mg/L | BQL (LOQ:0.05) | APHA 24 th Ed. 2023, 4500-Cl G |
| 4. | Total Dissolved Solids | mg/L | 860 | IS 3025 (Part 16):2023 |
| 5. | Total Suspended Solids | mg/L | BQL (LOQ:5) | APHA 24 th Ed. 2023, 2540-D |
| 6. | Chloride (as Cl) | mg/L | 183 | APHA 24 th Ed. 2023, 4500-Cl-B |
| 7. | Sulphate (as SO ₄) | mg/L | 131 | APHA 24 th Ed. 2023, 4500-SO ₄ -E |
| 8. | Nitrate (as NO ₃) | mg/L | 21.7 | APHA 24 th Ed. 2023, 4500-NO ₃ , B |
| 9. | Total Hardness (as CaCO ₃) | mg/L | 376 | APHA 24 th Ed. 2023, 2340-C |
| 10. | Alkalinity Total (as CaCO ₃) | mg/L | 320 | APHA 24 th Ed. 2023, 2320-B |
| 11. | Phosphate Total (as PO ₄) | mg/L | 0.453 | APHA 24 th Ed. 2023, 4500-P, E |
| 12. | Fluoride (as F) | mg/L | 0.52 | APHA 24 th Ed. 2023, 4500-F, D |
| 13. | Dissolved Oxygen | mg/L | 6.4 | APHA 24 th Ed. 2023, 4500-O, B & C |
| 14. | Biochemical Oxygen Demand (3 days 27°C) | mg/L | 6.9 | IS 3025 (Part 44): 2023 |
| 15. | Chemical Oxygen Demand | mg/L | 22 | APHA 24 th Ed. 2023, 5220-B |
| 16. | Oil and Grease | mg/L | BQL (LOQ:1) | IS 3025 (Part 39): 2021 |

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Page 1 of 2
QF/SALE/02
Issue No 03
Date 05.12.2019.
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Sagar Yeul
Dy. Technical Manager
Chemical Testing



TC-147



Mahabal Enviro Engineers Pvt. Ltd.

PLOT NOS. 13,14,17,18, GRAMPANCHAYAT BOKHARA, CHHINDWARA ROAD, KORADI, NAGPUR, MAHARASHTRA, INDIA
Phone: 0712-2612162/2612212 email: nagpur@mahabal.com

1250

TEST REPORT



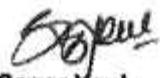
| | | | |
|-------------|--------------------|-------|------------|
| Report No.: | ME-1889250529 | Date: | 06.06.2025 |
| ULR No.: | TC748725000010446F | | |

| Sr. No. | Parameter | Unit | Result | Method Reference |
|---------|----------------------------------------------------------|------|------------------|----------------------------------------------------------------------------------------------------------------------------|
| 17. | Free Ammonia | mg/L | BQL (LOQ:0.1) | Test Procedures for Water and Wastewater Maharashtra Engineering Research Institute Government of Maharashtra (MERI): 1992 |
| 18. | Total Kjeldahl Nitrogen | mg/L | 1.50 | APHA 24 th Ed. 2023, 4500 N Org-B |
| 19. | Sulphide (as S) | mg/L | BQL (LOQ:0.05) | APHA 24 th Ed. 2023, 4500-S-C, D |
| 20. | Cyanide (as CN) | mg/L | BQL (LOQ:0.001) | APHA 24 th Ed. 2023, 4500-CN, C & E |
| 21. | Phenolic Compounds (as C ₆ H ₅ OH) | mg/L | BQL (LOQ:0.001) | APHA 24 th Ed. 2023, 5530-B & C |
| 22. | Fixed Dissolved Solids | mg/L | 680 | IS 3025 (Part 18):2022 |
| | Product Group: Residues in water (Ground Water) | | | |
| 23. | Iron (as Fe) | mg/L | 0.148 | IS 3025 (Part 2): 2019 |
| 24. | Manganese (as Mn) | mg/L | BQL (LOQ:0.01) | IS 3025(Part 2): 2019 |
| 25. | Copper (as Cu) | mg/L | BQL (LOQ:0.01) | IS 3025 (Part 2): 2019 |
| 26. | Lead (as Pb) | mg/L | BQL (LOQ:0.008) | IS 3025 (Part 2): 2019 |
| 27. | Zinc (as Zn) | mg/L | 0.031 | IS 3025(Part 2): 2019 |
| 28. | Arsenic (as As) | mg/L | BQL (LOQ:0.007) | IS 3025(Part 2): 2019 |
| 29. | Nickel (as Ni) | mg/L | BQL (LOQ:0.01) | IS 3025(Part 2): 2019 |
| 30. | Mercury (as Hg) | mg/L | BQL (LOQ:0.0005) | APHA 24 th Ed. 2023, 3112-B |
| 31. | Hexavalent Chromium (as Cr ⁺⁶) | mg/L | BQL (LOQ:0.02) | APHA 24 th Ed. 2023, 3500- Cr-B |
| 32. | Chromium Total (as Cr) | mg/L | BQL (LOQ:0.01) | IS 3025 (Part 2): 2019 |
| 33. | Cadmium (as Cd) | mg/L | BQL (LOQ:0.0027) | IS 3025 (Part 2): 2019 |
| 34. | Selenium (as Se) | mg/L | BQL (LOQ:0.01) | IS 3025 (Part 2): 2019 |
| 35. | Vanadium (as V) | mg/L | BQL (LOQ:0.01) | IS 3025(Part 2): 2019 |

END OF REPORT

- Note:**
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Page 2 of 2
QF/SALE/02
Issue No 03
Date 05.12.2019.
Amd 03 Date
18.07.2023

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Sagar Yeul
Dy. Technical Manager
Chemical Testing



TC-148F



1251

Mahabal Enviro Engineers Pvt. Ltd.

PLOT NOS. 13,14,17,18, GRAMPANCHAYAT BOKHARA, CHHINDWARA ROAD, KORADI, NAGPUR, MAHARASHTRA, INDIA
Phone: 0712-2612162/2612212 email: nagpur@mahabal.com

TEST REPORT



| | | | |
|-------------|----------------|-------|------------|
| Report No.: | ME-1889250529N | Date: | 06.06.2025 |
| ULR No.: | - | | |

| | | | |
|------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|------------------------------------------------------|
| Name and Address of Customer | THE CHIEF ENGINEER, MAHARASHTRA STATE POWER GENERATION COMPANY LIMITED, Koradi Thermal Power Station Koradi, Dist. Nagpur. (3X660MW) | | PO No.: KTPS/4550023222/01038 PO Date: 22.08.2024 |
| Sample Description / Type | Ground water | Sampling Done by | Laboratory |
| Sampling Location | Dugwell Khasala Village | Sample Quantity / Packing | 10L X 1 No. PVC Can 500 mL X 1 No. PVC Can |
| Date of Sampling | 29.05.2025 | Date of Receipt of Sample | 29.05.2025 |
| Sampling Procedure | IS: 17614; APHA 24 th Ed. 2023, 1060-B | | |
| Date of Start of Analysis | 29.05.2025 | Date of Completion of Analysis | 06.06.2025 |

| Sr. No. | Parameter | Unit | Result | Method Reference |
|---------|----------------------------------------------------------------------------------------------|------|-----------------------------------------------------------------------------------------------|------------------|
| | Discipline: Chemical Testing: Product Group: Water (Ground Water) | | | |
| 1. | Bioassay test | - | Free from acute lethal toxicity (100% Survival of Fish after first 96 hours in 100% water) | IS 8582:1971 |
| 2. | Trivalent Chromium (as Cr ⁺³) | mg/L | BQL (LOQ:0.01) | WISAP/WW/56 |

END OF REPORT

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Page 1 of 1
QF/SALE/02
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Sagar Yeul
Dy. Technical Manager
Chemical Testing





Mahabal Enviro Engineers Pvt. Ltd.

PLOT NOS. 13,14,17,18, GRAMPANCHAYAT BOKHARA, CHHINDWARA ROAD, KORADI, NAGPUR, MAHARASHTRA, INDIA
Phone: 0712-2612162/2612212 email: nagpur@mahabal.com

1252

TEST REPORT



| | | | |
|-------------|--------------------|-------|------------|
| Report No.: | ME-1891250529 | Date: | 06.06.2025 |
| ULR No.: | TC748725000010448F | | |

| | | | |
|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|----------------------------------------------------------------------------------------------------|
| Name and Address of Customer | THE CHIEF ENGINEER, MAHARASHTRA STATE POWER GENERATION COMPANY LIMITED, Koradi Thermal Power Station Koradi, Dist. Nagpur. (3X660MW) | | PO No.: KTPS/4550023222/01038 PO Date: 22.08.2024 |
| Sample Description / Type | Ground water | Sampling Done by | Laboratory |
| Sampling Location | Dugwell Khairi Village | Sample Quantity / Packing | 10L X 1 No. PVC Can 500 mL X 1 No. PVC Can 100 mL X 1 No. PVC Can 1L X 1 No. Glass Bottle |
| Date of Sampling | 29.05.2025 | Date of Receipt of Sample | 29.05.2025 |
| Sampling Procedure | IS: 17614; APHA 24 th Ed. 2023, 1060-B | | |
| Date of Start of Analysis | 29.05.2025 | Date of Completion of Analysis | 06.06.2025 |

| Sr. No. | Parameter | Unit | Result | Method Reference |
|---------|----------------------------------------------------------------------------------|------|----------------|----------------------------------------------------------|
| | Discipline: Chemical Testing: Product Group: Water (Ground Water) | | | |
| 1. | Temperature | °C | 28.0 | APHA 24 th Ed. 2023, 2550-B |
| 2. | pH | - | 8.0 | APHA 24 th Ed. 2023, 4500-H+B |
| 3. | Free Chlorine (Residual) | mg/L | BQL (LOQ:0.05) | APHA 24 th Ed. 2023, 4500-C; G |
| 4. | Total Dissolved Solids | mg/L | 875 | IS 3025 (Part 16):2023 |
| 5. | Total Suspended Solids | mg/L | BQL (LOQ:5) | APHA 24 th Ed. 2023, 2540-D |
| 6. | Chloride (as Cl) | mg/L | 213 | APHA 24 th Ed. 2023, 4500-Cl-B |
| 7. | Sulphate (as SO ₄) | mg/L | 151 | APHA 24 th Ed. 2023, 4500-SO ₄ -E |
| 8. | Nitrate (as NO ₃) | mg/L | 2.10 | APHA 24 th Ed. 2023, 4500-NO ₃ , B |
| 9. | Total Hardness (as CaCO ₃) | mg/L | 456 | APHA 24 th Ed. 2023, 2340-C |
| 10. | Alkalinity Total (as CaCO ₃) | mg/L | 270 | APHA 24 th Ed. 2023, 2320-B |
| 11. | Phosphate Total (as PO ₄) | mg/L | 0.496 | APHA 24 th Ed. 2023, 4500-P, E |
| 12. | Fluoride (as F) | mg/L | 0.54 | APHA 24 th Ed. 2023, 4500-F, D |
| 13. | Dissolved Oxygen | mg/L | 6.3 | APHA 24 th Ed. 2023, 4500-O, B & C |
| 14. | Biochemical Oxygen Demand (3 days 27°C) | mg/L | 7.0 | IS 3025 (Part 44): 2023 |
| 15. | Chemical Oxygen Demand | mg/L | 24 | APHA 24 th Ed. 2023, 5220-B |
| 16. | Oil and Grease | mg/L | BQL (LOQ:1) | IS 3025 (Part 39): 2021 |

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Sagar Yeul
Dy. Technical Manager
Chemical Testing

Page 1 of 2
QF/SALE/02
Issue No 03
Date 05.12.2019.
Amd 03 Date
18.07.2023



1253



Mahabal Enviro Engineers Pvt. Ltd.

PLOT NOS. 13,14,17,18, GRAMPANCHAYAT BOKHARA, CHHINDWARA ROAD, KORADI, NAGPUR, MAHARASHTRA, INDIA
Phone: 0712-2612162/2612212 email: nagpur@mahabal.com

TEST REPORT



| | | | |
|-------------|--------------------|-------|------------|
| Report No.: | ME-1891250529 | Date: | 06.06.2025 |
| ULR No.: | TC748725000010448F | | |

| Sr. No. | Parameter | Unit | Result | Method Reference |
|---------|-------------------------------------------------------------|------|------------------|----------------------------------------------------------------------------------------------------------------------------------|
| 17. | Free Ammonia | mg/L | BQL (LOQ:0.1) | Test Procedures for Water and Wastewater Maharashtra Engineering Research Institute Government of Maharashtra (MERI): 1992 |
| 18. | Total Kjeldahl Nitrogen | mg/L | 1.40 | APHA 24 th Ed. 2023, 4500 N Org-B |
| 19. | Sulphide (as S) | mg/L | BQL (LOQ:0.05) | APHA 24 th Ed. 2023, 4500-S-C, D |
| 20. | Cyanide (as CN) | mg/L | BQL (LOQ:0.001) | APHA 24 th Ed. 2023, 4500-CN, C & E |
| 21. | Phenolic Compounds (as C ₆ H ₅ OH) | mg/L | BQL (LOQ:0.001) | APHA 24 th Ed. 2023, 5530- B & C |
| 22. | Fixed Dissolved Solids | mg/L | 680 | IS 3025 (Part 18):2022 |
| | Product Group: Residues in water (Ground Water) | | | |
| 23. | Iron (as Fe) | mg/L | 0.150 | IS 3025 (Part 2) 2019 |
| 24. | Manganese (as Mn) | mg/L | BQL (LOQ:0.01) | IS 3025(Part 2): 2019 |
| 25. | Copper (as Cu) | mg/L | BQL (LOQ:0.01) | IS 3025 (Part 2) 2019 |
| 26. | Lead (as Pb) | mg/L | BQL (LOQ:0.008) | IS 3025 (Part 2) 2019 |
| 27. | Zinc (as Zn) | mg/L | 0.032 | IS 3025(Part 2): 2019 |
| 28. | Arsenic (as As) | mg/L | BQL (LOQ:0.007) | IS 3025(Part 2): 2019 |
| 29. | Nickel (as Ni) | mg/L | BQL (LOQ:0.01) | IS 3025(Part 2): 2019 |
| 30. | Mercury (as Hg) | mg/L | BQL (LOQ:0.0005) | APHA 24 th Ed. 2023, 3112-B |
| 31. | Hexavalent Chromium (as Cr ⁶⁺) | mg/L | BQL (LOQ:0.02) | APHA 24 th Ed. 2023, 3500- Cr-B |
| 32. | Chromium Total (as Cr) | mg/L | BQL (LOQ:0.01) | IS 3025 (Part 2) 2019 |
| 33. | Cadmium (as Cd) | mg/L | BQL (LOQ:0.0027) | IS 3025 (Part 2) 2019 |
| 34. | Selenium (as Se) | mg/L | BQL (LOQ:0.01) | IS 3025 (Part 2) 2019 |
| 35. | Vanadium (as V) | mg/L | BQL (LOQ:0.01) | IS 3025(Part 2): 2019 |

END OF REPORT

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Page 2 of 2
QF/SALE/02
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Sagar Yeul
Dy. Technical Manager
Chemical Testing



TC-748F



Mahabal Enviro Engineers Pvt. Ltd.

PLOT NOS. 13,14,17,19, GRAMPANCHAYAT BOKHARA, CHHINDWARA ROAD, KORADI, NAGPUR, MAHARASHTRA, INDIA
Phone: 0712-2612162/2612212 email: nagpur@mahabal.com

TEST REPORT



| | | | |
|-------------|----------------|-------|------------|
| Report No.: | ME-1891250529N | Date: | 06.06.2025 |
| ULR No.: | - | | |

| | | | |
|------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|------------------------------------------------------|
| Name and Address of Customer | THE CHIEF ENGINEER, MAHARASHTRA STATE POWER GENERATION COMPANY LIMITED, Koradi Thermal Power Station Koradi, Dist. Nagpur. (3X660MW) | | PO No.: KTPS/4550023222/01038 PO Date: 22.08.2024 |
| Sample Description / Type | Ground water | Sampling Done by | Laboratory |
| Sampling Location | Dugwell Khairi Village | Sample Quantity / Packing | 10L X 1 No. PVC Can 500 mL X 1 No. PVC Can |
| Date of Sampling | 29.05.2025 | Date of Receipt of Sample | 29.05.2025 |
| Sampling Procedure | IS: 17814; APHA 24 th Ed. 2023, 1060-B | | |
| Date of Start of Analysis | 29.05.2025 | Date of Completion of Analysis | 06.06.2025 |

| Sr. No. | Parameter | Unit | Result | Method Reference |
|---------|----------------------------------------------------------------------------------------------|------|-----------------------------------------------------------------------------------------------|------------------|
| | Discipline: Chemical Testing: Product Group: Water (Ground Water) | | | |
| 1. | Bioassay test | - | Free from acute lethal toxicity (100% Survival of Fish after first 96 hours in 100% water) | IS 6582:1971 |
| 2. | Trivalent Chromium (as Cr ³⁺) | mg/L | BQL (LOQ:0.01) | WI/SAP/WW/56 |

END OF REPORT

- Note:**
1. BQL: Below Quantification Limit
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Page 1 of 1
QF/SALE/02
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Sagar Yeul
Dy. Technical Manager
Chemical Testing





1255

Mahabal Enviro Engineers Pvt. Ltd.

PLOT NOS. 13,14,17,18, GRAMPANCHAYAT BOKHARA, CHHINDWARA ROAD, KORADI, NAGPUR, MAHARASHTRA, INDIA
Phone: 0712-2612162/2612212 email: nagpur@mahabal.com

TEST REPORT



| | | | |
|-------------|--------------------|-------|------------|
| Report No.: | ME-1890250529 | Date: | 06.06.2025 |
| ULR No.: | TC748725000010447F | | |

| | | | |
|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|----------------------------------------------------------------------------------------------------|
| Name and Address of Customer | THE CHIEF ENGINEER, MAHARASHTRA STATE POWER GENERATION COMPANY LIMITED, Koradi Thermal Power Station Koradi, Dist. Nagpur. (3X660MW) | | PO No.: KTPS/4550023222/01038 PO Date: 22.08.2024 |
| Sample Description / Type | Ground water | Sampling Done by | Laboratory |
| Sampling Location | Borewell Khairi Village | Sample Quantity / Packing | 10L X 1 No. PVC Can 500 mL X 1 No. PVC Can 100 mL X 1 No. PVC Can 1L X 1 No. Glass Bottle |
| Date of Sampling | 29.05.2025 | Date of Receipt of Sample | 29.05.2025 |
| Sampling Procedure | IS: 17614; APHA 24 th Ed. 2023, 1060-B | | |
| Date of Start of Analysis | 29.05.2025 | Date of Completion of Analysis | 06.06.2025 |

| Sr. No. | Parameter | Unit | Result | Method Reference |
|---------|----------------------------------------------------------------------------------|------|----------------|---------------------------------------------------------|
| | Discipline: Chemical Testing; Product Group: Water (Ground Water) | | | |
| 1. | Temperature | °C | 28.0 | APHA 24 th Ed. 2023, 2550-B |
| 2. | pH | - | 7.9 | APHA 24 th Ed. 2023, 4500-H+B |
| 3. | Free Chlorine (Residual) | mg/L | BQL (LOQ:0.05) | APHA 24 th Ed. 2023, 4500-Cl-G |
| 4. | Total Dissolved Solids | mg/L | 1204 | IS 3025 (Part 16):2023 |
| 5. | Total Suspended Solids | mg/L | 5 | APHA 24 th Ed. 2023, 2540-D |
| 6. | Chloride (as Cl) | mg/L | 262 | APHA 24 th Ed. 2023, 4500-Cl-B |
| 7. | Sulphate (as SO ₄) | mg/L | 221 | APHA 24 th Ed. 2023, 4500-SO ₄ -E |
| 8. | Nitrate (as NO ₃) | mg/L | 38.3 | APHA 24 th Ed. 2023, 4500-NO ₃ -B |
| 9. | Total Hardness (as CaCO ₃) | mg/L | 508 | APHA 24 th Ed. 2023, 2340-C |
| 10. | Alkalinity Total (as CaCO ₃) | mg/L | 378 | APHA 24 th Ed. 2023, 2320-B |
| 11. | Phosphate Total (as PO ₄) | mg/L | 0.153 | APHA 24 th Ed. 2023, 4500-P, E |
| 12. | Fluoride (as F) | mg/L | 0.60 | APHA 24 th Ed. 2023, 4500-F, D |
| 13. | Dissolved Oxygen | mg/L | 6.1 | APHA 24 th Ed. 2023, 4500-O, B & C |
| 14. | Biochemical Oxygen Demand (3 days 27°C) | mg/L | 5.9 | IS 3025 (Part 44): 2023 |
| 15. | Chemical Oxygen Demand | mg/L | 20 | APHA 24 th Ed. 2023, 5220-B |
| 16. | Oil and Grease | mg/L | BQL (LOQ:1) | IS 3025 (Part 39): 2021 |

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Page 1 of 2
QF/SALE/02
Issue No 03
Date 05.12.2019.
Amd 03 Date
18.07.2023


Sagar Yeul
Dy. Technical Manager
Chemical Testing



TC-7487



1256

Mahabal Enviro Engineers Pvt. Ltd.

PLOT NOS. 13,14,17,18, GRAMPANCHAYAT BOKHARA, CHHINDWARA ROAD, KORADI, NAGPUR, MAHARASHTRA, INDIA
Phone: 0712-2612162/2612212 email: nagpur@mahabal.com

TEST REPORT



| | | | |
|-------------|--------------------|-------|------------|
| Report No.: | ME-1890250529 | Date: | 06.06.2025 |
| ULR No.: | TC748725000010447F | | |

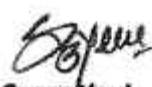
| Sr. No. | Parameter | Unit | Result | Method Reference |
|---------|----------------------------------------------------------|------|------------------|----------------------------------------------------------------------------------------------------------------------------|
| 17. | Free Ammonia | mg/L | BQL (LOQ:0.1) | Test Procedures for Water and Wastewater Maharashtra Engineering Research Institute Government of Maharashtra (MERI): 1992 |
| 18. | Total Kjeldahl Nitrogen | mg/L | 2.20 | APHA 24 th Ed. 2023, 4500 N Org-B |
| 19. | Sulphide (as S) | mg/L | BQL (LOQ:0.05) | APHA 24 th Ed. 2023, 4500-S-C, D |
| 20. | Cyanide (as CN) | mg/L | BQL (LOQ:0.001) | APHA 24 th Ed. 2023, 4500-CN, C & E |
| 21. | Phenolic Compounds (as C ₆ H ₅ OH) | mg/L | BQL (LOQ:0.001) | APHA 24 th Ed. 2023, 5530-B & C |
| 22. | Fixed Dissolved Solids | mg/L | 960 | IS 3025 (Part 18):2022 |
| | Product Group: Residues in water (Ground Water) | | | |
| 23. | Iron (as Fe) | mg/L | 0.133 | IS 3025 (Part 2) 2019 |
| 24. | Manganese (as Mn) | mg/L | 0.018 | IS 3025 (Part 2): 2019 |
| 25. | Copper (as Cu) | mg/L | BQL (LOQ:0.01) | IS 3025 (Part 2) 2019 |
| 26. | Lead (as Pb) | mg/L | BQL (LOQ:0.008) | IS 3025 (Part 2) 2019 |
| 27. | Zinc (as Zn) | mg/L | 0.042 | IS 3025 (Part 2): 2019 |
| 28. | Arsenic (as As) | mg/L | BQL (LOQ:0.007) | IS 3025 (Part 2): 2019 |
| 29. | Nickel (as Ni) | mg/L | BQL (LOQ:0.01) | IS 3025 (Part 2): 2019 |
| 30. | Mercury (as Hg) | mg/L | BQL (LOQ:0.0005) | APHA 24 th Ed. 2023, 3112-B |
| 31. | Hexavalent Chromium (as Cr ⁶⁺) | mg/L | BQL (LOQ:0.02) | APHA 24 th Ed. 2023, 3500-Cr-B |
| 32. | Chromium Total (as Cr) | mg/L | BQL (LOQ:0.01) | IS 3025 (Part 2) 2019 |
| 33. | Cadmium (as Cd) | mg/L | BQL (LOQ:0.0027) | IS 3025 (Part 2) 2019 |
| 34. | Selenium (as Se) | mg/L | BQL (LOQ:0.01) | IS 3025 (Part 2) 2019 |
| 35. | Vanadium (as V) | mg/L | 0.011 | IS 3025 (Part 2): 2019 |

END OF REPORT

- Note:
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Page 2 of 2
QF/SALE/02
Issue No 03
Date 05.12.2019.
Amd 03 Date
18.07.2023

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authorised by


Sagar Yeul
Dy. Technical Manager
Chemical Testing





Mahabal Enviro Engineers Pvt. Ltd.

PLOT NOS. 13,14,17,18, GRAMPANCHAYAT BOKHARA, CHHINDWARA ROAD, KORADI, NAGPUR, MAHARASHTRA, INDIA
Phone: 0712-2612162/2612212 email: nagpur@mahabal.com

TEST REPORT



QR 58801423

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|-------------|----------------|-------|------------|
| Report No.: | ME-1890250529N | Date: | 06.06.2025 |
| ULR No.: | - | | |

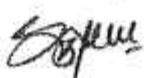
| | | | |
|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|------------------------------------------------------|
| Name and Address of Customer | THE CHIEF ENGINEER, MAHARASHTRA STATE POWER GENERATION COMPANY LIMITED, Koradi Thermal Power Station Koradi, Dist. Nagpur. (3X660MW) | | PO No.: KTPS/4550023222/01038 PO Date: 22.08.2024 |
| Sample Description / Type | Ground water | Sampling Done by | Laboratory |
| Sampling Location | Borewell Khairi Village | Sample Quantity / Packing | 10L X 1 No. PVC Can 500 mL X 1 No. PVC Can |
| Date of Sampling | 29.05.2025 | Date of Receipt of Sample | 29.05.2025 |
| Sampling Procedure | IS: 17614; APHA 24 th Ed. 2023, 1060-B | | |
| Date of Start of Analysis | 29.05.2025 | Date of Completion of Analysis | 06.06.2025 |

| Sr. No. | Parameter | Unit | Result | Method Reference |
|---------|----------------------------------------------------------------------------------|------|-----------------------------------------------------------------------------------------------|------------------|
| | Discipline: Chemical Testing; Product Group: Water (Ground Water) | | | |
| 1. | Bioassay test | - | Free from acute lethal toxicity (100% Survival of Fish after first 96 hours in 100% water) | IS 6582:1971 |
| 2. | Trivalent Chromium (as Cr ⁺³) | mg/L | BQL (LOQ:0.01) | WI/SAP/WW/56 |

END OF REPORT

- Note:**
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Page 1 of 1
QF/SALE/02
Issue No 03
Date 05.12.2019.
Amd 03 Date
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Dy. Technical Manager
Chemical Testing





Mahabal Enviro Engineers Pvt. Ltd.

PLOT NOS. 13,14,17,18, GRAMPANCHAYAT BOKHARA, CHHINDWARA ROAD, KORADI, NAGPUR, MAHARASHTRA, INDIA
Phone: 0712-2612162/2612212 email: nagpur@mahabal.com

1258

TEST REPORT



| | | | |
|-------------|--------------------|-------|------------|
| Report No.: | ME-1892250529 | Date: | 08.06.2025 |
| ULR No.: | TC748725000010449F | | |

| | | | |
|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|----------------------------------------------------------------------------------------------------|
| Name and Address of Customer | THE CHIEF ENGINEER, MAHARASHTRA STATE POWER GENERATION COMPANY LIMITED, Koradi Thermal Power Station Koradi, Dist. Nagpur. (3X660MW) | | PO No.: KTPS/4560023222/01038 PO Date: 22.08.2024 |
| Sample Description / Type | Ground water | Sampling Done by | Laboratory |
| Sampling Location | Borewell Panjra Village | Sample Quantity / Packing | 10L X 1 No. PVC Can 500 mL X 1 No. PVC Can 100 mL X 1 No. PVC Can 1L X 1 No. Glass Bottle |
| Date of Sampling | 29.05.2025 | Date of Receipt of Sample | 29.05.2025 |
| Sampling Procedure | IS: 17614; APHA 24 th Ed. 2023, 1060-B | | |
| Date of Start of Analysis | 29.05.2025 | Date of Completion of Analysis | 08.06.2025 |

| Sr. No. | Parameter | Unit | Result | Method Reference |
|---------|----------------------------------------------------------------------------------|------|----------------|---------------------------------------------------------|
| | Discipline: Chemical Testing; Product Group: Water (Ground Water) | | | |
| 1. | Temperature | °C | 29.0 | APHA 24 th Ed. 2023, 2550-B |
| 2. | pH | - | 7.5 | APHA 24 th Ed. 2023, 4500-H+B |
| 3. | Free Chlorine (Residual) | mg/L | BQL (LOQ:0.05) | APHA 24 th Ed. 2023, 4500-Cl G |
| 4. | Total Dissolved Solids | mg/L | 271 | IS 3025 (Part 16):2023 |
| 5. | Total Suspended Solids | mg/L | BQL (LOQ:5) | APHA 24 th Ed. 2023, 2540-D |
| 6. | Chloride (as Cl) | mg/L | 33.5 | APHA 24 th Ed. 2023, 4500-Cl-B |
| 7. | Sulphate (as SO ₄) | mg/L | 49.1 | APHA 24 th Ed. 2023, 4500-SO ₄ -E |
| 8. | Nitrate (as NO ₃) | mg/L | 3.48 | APHA 24 th Ed. 2023, 4500-NO ₃ -B |
| 9. | Total Hardness (as CaCO ₃) | mg/L | 126 | APHA 24 th Ed. 2023, 2340-C |
| 10. | Alkalinity Total (as CaCO ₃) | mg/L | 112 | APHA 24 th Ed. 2023, 2320-B |
| 11. | Phosphate Total (as PO ₄) | mg/L | 0.220 | APHA 24 th Ed. 2023, 4500-P, E |
| 12. | Fluoride (as F) | mg/L | 0.57 | APHA 24 th Ed. 2023, 4500-F, D |
| 13. | Dissolved Oxygen | mg/L | 5.9 | APHA 24 th Ed. 2023, 4500-O, B & C |
| 14. | Biochemical Oxygen Demand (3 days 27°C) | mg/L | 6.7 | IS 3025 (Part 44): 2023 |
| 15. | Chemical Oxygen Demand | mg/L | 22 | APHA 24 th Ed. 2023, 5220-B |
| 16. | Oil and Grease | mg/L | BQL (LOQ:1) | IS 3025 (Part 39): 2021 |

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Sagar Yeul
Dy. Technical Manager
Chemical Testing

Page 1 of 2
QF/SALE/02
Issue No 03
Date 05.12.2019.
Amd 03 Date
18.07.2023



TC-1482



1259

Mahabal Enviro Engineers Pvt. Ltd.

PLOT NOS. 13,14,17,18, GRAMPANCHAYAT BOKHARA, CHHINDWARA ROAD, KORADI, NAGPUR, MAHARASHTRA, INDIA
Phone: 0712-2612162/2612212 email: nagpur@mahabal.com

TEST REPORT



| | | | |
|-------------|--------------------|-------|------------|
| Report No.: | ME-1892250529 | Date: | 06.06.2025 |
| ULR No.: | TC748725000010449F | | |

| Sr. No. | Parameter | Unit | Result | Method Reference |
|---------|----------------------------------------------------------|------|------------------|----------------------------------------------------------------------------------------------------------------------------|
| 17. | Free Ammonia | mg/L | BQL (LOQ:0.1) | Test Procedures for Water and Wastewater Maharashtra Engineering Research Institute Government of Maharashtra (MERI): 1992 |
| 18. | Total Kjeldahl Nitrogen | mg/L | 1.56 | APHA 24 th Ed. 2023, 4500-N Org-B |
| 19. | Sulphide (as S) | mg/L | BQL (LOQ:0.05) | APHA 24 th Ed. 2023, 4500-S-C, D |
| 20. | Cyanide (as CN) | mg/L | BQL (LOQ:0.001) | APHA 24 th Ed. 2023, 4500-CN, C & E |
| 21. | Phenolic Compounds (as C ₆ H ₅ OH) | mg/L | BQL (LOQ:0.001) | APHA 24 th Ed. 2023, 5530-B & C |
| 22. | Fixed Dissolved Solids | mg/L | 206 | IS 3025 (Part 18):2022 |
| | Product Group: Residues in water (Ground Water) | | | |
| 23. | Iron (as Fe) | mg/L | 0.073 | IS 3025 (Part 2) 2019 |
| 24. | Manganese (as Mn) | mg/L | 0.036 | IS 3025 (Part 2): 2019 |
| 25. | Copper (as Cu) | mg/L | BQL (LOQ:0.01) | IS 3025 (Part 2) 2019 |
| 26. | Lead (as Pb) | mg/L | BQL (LOQ:0.008) | IS 3025 (Part 2) 2019 |
| 27. | Zinc (as Zn) | mg/L | 0.061 | IS 3025 (Part 2): 2019 |
| 28. | Arsenic (as As) | mg/L | BQL (LOQ:0.007) | IS 3025 (Part 2): 2019 |
| 29. | Nickel (as Ni) | mg/L | BQL (LOQ:0.01) | IS 3025 (Part 2): 2019 |
| 30. | Mercury (as Hg) | mg/L | BQL (LOQ:0.0005) | APHA 24 th Ed. 2023, 3112-B |
| 31. | Hexavalent Chromium (as Cr ⁶⁺) | mg/L | BQL (LOQ:0.02) | APHA 24 th Ed. 2023, 3500-Cr-B |
| 32. | Chromium Total (as Cr) | mg/L | BQL (LOQ:0.01) | IS 3025 (Part 2) 2019 |
| 33. | Cadmium (as Cd) | mg/L | BQL (LOQ:0.0027) | IS 3025 (Part 2) 2019 |
| 34. | Selenium (as Se) | mg/L | BQL (LOQ:0.01) | IS 3025 (Part 2) 2019 |
| 35. | Vanadium (as V) | mg/L | 0.014 | IS 3025 (Part 2): 2019 |

END OF REPORT

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Page 2 of 2
QF/SALE/02
Issue No 03
Date 05.12.2019
Amd 03 Date
18.07.2023

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Sagar Yeul
Dy. Technical Manager
Chemical Testing



TC-7487



Mahabal Enviro Engineers Pvt. Ltd.

PLOT NOS. 13,14,17,18, GRAMPANCHAYAT BOKHARA, CHHINDWARA ROAD, KORADI, NAGPUR, MAHARASHTRA, INDIA
Phone: 0712-2612162/2612212 email: nagpur@mahabal.com

1260

TEST REPORT



| | | | |
|-------------|----------------|-------|------------|
| Report No.: | ME-1892250529N | Date: | 06.06.2025 |
| ULR No.: | - | | |

| | | | |
|------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|------------------------------------------------------|
| Name and Address of Customer | THE CHIEF ENGINEER, MAHARASHTRA STATE POWER GENERATION COMPANY LIMITED, Koradi Thermal Power Station Koradi, Dist. Nagpur. (3X660MW) | | PO No.: KTPS/4550023222/01038 PO Date: 22.08.2024 |
| Sample Description / Type | Ground water | Sampling Done by | Laboratory |
| Sampling Location | Borewell Panjra Village | Sample Quantity / Packing | 10L X 1 No. PVC Can 500 mL X 1 No. PVC Can |
| Date of Sampling | 29.05.2025 | Date of Receipt of Sample | 29.05.2025 |
| Sampling Procedure | IS: 17614; APHA 24 th Ed. 2023, 1060-B | | |
| Date of Start of Analysis | 29.05.2025 | Date of Completion of Analysis | 06.06.2025 |

| Sr. No. | Parameter | Unit | Result | Method Reference |
|---------|----------------------------------------------------------------------------------------------|------|-----------------------------------------------------------------------------------------------|------------------|
| | Discipline: Chemical Testing: Product Group: Water (Ground Water) | | | |
| 1. | Bioassay test | - | Free from acute lethal toxicity (100% Survival of Fish after first 96 hours in 100% water) | IS 6582:1971 |
| 2. | Trivalent Chromium (as Cr ³⁺) | mg/L | BQL (LOQ:0.01) | WISAP/WW/56 |

END OF REPORT

- Note:**
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Page 1 of 1
QF/SALE/02
Issue No 03
Date 05.12.2019
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Sagar Yeul
Dy. Technical Manager
Chemical Testing





1261

Mahabal Enviro Engineers Pvt. Ltd.

PLOT NOS. 13,14,17,18, GRAMPANCHAYAT BOKHARA, CHHINDWARA ROAD, KORADI, NAGPUR, MAHARASHTRA, INDIA
Phone: 0712-2612162/2612212 email: nagpur@mahabal.com

TEST REPORT



| | | | |
|-------------|--------------------|-------|------------|
| Report No.: | ME-1893250529 | Date: | 06.06.2025 |
| ULR No.: | TC748725000010450F | | |

| | | | |
|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|----------------------------------------------------------------------------------------------------|
| Name and Address of Customer | THE CHIEF ENGINEER, MAHARASHTRA STATE POWER GENERATION COMPANY LIMITED, Koradi Thermal Power Station Koradi, Dist. Nagpur. (3X660MW) | | PO No.: KTPS/4550023222/01038 PO Date: 22.08.2024 |
| Sample Description / Type | Ground water | Sampling Done by | Laboratory |
| Sampling Location | Dugwell Panjra Village | Sample Quantity / Packing | 10L X 1 No. PVC Can 500 mL X 1 No. PVC Can 100 mL X 1 No. PVC Can 1L X 1 No. Glass Bottle |
| Date of Sampling | 29.05.2025 | Date of Receipt of Sample | 29.05.2025 |
| Sampling Procedure | IS: 17614; APHA 24 th Ed. 2023, 1060-B | | |
| Date of Start of Analysis | 29.05.2025 | Date of Completion of Analysis | 06.06.2025 |

| Sr. No. | Parameter | Unit | Result | Method Reference |
|---------|----------------------------------------------------------------------------------|------|----------------|---------------------------------------------------------|
| | Discipline: Chemical Testing: Product Group: Water (Ground Water) | | | |
| 1. | Temperature | °C | 28.0 | APHA 24 th Ed. 2023, 2550-B |
| 2. | pH | - | 8.1 | APHA 24 th Ed. 2023, 4500-H+B |
| 3. | Free Chlorine (Residual) | mg/L | BQL (LOQ:0.05) | APHA 24 th Ed. 2023, 4500-CI G |
| 4. | Total Dissolved Solids | mg/L | 257 | IS 3025 (Part 16):2023 |
| 5. | Total Suspended Solids | mg/L | BQL (LOQ:5) | APHA 24 th Ed. 2023, 2540-D |
| 6. | Chloride (as Cl) | mg/L | 42.0 | APHA 24 th Ed. 2023, 4500-CI-B |
| 7. | Sulphate (as SO ₄) | mg/L | 44.0 | APHA 24 th Ed. 2023, 4500-SO ₄ -E |
| 8. | Nitrate (as NO ₃) | mg/L | 1.43 | APHA 24 th Ed. 2023, 4500-NO ₃ -B |
| 9. | Total Hardness (as CaCO ₃) | mg/L | 146 | APHA 24 th Ed. 2023, 2340-C |
| 10. | Alkalinity Total (as CaCO ₃) | mg/L | 108 | APHA 24 th Ed. 2023, 2320-B |
| 11. | Phosphate Total (as PO ₄) | mg/L | 0.447 | APHA 24 th Ed. 2023, 4500-P, E |
| 12. | Fluoride (as F) | mg/L | 0.44 | APHA 24 th Ed. 2023, 4500-F, D |
| 13. | Dissolved Oxygen | mg/L | 6.3 | APHA 24 th Ed. 2023, 4500-O, B & C |
| 14. | Biochemical Oxygen Demand (3 days 27°C) | mg/L | 6.6 | IS 3025 (Part 44): 2023 |
| 15. | Chemical Oxygen Demand | mg/L | 24 | APHA 24 th Ed. 2023, 5220-B |
| 16. | Oil and Grease | mg/L | BQL (LOQ:1) | IS 3025 (Part 39): 2021 |

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Sagar Yeul
Dy. Technical Manager
Chemical Testing

Page 1 of 2
QF/SALE/02
Issue No 03
Date 05.12.2019.
Amd 03 Date
18.07.2023





1262

Mahabal Enviro Engineers Pvt. Ltd.

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Phone: 0712-2612162/2612212 email: nagpur@mahabal.com

TEST REPORT



| | | | |
|-------------|--------------------|-------|------------|
| Report No.: | ME-1893250529 | Date: | 06.06.2025 |
| ULR No.: | TC748725000010450F | | |

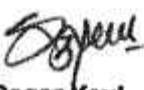
| Sr. No. | Parameter | Unit | Result | Method Reference |
|--------------------------------------------------------|-------------------------------------------------------------|------|------------------|----------------------------------------------------------------------------------------------------------------------------------|
| 17. | Free Ammonia | mg/L | BQL (LOQ:0.1) | Test Procedures for Water and Wastewater Maharashtra Engineering Research Institute Government of Maharashtra (MERI): 1992 |
| 18. | Total Kjeldahl Nitrogen | mg/L | 1.30 | APHA 24 th Ed. 2023, 4500 N Org-B |
| 19. | Sulphide (as S) | mg/L | BQL (LOQ:0.05) | APHA 24 th Ed. 2023, 4500-S-C, D |
| 20. | Cyanide (as CN) | mg/L | BQL (LOQ:0.001) | APHA 24 th Ed. 2023, 4500-CN, C & E |
| 21. | Phenolic Compounds (as C ₆ H ₅ OH) | mg/L | BQL (LOQ:0.001) | APHA 24 th Ed. 2023, 5530- B & C |
| 22. | Fixed Dissolved Solids | mg/L | 200 | IS 3025 (Part 18):2022 |
| Product Group: Residues in water (Ground Water) | | | | |
| 23. | Iron (as Fe) | mg/L | 0.099 | IS 3025 (Part 2) 2019 |
| 24. | Manganese (as Mn) | mg/L | BQL (LOQ:0.01) | IS 3025(Part 2): 2019 |
| 25. | Copper (as Cu) | mg/L | BQL (LOQ:0.01) | IS 3025 (Part 2) 2019 |
| 26. | Lead (as Pb) | mg/L | BQL (LOQ:0.008) | IS 3025 (Part 2) 2019 |
| 27. | Zinc (as Zn) | mg/L | BQL (LOQ:0.02) | IS 3025(Part 2): 2019 |
| 28. | Arsenic (as As) | mg/L | BQL (LOQ:0.007) | IS 3025(Part 2): 2019 |
| 29. | Nickel (as Ni) | mg/L | BQL (LOQ:0.01) | IS 3025(Part 2): 2019 |
| 30. | Mercury (as Hg) | mg/L | BQL (LOQ:0.0005) | APHA 24 th Ed. 2023, 3112-B |
| 31. | Hexavalent Chromium (as Cr ⁶⁺) | mg/L | BQL (LOQ:0.02) | APHA 24 th Ed. 2023, 3500- Cr-B |
| 32. | Chromium Total (as Cr) | mg/L | BQL (LOQ:0.01) | IS 3025 (Part 2) 2019 |
| 33. | Cadmium (as Cd) | mg/L | BQL (LOQ:0.0027) | IS 3025 (Part 2) 2019 |
| 34. | Selenium (as Se) | mg/L | BQL (LOQ:0.01) | IS 3025 (Part 2) 2019 |
| 35. | Vanadium (as V) | mg/L | 0.010 | IS 3025(Part 2): 2019 |

END OF REPORT

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Page 2 of 2
QF/SALE/02
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Dy. Technical Manager
Chemical Testing





Mahabal Enviro Engineers Pvt. Ltd.

PLOT NOS. 13,14,17,18, GRAMPANCHAYAT BOKHARA, CHHINDWARA ROAD, KORADI, NAGPUR, MAHARASHTRA, INDIA
Phone: 0712-2612162/2612212 email: nagpur@mahabal.com

TEST REPORT



| | | | |
|-------------|----------------|-------|------------|
| Report No.: | ME-1893250529N | Date: | 06.06.2025 |
| ULR No.: | - | | |

| | | | |
|------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|------------------------------------------------------|
| Name and Address of Customer | THE CHIEF ENGINEER, MAHARASHTRA STATE POWER GENERATION COMPANY LIMITED, Koradi Thermal Power Station Koradi, Dist. Nagpur. (3X660MW) | | PO No.: KTPS/4550023222/01038 PO Date: 22.08.2024 |
| Sample Description / Type | Ground water | Sampling Done by | Laboratory |
| Sampling Location | Dugwell Panjra Village | Sample Quantity / Packing | 10L X 1 No. PVC Can 500 mL X 1 No. PVC Can |
| Date of Sampling | 29.05.2025 | Date of Receipt of Sample | 29.05.2025 |
| Sampling Procedure | IS: 17614; APHA 24 th Ed. 2023, 1060-B | | |
| Date of Start of Analysis | 29.05.2025 | Date of Completion of Analysis | 06.06.2025 |

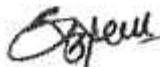
| Sr. No. | Parameter | Unit | Result | Method Reference |
|---------|----------------------------------------------------------------------------------------------|------|-----------------------------------------------------------------------------------------------|------------------|
| | Discipline: Chemical Testing: Product Group: Water (Ground Water) | | | |
| 1. | Bioassay test | - | Free from acute lethal toxicity (100% Survival of Fish after first 96 hours in 100% water) | IS 6562:1971 |
| 2. | Trivalent Chromium (as Cr ³⁺) | mg/L | BQL (LOQ:0.01) | W/SAP/WW/56 |

END OF REPORT

- Note:**
1. BQL: Below Quantification Limit.
 2. LOQ: Limit of Quantification.
 3. The result listed refers only to the tested sample(s) and applicable parameter(s).
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Page 1 of 1
QF/SALE/02
Issue No 03
Date 05.12.2019.
Amd 03 Date
18.07.2023

Reviewed and
authorised by


Sagar Yeul
Dy. Technical Manager
Chemical Testing





Mahabal Enviro Engineers Pvt. Ltd.

PLOT NOS. 13,14,17,18, GRAMPANCHAYAT BOKHARA, CHHINDWARA ROAD, KORADI, NAGPUR, MAHARASHTRA, INDIA
Phone: 0712-2612162/2612212 email: nagpur@mahabal.com

TEST REPORT



| | | | |
|-------------|--------------------|-------|------------|
| Report No.: | ME-1894250529 | Date: | 06.06.2025 |
| ULR No.: | TC748725000010451F | | |

| | | | |
|------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|----------------------------------------------------------------------------------------------------|
| Name and Address of Customer | THE CHIEF ENGINEER, MAHARASHTRA STATE POWER GENERATION COMPANY LIMITED, Koradi Thermal Power Station Koradi, Dist. Nagpur. (3X660MW) | | PO No.: KTPS/4550023222/01038 PO Date: 22.08.2024 |
| Sample Description / Type | Ground water | Sampling Done by | Laboratory |
| Sampling Location | Borewell Kawtha Village | Sample Quantity / Packing | 10L X 1 No. PVC Can 500 mL X 1 No. PVC Can 100 mL X 1 No. PVC Can 1L X 1 No. Glass Bottle |
| Date of Sampling | 29.05.2025 | Date of Receipt of Sample | 29.05.2025 |
| Sampling Procedure | IS: 17614; APHA 24 th Ed. 2023, 1060-B | | |
| Date of Start of Analysis | 29.05.2025 | Date of Completion of Analysis | 06.06.2025 |

| Sr. No. | Parameter | Unit | Result | Method Reference |
|---------|----------------------------------------------------------------------------------|------|----------------|----------------------------------------------------------|
| | Discipline: Chemical Testing: Product Group: Water (Ground Water) | | | |
| 1. | Temperature | °C | 27.0 | APHA 24 th Ed. 2023, 2550-B |
| 2. | pH | - | 7.7 | APHA 24 th Ed. 2023, 4500-H+B |
| 3. | Free Chlorine (Residual) | mg/L | BQL (LOQ:0.05) | APHA 24 th Ed. 2023, 4500-Cl G |
| 4. | Total Dissolved Solids | mg/L | 1074 | IS 3025 (Part 16):2023 |
| 5. | Total Suspended Solids | mg/L | 6 | APHA 24 th Ed. 2023, 2540-D |
| 6. | Chloride (as Cl) | mg/L | 280 | APHA 24 th Ed. 2023, 4500-Cl-B |
| 7. | Sulphate (as SO ₄) | mg/L | 109 | APHA 24 th Ed. 2023, 4500-SO ₄ -E |
| 8. | Nitrate (as NO ₃) | mg/L | 4.46 | APHA 24 th Ed. 2023, 4500-NO ₃ , B |
| 9. | Total Hardness (as CaCO ₃) | mg/L | 420 | APHA 24 th Ed. 2023, 2340-C |
| 10. | Alkalinity Total (as CaCO ₃) | mg/L | 374 | APHA 24 th Ed. 2023, 2320-B |
| 11. | Phosphate Total (as PO ₄) | mg/L | 0.309 | APHA 24 th Ed. 2023, 4500-P, E |
| 12. | Fluoride (as F) | mg/L | 0.43 | APHA 24 th Ed. 2023, 4500-F, D |
| 13. | Dissolved Oxygen | mg/L | 6.5 | APHA 24 th Ed. 2023, 4500-O, B & C |
| 14. | Biochemical Oxygen Demand (3 days 27°C) | mg/L | 5.5 | IS 3025 (Part 44): 2023 |
| 15. | Chemical Oxygen Demand | mg/L | 18 | APHA 24 th Ed. 2023, 5220-B |
| 16. | Oil and Grease | mg/L | BQL (LOQ:1) | IS 3025 (Part 39): 2021 |

Reviewed and authorised by

Sagar Yeul
Dy. Technical Manager
Chemical Testing

Page 1 of 2
QF/SALE/02
Issue No 03
Date 05.12.2019.
Amd 03 Date
18.07.2023



TC-7487



1265

Mahabal Enviro Engineers Pvt. Ltd.

PLOT NOS. 13,14,17,18, GRAMPANCHAYAT BOKHARA, CHHINDWARA ROAD, KORADI, NAGPUR, MAHARASHTRA, INDIA
Phone: 0712-2612162/2612212 email: nagpur@mahabal.com

TEST REPORT



| | | | |
|-------------|--------------------|-------|------------|
| Report No.: | ME-1894250529 | Date: | 06.06.2025 |
| ULR No.: | TC748725000010451F | | |

| | | | |
|------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|----------------------------------------------------------------------------------------------------|
| Name and Address of Customer | THE CHIEF ENGINEER, MAHARASHTRA STATE POWER GENERATION COMPANY LIMITED, Koradi Thermal Power Station Koradi, Dist. Nagpur. (3X660MW) | | PO No.: KTPS/4550023222/01038 PO Date: 22.08.2024 |
| Sample Description / Type | Ground water | Sampling Done by | Laboratory |
| Sampling Location | Borewell Kawtha Village | Sample Quantity / Packing | 10L X 1 No. PVC Can 500 mL X 1 No. PVC Can 100 mL X 1 No. PVC Can 1L X 1 No. Glass Bottle |
| Date of Sampling | 29.05.2025 | Date of Receipt of Sample | 29.05.2025 |
| Sampling Procedure | IS: 17614, APHA 24 th Ed. 2023, 1060-B | | |
| Date of Start of Analysis | 29.05.2025 | Date of Completion of Analysis | 06.06.2025 |

| Sr. No. | Parameter | Unit | Result | Method Reference |
|---------|----------------------------------------------------------------------------------|------|----------------|---------------------------------------------------------|
| | Discipline: Chemical Testing; Product Group: Water (Ground Water) | | | |
| 1. | Temperature | °C | 27.0 | APHA 24 th Ed. 2023, 2550-B |
| 2. | pH | - | 7.7 | APHA 24 th Ed. 2023, 4500-H+B |
| 3. | Free Chlorine (Residual) | mg/L | BQL (LOQ:0.05) | APHA 24 th Ed. 2023, 4500-Cl-G |
| 4. | Total Dissolved Solids | mg/L | 1074 | IS 3025 (Part 16):2023 |
| 5. | Total Suspended Solids | mg/L | 6 | APHA 24 th Ed. 2023, 2540-D |
| 6. | Chloride (as Cl) | mg/L | 280 | APHA 24 th Ed. 2023, 4500-Cl-B |
| 7. | Sulphate (as SO ₄) | mg/L | 109 | APHA 24 th Ed. 2023, 4500-SO ₄ -E |
| 8. | Nitrate (as NO ₃) | mg/L | 4.46 | APHA 24 th Ed. 2023, 4500-NO ₃ -B |
| 9. | Total Hardness (as CaCO ₃) | mg/L | 420 | APHA 24 th Ed. 2023, 2340-C |
| 10. | Alkalinity Total (as CaCO ₃) | mg/L | 374 | APHA 24 th Ed. 2023, 2320-B |
| 11. | Phosphate Total (as PO ₄) | mg/L | 0.309 | APHA 24 th Ed. 2023, 4500-P, E |
| 12. | Fluoride (as F) | mg/L | 0.43 | APHA 24 th Ed. 2023, 4500-F, D |
| 13. | Dissolved Oxygen | mg/L | 6.5 | APHA 24 th Ed. 2023, 4500-O, B & C |
| 14. | Biochemical Oxygen Demand (3 days 27°C) | mg/L | 5.5 | IS 3025 (Part 44): 2023 |
| 15. | Chemical Oxygen Demand | mg/L | 18 | APHA 24 th Ed. 2023, 5220-B |
| 16. | Oil and Grease | mg/L | BQL (LOQ: 1) | IS 3025 (Part 39): 2021 |

Reviewed and
authorised by

Sagar Yeul
Dy. Technical Manager
Chemical Testing

Page 1 of 2
QF/SALE/02
Issue No 03
Date 05.12.2019
Amd 03 Date
18.07.2023



TC-7487



1266

Mahabal Enviro Engineers Pvt. Ltd.

PLOT NOS. 13,14,17,18, GRAMPANCHAYAT BOKHARA, CHHINDWARA ROAD, KORADI, NAGPUR, MAHARASHTRA, INDIA

Phone: 0712-2612162/2612212 email: nagpur@mahabal.com

TEST REPORT



| | | | |
|-------------|--------------------|-------|------------|
| Report No.: | ME-1894250529 | Date: | 06.06.2025 |
| ULR No.: | TC748725000010451F | | |

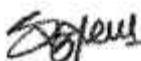
| Sr. No. | Parameter | Unit | Result | Method Reference |
|---------|-------------------------------------------------------------|------|------------------|----------------------------------------------------------------------------------------------------------------------------------|
| 17. | Free Ammonia | mg/L | BQL (LOQ:0.1) | Test Procedures for Water and Wastewater Maharashtra Engineering Research Institute Government of Maharashtra (MERI): 1992 |
| 18. | Total Kjeldahl Nitrogen | mg/L | 2.30 | APHA 24 th Ed. 2023, 4500 N Org-B |
| 19. | Sulphide (as S) | mg/L | BQL (LOQ:0.05) | APHA 24 th Ed. 2023, 4500-S-C, D |
| 20. | Cyanide (as CN) | mg/L | BQL (LOQ:0.001) | APHA 24 th Ed. 2023, 4500-CN, C & E |
| 21. | Phenolic Compounds (as C ₆ H ₅ OH) | mg/L | BQL (LOQ:0.001) | APHA 24 th Ed. 2023, 5530-B & C |
| 22. | Fixed Dissolved Solids | mg/L | 840 | IS 3025 (Part 18): 2022 |
| | Product Group: Residues in water (Ground Water) | | | |
| 23. | Iron (as Fe) | mg/L | 0.151 | IS 3025 (Part 2): 2019 |
| 24. | Manganese (as Mn) | mg/L | BQL (LOQ:0.01) | IS 3025 (Part 2): 2019 |
| 25. | Copper (as Cu) | mg/L | BQL (LOQ:0.01) | IS 3025 (Part 2): 2019 |
| 26. | Lead (as Pb) | mg/L | BQL (LOQ:0.008) | IS 3025 (Part 2): 2019 |
| 27. | Zinc (as Zn) | mg/L | 0.032 | IS 3025 (Part 2): 2019 |
| 28. | Arsenic (as As) | mg/L | BQL (LOQ:0.007) | IS 3025 (Part 2): 2019 |
| 29. | Nickel (as Ni) | mg/L | BQL (LOQ:0.01) | IS 3025 (Part 2): 2019 |
| 30. | Mercury (as Hg) | mg/L | BQL (LOQ:0.0005) | APHA 24 th Ed. 2023, 3112-B |
| 31. | Hexavalent Chromium (as Cr ⁺⁶) | mg/L | BQL (LOQ:0.02) | APHA 24 th Ed. 2023, 3500-Cr-B |
| 32. | Chromium Total (as Cr) | mg/L | BQL (LOQ:0.01) | IS 3025 (Part 2): 2019 |
| 33. | Cadmium (as Cd) | mg/L | BQL (LOQ:0.0027) | IS 3025 (Part 2): 2019 |
| 34. | Selenium (as Se) | mg/L | BQL (LOQ:0.01) | IS 3025 (Part 2): 2019 |
| 35. | Vanadium (as V) | mg/L | BQL (LOQ:0.01) | IS 3025 (Part 2): 2019 |

END OF REPORT

- Note:**
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Page 2 of 2
QF/SALE/02
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Amd 03 Date
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authorised by


Sagar Yeul
Dy. Technical Manager
Chemical Testing





Mahabal Enviro Engineers Pvt. Ltd.

PLOT NOS. 13,14,17,18, GRAMPANCHAYAT BOKHARA, CHHINDWARA ROAD, KORADI, NAGPUR, MAHARASHTRA, INDIA
Phone: 0712-2612162/2612212 email: nagpur@mahabal.com

TEST REPORT



| | | | |
|-------------|----------------|-------|------------|
| Report No.: | ME-1894250529N | Date: | 06.06.2025 |
| ULR No.: | - | | |

| | | | |
|------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|------------------------------------------------------|
| Name and Address of Customer | THE CHIEF ENGINEER, MAHARASHTRA STATE POWER GENERATION COMPANY LIMITED, Koradi Thermal Power Station Koradi, Dist. Nagpur. (3X660MW) | | PO No.: KTPS/4550023222/01038 PO Date: 22.08.2024 |
| Sample Description / Type | Ground water | Sampling Done by | Laboratory |
| Sampling Location | Borewell Kawtha Village | Sample Quantity / Packing | 10L X 1 No. PVC Can 500 mL X 1 No. PVC Can |
| Date of Sampling | 29.05.2025 | Date of Receipt of Sample | 29.05.2025 |
| Sampling Procedure | IS: 17614; APHA 24 th Ed. 2023, 1060-B | | |
| Date of Start of Analysis | 29.05.2025 | Date of Completion of Analysis | 06.06.2025 |

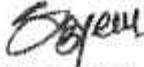
| Sr. No. | Parameter | Unit | Result | Method Reference |
|---------|----------------------------------------------------------------------------------------------|------|-----------------------------------------------------------------------------------------------|------------------|
| | Discipline: Chemical Testing: Product Group: Water (Ground Water) | | | |
| 1. | Bioassay test | - | Free from acute lethal toxicity (100% Survival of Fish after first 96 hours in 100% water) | IS 5582:1971 |
| 2. | Trivalent Chromium (as Cr ³⁺) | mg/L | BQL (LOQ:0.01) | WI/SAP/WWW/56 |

END OF REPORT

- Note:
1. BQL: Below Quantification Limit.
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Page 1 of 1
QF/SALE/02
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Dy. Technical Manager
Chemical Testing





Mahabal Enviro Engineers Pvt. Ltd.

PLOT NOS. 13,14,17,18, GRAMPANCHAYAT BOKHARA, CHHINDWARA ROAD, KORADI, NAGPUR, MAHARASHTRA, INDIA
Phone: 0712-2612162/2612212 email: nagpur@mahabal.com

1268

TEST REPORT



| | | | |
|-------------|--------------------|-------|------------|
| Report No.: | ME-1895250529 | Date: | 06.06.2025 |
| ULR No.: | TC748725000010452F | | |

| | | | |
|------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|----------------------------------------------------------------------------------------------------|
| Name and Address of Customer | THE CHIEF ENGINEER, MAHARASHTRA STATE POWER GENERATION COMPANY LIMITED, Koradi Thermal Power Station Koradi, Dist. Nagpur. (3X660MW) | | PO No.: KTPS/4550023222/01038 PO Date: 22.08.2024 |
| Sample Description / Type | Ground water | Sampling Done by | Laboratory |
| Sampling Location | Dugwell Kawtha Village | Sample Quantity / Packing | 10L X 1 No. PVC Can 500 mL X 1 No. PVC Can 100 mL X 1 No. PVC Can 1L X 1 No. Glass Bottle |
| Date of Sampling | 29.05.2025 | Date of Receipt of Sample | 29.05.2025 |
| Sampling Procedure | IS: 17614; APHA 24 th Ed. 2023, 1060-B | | |
| Date of Start of Analysis | 29.05.2025 | Date of Completion of Analysis | 06.06.2025 |

| Sr. No. | Parameter | Unit | Result | Method Reference |
|---------|----------------------------------------------------------------------------------------------|------|----------------|----------------------------------------------------------|
| | Discipline: Chemical Testing: Product Group: Water (Ground Water) | | | |
| 1. | Temperature | °C | 27.0 | APHA 24 th Ed. 2023, 2550-B |
| 2. | pH | - | 8.5 | APHA 24 th Ed. 2023, 4500-H-B |
| 3. | Free Chlorine (Residual) | mg/L | BQL (LOQ:0.05) | APHA 24 th Ed. 2023, 4500-Cl-G |
| 4. | Total Dissolved Solids | mg/L | 810 | IS 3025 (Part 16):2023 |
| 5. | Total Suspended Solids | mg/L | 8 | APHA 24 th Ed. 2023, 2540-D |
| 6. | Chloride (as Cl) | mg/L | 211 | APHA 24 th Ed. 2023, 4500-Cl-B |
| 7. | Sulphate (as SO ₄) | mg/L | 137 | APHA 24 th Ed. 2023, 4500-SO ₄ -E |
| 8. | Nitrate (as NO ₃) | mg/L | 3.46 | APHA 24 th Ed. 2023, 4500-NO ₃ , B |
| 9. | Total Hardness (as CaCO ₃) | mg/L | 288 | APHA 24 th Ed. 2023, 2340-C |
| 10. | Alkalinity Total (as CaCO ₃) | mg/L | 256 | APHA 24 th Ed. 2023, 2320-B |
| 11. | Phosphate Total (as PO ₄) | mg/L | 0.676 | APHA 24 th Ed. 2023, 4500-P, E |
| 12. | Fluoride (as F) | mg/L | 0.54 | APHA 24 th Ed. 2023, 4500-F, D |
| 13. | Dissolved Oxygen | mg/L | 6.1 | APHA 24 th Ed. 2023, 4500-O, B & C |
| 14. | Biochemical Oxygen Demand (3 days 27°C) | mg/L | 7.5 | IS 3025 (Part 44): 2023 |
| 15. | Chemical Oxygen Demand | mg/L | 24 | APHA 24 th Ed. 2023, 5220-B |
| 16. | Oil and Grease | mg/L | BQL (LOQ:1) | IS 3025 (Part 39): 2021 |

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Page 1 of 2
QF/SALE/02
Issue No 03
Date 05.12.2019.
Amd 03 Date
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Sagar Yeul
Dy. Technical Manager
Chemical Testing





1269

Mahabal Enviro Engineers Pvt. Ltd.

PLOT NOS. 13,14,17,18, GRAMPANCHAYAT BOKHARA, CHHINDWARA ROAD, KORADI, NAGPUR, MAHARASHTRA, INDIA
Phone: 0712-2612162/2612212 email: nagpur@mahabal.com

TEST REPORT



| | | | |
|-------------|--------------------|-------|------------|
| Report No.: | ME-1895250529 | Date: | 06.06.2025 |
| ULR No.: | TC748725000010452F | | |

| Sr. No. | Parameter | Unit | Result | Method Reference |
|---------|----------------------------------------------------------|------|------------------|----------------------------------------------------------------------------------------------------------------------------|
| 17. | Free Ammonia | mg/L | BQL (LOQ:0.1) | Test Procedures for Water and Wastewater Maharashtra Engineering Research Institute Government of Maharashtra (MERI): 1992 |
| 18. | Total Kjeldahl Nitrogen | mg/L | 2.90 | APHA 24 th Ed. 2023, 4500 N Org-B |
| 19. | Sulphide (as S) | mg/L | BQL (LOQ:0.05) | APHA 24 th Ed. 2023, 4500-S-C, D |
| 20. | Cyanide (as CN) | mg/L | BQL (LOQ:0.001) | APHA 24 th Ed. 2023, 4500-CN, C & E |
| 21. | Phenolic Compounds (as C ₆ H ₅ OH) | mg/L | BQL (LOQ:0.001) | APHA 24 th Ed. 2023, 5530- B & C |
| 22. | Fixed Dissolved Solids | mg/L | 630 | IS 3025 (Part 18):2022 |
| | Product Group: Residues in water (Ground Water) | | | |
| 23. | Iron (as Fe) | mg/L | 0.086 | IS 3025 (Part 2) 2019 |
| 24. | Manganese (as Mn) | mg/L | 0.037 | IS 3025(Part 2): 2019 |
| 25. | Copper (as Cu) | mg/L | BQL (LOQ:0.01) | IS 3025 (Part 2) 2019 |
| 26. | Lead (as Pb) | mg/L | BQL (LOQ:0.008) | IS 3025 (Part 2) 2019 |
| 27. | Zinc (as Zn) | mg/L | 0.063 | IS 3025(Part 2): 2019 |
| 28. | Arsenic (as As) | mg/L | BQL (LOQ:0.007) | IS 3025(Part 2): 2019 |
| 29. | Nickel (as Ni) | mg/L | BQL (LOQ:0.01) | IS 3025(Part 2): 2019 |
| 30. | Mercury (as Hg) | mg/L | BQL (LOQ:0.0005) | APHA 24 th Ed. 2023, 3112-B |
| 31. | Hexavalent Chromium (as Cr ⁶⁺) | mg/L | BQL (LOQ:0.02) | APHA 24 th Ed. 2023, 3500- Cr-B |
| 32. | Chromium Total (as Cr) | mg/L | BQL (LOQ:0.01) | IS 3025 (Part 2) 2019 |
| 33. | Cadmium (as Cd) | mg/L | BQL (LOQ:0.0027) | IS 3025 (Part 2) 2019 |
| 34. | Selenium (as Se) | mg/L | BQL (LOQ:0.01) | IS 3025 (Part 2) 2019 |
| 35. | Vanadium (as V) | mg/L | 0.015 | IS 3025(Part 2): 2019 |

END OF REPORT

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Page 2 of 2
QF/SALE/02
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Sagar Yeul
Dy. Technical Manager
Chemical Testing



TC-1481



Mahabal Enviro Engineers Pvt. Ltd.

PLOT NOS. 13,14,17,18, GRAMPANCHAYAT BOKHARA, CHHINDWARA ROAD, KORADI, NAGPUR, MAHARASHTRA, INDIA
Phone: 0712-2612162/2612212 email: nagpur@mahabal.com

1270

TEST REPORT



| | | | |
|-------------|----------------|-------|------------|
| Report No.: | ME-1895250529N | Date: | 06.06.2025 |
| ULR No.: | - | | |

| | | | |
|------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|------------------------------------------------------|
| Name and Address of Customer | THE CHIEF ENGINEER, MAHARASHTRA STATE POWER GENERATION COMPANY LIMITED, Koradi Thermal Power Station Koradi, Dist. Nagpur. (3X660MW) | | PO No.: KTPS/4550023222/01038 PO Date: 22.08.2024 |
| Sample Description / Type | Ground water | Sampling Done by | Laboratory |
| Sampling Location | Dugwell Kawtha Village | Sample Quantity / Packing | 10L X 1 No. PVC Can 500 mL X 1 No. PVC Can |
| Date of Sampling | 29.05.2025 | Date of Receipt of Sample | 29.05.2025 |
| Sampling Procedure | IS: 17614; APHA 24 th Ed. 2023, 1060-B | | |
| Date of Start of Analysis | 29.05.2025 | Date of Completion of Analysis | 06.06.2025 |

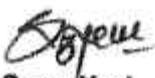
| Sr. No. | Parameter | Unit | Result | Method Reference |
|---------|----------------------------------------------------------------------------------------------|------|-----------------------------------------------------------------------------------------------|------------------|
| | Discipline: Chemical Testing: Product Group: Water (Ground Water) | | | |
| 1. | Bioassay test | - | Free from acute lethal toxicity (100% Survival of Fish after first 96 hours in 100% water) | IS 6582:1971 |
| 2. | Trivalent Chromium (as Cr ³⁺) | mg/L | BQL (LOQ:0.01) | WI/SAP/WW/56 |

END OF REPORT

- Note:
1. BQL: Below Quantification Limit.
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Page 1 of 1
QF/SALE/02
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18.07.2023

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Sagar Yeul
Dy. Technical Manager
Chemical Testing





Date: 31/05/2025

Action Plan for maximizing Ash Utilization

Short Term action plan:

| Sr.No | Action plan | Status |
|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | Tender published for proposal of "Approach and Peripheral Road condition of Koradi & Khasara ash bunds of Koradi TPS" which will be beneficial for maximizing ash utilization in Rainy season. | Work is in progress, Peripheral Road at Khasara ash Bund will get completed by July 2025. |
| 2 | A letter no. 7057 dtd 13.12.2024 to accord an approval to provide Financial Assistance at actual in providing the ash from Khasara Ash Bund of KTPS Koradi to NHAI/MSRDC & other Govt. Infrastructure development Projects/Road Projects at various locations, on NTPC basis i. e. Rs/Tonn/Km, has been sent to HO, MSPGCL, Mumbai. | As per B.R. no. MSPGCL/BM226/Item226.27 Dated 23.09.2024 MSPGCL to pay financial assistance of Rs.125 /per Tonn basis & pass-through charges on NTPC basis of Rs/Tonn/Km basis is under consideration. |
| 3 | Proposal for Work of Excavation, Collection, Loading & Transportation of 1,00,000 MT of pond ash from Khasara ash Bund to Umri (Jungli-Khurd) Area on Limited Enquiry basis has been sent to HO, MSPGCL, Mumbai for the approval. | Approval from HO shall receive soon. |
| 4 | Proposal for Work of Excavation, Collection, Loading & Transportation of 1,00,000 MT of pond ash from Khasara ash Bund to Pachgaon, Salai Menda and Navegaon Crusher Mines on Limited Enquiry basis has been sent to HO, MSPGCL, Mumbai for the approval. | Approval from HO shall receive soon. |
| 5 | On Hon. MSPGCL B.R. for Rs. 125/- per Ton financial assistance, this office has initiated the proposal for installation and commissioning of 100 MT Weighbridge at Khasara Ash Bund premises for measurement and weighment purpose. Tender published (RFX no. 52575). Price bid opened on dtd 04.02.2025. | PO for installation of 100 MT weighbridge placed, material received at site, work is in progress and same shall complete by end of July 2025. |
| 6 | Further additional 100 MT Weighbridge for the pond ash utilization from Koradi ash bund is also proposed through PR No. 1100165069. | The tender published, PO shall be finalized up to 31 July-25. |

MAHARASHTRA STATE POWER GENERATION CO. LTD.

(Govt. of Maharashtra undertaking)

KORADI THERMAL POWER STATION, KORADI

O/o Chief Engineer (O&M), K.T.P.S., Koradi, Dist. Nagpur, PIN - 441111

(ISO 9001:2015, ISO 14001:2015, ISO 45001: 2018 & ISO 50001:2018)

Email - cegenkoradi@mahagenco.in CIN: U40100MH2005SGC153648

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| | | |
|----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|
| | | |
| 7 | Presently, daily DFA utilization by Road is @ 3000 MT to 5000 MT Per day. If Rail infrastructure is developed in the nearby period then, daily DFA ash Utilization would be achieved 100%. | The proposal is under process with the railway department for approval. |
| 8 | M/s Ultrafine Mineral (RDC Concrete Unit) started civil work (shed erection, silo erection) at the allotted designated area at 3X660 MW Koradi TPS. | M/s Ultrafine minerals has started the work at site, the ash utilisation will start by Aug-25 |
| 9 | Parking space for DFA lifting bulkers made available near Y-gate point, Urja Bhavan Road. | Available. |
| 10 | At present average daily Pond ash utilization from Koradi & Khasara ash bund is around @ 7000 to 8000 MT Per day (Major ash utilization in Fair season). If Financial assistance is provided based on NTPC basis i.e. Rs/Ton/Km, Maximum Pond ash would be utilized for nearby stone quarries backfilling, coal mines backfilling and various Govt. Projects by NHAI, MSRDC, MOIL and other infrastructural development Projects etc. Then after we will achieve the maximum ash utilization target. | The proposal is under process at H.O. Mumbai. |
| 11 | In the rainy season, after WBM road completion work, Pond ash utilization will be continued as per the ash demand. | WBM road completion work, Pond ash utilization will be continued as per the ash demand. |



Long Term action plan:

To achieve 100 % Legacy ash utilization, as per MOEF & CC notification, following long term measures are being taken-

| Sr.No | Action plan |
|-------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | <p>For transportation of dry fly ash beside Railway siding line of Railway chord cabin for loading of dry fly ash in Railway wagon at 3x660MW.</p> <ul style="list-style-type: none"> ➤ Railway Platform no.1 is ready. ➤ The size of the platform is 20 x 180 mtrs. |
| 2 | <p>For loading & transportation of pond ash beside Railway Shunting neck track in between Koradi/Khasara Ash Bund.</p> <ul style="list-style-type: none"> ➤ Railway Platform no.2 is ready. ➤ The size of platform is 20 x 650 mtrs. |
| 3 | <p>M/s Rites submitted DPR for BG siding for ash utilization vide M/s RITES letter 1067 Dtd 01.04.2024, TPS Koradi given approval 1154 dtd 02.04.2024 for DPR & M/s RITES submitted above DPR to railways for their approval by vide letter 1080 Dtd 17.04.2024. The approval is pending from Railway. After getting approval the said Railway track work will be start through remote silo site and it will be very helpful to maximize the dry fly ash utilization. The proposed target is @ 8 - 10 months.</p> |
| 4 | <p>ASH CONSUMER MEET' was organized by MSPGCL on Dt. 13.08.2024 at Nagpur, Hotel Centre Point. Invitation were sent to All Govt. Authorities/ Agencies viz MoEF & CC, MPCB, Nagpur District Collector Office, District Mining Officer, Railways, NHAI, MSRDC, WRD, PWD, NIT, NMC, WCL, MOIL etc. Ash Utilizing Industries such as M/s; Ambuja, Dalmiya, Shree Cement, Ultrafine etc, Ash Transporting Agencies such as TRP, SS Transport, RCCPL etc, Bricks and Cement products manufacturing agencies, Stone quarries agencies etc A very good and positive response to the 'Ash Consumer Meet' from all of above noticed. Agencies representatives/ owners put forward their suggestions, views and queries on Ash Utilization from Mahagenco's TPS at Chandrapur, Koradi & Khaperkheda. Total 138 nos. members were present in the 'Ash Consumer Meet'.</p> <ul style="list-style-type: none"> ➤ MSPGCL Hon. Director (Fuel and E&S), ED (E&S) & ED (O&M-II) addressed the "Ash Consumer Meet". ➤ Chief Engineers from respective TPPs of CSTPS, KTPS, KPKD, Chief Engineer (EST) & Chief Engineer (E&S) were present in the 'Ash Consumer Meet'. |



भारत का राजपत्र The Gazette of India

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असाधारण
EXTRAORDINARY

भाग II—खण्ड 3—उप-खण्ड (i)
PART II—Section 3—Sub-section (i)

प्राधिकार से प्रकाशित
PUBLISHED BY AUTHORITY

सं. 725]

नई दिल्ली, सोमवार, दिसम्बर 30, 2024/ पौष 9, 1946

No. 725]

NEW DELHI, MONDAY, DECEMBER 30, 2024/PAUSHA 9, 1946

पर्यावरण, वन और जलवायु परिवर्तन मंत्रालय अधिसूचना

नई दिल्ली, 30 दिसम्बर, 2024

सा.का.नि. 787(अ). — पर्यावरण (संरक्षण) अधिनियम, 1986 (1986 का 29) की धारा 3, 6 और 25 के द्वारा प्रदत्त शक्तियों का प्रयोग करते हुए, केंद्रीय सरकार एतद्वारा पर्यावरण (संरक्षण) नियम, 1986 में आगे और संशोधन करने के लिए निम्नलिखित नियम बनाती है, अर्थात् :-

- (1) इन नियमों को पर्यावरण (संरक्षण) तीसरा संशोधन नियम, 2024 कहा जाएगा।
(2) ये राजपत्र में उनके प्रकाशन की तारीख से प्रवृत्त होंगे।
- पर्यावरण (संरक्षण) नियम, 1986 में, अनुसूची-1 में क्रम संख्या 25 में "तालिका 1" में,
(i) क्रम संख्या 1 के सामने, कॉलम (5) की प्रविष्टियों में, "31 दिसंबर, 2024 तक" शब्दों और आंकड़ों के स्थान पर "31 दिसंबर, 2027 तक" शब्द और आंकड़े प्रतिस्थापित किए जाएंगे;
(ii) क्रम संख्या 2 के सामने, कॉलम (5) की प्रविष्टियों में, "31 दिसंबर, 2025 तक" शब्दों और आंकड़ों के स्थान पर "31 दिसंबर, 2028 तक" शब्द और आंकड़े प्रतिस्थापित किए जाएंगे;

- (iii) क्रम संख्या 3 के सामने, कॉलम (5) की प्रविष्टियों में, "31 दिसंबर, 2026 तक" शब्दों और आंकड़ों के स्थान पर "31 दिसंबर, 2029 तक" शब्द और आंकड़े प्रतिस्थापित किए जाएंगे;
- (iv) कॉलम (7) की प्रविष्टियों में, "31 दिसंबर, 2027 तक" शब्दों और आंकड़ों के स्थान पर "31 दिसंबर, 2030 तक" शब्द और आंकड़े प्रतिस्थापित किए जाएंगे;

[फा सं. क्यू-15017/40/2007-सीपीडब्ल्यू]

वेद प्रकाश मिश्रा, संयुक्त सचिव

टिप्पणी : मूल नियम भारत के राजपत्र, असाधारण, भाग II, खंड 3, उप-खंड (i) में का.आ. संख्या 844(अ), तारीख 19 नवंबर, 1986 द्वारा प्रकाशित किए गए थे और इन्हें अंतिम बार अधिसूचना सं. का.आ. 3864(अ), तारीख 09 सितंबर, 2024 द्वारा संशोधित किया गया था।

**MINISTRY OF ENVIRONMENT, FOREST AND CLIMATE CHANGE
NOTIFICATION**

New Delhi, the 30th December, 2024

G.S.R. 787(E).— In exercise of the powers conferred by sections 3, 6 and 25 of the Environment (Protection) Act, 1986 (29 of 1986), the Central Government hereby makes the following rules further to amend the Environment (Protection) Rules, 1986, namely:—

1. (1) These rules may be called the Environment (Protection) Third Amendment Rules, 2024.
(2) They shall come into force on the date of their publication in the Official Gazette.
2. In the Environment (Protection) Rules, 1986, in Schedule – I, in serial number 25, in Table 1,—
 - (i) against serial number 1, in the entries under column (5), for the words and figures "Up to 31st December, 2024" the words and figures "Up to 31st December, 2027.", shall be substituted;
 - (ii) against serial number 2, in the entries under column (5), for the words and figures "Up to 31st December, 2025" the words and figures "Up to 31st December, 2028.", shall be substituted;
 - (iii) against serial number 3, in the entries under column (5), for the words and figures "Up to 31st December, 2026" the words and figures "Up to 31st December, 2029.", shall be substituted;
 - (iv) in the entries under column (7), for the words and figures "Up to 31st December, 2027" the words and figures "Up to 31st December, 2030.", shall be substituted.

[F. No. Q-15017/40/2007-CPW]
VED PRAKASH MISHRA, Jt. Secy.

Note.— The principle rules were published in the Gazette of India, Extraordinary, Part II, Section 3, Sub-section (i), vide number S.O. 844(E), dated the 19th November, 1986 and last amended vide notification S.O. 3864(E), dated the 9th September, 2024.