

**BEFORE THE HON'BLE NATIONAL GREEN TRIBUNAL  
SOUTHERN ZONE, CHENNAI**

Original Application No.107 of 2023

Suo Motu based on the news item published  
in the New Indian Express, dated 9.8.2023,  
under the caption "Huge pollution risk in 8 Km  
around NLC" and in the Times of India,  
Chennai edition dated 9.8.2023 under the  
caption "Water near NLC full of Mercury".

Vs

1.Managing Director

NLC India Ltd.

No-135, EVR Periyar High Road,

Kilpauk, Chennai-600 010

Tamil Nadu, India and 10 others

REJOINDER FILED BY RESPONDENT NO.11



Counsel for Respondent No.11

**BEFORE THE HON'BLE NATIONAL GREEN TRIBUNAL**

**SOUTHERN ZONE, CHENNAI**

Original Application No.107 of 2023

Suo Motu based on the news item published in the New Indian Express, dated 9.8.2023, under the caption "Huge pollution risk in 8 Km around NLC" and in the Times of India, Chennai edition dated 9.8.2023 under the caption "Water near NLC full of Mercury".

Vs

1.Managing Director  
NLC India Ltd.  
No-135, EVR Periyar High Road,  
Kilpauk, Chennai-600 010  
Tamil Nadu, India and 10 others

INDEX

S.No	Date	Description	Page No
1	14.2.2025	Rejoinder of Respondent No.11	1 - 20
2	17.5.2005	"Heavy metal pollution assessment in the surface water bodies and its suitability for irrigation around the Neyveli lignite mines and associated industrial complex, Tamil Nadu, India" done by R.Khan Et al was published o-in the Mine water and environment journal , Springer-Verlag 2005	21 - 27
3	October 2021	Emission Watch Report	28 - 75
4	August 2023	Powering Pollution Report	76 - 150
5		Annexure 1 – Map showing sample location	152
6		Annexure 2 – Photos exhibiting collection of samples	153 - 159
7		Annexure 3 – Latitude and longitude of sample collected locations	160 - 163
8		Annexure 4 – Test Analysis Reports	164 - 269
9		Map describing the location of sample collected at Tholkappier Nagar, Vadakkuvellur	270

Dated at Chennai on 14 February of 2025

  
Counsel for Respondent No.11

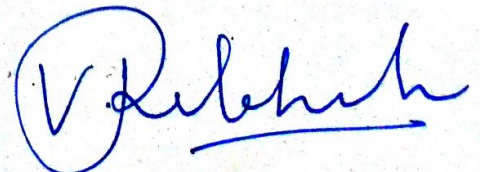
**BEFORE THE HON'BLE NATIONAL GREEN TRIBUNAL**  
**SOUTHERN ZONE, CHENNAI**

Original Application No.107 of 2023

Suo Motu based on the news item published in the New Indian Express, dated 9.8.2023, under the caption "Huge pollution risk in 8 Km around NLC" and in the Times of India, Chennai edition dated 9.8.2023 under the caption "Water near NLC full of Mercury".

Vs

1. Managing Director  
NLC India Ltd.  
No-135, EVR Periyar High Road,  
Kilpauk, Chennai-600 010  
Tamil Nadu, India
2. Ministry of Environment, Forest and Climate Change,  
Through its Secretary,  
Indira Paryavaran Bhawan Jorbagh Road,  
New Delhi – 110 003, India.
3. Department of Environment, Climate Change and Forests,  
Through its Additional Chief Secretary to Government,  
Government Of Tamil Nadu,  
Technology Department Secretariat,  
Fort St George, Chennai – 600 009
4. Central Pollution Control Board,  
Through its Chairman,  
Parivesh Bhawan, Maharshi Valmiki Marg, East Arjun Nagar, Vishwas Nagar,  
Extension Vishwas Nagar, Shahdara, Delhi – 110 032
5. Tamil Nadu Pollution Control Board,  
Through its Chairman,  
TNPCB, No. 76, Mount Salai Guindy,  
Chennai – 600 032
6. Chennai Metropolitan Water Supply and Sewerage Board,  
Through its Chairman,  
No.75, Santhome High Road,  
MRC Nagar, R.A.Puram,  
Chennai-600 028



7. Directorate of Public Health  
Through its Director,  
64,75, Main Road, Chokkalingam Nagar,  
Teynampet, Chennai, Tamil Nadu 600 006

8. District Collector  
Gundu Salai Road,  
Alpet, Manjakuppam,  
Cuddalore, Tamil Nadu 607 001

9. Department Of Municipal Administration and Water Supply,  
Through its Director,  
No.31, Kamarajar Salai, Chepauk,  
Chennai – 600 005

10. Tamil Nadu Water Supply and Drainage (TWAD) Board  
Through its Managing Director,  
No.31, Kamarajar Salai, Chepauk,  
Chennai -600 005

11. Prabhakaran Veeraarasu  
No. 72, Anjugam Nagar  
3rd Street, Jafferkhanpet  
Chennai 600 083

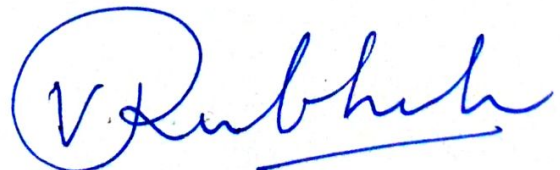
... Respondents

### **Rejoinder of Respondent No.11**

I, Prabhakaran Veeraarasu, Son of Veeraarasu, aged about 32 years, having residence at No.72, Anjugam Nagar, 3rd Street, Jafferkhanpet, Chennai – 600083, do hereby on solemn affirmation state as under:

1.. I am the Respondent No.11 herein. I am conversant with the facts of the case. I am competent to file this rejoinder. I have gone through the reports filed by respondents 2, 4, 5,6 and 7 and in response thereto I am filing this rejoinder.

2.. I state that Respondent No.1- Neyveli Lignite Corporation India Ltd (herein NLC) started its lignite mining operation of Mine I in 1956, and further expanded mining activities of Mine I-A in 2015 and Mine II in 2002. The total capacity of mining is 32.5 Million Tons per annum. NLC has also established four lignite-based pit head thermal power stations with total capacity of 3390 MW viz, Neyveli Thermal



Power Station – I Expansion in the year 1990, Neyveli Thermal Power Station – II in the year 1983, Neyveli Thermal Power Station – II Expansion in the year 2003, and Neyveli New Thermal Power Station in the year 2010 at Kurinjipadi, Panruti, Bhuvanagiri, Virudhachalam taluks, of Cuddalore district. Neyveli Thermal Power Station – I established in 1960 was decommissioned in 2020.

- 3.. I state that the Environmental Clearances under Environment Protection Act, 1985, and Consent to operate orders under Water Act, and Air Act are granted to the Respondent – NLC's mining operation viz Mine – I, Mine – IA and Mine – II and also for operation of thermal power stations. The environmental clearance and consent to operate orders mandate the Respondent – NLC to carry out their activities within the stipulated standards and conditions prescribed under various environmental legislations.
- 4.. I state that the Respondent - NLC operated thermal power stations and mines have a longstanding history of extensive air, water and land pollution along with serious problems faced by people due to land acquisition. These issues have been well documented by the media, local citizens, civil society organizations and various other agencies. In the same district, on the coastal belt, M/s IL&FS Tamil Nadu Power Company Limited (ITPCL) operates a sea water based 2x600 MW imported coal-based power plant in Parangipettai, a coastal town located on the north bank of Vellar river. Similar to Neyveli, the Parangipettai region also suffers from adverse impacts from the ITPCL TPS operations in terms of air, land, water pollution, as well as the impact on the fishing community and health of local people. Despite its documentation by the media, local citizens, civil society organizations and various agencies, the pollution related issues persist.
- 5.. I state that, a study titled "Heavy metal pollution assessment in the surface water bodies and its suitability for irrigation around the Neyveli lignite mines and associated industrial complex, Tamil Nadu, India" done by R.Khan Et al was published on 17 June 2005 in the mine water and environment journal , Springer-Verlag 2005. The study states that "copper, zinc, Magnesium, Iron, Nickel, Cadmium, Chromium, Cobalt, Lead, Mercury concentrations in the surface water of



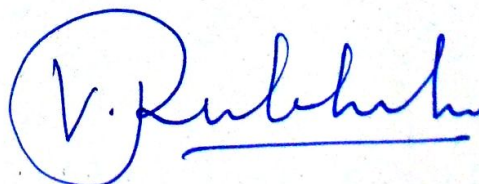
the study area are from 2 to 1200 times higher than the average concentrations in river waters worldwide”.

6.. I state that Cuddalore district was identified and declared as a mine affected area under the Tamil Nadu District Mineral Foundation Rules, 2017.

7.. I state that the data on stack emission of the thermal power plants at Neyveli given by the Central Electricity Authority shows serious violations of the standards prescribed under the Environment Protection Rules. The Central Electricity Authority report dated February 2023 shows that all the seven units in Neyveli Thermal Power Station II exceeded the sulphur dioxide levels by 5 to 6 times. Even the new Neyveli thermal power station exceeded the limits for Particulate Matters, Sulphur dioxide and Nitrogen Oxides.

8.. I state that the study titled “Emission Watch” was published on October 2021 by Poovulagin Nanbargal, Centre for Energy and Clean Air and ASAR, on the status of Sulphur dioxide emission and FGD installations for coal-based power plants in Tamil Nadu. The study identified Neyveli as one of the major coal burning clusters of Tamil Nadu that has repeatedly been highlighted as one of the Sulphur dioxide hotspots of the country. And even made into the world’s highest hotspots in 2019. It is pertinent to note that sulphur dioxide is a very potent air pollutant that is a byproduct of combustion of fossil fuel such as coal containing sulphur. Sulphur dioxide has been linked to Cardio vascular and respiratory diseases. Thermal power plants are one of the largest emitters of SO<sub>2</sub>. A report titled “Life amidst lignite; how coal dust is sparking a massive health crisis for Neyveli residents” was published in the newsminute.com on 04.08.2017.

9.. I state that, on this background the study “Powering Pollution- The Environmental and Pollution Impacts of Thermal Power Stations and Mining Operations in Neyveli and Parangipettai” was carried out and published on August 2023. I was also a part of the team consisting of Mr. Shripad Dharmadhikary of Manthan Adhyayan Kendra, Medha Kapoor of Manthan Adhyayan Kendra, Rachel Pearl, researcher, who have carried out the study. The objective of the study is to have carried out a comprehensive assessment in both Neyveli and Parangipettai

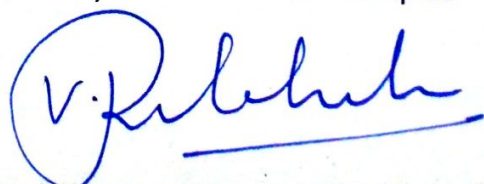


regions with the involvement of the local communities to understand the status of the documented issues, bring out new issues that may have not been previously highlighted, identify sources of pollution and suggest ways in which the issues could be addressed. The study has followed a four-tier approach. First is the literature review of the documented environmental and pollution issues. The second tier is field observations to understand the current status of the documented issues. The third tier has been questionnaire-based surveys and Focus Group Discussions to gather the experiences of local communities who are directly affected by the activities of mining and operation of thermal power stations by the NLC Ltd. And the fourth stage involved carrying out water and soil sampling and testing to understand water and soil quality issues in the areas of Neyveli.

11.. I state that a detailed questionnaire-based survey and a focused group discussion was conducted in 7 villages in Neyveli namely Aadhandarkollai (Kokkankuppam), Akilandagangapuram, Kallukuzhi, Thenkuthu, Vanathirayapuram, Vadakuvellur, Thoppalikuppam, and in two villages in Parangipettai namely Pudhukuppam and Karikuppam.

12.. I state that we undertook two rounds of collection of water and soil samples for testing for various parameters to get a sense of how the pollutants from the power plants, mines and related infrastructure were affecting the water and soil in the area. 5 Litres plastic containers were used for sampling purposes. The sampling point was flushed for 2-3 minutes to remove any stagnant water. The bottle was uncapped carefully to avoid contamination of the inner surface and cap, then filled leaving appropriate headspace (approximately 2.5 cm) to allow for mixing before analysis. The sample was collected without splashing and the container was immediately sealed. During collection, aseptic technique was maintained by wearing sterile gloves and avoiding contact with the bottle mouth or cap interior. The sample was properly labelled with location, date, and time. Following the collection, the sample was transported to the laboratory within the standard 12 hour holding time window to ensure sample integrity.

13.. I state that the first round of sampling, carried out on 2.2.2023 and 11.2.2023, we collected a total of 20 samples from the Neyveli area. These samples



consisted of 12 from surface water, 4 from groundwater, 1 from piped water, 2 soil samples from agricultural fields and one sample from fly ash. In the second round, on 15.04.2023, we collected a total of 11 samples, with 8 from surface waters, 1 from ground water, and two soil samples. In Parangipettai area only one round of sampling was done, on February 2023, and a total of 6 samples were collected. These consisted of 2 from surface water, 2 from groundwater, 1 from piped water and one soil sample from agricultural field. These locations included locations where effluents were being discharged directly from mines, thermal power plants, and ash ponds, and locations where water bodies were thought to be receiving discharges, other ambient water bodies, water bodies from which water was being used for irrigation and other uses, wells and borewells or piped water supply in villages in the region being used for drinking and domestic use, agricultural fields where coal and ash was depositing or fields being irrigated with local water sources, and two control points.

14.. I stat that We have categorised the surface water samples into two categories – one is "ambient water bodies", essentially streams, rivers, ponds, lakes etc. The other is "effluent discharge" which is basically effluents being directly discharged by either a mine or a TPP or an ash pond or any related infrastructure; this may be being discharged into a local ambient water body or it may be being discharged onto land. Though the "effluent discharge" also ultimately ends up contaminating the local water bodies, one reason to make this distinction is that there are legally binding discharge standards for effluent discharges under the Environment Protection Rules, 1986. While collecting the samples, if we were able to observe effluents being directly discharged into ambient water body or land, we classified them as "effluent discharge" locations; and where there was no such direct discharge seen or reported, we categories the location as "Ambient Water Body". However, in cases where we were informed by reliable sources that effluents are being directly discharged into a water body but we did not see it directly, or we saw effluents being directly discharged but the actual discharge point was some distance away from that sampling location and effluents could potentially be diluted by other

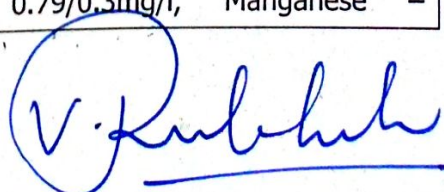


water received in between, then we categorised those locations as an intermediate "Effluent Discharge / Ambient Water Body Receiving Discharge" category.

15.. I state that all water samples were tested for basic parameters like pH, TDS, alkalinity, TSS etc as well as for heavy metals, and some of the samples, mainly the effluent discharge samples were additionally tested for COD (Chemical Oxygen Demand) and for Oil and Grease. For assessing the water quality of surface water, ground water and piped drinking water, we have mainly used the standards under the Drinking Water – Specification (IS 10500: 2012). Soil samples were tested for 12 parameters as per the 'Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health', since there are no Indian standards for soil quality from the point of view of human health.

16.. I state that the finding of the lab analysis of the Surface water, ground water and piped drinking water, samples collected at Neyveli and Parangipettai shows exceeded level of many parameters under the Drinking Water – Specification (IS 10500: 2012). The analysis report of the samples of exceeding parameters are as follows:

Location Identification	Location Name	Type of Sample	Exceeded Parameters under Drinking Water – Specification (IS 10500: 2012)
R1-L 6	Opposite to Main Gate of Mine II-KootuKudineerThittam near Valaiyamadevi	Surface water	Iron – 20.7/0.3mg/l, Chromium – 0.085/0.05mg/l, Manganese – 0.393/0.1mg/l, Mercury – 0.003/0.001 mg/l, Aluminium – 22.5/0.2mg/l, Nickel – 0.032/0.02 mg/l
R1-L 8	Parawnar River	Surface water	Iron - 1.31/0.3 mg/l, Aluminium – 1.638/0.2 mg/l
R1-L 10	Walaja Lake	Surface water	Iron – 1.21/0.3mg/l, Manganese – 0.121/0.1mg/l, Aluminium – 1.61/0.03mg/l, Nickel – 0.093/0.02 mg/l
R1-L 12	Aadhandarkollai Borewell near	Ground water	Fluoride – 1.11/1.0mg/l, Iron – 0.79/0.3mg/l, Manganese –



	Thiravupathi Amman Temple, 300 m away from ash Pond		0.426/0.1mg/l
R1-L13	Pond near Ash Pond, Water discharge to the Pond sometimes (Adhandarkollai)	Surface water	Iron 0.34/0.3mg/l, Manganese 0.731/0.1mg/l, Aluminium - 0.164/0.03mg/l, Nickel - 0.034/0.02 mg/l
R1-L 14	Vaanadhirayapuram Village 100 meters from the Mine	Ground water	Boron - 0.56/0.5mg/l
R1-L 16	Kanjamandanpettai Pond (Control Point)	Surface water	Iron - 0.89/0.3mg/l, Aluminium - 2.871/0.03mg/l
R1-L 18	Vellankulam	Drinking water	Zinc - 5.903/5mg/l
R1-L 20	Iyyan Lake	Surface water	Aluminium - 0.061/0.03mg/l, Nickel - 0.031/0.02mg/l
R1-L 23	Karikuppam Village Fish Pond	Surface water	Fluoride - 1.10/1.0mg/l, Iron - 0.89/0.3mg/l
R1-L 25	Canal near the Thermal Power Plant	Surface water	Fluoride - 1.21/1.0mg/l, Boron - 0.526/0.5mg/l, Iron - 0.93/0.3mg/l
R1-L 26	Karikuppam Village	Ground water	Fluoride 1.15/1.0mg/l, Iron - 0.39/0.3mg/l, Manganese - 0.101/0.1mg/l
R2-S 2	Ramapuri, Mantharakuppam-Vadakkuvellur	Surface Water	Sulphate - 206.24/200mb/l, Mercury - 0.02/0.001mg/l, Selenium - 0.024/0.01mg/l
R2-S 3	Vadakkuvellur-Ammeri	Surface Water	Selenium - 0.014/0.01mg/l
R2-S 6	Stream near to Central Store	Surface Water	Mercury - 0.03/0.001mg/l, Selenium - 0.024/0.01mg/l

*V. Ruben*

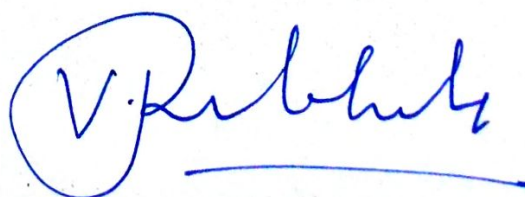
R2-S 8	Tholkappiar Nagar	Ground water	Mercury - 0.25/0.001mg/l, Selenium - 0.014/0.01mg/l
R2-S 9	Muppaneri	Surface Water	Selenium - 0.047/0.01mg/l

17.. I state that the results of analysis of soil samples reveals the level of various variable under the Canadian Soil Quality Guidelines for protection of environment and human health as follows:

Location Identification	Location Name	Type of Sample	Exceeded Parameters under Canadian Soil Quality Guidelines
R1-L 9	Paddy Field within 1km from the stack of NNTPS	Soil	Nickel - 87.4/50mg/kg, Zinc- 205/200mg/kg, Copper - 87.5/63mg/kg
R1-L 11	Agriculture Land near Iyyan Lake	Soil	Chromium - 78.6/64mg/kg
R1-L 24	Karikuppam village agricultural land near Thermal Power Plant	Soil	Boron - 59.3
R2-S 4	Karumbu Thottam, Vadakkuvellur	Soil	Selenium - 24.12/1.0mg/kg
R2-S 11	Vadakkuvellur bypass	Soil	Selenium - 23.56/1.0mg/kg

18.. I state that the test analysis report reveals that sample collected from the overhead tank at Tholkappier Nagar, Vadakkuvellur found to be seriously contaminated with heavy metals such as Mercury (0.25/0.001mg/l), and Selenium - (0.014/0.01mg/l). Thus, it is clear that the presence of mercury is around 250 times above the permissible limit.

19.. I state that the analysis report on the samples of surface water shows that the surface water is found to be seriously contaminated with heavy metals such as mercury, selenium, nickel, chromium, and other substances such as fluoride, iron, magnesium, silicon, calcium. The sample collected from the stream opposite the



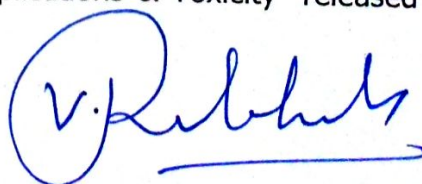
main gate of Mine – II near Kootu kudineer Thittam at Valaiyamadevi which is connected to Walaja lake is found to be having high levels of nickel, chromium, mercury, manganese, iron, aluminium, calcium, magnesium, hardness, alkalinity, TDS and turbidity.

20.. I state that the Central water commission in its report dated August 2019 "Status of trace and toxic metals in Indian rivers" states that:

"Owing to their chemical characteristics, metals remain in the environment, in many cases only changing from one chemical state to another one and eventually accumulating in the food chain... Because of their high water solubility, heavy metals can be easily absorbed by living organisms and, due to their mobility in natural water ecosystems and their toxicity to living forms, have been ranked as major inorganic contaminants in surface and ground waters. While exceedance with respect to certain limits is of concern, metals found below the limits also can lead to serious health impacts due to their persistence in water and the property of bio-accumulation and bio-magnification. Even if they may be present in dilute, almost undetectable quantities, their recalcitrance to degradation and consequent persistence in water bodies imply that, through natural processes such as bio-magnification, their concentration may become elevated to such an extent that they begin exhibiting toxic effects."

Thus, a significant presence of heavy metals itself can be of concern, even if they are not exceeding any standards or even if they are present in very small quantities.

21.. I state that abovesaid report also states, "People drinking arsenic contaminated water generally show arsenical skin lesions, which are a late manifestation of arsenic toxicity. Long term exposure to arsenic contaminated water may lead to various diseases such as conjunctivitis, hyperkeratosis, hyperpigmentation, cardiovascular diseases, disturbance in the peripheral vascular and nervous systems, skin cancer, gangrene, leucomelosis, non pitting swelling, hepatomegaly and splenomegaly (Kiping, 1977; WHO, 2001; Pershagen, 1983)." Further, the report titled "Mercury: Environmental Implications & Toxicity" released



by CPCB, states that "Mercury is very toxic and it may be fatal if inhaled and harmful if absorbed through the skin. It may cause harmful effects on the nervous system, digestive and respiratory systems and kidneys. Short term exposure to high concentrations of mercury vapour leads to acute mercury poisoning."

### **Report of CMWSSB**

22.. I state that Respondent No.6 – Chennai Metropolitan Water Supply and Sewerage Board has stated in the report dated 24.7.2024 that the treated water sample from the Vadakuthu water treatment plant was tested on 29.01.2023 at Chennai testing laboratory, Guindy, Chennai, for complete chemical and biological analysis. The report also states that out of 1040MLD of treated water supplied to Chennai, around 175 MLD is drawn from the various sources in Cuddalore district. In the above said 175MLD, 130 MLD is collected from Veeranam lake and 45 MLD is drawn from the NLC Mine IA, Parawnar river and deep bore wells in the Neyveli aquifer. It can only be inferred from the analysis report of the respondent CMWSSB that water from various sources is being treated under the treatment plant and nothing more.

### **Report of Department of Health and Preventive Medicine**

23.. I state that Respondent no.7 – Department of Public Health and preventive medicine has stated that in the report dated 17.10.2023 that they have carried out testing of drinking water samples from about 170 sources in and around 8 kms of NLC, Cuddalore out of which only 93 samples were analysed for the presence of heavy metals. Why all the 170 samples were not analysed for the presence of heavy metals remains unanswered. The respondent department of public health has not collected water samples from the 7 drinking water locations and 22 surface water locations pointed out in the powering pollution report. Water samples from only two locations viz. Tholkappier Nagar and Vanathirayapuram which has been mentioned in the powering pollution report, has been collected, out of which only the sample from Tholkappier Nagar is tested for the presence of heavy metals and the details with regard to heavy metals in Vanathirayapuram are not found in the report.

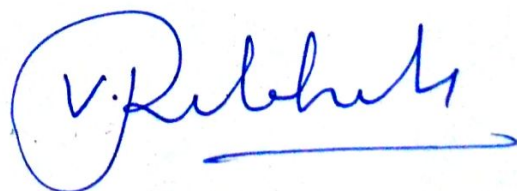


**Report of CPCB**

24.. I state that Respondent no.4- Central Pollution Control Board has stated in the affidavit dated 09.10.2023 that during September 28-19, 2023, CPCB has collected a total of 16 samples from surface and ground water sources in and around NLC, the treated effluent from Mines I, IA, and TPS I expansion, TPS II, TPS II expansion and NNTPS. It is also stated that the analysis results of the treated effluent discharge from the TPS-II is not meeting the standards prescribed by TNPCB with regard to TSS, BOD and COD parameters. The lake sample results shows that the lakes fall under Class A, B & E of designated Best use (pH & BOD parameter). However, these three locations, the concentration of Nickel (0.031mg/l, 0.086mg/l, 0.040mg/l) is exceeding the drinking water standard of 0.02mg/L. The latitude and longitude of the locations wherein samples were collected by the respondent – CPCB are not furnished so as to verify with the locations mentioned in the report – Powering Pollution. CPCB has also not furnished test analysis report.

**Report of MoEF&CC**

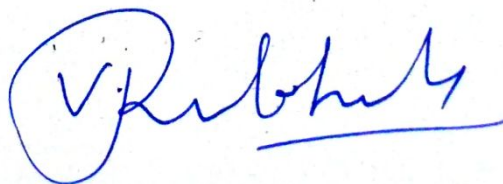
25.. I state that Respondent No. 2 -- Ministry of Environment Forest and Climate Change (MoEF&CC herein) report dated 10.1.2024 states that the combustion of coal in particular lignite, is one of the main sources of anthropogenic emissions of mercury. Mercury compounds which occur in coals/lignite are decomposed at high temperatures in the boiler furnace and mercury is released from the coal/lignite as elemental mercury. The mercury compounds and elemental mercury (Hg0) are removed partially during the flow of the flue gas through purification systems such as electrostatic precipitators (ESPs) or flue gas desulphurization (FGD) installations. The mercury that is not retained by those systems is released into the atmosphere mainly in the form of Hg0 can be transformed into methyl mercury, which is the form of most concern and which is a threat to living species. ESP and FGD are to capture the mercury and other particulate matter released into the atmospheric air. It is observed that ESPs are provided for all stacks of thermal power plants. FGD installation in TPS I Expansion, TPS II, NNTPS units are in progress. TPS II Expansion unit has an inbuilt FGD mechanism.



26.. I state that, the MoEF&CC report has not furnished any details with regard to the analysis of heavy metals such as Cadmium, Nickel, Mercury, Selenium, Chromium from the water samples collected from the dug wells of Neyveli Basin. The Ambient air quality analysis report has not furnished details with regard to the level of Mercury from the stack. The Analysis report of lignite and ash samples from NNTPS has no details on the data collection of samples and the details of test analysis. The report has not furnished details with regard to the other Ash ponds. The report has not furnished any details with regard to the stack emission details of Mercury. The report has not furnished any details on the analysis of heavy metals in the treated effluent and sewage. Respondent No.2 – Ministry of Environment, Forest and Climate Change has not independently analysed all ash samples from NNTPS, they have reproduced the analysis report of TNPCB, Annexure 34 of the report dated Nov 2023. The latitude and longitude of the locations wherein samples were collected by the respondent – MoEF& CC are not furnished with, so as to verify with the locations mentioned in the report – Powering Pollution.

### **Reports of TNPCB**

27.. I state that the report of Respondent No.5 – Tamil Nadu Pollution Control Board dated November 2023, consists of two types of data of analysis. The first part consists of consolidated report of analysis on treated sewage, treated effluent and ambient air quality of mine I, mine IA, mine II, Neyveli TPS II, Neyveli TPS II expansion, TPS I expansion, NNTPS, TAQA, IL&FS for the year 2018-2023. These consolidated analysis report doesn't have details with regard to the analysis of heavy metals in treated sewage, and treated effluent. The consolidated report of analysis on the stack emission also doesn't have data with regard to mercury emission. The consolidated report of the stack emission survey conducted for the year 2018 to 2023 reveals that the level of Sulphur dioxide has exceeded from 2-6 times above the permissible limit. For the period 2021 to 2022 (First half year) the emission of sulphur dioxide from the stack of M/s Neyveli Thermal Power Station II Expansion exceeded to 2719  $\mu\text{g}/\text{m}^3$  which is 4.5 times higher than the permissible limits of 600  $\mu\text{g}/\text{m}^3$ . Even though the TPS II Expansion unit has an inbuilt FGD mechanism the  $\text{SO}_2$  emission levels are very high. For the period 2018 to 2023 the emission of

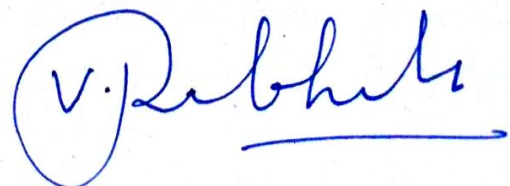


sulphur dioxide from the stack of M/s Neyveli Thermal Power Station-I Expansion exceeded from 1704  $\mu\text{g}/\text{m}^3$  to 3803  $\mu\text{g}/\text{m}^3$  which is 2.84 to 6.3 times higher than the permissible limits of 600  $\mu\text{g}/\text{m}^3$ . For the period 2020 to 2023 (For three years) the emission of sulphur dioxide from the stack of M/s New Neyveli Thermal Power Station exceeded from 592  $\mu\text{g}/\text{m}^3$  to 1518  $\mu\text{g}/\text{m}^3$  which is 5.9 to 15 times higher than the permissible limits of 100  $\mu\text{g}/\text{m}^3$ . For the period 2018 to 2023 (For five years) the emission of sulphur dioxide from the stack of M/s TAQA Neyveli Power Company Pvt Limited exceeded from 3521  $\mu\text{g}/\text{m}^3$  to 3835  $\mu\text{g}/\text{m}^3$  which is 5.8 to 6.3 times higher than the permissible limits of 600  $\mu\text{g}/\text{m}^3$ .

28.. I state that the second part of report of Respondent - TNPCB dated Nov 2023, consists of analysis details on samples collected by the committee constituted by TNPCB. From the result details of analysis, it can be understood that there is presence of heavy metals above the permissible limits viz. (i) Lead, and Nickel in Vanathirayapuram, (ii) Nickel in Ayyikuppam, (iii) Nickel in NLC supplied water at U.Mangalam Tank, (iv) Nickel in Block 22 Pump house Vellankulam, (v) Zinc, and Nickel in Vadakuvellur Bypass, (vi) Selenium, Nickel, and Boron in Walajah Tank Embankment, (vii) Nickel, and Selenium in Parawanar River Bank, (viii) Lead, and Boron in Pudukorapettai Borewell (ix) Nickel, and Lead in U. Agaram Groundwater (x) Lead in Near Ash Pond (xi) Nickel, and Lead in U Mangalam Groundwater (xii) Nickel, and Magesium in Erumboor (xiii) Boron in Arasakuzhi.

29.. I state that the Respondent – TNPCB report on the Air Quality states: "However, Mercury concentration was observed in heavy metal analysis of gaseous phase in the order of 0.07  $\text{mg}/\text{Nm}^3$  in M/s Neyveli New Thermal Power Plant of M/s NLC India Ltd and 0.05 and 0.07  $\text{mg}/\text{Nm}^3$  in M/s IL&FS Tamil Nadu Power Company Ltd., against the standard of 0.03  $\text{mg}/\text{Nm}^3$ ."

30.. I state that the Respondent – TNPCB report has made recommendations on installation of Flue Gas Desulphurization, Ash disposal, usage of ground water, cumulative Environmental Impact Assessment and calculation of carrying capacity as follows:



(i) Installation of Flue Gas Desulphurization, in Thermal Station II, Thermal Power Station I Expansion, Neyveli New Thermal Power Station, and TAQA Neyveli Power Company Private Limited on or before 31.12.2026.

(ii) M/s NLC India Limited Thermal Power Station II "shall dispose the accumulated quantity of 4,204,381 MT ash dumped in the ash pond and the unit shall submit the concrete proposal for disposal of fly ash as per the fly ash notification dt 31.12.2021" and M/s TAQA Neyveli Power Company Private Limited to "dispose the accumulated quantity legacy ash of 188,661 MT ash dumped in the ash pond and the unit shall submit the concrete proposal for disposal of fly ash as per the fly ash notification dt 31.12.2021."

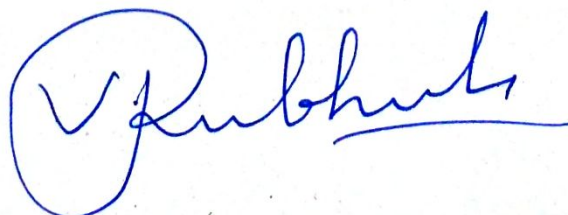
(iii) M/s NLC India Limited Thermal Power Station II "shall stop the consumption of ground water quantity of approximately 16,000 KLD." M/s NLC India Limited Thermal Power Station I Expansion "shall switch over to utilize 500 KLD for mine water (Mine I & IA) for boiler make up instead of ground water." M/s TAQA Neyveli Power Company Private Limited "shall stop the consumption of ground water quantity of 21,000 KLD which is being presently used."

(iv) "To have an effective and continuous monitoring in the NLC complex, it is suggested to form an Assistant Environmental Engineer (AEE) office at M/s NLC India Ltd, Neyveli."

(v) "M/s NLC India Limited shall carry out a cumulative carrying of environmental impact including heavy metals by considering all the industrial activities through reputed institutes like NEERI, IIT Madras etc."

(vi) "Detailed hydrogeological study shall be conducted by reputed institutes like National Geophysical Research Institute (NGRI) for all the three mines in Neyveli region to investigate the impacts of mining in the Neyveli region."

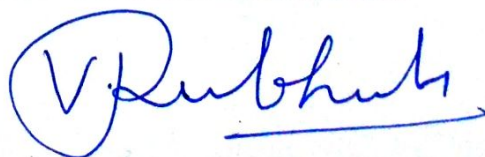
The locations wherein samples were collected by the committee of TNPCB differ from the locations mentioned in the report of powering pollution.



### Additional Report of TNPCB

31.. I state that pursuant to the direction of this Hon'ble Tribunal vide its order dated 15.3.2024, the Respondent – TNPCB has filed an additional report dated 20.5.2024, consisting of analysis report from the laboratories of Chennai Mettix Lab Private Limited, Tamil Nadu Test House, Advanced Environmental Lab, TNPCB, and IIT Madras CUBE. The comparison analysis report reveals presence of Mercury and other heavy metals, beyond the prescribed standard limits of Drinking Water – Specification (IS 10500:2012), in the drinking water around the villages of Neyveli. The details regarding the level of mercury and other heavy metals above the permissible limits in drinking water samples as given in the additional report of TNPCB are as follows:

S. No.	Drinking water sources	TNPCB	Mettex Lab, Guindy	Tamil Nadu Test House
1.	Adhandarkolli Borewell near Dhropathiamma nkovil	Cadmium - 0.035/0.003mg/l (11 times), Lead - 0.069/0.01mg/l (6.9times), Nickel - 0.050/0.02mg/l, Aluminium - 0.480/0.03mg/l, Iron - 0.272/0.3mg/l.	-----	Iron - 0.35/0.3mg/l
2.	Vanathirayapuram Village	Cadmium - 0.040/0.003mg/l (13 times), Lead - 0.01/0.110mg/l (11 times), Arsenic - 0.206/0.01mg/l (20 times), Nickel - 0.087/0.02mg/l, Iron - 0.329/0.3mg/l, Aluminium - 0.187/0.3mg/l.	Iron-0.34/0.3 mg/l, Aluminium - 0.040/0.3mg/l	Iron - 1.64/0.3mg/l(5.4times)
3.	Aiyikuppam, Kullanchavadi Borewell	Lead - 0.114/0.01mg/l(11 times), Cadmium - 0.040/0.003mg/l, Nickel -	-----	Fluoride - 8.444/1mg/l (8.4 times)



	(Control Point)	0.068/0.02mg/l.		
4.	NLC pipe water, drinking water supplied by NLC management	Cadmium - 0.038/0.003mg/l (12 times), Nickel - 0.055/0.02mg/l, Lead - 0.081/0.01mg/l (8 times), Aluminium - 0.164/0.03mg/l.	-----	Fluoride - 7.579/1mg/l (7.5 times)
5.	Vellankulam	Cadmium - 0.044/0.003mg/l (14.6 times), Nickel - 0.055/0.02mg/l, Lead - 0.082/0.01mg/l (8times), Mercury - 0.005/0.001mg/l(5 times), Boron - 5/0.5mg/l (10 times), Aluminium - 0.211/0.03mg/l (7 times).	-----	Fluoride - 8.067/1mg/l (8 times)
6.	Pudukuppam Village	Cadmium - 0.041/0.003mg/l (13.6times), Nickel - 0.055/0.02mg/l, Lead-0.090/0.01mg/l (9times), Mercury - 0.007/0.001mg/l (7times), Manganese - 0.237/0.1mg/l, Aluminium - 0.149/0.03mg/l.	Manganese - 0.192/0.1mg/l	Fluoride - 9.235/1mg/l (9.2 times)
7.	Pudukuppam Village pipe water	Cadmium - 0.042/0.003mg/l (14 times), Nickel - 0.082/0.02mg/l(4times), Lead - 0.143/0.01mg/l(14.3times), Aluminium - 0.065/0.1mg/l		Fluoride - 11.56/1mg/l (11.5 times)
8.	Karikuppam	Cadmium- 0.044/0.003mg/l	Iron -	Fluoride -

*V. Subhuti*

	Village	(14.6 times), Nickel - 0.063/0.02mg/l (3.1 times), Lead - 0.094/0.01mg/l (9.4 times), Boron - 0.52/0.5mg/l, Manganese - 0.138/0.1mg/l, Aluminium - 0.238/0.03mg/l.	0.30/0.3mg/l	7.59/1mg/l (7.6 times), Iron - 1.1/0.3mg/l (3.6 times)
9.	Tholkappier Nagar	Cadmium - 0.053/0.003mg/l (17.6 times), Nickel - 0.05/0.02mg/l (2.5 times), Lead - 0.116/0.01mg/l (11.6 times), Aluminium - 0.139/0.03mg/l (4.6 times)	Iron - 0.52/0.3mg/l	Fluoride - 8.02/1mg/l (8 times), Iron - 0.4/0.3mg/l

32.. I state that in the additional report of TNPCB, analysis data of Advanced Environmental Lab, TNPCB, Chennai/Cuddalore indicates the presence of Chromium in all the 9 drinking water samples as <0.6 mg/l, which exceeds the permissible standard of 0.5 mg/l. Likewise, the analysis data also indicates the presence of Sulphide exceeding in all 9 drinking water samples as value of <1 mg/l beyond the limit of 0.01 mg/l. From the additional report of TNPCB, it can be understood that the drinking water sources at (i) Adhandarkolli Borewell near Dhropathi Amman Kovil, (ii) Vanathirayapuram Village, (iii) Aiyikuppam, Kullanchavadi Borewell (Control Point), (iv) NLC pipe water, drinking water supplied by NLC management, (v) Vellankulam (vi) Pudukuppam Village, (vii) Pudukuppam Village pipe water, (viii) Karikuppam Village and (ix) Tholkappier Nagar, are unsafe for consumption and injurious to human health and environment.



33.. I state that TNPCB additional report also provides details with regard to the level of heavy metals in soil above the permissible limits are as follows:

S.No	Soil Sample Locations	TNPCB	Mettax Lab	Tamil Nadu Test House
1.	Karumbuthottam, Vadakuvellur	Selenium - 2.31/1.0mg/kg	-----	Arsenic - 16.7/12mg/kg
2.	Vadakuvelur Bypass	Selenium - 6.77/1.0mg/kg (6.7times)	-----	Arsenic - 21.18/12mg/kg
3.	Agricultural Land, Ayyan Lake	-----	-----	Arsenic - 15.4/12mg/kg
4.	Paddy field, 1 km from NNTPS	-----	-----	Chromium-67.7/6 4mg/kg

The latitude and longitude of the locations wherein samples were collected by the respondent – TNPCB has not been furnished so as to verify with the locations mentioned in the report – Powering Pollution.

#### **Water Analysis of Tholkappier Nagar, Vadakuvellur**

32.. I state that there are two water tanks in Tholkappier Nagar, Vadakuvellur village, one is situated about 70m from the Mine - I, and the other is situated about 140m from the Mine - I. The sample which was found to have 250 times of mercury, reported in the Powering Pollution, was collected from the outlet of water tank located 70m from the Mine I, whereas from page 149, comparison – 29 of the TNPCB report dated November, 2023, it can be understood that the sample was collected from the other water tank located from 140m from Mine - I. Moreover, the latitude and longitude, mentioned with regard to the bore well water sample from the Tholkappiar Nagar in the report, differs from data provided under the table with the data provided under the photo taken from GPS Map Camero Lite.

For the reasons aforesaid, it is prayed that the Hon'ble Tribunal be pleased to declare all the locations shown in paragraph 32 above unsafe for human consumption and consequently declare the said locations as "critically polluted zones," and direct respondents 2 and 3 to assess the loss of ecology and determine the amount of compensation to be paid to the concerned affected people, and fix a time limit for implementing the recommendations of the Tamil Nadu Pollution Control Board, and to form an independent committee of experts to undertake a fresh study on water quality in and around Neyveli more specifically with reference to the presence of heavy metals and other toxic substances, and thus render justice.

Solemnly affirmed at Chennai  
on this the 14<sup>th</sup> day of February 2025  
and signed his name in my presence



Before Me  
of (S. Aarthy  
Ms. 2529/15  
134, Thambu St  
Ch-1  
Ph: 81223 00924)

### Technical Communication

## Heavy Metal Pollution Assessment in Surface Water Bodies and its Suitability for Irrigation around the Neyveli Lignite Mines and Associated Industrial Complex, Tamil Nadu, India

R. Khan<sup>1</sup>, S.H. Israili<sup>1</sup>, H. Ahmad<sup>2</sup>, and A. Mohan<sup>3</sup>

<sup>1</sup>Dept of Geology, Aligarh Muslim Univ, Aligarh-202002, India; <sup>2</sup>Govt PG College, Jhalawar, Rajasthan-326001, India; <sup>3</sup>Toxicology and Env Lab, Hamdard Univ, New Delhi-110029, India; corresponding author's e-mail: rizwan\_tsm@yahoo.co.uk

**Abstract.** Opencast lignite mines, pit-head thermal power plants, and other associated industries in the Neyveli mining and industrial complex generate huge quantities of solid and liquid wastes that are contaminated with heavy metals. Some of these are toxic or carcinogenic at sufficient concentrations. Copper, Zn, Mn, Fe, Ni, Cd, Cr, Co, Pb, and Hg concentrations in surface water in the study area are from 2 to 1200 times higher than average concentrations in river water worldwide. Heavy metal contamination in the natural reservoirs (Peria, Kolakudi, Walaza, and Perumal Ponds, and the Paravannar River) is mainly due to the discharge of untreated mine water, fly-ash pond water, and effluents from associated industries. These waters have long been used for bathing, washing, animal watering, etc. Untreated mine and industrial waste water, and natural reservoir water have been used by nearby villagers for irrigation for the last four decades, which may have led to deterioration of soils, surface water, and groundwater. Heavy metal analyses of mine water, fly-ash pond and industrial effluents and the natural reservoirs reveals that Co, Cr, and Hg are above the recommended irrigation water quality standards in 17%, 75%, and 100% of the samples, respectively. Most samples were within the permissible limits for Mn, Ni, and Fe, while Pb, Zn, Cd, and Cu were within the limits in all samples. At elevated concentrations, toxic metals like Cr, Co, and Hg can accumulate in soils and enter the food chain, leading to serious health hazards and threatening the long-term sustainability of the local ecosystem.

**Key Words:** Fly ash; heavy metals; irrigation; lignite; Neyveli; opencast mines; Tamil Nadu; thermal power plants; wastewater

### Introduction

The contamination of aquatic and terrestrial ecosystems with heavy metals is a major environmental problem. Some of these metals are potentially toxic or carcinogenic at sufficient concentrations and can cause serious human health hazards if they enter the food chain. Investigations have been made of the extent of heavy metal pollution of surface water, groundwater, soils, air and vegetation by mining and associated industrial activities, particularly thermal power plants and opencast coal mines (Allan 1988; Benvenuti et al. 1997; Caruccio 1972; Coulthard et al. 2003; Fang et al. 2003; Gulec et al. 2001; Hansen and Fisher 1980; Kabata-Pendias 1995; Klein et al. 1975; Lee 1975; Liorens et al. 2001; Mohanty et al. 2001; Rupper et al. 1996; Sahu 1998; Sen et al. 1996; Swaine 1990). Metal pollution by mining and associated industrial activities is somewhat mitigated today by strict implementation of clean technology and environmental measures. However, metals released previously by such activities have been retained in the sediments and soils, and still contaminate surface and ground water resources.

We examined an area that includes two very large (Mines I and II) and one small (Mine IA) opencast

lignite mines, associated industries (two pit-head thermal power plants, a urea plant, and a briquetting and carbonization plant) that are operated by Neyveli Lignite Corporation Ltd. (NLC), and an independent power plant. Initially, in 1962, NLC had one captive opencast mine with a capacity of 3.5 MT/y linked to a 50 MW capacity pit-head thermal power station (TPS I). Since then, with the growing demand for electricity, lignite production and power-generation capacity has increased tremendously. Currently, NLC is mining 10.39 MT/y (Mine I), 8.70 MT/y (Mine II), and 1.46 MT/y (Mine IA) of lignite linked to 600 MW (TPS-I) and 1470 MW (TPS-II) capacity thermal power plants. The independent power plant, with a capacity of 250 MW, has not yet been activated. Furthermore, the Indian government has sanctioned the expansion of Mines I and II from 6.5 to 10.5 MT and 10.5 to 15 MT and the expansion of TPS-I and TPS-II from 600 to 1020 MW and 1470 to 1970 MW, respectively.

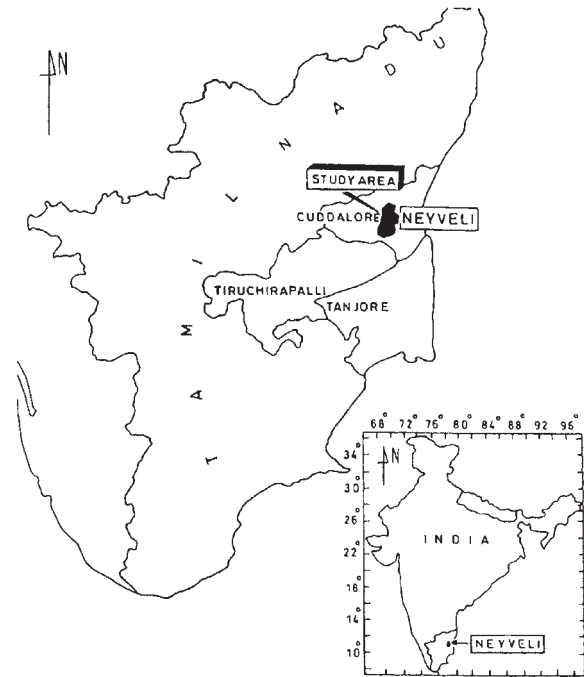
However, the production of urea (fertilizer plant) and coke (briquetting and carbonization plant) has declined from 0.152 (1966) to 0.062 MT (2002) and 0.436 (1965) to 0.004 MT (2002), respectively. These activities previously generated huge quantities of solid and liquid wastes that were indiscriminately dumped and drained into natural reservoirs and agricultural land.

Solid wastes included overburden mine waste, fly ash dumped from thermal power plants, and wastes from the briquetting and carbonization plant. About 1250 MCM of overburden has been removed since inception (1957) from Mine I, which is currently removing 70 MCM/Y. Mine II has removed a total of 700 MCM of overburden since inception (1982) and is presently removing 61 MCM/Y. The power plants (TPS-I, 600 MW and TPS-II, 1417 MW) consume about 10,000 and 85,000 T/d of lignite, and 45,500 and 386,000 L/min of water respectively. As a result, TPS-I and TPS-II produce approximately 3300 and 11650 T/d of fly ash as a by-product. Thus, the dumping of fly ash, overburden, mine and industrial waste, and the discharge of mine water, fly-ash pond water, and associated industrial effluents pose major environmental challenges for both mining engineers and environmental scientists. Every MW generating capacity of power plant requires 1 ha of land for ash disposal (Murty 1996).

Generally, about 550,000 L/min of water are pumped from the pits in a normal season, though much more is pumped during monsoons. Huge quantities of untreated wastewater are also discharged from fly-ash ponds and associated industries into natural reservoirs (Peria, Kolakudi, Walaza and Perumal Ponds, and Paravannar River) and agricultural fields. The water in the ponds and river is severely contaminated with heavy metals, but has been used for the last several decades by nearby villages for irrigation, animal watering, bathing, and washing, etc. Today, about 8,100 ha of agricultural land are irrigated by wastewater discharged from the mine pits and associated industries. Thus, even though the lignite mining, thermal power plants and associated industries have been operating under some form of environmental control, the reservoirs receive an influx of potentially toxic metals from them. To our knowledge, no work has been done on the heavy metal contamination of surface-water bodies caused by the mining, power plants and associated industries in and around the Neyveli mine-industrial complex. This study assessed the level of heavy metal contamination in the surface-water bodies, its distribution and sources, and possible risk connected with the use of this water for agricultural irrigation.

### Description of Study Area

The Neyveli mine-industrial complex is located in the Cuddalore District, Tamil Nadu, India (Figure 1). The area has a tropical climate with the highest and lowest temperatures recorded in June (43.3°C) and January (10.4°C), respectively. At the mine site, the average annual precipitation is 1369 mm with 55% and 45% rainfall from the NE and SW monsoons, respectively.



**Figure 1.** Location map of the study area

The area gently slopes southeast and east, and is not drained by any major river except for a small ephemeral stream (the Paravannar River) flowing east. This carries mine water and industrial effluent instead of natural water, and discharges into the Walaza and Perumal Ponds east of the lignite mines.

The study area is underlain by the Tertiary Cuddalore Formation and by Recent alluvium. The Cuddalore sandstones cover mostly the north and west areas and the alluvium mostly the east and southeast areas of the Neyveli lignite region. The lignite occurs in the Cuddalore formation at depths ranging from 45 to 120 m below ground level (bgl).

The hydrogeology of the Neyveli Groundwater basin is extremely complex, consisting of a series of productive confined aquifers below the lignite seam in both the Mine I and II areas, while a semi-confined aquifer lies above the seam and occurs only in the Mine II area. In the Cuddalore sandstones, groundwater occurs in unconfined, semi-confined, and confined conditions, while in the alluvium it occurs in an unconfined condition. In the study area, both the Tertiary Cuddalore Formation and the Recent alluvium form a potential aquifer system.

### Lignite Mining

Lignite is mined by the opencast method, using a bucket wheel excavator, conveyors, and spreader. Annual production is shown in Figure 2. Figure 3 presents average annual pumping of mine water and groundwater from Mine I.

The Cuddalore sandstones and Recent alluvium form the principal overburden waste material, together with small amounts of clays (fire clay and white clay). Details of average overburden removal are given in Figure 4. The sandstones are very hard, compact, and abrasive in nature. According to NLC (Balasundar 1968), the average chemical composition of the Cuddalore sandstones is: SiO<sub>2</sub> (76%), Al<sub>2</sub>O<sub>3</sub> (14.5%), Fe<sub>2</sub>O<sub>3</sub>+FeO (4.25%), CaO (0.5%), MgO (1%), NaO<sub>2</sub> (Trace), and TiO<sub>2</sub> (Trace).

Marcasite (FeS<sub>2</sub>) occurs in various forms in the lignite, sandstones and aquifer sands. It is difficult to separate marcasite from lignite because of its non-magnetic character and sporadic occurrences. It causes damage to excavating machinery because of its hardness, and also causes ash melting, sintering, slagging, etc. in the power plants. Marcasite oxidizes when it comes in contact with the atmosphere during mining. Pumping of groundwater then releases significant amounts of metals (Powell 1988).

Power plants at Neyveli produce approximately 500 M<sup>3</sup> of fly ash per day and its disposal is a major challenge to plant engineers. Moreover, fly ash tends to adsorb and often contains various metals (Pb, Hg, Cr, Mn, Cu, Co, Ni, Cd, Zn, etc.), some of which are very toxic and/or carcinogenic.

### Materials and Methods

Twenty-eight representative surface-water samples were collected from mine sumps and effluents power-plant reservoirs and effluents, fly-ash ponds, natural ponds and the river in the vicinity of the Neyevli mine industrial complex. Sampling was carried out in Feb. 2003 using standard techniques (APHA 1995). Sampling stations are shown in Figure 5. Water samples were collected in sterile 1 L polyethylene bottles and after being filtered (pore size=0.45µm), each sample was treated with 10 ml HNO<sub>3</sub> to prevent possible precipitation of heavy metals.

The water samples were analyzed for heavy metals according to international standard methods (APHA 1995). The analyses of Cu, Fe, Cr, Mn, Ni and Co were performed in the Dept of Geology, A.M.U., Aligarh, using Atomic Absorption Spectrophotometer (AAS) (Perkin-Elmer, Analyst 800). The Pb, Hg, and Cd analyses were done in the Toxicology and Environmental Lab, Dept. of Medical Elementology and Toxicology, Hamdard University, New Delhi, using AAS (Analytic Xena Zeenit 65). In the heavy metal analysis by AAS, quality control was monitored using 10% sample blanks and 10% sample replicates in each set of sample analyses.

## Results and Discussion

The heavy metal concentrations in various surface water samples collected in the vicinity of the mine-industrial complex are given in Table 1. Certain trends

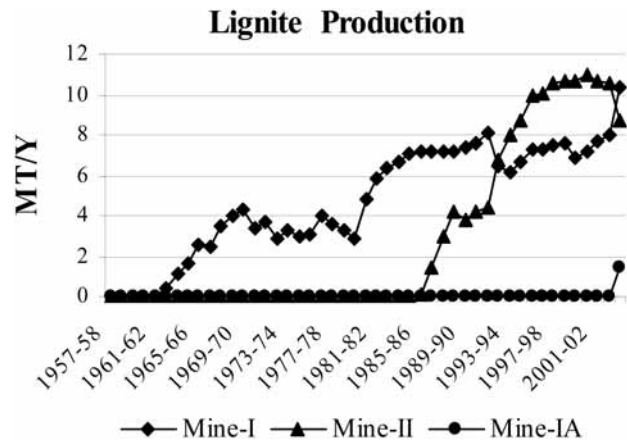


Figure 2. Average annual lignite production

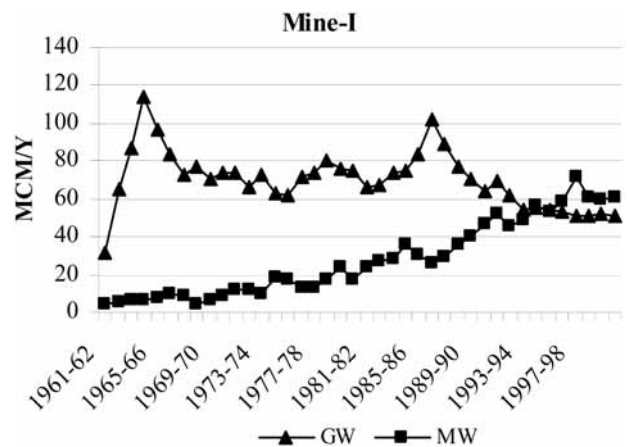
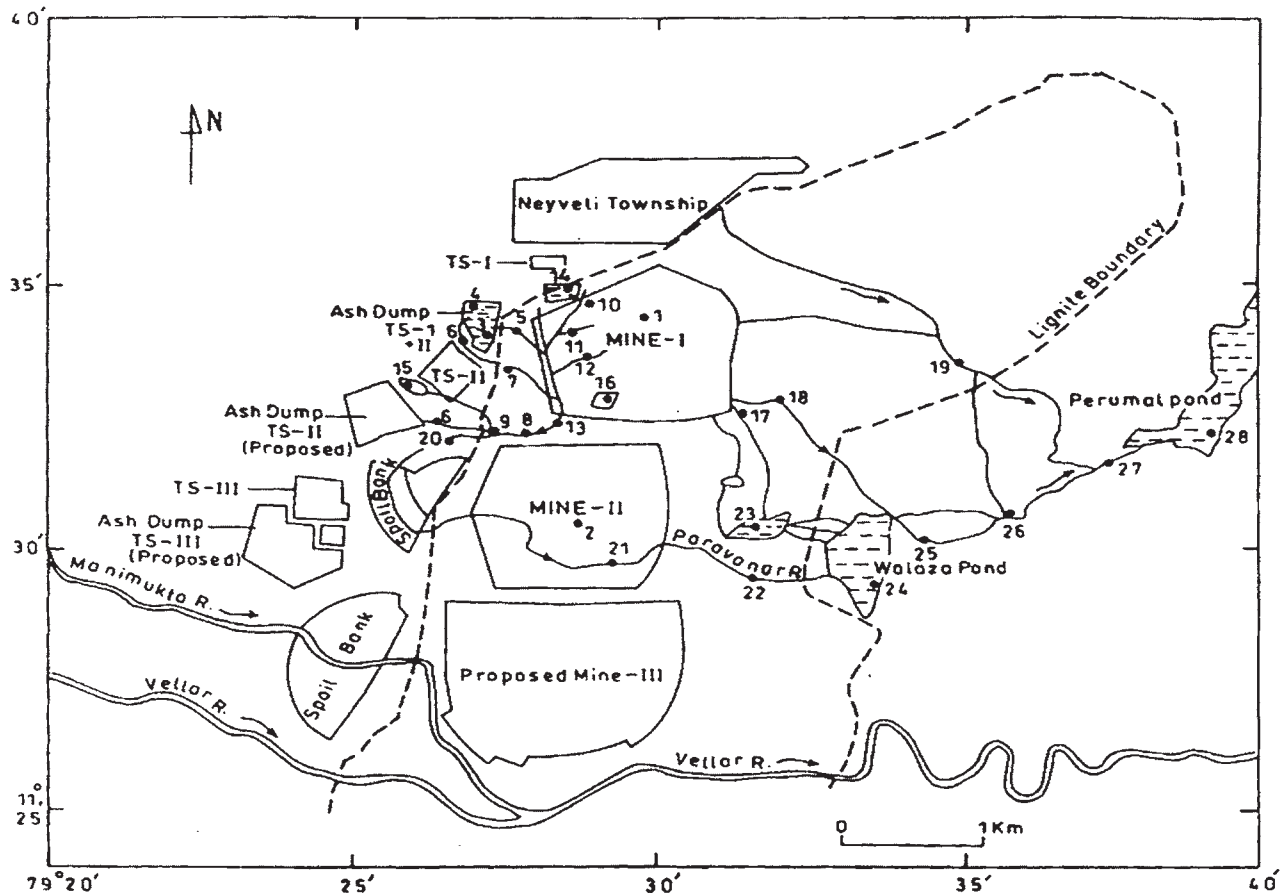


Figure 3. Annual pumping of groundwater (GW) and mine water (MW) from Mine I



Figure 4. Total annual removal of overburden



**Figure 5.** Schematic diagram of surface water flow from the lignite mining and industrial complex and location of sampling sites

should be noted. Samples taken directly from the fly-ash slurry pipe had higher metal concentrations than samples taken after settling in the fly-ash pond. Thus, a significant amount of toxic metals had been absorbed by the fly ash. Nevertheless, the wastewater released from the fly-ash ponds and mine pits that discharge into natural reservoirs still had elevated metal concentrations. The lowest concentrations were recorded at Perumal Pond, which is located 13 km from the mining activities. The heavy metal concentrations in Paravannar River decrease downstream, except for iron at a few places. Furthermore, the concentrations of heavy metals in other surface water bodies located near the complex are higher than in those located further away.

In summary, the highest total metal levels in the study area were in water samples collected directly from the slurry pipe at fly-ash pond-II, followed by fly-ash pond-II water (after settling) and in mine water; the lowest were in Perumal Pond. The lignite, fly-ash disposal at ash ponds, overburden mine waste, mine water, oxidation of marcasite and emission of toxic metals from the power plants are considered the principal geochemical sources of heavy metal pollution in the study area.

### Heavy Metal Pollution Assessment

Wastewater from the mine pits, fly-ash ponds and various industries are discharged without prior treatment into natural reservoirs (Kolakudi, Walaza and Perumal Ponds, and Paravannar River) and agricultural fields, resulting in serious metal contamination in surface-water, soil, and groundwater. We assessed the extent of heavy-metal contamination in surface-water bodies by comparing concentration ranges and mean values recorded in the study area with the average metal content of the world's rivers (Taylor and McLennan 1985) (Table 2). The mean value of Cu, Zn, Mn, Fe, Ni, Cd, Cr, Co, Pb, and Hg in the investigated area are respectively 2, 6, 17, 75.5, 200, 260, 275, 350, 484, and 1200 times higher than the average levels in the world's rivers. The Fe, Cr, Co, Ni, Pb, Mn, and Hg in all of the surface water bodies exceeded the average levels in the world's rivers.

Almost all of the metal concentrations in pond water exceeded the averages in the world's rivers, but the metal content in pond water overall was relatively less than in the other surface water bodies. The high concentration of Fe was mainly due to oxidation of marcasite and ferruginous sandstones, but Fe is much

**Table 1.** Heavy metal concentrations in surface-water bodies around the Neyveli lignite mine-industrial complex (Feb., 2003); all values in mg/L

Sample	Location	Fe	Pb	Zn	Cr	Co	Ni	Mn	Cd	Cu	Hg
MW-1	Mine-I	2.493	0.881	0.067	0.316	0.146	0.049	0.039	0.004	0.02	0.063
MW-2	Mine-II	2.103	0.69	0.039	0.297	0.112	0.05	0.049	0.003	0.039	0.071
FE-3	Flyash pond-II(slurry pipe)	29.36	1.476	0.944	0.946	0.158	0.236	0.37	0.009	0.039	0.278
FE-4	Flyash pond-II(after settling)	2.528	1.132	0.05	0.267	0.52	0.087	0.031	0.007	0.014	0.154
FE-5	Overflow flyash pond-II(east)	1.353	0.478	0.043	0.107	0.026	0.068	0.022	0.004	0.01	0.125
FE-6	Overflow flyash pond-II(west)	1.638	1.049	0.044	0.113	0.033	0.083	0.073	0.005	0.014	0.115
FE-7	Near TPS-II	1.813	0.091	0.041	0.406	0.018	0.071	0.078	0.004	0.022	0.101
FE-8	Vadakuvellur	1.222	0.493	0.069	0.49	0.024	0.062	0.253	0.003	0.023	0.033
FE-9	Umangalam	1.714	0.398	0.033	0.443	0.048	0.076	0.143	0.004	0.003	0.03
TE-10	B-point(near mine-I)	3.666	0.497	0.032	0.405	0.009	0.024	0.469	0.002	0.015	0.037
MW-11	Near lignite yard	0.411	0.39	0.057	0.043	0.005	0.036	0.036	0.003	0.009	0.328
MW-12	Thoppilekkuppam	4.055	0.488	0.075	0.295	0.007	0.013	0.08	0.003	0.011	0.206
ME-13	Mandarkuppam	4.968	0.81	0.089	0.396	0.022	0.087	0.115	0.001	0.019	0.154
PW-14	TPS-I(reservoir water)	1.23	0.231	0.015	0.033	0.004	0.024	0.102	0.002	0.005	0.029
PW-15	TPS-II(reservoir water)	1.601	0.69	0.017	0.426	0.025	0.065	0.02	0.003	0.018	0.028
PW-16	Peria Pond	0.212	0.612	0.258	0.161	0.005	0.026	0.019	BDL	0.017	0.025
MW-17	Periyakkurichi	2.186	0.468	0.052	0.281	0.023	0.034	0.058	0.002	0.014	0.086
MW-18	Near Seplanatham	2.546	0.31	0.09	0.433	0.018	0.031	0.088	BDL	0.013	0.053
MW-19	Veenankeni	2.609	0.437	1.058	0.412	0.132	0.153	0.403	0.002	0.029	0.048
ME-20	Near pump house	3.017	0.403	0.068	0.249	0.021	0.08	0.167	0.001	0.011	0.098
ME-21	Karuvatti	3.48	0.213	0.04	0.094	0.013	0.049	0.084	0.001	0.004	0.042
ME-22	Turinjikollai	2.032	0.19	0.034	0.106	0.011	0.031	0.084	0.002	0.002	0.031
PW-23	Kolakundi Pond	0.681	0.11	0.028	0.014	0.02	0.038	0.083	0.001	0.014	0.044
PW-24	Walaja Pond	3.89	0.71	0.072	0.435	0.018	0.058	0.199	0.003	0.028	0.038
ME-25	Karamedu	2.634	0.39	0.044	0.382	0.016	0.043	0.132	0.001	0.011	0.03
ME-26	Paravanar Bridge	0.419	0.19	0.049	0.084	0.019	0.053	0.043	0.001	0.011	0.029
ME-27	Aduragram Bridge	0.379	0.084	0.041	0.048	0.013	0.043	0.036	0.001	0.01	0.029
ME-28	Perumal Pond	0.338	0.063	0.037	0.021	0.009	0.034	0.031	0.001	0.009	0.025

MW=mine water, FE=fly ash effluent, TE=thermal power plant effluent, PW=pond water, ME=mixed effluent

**Table 2.** Average and range of heavy metals in surface water bodies around the Neyveli mine-industrial complex compared with the average in the world's rivers (Taylor and McLennan 1985) and irrigation water quality standards (FAO 1985; WHO 1989); all values in mg/L

Elements	World River Water (Avg)	Irrigation Water standards	Study Area		
			Ranges for all surface water bodies in area	Ranges for pond water in the area	Average
Fe	0.04	5	29.36-0.338	3.89-0.212	3.02
Pb	0.001	5	1.476-0.063	0.71-0.063	0.484
Zn	0.02	2	0.944-0.015	0.258-0.028	0.124
Cr	0.001	0.1	0.946-0.014	0.435-0.014	0.275
Co	0.0001	0.05	0.150-0.004	0.02-0.005	0.35
Ni	0.0003	0.2	0.236-0.013	0.058-0.026	0.06
Mn	0.007	0.2	0.490-0.012	0.199-0.019	0.12
Cd	0.00001	0.01	0.009-BDL	0.003-BDL	0.0026
Cu	0.007	0.2	0.038-0.003	0.028-0.009	0.015
Hg	0.00007	0.01	0.328-0.025	0.044-0.026	0.084

less toxic than some of the other metals. Pb concentrations were above the average levels in the world's rivers. Elevated concentrations of Cr in the area are mainly due to lignite, fly-ash dumps from thermal power plants, and mine water. The burning of

coal alone discharges 3000 T of Cr annually into the environment (Taylor et al. 1979). Cd concentrations in the majority of the samples were equivalent to the average of the world's river water, except at Periyakkurichi and Veenankeni. The highest

concentrations of Zn, Ni, Co, and Cu were in fly-ash pond water, and the lowest in the TPS-I reservoir water. The Zn concentrations in the majority of samples were above the average for the world's rivers, except for the TPS-I and TPS-II reservoirs. In the case of Cu, all but four samples showed concentrations below the average of the world's rivers.

### Suitability for Irrigation

Currently, about 550,000 L/min of water is pumped from the mines pits in a normal season, with much higher quantities going into natural reservoirs such as Kolakudi, Walaz and Perumal Ponds and the Paravannar River during the monsoon period. Furthermore, huge quantities of water enter the reservoirs through drainage channels from the fly-ash ponds and other industries. For the last four decades, this wastewater has been discharged into the reservoirs without any treatment and then used for irrigation, bathing, washing and animal watering. In such conditions, toxic elements often accumulate in the soil and may gradually pass into edible parts of crops and into the food chain, posing considerable health risks to human and animals (Pillay et al. 2003). Before the opening of Mine II in 1985, about 2400 ha of land were being irrigated by surplus water from Mine I alone. At present, NLC plans to irrigate about 8000 ha of land by surplus water from the lignite mines (>[www.nlcindia.com](http://www.nlcindia.com)<).

The deficiency or excess of certain trace elements in irrigation water can retard growth and metabolic activities. Hence, neither the nutrient value nor the toxicity of trace elements in irrigation water can be ignored. Wastewaters discharged from the lignite mine pits, fly-ash ponds and associated industries, and water from Kolakudi, Walaza and Perumal Ponds, and Paravannar River were compared with the maximum permissible limits of heavy metals for Irrigation Water Quality Standards (FAO 1985; WHO 1989). Table 2 reveals that the average concentrations of Hg (0.084 mg/L) and Cr (0.275 mg/L) exceeded the recommended limits whereas Pb, Mn, Ni, Co, Zn, Cu, Cd, and Fe were well within the permissible limits. Hg is a neurotoxin that accumulates in the food chain and can damage the brain, spinal cord, kidneys, liver and is also hazardous to developing fetuses. Hg in all samples was above the recommended limits (Hg=0.01 mg/L). Cr can also be highly toxic, depending on its valence state. The Cr concentrations in 75% of the samples were above the maximum acceptable limit.

The Co concentrations at FE-3, MW-1 (Co=0.146 mg/L), MW-19 (Co=0.132 mg/L), MW-2 (Co=0.112 mg/L), and FE-4 (Co=0.052 mg/L) were above the

maximum acceptable limit (Co=0.05 mg/L) whereas other samples were within the recommended limits. Only one sample showed Ni concentrations above the permissible limits. The Mn concentrations in two samples were above the recommended limits. In the case of Fe, only one sample had a concentration above the recommended limit. However, Zn, Pb, Cd, and Cu concentrations in the surface-water bodies were well within the maximum acceptable limit established for irrigation water quality. The Fe, Pb, Mn, Co, Ni, Cd, Cu, and Zn concentrations were in compliance with the irrigation standards, while Hg and Cr were above the recommended limits.

### Conclusions

Elevated concentration of heavy metals (i.e. Pb, Cr, Hg, Cd, Fe, Cu, Ni, Co, Zn and Mn) were recorded in untreated wastewater discharged from mine pits, fly-ash ponds and industrial effluents in the vicinity of the Neyveli mines-industrial complex. This untreated wastewater drains into natural reservoirs (Kolakudi, Walaza and Perumal Ponds and Paravannar River), resulting in concentrations several times higher than average world river water values. It not only pollutes surface-water bodies but also contaminates groundwater resources to the east and southeast of the Neyveli mines-industrial area.

Wastewater discharged from the lignite mine-industrial complex and water from the natural reservoirs has been used for irrigation by nearby villages for four decades. This study reveals that some of the more toxic metals (Hg, Cr, and Co) exceed the maximum acceptable limits for irrigation. Irrigation using this metal-loaded wastewater may not only pollute the soils but could also be allowing toxic metals to enter into the food chain, posing a serious health hazard. Long-term utilization of this untreated wastewater for irrigation is presumed to be unhealthy for the local environmental ecosystem. Given the planned expansion of the operations in the area, the environmental risks will increase if remedial measures are not taken to properly manage and treat the wastewater before it is discharged into natural reservoirs and agricultural fields.

### Acknowledgments

The authors thank Prof. M. Raza, Dept of Geology, Aligarh Muslim University, for assistance and support provided during heavy metal analysis, and the NLC personnel who helped during sampling.

**References**

- Allan RJ (1988) Mining activities as sources of metals and metalloids to the hydrosphere. *Metal and Metalloids in the Hydrosphere, Impact through Mining and Industry, and Prevention Technology*, Technical Documents in Hydrology, UNESCO, Paris, p 45-67
- American Public Health Association (APHA) (1995) *Standard methods for the Examination of Water and Waste Water*. Washington DC, 19<sup>th</sup> edit, 1019 pp
- Balasundar NK (1968) Tertiary deposits of Neyveli lignite field. *Geol Soc India Mem # 2*, p 256-262
- Benvenuti M, Mascaro I, Corsini F, Lattanzi P, Parrini P, Tanelli G (1997) Mine water dumps and heavy metal pollution in abandoned mining district of Boccheggiano (southern Tuscany, Italy). *Environ Geol* 30 (3/4): 238-243
- Coulthard TJ, Macklin MG (2003) Modeling long-term contamination in river systems from historical metal mining. *Geology* 31(5): 451-454
- Fang WX, Huang ZY and Wu PW (2003) Contamination of the environmental ecosystems by trace elements from mining activities of Badao bone coal mine in China. *Environ Geol* 44: 373-378
- FAO (1985) *Water quality for agriculture*. R.S.Ayers and D.W.Westcot. Irrigation and drainage paper 29 Rev.1.FAO, Rome, 174 pp
- Fergusson JE (1990) *The heavy elements; chemistry, environmental impact and health effects*. Pergamon Press, Oxford, 614 pp
- Caruccio FT (1972) Trace element distribution in reactive and inert pyrite. *Proc, 4<sup>th</sup> Symp on Coal Mine Drainage Research*. Mellon Institute, Pittsburgh, PA, USA, p 48-59
- Gluec N, Gunal (Canci) B, Erler A (2001) Assessment of soil and water contamination around an ash-disposal site: a case study from the Seyetomer coal-fired power plant in Western Turkey. *Environ Geol* 40(3): 331-344
- Hansen LD, Fisher GL (1980) Elemental distribution in coal fly ash particles. *Environ Sci Technol* 14:1111-1117
- Kabata – Pendias A (1995) Agricultural problems related to excessive trace metal contents of soils. In: Salomons W, Forstner U, Mader P (eds). *Heavy metals: Problems and Solutions*, Springer, Berlin, p 3-18
- Klein DH, Andren AW, Carter JA, Emery JF, Feldman C, Fulkerson W, Lyon WS, Ogle JH, Talmi Y, Van Hooh RI, Bolton N (1975) Pathways of thirty severe trace elements through coal fire power plant. *Environ Sci Technol* 9: 973-978
- Lee G (1975) Role of hydrous metal oxides into transport of heavy metals in the environment. In: Krenkel P (ed), *Heavy metals in the aquatic environment*, Pergamon Press, Oxford, UK, p 137-147
- Liorense JF, Fernandez-Turiel JL, Querol X (2001) The fate of trace elements in a large coal-fired power plant. *Environ Geol* 40 (4-5): 409-416
- Mohanty JK, Misra SK, and Nayak BB (2001). Sequential leaching of trace elements in coal: a case study from Talcher coalfield. Orissa. *Jour Geol Soc India* 58: 441-447
- Murty AVSR (1996) Fly ash in construction of roads and embankments. In: Raju V.S. et al. (eds) *Ash Ponds and Disposal Systems*, Narosa, India, p 222-237
- Neyveli Lignite Corporation Ltd, Tamil Nadu, India (2004), [www.nlcindia.com](http://www.nlcindia.com)
- Pillay AE, Williams JR, Al-Lawati MO, Al-Hadabbi SMH, Al-Hamdi MH, Al-Hamdi A (2003) Risk assessment of chromium and arsenic in date palm leaves used as livestock feed. *Environ International* 29(2003): 541-545
- Powell JD (1988) Origin and influence of coal mine drainage on streams of the United States. *Environ Geol. Water Sci* 11(2):141-152
- Rupper LF, Finkelman RB, Boti E, Milosavljevic M, Tewalt S, Simon N, Dulong F (1996) Origin and significance of high nickel and chromium concentrations in the Pliocene lignite of the Kosovo basin, Serbia. *Internat Jour Coal Geol* 5(29): 235-258
- Sahu KC (1998) Impact of residual soil on heavy metal leachate from ash pond at Korba - an experimental approach. *Indian J of Earth Sciences* 25(1-4): 58-67
- Sen PK, Saxena AK, Bhowmik S (1996) Groundwater contamination around ash pond. In: Raju V.S. et al. (eds) *Ash Ponds and Disposal Systems*, Narosa, India, p 326-342
- Swaine DJ (1980) *Trace Elements in Coal*. Butterworths, London, UK, 278 pp
- Taylor SR, McLennan SM (1985) *The Continental Crust: its Composition and Evolution*. Blackwell, Oxford, UK, 312 pp
- WHO (World Health Organization) (1989) *Health Guidelines for the use of waste water in agriculture and aquaculture*. Report of a WHO Scientific Group, WHO Technical Report Series 778, 74 pp

Received Feb 3, 2005; accepted June 17, 2005



POOVULAGIN  
NANBARGAL



CREA  
Centre for Research on Energy and Clean Air



# Emission watch

## Status assessment of SO<sub>2</sub> emission and FGD installation for coal-based power plants in Tamil Nadu

Prabhakaran Veeraarasu, Satheesh Lakshmanan, and Sunil Dahiya

OCTOBER 2021



## Authors + acknowledgements

### AUTHORS

Prabhakaran Veeraarasu, *Researcher, Poovulagin Nanbargal*

Satheesh Lakshmanan, *Researcher, Poovulagin Nanbargal*

Sunil Dahiya, *Analyst, Centre for Research on Energy and Clean Air*

### EDITOR

Kavitha Muralidharan, *Senior journalist*

### DESIGNER

Pallavi Baasri

## Table of contents

- 1.0** Key messages
- 2.0** Introduction
- 3.0** Tamil Nadu state power sector overview
- 4.0** Overview of emissions standards notification for coal-based power plants, it's amendments and implementation
- 5.0** OCEMS data quality and data transparency
- 6.0** Conclusions and recommendations
- 7.0** Annexure 1
- 8.0** Endnotes

1.0

## Key messages

- 1** Neyveli, Chennai, Tuticorin and Mettur are four major coal burning clusters in the state of Tamil Nadu. Neyveli and Chennai rank among the top 50 SO<sub>2</sub> hotspots globally in 2019.
- 2** The reactive gases such as SO<sub>2</sub> and NO<sub>x</sub> react with other gases and materials, and turn into secondary particles to form a major portion of particulate matter (PM<sub>2.5</sub>), which is a globally known health hazard.
- 3** Only two units (1,200 MW) out of 40 operational units (13,160 MW) in Tamil Nadu have installed Flue Gas Desulfuriser (FGD) as of August 2021. Another 8 units (3,950 MW) have awarded the bids for FGD installation, essentially leaving 30 units (8,810 MW) out of 40 without any significant progress towards installing FGDs. None of the state sector units as well as NLC-owned power plants have awarded the tenders yet.

- 4 There are discrepancies in the power plant emissions data (OEMS) collected through RTI and the data provided on PCB website (the RTI information was obtained for three months—April, May and June 2021). The data procured through RTI shows unusually low values for SO<sub>2</sub> emissions in absence of any control methods for few units.
- 5 Tamil Nadu's total coal and lignite based installed capacity for electricity generation stands at 13.6 GW which includes shares from state, central and independent power producers, with current utilisation of less than 53%.
- 6 The actual peak demand for Tamil Nadu was 8.8%, 13.6 % and 15.5% lower than projected demand under EPS 19 respectively for 2018–19, 2019–20 and 2020–21.
- 7 Tamil Nadu has more than 7.5 GW coal-based thermal power plants under various stages of construction which will further add to the surplus capacity that is actually not required at this point and will ultimately lead to wastage of public money and Non-Performing Assets (NPAs) in the power sector.

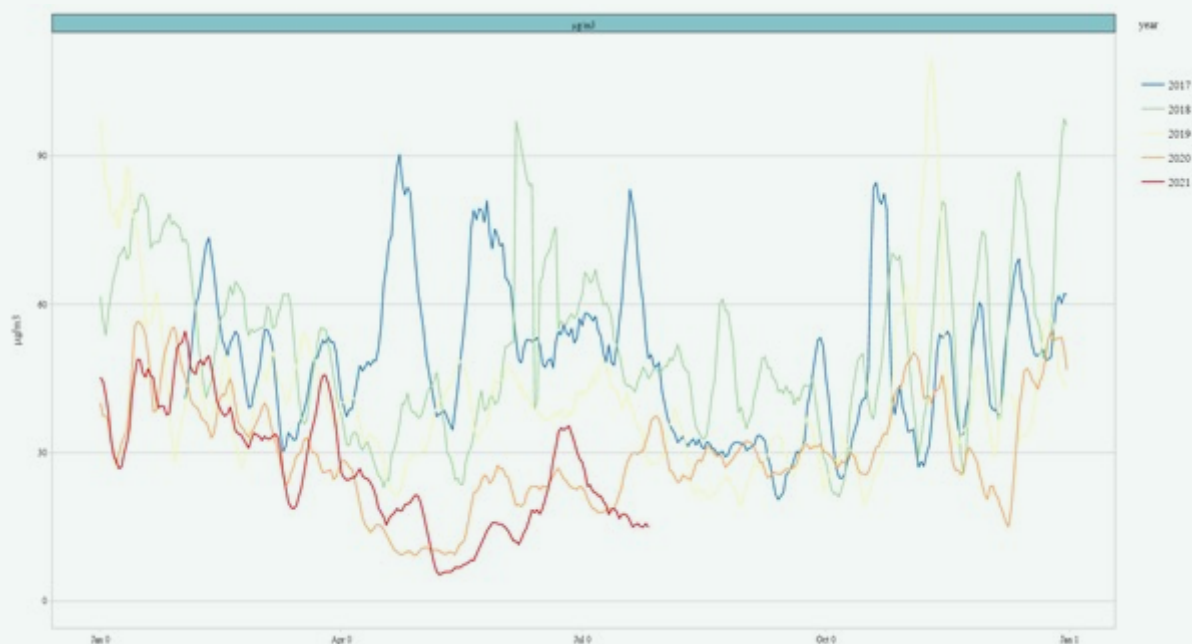
2.0

## Introduction

**Chennai witnessed more than 51% of the days (~188 days) in 2020 with PM<sub>2.5</sub> levels higher than 25µg/m<sup>3</sup>—the daily average prescribed level by WHO**

India ranks among the most polluted countries and is home to 35 cities in the list of 50 most polluted cities across the globe<sup>1</sup>. According to an analysis by IQAir, Chennai witnessed more than 51% of the days (~188 days) in 2020 with PM<sub>2.5</sub> levels higher than 25µg/m<sup>3</sup>—the daily average prescribed level by World Health Organisation (WHO) and much higher than the annual prescribed levels of 10µg/m<sup>3</sup>. Although, the air pollution levels in the city have dropped slightly over the past three years, major pollution sources such as coal-based power plants still operate without any adequate pollution control technology/equipment installations resulting in health hazards for citizens in the region.

While we have some level of air quality monitoring in Chennai, many other parts of Tamil Nadu are much more polluted than Chennai but lack of publicly available data helps cover up the wrongdoings committed by industries and other polluting sectors in such areas.

**FIGURE 01**Air Pollution (PM<sub>2.5</sub>) levels in Chennai since January 2017 till June 2021

**16 of 64 air quality monitoring stations installed across Tamil Nadu are located in Chennai alone leaving most of the other parts of state inadequately monitored**

Tamil Nadu has 28 manual National Air quality Monitoring Program (NAMP) stations installed across eight cities<sup>2</sup>, i.e., Chennai, Cuddalore, Coimbatore, Madurai, Salem, Mettur, Trichy and Thoothukudi while there are 36 Continuous Ambient Air Quality Monitoring Stations (CAAQMS) installed across the state<sup>3</sup>, with Chennai having the most of them out of which 8 are manual and another 8 CAAQMS.

There are multiple sources of pollution across the state i.e., transport, industries, waste burning, coal base power generation etc., which are responsible for high levels of pollution exposure and related health impacts to the population residing in the state. Major coal burning clusters in the state such as Neyveli, Chennai, Tuticorin and Mettur have been repeatedly highlighted as the SO<sub>2</sub> emission hotspots in the state and have made it to the list of world's highest SO<sub>2</sub> emission hotspots in 2019<sup>4</sup>. This is indicative of the impact of industries and fossil fuel burning on the pollution of the state.

**TABLE 01**SO<sub>2</sub> emission hotspots in Tamil Nadu featured in the global SO<sub>2</sub> hotspot list (CREA & Greenpeace, 2020)

Rank	Hotspot	Country	Source Type	Emissions 2019 (kt)
14	Neyveli	India	Coal	299
36	Chennai	India	Coal	142
131	Tuticorin	India	Coal	52
144	Mettur	India	Coal	47

Pollution, once emitted from power plants or other tall industrial stacks, travels across long distances. The spread of pollution is governed by multiple factors such as chemical transformations that occur when pollutants react with particles in the atmosphere, as well as meteorological conditions. The reactive gases such as SO<sub>2</sub> and NO<sub>x</sub> react with other gases and materials to turn into secondary pollutants and form a major portion of particulate matter (PM<sub>2.5</sub>), which is a globally known health hazard. The particulate matter (primary and secondary) contributes to ambient air pollution levels even in areas hundreds of kilometres away from the locations of the tall stacks its been emitted from. The stack properties and combustion process of a power plant can also affect the dispersion of its pollutant emissions. While many power plants are deliberately not built to be in proximity to the cities, their emissions nevertheless contribute to air pollution in these high-density areas, increasing the risk of death and illness from both acute and chronic diseases.

Various researchers across the globe have established strong correlation between coal combustion and adverse health impacts on humans as well as the ecosystem. Laden et al.<sup>5</sup> and Ito et al.<sup>6</sup> used source apportionment strategies to identify positive associations between coal combustion and daily mortality in cities of the United States. The retirement of coal and oil plants in California has been linked to reductions in preterm births<sup>7</sup>.

A national source apportionment study in the United States found that particulate matter from coal combustion was the dominant source contributing to ischemic heart disease mortality<sup>8</sup>. Coal combustion has been linked to higher mortality in Spain<sup>9</sup> and China<sup>10</sup> and to numerous poor health outcome indicators in India locally<sup>11,12</sup>. Cropper et al.,

## Implementation of emission standards for coal-based power plants as notified in 2015 can save 76,000 lives every year

highlighted that the operational and planned coal power plants could result in 13% of average ambient PM<sub>2.5</sub> levels and 1,12,000 deaths annually in India<sup>13</sup>. Another estimate suggested that implementation of emission standards for coal-based power plants as notified in 2015 can save 76,000 lives every year<sup>14</sup>. Also, a systematic review of 113 peer-reviewed publications by Kravchenko & Lyerly<sup>15</sup> concluded that living near coal power plants was associated with numerous adverse public health impacts, including all-cause and premature mortality, respiratory disease and lung cancer, cardiovascular disease, poorer child health, and higher infant mortality. Pollutants linked to health effects include sulfur dioxide (SO<sub>2</sub>) and nitrogen dioxide (NO<sub>2</sub>), particulate matter at fine (PM<sub>2.5</sub>, aerodynamic diameter <2.5 µm) and ultrafine (≤100 nm) scales, and metals such as arsenic, chromium, and others.

Tamil Nadu Pollution Control Board (TNPCB) also records health problems caused by Mettur thermal power plant in its report *“Evaluation of CEPI Score & Action Plan for CEPI Area of Mettur”*<sup>16</sup>, health statistics in the report obtained from Government Primary Health Centre (GPHC), Kolathur reveals an increase in asthma cases from 24 in 2012 to 44 in 2018, and bronchitis cases increased from 21 in 2012 to 55 in 2018.

Social, economic and health impacts of coal-based power plants have been widely documented globally. In the current report we will look at the power demand-supply scenario and the state of operation, pollution control technology upgradation and data transparency by the operation of coal-based power plants in Tamil Nadu. This exercise is an attempt to answer the following questions:

- 1 Does Tamil Nadu need installation of any new coal-based power plants beyond the ones already in operation?
- 2 How far have the coal-based power plants progressed in terms of installing the retrofits as required to comply to Ministry of Environment, Forest and Climate Change (MoEF&CC) December 2015 emission standard notification for coal-based power plants?
- 3 Have coal-based power plants/TNPCB ensured data transparency for emissions from coal-based power plants?

3.0

# Tamil Nadu state power sector overview

**Tamil Nadu has an installed electricity generation capacity 33,696 MW against calculated peak demand of 19,240 MW**

With total installed thermal power<sup>17</sup> generation capacity of 234 GW (including coal, lignite and gas-based power plants), coal and lignite alone produced nearly 80% of the total power generation in the country (2020–21). In 2020–21, the private sector supplied 37% of India's thermal power whereas Centre and state came up with 35% and 28% share respectively in the actual thermal electricity generation mix. Tamil Nadu currently has an installed capacity (including allocation from central generating stations) of 33,696 MW against calculated peak demand of 19,240 MW (actual peak demand of 16,263 MW) during 2020–21, showing a huge surplus installed capacity.

**TABLE 02**

Source wise installed electricity generation capacity in Tamil Nadu (MW)

Coal	Lignite	Gas	Diesel	Nuclear	Hydro	RES	Total
<b>INSTALLED CAPACITY (MW)—CEA (INCLUDING ALLOCATED SHARES IN JOINT &amp; CENTRAL SECTOR UTILITIES)</b>							
11,833	1,767	1,027	211.7	1,448	2,178	15,230	33,696

**Demand projected through EPS 19 is very high compared to the actual demand data for the past four years**

For electricity requirement, EPS 18 (Electric Power Survey 2018) projected peak demand in Tamil Nadu to be at 20,816 MW in 2016–17 which was revised to 15,412 MW by EPS 19 showing a change of nearly 26% in projected demand. Further, the demand projected through EPS 19 also seems to be on a higher side when compared to actual demand data for the past four years wherein the actual peak demand was 8.8%, 13.6 % and 15.5% lower than projected demand under EPS 19 respectively for 2018–19, 2019–20 and 2020–21.

**TABLE 03**

Projected vs. actual peak demand for Tamil Nadu (MW)

	2016–17	2017–18	2018–19	2019–20	2020–21
Actual peak demand (MW)	14,823	15,001	15,712	15,727	16,263
Projected (EPS 19) peak electricity demand at power station bus bars (utilities) (MW)	15,412	16,299	17,230	18,213	19,240
% Difference between projected peak demand and actual peak demand (MW)	–3.8%	–8.0%	–8.8%	–13.6%	–15.5%

Total energy demand also saw similar fluctuations. The actual energy demand was respectively 6.9%, 12% and 22.3% lower than the projected energy requirement by EPS 19 for 2018–19, 2019–20 and 2020–21 as depicted in the following table.

**TABLE 04**

Projected vs. actual energy demand for Tamil Nadu (MU)

	2016–17	2017–18	2018–19	2019–20	2020–21
Actual energy requirement (MU)	1,04,511	1,06,031	1,09,375	1,08,816	1,01,194
Projected (EPS 19) electrical energy requirement at power station bus bars (utilities) (MU)	1,05,923	1,11,583	1,17,505	1,23,724	1,30,189
% Difference between projected energy demand and actual energy demand (MU)	-1.3%	-5.0%	-6.9%	-12.0%	-22.3%

Tamil Nadu's total Coal and lignite based installed capacity for electricity generation stands at 13.6 GW which includes shares from state, central and independent power producers (13.1 GW installed in Tamil Nadu).

The utilisation of this installed capacity has been suboptimal and current average capacity utilisation of thermal power plants in the state stands at less than 53%<sup>18</sup>. In terms of asset ownership:

- *Tamil Nadu Generation and distribution corporation (TANGEDCO) controls four large thermal power plants with an installed capacity of 4.3 GW, while*
- *NLC India Ltd. has 3.4 GW of mainly mine-mouth lignite-fired power plants*
- *NTPC Ltd. and Infrastructure Leasing & Financial Services Limited (IL&FS) are the other major coal plant operators*
- *Across all coal based installed capacity in the state, North Chennai thermal power plant located at Ennore port has the largest capacity among all thermal power plants in Tamil Nadu*

**TABLE 05**

List of operational coal-based power plants in Tamil Nadu

S. No.	Power plant name	Capacity (MW)
1	Chennai Power Station	414
2	Cuddalore IL&FS Power Station	1,200
3	Mettur Thermal Power Station	1,440
4	Mutiara Thermal Power Plant (Coastal Energen)	1,200
5	Neyveli Thermal Power Station I	920
6	Neyveli Thermal Power Station II	1,970
7	Neyveli Zero Power Station	250
8	North Chennai Thermal Power Station	1,830
9	Tuticorin IBTPL Power Station	300
10	Tuticorin NTPL Power Station	1,000
11	Tuticorin Thermal Power Station	1,050
12	Vallur Thermal Power Plant	1,500
	<b>Total (MW)</b>	<b>13,074</b>

**Tamil Nadu has over 7.5 GW of coal-based power plants under various stages of construction**

The facts stated above very clearly advocate that the state has surplus power generation capacity installed across various sources due to poor planning while estimating the future demand under past Electric Power Survey (EPS) reports. The power surplus situation has started reflecting in terms of poor utilisation of installed assets at sub-optimal Plant Load Factors (PLF) resulting in higher pollution as well as economic cost for the state. Further, Tamil Nadu has more than 7.5 GW coal-based power plants under various stages of construction which are further going to add to the surplus capacity. In reality, this will not even be required by the state as further growth in energy demand can be fueled by cheaper and sustainable renewable energy sources, and will ultimately lead to wastage of public money and development of further Non-Performing Assets (NPAs) in the power sector.

**TABLE 06**

In-pipeline (under construction and planned) coal-based power plants in Tamil Nadu (MW)

S. No.	Power plant name	Capacity (MW)
1	Ennore SEZ Super Critical Thermal Power Project (Vayalur)	1320
2	Ennore Thermal Power Station	660
3	New Neyveli Thermal Power Station	1000
4	North Chennai Thermal Power Station	800
5	SEPC Tuticorin Power Station	525
6	Udangudi Super Critical Thermal Power Project	1600
7	Uppur Power Station	1600
	<b>Total (MW)</b>	<b>7505</b>

4.0

# Overview of emission standards notification for coal-based power plants, its amendments and implementation

**Coal-based power plants were a big emitter of SO<sub>2</sub> and NO<sub>x</sub> gas, which became a big part of PM<sub>2.5</sub> pollution in the form of sulphates and nitrates**

For the first time in India on 7<sup>th</sup> December 2015, the Ministry of Environment, Forest and Climate Change (MoEF&CC) introduced the emission standard notification for coal-based power plants which aimed at controlling emissions of SO<sub>2</sub>, NO<sub>x</sub>, Hg as well as introduce water consumption norms for the coal-based power plants. Prior to this, power plants were only given particulate emission limits which were very high and effectively failed to control pollution from coal-based power plants making them one of the biggest contributors to ambient air pollution in India. Also before December 2015, the SO<sub>2</sub> emissions from coal-based power plants were not limited through reduction in emission; rather, provision of higher stack height was in place to facilitate dispersion of the pollution to longer distances and larger geography to reduce adverse impacts on nearby locations. This effectively meant that coal-based power plants were a big emitter of SO<sub>2</sub> and NO<sub>x</sub> gas which through secondary conversions became a significant part of PM<sub>2.5</sub> pollution in the form of sulphates and nitrates.

**On March 31 2021, MoEF&CC came up with another amendment on the original notification; giving an extended timeline running till 2025 to coal-based power plants to comply with the emission standard limits**

With sluggish progress on retrofitting the power plants, almost all the power plants failed to comply with the initial deadline of two years given to the power plants (7<sup>th</sup> December 2015 to 7<sup>th</sup> December 2017) to implement the standards set for control of emissions. After this,

- *The CPCB (Central Pollution Control Board) extended the deadline for compliance to December 2022 through a directive passed by letters to power plant authorities, dated 11.12.2017.*
- *In June 2018 MoEF&CC diluted the water consumption norms and increased the water consumption for new power plants from 2.5 m<sup>3</sup>/MWh to 3.0 m<sup>3</sup>/MWh. This was the first dilution in the original emission standards notification for coal based power plants passed in December 2015.*
- *In October 2019 MoEF&CC came-up with another dilution of the norms wherein coal-based power plants were given a relaxation for NO<sub>x</sub> emissions by changing the emission limit for coal-based power plants installed between 2003 to 2017 from 300 mg/Nm<sup>3</sup> to 450 mg/Nm<sup>3</sup>.*

While all these dilutions were taking place, the coal-based power plants didn't make any significant progress on complying with the laws even after repeated warnings from the Supreme Court.

On March 31 2021, MoEF&CC came up with another amendment on the original notification. This time, an extended timeline running till 2025 was given to the coal-based power plants to comply with the emission standard limits. This means a significant 8-year delay from the initial timeline of December 2017 and 10 years since the notification was first communicated in 2015.

Despite multiple timeline extensions and dilutions, the progress on retrofitting the polluting power plants is depressingly slow and shows no firm intent from the power plant companies—both private and government owned.

As of August 2021<sup>19</sup> (latest status made available by CEA (Central Electricity Authority) less than 1.5% of the capacity under the phasing plan, have actually completed retrofits to be installed to control SO<sub>2</sub> emissions.

While the central sector power plants have moved ahead in at least placing the orders for installation of FGDs (but the technology is yet to be installed and still a long way to go in terms of operation), the private and state sector power plants haven't shown any serious intent for complying with the emission limits yet.

**TABLE 07**

FGD installation status of coal-based power plant units in India (CEA, August 2021)

<b>Sl. No. 1</b>	<b>Sector (Capacity in MW) Central</b>	<b>FGD planner 55,260</b>
<b>Feasibility study started 55,260</b>	<b>Feasibility study completed 55,260</b>	<b>Tender specifications made 55,260</b>
<b>NIT issued 55,260</b>	<b>Bids awarded 47,740</b>	<b>FGD commissioned 840</b>
<b>Sl. No. 2</b>	<b>Sector (Capacity in MW) State</b>	<b>FGD planner 53,225</b>
<b>Feasibility study started 53,225</b>	<b>Feasibility study completed 52,025</b>	<b>Tender specifications made 36,495</b>
<b>NIT issued 31,375</b>	<b>Bids awarded 4,320</b>	<b>FGD commissioned 0</b>
<b>Sl. No. 3</b>	<b>Sector (Capacity in MW) Private</b>	<b>FGD planner 61,237</b>
<b>Feasibility study started 59,327</b>	<b>Feasibility study completed 56,247</b>	<b>Tender specifications made 50,092</b>
<b>NIT issued 44,692</b>	<b>Bids awarded 16,600</b>	<b>FGD commissioned 1,320</b>
<b>TOTAL</b>		<b>FGD planner 1,69,722</b>
<b>Feasibility study started 1,67,812</b>	<b>Feasibility study completed 1,63,532</b>	<b>Tender specifications made 1,41,847</b>
<b>NIT issued 1,31,327</b>	<b>Bids awarded 68,660</b>	<b>FGD commissioned 2,160</b>

The following table compiled from multiple sources i.e., information gathered from news articles, government websites and government documents collected through RTI applications present the current status of FGD installation and operation of coal-based power plants unit in Tamil Nadu.

**TABLE 08**

FGD installation status of coal-based power generation units in Tamil Nadu (August, 2021)

SECTOR: STATE						
<b>Sl. No. 1</b>	<b>TPP name</b> NCTPS Unit 1	<b>Capacity (MW)</b> 210		<b>Commissioning year</b> 1994		<b>Plant age*</b> 27
<b>Electricity Generation (GW)</b>		<b>2017-18</b> 1,368	<b>2018-19</b> 1,059	<b>2019-20</b> 1,161	<b>2020-21</b> 937	<b>2021-22</b> 505
<b>Plant Load Factor (PLF)</b>		<b>2017-18</b> 74%	<b>2018-19</b> 58%	<b>2019-20</b> 65%	<b>2020-21</b> 63%	<b>2021-22</b> 82%
<b>Emission limit</b> 600		<b>FGD installation (July 2021)</b> NIT issued				
<b>Sl. No. 2</b>	<b>TPP name</b> NCTPS Unit 2	<b>Capacity (MW)</b> 210		<b>Commissioning year</b> 1995		<b>Plant age*</b> 26
<b>Electricity Generation (GW)</b>		<b>2017-18</b> 1,380	<b>2018-19</b> 1,480	<b>2019-20</b> 1,110	<b>2020-21</b> 973	<b>2021-22</b> 381
<b>Plant Load Factor (PLF)</b>		<b>2017-18</b> 75%	<b>2018-19</b> 80%	<b>2019-20</b> 63%	<b>2020-21</b> 60%	<b>2021-22</b> 62%
<b>Emission limit</b> 600		<b>FGD installation (July 2021)</b> NIT issued				
<b>Sl. No. 3</b>	<b>TPP name</b> NCTPS Unit 3	<b>Capacity (MW)</b> 210		<b>Commissioning year</b> 1996		<b>Plant age*</b> 25
<b>Electricity Generation (GW)</b>		<b>2017-18</b> 1,460	<b>2018-19</b> 1,460	<b>2019-20</b> 1,022	<b>2020-21</b> 898	<b>2021-22</b> 456
<b>Plant Load Factor (PLF)</b>		<b>2017-18</b> 79%	<b>2018-19</b> 79%	<b>2019-20</b> 58%	<b>2020-21</b> 56%	<b>2021-22</b> 74%
<b>Emission limit</b> 600		<b>FGD installation (July 2021)</b> NIT issued				
<b>Sl. No.4</b>	<b>TPP name</b> NCTPS Unit 4	<b>Capacity (MW)</b> 600		<b>Commissioning year</b> 2013		<b>Plant age*</b> 8
<b>Electricity Generation (GW)</b>		<b>2017-18</b> 3,376	<b>2018-19</b> 3,414	<b>2019-20</b> 2,424	<b>2020-21</b> 1,762	<b>2021-22</b> 666
<b>Plant Load Factor (PLF)</b>		<b>2017-18</b> 64%	<b>2018-19</b> 65%	<b>2019-20</b> 48%	<b>2020-21</b> 46%	<b>2021-22</b> 38%
<b>Emission limit</b> 200		<b>FGD installation (July 2021)</b> NIT issued				

\* As of 2021

<b>Sl. No. 5</b>	<b>TPP name</b> NCTPS Unit 5	<b>Capacity (MW)</b> 600	<b>Commissioning year</b> 2013		<b>Plant age*</b> 8
<b>Electricity Generation (GW)</b>	<b>2017-18</b> 2,485	<b>2018-19</b> 3,299	<b>2019-20</b> 3,238	<b>2020-21</b> 1,893	<b>2021-22</b> 325
<b>Plant Load Factor (PLF)</b>	<b>2017-18</b> 74%	<b>2018-19</b> 58%	<b>2019-20</b> 65%	<b>2020-21</b> 63%	<b>2021-22</b> 82%
<b>Emission limit</b> 200	<b>FGD installation (July 2021)</b> NIT issued				

<b>Sl. No. 6</b>	<b>TPP name</b> NCTPS Unit 6	<b>Capacity (MW)</b> 800	<b>Commissioning year</b> —		<b>Plant age*</b> —
<b>Electricity Generation (GW)</b>	<b>2017-18</b> —	<b>2018-19</b> 0	<b>2019-20</b> 0	<b>2020-21</b> 0	<b>2021-22</b> 0
<b>Plant Load Factor (PLF)</b>	<b>2017-18</b> —	<b>2018-19</b> —	<b>2019-20</b> —	<b>2020-21</b> —	<b>2021-22</b> —
<b>Emission limit</b> —	<b>FGD installation (July 2021)</b> —				

## SECTOR: CENTRAL

<b>Sl. No. 7</b>	<b>TPP name</b> Vallur TPP Unit 1	<b>Capacity (MW)</b> 500	<b>Commissioning year</b> 2013		<b>Plant age*</b> 8
<b>Electricity Generation (GW)</b>	<b>2017-18</b> 3,211	<b>2018-19</b> 2,225	<b>2019-20</b> 1,988	<b>2020-21</b> 1,223	<b>2021-22</b> 913
<b>Plant Load Factor (PLF)</b>	<b>2017-18</b> 73%	<b>2018-19</b> 51%	<b>2019-20</b> 47%	<b>2020-21</b> 45%	<b>2021-22</b> 62%
<b>Emission limit</b> 200	<b>FGD installation (July 2021)</b> Bid awarded				

<b>Sl. No. 8</b>	<b>TPP name</b> Vallur TPP Unit 2	<b>Capacity (MW)</b> 500	<b>Commissioning year</b> 2014		<b>Plant age*</b> 7
<b>Electricity Generation (GW)</b>	<b>2017-18</b> 3,094	<b>2018-19</b> 2,323	<b>2019-20</b> 1,841	<b>2020-21</b> 1,501	<b>2021-22</b> 890
<b>Plant Load Factor (PLF)</b>	<b>2017-18</b> 71%	<b>2018-19</b> 53%	<b>2019-20</b> 44%	<b>2020-21</b> 42%	<b>2021-22</b> 61%
<b>Emission limit</b> 200	<b>FGD installation (July 2021)</b> Bid awarded				

<b>Sl. No. 9</b>	<b>TPP name</b> Vallur TPP Unit 3	<b>Capacity (MW)</b> 500	<b>Commissioning year</b> 1986		<b>Plant age*</b> 35
<b>Electricity Generation (GW)</b>	<b>2017-18</b> 767	<b>2018-19</b> 3,118	<b>2019-20</b> 1,715	<b>2020-21</b> 1,646	<b>2021-22</b> 891
<b>Plant Load Factor (PLF)</b>	<b>2017-18</b> 18%	<b>2018-19</b> 71%	<b>2019-20</b> 41%	<b>2020-21</b> 39%	<b>2021-22</b> 61%
<b>Emission limit</b> 200	<b>FGD installation (July 2021)</b> Bid awarded				

\* As of 2021

SECTOR: CENTRAL						
<b>Sl. No. 10</b>	<b>TPP name</b> NLC 2 TPS Unit 1	<b>Capacity (MW)</b> 210	<b>Commissioning year</b> 1987		<b>Plant age*</b> 34	
<b>Electricity Generation (GW)</b>		<b>2017-18</b> 1,469	<b>2018-19</b> 1,477	<b>2019-20</b> 1,509	<b>2020-21</b> 1,370	<b>2021-22</b> 537
<b>Plant Load Factor (PLF)</b>		<b>2017-18</b> 80%	<b>2018-19</b> 80%	<b>2019-20</b> 85%	<b>2020-21</b> 82%	<b>2021-22</b> 87%
<b>Emission limit</b> 600		<b>FGD installation (July 2021)</b> Under techno commercial evaluation				
<b>Sl. No. 11</b>	<b>TPP name</b> NLC 2 TPS Unit 2	<b>Capacity (MW)</b> 210	<b>Commissioning year</b> 1986		<b>Plant age*</b> 35	
<b>Electricity Generation (GW)</b>		<b>2017-18</b> 1,494	<b>2018-19</b> 1,452	<b>2019-20</b> 1,440	<b>2020-21</b> 1,228	<b>2021-22</b> 554
<b>Plant Load Factor (PLF)</b>		<b>2017-18</b> 81%	<b>2018-19</b> 79%	<b>2019-20</b> 81%	<b>2020-21</b> 78%	<b>2021-22</b> 90%
<b>Emission limit</b> 600		<b>FGD installation (July 2021)</b> Under techno commercial evaluation				
<b>Sl. No. 12</b>	<b>TPP name</b> NLC 2 TPS Unit 3	<b>Capacity (MW)</b> 210	<b>Commissioning year</b> 1991		<b>Plant age*</b> 30	
<b>Electricity Generation (GW)</b>		<b>2017-18</b> 1,173	<b>2018-19</b> 1,605	<b>2019-20</b> 1,468	<b>2020-21</b> 1,340	<b>2021-22</b> 552
<b>Plant Load Factor (PLF)</b>		<b>2017-18</b> 64%	<b>2018-19</b> 87%	<b>2019-20</b> 83%	<b>2020-21</b> 80%	<b>2021-22</b> 90%
<b>Emission limit</b> 600		<b>FGD installation (July 2021)</b> Under techno commercial evaluation				
<b>Sl. No. 13</b>	<b>TPP name</b> NLC 2 TPS Unit 4	<b>Capacity (MW)</b> 210	<b>Commissioning year</b> 1991		<b>Plant age*</b> 30	
<b>Electricity Generation (GW)</b>		<b>2017-18</b> 1,532	<b>2018-19</b> 1,503	<b>2019-20</b> 1,489	<b>2020-21</b> 1,054	<b>2021-22</b> 508
<b>Plant Load Factor (PLF)</b>		<b>2017-18</b> 83%	<b>2018-19</b> 82%	<b>2019-20</b> 84%	<b>2020-21</b> 81%	<b>2021-22</b> 83%
<b>Emission limit</b> 600		<b>FGD installation (July 2021)</b> Under techno commercial evaluation				
<b>Sl. No.14</b>	<b>TPP name</b> NLC 2 TPS Unit 5	<b>Capacity (MW)</b> 210	<b>Commissioning year</b> 1992		<b>Plant age*</b> 29	
<b>Electricity Generation (GW)</b>		<b>2017-18</b> 1,464	<b>2018-19</b> 1,545	<b>2019-20</b> 1,499	<b>2020-21</b> 363	<b>2021-22</b> 308
<b>Plant Load Factor (PLF)</b>		<b>2017-18</b> 80%	<b>2018-19</b> 84%	<b>2019-20</b> 85%	<b>2020-21</b> 82%	<b>2021-22</b> 50%
<b>Emission limit</b> 600		<b>FGD installation (July 2021)</b> Under techno commercial evaluation				

\* As of 2021

<b>Sl. No. 15</b>	<b>TPP name</b> NLC 2 TPS Unit 6	<b>Capacity (MW)</b> 210	<b>Commissioning year</b> 1993		<b>Plant age*</b> 28	
<b>Electricity Generation (GW)</b>		<b>2017-18</b> 1,473	<b>2018-19</b> 1,595	<b>2019-20</b> 1,273	<b>2020-21</b> 472	<b>2021-22</b> 534
<b>Plant Load Factor (PLF)</b>		<b>2017-18</b> 80%	<b>2018-19</b> 87%	<b>2019-20</b> 472%	<b>2020-21</b> 69%	<b>2021-22</b> 87%
<b>Emission limit</b> 600		<b>FGD installation (July 2021)</b> Under techno commercial evaluation				
<b>Sl. No. 16</b>	<b>TPP name</b> NLC 2 TPS Unit 7	<b>Capacity (MW)</b> 210	<b>Commissioning year</b> 2002		<b>Plant age*</b> 19	
<b>Electricity Generation (GW)</b>		<b>2017-18</b> 1,528	<b>2018-19</b> 1,568	<b>2019-20</b> 1,354	<b>2020-21</b> 1,130	<b>2021-22</b> 417
<b>Plant Load Factor (PLF)</b>		<b>2017-18</b> 83%	<b>2018-19</b> 85%	<b>2019-20</b> 76%	<b>2020-21</b> 74%	<b>2021-22</b> 68%
<b>Emission limit</b> 600		<b>FGD installation (July 2021)</b> Under techno commercial evaluation				
<b>Sl. No. 17</b>	<b>TPP name</b> NLC EXT TPS Unit 1	<b>Capacity (MW)</b> 500	<b>Commissioning year</b> 2003		<b>Plant age*</b> 18	
<b>Electricity Generation (GW)</b>		<b>2017-18</b> 1,636	<b>2018-19</b> 1,542	<b>2019-20</b> 1,627	<b>2020-21</b> 1,308	<b>2021-22</b> 598
<b>Plant Load Factor (PLF)</b>		<b>2017-18</b> 89%	<b>2018-19</b> 84%	<b>2019-20</b> 92%	<b>2020-21</b> 88%	<b>2021-22</b> 97%
<b>Emission limit</b> 600		<b>FGD installation (July 2021)</b> Under techno commercial evaluation				
<b>Sl. No. 18</b>	<b>TPP name</b> NLC EXT TPS Unit 2	<b>Capacity (MW)</b> 210	<b>Commissioning year</b> 2015		<b>Plant age*</b> 6	
<b>Electricity Generation (GW)</b>		<b>2017-18</b> 1,581	<b>2018-19</b> 1,408	<b>2019-20</b> 1,580	<b>2020-21</b> 1,478	<b>2021-22</b> 443
<b>Plant Load Factor (PLF)</b>		<b>2017-18</b> 86%	<b>2018-19</b> 77%	<b>2019-20</b> 89%	<b>2020-21</b> 86%	<b>2021-22</b> 72%
<b>Emission limit</b> 600		<b>FGD installation (July 2021)</b> Under techno commercial evaluation				
<b>Sl. No.19</b>	<b>TPP name</b> NLC 2 TPS Exp Unit 1	<b>Capacity (MW)</b> 250	<b>Commissioning year</b> 2015		<b>Plant age*</b> 6	
<b>Electricity Generation (GW)</b>		<b>2017-18</b> 1154	<b>2018-19</b> 1037	<b>2019-20</b> 820	<b>2020-21</b> 1079	<b>2021-22</b> 406
<b>Plant Load Factor (PLF)</b>		<b>2017-18</b> 53%	<b>2018-19</b> 47%	<b>2019-20</b> 39%	<b>2020-21</b> 37%	<b>2021-22</b> 56%
<b>Emission limit</b> 600		<b>FGD installation (July 2021)</b> CFBC boiler				

\* As of 2021

SECTOR: CENTRAL						
Sl. No. 20	TPP name NLC 2 TPS Exp Unit 2	Capacity (MW) 250	Commissioning year 2015		Plant age* 6	
Electricity Generation (GW)		2017-18 817	2018-19 891	2019-20 751	2020-21 1,005	2021-22 502
Plant Load Factor (PLF)		2017-18 37%	2018-19 41%	2019-20 36%	2020-21 34%	2021-22 69%
Emission limit 600		FGD installation (July 2021) CFBC boiler				

SECTOR: PRIVATE						
Sl. No. 21	TPP name ITPCL Unit 1	Capacity (MW) 600	Commissioning year 2016		Plant age* 5	
Electricity Generation (GW)		2017-18 3,216	2018-19 2,213	2019-20 3,585	2020-21 3,267	2021-22 520
Plant Load Factor (PLF)		2017-18 61%	2018-19 42%	2019-20 71%	2020-21 68%	2021-22 30%
Emission limit 200		FGD installation (July 2021) FGD installed				

Sl. No. 22	TPP name ITPCL Unit 2	Capacity (MW) 600	Commissioning year 1987		Plant age* 34	
Electricity Generation (GW)		2017-18 2,506	2018-19 3,328	2019-20 3,362	2020-21 1,552	2021-22 1,253
Plant Load Factor (PLF)		2017-18 48%	2018-19 63%	2019-20 66%	2020-21 64%	2021-22 71%
Emission limit 200		FGD installation (July 2021) FGD installed				

SECTOR: STATE						
Sl. No. 23	TPP name Mettur Unit 1	Capacity (MW) 210	Commissioning year 1987		Plant age* 34	
Electricity Generation (GW)		2017-18 1,164	2018-19 1,438	2019-20 940	2020-21 1,286	2021-22 362
Plant Load Factor (PLF)		2017-18 63%	2018-19 78%	2019-20 53%	2020-21 51%	2021-22 59%
Emission limit 600		FGD installation (July 2021) NIT issued				

\* As of 2021

<b>Sl. No. 24</b>	<b>TPP name</b> Mettur Unit 2	<b>Capacity (MW)</b> 210	<b>Commissioning year</b> 1989		<b>Plant age*</b> 32	
<b>Electricity Generation (GW)</b>		<b>2017-18</b> 1,393	<b>2018-19</b> 1,461	<b>2019-20</b> 1,071	<b>2020-21</b> 793	<b>2021-22</b> 256
<b>Plant Load Factor (PLF)</b>		<b>2017-18</b> 76%	<b>2018-19</b> 79%	<b>2019-20</b> 60%	<b>2020-21</b> 58%	<b>2021-22</b> 42%
<b>Emission limit</b> 600		<b>FGD installation (July 2021)</b> NIT issued				

<b>Sl. No. 25</b>	<b>TPP name</b> Mettur Unit 3	<b>Capacity (MW)</b> 210	<b>Commissioning year</b> 1990		<b>Plant age*</b> 31	
<b>Electricity Generation (GW)</b>		<b>2017-18</b> 1,238	<b>2018-19</b> 1,400	<b>2019-20</b> 1,292	<b>2020-21</b> 848	<b>2021-22</b> 333
<b>Plant Load Factor (PLF)</b>		<b>2017-18</b> 67%	<b>2018-19</b> 76%	<b>2019-20</b> 73%	<b>2020-21</b> 70%	<b>2021-22</b> 54%
<b>Emission limit</b> 600		<b>FGD installation (July 2021)</b> NIT issued				

<b>Sl. No. 26</b>	<b>TPP name</b> Mettur Unit 4	<b>Capacity (MW)</b> 210	<b>Commissioning year</b> 2012		<b>Plant age*</b> 9	
<b>Electricity Generation (GW)</b>		<b>2017-18</b> 1,313	<b>2018-19</b> 1,508	<b>2019-20</b> 1,175	<b>2020-21</b> 617	<b>2021-22</b> 280
<b>Plant Load Factor (PLF)</b>		<b>2017-18</b> 71%	<b>2018-19</b> 82%	<b>2019-20</b> 66%	<b>2020-21</b> 64%	<b>2021-22</b> 45%
<b>Emission limit</b> 600		<b>FGD installation (July 2021)</b> NIT issued				

<b>Sl. No. 27</b>	<b>TPP name</b> Mettur 2 Unit 1	<b>Capacity (MW)</b> 600	<b>Commissioning year</b> 1979		<b>Plant age*</b> 42	
<b>Electricity Generation (GW)</b>		<b>2017-18</b> 2457	<b>2018-19</b> 3153	<b>2019-20</b> 2535	<b>2020-21</b> 1418	<b>2021-22</b> 1164
<b>Plant Load Factor (PLF)</b>		<b>2017-18</b> 47%	<b>2018-19</b> 60%	<b>2019-20</b> 50%	<b>2020-21</b> 48%	<b>2021-22</b> 66%
<b>Emission limit</b> 200		<b>FGD installation (July 2021)</b> NIT issued				

<b>Sl. No. 28</b>	<b>TPP name</b> Tuticorin TPS Unit 1	<b>Capacity (MW)</b> 210	<b>Commissioning year</b> 1980		<b>Plant age*</b> 41	
<b>Electricity Generation (GW)</b>		<b>2017-18</b> 711	<b>2018-19</b> 1,178	<b>2019-20</b> 728	<b>2020-21</b> 731	<b>2021-22</b> 322
<b>Plant Load Factor (PLF)</b>		<b>2017-18</b> 39%	<b>2018-19</b> 64%	<b>2019-20</b> 41%	<b>2020-21</b> 40%	<b>2021-22</b> 52%
<b>Emission limit</b> 600		<b>FGD installation (July 2021)</b> NIT issued				

\* As of 2021

<b>Sl. No. 29</b>	<b>TPP name</b> Tuticorin TPS Unit 2	<b>Capacity (MW)</b> 210	<b>Commissioning year</b> 1982		<b>Plant age*</b> 39	
<b>Electricity Generation (GW)</b>		<b>2017-18</b> 1,034	<b>2018-19</b> 1,419	<b>2019-20</b> 1,240	<b>2020-21</b> 964	<b>2021-22</b> 162
<b>Plant Load Factor (PLF)</b>		<b>2017-18</b> 56%	<b>2018-19</b> 77%	<b>2019-20</b> 70%	<b>2020-21</b> 67%	<b>2021-22</b> 26%
<b>Emission limit</b> 600		<b>FGD installation (July 2021)</b> NIT issued				

<b>Sl. No. 30</b>	<b>TPP name</b> Tuticorin TPS Unit 3	<b>Capacity (MW)</b> 210	<b>Commissioning year</b> 1990		<b>Plant age*</b> 31	
<b>Electricity Generation (GW)</b>		<b>2017-18</b> 1,002	<b>2018-19</b> 1,321	<b>2019-20</b> 1,106	<b>2020-21</b> 804	<b>2021-22</b> 136
<b>Plant Load Factor (PLF)</b>		<b>2017-18</b> 54%	<b>2018-19</b> 72%	<b>2019-20</b> 62%	<b>2020-21</b> 60%	<b>2021-22</b> 22%
<b>Emission limit</b> 600		<b>FGD installation (July 2021)</b> NIT issued				

<b>Sl. No. 31</b>	<b>TPP name</b> Tuticorin TPS Unit 4	<b>Capacity (MW)</b> 210	<b>Commissioning year</b> 1992		<b>Plant age*</b> 29	
<b>Electricity Generation (GW)</b>		<b>2017-18</b> 1,330	<b>2018-19</b> 886	<b>2019-20</b> 1,363	<b>2020-21</b> 1,180	<b>2021-22</b> 213
<b>Plant Load Factor (PLF)</b>		<b>2017-18</b> 72%	<b>2018-19</b> 48%	<b>2019-20</b> 77%	<b>2020-21</b> 74%	<b>2021-22</b> 35%
<b>Emission limit</b> 600		<b>FGD installation (July 2021)</b> NIT issued				

<b>Sl. No. 32</b>	<b>TPP name</b> Tuticorin TPS Unit 5	<b>Capacity (MW)</b> 210	<b>Commissioning year</b> 2014		<b>Plant age*</b> 7	
<b>Electricity Generation (GW)</b>		<b>2017-18</b> 1,174	<b>2018-19</b> 1,502	<b>2019-20</b> 718	<b>2020-21</b> 453	<b>2021-22</b> 439
<b>Plant Load Factor (PLF)</b>		<b>2017-18</b> 64%	<b>2018-19</b> 82%	<b>2019-20</b> 40%	<b>2020-21</b> 39%	<b>2021-22</b> 71%
<b>Emission limit</b> 600		<b>FGD installation (July 2021)</b> NIT issued				

<b>SECTOR: PRIVATE</b>						
<b>Sl. No. 33</b>	<b>TPP name</b> Muthiara TPP Unit 1	<b>Capacity (MW)</b> 600	<b>Commissioning year</b> 2016		<b>Plant age*</b> 5	
<b>Electricity Generation (GW)</b>		<b>2017-18</b> 1,237	<b>2018-19</b> 1,310	<b>2019-20</b> 2,245	<b>2020-21</b> 1,080	<b>2021-22</b> 406
<b>Plant Load Factor (PLF)</b>		<b>2017-18</b> 24%	<b>2018-19</b> 25%	<b>2019-20</b> 44%	<b>2020-21</b> 43%	<b>2021-22</b> 23%
<b>Emission limit</b> 200		<b>FGD installation (July 2021)</b> Bid awarded				

\* As of 2021

<b>Sl. No. 34</b>	<b>TPP name</b> Muthiara TPP Unit 2	<b>Capacity (MW)</b> 600	<b>Commissioning year</b> 2013		<b>Plant age*</b> 8
<b>Electricity Generation (GW)</b>	<b>2017-18</b> 2,661	<b>2018-19</b> 1,908	<b>2019-20</b> 1,112	<b>2020-21</b> 1,217	<b>2021-22</b> 157
<b>Plant Load Factor (PLF)</b>	<b>2017-18</b> 51%	<b>2018-19</b> 36%	<b>2019-20</b> 22%	<b>2020-21</b> 21%	<b>2021-22</b> 9%
<b>Emission limit</b> 200	<b>FGD installation (July 2021)</b> Bid awarded				

<b>Sl. No. 35</b>	<b>TPP name</b> Tuticorin (P) TPS Unit 1	<b>Capacity (MW)</b> 150	<b>Commissioning year</b> 2013		<b>Plant age*</b> 8
<b>Electricity Generation (GW)</b>	<b>2017-18</b> 0	<b>2018-19</b> 0	<b>2019-20</b> 0	<b>2020-21</b> 0	<b>2021-22</b> 0
<b>Plant Load Factor (PLF)</b>	<b>2017-18</b> 0%	<b>2018-19</b> 0%	<b>2019-20</b> 0%	<b>2020-21</b> 0%	<b>2021-22</b> 0%
<b>Emission limit</b> 600	<b>FGD installation (July 2021)</b> CFBC boiler				

<b>Sl. No. 36</b>	<b>TPP name</b> Tuticorin (P) TPS Unit 2	<b>Capacity (MW)</b> 150	<b>Commissioning year</b> 2002		<b>Plant age*</b> 19
<b>Electricity Generation (GW)</b>	<b>2017-18</b> 0	<b>2018-19</b> 0	<b>2019-20</b> 0	<b>2020-21</b> 0	<b>2021-22</b> 0
<b>Plant Load Factor (PLF)</b>	<b>2017-18</b> 0%	<b>2018-19</b> 0%	<b>2019-20</b> 0%	<b>2020-21</b> 0%	<b>2021-22</b> 0%
<b>Emission limit</b> 600	<b>FGD installation (July 2021)</b> CFBC boiler				

<b>Sl. No. 37</b>	<b>TPP name</b> Neyveli TPS Unit 1	<b>Capacity (MW)</b> 250	<b>Commissioning year</b> 2015		<b>Plant age*</b> 6
<b>Electricity Generation (GW)</b>	<b>2017-18</b> 1,025	<b>2018-19</b> 1,288	<b>2019-20</b> 1,351	<b>2020-21</b> 886	<b>2021-22</b> 586
<b>Plant Load Factor (PLF)</b>	<b>2017-18</b> 47%	<b>2018-19</b> 59%	<b>2019-20</b> 64%	<b>2020-21</b> 62%	<b>2021-22</b> 80%
<b>Emission limit</b> 600	<b>FGD installation (July 2021)</b> Bid awarded				

## SECTOR: CENTRAL

<b>Sl. No. 38</b>	<b>TPP name</b> Tuticorin (JV) TPP Unit 1	<b>Capacity (MW)</b> 500	<b>Commissioning year</b> 2015		<b>Plant age*</b> 6
<b>Electricity Generation (GW)</b>	<b>2017-18</b> 2,635	<b>2018-19</b> 3,208	<b>2019-20</b> 2,756	<b>2020-21</b> 2,527	<b>2021-22</b> 8,79
<b>Plant Load Factor (PLF)</b>	<b>2017-18</b> 60%	<b>2018-19</b> 73%	<b>2019-20</b> 65%	<b>2020-21</b> 63%	<b>2021-22</b> 60%
<b>Emission limit</b> 200	<b>FGD installation (July 2021)</b> Bid awarded				

\* As of 2021

<b>Sl. No. 39</b>	<b>TPP name</b> Tuticorin (JV) TPP Unit 2	<b>Capacity (MW)</b> 500	<b>Commissioning year</b> 2019		<b>Plant age*</b> 2
<b>Electricity Generation (GW)</b>	<b>2017-18</b> 2,755	<b>2018-19</b> 2,278	<b>2019-20</b> 1,914	<b>2020-21</b> 2,764	<b>2021-22</b> 855
<b>Plant Load Factor (PLF)</b>	<b>2017-18</b> 63%	<b>2018-19</b> 52%	<b>2019-20</b> 45%	<b>2020-21</b> 44%	<b>2021-22</b> 58%
<b>Emission limit</b> 200	<b>FGD installation (July 2021)</b> Bid awarded				

<b>Sl. No. 40</b>	<b>TPP name</b> NLC New TPP Unit 1	<b>Capacity (MW)</b> 500	<b>Commissioning year</b> 2021		<b>Plant age*</b> 0
<b>Electricity Generation (GW)</b>	<b>2017-18</b> —	<b>2018-19</b> —	<b>2019-20</b> 425	<b>2020-21</b> 2,918	<b>2021-22</b> 1,217
<b>Plant Load Factor (PLF)</b>	<b>2017-18</b> —	<b>2018-19</b> —	<b>2019-20</b> 10%	<b>2020-21</b> 10%	<b>2021-22</b> 83%
<b>Emission limit</b> 100	<b>FGD installation (July 2021)</b> Under techno commercial evaluation				

<b>Sl. No. 41</b>	<b>TPP name</b> NLC New TPP Unit 2	<b>Capacity (MW)</b> 500	<b>Commissioning year</b> 2021		<b>Plant age*</b> 0
<b>Electricity Generation (GW)</b>	<b>2017-18</b> —	<b>2018-19</b> —	<b>2019-20</b> —	<b>2020-21</b> 341	<b>2021-22</b> 940
<b>Plant Load Factor (PLF)</b>	<b>2017-18</b> —	<b>2018-19</b> —	<b>2019-20</b> —	<b>2020-21</b> —	<b>2021-22</b> 64%
<b>Emission limit</b> 100	<b>FGD installation (July 2021)</b> Under techno commercial evaluation				

<b>SECTOR: PRIVATE</b>					
<b>Sl. No. 42</b>	<b>TPP name</b> Tuticorin TPP ST IV Unit 1	<b>Capacity (MW)</b> 500	<b>Commissioning year</b> 2021		<b>Plant age*</b> 0
<b>Electricity Generation (GW)</b>	<b>2017-18</b> 3,094	<b>2018-19</b> 2,323	<b>2019-20</b> 1,841	<b>2020-21</b> 1,501	<b>2021-22</b> 890
<b>Plant Load Factor (PLF)</b>	<b>2017-18</b> —	<b>2018-19</b> —	<b>2019-20</b> —	<b>2020-21</b> —	<b>2021-22</b> —
<b>Emission limit</b> —	<b>FGD installation (July 2021)</b> —				

\* As of 2021

As per the latest available information, only two units (1,200 MW) out of 40 operational units (13,160 MW) in Tamil Nadu have installed FGD by July 2021. Another 8 units (3,950 MW) have awarded the bids for FGD installation, leaving 30 (8,810 MW) out of 40 units without any significant progress towards installing FGDs. None of the state sector units and NLC-owned power plants have awarded the tenders yet.

5.0

## OCEMS data quality and data transparency

**The Supreme Court's industrial emission data transparency directive of 2017 directed the industrial facilities to install easily accessible and effective OCEMS**

While installation of the pollution control devices to reduce emission at source is the key to reduce pollution, operating the pollution control devices, i.e., Flue Gas Desulphurisation (FGD) is the key to ensure the actual pollution reduction. This means an additional cost to the cost of power generation and not all power plants move with the same pace towards installing the pollution reduction technology/devices. The MERIT order dispatch system in its existing form ensures that the power plants with least cost will be able to sell the power before moving to the next higher cost source. Which implies that due to higher cost by virtue of operation of FGDs, the operation of FGD even after its installation might not be ensured until and unless there is publicly available information on operation of such devices and pollutant emissions from the power plants.

The Supreme Court's industrial emission data transparency directive of 2017 in Paryavaran Suraksha Samiti vs. Union of India case directed the industrial facilities to install easily accessible and effective Online Continuous Emissions Monitoring Systems (OCEMS). While delivering the order the bench observed that, in the interest of implementation of the objective that is being

sought to be achieved, it required each concerned state (and each, concerned union territory) to make provision for 'online, real time, continuous monitoring system' to display emission levels, in the public domain, on the portal of the concerned State Pollution Control Board.

It has been more than three years since the directive but even till date the availability and quality of OCEMS data in public domain has been very poor. If this persists, it will be very difficult to ascertain whether any installed FGD system or any other pollution control device is being operated efficiently or not.

In March, 2021 another petition (O.A. No. 82 of 2021 (SZ)) at the southern zone of the National Green Tribunal (NGT) asked the bench to intervene and ensure that the Supreme Court's direction of 2017 is implemented in the southern states, after which new directions were issued to the concerned State Pollution Control Boards (SPCBs) to submit the updated status and ensure the compliance of the directive, but the public availability of the data as well as data quality still remains very opaque.

The following table presents the data collected through RTI applications for OCEMS as well as manual monitoring done at the coal-based power plants with the prescribed emission limits set for the respective units by MoEF&CC.

**TABLE 09**

Data quality for SO<sub>2</sub> emissions from coal-based units in Tamil Nadu (Source: RTI & TNPCB website)

<b>Sl. No. 1</b>	<b>TPP name</b> NCTPS Unit 1	<b>Capacity (MW)</b> 210	<b>Plant age*</b> 2021	<b>Emission limit</b> 600
<b>SO<sub>2</sub> emission levels (mg/Nm<sup>3</sup>)**</b>		<b>April, 2021</b> 811	<b>May, 2021</b> 711	<b>June, 2021</b> 650
<b>Emission levels from manual monitoring**</b> –		<b>OCEMS data***</b> Around the limit of 600 mg/Nm <sup>3</sup>		
<b>Sl. No. 2</b>	<b>TPP name</b> NCTPS Unit 2	<b>Capacity (MW)</b> 210	<b>Plant age*</b> 2021	<b>Emission limit</b> 600
<b>SO<sub>2</sub> emission levels (mg/Nm<sup>3</sup>)**</b>		<b>April, 2021</b> 532	<b>May, 2021</b> 422	<b>June, 2021</b> 616
<b>Emission levels from manual monitoring**</b> –		<b>OCEMS data***</b> Around the limit of 600 mg/Nm <sup>3</sup>		
<b>Sl. No. 3</b>	<b>TPP name</b> NCTPS Unit 3	<b>Capacity (MW)</b> 210	<b>Plant age*</b> 2021	<b>Emission limit</b> 600
<b>SO<sub>2</sub> emission levels (mg/Nm<sup>3</sup>)**</b>		<b>April, 2021</b> 399	<b>May, 2021</b> 445	<b>June, 2021</b> 435
<b>Emission levels from manual monitoring**</b> –		<b>OCEMS data***</b> Around the limit of 600 mg/Nm <sup>3</sup>		

\* As of 2021 | \*\*RTI data | \*\*\* From TNPCB website

Sl. No. 4	TPP name NCTPS Unit 4	Capacity (MW) 600	Plant age* 2021	Emission limit 200
SO2 emission levels (mg/Nm3)**		April, 2021 520	May, 2021 6	June, 2021 154
Emission levels from manual monitoring** –		OCEMS data*** Above the limit of 200 mg/Nm3		
Sl. No. 5	TPP name NCTPS Unit 5	Capacity (MW) 600	Plant age* 2021	Emission limit 200
SO2 emission levels (mg/Nm3)**		April, 2021 555	May, 2021 N.A.	June, 2021 785
Emission levels from manual monitoring** –		OCEMS data*** Above the limit of 200 mg/Nm3		
Sl. No. 6	TPP name NCTPS Unit 6	Capacity (MW) –	Plant age* –	Emission limit –
SO2 emission levels (mg/Nm3)**		April, 2021 –	May, 2021 –	June, 2021 –
Emission levels from manual monitoring** –		OCEMS data*** –		
Sl. No. 7	TPP name Vallur TPP Unit 1	Capacity (MW) 500	Plant age* 2021	Emission limit 200
SO2 emission levels (mg/Nm3)**		April, 2021 883	May, 2021 719	June, 2021 856
Emission levels from manual monitoring** –		OCEMS data*** Above the limit of 200 mg/Nm3		
Sl. No. 8	TPP name Vallur TPP Unit 2	Capacity (MW) 500	Plant age* 2021	Emission limit 200
SO2 emission levels (mg/Nm3)**		April, 2021 841	May, 2021 700	June, 2021 693
Emission levels from manual monitoring** –		OCEMS data*** Above the limit of 200 mg/Nm3		
Sl. No. 9	TPP name Vallur TPP Unit 3	Capacity (MW) 500	Plant age* 2021	Emission limit 200
SO2 emission levels (mg/Nm3)**		April, 2021 875	May, 2021 857	June, 2021 878
Emission levels from manual monitoring** –		OCEMS data*** Above the limit of 200 mg/Nm3		
Sl. No. 10	TPP name NLC 2 TPS Unit 1	Capacity (MW) 210	Plant age* 2021	Emission limit 600
SO2 emission levels (mg/Nm3)**		April, 2021 850	May, 2021 961	June, 2021 1,045
Emission levels from manual monitoring** –		OCEMS data*** Above the limit of 600 mg/Nm3		
Sl. No. 11	TPP name NLC 2 TPS Unit 2	Capacity (MW) 210	Plant age* 2021	Emission limit 600
SO2 emission levels (mg/Nm3)**		April, 2021 1,280	May, 2021 1,261	June, 2021 1,165
Emission levels from manual monitoring** –		OCEMS data*** Above the limit of 600 mg/Nm3		

\* As of 2021 | \*\*RTI data | \*\*\* From TNPCB website

<b>Sl. No. 12</b>	<b>TPP name</b> NLC 2 TPS Unit 3	<b>Capacity (MW)</b> 210	<b>Plant age*</b> 2021	<b>Emission limit</b> 600
<b>SO2 emission levels (mg/Nm3)**</b>		<b>April, 2021</b> 1,134	<b>May, 2021</b> 1,021	<b>June, 2021</b> 1,170
<b>Emission levels from manual monitoring**</b> –		<b>OCEMS data***</b> Above the limit of 600 mg/Nm3		
<b>Sl. No. 13</b>	<b>TPP name</b> NLC 2 TPS Unit 4	<b>Capacity (MW)</b> 210	<b>Plant age*</b> 2021	<b>Emission limit</b> 600
<b>SO2 emission levels (mg/Nm3)**</b>		<b>April, 2021</b> 1,412	<b>May, 2021</b> 1,275	<b>June, 2021</b> 1,326
<b>Emission levels from manual monitoring**</b> –		<b>OCEMS data***</b> Above the limit of 600 mg/Nm3		
<b>Sl. No. 14</b>	<b>TPP name</b> NLC 2 TPS Unit 5	<b>Capacity (MW)</b> 210	<b>Plant age*</b> 2021	<b>Emission limit</b> 600
<b>SO2 emission levels (mg/Nm3)**</b>		<b>April, 2021</b> No data	<b>May, 2021</b> 1,411	<b>June, 2021</b> 1,488
<b>Emission levels from manual monitoring**</b> –		<b>OCEMS data***</b> Above the limit of 600 mg/Nm3		
<b>Sl. No. 15</b>	<b>TPP name</b> NLC 2 TPS Unit 6	<b>Capacity (MW)</b> 210	<b>Plant age*</b> 2021	<b>Emission limit</b> 600
<b>SO2 emission levels (mg/Nm3)**</b>		<b>April, 2021</b> 935	<b>May, 2021</b> 891	<b>June, 2021</b> 923
<b>Emission levels from manual monitoring**</b> –		<b>OCEMS data***</b> Above the limit of 600 mg/Nm3		
<b>Sl. No. 16</b>	<b>TPP name</b> NLC 2 TPS Unit 7	<b>Capacity (MW)</b> 210	<b>Plant age*</b> 2021	<b>Emission limit</b> 600
<b>SO2 emission levels (mg/Nm3)**</b>		<b>April, 2021</b> 88	<b>May, 2021</b> 1,098	<b>June, 2021</b> 933
<b>Emission levels from manual monitoring**</b> –		<b>OCEMS data***</b> Above the limit of 600 mg/Nm3		
<b>Sl. No. 17</b>	<b>TPP name</b> NLC EXT TPS Unit 1	<b>Capacity (MW)</b> 210	<b>Plant age*</b> 2021	<b>Emission limit</b> 600
<b>SO2 emission levels (mg/Nm3)**</b>		<b>April, 2021</b> 2,498	<b>May, 2021</b> 1,380	<b>June, 2021</b> 1,901
<b>Emission levels from manual monitoring**</b> –		<b>OCEMS data***</b> Above the limit of 600 mg/Nm3		
<b>Sl. No. 18</b>	<b>TPP name</b> NLC EXT TPS Unit 2	<b>Capacity (MW)</b> 210	<b>Plant age*</b> 2021	<b>Emission limit</b> 600
<b>SO2 emission levels (mg/Nm3)**</b>		<b>April, 2021</b> 940	<b>May, 2021</b> 1,192	<b>June, 2021</b> 2,051
<b>Emission levels from manual monitoring**</b> –		<b>OCEMS data***</b> Above the limit of 600 mg/Nm3		
<b>Sl. No. 19</b>	<b>TPP name</b> NLC 2 TPS Exp Unit 1	<b>Capacity (MW)</b> 250	<b>Plant age*</b> 2021	<b>Emission limit</b> 600
<b>SO2 emission levels (mg/Nm3)**</b>		<b>April, 2021</b> 315	<b>May, 2021</b> –	<b>June, 2021</b> 314
<b>Emission levels from manual monitoring**</b> –		<b>OCEMS data***</b> over than limit of 600 mg/Nm3		

\* As of 2021 | \*\*RTI data | \*\*\* From TNPCB website

<b>Sl. No. 20</b>	<b>TPP name</b> NLC 2 TPS Exp Unit 2	<b>Capacity (MW)</b> 250	<b>Plant age*</b> 2021	<b>Emission limit</b> 600
<b>SO2 emission levels (mg/Nm3)**</b>		<b>April, 2021</b> 305	<b>May, 2021</b> —	<b>June, 2021</b> 306
<b>Emission levels from manual monitoring**</b> —		<b>OCEMS data***</b> Lower than limit of 600 mg/Nm3		
<b>Sl. No. 21</b>	<b>TPP name</b> ITPCL Unit 1	<b>Capacity (MW)</b> 600	<b>Plant age*</b> 2021	<b>Emission limit</b> 200
<b>SO2 emission levels (mg/Nm3)**</b>		<b>April, 2021</b> 143	<b>May, 2021</b> 159	<b>June, 2021</b> No data
<b>Emission levels from manual monitoring**</b> 224		<b>OCEMS data***</b> Around the limit of 200 mg/Nm3		
<b>Sl. No. 22</b>	<b>TPP name</b> ITPCL Unit 2	<b>Capacity (MW)</b> 600	<b>Plant age*</b> 2021	<b>Emission limit</b> 200
<b>SO2 emission levels (mg/Nm3)**</b>		<b>April, 2021</b> 141	<b>May, 2021</b> 158	<b>June, 2021</b> 158
<b>Emission levels from manual monitoring**</b> 230		<b>OCEMS data***</b> Around the limit of 200 mg/Nm3		
<b>Sl. No. 23</b>	<b>TPP name</b> Mettur Unit 1	<b>Capacity (MW)</b> 210	<b>Plant age*</b> 2021	<b>Emission limit</b> 600
<b>SO2 emission levels (mg/Nm3)**</b>		<b>April, 2021</b> No data	<b>May, 2021</b> No data	<b>June, 2021</b> No data
<b>Emission levels from manual monitoring**</b> 417		<b>OCEMS data***</b> Above the limit of 600 mg/Nm3		
<b>Sl. No. 24</b>	<b>TPP name</b> Mettur Unit 2	<b>Capacity (MW)</b> 210	<b>Plant age*</b> 2021	<b>Emission limit</b> 600
<b>SO2 emission levels (mg/Nm3)**</b>		<b>April, 2021</b> No data	<b>May, 2021</b> No data	<b>June, 2021</b> No data
<b>Emission levels from manual monitoring**</b> 391		<b>OCEMS data***</b> Above the limit of 600 mg/Nm3		
<b>Sl. No. 25</b>	<b>TPP name</b> Mettur Unit 3	<b>Capacity (MW)</b> 210	<b>Plant age*</b> 2021	<b>Emission limit</b> 600
<b>SO2 emission levels (mg/Nm3)**</b>		<b>April, 2021</b> No data	<b>May, 2021</b> No data	<b>June, 2021</b> No data
<b>Emission levels from manual monitoring**</b> 418		<b>OCEMS data***</b> Above the limit of 600 mg/Nm3		
<b>Sl. No. 26</b>	<b>TPP name</b> Mettur Unit 4	<b>Capacity (MW)</b> 210	<b>Plant age*</b> 2021	<b>Emission limit</b> 600
<b>SO2 emission levels (mg/Nm3)**</b>		<b>April, 2021</b> No data	<b>May, 2021</b> No data	<b>June, 2021</b> No data
<b>Emission levels from manual monitoring**</b> 429		<b>OCEMS data***</b> Above the limit of 600 mg/Nm3		
<b>Sl. No. 27</b>	<b>TPP name</b> Mettur 2 Unit 1	<b>Capacity (MW)</b> 600	<b>Plant age*</b> 2021	<b>Emission limit</b> 200
<b>SO2 emission levels (mg/Nm3)**</b>		<b>April, 2021</b> No data	<b>May, 2021</b> No data	<b>June, 2021</b> No data
<b>Emission levels from manual monitoring**</b> 181		<b>OCEMS data***</b> Above the limit of 200 mg/Nm3		

\* As of 2021 | \*\*RTI data | \*\*\* From TNPCB website

<b>Sl. No. 28</b>	<b>TPP name</b> Tuticorin TPS Unit 1	<b>Capacity (MW)</b> 210	<b>Plant age*</b> 2021	<b>Emission limit</b> 600
<b>SO2 emission levels (mg/Nm3)**</b>		<b>April, 2021</b> No data	<b>May, 2021</b> No data	<b>June, 2021</b> 276
<b>Emission levels from manual monitoring**</b> N.A.		<b>OCEMS data***</b> Lower than limit of 600 mg/Nm3		
<b>Sl. No. 29</b>	<b>TPP name</b> Tuticorin TPS Unit 2	<b>Capacity (MW)</b> 210	<b>Plant age*</b> 2021	<b>Emission limit</b> 600
<b>SO2 emission levels (mg/Nm3)**</b>		<b>April, 2021</b> 158	<b>May, 2021</b> 108	<b>June, 2021</b> 161
<b>Emission levels from manual monitoring**</b> N.A.		<b>OCEMS data***</b> Lower than limit of 600 mg/Nm3		
<b>Sl. No. 30</b>	<b>TPP name</b> Tuticorin TPS Unit 3	<b>Capacity (MW)</b> 210	<b>Plant age*</b> 2021	<b>Emission limit</b> 600
<b>SO2 emission levels (mg/Nm3)**</b>		<b>April, 2021</b> 407	<b>May, 2021</b> 296	<b>June, 2021</b> 260
<b>Emission levels from manual monitoring**</b> N.A.		<b>OCEMS data***</b> Lower than limit of 600 mg/Nm3		
<b>Sl. No. 31</b>	<b>TPP name</b> Tuticorin TPS Unit 4	<b>Capacity (MW)</b> 210	<b>Plant age*</b> 2021	<b>Emission limit</b> 600
<b>SO2 emission levels (mg/Nm3)**</b>		<b>April, 2021</b> No data	<b>May, 2021</b> No data	<b>June, 2021</b> No data
<b>Emission levels from manual monitoring**</b> N.A.		<b>OCEMS data***</b> N.A.		
<b>Sl. No. 32</b>	<b>TPP name</b> Tuticorin TPS Unit 5	<b>Capacity (MW)</b> 210	<b>Plant age*</b> 2021	<b>Emission limit</b> 600
<b>SO2 emission levels (mg/Nm3)**</b>		<b>April, 2021</b> No data	<b>May, 2021</b> No data	<b>June, 2021</b> No data
<b>Emission levels from manual monitoring**</b> N.A.		<b>OCEMS data***</b> N.A.		
<b>Sl. No. 33</b>	<b>TPP name</b> Muthiara TPP Unit 1	<b>Capacity (MW)</b> 600	<b>Plant age*</b> 2021	<b>Emission limit</b> 200
<b>SO2 emission levels (mg/Nm3)**</b>		<b>April, 2021</b> 111	<b>May, 2021</b> 96	<b>June, 2021</b> 155
<b>Emission levels from manual monitoring**</b> N.A.		<b>OCEMS data***</b> Lower than limit of 200 mg/Nm3		
<b>Sl. No. 34</b>	<b>TPP name</b> Muthiara TPP Unit 2	<b>Capacity (MW)</b> 600	<b>Plant age*</b> 2021	<b>Emission limit</b> 200
<b>SO2 emission levels (mg/Nm3)**</b>		<b>April, 2021</b> N.A.	<b>May, 2021</b> N.A.	<b>June, 2021</b> N.A.
<b>Emission levels from manual monitoring**</b> N.A.		<b>OCEMS data***</b> Lower than limit of 200 mg/Nm3		
<b>Sl. No. 35</b>	<b>TPP name</b> Tuticorin (P) TPS Unit 1	<b>Capacity (MW)</b> 150	<b>Plant age*</b> 2021	<b>Emission limit</b> 600
<b>SO2 emission levels (mg/Nm3)**</b>		<b>April, 2021</b> N.A.	<b>May, 2021</b> N.A.	<b>June, 2021</b> N.A.
<b>Emission levels from manual monitoring**</b> N.A.		<b>OCEMS data***</b> N.A.		

\* As of 2021 | \*\*RTI data | \*\*\* From TNPCB website

<b>Sl. No. 36</b>	<b>TPP name</b> Tuticorin (P) TPS Unit 2	<b>Capacity (MW)</b> 150	<b>Plant age*</b> 2021	<b>Emission limit</b> 600
<b>SO2 emission levels (mg/Nm3)**</b>		<b>April, 2021</b> N.A.	<b>May, 2021</b> N.A.	<b>June, 2021</b> N.A.
<b>Emission levels from manual monitoring**</b> N.A.		<b>OCEMS data***</b> N.A.		

<b>Sl. No. 37</b>	<b>TPP name</b> Neyveli TPS Unit 1	<b>Capacity (MW)</b> 250	<b>Plant age*</b> 2021	<b>Emission limit</b> 600
<b>SO2 emission levels (mg/Nm3)**</b>		<b>April, 2021</b> 3,078	<b>May, 2021</b> 3,646	<b>June, 2021</b> 1,993
<b>Emission levels from manual monitoring**</b> N.A.		<b>OCEMS data***</b> Wrong threshold of 6244 mg/Nm3 shown		

<b>Sl. No. 38</b>	<b>TPP name</b> Tuticorin (JV) TPP Unit 1	<b>Capacity (MW)</b> 500	<b>Plant age*</b> 2021	<b>Emission limit</b> 200
<b>SO2 emission levels (mg/Nm3)**</b>		<b>April, 2021</b> 147	<b>May, 2021</b> 98	<b>June, 2021</b> 119
<b>Emission levels from manual monitoring**</b> N.A.		<b>OCEMS data***</b> N.A.		

<b>Sl. No. 39</b>	<b>TPP name</b> Tuticorin (JV) TPP Unit 2	<b>Capacity (MW)</b> 500	<b>Plant age*</b> 2021	<b>Emission limit</b> 200
<b>SO2 emission levels (mg/Nm3)**</b>		<b>April, 2021</b> 131	<b>May, 2021</b> 109	<b>June, 2021</b> 76
<b>Emission levels from manual monitoring**</b> N.A.		<b>OCEMS data***</b> N.A.		

<b>Sl. No. 40</b>	<b>TPP name</b> NLC New TPP Unit 1	<b>Capacity (MW)</b> 500	<b>Plant age*</b> 2021	<b>Emission limit</b> 100
<b>SO2 emission levels (mg/Nm3)**</b>		<b>April, 2021</b> N.A.	<b>May, 2021</b> N.A.	<b>June, 2021</b> N.A.
<b>Emission levels from manual monitoring**</b> N.A.		<b>OCEMS data***</b> N.A.		

<b>Sl. No. 41</b>	<b>TPP name</b> NLC New TPP Unit 2	<b>Capacity (MW)</b> 500	<b>Plant age*</b> 2021	<b>Emission limit</b> 100
<b>SO2 emission levels (mg/Nm3)**</b>		<b>April, 2021</b> N.A.	<b>May, 2021</b> N.A.	<b>June, 2021</b> N.A.
<b>Emission levels from manual monitoring**</b> N.A.		<b>OCEMS data***</b> N.A.		

\* As of 2021 | \*\*RTI data | \*\*\* From TNPCB website

**Same size and technology units show different values, giving room to suspicion since the average coal quality and quantity might be mostly similar for these units**

The OCEMS data column in the above table represents the interpretation of data as collected from Tamil Nadu State Pollution Control Board website for the period of January 2021–July 2021 (Annexure 1). Observations on data quality and data transparency can be summarised as follows:


- *The data collected through RTI Application for several months shows variation in the recorded values for the same units. Also, same size and technology units show different values, giving room to suspicion since average coal quality and quantity might be mostly similar for these units. In absence of any effective SO<sub>2</sub> control technology, it will be hard to have huge variations in SO<sub>2</sub> emissions from similar coal quality.*
- *The interpretation of the data collected through RTI and the data accessed from the TNPCB website also shows huge differences, making it hard for researchers and the general public to ascertain whether the data provided under various platforms by the power plant authorities and pollution control board can be trusted.*
- *While the OCEMS data was made available in graphical and tabular form by the TNPCB, access to historical data in downloadable form such as CSV, XLS or PDF formats, wasn't available, making it hard to use the available data for any research or monitoring purpose.*
- *The available data was in different units for different power plants making it confusing for the stakeholder looking at the data to comprehend and compare, the data to each other and to the standards.*

## 6.0

## Conclusions and recommendations



The power surplus and overcapacity situation in the state is acute in nature consequently leading to sub-optimal utilisation of the existing assets. This might be a hindrance to the aggressive renewable energy integration due to limited financial resources being available for the power sector and poor planning. While the energy transition is unfolding in the state it is also crucial to reduce the environmental footprint and health burden from the existing power plants. This can be ensured by installation of the state-of-the-art pollution control technology such as FGD for SO<sub>2</sub>, SCR/SNCR etc., for NO<sub>x</sub> and operating them efficiently to ensure pollution emission capture at source. While these technologies are being installed it is also important to strengthen the data monitoring, data transparency and law enforcement protocols for efficient utilisation of the installed pollution control technology. Based on information collected for this analysis, the above mentioned actions have to be necessarily taken by the power plant operators and Tamil Nadu Pollution Control Board to ensure reduction of pollution footprint from the coal-based power plants, and move forwards helping achieve breathable air across polluted geographies.



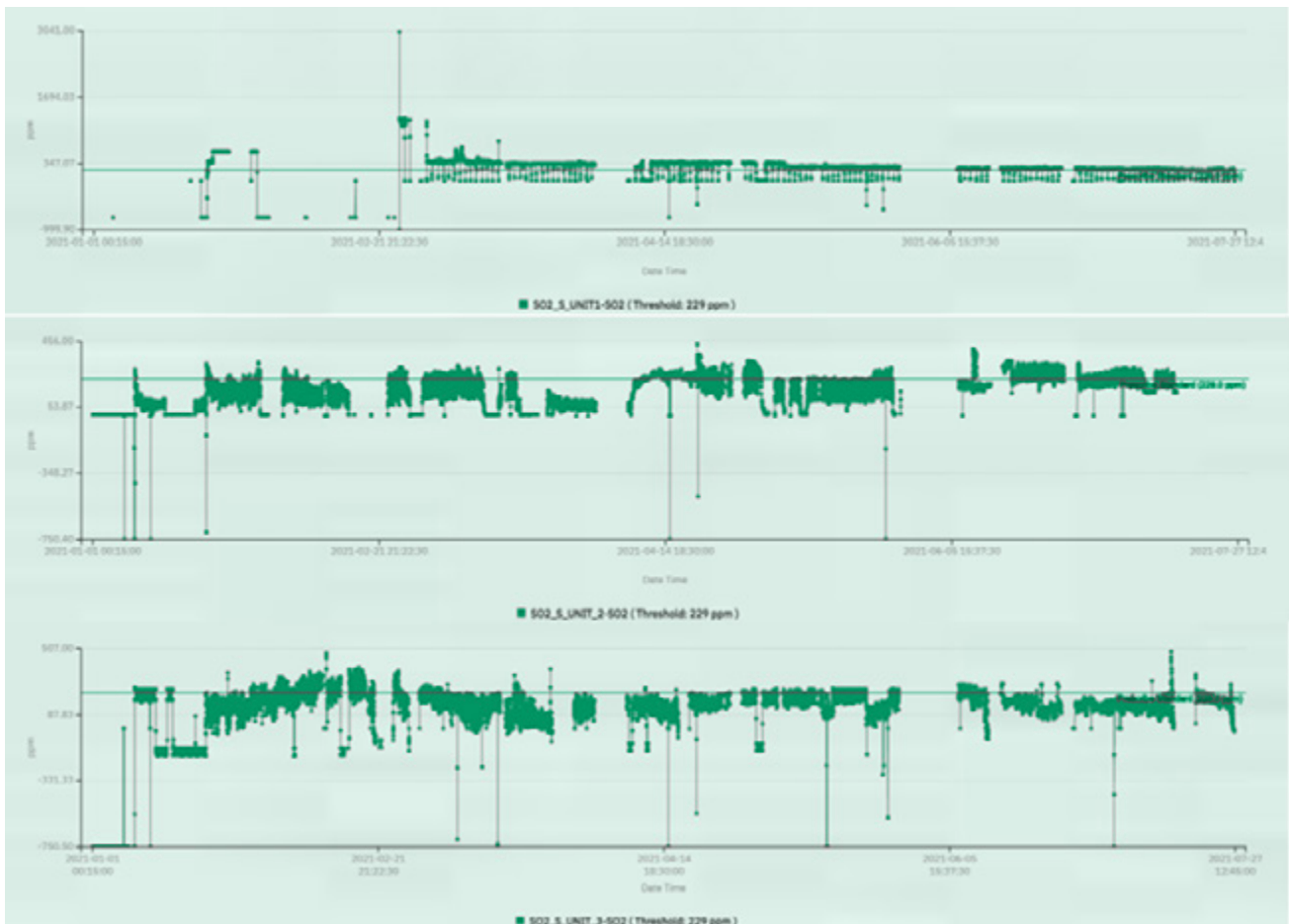
Going forward the urgent action points-based on the current report can be summarised as follows:

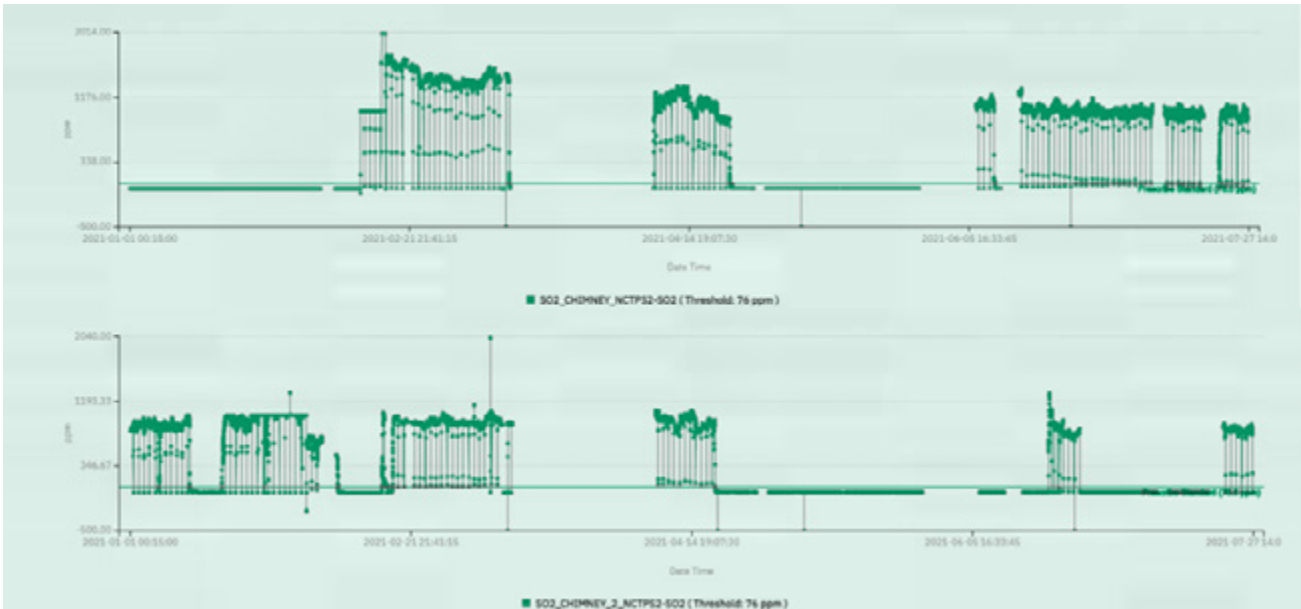
- 1 Rationalise power generation sources
- 2 Stop further financial investments for coal-based power infrastructure
- 3 Ensure aggressive shut down of old, polluting units
- 4 Rationalise the power purchase agreements to reduce fixed cost burdens
- 5 Stop all proposed, under-construction power plants at initial stages
- 6 Ensure the FGD and NOx reduction technologies are installed at all operational coal-based power generation units in the state
- 7 Ensure installation, operation and calibration of the OCEMS at all operational coal-based power generation units in the state
- 8 Ensure data quality and data transparency of the data collected through OCEMS and manual monitoring at coal-based power plant units in the public domain to enhance compliance and operation of the pollution control devices

7.0

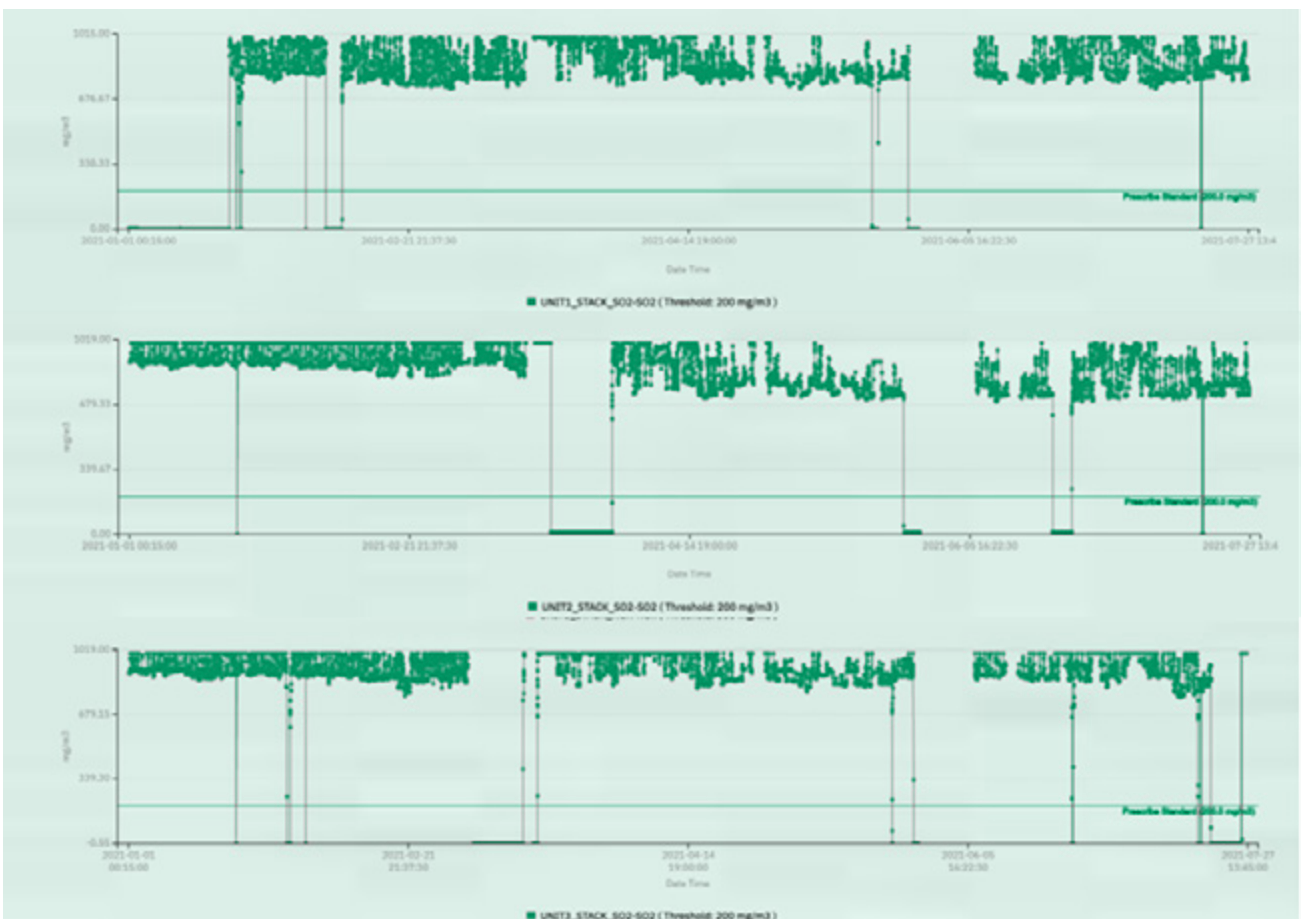
# Annex I

## North Chennai Thermal Power Station





## Vallur Thermal Power Station

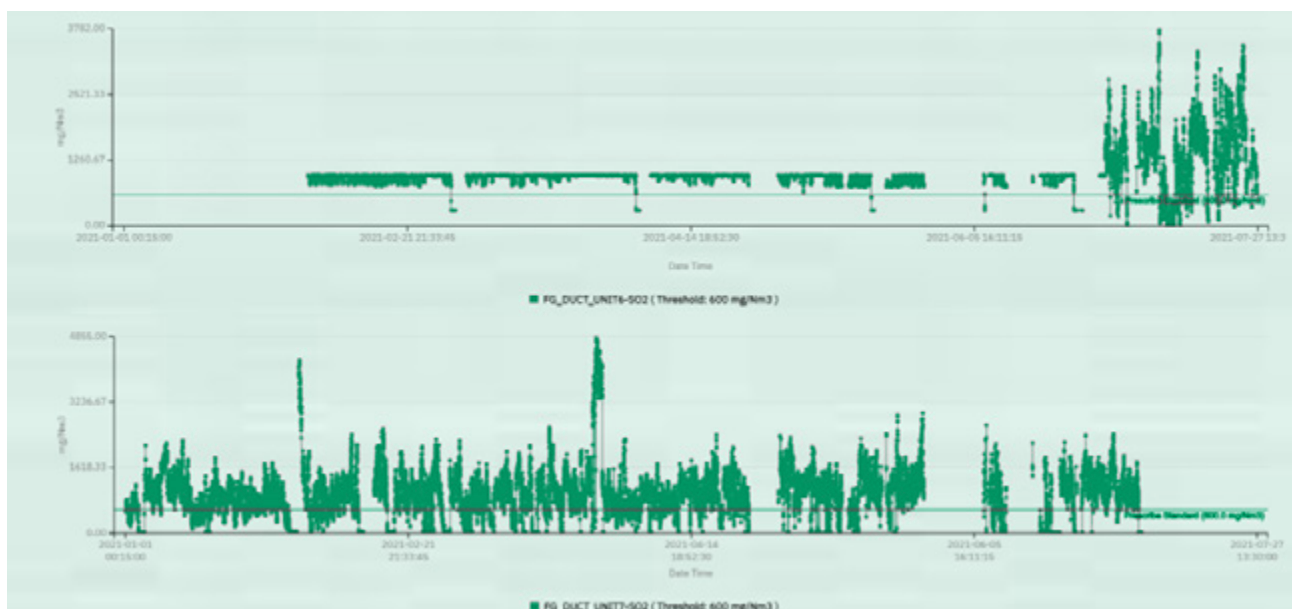
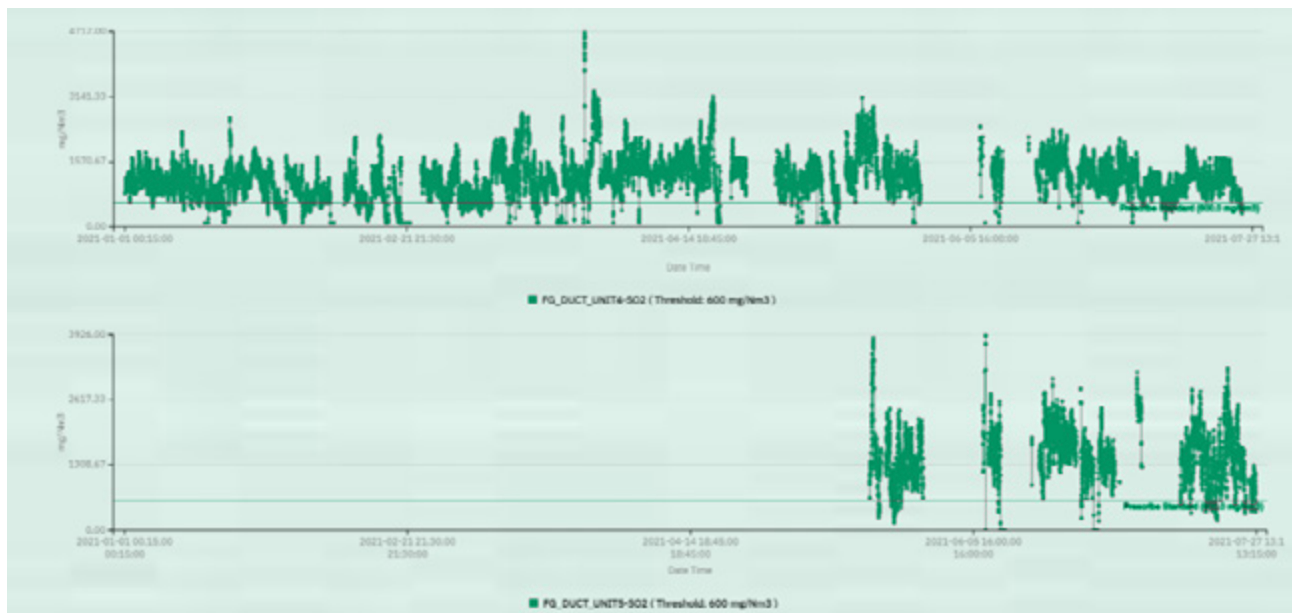


## Neyveli Lignite Corporation (NLC), Tuticorin



## Neyveli Lignite Corporation (NLC) 2

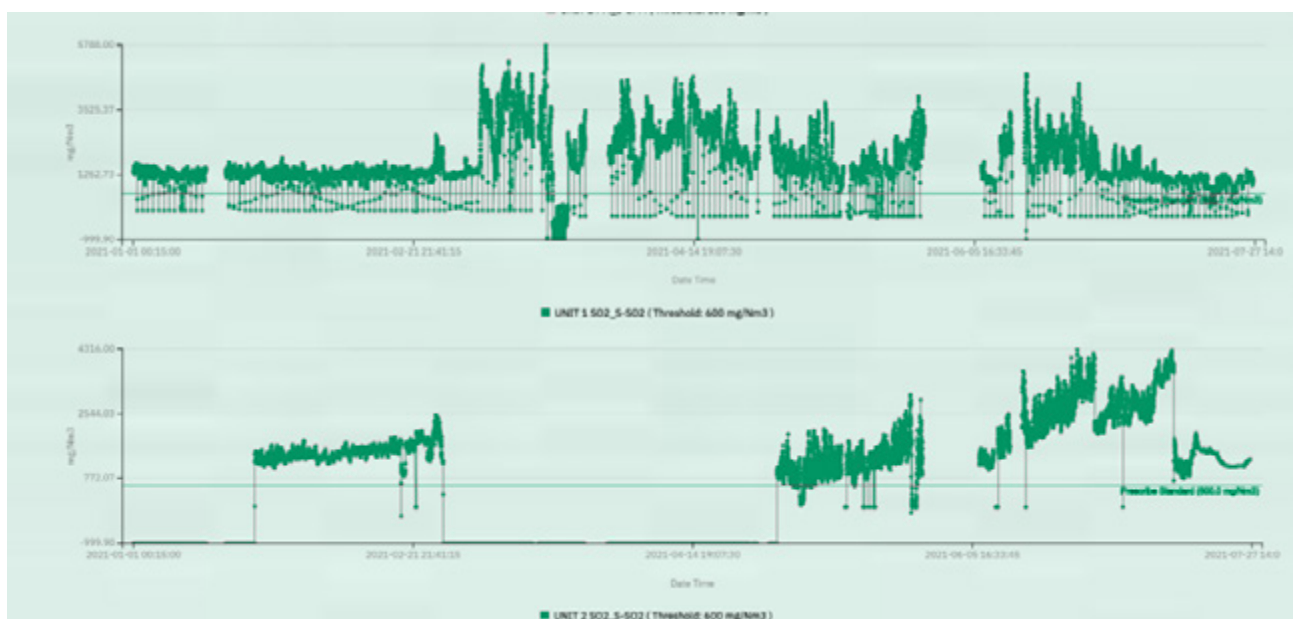




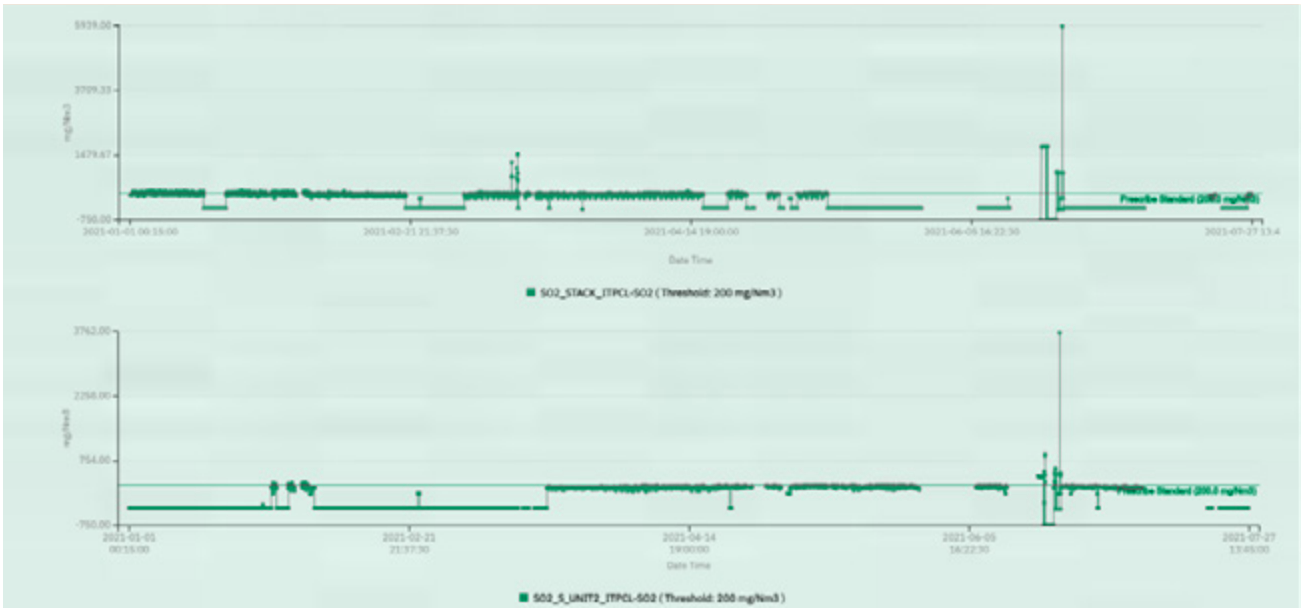
## Neyveli Lignite Corporation (NLC) 2 Expansion



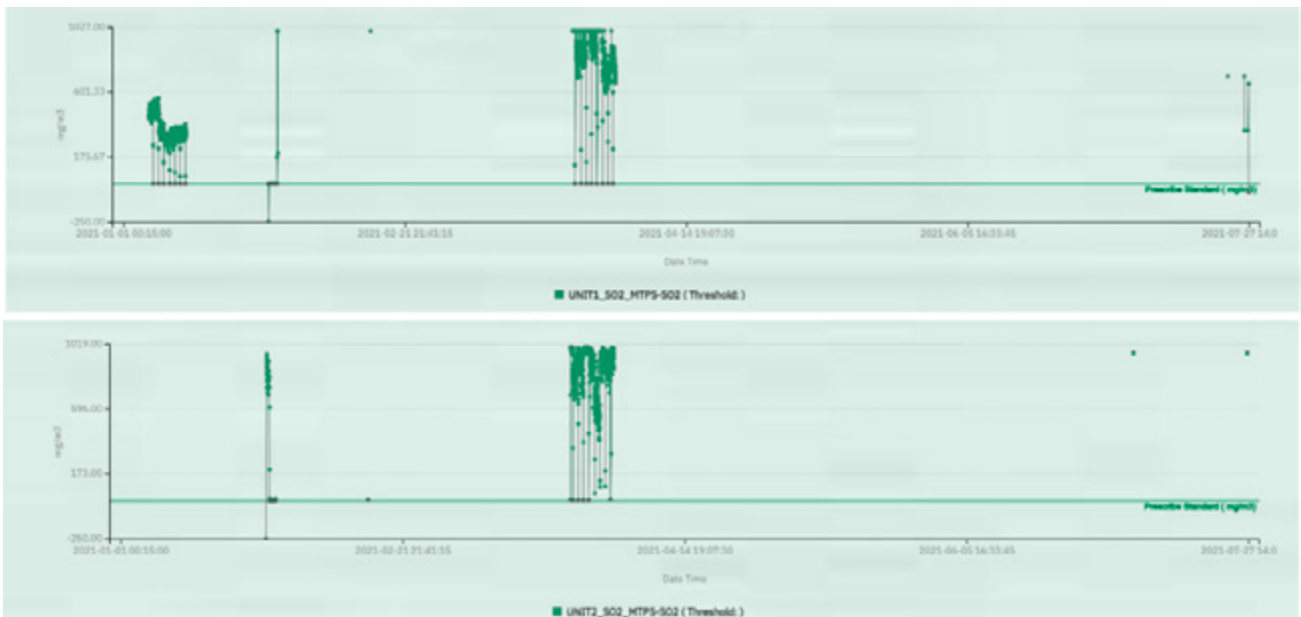
## Neyveli Lignite Corporation (NLC) 1 Expansion

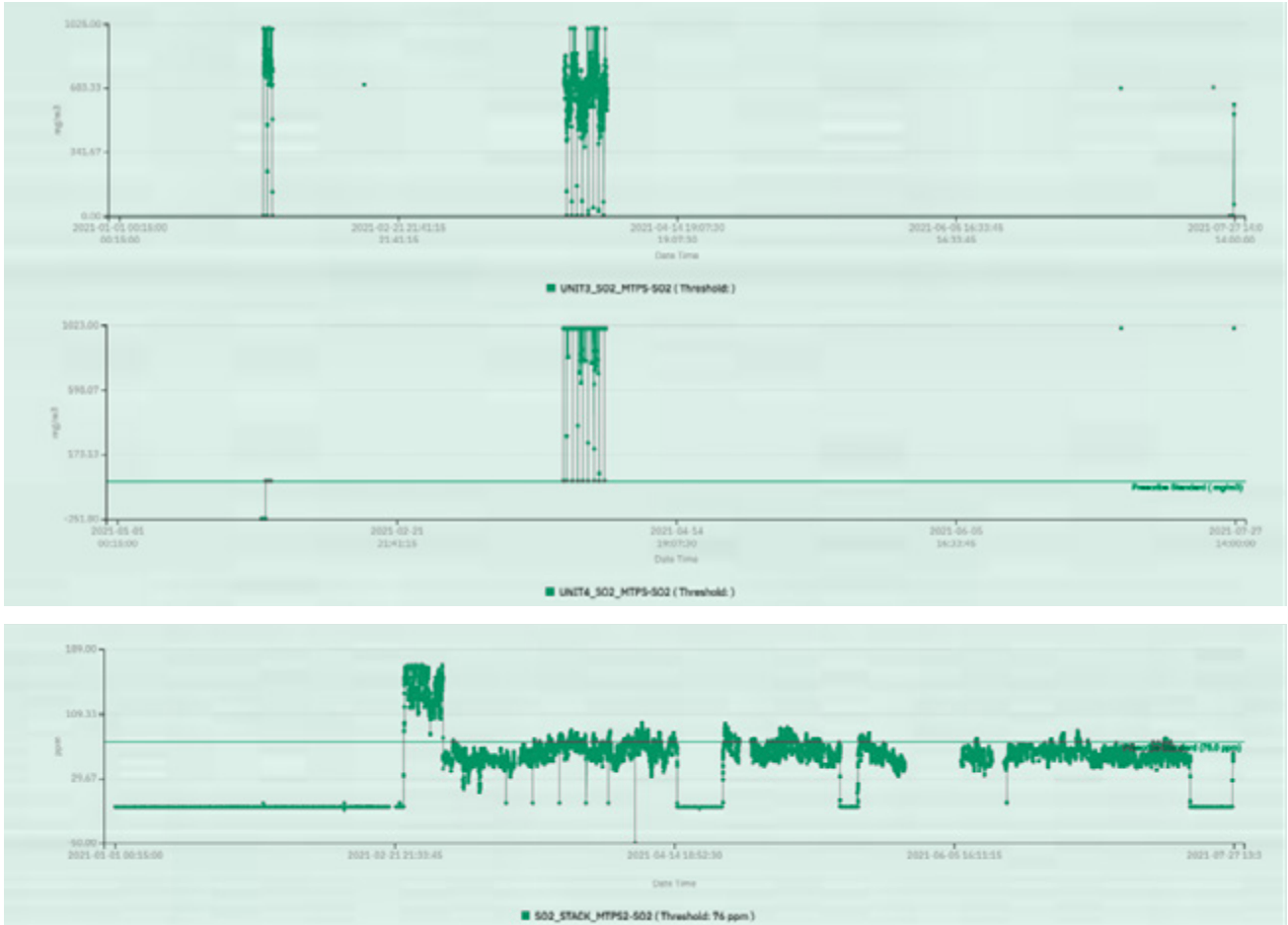


## IL&FS Tamil Nadu Power Company Ltd, Cuddalore



## Mettur Thermal Power Plant

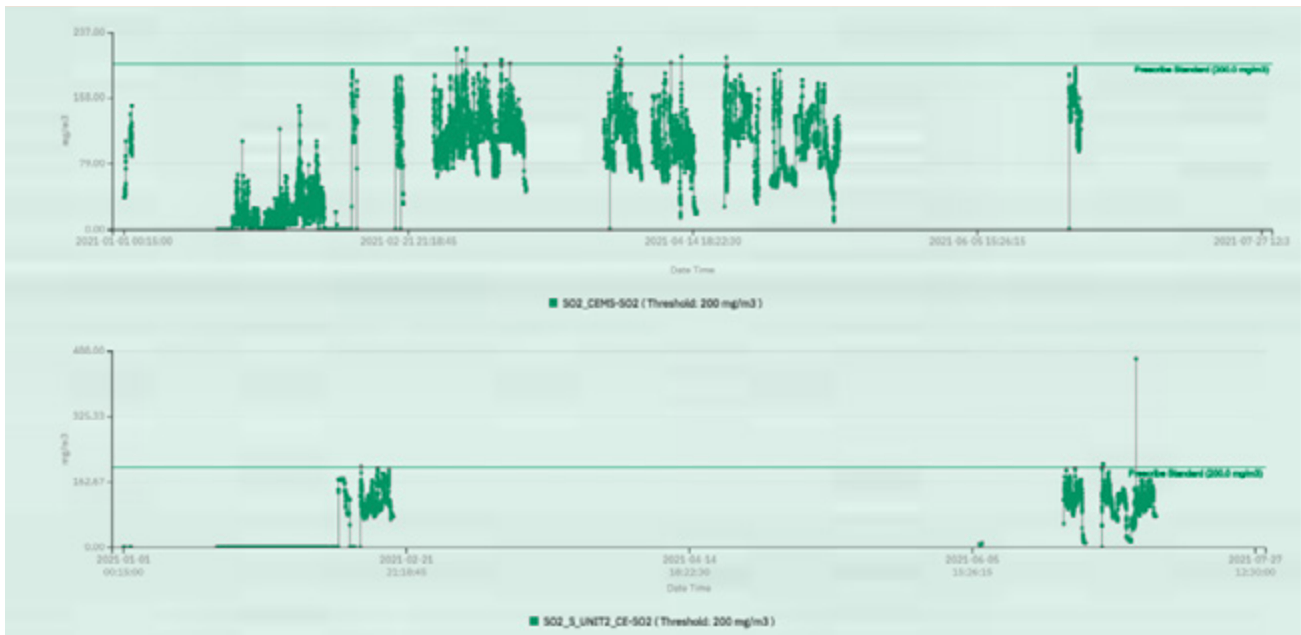




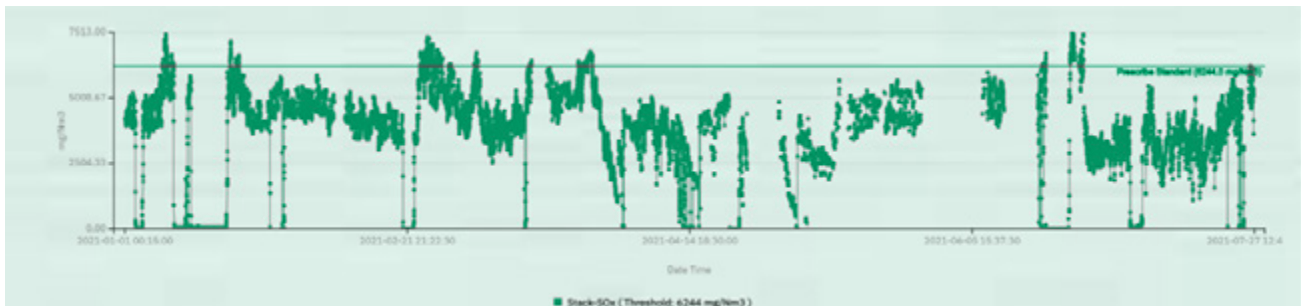
## Tuticorin Thermal Power Station, TANGEDCO



## Mutiara Thermal Power Plant (Coastal Energen)



## Taqā Neyveli Power Company

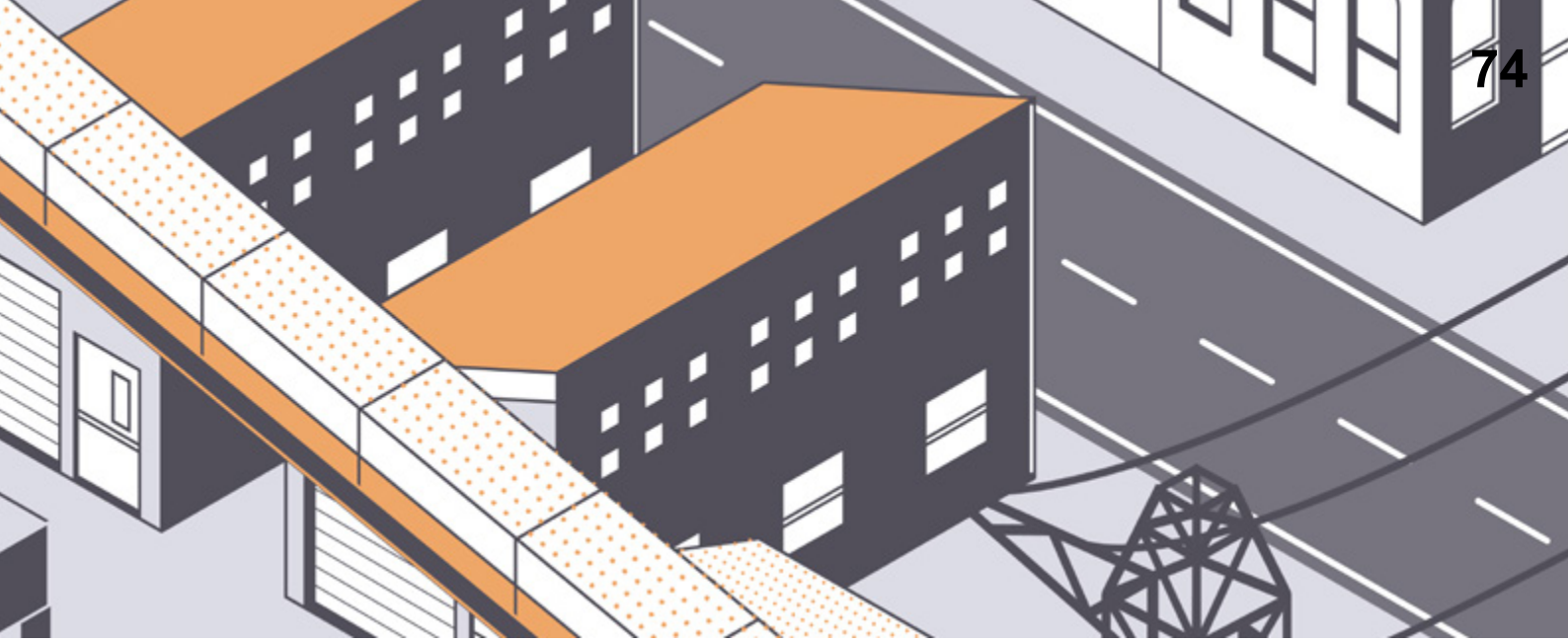


## 8.0

---

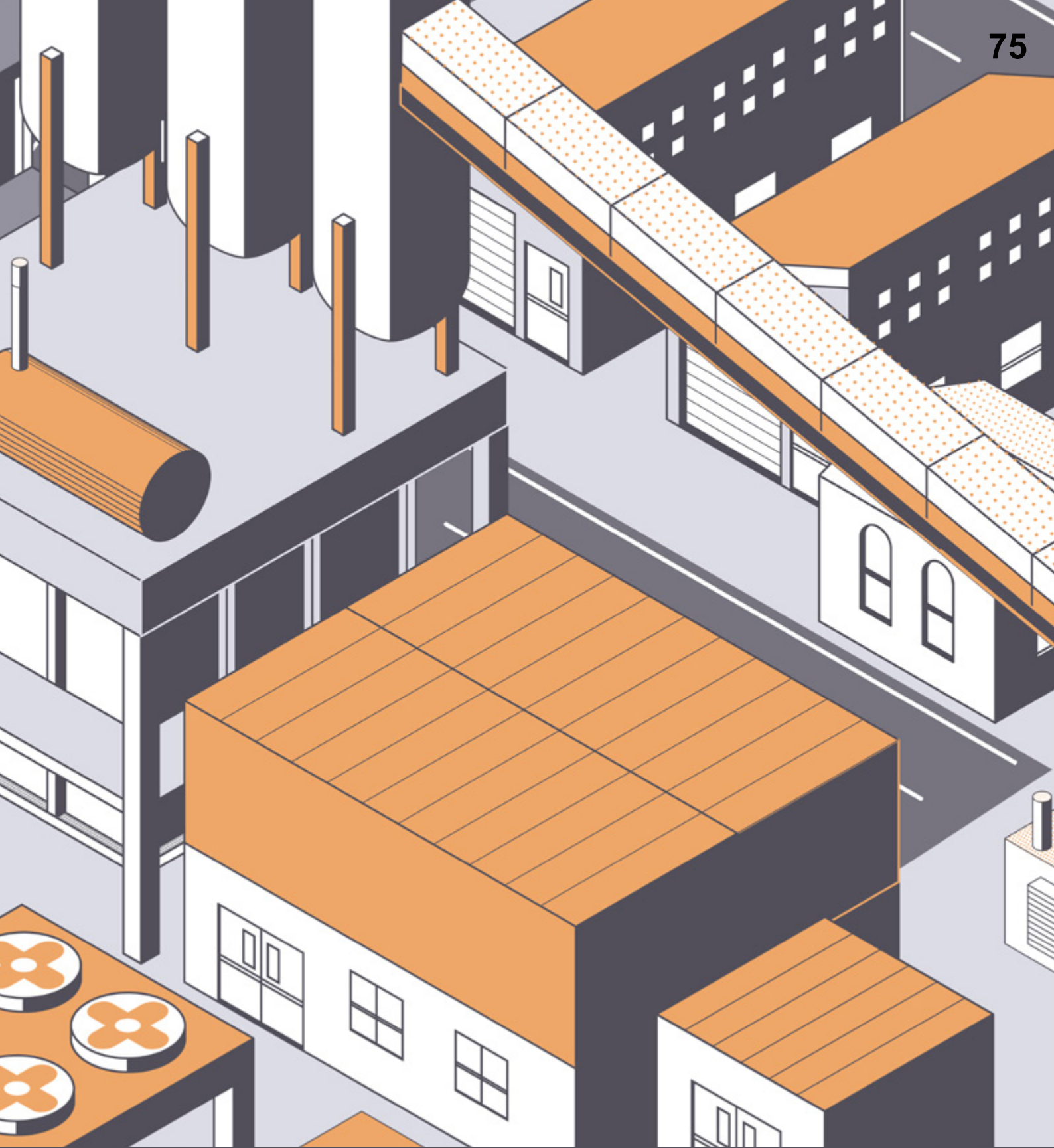
## Endnotes

- 1 [www.iqair.com/world-most-polluted-cities](http://www.iqair.com/world-most-polluted-cities)
- 2 [www.tnpcb.gov.in/air-quality.php#collapseJul2121\\_13](http://www.tnpcb.gov.in/air-quality.php#collapseJul2121_13)
- 3 [www.tnpcb.gov.in/pdf\\_2021/caaqms\\_01\\_08\\_21.PDF](http://www.tnpcb.gov.in/pdf_2021/caaqms_01_08_21.PDF)
- 4 [www.greenpeace.org/static/planet4-mena-stateless/a372e5fe-so2-report-english.pdf](http://www.greenpeace.org/static/planet4-mena-stateless/a372e5fe-so2-report-english.pdf)
- 5 [www.ehp.niehs.nih.gov/doi/abs/10.1289/ehp.00108941](http://www.ehp.niehs.nih.gov/doi/abs/10.1289/ehp.00108941)
- 6 [www.nature.com/articles/7500464](http://www.nature.com/articles/7500464)
- 7 [www.academic.oup.com/aje/article/187/8/1586/4996680?login=true](http://www.academic.oup.com/aje/article/187/8/1586/4996680?login=true)
- 8 [www.ehp.niehs.nih.gov/doi/full/10.1289/ehp.1509777](http://www.ehp.niehs.nih.gov/doi/full/10.1289/ehp.1509777)
- 9 [www.ehp.niehs.nih.gov/doi/full/10.1289/ehp.1103618](http://www.ehp.niehs.nih.gov/doi/full/10.1289/ehp.1103618)
- 10 [www.pnas.org/content/110/32/12936.short](http://www.pnas.org/content/110/32/12936.short)
- 11 [www.pnas.org/content/118/5/e2017936118.short](http://www.pnas.org/content/118/5/e2017936118.short)



- 12 [www.adc.bmj.com/content/70/4/305.short](http://www.adc.bmj.com/content/70/4/305.short)
- 13 [www.pnas.org/content/118/5/e2017936118](http://www.pnas.org/content/118/5/e2017936118)
- 14 [www.greenpeace.org/static/planet4-india-stateless/2018/12/21b5f97a-health-and-environmental-benefits-of-implementing-emission-standards-for-coal-based-tpps\\_final.pdf](http://www.greenpeace.org/static/planet4-india-stateless/2018/12/21b5f97a-health-and-environmental-benefits-of-implementing-emission-standards-for-coal-based-tpps_final.pdf)
- 15 [www.ncmedicaljournal.com/content/79/5/289.short](http://www.ncmedicaljournal.com/content/79/5/289.short)
- 16 [www.npp.gov.in/public-reports/cea/monthly/generation/18%20col%20act/2021/JUN/18%20col%20act-16\\_2021-JUN.pdf](http://www.npp.gov.in/public-reports/cea/monthly/generation/18%20col%20act/2021/JUN/18%20col%20act-16_2021-JUN.pdf)
- 17 [www.tnpcb.gov.in/pdf/Annual\\_Report/CEPI\\_MttrRpt4920.pdf](http://www.tnpcb.gov.in/pdf/Annual_Report/CEPI_MttrRpt4920.pdf)
- 18 [www.npp.gov.in/public-reports/cea/monthly/generation/18%20col%20act/2021/JUN/18%20col%20act-16\\_2021-JUN.pdf](http://www.npp.gov.in/public-reports/cea/monthly/generation/18%20col%20act/2021/JUN/18%20col%20act-16_2021-JUN.pdf)
- 19 [www.cea.nic.in/wp-content/uploads/tprm/2021/02/summary\\_feb21.pdf](http://www.cea.nic.in/wp-content/uploads/tprm/2021/02/summary_feb21.pdf)





## Emission watch

Status assessment of SO<sub>2</sub> emission and FGD installation for coal-based power plants in Tamil Nadu

# POWERing Pollution

The Environmental Impacts  
of Thermal Power Stations  
and Mining Operations in  
Neyveli & Parangipettai

August 2023



manthan  
मंथन अध्ययन केंद्र



# AUTHORS AND ACKNOWLEDGEMENTS

**Organizations Participating in the  
Study and Publishers of the  
Report**

**Poovulagin Nanbargal  
Manthan Adhyayan Kendra**

*August 2023*

**Authors**

**Shripad Dharmadhikary**, Manthan Adhyayan Kendra  
**Prabhakaran Veeraarasu**, Poovulagin Nanbargal  
**Jenny Mariadhas**, Poovulagin Nanbargal  
**Medha Kapoor**, Researcher  
**Rachel Pearlín**, Researcher

**Maps**

**Lokesh P**

**Photographers**

**Vignesh A**  
**Thiyagu Gurusev G.**  
**and Authors**

**Designer**

**Penmi Rungsung**

**Contact for Publishers and  
Authors**

**Prabhakaran Veeraarasu**  
Email: *prabhakaranenvi@gmail.com*

**Shripad Dharmadhikary**  
Email: *manthan.shripad@gmail.com*

**Water and Soil Sample Collection  
and Testing**

**Chennai Mettex Lab Private Limited**  
**Tamilnadu Test House Private Limited**



# TABLE OF CONTENTS

## 06 List of Abbreviations

## 07 List of Figures and Tables

## 10 Executive Summary

## 18 Introduction

## 19 NEYVELI - POWER PLANTS AND MINES

### Background

Neyveli Thermal Power Stations	20
Neyveli Mines I, IA and II	23
Proposed Expansion	24
Water Resources	24

### History of Pollution from the TPSs and Mines

Air Pollution	25
Water Pollution	26
Land Acquisition / Impact on Agriculture, Livelihoods	27
Health Impacts	27

### Experiences of Impacted Communities 29

Impact on Water Used for Irrigation and Drinking	30
Effects on Agricultural Land and Cattle	31
Impact on Health	32
Dust Pollution and its Impact	32
Impact of Displacement and Acquisition of Land on People	33

### Field Observations of Study Team

Water Discharge from NLC Mines and TPSs into Local Water Bodies	34
<i>NLC TPSs Effluents</i>	35
<i>NLC Mines Discharge</i>	37
Indiscriminate Dumping of Fly Ash in Common Spaces and Other Fly Ash Related Pollution	38
Dust / Ash Pollution	39
Compromised Agricultural Yield Due to the Use of Polluted Water for Irrigation	40

<b>Water and Soil Sampling, Testing and Results</b>	<b>41</b>
Parameters Tested and Standards Used	42
Findings of Sample Testing: Summary	44
Findings of Sample Testing: Details	47
<i>Drinking and Domestic Water Use Sources</i>	47
<i>Effluent Discharges</i>	48
<i>Ambient Water Body, Ambient Water Body Receiving Discharge</i>	49
<i>Agricultural Fields – Soil Samples</i>	49
<b>Conclusions</b>	<b>50</b>
<b>Recommendations for Way Forward</b>	<b>51</b>
Immediate Actions	51
Medium and Long term Actions	52

## 57 ITPCL CUDDALORE TPS

<b>Background</b>	<b>58</b>
Proposed Expansion	60
Water Resources	60
Other Natural Resources in the Vicinity	60
<b>Documentation of Social and Environmental Impacts till Date</b>	
Air Pollution	61
Impact on Fishing Communities	62
Employment	62
Other	63
<b>Experience of the Impacted Communities</b>	<b>63</b>
Impacts on the Fisherfolk (Pudukuppam Village, Fishing Village)	64
Impacts on Agriculture (Karikuppam Village, Farming Village)	64
Impacts on Health	64
Impacts from Dust Pollution	65
<b>Field Observation of Study Team</b>	<b>66</b>
<b>Water Sampling and Results</b>	<b>68</b>
Characterizing the Locations	68
Findings of Sample Analysis: Summary	68
<i>Drinking and Domestic Water Use Sources</i>	69
<b>Conclusions</b>	<b>70</b>
<b>Recommendations for Way Forward</b>	<b>71</b>
Immediate Actions	71
Medium and Long term Actions	71

## 73 Annexure 1

# LIST OF ABBREVIATIONS

Abbreviation	Expanded Form	Abbreviation	Expanded Form
<b>BIS</b>	Bureau of Indian Standards	<b>MoEFCC</b>	Ministry of Environment, Forests and Climate Change
<b>BOD</b>	Biological Oxygen Demand		
<b>CAG</b>	Citizen consumer and civic Action Group	<b>MTPA</b>	Million Tonnes Per Annum
		<b>MW</b>	MegaWatt
<b>CEA</b>	Central Electricity Authority	<b>NEP</b>	National Electricity Plan
<b>CFBC</b>	Circulating Fluidised Bed Combustion	<b>NGT</b>	National Green Tribunal
<b>CIA</b>	Cumulative Impact Assessment	<b>NLC</b>	NLC India Ltd. (Formerly Neyveli Lignite Corporation)
<b>COD</b>	Chemical Oxygen Demand		
<b>CPCB</b>	Central Pollution Control Board	<b>NNTPS</b>	Neyveli New Thermal Power Station
<b>CRZ</b>	Coastal Regulation Zone	<b>NOx</b>	Nitrogen Oxides
<b>CSR</b>	Corporate Social Responsibility	<b>NTPS</b>	Neyveli Thermal Power Station
<b>CTO</b>	Consent To Operate	<b>OB</b>	Overburden
<b>CWC</b>	Central Water Commission	<b>PLF</b>	Plant Load Factor
<b>DMFT</b>	District Mineral Foundation Trust	<b>PM</b>	Particulate Matter
<b>EAC</b>	Environmental Appraisal Committee	<b>SC</b>	Supreme Court
<b>EC</b>	Environment Clearance	<b>SO2</b>	Sulphur dioxide
<b>ECCR</b>	Environment Clearance Compliance Reports	<b>TDS</b>	Total Dissolved Solids
		<b>TNPCB</b>	Tamil Nadu Pollution Control Board
<b>EPA</b>	Environmental Protection Act	<b>TPS</b>	Thermal Power Station
<b>ESP</b>	Electrostatic Precipitator	<b>TSS</b>	Total Suspended Solids
<b>EXP</b>	Expansion	<b>USEPA</b>	United States Environmental Protection Agency
<b>EXT</b>	Extension		
<b>FGD</b>	Flue Gas Desulphurisation	<b>WHO</b>	World Health Organisation
<b>FoGD</b>	Focus Group Discussion		
<b>Ha</b>	Hectare		
<b>ITPCL</b>	IL&FS TamilNadu Power Company Limited		
<b>KLD</b>	Kiloliters per day		
<b>Mg/Nm3</b>	Milligram per Normal Meter Cube		
<b>MLD</b>	Million Liters per Day		

# LIST OF FIGURES AND TABLES

No.	Figure Description	Page No.
<b>Fig. 1</b>	Map showing thermal power plants and open cast mines operating in the Neyveli region.	<b>21</b>
<b>Fig. 2</b>	Villages where questionnaire survey and FoGD was conducted.	<b>30</b>
<b>Fig. 3</b>	Questionnaire survey being conducted at Adhandarkollai village.	<b>33</b>
<b>Fig. 4</b>	Water that is used to irrigate the fields and is the cause of people's skin disease as they walk on the field.	<b>35</b>
<b>Fig. 5</b>	Stream reportedly carrying water from Neyveli TPS I EXP.	<b>35</b>
<b>Fig. 6</b>	Small bunds created by the villagers to arrest lignite further down the same stream.	<b>35</b>
<b>Fig. 7</b>	Effluent directly discharged from NLC TPS II with plant boundary visible in the background.	<b>36</b>
<b>Fig. 8</b>	Black colour stream with oil in it.	<b>36</b>
<b>Fig. 9</b>	Stream carrying discharge from all TPS.	<b>36</b>
<b>Fig. 10</b>	Polluted stream opposite Mine II gate.	<b>37</b>
<b>Fig. 11</b>	Brown-Yellow colour of the discharge stream from Mine 1 and 1A.	<b>37</b>
<b>Fig. 12</b>	Ash dumped near the central water store.	<b>38</b>
<b>Fig. 13</b>	Ash dumped just outside of Neyveli II TPS.	<b>38</b>
<b>Fig. 14</b>	A kutchra road separating the homes of the people and Mine I boundary.	<b>39</b>
<b>Fig. 15</b>	Uncovered trucks carrying the residue to an unidentified location.	<b>40</b>
<b>Fig. 16</b>	Ash deposits on the field where the sugarcane plantation was burnt by the villagers.	<b>40</b>
<b>Fig. 17</b>	Agricultural patch of land that bore no yield.	<b>40</b>
<b>Fig. 18</b>	Map showing locations from first and second round of water and soil sampling.	<b>41</b>

No.	Table Description	Page No.
<b>Table 1</b>	Lignite Based Power Plants at Neyveli	<b>20</b>
<b>Table 2</b>	Average PLF of of Thermal Power Stations in Neyveli	<b>22</b>
<b>Table 3</b>	Details of NLC Mines at Neyveli	<b>23</b>
<b>Table 4</b>	List of Villages where Questionnaire Survey and FoGD was Conducted (Neyveli)	<b>29</b>
<b>Table 5</b>	Summary of Findings from Test Results (Classification of Locations) (Neyveli)	<b>44</b>
<b>Table 6</b>	Details of Sampling Locations and Test Results for Round One	<b>45</b>
<b>Table 7</b>	Details of Sampling Locations and Test Results for Round Two	<b>47</b>
<b>Table 8</b>	Details of ITPCL Plant	<b>58</b>
<b>Table 9</b>	Fly Ash Utilization Levels of ITPCL TPS Between 2019 and 2022	<b>58</b>
<b>Table 10</b>	List of Villages where Questionnaire Survey and FoGD was Conducted (ITPCL)	<b>63</b>
<b>Table 11</b>	Summary of Findings from Test Results (Classification of Locations) (ITPCL)	<b>68</b>



# EXECUTIVE SUMMARY

## BACKGROUND

M/S NLC India Limited (formerly Neyveli Lignite Corporation, referred hereinafter as NLC) set up in 1956, operates 3 opencast lignite mines and 4 lignite based pit head thermal power stations (TPS) in Cuddalore district (Kurinjipadi, Panruti, Bhuvanagiri, Virudhachalam taluks) in Tamil Nadu.

While NLC run TPSs and mines form the core of Neyveli town's economic base (since the 1950s), they have failed to deliver on its strategy of being a “*socially responsible company*” along with having a “*minimum impact on environment and fulfilling the aspirations of various stakeholders*”.

Quite the contrary, NLC operated TPSs and mines have a longstanding history of extensive air, water and land pollution along with serious problems faced by people due to land acquisition. These issues have been well documented by the media, local citizens, civil society organizations and various agencies. In spite of this, the pollution and displacement related problems persist.

In the same district, on the coastal belt, M/S IL&FS TamilNadu Power Company Limited (ITPCL) operates a sea water based 2x600 MW imported coal based power plant in Parangipettai, a coastal town located on the north bank of Vellar river. Similar to Neyveli, the Parangipettai region also suffers from adverse impacts from the ITPCL TPS operations in terms of air, land, water pollution, as well as the impact on the fishing community and health of local people. Despite its documentation by the media, local citizens, civil society organizations and various agencies, the pollution and issues persist.

## OBJECTIVE AND APPROACH OF THE STUDY

Given this, Poovulagin Nanbargal and Manthan Adhyayan Kendra together have carried out a comprehensive assessment in both Neyveli and Parangipettai regions with the involvement of the local communities to understand the status of the documented issues, bring out new issues that may have not been previously highlighted, identify sources of pollution and suggest ways in which the issues could be addressed.

The study has followed a four-tier approach. First is the literature review of the documented environmental and pollution issues. The second tier is field observations to understand the current status of the documented issues. The third tier involved carrying out water and soil sampling and testing to understand water and soil

quality issues in the areas, and fourth has been questionnaire-based surveys and Focus Group Discussions to gather the experiences of local communities who are directly affected by the activities of NLC TPSs and the mines and ITPCL TPS.

## DOCUMENTATION BY MEDIA, LOCAL CITIZENS, CIVIL SOCIETY

### Neyveli

The documentation includes reports of high SO<sub>2</sub> stack emissions from NLC TPSs; coal dust and fly ash plaguing homes and lives of people causing health issues; high concentration of heavy metals in water due to discharge of mine water, fly-ash pond water, and effluents from associated industries; steady depletion of groundwater table and loss of aquifers, degradation of water quality; unsatisfactory to no employment generation by NLC for the people whose land has been acquired (multiple times in some cases); inadequate compensation given to land oustees and health issues primarily pertaining to kidney, skin and respiratory tract.

### Parangipettai

The documentation includes reports of coal dust pollution in the area near the ITPCL power plant from the coal stock yard and coal unloading area of the TPS, and from coal transportation; and its subsequent impact on health. It also highlights the loss of space to berth boats of the fisherfolk, damage to their fishing boats, the reduced quality and number of fish catch; inadequate employment given to locals by the plant authorities; and possible polluted discharge into the Buckingham canal.

## REPORTS BY OFFICIAL AGENCIES

### Neyveli

In 2022 Cuddalore district was identified and declared as a mine affected area by the District Mineral Foundation Trust (DMFT) due to adverse impacts of mining of lignite and other minerals by the NLC.

In May 2022, the National Green Tribunal (NGT) heard a matter against the grant of Environment Clearance to NLC's TPS II 2<sup>nd</sup> Expansion in which it was argued that the instances of kidney related diseases have been increasing to which NLC responded saying that none of the kidney related issues are due to operations of its thermal units.

The NGT directed NLC to conduct a health survey in the villages of the project impact area to ascertain the impact of its activities on the health issues. To the best of our information, this has not yet been done.

## EXPERIENCES OF THE IMPACTED COMMUNITIES

### Neyveli

A detailed questionnaire-based survey was conducted in 7 villages with Focus Group Discussions in all 7 villages. Further, 101 individuals were interviewed in these villages spread out around NLC TPSs and mines. People responded to the survey narrating a huge number of problems faced by them due to the NLC TPSs and lignite mines.

These include worsening of water quality over the years; groundwater depletion; fly ash laden water from NLC plants getting mixed with streams used for irrigation and other uses; coal dust and fly ash settling on fields; reduced quantity and quality of agricultural yield; reduced milk yield from cattle; prevalence of kidney, skin and respiratory diseases; increased occurrence of diseases due to fly ash from TPS, coal dust from mines, mixing of fly ash with water and NLC discharges polluting water; difficulty in access to treatment due to the cost of treatment and distance from medical facilities; reduced land area for cultivation after acquisition by NLC; inadequate or no compensation from NLC for land acquired from the people; and no jobs/no permanent jobs given to people.

### Parangipettai

A detailed questionnaire-based survey was conducted in two villages (Karikuppam and Pudukuppam) with Focus Group Discussions in both villages and individual interviews with 11 people in these villages around the ITPCL TPS. People responded to the survey narrating a number of problems faced by them due to the operations of ITPCL TPS.

These include reduction in daily fish catch from 300 to 100 (reportedly due to discharge of hot water by the M/S ITPCL into the sea), reduction in variety and quality of fish; loss of access to the traditional fishing route; fly ash and coal dust from the coal handling, coal storage area of the TPS, and from coal transportation settling on the agricultural land affecting the yield and soil fertility causing loss of income; groundwater quality degradation; prevalence of lung and skin diseases; difficulty in access to treatment due to the distance from medical facilities; and fly ash and coal dust pollution caused by ash dump/handling/pipeline, coal bunker and stack of the ITPCL TPS.



## WATER AND SOIL SAMPLING AND TESTING

In both areas – Neyveli and Parangipettai, water and soil samples were collected and water samples were tested for basic parameters like pH, TDS, alkalinity, TSS etc. as well as for heavy metals, and some of the samples were tested for COD and oil and grease; whereas soil samples were tested for 12 parameters as per the Soil Health Card and for heavy metals. While individual parameters were assessed against the relevant standards, we also used a broad thumb-rule criteria based on which parameters are exceeding limits, the extent of the exceedance etc. to classify sites into **Seriously Contaminated, Significantly Contaminated, Some Contamination and No Contamination.**

### Neyveli

Samples of ground and surface water, as well as soil were collected from 20 locations in the first round and from 11 locations in the second round, to assess the water and soil quality of the area.

The sampling results reveal that there is extensive pollution of local water and soil resources. Several effluent discharge streams coming from mines and TPSs had critical parameters exceeding the legally binding limits, polluting local water and land resources. Several of the drinking water sources were found seriously contaminated with high levels of Mercury, Selenium, Fluoride etc.

More generally, several surface as well as groundwater sources were found to have high levels of turbidity, hardness, Total Dissolved Solids (TDS), Total Suspended Solids (TSS), Oil and Grease, high Chemical Oxygen Demand (COD) and presence of elements like Aluminium, Boron, Fluoride, Iron, Manganese, Magnesium, Mercury and Selenium in high concentration.

Both rounds of soil sampling revealed contamination with high levels of Nickel, Zinc, Copper, Chromium, Selenium and low pH. Both soil samples from the second round had high concentrations of Selenium. Broadly, out of 20 locations in the first round, 9 locations were found to be Seriously Contaminated and 9 Significantly Contaminated whereas in the second round, out of 11 locations tested, 8 were Seriously Contaminated and 2 Significantly Contaminated.

For instance, the sample taken from the borewell at Tholkappiar Nagar, Vadakuvellur (Location R2-S8) showed mercury levels around 250 times higher than the limit. People in the location drink this bore water. There are many kidney patients, people affected with lung disease, cancer patients and skin diseases among the community in Tholkappiar Nagar.

### Parangipettai

6 samples of ground and surface water as well as soil were collected in a single sampling round here to assess the water and soil quality of the area. Out of these, 3 locations were found to be Seriously Contaminated and 2 Significantly Contaminated.

The sampling results reveal that there is heavy pollution in drinking and domestic water sources of the people at Karikuppam village. Borewell water used for drinking and domestic purposes is contaminated with turbidity, hardness, alkalinity, TDS, Fluoride, Iron, Calcium, Magnesium and Silicon all exceeding the limits. The canal near the ITPCL TPS in which there are occasional discharges from the TPS was found to be contaminated with turbidity, hardness, high chlorides and Iron. The soil sample from Karikuppam was found to be seriously contaminated with Boron and it was low in Organic Carbon. Farmers report that paddy does not survive in the soil, because of which many have changed their occupation from farmers to laborers.

## FIELD OBSERVATIONS OF THE STUDY TEAM

### Neyveli

During the visits of the study team to the area, the team directly observed many instances of pollution and violation of environmental norms; and also heard many stories of such instances from local communities. Some of the important observations of the team are given below.

Several streams in the area are massively polluted. They are dark in colour, have a foul odor and carry oil and grease. Many streams carry ash and effluent discharges from TPSs or mines. These streams then merge into other water streams, or other local water bodies like ponds, thus spreading the pollution extensively over the area, including to groundwater. Many of these streams and water bodies are used by local communities for various purposes. For example, several of these streams meet Walajah lake which is a major source of irrigation. There is ash deposition in agricultural fields that is carried with water. It adversely impacts the quality and quantity of the yield.

There is indiscriminate dumping of fly ash in common spaces. These ash dumps are places from where ash is easily blown by the wind and deposited on people's homes, land, crops, water sources etc; and it can also run-off into local water bodies. All of this creates severe pollution and health hazards.

There is rampant dust pollution in the area from fly ash and coal dust. Dry fly ash from the ash pond and from illegal ash dumps gets blown by the wind and gets deposited on roads/crops/trees. Dust blows from Mine I into the homes of people across the road (due to lack of any green belt around the mine). Uncovered trucks carry residue composed of sand, ash and some lignite particles that are left after combustion of lignite, and dump it in unknown locations, leading to dust and other pollution.

All these instances clearly show that people around the NLC TPSs and coal mines suffer from the severe impact of persistent and unchecked pollution affecting air, land and water. Despite such glaring evidence of rampant and unchecked pollution caused by the NLC TPSs and mines, there is no meaningful response given to the local people by the authorities despite repeated attempts of reaching out to them by the affected communities.

### Parangipettai

During the visit to the study area, persistence of pollution was found and reported. Some important observations are as follows:-

In Pudukuppam, M/S ITPCL plant operations have contaminated the groundwater that people used for drinking, and rendered it unfit for use. Even the piped drinking water they receive from Neyveli is not of good quality. Instead, they now have to purchase water for drinking and cooking.

Coal dust pollution is rampant in Pudukuppam village. Fly ash settles on trees and crops. The rail wagons that carry coal are mostly open and rarely covered. In the Buckingham canal which is one of the two discharge locations of the TPS, reportedly, a large number of fish die whenever there is a discharge into it from the TPS.

The fishing community of Pudukuppam do not have easy access to the sea anymore, their fish catch has reduced and the quality and variety of fish has also reduced.

## RECOMMENDATIONS FOR WAY FORWARD

### Neyveli

#### ONE

M/S NLC India Ltd. should undertake immediate steps to stop all pollution including dust pollution, dry fly ash pollution and discharges/leakages of untreated waste/ contaminants into natural water bodies from mines and thermal power plants.

#### TWO

TNPCB and MoEFCC should put in place a mechanism to monitor this. There should be strict action against the power plants including fines and penalties or temporary suspension of plant operations if the pollution persists.

#### THREE

A formal and legally recognized committee of key officials from M/S NLC India Ltd, representatives/village panchayat heads of the villages in the vicinity of respective projects, along with representatives of civil society groups and independent experts should be set up to monitor the progress from the local people's point of view. This committee can be under the ambit of a TNPCB and MoEFCC mechanism that needs to be put in place to undertake some immediate remediation measures and medium-term monitoring.

#### FOUR

There must be a comprehensive assessment of damage already caused to the environment, livelihood and the health of human beings and cattle and compensation for the same, as well as measures for and mitigation and amelioration of the impacts till date. A technical committee consisting of representation from the TNPCB, MoEFCC and with participation of the monitoring committee should be set up and must undertake this assessment of the damages, arrive at a fair compensation and oversee its distribution among affected individuals and the affected communities.

#### FIVE

The implementation of recommendations made by the NGT in its Order of 31 May 2022 in the matter of P.Sundaravathanam vs Union of India and Others (Appeal No. 13 of 2019 (SZ)) should be taken up.

#### SIX

An extensive and appropriate network of health facilities should be created in the area by M/S NLC India Ltd. which can be accessed by the local community.

#### EIGHT

The people affected by land acquisition have put together a series of demands including proper assessment of the problems and provision of compensation and rehabilitation to all land affected people, and no more acquisition. This should be addressed urgently.

#### NINE

Since NLC has failed in controlling pollution and other impacts, persisting for decades, local communities have lost confidence that NLC will be able to address the problems. Given this, no new brownfield or greenfield coal thermal power projects and mining projects should be considered in the Neyveli region as this would add to the pollution load. Further, the Union Government should come up with a clear road-map and decommissioning plan for Neyveli Mines and power plants.

#### SEVEN

M/S NLC India Ltd. should ensure that all the eligible units follow the legally binding requirements of pollution control, including the 2015 norms for SO<sub>2</sub>, PM, NO<sub>x</sub> and Mercury emissions and the 2019 Notification for disposal of fly ash in mine voids. It should ensure the installation of necessary equipment like FGD, ESP etc. in accordance with the revised timeline of compliance norms.

## Parangipettai

### ONE

M/S ITPCL should undertake immediate steps to stop all pollution including dust pollution, fly ash pollution and discharges/leakages of untreated waste/ contaminants in the natural water bodies from its activities.

### TWO

TNPCB and MoEFCC should put in place a mechanism to monitor this. There should be strict action against the power plant including fines and penalties or temporary suspension of plant operations if the pollution persists.

### THREE

A formal and legally recognized committee of key officials from M/S ITPCL, representatives/ village panchayat heads of the villages in the vicinity, along with representatives of civil society groups and independent experts should be set up to monitor the progress from the local people's point of view. This committee can be under the ambit of TNPCB and MoEFCC mechanism that needs to be put in place to undertake some immediate remediation measures and medium-term monitoring.

### FOUR

There must be a comprehensive assessment of damage already caused to the environment, livelihoods and the health of human beings and cattle and compensation for the same, as well as measures for and mitigation and amelioration of the impacts till date. A technical committee consisting of representation from the TNPCB, MoEFCC and with participation of the monitoring committee should be set up and must undertake this assessment of the damages, arrive at a fair compensation and oversee its distribution among affected individuals and the affected communities.

### FIVE

As already mandated by the EC, M/S ITPCL TPS should undertake regular monthly marine monitoring along the impacted sea coast. The report by Annamalai University (which has been engaged by the plant to undertake the monitoring) must be made available in the public domain/ ITPCL website on a monthly basis.

### SIX

As mandated by the EC, fish catch along the impacted zone of the sea should be monitored periodically by the Department of Fisheries, Government of Tamil Nadu. This monitoring should be done on priority basis and the resultant report should be made available in the public domain. This monitoring should be done with the involvement of the local fishing community.

# INTRODUCTION

Cuddalore district is located on the eastern coastal region of Tamil Nadu, bordered by the Bay of Bengal on the east side with a coast line of 68 kms.

Cuddalore is flanked by Puducherry in the north and the mouth of Coleroon river in the south. Cuddalore district is endowed with lignite deposits; and is one of the major fishing towns of the state. Agriculture is the dominant sector of the district's economic mix, with 80% of the population depending on agriculture and allied activities.<sup>1</sup>

Neyveli is an industrial town located in the Cuddalore district. Neyveli town gained significance after discovery of abundant lignite reserves in the 1930s, after which the Neyveli Lignite Corporation (now NLC India Limited, referred to hereafter as NLC) was set up by the Government of India in 1956 for lignite production and electricity generation. NLC today operates 3 opencast lignite mines and 4 lignite-based pit head thermal power stations at Neyveli. NLC and its operational mines and thermal power plants form the largest share of Neyveli town's economic base.

M/S IL&FS Tamil Nadu Power Company Limited (ITPCL) has developed a sea water based 2 x 600 MW imported coal-based power plant along with a 30 MLD desalination plant and a proposed captive port in Parangipettai, Cuddalore district, Tamil Nadu. Parangipettai, is a panchayat town located on the north bank of the Vellar river and is one of the most densely populated areas of the region. Historically Parangipettai has been a major trading town and continues to be so. Being a coastal plant, it falls under the Coastal Regulation Zone (CRZ) notification.

---

<sup>1</sup> <https://cuddalore.nic.in/about-district/>





# NEYVELI

---

**Power Plants  
and Mines**

# BACKGROUND

## Neyveli Thermal Power Stations (NLC)

The NLC owns and operates 4 power plants currently at Neyveli. Neyveli TPS I, NLC's first lignite based thermal power station that became operational from 1962, was retired recently in September 2020 giving way to Neyveli New TPS in its place.

The stations currently under operation by NLC are Neyveli TPS II, Neyveli I [EXP], Neyveli II [EXP], Neyveli New TPS<sup>2</sup>. The Neyveli (Z) power station is operated by M/S TAQA, also known as the Abu Dhabi National Energy Company<sup>3</sup>. The details of these power plants are given in Table 1.

Table 1: Lignite Based Power Plants at Neyveli<sup>4</sup>

Power Plant	Capacity (in MW)	No. of Units	Age of Units (as in 2023)	
			Unit Number	Age (in years)
Neyveli II	1470 (210 x 7)	7	Unit 1	37
			Unit 2	35
			Unit 3	35
			Unit 4	32
			Unit 5	32
			Unit 6	31
			Unit 7	30
Neyveli I Expansion	420 (210 x 2)	2	Unit 1	21
			Unit 2	20
Neyveli II Expansion	500 (250 x 2)	2	Unit 1	11
			Unit 2	8
Neyveli New Thermal Power Station	1000 (500 x 2)	2	Unit 1	4
			Unit 2	2
Neyveli (Z) Neyveli TAQA power company Ltd	250 (1 x 250)	1	Unit 1	21

<sup>2</sup>Website of NLC [https://www.nlcindia.in/new\\_website/index.htm](https://www.nlcindia.in/new_website/index.htm)

<sup>3</sup><https://india.taqa.com/>

<sup>4</sup>[https://cea.nic.in/wp-content/uploads/pdm/2023/01/List\\_of\\_Power\\_Stations\\_31.03.2022.pdf](https://cea.nic.in/wp-content/uploads/pdm/2023/01/List_of_Power_Stations_31.03.2022.pdf)

All the older, 210 MW units (total 9 in number) had been slated for retirement as per the National Electricity Plan (NEP) 2018<sup>5</sup>, mainly because of reasons related to compliance with environmental norms relating to Flue Gas Desulphurisation (FGD). But they were not retired and in the latest NEP 2023 they are no longer slated for retirement.

See Map at Figure 1 for the location and layout of the power plants and the mines.

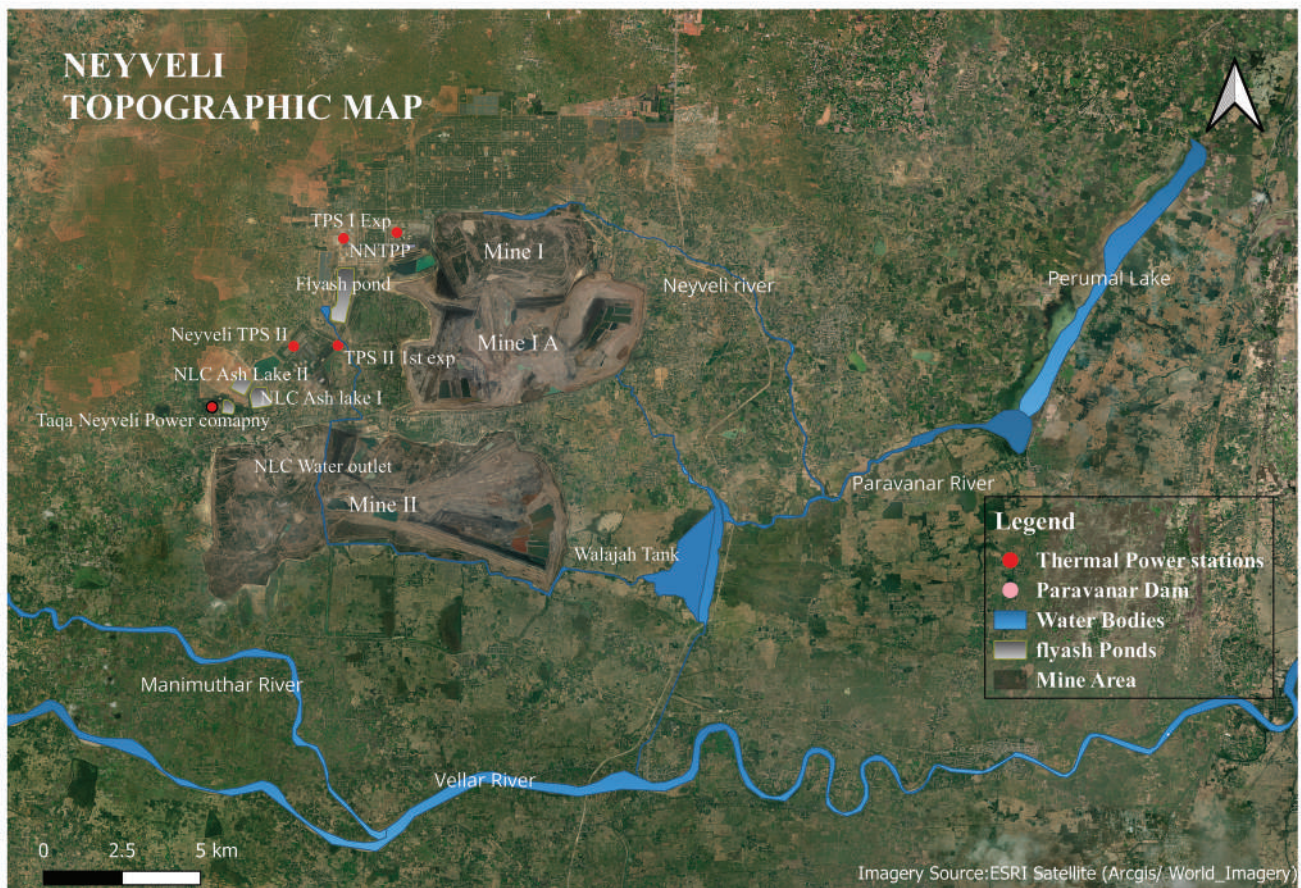


Figure 1: Map showing thermal power plants and open cast mines operating in the Neyveli region

<sup>5</sup> National Electricity Plan, Vol I, Generation, January 2018. Central Electricity Authority. Page 5.34 [http://cea.nic.in/reports/committee/nep/nep\\_jan\\_2018.pdf](http://cea.nic.in/reports/committee/nep/nep_jan_2018.pdf) Downloaded 19 April 2018

The average Plant Load Factor from 2016 to 2022 of thermal power stations (TPS) in Neyveli region is presented in Table 2<sup>6</sup>.

Table 2: Average PLF of Thermal Power Stations in Neyveli

TPS	Capacity (in MW)	Average PLF (2016 - 2022)
Neyveli TPS II	1470 (210 x 7)	76%
Neyveli I EXP TPS	420 (210 x 2)	85.2%
Neyveli TPS-II EXP	500 (250 x 2)	41%
Neyveli New TPS	1000 (500 x 2)	70%*
TAQA Neyveli TPS	250 (1 x 250)	55%

\*The PLF recorded for Neyveli New TPS is for the year 2021-22 only

The coal for Neyveli New TPS is sourced through a conveyor belt system from Mine I and Mine IA which are contiguous mines. Mine IA also supplies coal to Neyveli TAQA TPS. TPS II EXP receives coal from Mine II through a belt conveyor system. Neyveli I EXP and II source coal from the same basket of mines.

As for water utilization, Neyveli New TPS sources its water from mine water generated by pumped water from existing NLC mines<sup>7</sup>. This water is stored in a lake behind the location of erstwhile TPS I and TPS I EXP. TPS II and TPS II EXP meet their entire requirement by the discharge of Mine II after being treated in the water treatment plant located in TPS II EXP.

As per the reports of the Central Electricity Authority (CEA), all the Neyveli TPSs are meeting the requirement of 100% utilization of ash and for years 2019 to 2022, have annual utilisations of 100% or more. The CEA *Report on Fly Ash Generation At Coal / Lignite Based Thermal Power Stations And Its Utilization In The Country For The Year 2021 - 22*<sup>8</sup> reports that the legacy ash (total stock of ash) at various TPSs in Neyveli is 7.2453 million tons for Neyveli -II, 0.055 million tons for Neyveli II [EXP], and 0.2535 million tons for Neyveli TAQA TPS. For all other plants, it is reported as zero.

As per TPS II [EXP], it has achieved 100% utilization of ash since commissioning and therefore its 24 ha ash pond is not in use and is only a backup for emergency purposes. The plant has a dry fly ash collection system

installed, whereas the bottom ash is sent for backfilling of Mine II. Similarly, Neyveli New TPS has adopted a dry fly ash collection system and ash is sent to the ash pond only in emergencies. The TPS is making efforts to supply bottom ash to brick manufacturers but is also disposed off in mine fills. Neyveli I [EXP] and TPS II also use 100% dry fly ash disposal system. Bottom ash of TPS I is disposed off in the ash pond and bottom ash of TPS II is sent for mine backfilling and dry fly ash is sent to cement and brick manufacturers. The ash pond is for emergency purposes only. Neyveli TPS I [EXP], and TPS II [EXP] also feature emergency ash ponds. Neyveli TAQA TPS features a dry evacuation system for fly ash, and bottom ash is disposed off in the ash pond. This study has not been able to look at the ground situation of the fly ash disposal and utilization.

It should be noted that a significant amount of fly ash is being used for filling of mine voids. In 2019, CPCB brought out new Guidelines for use of fly ash in filling of mine voids and a MoEFCC Notification<sup>9</sup> of the same year makes these guidelines mandatory. This study has not been able to assess whether these guidelines are being followed. A matter of concern is that the EC for the mines mandates that the land recovered after backfilling should be made available for agriculture, but the 2019 guidelines state that ash filled land should not be used even for fruit trees. This issue needs to be considered.

As for emission control from the TPSs, the deadline for compliance with the 2015 emission norms is 2026 for

<sup>6</sup> <https://npp.gov.in/monthlyGenerationReportsAct>

<sup>7</sup> <https://environmentclearance.nic.in/Auth/openletter.aspx?EC=6385>

<sup>8</sup> [https://cea.nic.in/wp-content/uploads/tod/2022/08/Fly\\_ash\\_Generation\\_and\\_utilisation\\_Report\\_2021\\_22-1.pdf](https://cea.nic.in/wp-content/uploads/tod/2022/08/Fly_ash_Generation_and_utilisation_Report_2021_22-1.pdf) Accessed 20 June 2023

<sup>9</sup> *Guidelines for disposal/utilization of Fly Ash for reclamation of Low Lying Areas and in stowing of Abandoned mines/Quarries*

[https://environmentclearance.nic.in/writereaddata/public\\_display/circulars/KC9W7MKA\\_OM%20Flyash%20Final.pdf](https://environmentclearance.nic.in/writereaddata/public_display/circulars/KC9W7MKA_OM%20Flyash%20Final.pdf)

the Neyveli TPSs, and as far as the progress on installation of SO<sub>2</sub> pollution control technology (FGDs) is concerned, only ITPCL TPS is operating with an installed FGD and for only Neyveli New TPS and Neyveli TAQA TPS bids of FGD have been awarded. The other two - Neyveli TPS I [ EXP] and Neyveli TPS II are still in the bidding phase (status as of July 2023). Neyveli II EXP which operates with a CFBC boiler does not require FGD installation.<sup>10</sup>

## Neyveli Mines I , IA and II

Mine I, II and IA are opencast lignite mines that were commissioned in 1962, 1985 and 2003 respectively. Mine I, the oldest of all, is located at the northern part of the Neyveli lignite field. Mine IA is contiguous with Mine I located on the east side of it and Mine II is located south of Mine I. See Table 3 for the details of the mines. Coal evacuation from Mine I is done via belt conveyor system to the pit head TPSs<sup>11</sup>. For Mine IA, it's done via conveyors and tippers to silos. The rail wagons are loaded through silos.

Table 3 : Details of NLC Mines at Neyveli

Mine	Capacity (MTPA)	Type	Year of commissioning
Mine I	10.5	Lignite	1962
Mine II	15	Lignite	1985
Mine IA	3	Lignite	2003

Source: NLC Website

See Map at Figure 1 for the location of the mines as well as the power plants.

Regarding the handling of the overburden (OB), NLC has stated, through the ECCR documents, that the OB is being used for backfilling the mines and recovering land for agriculture. In particular, for Mine I *“dumping of overburden is being carried out in the de-coaled area and the mine is closed progressively and the dump is being vegetated continuously”* and the *“excavated Overburden is backfilled within the de-coaled area”*.<sup>12</sup> *“There is no delineated OB dumping area for Mine IA. Currently its being carried out in the de-coaled area of Mine I & IA.”*<sup>13</sup> For Mine II, *“the OB dump has attained its maximum allocated height of 65 m and concurrent*

*backfilling to ground level and rehabilitation work is being continuously carried out.”*<sup>14</sup> The ECCR documents also state that no groundwater extraction is done for Mines I and IA, and that 1083 ha of mining land of Mine I has been biologically reclaimed till September 2022 by filling the void with excavated soil and agriculture is being practiced on reclaimed area.<sup>15</sup> For Mine IA 340.27 ha of land has been reclaimed and has been brought under agricultural use till Sept 2022<sup>16</sup>. Mine IA is advancing in western direction, land for which is already under NLC's possession<sup>17</sup>.

<sup>10</sup> [https://cea.nic.in/wp-content/uploads/tprm/2023/06/Unit\\_wise\\_FGD\\_implementation\\_status\\_and\\_summary\\_sheet\\_June2023.pdf](https://cea.nic.in/wp-content/uploads/tprm/2023/06/Unit_wise_FGD_implementation_status_and_summary_sheet_June2023.pdf)

<sup>11</sup> [https://environmentclearance.nic.in/writereaddata/Compliance/0307202392575215NLCILMineIECCComplianceApril22toSep22\\_compressed\(2\).pdf](https://environmentclearance.nic.in/writereaddata/Compliance/0307202392575215NLCILMineIECCComplianceApril22toSep22_compressed(2).pdf)

<sup>12</sup> [https://environmentclearance.nic.in/writereaddata/Compliance/0307202392575215NLCILMineIECCComplianceApril22toSep22\\_compressed\(2\).pdf](https://environmentclearance.nic.in/writereaddata/Compliance/0307202392575215NLCILMineIECCComplianceApril22toSep22_compressed(2).pdf)

<sup>13</sup> <https://environmentclearance.nic.in/writereaddata/Compliance/0306202388636807NLCILMineIAECCComplianceReportNo13April22toSept22.pdf>

<sup>14</sup> [https://environmentclearance.nic.in/writereaddata/Compliance/06\\_Mar\\_2023\\_17364065384205505Oct-21toMar22.pdf](https://environmentclearance.nic.in/writereaddata/Compliance/06_Mar_2023_17364065384205505Oct-21toMar22.pdf)

<sup>15</sup> [https://environmentclearance.nic.in/writereaddata/Compliance/0307202392575215NLCILMineIECCComplianceApril22toSep22\\_compressed\(2\).pdf](https://environmentclearance.nic.in/writereaddata/Compliance/0307202392575215NLCILMineIECCComplianceApril22toSep22_compressed(2).pdf)

<sup>16</sup> <https://environmentclearance.nic.in/writereaddata/Compliance/0306202388636807NLCILMineIAECCComplianceReportNo13April22toSept22.pdf>

<sup>17</sup> [https://environmentclearance.nic.in/writereaddata/Compliance/06\\_Mar\\_2023\\_17370442380607037April22-Sept22.pdf](https://environmentclearance.nic.in/writereaddata/Compliance/06_Mar_2023_17370442380607037April22-Sept22.pdf)

However, it should be clarified that this study has not looked at the use of OB and the claimed recovery of land etc. which may be taken up in a next phase of the study. An important concern that needs to be flagged here is that since fly ash is also being used in the back filling of the mines, the safety in terms of use of the recovered land for agriculture is questionable.

## Proposed Expansion

In the pipeline is a second proposed expansion<sup>18</sup> by 1320 MW of Neyveli II TPS, stage II at Muthanai village 5 kms away from the present location to be set up adjacent to the existing TPS II and and TPS II Expansion. The land for this is already in possession of NLC and it is proposed to share the common emergency ash pond of TPS II and its water reservoir. The raw water requirement is proposed to be met from the water pumped out during mining operations of various NLC mines.

A new mine, Mine-III with capacity of 11.5 MTPA spread over an area of 4841.99 ha is also proposed to be set up to tap the lignite reserves available in the south of the existing Mine II to meet the fuel requirement of the proposed second expansion of TPS II. Lignite is proposed to be transported to the TPS via conveyor system. The proposed Mine III<sup>19</sup> has a water requirement of 900 KLD that will be sourced from the mine reservoir. The proposed mine also involves groundwater extraction and is located adjacent to the Vellar river.

## Water Resources

Cuddalore district falls under Vellar Pravar river basin. The major issues plaguing the river basin are the declining levels of groundwater and sustainability of wells. The Paravar river is a seasonal river that originates in the highlands northwest of NLC area (Mine II), i.e. from Semmakottai Reserve forest. The Vellar river originates in Salem and flows through Cuddalore, flows south of the Neyveli mines and TPS cluster and continues to flow east to meet the Bay of Bengal in Parangipettai where ITPCL Cuddalore plant is located. The Tamil Nadu Water Supply and Drainage Board (TWAD) notes that “Cuddalore district being a coastal zone is mostly covered by plain terrain, without any high relief zone except some sedimentary high ground in Virudhachalam, Cuddalore and Panruti blocks.

<sup>18</sup> <https://environmentclearance.nic.in/writereaddata/Form-1A/EC/102920181EClettertoNLCIndiaTamilnadu29102018.PDF>

<sup>19</sup> [https://www.google.com/url?q=http://environmentclearance.nic.in/auth/ECGeneral\\_Report.aspx?pid%3D16608&sa=D&source=docs&ust=1688460765666503&usg=AOvVaw2pJwyDOTBoK3wMkJ01bNVz](https://www.google.com/url?q=http://environmentclearance.nic.in/auth/ECGeneral_Report.aspx?pid%3D16608&sa=D&source=docs&ust=1688460765666503&usg=AOvVaw2pJwyDOTBoK3wMkJ01bNVz)



# HISTORY OF POLLUTION FROM THE TPSs AND MINES

The mines and the thermal power plants have been causing serious pollution in the district and this has been highlighted regularly by various agencies over the years. This is in addition to pollution from other industrial establishments. This has been documented by the media, by local communities, by civil society groups and by official agencies. We present some of these instances, focussing on the mines and power plants, to highlight that pollution has been rampant in the district.

In 2022 Cuddalore district was identified and declared as a mine affected area by the District Mineral Foundation Trust (DMFT)<sup>20</sup>, Cuddalore which was announced by the Union Minister of Mines, Coal and Parliamentary Affairs in the Rajya Sabha. The minister added that the whole district was declared a mine-affected area considering the adverse impact of mining of lignite and other minerals by the NLC.

## Air Pollution

The data on stack emissions of the power plants at Neyveli put out by CEA shows serious violations of the 2015 Norms which set the limits for emissions by power plants. For e.g., the report for February 2023<sup>21</sup> shows that all the 7 units of Neyveli TPS II (all 210 MW units) exceeded the SO<sub>2</sub> emission limits by 5-6 times, with even the minimum emission for several units being above the permissible limit. Even the Neyveli New TPS exceeded the limits for PM, SO<sub>2</sub> and NO<sub>x</sub> in the same month. This is a serious cause for concern. Technically, the units are not in legal violation, as the deadlines for meeting these norms have been pushed forward by the MoEFCC. Yet as all the units of 210 MW were planned to be retired as they may not be able to meet the norms and since they are not being retired, their ability and willingness to meet the norms remains a question.

TNPCB data also confirms that the CEA data given above is not a one-off occurrence but that the Neyveli TPSs are in continuous violation of emission limits. Real time emission data of SO<sub>2</sub> emissions of NLC II TPS on TNPCB website reveals that SO<sub>2</sub> emissions from TPS II (7 x 210 MW) have ranged from 800 mg/Nm<sup>3</sup> to more than 2600 mg/Nm<sup>3</sup> between June 2022 to June 2023 whereas the applicable norms are 600 mg/Nm<sup>3</sup>. SO<sub>2</sub> emissions from TPS 1 EXP roughly range between 500 - 5000 mg/Nm<sup>3</sup> between the same period and emissions of Neyveli TAQA roughly range between 2000 and 5000 mg/nm<sup>3</sup> and occasionally shoot up upwards of 7000 mg/Nm<sup>3</sup>.

It may be noted that the new emission norms for coal based thermal power plants were first notified in 2015 with a compliance deadline of 31.12.2017. However, the deadline has been revised multiple times and the deadline to comply with them currently stands at 31 Dec 2026 for SO<sub>2</sub> emissions and 31 Dec 2024 for other emissions for the NLC TPSs.

<sup>20</sup> <https://www.thehindu.com/news/national/tamil-nadu/entire-cuddalore-district-is-declared-a-mine-affected-area-union-minister/article65750591.ece>

<sup>21</sup> [https://cea.nic.in/wp-content/uploads/environmental\\_rep/2023/04/environment\\_status\\_report\\_Feb\\_2023.pdf](https://cea.nic.in/wp-content/uploads/environmental_rep/2023/04/environment_status_report_Feb_2023.pdf) Accessed 15 March 2023

A study was done in October 2021 by Poovulagin Nanbargal, Centre for Energy and Clean Air (CREA) and Asar<sup>22</sup> that assessed the status of SO<sub>2</sub> emission and FGD installation for coal-based power plants in Tamil Nadu. It identified Neyveli as one of the major coal burning clusters of Tamil Nadu that has repeatedly been highlighted as one of the SO<sub>2</sub> hotspots of the country, and even made it to the list of world's highest SO<sub>2</sub> emission hotspots in 2019 (*SO<sub>2</sub> is a very potent air pollutant that is a byproduct of combustion of fossil fuel such as coal containing Sulphur. SO<sub>2</sub> has been linked*

*to cardiovascular and respiratory diseases<sup>23</sup>. Thermal power plants are one of the largest emitters of SO<sub>2</sub>.)*

A media report titled “*Life amidst lignite: How coal dust is sparking a massive health crisis for Neyveli residents*” from 2017<sup>24</sup> narrates the story of residents living around Neyveli Township. It talks about how coal from mines and coal dust and ash from power plants carried by the winds, cake the homes of residents and cause respiratory issues.

## Water Pollution

A study done in 2005<sup>25</sup> titled “*Heavy Metal Pollution Assessment in Surface Water Bodies and its Suitability for Irrigation around the Neyveli Lignite Mines and Associated Industrial Complex, Tamil Nadu, India*” found high concentrations of heavy metals in the surface water from a range of 2 to 1200 times higher than average concentrations in river water worldwide. This was attributed to discharge of untreated mine water, fly ash pond water, and effluents from associated industries. The surface water bodies were in use for bathing, washing, and irrigation which may have led to deterioration of soils, surface water, and groundwater. The heavy metal analysis of mine water, fly ash pond and industrial effluents and the natural reservoirs revealed higher concentrations of Cobalt, Chromium, and Mercury than the recommended irrigation water quality standards. The study reports that higher concentrations of these heavy metals lead to their accumulation in soils and enter the food chain, leading to serious health hazards.

A 2013 study by Environics Trust<sup>26</sup> reported that extensive mining activities by NLC over a large area have completely transformed surface and groundwater regimes. Mining and its expansion have led to loss of potential surface storages and recharge. The groundwater is deeply impacted due to the unique hydrogeological conditions of the region - unconfined and semi-confined aquifers used to exist in upper layers and artesian aquifers in layers below lignite. Therefore, in order to reach the lignite, the shallow aquifers were destroyed and renewable storage capacity (the sand and sandy clay above the water) of groundwater was also lost. The artesian conditions of the water found below also posed a risk as the drilling of the ground would lead to immediate release of the

pressure of water underneath resulting in a sudden “burst”, resulting in a water gush up to 35 meters height. This was dealt with extensive pumping of water from the ground which ultimately also led to intrusion of seawater in the coastal aquifer east of the mines (as reported By Ministry of Water Resources).

The study also reports pollution of the surface streams from the pumped-out water and effluents from the coal stock yards of the thermal power plants. This rendered the stream between the mines and TPS totally unfit for human use. Heavy metals including fluoride were found in the stream and some wells of the study area. A study was quoted in the report that milk samples taken from cows and buffaloes along the banks of Paravanar river in and around Neyveli area indicated presence of higher levels of trace elements than the samples taken from unexposed areas.

According to Cuddalore disaster management plan of 2018<sup>27</sup> the rivers Sengal Odai and Middle Paravanar are continuously silted by NLC pumped water. Over long periods this drastically reduces the carrying capacity, which in turn creates heavy flooding in and around this area. In response, NLC says it has allocated its CSR funds to undertake strengthening works of the banks of the Sengal Odai to avoid flooding of 12 villages in the area and resultant property damage. As per the disaster management plan of 2021<sup>28</sup>, the desilting and strengthening work by NLC of both Sengal and Middle Paravanar Odai has been completed. However, it is not clear if the basic reason for the siltation happening in the first place - the sediment laden NLC pumped water - has been addressed. If not, the problem is sure to reoccur.

<sup>22</sup> [https://energyandcleanair.org/wp/wp-content/uploads/2021/10/TN-Emission-report\\_final.pdf](https://energyandcleanair.org/wp/wp-content/uploads/2021/10/TN-Emission-report_final.pdf)

<sup>23</sup> <https://www.epa.gov/so2-pollution/sulfur-dioxide-basics>

<sup>24</sup> <https://www.thenewsminute.com/article/life-amidst-lignite-how-coal-dust-sparking-massive-health-crisis-neyveli-residents-66256>

<sup>25</sup> <https://link.springer.com/article/10.1007/s10230-005-0087-x>

<sup>26</sup> <https://environicsindia.in/wp-content/uploads/2016/03/WaterinMiningAreasIndia.pdf>

<sup>27</sup> <https://cdn.s3waas.gov.in/s3a96b65a721e561e1e3de768ac819ffb/uploads/2018/07/2018070974.pdf>

<sup>28</sup> <https://cdn.s3waas.gov.in/s3a96b65a721e561e1e3de768ac819ffb/uploads/2021/12/2021120618-1.pdf>

## Land Acquisition / Impact on Agriculture, Livelihoods

A media report from 2017<sup>29</sup> narrates how the residents have been evicted and relocated thrice ever since the land was first acquired by NLC for Mine I and the coal bunker. Despite the multiple displacement, the compensatory jobs have not kept pace with it. It reports that the third time the residents were evicted, no jobs were provided by the NLC, instead those jobs went to migrants.

A media report dated 1st February 2023<sup>30</sup> reports farmers to be the worst sufferers at the hands of Neyveli Lignite Corporation and such industries. It mentions that NLC allegedly “took over around 36,000 acres from the landowners and sucked out groundwater from 44 villages in Cuddalore district, and groundwater levels have seen a steep decrease from eight feet to 1,000 feet now.” It also reports that NLC has tied up with a private company to evaluate lignite deposits around Veeranam lake with no regard to local people’s livelihood and mentioned that the surrounding areas of the lake that have been earmarked for evaluation fall under the protected agricultural zone.

A media report dated 10 March 2023<sup>31</sup> talked about the plight of farmers who have not been given adequate compensation for the land acquired from them for the

expansion work of NLC over the years that had also attracted several protests from the landowners. No employment opportunities have surfaced for the families of those land providers as of date, and announcements are being made progressively for acquisition of more agricultural land for various expansion activities. The most recent one is NLC’s plan to acquire 25,000 acres<sup>32</sup> of agricultural land for the 2nd mine expansion project which attracted a day long protest.

A media report dated 8th April 2023<sup>33</sup> reported that following all the protests around the proposals of new mines, the union government has excluded three proposed lignite mines in Tamil Nadu from the commercial coal auction list. This was after the Chief Minister of Tamil Nadu wrote to the union government following many protests against the proposed mines. The three proposed blocks Vadaseri, East of Sethiathope and Michaelpatti fell in the Cauvery delta region of the state. Two out of the three fall in the protected agricultural zone and one in a paddy cultivation zone.

## Health Impacts

On 31.5.2022 the NGT<sup>34</sup> heard and disposed off the matter of P. Sundaravathanam vs Union of India and Others (Appeal No. 13 of 2019 (SZ)) regarding opposition of grant of environmental clearance by MoEFCC in favor of NLC for their 2nd expansion of the lignite based thermal power plant having a supercritical capacity of 2x660 MW. Some of the issues highlighted by the appellant were that the instances of kidney related diseases have been increasing to which NLC responded saying that none of the kidney related ailments were linked to activities of its thermal units. NLC also mentioned that they are conducting health camps and also having primary health centers to provide free medical aid to the people of the project impact area and using their CSR funds they have promised to provide a dialysis unit in the government hospital to meet the demand of the people in that locality.

<sup>30</sup> <https://newsroomodisha.com/pmk-attacks-stalin-over-land-acquisition-for-neyveli-lignite-corp/>

<sup>31</sup> <https://www.dtnext.in/tamilnadu/2023/03/10/nlc-land-acquisition-tn-leaders-oppose-union-govts-action>

<sup>32</sup> <https://myind.net/Home/ViewArticle/pmk-protests-against-neyveli-lignite-corporations-land-acquisition-for-mine-expansion-in-tamil-nadu>

<sup>33</sup> <https://theprint.in/india/cauvery-delta-will-become-desert-why-tn-farmers-parties-are-opposing-modi-govts-coal-block-auction/1504818/>

<sup>34</sup> <http://www.indiaenvironmentportal.org.in/files/file/Virudhachalam-NLC-lignite-plant-NGT-Judgment-May31-2022.pdf>

In response to all averments, the NGT gave the following directions to NLC to:

***“ii. Conduct a health survey in the villages of project impact area to ascertain the impact of activities on the health issues by an accredited agency approved by the MoEF&CC and on the basis of the recommendations made by them, they are directed to carry out the recommendations and provide such facility which are recommended by them to meet the situation and to remove the apprehensions of the people in that locality.***

***“iii. increase the CSR Fund, if permissible under law for the purpose of conducting more medical camps and also to provide more facilities in the Primary Health Clinics established by them and also extend their CSR Fund for other Government Hospitals to increase the facility of meeting the probable Kidney disease that is being increased in that area by providing necessary infrastructure to meet the same. They are also directed to ensure the quality of medicine supplied in Primary Health Clinics as part of their CSR activity.”***

As far as we are aware, these orders, especially pertaining to the health survey have not been carried out.

A media report from 2017<sup>35</sup> reports the deteriorating health conditions of the residents living around Neyveli cluster of mines and TPSs. It talks about people suffering from issues like skin allergies, respiratory issues, blood pressure, urinary infections and kidney stones due to coal ash. The source of this coal ash has been identified as the coal bunker of Mine II. The agricultural yields have also taken a hit. The soil quality has degraded which has led to reduction of yields.

Thus, we see that several different agencies ranging from the media to research NGOs as well as judicial authorities have taken cognisance of the significant pollution due to mines and power plants in Neyveli over the years.

<sup>35</sup> <https://www.thenewsminute.com/article/life-amidst-lignite-how-coal-dust-sparking-massive-health-crisis-neyveli-residents-66256>



## EXPERIENCES OF IMPACTED COMMUNITIES

To understand the experiences of the communities impacted by the pollution in the area, and to have them directly talk about their own problems, we conducted a questionnaire based survey in seven villages in the Neyveli area. These seven villages were selected to give a geographical spread around the NLC TPSs and mines. The survey consisted of village level Focus Group Discussions (FoGD) in each of these seven villages, and individual interviews with 101 individuals in these villages. The list of the villages surveyed is given in Table 4, and the Map in Figure 2 shows their locations.

The survey reveals that people are facing a huge number of problems due to the operations of NLC TPSs and mines, many of which have been noted by other agencies also, as presented above. Some of the important problems which people face are extracted from the village FoGD and the individual questionnaires and a combined summary of it is presented below.

*Table 4: List of Villages where Questionnaire Survey and FoGD was Conducted*

Village Name
Aadhandarkollai (Kokkankuppam)
Akilandagangapuram
Kallukuzhi
Thenkuthu
Vanathirayapuram
Vadakuvellur
Thoppalikuppam



Figure 2: Villages where questionnaire survey and FoGD was conducted

## Impact on Water Used for Irrigation and Drinking

### ONE

Changes in the quality of water over the years, issues like bad odor from the water, changed color, presence of ash and oil in water.

### TWO

Reasons attributed for this are discharges by NLC mines and TPSs which is a combination of hot water, mixed with ash, dust, sand, chemicals, oil and other suspended particles.

### THREE

Significant fall in the depths of groundwater.

For irrigation purposes, 59 people reported using discharged water from NLC mines and TPSs. Other sources of irrigation water are groundwater, tank water and bore water. 59 people reported changes in the quality of water over the years. Bad odor from the water, changed color, presence of ash and oil in water are some of the issues prevalent. Of these 59, 53 people attributed it to discharges by NLC mines and TPSs which is a combination of hot water, mixed with ash, dust, sand, chemicals, oil and other suspended particles, fly ash and pollution from mines. Excessive groundwater extraction was also cited.

For drinking water quality, 66 people reported change in the quality over the years, particularly change in taste and smell of water. This was attributed to fly ash pollution from NLC TPSs, pollution from mines including blasting activities and groundwater withdrawal. In terms of water use pattern, 45 said that it has changed over the years. Water is found at greater depth now than before, earlier they would find water in the wells of their own land, now they have moved to bore well water from open wells and water from other sources.

## Effects on Agricultural Land and Cattle

### ONE

Water from NLC plants carrying fly ash gets mixed with streams and is used for irrigation.

### TWO

Coal dust and fly ash blown by wind settles on fields and crops.

### THREE

Reduction in quantity and degradation of quality of crop yield.

### FOUR

Impact on cattle health and reduction of milk yield.

Water from the NLC power plants which is mixed in the local streams is used for irrigation and it carries ash that settles on the agricultural fields of the farmers. There is also accumulation of dust on the fields. Fly ash deposition (through air and irrigation water), coal dust from mines and contaminated water are resulting in degradation of land, reduced yields, reduced quality of the yield therefore reduced income from selling the produce. 79 out of 101 people in the questionnaire survey reported deposition of ash/ coal dust particles from TPS and coal mines on the agriculture fields and 74 reported reductions in yields. Milk production in cattle has reduced and 37 people reported that the health of the cattle is affected with some people also mentioning specific issues like fever and death due to "komari disease".

Complaints have been filed to the concerned authorities, including NLC but no steps have been taken by the authorities or NLC to mitigate the issues faced by the people. 80 people reported no *panchnama* has been done for damages or impact on the agricultural land.

## Impact on Health

### ONE

Kidney diseases, skin diseases and respiratory issues are prevalent in the communities with several people undergoing dialysis.

### TWO

Increased occurrence of diseases attributed to 4 main reasons - fly ash from TPSs, coal dust from mines polluting the air, mixing of fly ash with water and NLC discharge polluting the water.

### THREE

Access to treatment is difficult due to distance of hospitals and cost of treatment.

89 out of 101 people said that kidney diseases, skin diseases and respiratory issues are prevalent in the communities with several people undergoing dialysis. 47 reported suffering from kidney stones/kidney failure, 36 have respiratory issues. Other health issues include heart ailments, high uric acid, fever, asthma, diarrhea, body aches, joint pains, premature graying of hair, hairfall, eye issues, blood pressure, swelling in legs. Several people suffer from multiple issues at the same time.

85 people think the occurrence of diseases has increased over the years and attributed the increased occurrence to 4 main sources - fly ash from TPS, coal

dust from mines polluting the air and mixing of fly ash with water and NLC discharge polluting the water. Fly ash was the dominant source, cited by 50 people.

64 people reported not having access to treatment in the hospital or a medical facility. The reasons for ill access were that the government hospital is very far (15km+) and the private hospital is 4-5 kms but expensive (cited by 38 people), transportation issues (cited by 15). They also reported that there is an NLC hospital with provisions in the vicinity but they only allow NLC employees to avail treatment from there. The average monthly expenditure on medical treatment ranges between Rs 2000 - Rs 3500 per family.

## Dust Pollution and its Impact

### ONE

Extensive deposition of coal dust/ash in and outside of their homes.

### TWO

Leads to respiratory issues and skin allergies.

### THREE

Requires repeated cleaning.

### FOUR

Affecting fertility and yield of crops.

95 people said there is deposition of pollutants like coal dust/ash in and outside of their homes spread through air. These people attributed the source of it to being a mix of stack, CHP, coal bunker, ash pond, ash dump, mines. 31 people exclusively attributed it to the ash pond/dump/pipeline. Due to the deposition of the dust,

people reported health issues like respiratory issues and skin allergies. They said the house gets very dusty and they have to clean multiple times. The dust gets deposited on walls, on water, on clothes and food. It is also affecting the fertility of the land and yield.

## Impact of Displacement and Acquisition of Land on People

<p><b>ONE</b></p> <p>Land area for agriculture reduced due to acquisition.</p>	<p><b>TWO</b></p> <p>Many people still not given compensation for the land acquired from them.</p>	<p><b>THREE</b></p> <p>In many cases, compensation was inadequate, could not buy alternative land.</p>
<p><b>FOUR</b></p> <p>Land given as compensation had many problems - very far, forested, not enough, no <i>pattas</i> given.</p>	<p><b>FIVE</b></p> <p>Serious impact on livelihoods, increased emigration.</p>	<p><b>SIX</b></p> <p>Promised jobs not given, or only contractual employment given.</p>

The area of agricultural land owned by the people has reduced as parts of people's agricultural land was acquired by NLC. People consider the compensation given to them for their land to be inadequate. It was highlighted that some people could not buy new land with the amount of compensation paid to them; people who were given new compensatory land were not given *pattas* (titles) for the land and/or the land given was either very far or forested which could not be used

for agriculture or it was not sufficient enough to practice agriculture on. Livelihoods are affected. Agriculture practice and jobs have reduced leading to migration of people. Those who have stayed back, their health and farming practices have been adversely affected due to high levels of pollution. It was reported that job promises were given by NLC but were not fulfilled. Either the job was not given to the people or was given on a contractual basis with no health benefits etc.



Figure 3: Questionnaire survey being conducted in Adhandarkollai village

## FIELD OBSERVATIONS OF STUDY TEAM

The study team carried out field visits at Neyveli in December 2022 and again in April 2023 to observe and understand the current status of the pollution issues, including some of those highlighted by various documents. What the team found was massive persistence of pollution of all kinds. The key observations are as follows:

### Water Discharge from NLC Mines and TPSs into Local Water Bodies

The study teams observed many cases of highly polluted local streams. These streams were often dark in colour, with bad odour, and oily. In several cases, the teams personally observed the discharge coming directly from a TPS or a mine. In many other cases, teams were told by highly reliable sources that the specific streams / water bodies were receiving and carrying effluent discharges coming directly from TPSs

or mines. These polluted streams then merged into other water streams, or met other local water bodies like ponds, thus spreading the pollution extensively over the area, including to groundwater. Many of these streams and water bodies are being used by local communities for a variety of uses. For example, the Walajah lake where several of the polluted streams converge is a major source of irrigation.



Specific examples of the teams' observations are presented below.

## I. NLC TPSs Effluents

### a.

In Vadakku Vellur, (April 2023) there was one such stream which reportedly was carrying water from Neyveli TPS II and Neyveli New TPS. As per the local people, this water flows to the Moopeneri lake and the water from here is used for irrigation. As per them, earlier 96 acres of this lake was accessible by the people, but now the accessible part has reduced to merely 1-2 acres. They informed the team that the water is now so polluted that not even insects can survive in it. The cattle also do not drink this water. Even the yield from fields irrigated with this water has reduced to a great extent and the food made from this yield tastes sour. When people sell this yield, they reportedly now fetch Rs. 300-350 less for a sack of rice than what they used to get. They report that they don't consume their produce themselves and have to purchase it from elsewhere. They said more than half the people have skin issues because they have to walk in the polluted water laden fields (Figure 4). It is not even easy to extract groundwater, as the water levels have gone down to 700-800 ft. Water testing from the stream done as part of this study (Location R2 S3) reveals high turbidity and elevated Selenium levels.

Figure 4: Water that is used to irrigate the fields and is the cause of people's skin disease as they walk on the field.



Figure 5: Stream reportedly carrying water from Neyveli TPS I EXP.

### b.

The team saw another stream which local people informed as originating from the Neyveli TPS I EXP. As informed, this water like other streams carrying water from other TPSs carries lignite washed water, boiler water and water from the coal stockyard of the TPS (Figure 5). A little further down the stream small bunds were seen, as locals informed, people have constructed these bunds to arrest the lignite particles mixed in the water. After collection, the local people sell this lignite (Figure 6). The stream meets the Walajah lake. Water sampling of this stream (Location R2 S7) revealed heavy contamination with high turbidity, hardness, Calcium, Magnesium and Selenium levels.



Figure 6: Small bunds created by the villagers to arrest lignite further down the same stream.

**C.**

In the visit made in December 2022, the study team observed a stream with heavily polluted water coming straight out of Neyveli TPS II premises. The water was dark and had oil floating on it. TPS II plant boundary wall was observed in the background of the stream (Figure 7). The fact that it is channelized also indicates that it is designed and intended as an effluent channel. This water is being discharged directly into the environment.



Figure 7: Effluent directly discharged from NLC TPS II with plant boundary visible in the background.



Figure 8: Black colour stream with oil in it.

**d.**

At yet another location, the team also observed a stream carrying highly contaminated water with oil. It was black in colour, indicative of the presence of coal dust. It was close to Neyveli TPS II and was probably carrying discharge from the plant (Figure 8).

**e.**

The study team noted a stream carrying discharge that was dark black in colour at yet another location. The team was informed by reliable sources that this stream is carrying discharge from several of the power plants coming together (Figure 9). The water from this point was sampled and tested in both the rounds of water testing (R1-L5 and R2 -S2) and was found to be seriously contaminated with high TSS in violation of limits, and presence of Mercury, Selenium, Fluoride, Iron, Magnesium, Silicon, Aluminium in high concentrations.



Figure 9: Stream carrying discharge from all TPS.

## II. NLC Mines Discharge

### f.

The team visited a location in front of the gate of Mine 2, where it saw a highly polluted stream which the team was informed by reliable sources was carrying discharge from the mine 2 (Figure 10).



Figure 10: Polluted stream opposite Mine II gate.

### g.

At another location where a discharge stream from Mine IA was observed, the team was informed that some discharge from Mine I is also mixed with this. The colour of the stream was yellow-brown which could indicate either high silt, but could also be indicative of acidic mine water discharge (Figure 11). As informed by the locals, this goes all the way to the Bay of Bengal. Water samples some distance downstream from this point had been collected for testing (R2 - S 1), and the test results showed the water to be uncontaminated. However, the sampling was done a few months after this field observation had been made. A more regular sampling and testing of this discharge is recommended.



Figure 11: Brown-Yellow colour of the discharge stream from Mine 1 and 1A.

The discharges from NLC mines observed are in clear violation of EPA rules and the EC conditions that mandate the *“industrial wastewater to be collected, treated so as to conform to the standards prescribed under GSR 422 (E) dated 19 March 1993 and 31st December 1993 before discharge.”*<sup>36</sup>

Several of these discharge locations that were sampled and tested showed clear violations of the discharge standards.

<sup>36</sup> [https://environmentclearance.nic.in/writereaddata/Compliance/0307202392575215NLCILMineIECCComplianceApril22toSep22\\_compressed\(2\).pdf](https://environmentclearance.nic.in/writereaddata/Compliance/0307202392575215NLCILMineIECCComplianceApril22toSep22_compressed(2).pdf) ; <https://environmentclearance.nic.in/writereaddata/Compliance/0306202388636807NLCILMineIAECCComplianceReportNo13April22toSept22.pdf> ; [https://environmentclearance.nic.in/writereaddata/Compliance/06\\_Mar\\_2023\\_17370442380607037April22-Sept22.pdf](https://environmentclearance.nic.in/writereaddata/Compliance/06_Mar_2023_17370442380607037April22-Sept22.pdf)

## Indiscriminate Dumping of Fly Ash in Common Spaces and Other Fly Ash Related Pollution

### h.

During the field visit in Neyveli in April 2023, near the central water store where reportedly all the chemical laden, untreated water used to clean all the equipment comes, huge amounts of fly ash was seen dumped on the ground (Figure 12). The local person told the team that it was deposited by Neyveli TPS I EXP.



Figure 12: Ash dumped near the central water store.



Figure 13: Ash dumped just outside of Neyveli II TPS.

### i.

Ash was also seen dumped right outside of the ash pond of NTPS II. The locals informed that the ash is dumped by Neyveli New TPS (Figure 13).

These instances of indiscriminate dumping of ash in public areas is a blatant violation of the EC condition mandating the disposal of any unutilized flyash in the form of slurry in the ash pond only with no ash storage in any low lying areas. Moreover, these ash dumps are places from where ash is easily blown by the wind and deposited on people's homes, land, crops, water sources etc; and it can also run-off into local water bodies. All of this creates severe pollution and health hazards.

## Dust / Ash Pollution

### j.

A very thin layer of foliage/green cover along the boundary line of the ash pond of TPS II was observed by the team. The green cover was at the same or lesser height of the ash bund. The locals informed the team that when winds blow, the dry ash blows from the ash pond and gets deposited on the trees/plants across the road. There were grey deposits on the trees on the other side of the road (across the ash pond).

### k.

Tholkappiar village is located right next to the boundary of NLC Mine I. The homes are located along the boundary of Mine I. There was no green belt or any safety measures at the mine boundary (Figure 14). The locals told the team that dust blows into the homes of the people across the street. Dust laden utensils and clothes were observed hanging outside the homes of the people. The locals reported that it is common for cattle to fall to their death if they get too close to the mine boundary which sees a sudden drop into the mine. No compensation has been provided for the loss of cattle. This is opposed to the EC condition of Mine I that mandates the mining area to be grounded by green belt having thick closed and thick canopy.

Additionally, the Consent to Operate (CTO) issued to the NLC Mine I on 14.11.2022 is valid subject to control

of all fugitive emissions emanating from lignite storage yard, lignite transfer points and lorry movement on the roads by the mine, with measures like water sprinkling system.

The rampant dust pollution observed in the village adjoining the Mine I very clearly shows that dust suppression measures are not adequately undertaken by Mine I.

It may be highlighted that the water testing of bore water from this village, used for drinking and domestic use by the people, showed alarmingly high levels of mercury and other pollutants. People also reported several serious ailments that are prevalent in the community here.



Figure 14: A kutchra road separating the homes of the people and Mine I boundary.

**l.**

While visiting the discharge stream reportedly carrying discharges from TPS II and ash pond of TPS II, a few uncovered trucks were seen carrying a mixture to an unknown location (Figure 15). The local people informed that the trucks were carrying a residue that is left after combustion of lignite for electricity generation. This residue consists of sand, ash and some lignite particles. They informed that the residue is collected, transported and then illegally dumped in some location not exactly known to them.



Figure 15: Uncovered trucks carrying the residue to an unidentified location.

## Compromised Agricultural Yield due to the use of Polluted Water for Irrigation



Figure 16: Ash deposits on the field where sugarcane plantation was burnt by the villagers.

**m.**

Next to the stream reportedly carrying water from Neyveli TPS II outlet, parts of agricultural land were seen covered in ash dust (Figure 16). Local people informed the study team that they had sown sugarcane in this ash laden soil but the yield was so poor and growth of the sugarcane was so stunted that they had to burn the yield. The soil sampling of this location found high Selenium content in the soil.

**n.**

Another patch of agricultural land was seen with ash dust in the soil (Figure 17). The locals reported that this agricultural land bore no yield. Soil sampling of this location revealed soil with low pH and serious contamination with high Selenium.



Figure 17: Agricultural patch of land that bore no yield.

# WATER AND SOIL SAMPLING, TESTING AND RESULTS

We undertook two rounds of collection of water and soil samples for testing to study how the pollutants from the power plants, mines and related infrastructure were affecting water and soil in the area.

In the first sampling, carried out in February 2023, we collected a total of 20 samples in the Neyveli area. These consisted of 12 from surface water, 4 from groundwater, 1 from piped water, 2 soil samples from agricultural fields and one sample of fly ash. In the second sampling, in April 2023, we collected a total of 11 samples, 8 from surface waters, 1 from groundwater, and two soil samples.

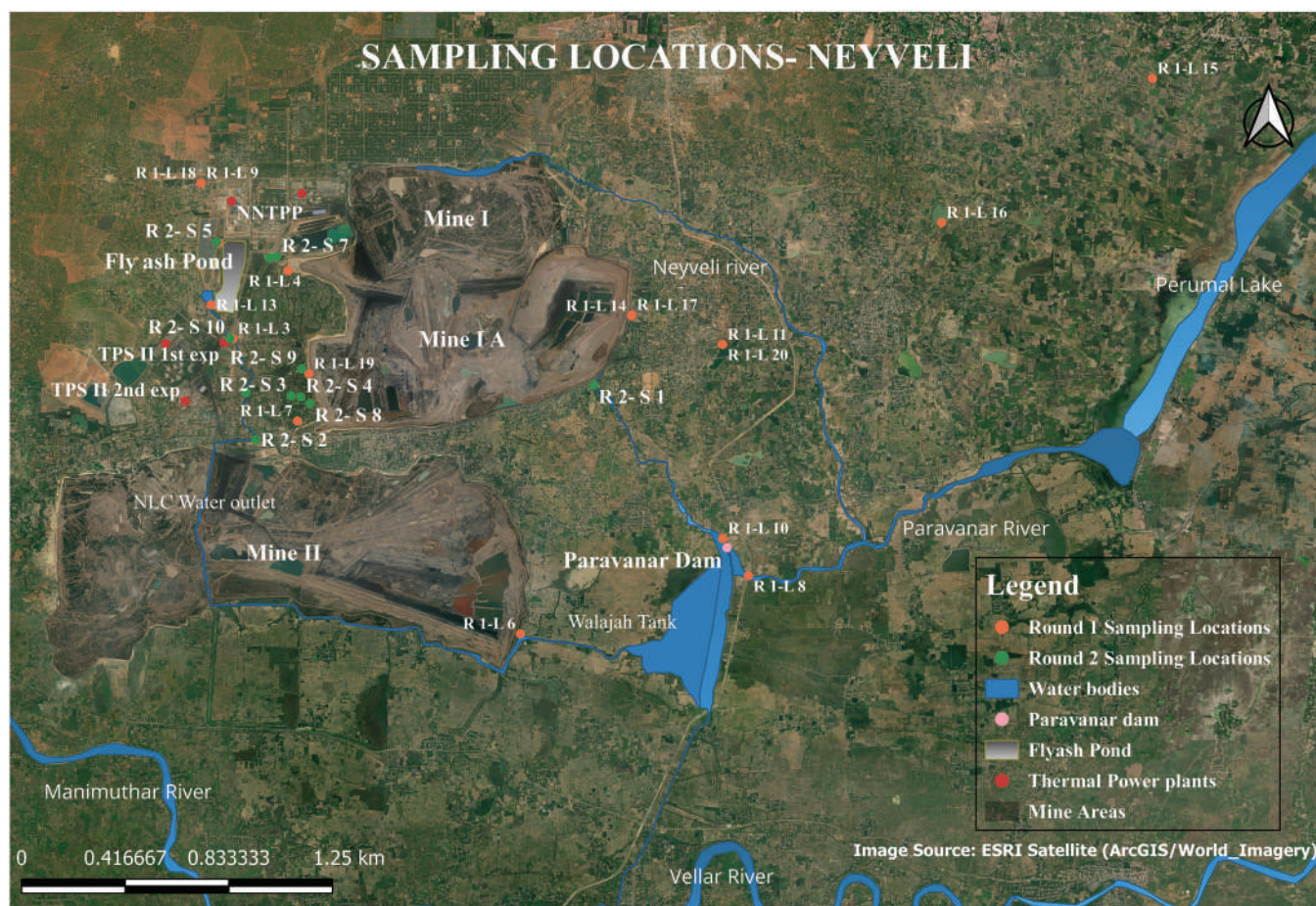


Figure 18: Map showing locations from first and second round of water and soil sampling

## Characterizing the Locations

Locations from where samples were collected were of several different types. There were locations where effluents were being discharged directly from mines/TPSs/ash ponds, locations where water bodies were presumed to be receiving discharges, other ambient water bodies, water bodies from which water was being used for irrigation and other uses, wells and borewells or piped water supply in villages in the region being used for drinking and domestic use, agricultural fields where coal dust and ash was depositing or fields that were irrigated with local water sources, and two control points.

We have categorized the surface water samples into two categories – one is “water bodies”, essentially streams, rivers, ponds, lakes etc. The other is “effluent discharge” which is basically effluents being directly discharged by either a mine or TPS or an ash pond or any related infrastructure; this may be being discharged into a local ambient water body or it may be being discharged onto land. Though the “effluent discharge” also ultimately ends up contaminating local

water bodies, the reason to make this distinction is that there are legally binding discharge standards for effluent discharges under the Environment Protection Rules (EPA Rules) 1986.

While collecting the samples, if we were able to observe effluents being directly discharged into a water body or land, we classified them as “effluent discharge” locations; and where there was no such direct discharge seen or reported, we categorized the location as “Ambient Water Body”. However, in cases where we were informed by reliable sources that effluents are being directly discharged into a water body but we did not see it directly, or we saw effluents being directly discharged but the actual discharge point was some distance away from that sampling location and effluents could potentially be diluted by other water received in between, then we categorised those locations as an intermediate “Effluent Discharge/Ambient Water Body Receiving Discharge” category.

## Parameters Tested and Standards Used

In both the rounds, all water samples were tested for basic parameters like pH, TDS, alkalinity, TSS etc. as well as for heavy metals, and some of the samples, mainly the effluent discharge samples were *additionally* tested for COD (Chemical Oxygen Demand) and for Oil and Grease. Soil samples were tested for 12 parameters as per the Soil Health Card<sup>37</sup> and also for heavy metals.

For assessing the water quality, we mainly used the Drinking Water Standards IS 10500 : 2012. A brief explanation on the standards used to assess the water quality is in order as not all samples were collected from sources known to be used for drinking water – like borewell or wells. The Indian framework for water quality standards for ambient water<sup>38</sup> mainly consists of the CPCB water quality framework for Designated Best Use<sup>39</sup>, the primary water quality criteria for

outdoor bathing<sup>40</sup> and water quality standards for coastal water marine outfalls<sup>41</sup> - apart from the BIS drinking water standards. The first two of these are standards for ambient water quality in inland water bodies like streams, lakes etc. However, these standards have norms only with respect to parameters like pH, Dissolved Oxygen, BOD, coliforms etc. and not for many other important parameters, especially heavy metals.

<sup>37</sup> <https://www.soilhealth.dac.gov.in/home>

<sup>38</sup> <https://cpcb.nic.in/wqstandards/>

<sup>39</sup> [https://cpcb.nic.in/wqm/Designated\\_Best\\_Use\\_Water\\_Quality\\_Criteria.pdf](https://cpcb.nic.in/wqm/Designated_Best_Use_Water_Quality_Criteria.pdf)

<sup>40</sup> [https://cpcb.nic.in/wqm/Primary\\_Water\\_Quality\\_Criteria.pdf](https://cpcb.nic.in/wqm/Primary_Water_Quality_Criteria.pdf)

<sup>41</sup> [https://cpcb.nic.in/wqm/coasteal\\_water\\_standards.pdf](https://cpcb.nic.in/wqm/coasteal_water_standards.pdf)

Many of the common water sources, especially surface water sources like streams, rivers and lakes are being used for multiple purposes like bathing, domestic use, bathing of cattle, drinking water for cattle, irrigation, fishing and sometimes also for drinking by humans. Given this, there are multiple pathways through which contaminants in these waters including heavy metals can enter the human body. Thus, in absence of other standards for heavy metals and other parameters we have used the drinking water standards for these water bodies too, as ultimately the pollutants are likely to enter the human body. We would like to point out that the Central Water Commission (CWC), in its study on

*Status of Trace & Toxic Metals in Indian Rivers*<sup>42</sup> also uses the BIS drinking water standards to assess the water quality of rivers with respect to heavy metals.

It is also important to note that as far as heavy metals are concerned, while exceedance with respect to certain limits is of concern, metals found below the limits also can lead to serious health impacts due to their persistence in water and the property of bio-accumulation and bio-magnification. As the report *Status of Trace & Toxic Metals in Indian Rivers* by the Central Water Commission (CWC) notes:<sup>43</sup>

***“Owing to their chemical characteristics, metals remain in the environment, in many cases only changing from one chemical state to another one and eventually accumulating in the food chain. Because of their high-water solubility, heavy metals can be easily absorbed by living organisms and, due to their mobility in natural water ecosystems and their toxicity to living forms, have been ranked as major inorganic contaminants in surface and ground waters. Even if they may be present in dilute, almost undetectable quantities, their recalcitrance to degradation and consequent persistence in water bodies imply that, through natural processes such as bio-magnification, their concentration may become elevated to such an extent that they begin exhibiting toxic effects.”***

Thus, a significant presence of heavy metals itself can be of concern, even if they are not exceeding any standards or are present in very small quantities.

Apart from the BIS Drinking Water standards, we have also used standards provided in the EPA Rules (1986) when the water sample is directly an effluent discharge from a power plant or a mine, as the EPA Rules provide limits to be observed by effluent discharges from these installations.

For the Soil Samples, since there are no Indian standards for soil quality from the point of view of human health, we have used two sets of standards or

norms to assess soil quality. One is the limits as proposed in the Soil Health Card for the parameters included in it; second, for parameters not included in the Soil Health Card, we have used the “Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health”,<sup>44</sup> taking the limits given for Agricultural Soils. It should be pointed out that these Canadian Guidelines have also been adopted by and included for screening purposes in the “*Guidance document for assessment and remediation of contaminated sites in India*” brought out as part of the “National Program for Rehabilitation of Polluted Sites in India”<sup>45</sup>.

<sup>44</sup> [https://support.esdat.net/Environmental%20Standards/canada/soil/rev\\_soil\\_summary\\_tbl\\_7.0\\_e.pdf](https://support.esdat.net/Environmental%20Standards/canada/soil/rev_soil_summary_tbl_7.0_e.pdf) Accessed 29 March 2023

<sup>45</sup> See in particular the “Volume II – Standards and checklists” of these Guidelines. Page 19-24 (pdf page). Downloaded from <https://kodaimercury.org/backdoor/wp-content/uploads/2016/05/Guidance-document-Volume-II-20150331.pdf>

## Findings of Sample Testing: Summary

The findings of the lab analysis of the samples reveal a very worrying picture. They show extensive pollution of local water and soil resources. For several effluent discharge streams coming from mines and the TPSs, the analysis shows critical parameters exceeding legally binding limits, indicating that not only are these effluents polluting local water and land resources, but they are also in clear violation of the law, requiring immediate legal action. What is a major cause of concern is that several of the drinking water sources are also seriously contaminated with high levels of Mercury, Selenium, Fluoride etc.

Surface as well as groundwater sources at various places are affected by high levels of turbidity, hardness, total dissolved solids (TDS), Total Suspended Solids (TSS), Oil and Grease and high Chemical Oxygen Demand (COD). Equally worrying is the presence of elements like Aluminium, Boron, Fluoride, Iron, Manganese, Magnesium, Mercury and Selenium found in high concentrations. These are elements that can have very serious impacts on human health as well as the health of cattle and on the ecology. While the serious health impacts of some metals are elaborated in the following paragraphs, comprehensive and detailed information about impacts of all these contaminants can be found at the website<sup>46</sup> of the “Agency for Toxic Substances and Disease Registry”, a federal public health agency of the U.S. Department of Health and Human Services.

In many cases, the complaints by local communities of high incidences of several health problems, of impact on agricultural yields and similar such issues also tie up with the contamination of water and soil as shown by the analysis of the samples. Much of the contamination seen in the water and soil resources can be directly linked to the effluents and emissions from the mines or the power plants.

As a broad classification based on the test results, we classified the locations as Seriously Contaminated, Significantly Contaminated, Some Contamination and No Contamination. These are based on a broad criteria like number of parameters exceeding limits, the extent of such exceedance and presence of highly toxic contaminants. These are indicative classifications and represent a continuum, especially the first two categories. Table 5 gives a summary of the locations as per this classification.

Table 5: Summary of Findings from Test Results (Classification of Locations)

	Sampling Round 1	Sampling Round 2
	(Number of Locations)	
Seriously Contaminated	9	8
Significantly Contaminated	9	2
Some Contamination	0	0
No Contamination	1	1
<b>TOTAL</b>	<b>20</b>	<b>11</b>

(One location of fly ash in Round 1 not classified as it was later found that it was waste brought from elsewhere and dumped at the location)

<sup>46</sup> <https://www.atsdr.cdc.gov/>

A location-wise summary of the first round and second round of the sampling test results giving details like name of the location, type of sample, parameters which exceeded the limits etc. is presented in Table 6 and Table 7, respectively.

Table 6: Details of Sampling Locations and Test Results for Round One (Feb 2023)

Location Identification	Location Name	Type of Sample	Exceeded Parameters	Location Categorization
R1-L 1	Neyveli PCS store discharge	Surface water	Turbidity, Hardness, Sulphate, TDS, TSS, Oil & Grease, Iron, Fluorine, Calcium, Magnesium, Manganese, Aluminium, Nickel	Seriously Contaminated
R1-L 2	Discharge from NNTPS	Surface water	Turbidity, Hardness, Sulphate, TDS, TSS, Oil & Grease, COD, Iron, Calcium, Magnesium, Aluminium	Seriously Contaminated
R1-L 3	Discharge from NNTPS	Surface water	Turbidity, Hardness, Chloride, Sulphate, TDS, TSS, Fluorine, Iron, Calcium, Magnesium, Manganese, Mercury, Aluminium, Nickel	Seriously Contaminated
R1-L 4	Direct discharge from Neyveli TPS I	Surface water	Turbidity, TSS, Oil & Grease, COD, Iron, Manganese, Aluminium, Nickel	Seriously Contaminated
R1-L 5	Discharge from Neyveli TPS II	Surface water	Turbidity, Hardness, TDS, TSS, Fluoride, Calcium, Magnesium, Iron, Aluminium	Seriously Contaminated
R1-L 6	Opposite to Main Gate of Mine 2- Kootu Kudineer Thittam near Valaiyamadevi	Surface water	Turbidity, Hardness, Alkalinity, TDS, TSS, Iron, Calcium, Magnesium, Total Chromium, Manganese, Mercury, Aluminium, Nickel	Significantly Contaminated
R1-L 7	Coal Mine discharge from Mine 1	Surface water	Turbidity, Iron, Aluminium	Significantly Contaminated
R1-L 8	Parawnar River Carrying NLC Mine 2 Discharge	Surface water	Turbidity, Total Hardness, Total Alkanlinity, TDS, Iron, Calcium, Magnesium, Aluminium	Significantly Contaminated
R1-L 9	Paddy Field within one Kilometer from the stack of NNTPS	Soil	Nickel, Zinc, Copper	Seriously contaminated
R1-L 10	Walaja Lake	Surface water	Turbidity, Total Hardness, TDS, Iron, Calcium, Magnesium, Manganese, Aluminium, Nickel	Seriously contaminated
R1-L 11	Agriculture Land near Iyyan Lake	Soil	pH (low), Total Chromium	Seriously contaminated
R1-L 12	Aadhandarkollai Borewell near Thiravupathi Amman Temple, 300 m away from ash Pond	Groundwater	Turbidity, Total Hardness, TDS, Fluoride, Iron, Calcium, Manganese	Seriously contaminated

Location Identification	Location Name	Type of Sample	Exceeded Parameters	Location Categorization
R1-L 13	Pond near Ash Pond, Water discharge to the Pond sometimes (Adhandarkollai)	Surface water	Turbidity, Total Hardness, TDS, Iron, Calcium, Manganese, Aluminium, Nickel	Significantly Contaminated
R1-L 14	Vaanadhirayapuram Village 100 meters from the Mine	Groundwater	Boron	Significantly Contaminated
R1-L 15	Ayikuppam – Kullanchavadi borewell (Control Point)	Groundwater		Virtually Uncontaminated
R1-L 16	Kanjamandanpettai Pond (Control Point)	Surface water	Turbidity, Iron, Aluminium	Significantly Contaminated
R1-L 17	NLC Pipe water (Drinking Water Supplied by NLC Management)	Piped Water	Aluminium	Significantly Contaminated
R1-L 18	Vellankulam	Drinking water	Zinc	Significantly Contaminated
R1-L 19	Palli Theru Vadakku Vellore near mine 1	Fly Ash		Location not considered in analysis as ash was found to be waste dumped from outside
R1-L 20	Iyyan Lake	Surface water	Turbidity, Aluminium, Nickel	Significantly Contaminated
R1-L 21	Pudukuppam Village	Groundwater	Hardness, Alkalinity, TDS	Some Contamination
R1-L 22	Pudukuppam Village- Pipe Water	Piped water	Hardness, Alkalinity, Calcium	Some Contamination
R1-L 23	Karikuppam Village Fish Pond	Surface water	Turbidity, Hardness, Alkalinity, TDS, Fluoride, Iron, Calcium, Magnesium	Seriously contaminated
R1-L 24	Karikuppam village agricultural land near Thermal Power Plant	Soil	Boron. Low Organic Carbon.	Seriously contaminated
R1-L 25	Canal near the Thermal Power Plant (Water Discharge from the plant time to time )	Surface water	Turbidity, Hardness, Chloride, Alkalinity, Fluoride, Magnesium, Boron, TDS, Iron	Significantly Contaminated
R1-L 26	Karikuppam Village	Groundwater	Turbidity, Hardness, Alkalinity, TDS, Fluoride, Iron, Calcium, Magnesium, Manganese	Seriously contaminated

Table 7: Details of Sampling Locations and Test Results for Round Two (Apr 2023)

Location Identification	Location Name	Type of Sample	Exceeded Parameters	Location Categorization
R2-S 1	Mine 1 Outlet, Veenageni	Surface Water	Turbidity	No Contamination
R2-S 2	Ramapuri, Mantharakuppam-Vadakkuvellur	Surface Water	Turbidity, Hardness, Chloride, Sulphate, TDS, Mercury, Selenium, Calcium, Magnesium	Seriously Contaminated
R2-S 3	Vadakkuvellur- Ammeri	Surface Water	Turbidity, Hardness, TSS, Selenium	Significantly Contaminated
R2-S 4	Karumbu Thottam-Vadakkuvellur	Soil	Selenium	Seriously Contaminated
R2-S 5	NNTPS Outlet near Thropathi Amman Temple	Surface Water	Turbidity, Hardness, Mercury, Selenium, Calcium, Magnesium	Seriously Contaminated
R2-S 6	Central Store	Surface Water	Turbidity, Hardness, Chloride, TDS, TSS, Mercury, Selenium, Calcium, Magnesium	Seriously Contaminated
R2-S 7	TPS Outlet, Karuvetti	Surface Water	Turbidity, Hardness, TSS, Selenium, Calcium, Magnesium	Seriously Contaminated
R2-S 8	Tholkappiar Nagar	Groundwater	Turbidity, Mercury, Selenium	Seriously Contaminated
R2-S 9	Muppaneri	Surface Water	Turbidity, Hardness, TSS, Selenium	Significantly Contaminated
R2-S 10	TPS 2 Outlet	Surface Water	Turbidity, Hardness, Sulphate, TDS, TSS, Mercury, Selenium, Calcium, Magnesium,	Seriously Contaminated
R2-S 11	Vadakkuvellur bypass	Soil	pH (high), Selenium	Seriously Contaminated

We discuss the findings in detail below.

## Findings of Sample Testing: Details

### Drinking and Domestic Water Use Sources

In the second round sampling, there was one location from where water was being directly used for drinking and domestic use, namely, the borewell at Tholkappiar Nagar, Vadakuvelur (Location R2-S8). This water was found to be seriously contaminated with high turbidity, Selenium and Mercury. Mercury was very high, around 250 times the limit. There are many kidney patients, people affected with lung disease, cancer patients and people with skin disease among the community in Tholkappiar nagar.

They drink this bore water. Discolouration of teeth was also observed in people.

According to the Central Pollution Control Board (CPCB)<sup>47</sup>, “Mercury is the most toxic substance known to mankind” and “Mercury ... may be fatal if inhaled and harmful if absorbed through the skin. It may cause harmful effects on the nervous system, digestive and respiratory systems and kidneys.”

<sup>47</sup> CPCB. (2009, November 17). Mercury : Environmental Implications & Toxicity. New Delhi, India: Central Pollution Control Board. Page 8 & 37 Retrieved August 31, 2021, from CPCB website: [https://cpcb.nic.in/uploads/News\\_Letter\\_Mercury\\_2017.pdf](https://cpcb.nic.in/uploads/News_Letter_Mercury_2017.pdf)

A US-EPA report<sup>48</sup> on thermal power plant pollution points out that “short-term exposure to Selenium at levels above the Maximum concentration limit (50 µg/L) can cause hair and fingernail changes, damage to the peripheral nervous system, and fatigue and irritability. Long-term exposure can damage the kidney, liver, and nervous and circulatory systems”

In the first round of sampling, there were 5 locations from where water was being directly used for drinking and domestic use. One of these was a control point location (Location 15) far away from the mining and TPS area, and this showed virtually no contamination. Borewell at Aadhandarkollai near Thiravupathi Amman temple (R1-L12) was found to be seriously contaminated with high turbidity, hardness, TDS, Fluoride, Iron, Calcium, Manganese. This is a hand pump close to the ash pond and people confirmed that they have been using it for drinking purposes.

According to the World Health Organisation (WHO)<sup>49</sup>, “Ingestion of excess Fluoride, most commonly in drinking water, can cause fluorosis which affects the

teeth and bones. Moderate amounts lead to dental effects, but long-term ingestion of large amounts can lead to potentially severe skeletal problems.”

The dugwell at Vaanadhirayapuram Village (R1-L14), about 100 meters from the Mine 1A showed high levels of Silicon and Boron. Local people have been complaining about the quality of this water.

The piped water supply close to this same location was also tested, as R1-L17, which is piped drinking water supplied by NLC management. The water was found to be contaminated with Aluminium exceeding the limits. People have complaints about skin diseases and kidney problems. It is likely that the health issues may be due to the combined impact of problems with water quality and other pollution like coal dust, etc as location is close to the mine.

The borewell at Vellankulam (R1-L18) was also found to be contaminated with high levels of Zinc. People who use this water for drinking have been complaining about kidney ailments.

## Effluent Discharges

In the first sampling round, 5 locations had been identified as effluent discharges, coming directly from the mines or TPSs. All 5 of these were found to be not only contaminated, but also in direct violation of the legally binding limits as specified in the EPA Rules 1986.

Effluents at three locations (R1-L1, R1-L2, R1-L4), coming from the power plants, were dark black and oily, and in all three cases, exceeded the limits for TSS, Oil and Grease and COD, violating legally binding limits. These discharges also had significant presence of heavy metals like Iron, Aluminium, Nickel, Manganese etc.

Effluents at location R1-L5 were a mix of effluents coming out from the power plants and may also contain mine discharges. This was also seriously contaminated with high TSS in violation of limits, and presence of Fluoride, Iron, Magnesium, Silicon, Aluminium in high concentrations.

Effluent from location R1-L 6, Opposite to Main Gate of NLC Mine 2, Kootu Kudineer Thittam near Valaiyamadevi carrying discharge of Mine 2 was also

violating limits for the TSS and Iron, and had presence of high levels of metals like Calcium, Magnesium, Iron, Chromium, Manganese, Mercury, Aluminium and Nickel. This discharge finally goes to Walajah lake. Most of the people in Kurinjipadi use Walajah lake water for irrigation.

In fact, the water from all the above-listed effluent discharges ultimately meets and contaminates other local streams and waterbodies in the area.

In the second sampling round, the location R2-S10, TPS 2 outlet, Kunankurichi, which was also tested in round one (as R1-L2), confirmed that the serious contamination continues. This time, it violated the legally binding limits for TSS and Mercury, and also showed high levels of Selenium.

Similarly, in the second round, the location R2-S2, where a mix of effluents coming out from the power plants and possibly also mine discharges come together, which was also tested in round one as R1-L5, confirmed that serious contamination continues. This time, it violated the legally binding limits for Mercury, and also showed high levels of Selenium.

<sup>48</sup> U.S. - EPA. (2013a). Environmental Assessment for the Proposed Effluent Limitations Guidelines and Standards for the Steam Electric Power Generating Point Source Category. Washington D.C.: United States Environment Protection Agency. Pages 3-4

<sup>49</sup> WHO. (n.d.). Water Sanitation and Health. Retrieved September 10, 2021, from World Health Organisation:

<https://www.who.int/teams/environment-climate-change-and-health/water-sanitation-and-health/burden-of-disease/other-diseases-and-risks/fluorosis>

## Ambient Water Body, Ambient Water Body Receiving Discharge

Totally seven locations of ambient surface water bodies were sampled in the first round. Out of these, some are water bodies that may also be receiving effluent discharges directly. All these seven samples were found to be contaminated or seriously contaminated. Even the control point for Surface water (R1-L16) had minor contamination of Aluminium and Iron.

Other locations together had presence of heavy metals like Iron, Aluminium, Mercury, Calcium, Magnesium, Silicon, Manganese and Nickel. While individual locations had only some of these elements in high concentration, it is also important to see the impact of these locations taken together as ultimately the contaminants from each location are also polluting the other water bodies in the area including groundwater. In the second round, six locations of ambient surface water bodies were sampled. Out of these, most are water bodies that may also be receiving some effluent discharges directly.

One of these (R2-S1) was found to be uncontaminated, even though it is a stream close to the Mine 1. Local people say that this may be spring water coming out from the mine.

All the other 5 were found to be seriously contaminated or contaminated.

## Agricultural Fields – Soil Samples

In the first round of sampling, we took soil samples from two fields (two locations). Both were found to be seriously contaminated.

Location R1-L9, a paddy field within one kilometer from the stack of NNTPS, was found to have high levels of Nickel, Zinc and Copper. Ash is being deposited on the soil and crops in the field and this could be the source of the metal contaminating the soil. Local villagers say that ash deposition and polluted water used for irrigation is the biggest reason for crop failure/reduced yield/ loss of soil fertility that they are experiencing.

Location R1-L11, agricultural land near Iyyan Lake was also found to be seriously contaminated, with low pH, and high levels of Chromium. Local people informed the team that the water used for irrigating the field is coming from the mines.

Similarly, two agricultural locations were sampled in round two. Both were found to be seriously contaminated.

The stream near Ammeri, Vadaku Vellur (R2-S3) was found to be contaminated with high levels of Selenium. People here use this water for irrigation, and had explicitly mentioned that they had skin problems, and reduced agricultural yield, both of which they attribute to the contamination of this water.

The discharge from the NNTPS outlet near Throupathi Ammeri (R2-S5) is seriously contaminated, with low pH (acidic) and high turbidity, Mercury, Selenium, Magnesium and Calcium. Water from there is used for irrigation by Melakuppam, Ammeri, Thoppilikuppam, Punangurichi villages.

The water body outside the Central Stores boundary near NLC Thermal 1 EXP and NNTPS (R2-S6), is seriously contaminated with very high levels of TSS, Mercury, Selenium, Calcium and Magnesium. Ash is also dumped near this location and this could be a reason for the high Mercury and Selenium apart from contaminants picked up from within plant premises. This water goes to Walajah lake, where 12 villages on the way use the water for irrigation. After going to Walajah lake there are more than 50 villages that use Walajah lake water for irrigation.

Field at Vadakuvellur-Karumbu Thottam (R- S4) was found to have high levels of Selenium in the soil. As told by the local people, the sugarcane crop was burnt by the villagers because it was half grown in this soil. This may be because of high Selenium in the soil. Ash dust was also seen on the soil. Selenium can come from coal dust or ash. Boiler water plus water used to wash lignite is discharged here. Some part of uncooled boiler water is also directly discharged.

The field near Vadakuvellur Bypass (R2-L11) had soils with low pH and seriously contaminated with high Selenium. Local people informed the team that lignite washed water from TPS 1 has resulted in no yield from the fields. Impact on yield may be due to Selenium and source of Selenium could be lignite washed water. Also, ash is being deposited on the fields and this may be a source of Selenium and also an additional cause of yield failure.

## CONCLUSIONS

The findings from the assessment by this study, which includes field visits to the impacted areas, a village based semi-structured individual survey and village based focus group discussions (FoGD) as well as collection of soil and water samples and testing indicate that the villages in Neyveli area around the cluster of NLC TPSs and Mines are reeling under severe pollution and its impacts due to the operations of NLC mines & TPSs. The pollution from the mines and TPSs is impacting the health of the people and cattle, agricultural land, air, water and livelihoods.

According to the responses from the areas visited and surveyed, reports of media and official agencies, and experiences of local citizens, the pollution in Neyveli region has been happening since the last 50 - 60 years ever since lignite mining and power generation started in the region by NLC. Unfortunately, the pollution and related problems continue to persist.

To add to the woes of the local communities, many of them are suffering from myriad problems caused as a result of the land acquisition and lack of proper compensation and rehabilitation. Even as these problems continue, local people are facing the threat of more land being acquired.

Impacted villages and communities have been raising these issues since long but there has not been a proper response or action to mitigate pollution and related issues. Meaningful action eludes the area, and severe pollution persists. This is in spite of substantial assessment, acknowledgement and orders by various agencies including judicial bodies like the NGT.



# RECOMMENDATIONS FOR WAY FORWARD

Based on our assessment, we would suggest a series of recommendations to address the issues:

## Immediate Actions

### ONE

M/S NLC India Ltd. should undertake immediate steps to stop all pollution including dust pollution, dry fly ash pollution and discharges/leakages of untreated waste/ contaminants into the natural water bodies from mines and TPSs.

#### Specifically, NLC should:

- ▶ Place in measures to control the dust pollution from the mines; stop all dust/dry fly ash pollution from stack, coal handling plant, coal storage area, ash pond and coal transportation from the TPSs and mines
- ▶ Ensure that all the effluent discharges coming out of coal mines and TPSs must follow all the effluent discharge standards, ensure proper treatment of mine discharges and discharges from the TPS
- ▶ Stop the discharge of fly ash into the local water bodies
- ▶ Ensure that there are no accidental leakages of effluents from power plants, mines, ash ponds etc, and that fugitive emissions are controlled
- ▶ Ensure all precautions for control of dust due to mining, loading, handling and transport of coal, including mist sprinklers, type wash arrangements in accordance with the CTO etc.
- ▶ Immediately clean up all ash deposits/ ash mounds dumped outside of the ash pond area in common spaces
- ▶ Carry out desiltation of streams that carry ash from the TPSs that gets deposited in the fields

### TWO

TNPCB and MoEFCC should put in place a mechanism to efficiently monitor this. Firstly, to ensure that NLC stops the polluting activities and does the clean up immediately including clean up of ash from common spaces, carry out desiltation of water bodies, and secondly, to ensure NLC implements measures to bring the pollution under control by stopping the discharge of untreated effluents and ash in the water bodies, arresting dry fly ash air pollution and ensure compliance of effluents with effluent discharge standards. There should be strict action against the power plants including fines and penalties or temporary suspension of plant operations if the pollution persists.

### THREE

Bi-annual health camps should be conducted by M/S NLC India Ltd. in collaboration with the district administration in which proper diagnosis of people's ailments should be done and appropriate treatment and medical aid should be provided free of cost. The first such camp must be planned immediately.

## Medium and Long term Actions

### FOUR

In order to make the pollution control monitoring and its implementation process more inclusive and participatory, a formal and legally recognized committee consisting of key officials from M/S NLC India Limited, representatives/village panchayat heads of the villages in the vicinity of respective projects, along with representatives of civil society groups and independent experts should be set up to monitor the progress from the local people's point of view. This committee can be under the ambit of TNPCB and MoEFCC's mechanism suggested in point 2 above, that needs to be put in place to undertake some immediate remediation measures and provide medium term monitoring.

This committee would give suggestions to NLC, would carry out field visits and identify predominant areas where pollution is felt, keep tabs on pollution in the villages, make sure that the NLC is following conditions stipulated in the Environment Clearance (EC) and in the Consent to Operate (CTO) as well as other measures agreed upon to address the issues of pollution including directions of the Supreme Court.

The Committee, with the help of TNPCB, should also ensure regular sampling and testing of water and soil in the area, including for heavy metals, to help identify pollution of local resources.

### FIVE

There must also be a comprehensive assessment of damage already caused to the environment, livelihood and the health of human beings and cattle and compensation for the same, as well as measures for and mitigation and amelioration of the impacts till date. A technical committee consisting of representation from the TNPCB, MoEFCC and with participation of the monitoring committee referred to in point 4 above should be set up and must undertake this assessment of the damages, arrive at a fair compensation and oversee its distribution among affected individuals and the affected communities.

### SEVEN

We strongly feel that addressing the health impacts in the area should not be constrained by any limitations of the CSR, and therefore, in addition to the recommendation of the NGT, we suggest that an extensive and appropriate network of health facilities should be created in the area by NLC which can be accessed by the local community. In addition, the existing NLC General Hospital and similar facilities should be open and accessible to the local communities. (Local communities have reported that M/S NLC India Ltd. refuse to treat outside patients here saying that it is meant only for NLC Employees).

### SIX

The directions of the NGT in its Order of 31 May 2022 in the matter of P. Sundaravathanam vs Union of India and Ors. (Appeal No. 13 of 2019 (SZ)) should be taken up immediately, in particular the following:

The recommendation on page 27, paragraph 38 (ii) directing "NLC to conduct a health survey in the villages of the project impact area to ascertain the impact of activities on the health issues by an accredited agency approved by the MoEF&CC. Further, based on their recommendations made, NLC to carry out the recommendations and provide such facility which are recommended by them to meet the situation."

The recommendation in paragraph 38 (iii) directing "NLC to increase the CSR fund, if permissible under law for the purpose of conducting more medical camps and to provide more facilities in the Primary Health Clinics established by them and also extend their CSR Fund for other Government Hospitals to increase the facility of meeting the probable Kidney disease that is being increased in that area by providing necessary infrastructure to meet the same. They are also directed to ensure the quality of medicine supplied in Primary Health Clinics as part of their CSR activity."

## EIGHT

M/S NLC India Ltd. must ensure that all the units follow the legally binding requirements of pollution control, including the 2015 norms for SO<sub>2</sub>, PM, NO<sub>x</sub> and Mercury emissions and the 2019 Notification for disposal of fly ash in mine voids. It should ensure the installation of necessary equipment like FGD, ESP etc. in accordance with the revised timeline of compliance norms.

## NINE

NLC should also focus on constructing groundwater recharge structures after identifying the groundwater recharge and discharge areas of the region in order to address the declining groundwater issues in the villages which is attributed mainly to the mining activities in the region.

## TEN

As mandated by the EC, a thick greenbelt must be built around Mine I to arrest the great degree of dust pollution it has been a source of pollution for the villages in the vicinity.

## ELEVEN

Some people whose land has been acquired by NLC over the years are a part of a committee that has a long-standing list of 16 demands to be fulfilled by NLC. While we believe all demands made by the people are important and should be addressed, here are 4 most important demands that we feel should be addressed on a priority basis (*the remaining demands can be found in Annexure 1*). This issue should be addressed with the close involvement of the affected people.

- ▶ *"Those who were affected by land acquisition in 1957 and living in the above area, and have not received land for housing, or land for land, have to be provided with permanent employment, land or compensation for the same firstly. The needful has to be done through CSR funds."*
- ▶ *"Agricultural losses caused by the industrial waste should be studied and appropriate compensation should be provided from the CSR fund."*
- ▶ *"The land/houses should not be acquired again. The reason being that there is not enough coal in the region. Therefore, the administrative permission allowing for acquisition in this area by the government must be revoked."<sup>50</sup>*
- ▶ *"The supply of purified drinking water to Vadakku Vellore, Ammeri, Kengaikondan Ward 1 to 3 through the CSR Fund must be undertaken."*

Though the villagers have demanded for some of their issues to be resolved by NLC through its CSR funds, we believe all social and environmental costs should be met by the NLC's own funds as they are a direct part of the cost of mining coal and producing power and need to be seen as part of the primary accounting of NLC. However, NLC should be encouraged to use the CSR funds for the development of additional social and health infrastructures within Neyveli. Funds from the District Mineral Fund should also be used for such additional facilities.

<sup>50</sup> Though people have given "there is not enough coal" as a reason for not acquiring the land/houses again, we feel that beyond this, there is a more fundamental reason. Basically it was NLC's responsibility to ensure that the people initially displaced were not settled (or did not settle) on lands where coal is known to be available. People should not be displaced second/ third time because that is an unwarranted suffering they are being subjected to due to no fault of theirs.

## TWELVE

No new brownfield or greenfield coal thermal power projects and mining projects should be conceived, proposed or considered in the Neyveli region. Further, no new land should be brought under active mining even if part of any earlier sanctioned Mine. This will be an important and necessary step to avoid adding onto the existing pollution load of the severely polluted region as well as to avoid displacing more people when existing affected populations are still to be meaningfully resettled or rehabilitated. This along with strict compliance measures (as stated in earlier recommendations above) will help reduce/manage the pollution intensity of the region.

## THIRTEEN

Since NLC has failed in controlling pollution and other impacts, which are persisting since decades, local communities have lost confidence that NLC will be able to address the problems. Our study also indicates a lack of willingness to address problems given that pollution is persisting so visibly and obviously. Given this, the Union Government should come up with a clear road-map and decommissioning plan for Neyveli mines and power plants. With the Tamil Nadu government indicating an intention of decarbonisation of the grid and also announcing plans to set up 20,000 MW of solar generation capacity along with 10,000 MW of battery storage by 2030, such a roadmap can aim for the decommissioning to happen in 10 years without any apprehension of disruption in electricity services.







# ITPCL

**Cuddalore TPS**

## BACKGROUND

M/S ITPCL Cuddalore TPS is a 1200 MW (2x600 MW) sea water-based power plant operated by IL&FS Tamil Nadu Power Company Limited (ITPCL) in an area of 546 hectares. Pichavaram mangroves are located at a distance of 8.0 km from the southern boundary of the plant, and the Buckingham canal flows at about 150 m on the western boundary of the plant.<sup>51</sup>

The first unit was commissioned in 2015, followed by the second in 2016. The power plant operates on imported coal which is sourced from Indonesia. The water requirement of the power station is entirely met by seawater and the water discharge takes place in deep sea. The TPS features a 43.3 ha ash pond (contiguous to the main plant premises<sup>52</sup>). The TPS follows a dry ash evacuation system with 100% ash utilization. The ash is supplied to the cement industry<sup>53</sup>. A desalination plant of 30 MLD is installed for the existing units.

A 15 MTPA captive port was planned as a part of the initial proposal to receive the imported coal. Currently coal is being imported through Karaikal Port, located at

a distance of 128 km, and brought through rail up to Pudukattiram station and through the private railway siding upto TPP's coal stockyard. Post commissioning of the captive jetty, the coal is envisaged to be transported through a conveyor system. The captive jetty was being planned in 2 phases, phase I being a 4.5 MTPA fair weather jetty and phase II being a 15 MTPA all weather jetty capable of handling bigger vessels. The TPS is also looking at the possibility of blending lignite with imported coal on a 20:80 basis (20% lignite, 80% imported coal). Lignite is proposed to be sourced from existing lignite mines located at a distance of less than 50 kms<sup>54</sup>. The port has not yet come up and it is not clear whether it will be built.

Table 8 below gives the details of the ITPCL plant and Table 9 presents the fly ash utilisation in the last three years.

Table 8: Details of ITPCL Plant

TPP	Capacity (MW)	No. of Units	Age (years) (As of 2023)
ITPCL TPS	1200 (2x600)	Unit -1 Unit - 2	6 5

Table 9: Fly Ash Utilization Levels of ITPCL TPS Between 2019 and 2022

	2019-20	2020-21	2021-22
ITPCL TPS - Fly Ash Utilisation in %	102	89.16	100

The average plant load factor (PLF) from 2016 to 2022 of ITPCL TPS was 50%, as per the National Power Portal.

<sup>51</sup> [https://www.itpclindia.com/images/EC%20\(TPP\)\\_%20Amendments%20&%20Extension.pdf](https://www.itpclindia.com/images/EC%20(TPP)_%20Amendments%20&%20Extension.pdf)

<sup>52</sup> Amended EC Letter dated 4th Feb 2014 [https://www.itpclindia.com/images/EC%20\(TPP\)\\_%20Amendments%20&%20Extension.pdf](https://www.itpclindia.com/images/EC%20(TPP)_%20Amendments%20&%20Extension.pdf)

<sup>53</sup> <https://www.itpclindia.com/EC%20and%20CRZ%20Conditions%20Compliance%20Status%20Apr-21%20to%20Sep-21.pdf>

<sup>54</sup> [https://environmentclearance.nic.in/writereaddata/modification/Amendment/Attach\\_file/0110201809MOUJR6ITPCLTechnicalNoteonUseofBlendedCoalConsolidatedReduced.pdf](https://environmentclearance.nic.in/writereaddata/modification/Amendment/Attach_file/0110201809MOUJR6ITPCLTechnicalNoteonUseofBlendedCoalConsolidatedReduced.pdf)

The EC granted on 31.10.2010 to ITPCL TPS 2 x 600 MW and 3 x 800 MW was challenged in the National Green Tribunal (NGT) on grounds of improper cumulative impact assessment (CIA) study among other reasons. The NGT in its judgment of 23.5.2012 upheld the validity of the EC but suspended it and directed the MoEFCC to review the CIA report and impose additional conditions in the EC if required. A Rapid Environmental Impact Assessment Study was conducted by ITPCL and submitted to MoEFCC. The EC was deliberated upon by the Environmental Appraisal Committee (EAC) based on the rapid assessment and the project was cleared on 14.08.2012 with a few extra EC conditions (Corrigendum to the EC). The Corrigendum was again challenged in the NGT by the petitioners and the Corrigendum was quashed by the NGT vide order dated 10.11.2014.

By an interim order dated 10.02.2015, the Supreme Court (SC) stayed the 10.11.2014 order of the NGT. Meanwhile the ITPCL plant established 2 x 600 MW units in 2015 & 2016. An appeal was made on behalf of the project proponent before the Supreme Court and it was prayed that all prior appeals be disposed off and the TPS be allowed to continue operations. Following are the arguments made by the project proponent/appellant:

1. Closing down the TPS now is not in public interest
2. The TPS supplies power to 40 lakh households
3. Tamil Nadu is an energy deficient state and closing of the TPS will hamper the power sector of the state

To support the argument it was further mentioned that the TPS is, by and large, in compliance with all EC conditions (except a few that were being addressed for compliance). It has installed a FGD to control SO<sub>2</sub> emissions. Taking cognisance of these arguments, the Supreme Court on 17.2.2023<sup>55</sup> disposed of the prior appeals and permitted the TPS to continue operations subject to full compliance with EC conditions (original as well as additional) including ones not complied with yet in the stipulated time given by the project proponent.

Some of the notable conditions that are in the EC and the response of the TPS with respect to their compliance as noted in the Supreme Court order are given as follows (As of Sept 2022):

## ONE

A 3-tier green belt of 50 to 100 m width around the power plant. As per the TPS, a 50-100 m 3 tier green belt is provided around the coal yard, ash dyke and northern side of the plant. A wind barrier is also provided along the coal yard. The TPS further notes that all dust generation areas like coal yards, coal unloading areas, transfer towers, coal crushers have dust suppression and dust extraction provisions like wind barriers. Additionally, fly ash and bottom ash is handled in closed conveyors and pipeline transfers therefore no dust generation takes place.

## TWO

Creation of fishermen welfare fund to enhance their quality of life through creation of facilities like fish landing platforms/fishing harbour/cold storage and provide relief in case of emergency situations. As per the TPS, it has incurred an expenditure of 13.5 crores (till sept 2022) under the fishermen welfare fund and has been providing relief assistance to fishermen in emergency situations.

<sup>55</sup> [https://main.sci.gov.in/supremecourt/2015/4405/4405\\_2015\\_4\\_1501\\_41935\\_Judgement\\_17-Feb-2023.pdf](https://main.sci.gov.in/supremecourt/2015/4405/4405_2015_4_1501_41935_Judgement_17-Feb-2023.pdf)

## THREE

Fish catch along the impacted zone of the sea should be monitored periodically by the Department of Fisheries, Government of Tamil Nadu and the project proponent shall take this up with the fisheries department. As per the TPS, they had written to the fisheries department on 19.7.2013 and await their reply. The TPS notes that they will follow up with the department and submit a response to MoEFCC on 31.3.23. The TPS additionally notes that they have engaged Annamalai University for conducting monthly marine monitoring and ensures there is no adverse impact on the fish catch along the impacted sea zone.

## FOUR

One of the conditions of the EC is that one time capital expenditure of Rs. 80 crores shall be earmarked for CSR programme with a recurring expenditure of Rs 16.0 crores per annum for CSR activities. Action plan was submitted to TNPCB which oversees the implementation of the CSR.

### Proposed Expansion

As per the original proposal of ITPCL TPS, the plant was to be set up in two phases - Phase I of 2 x 600 MW and Phase II of 3 x 800 MW, with a total of 3600 MW, which was later amended to 2 x 600 and 3 x 660 MW totalling to 3180 MW. While Phase I was commissioned in 2015 and 2016, Phase II is still envisaged. There seems to be no further progress on Phase II after being

granted the environment clearance. Considering the fact that IL&FS group was caught in a credit default scam in 2018<sup>56</sup>, which led to many of its subsidiaries going bankrupt, excluding ITPCL which has managed to stay afloat, a second phase of the project seems unlikely.

### Water Resources

Cuddalore district falls under Vellar Pravanar river basin.

The Vellar river flows through Cuddalore to meet the Bay of Bengal in Parangipettai where ITPCL Cuddalore

plant is located. The Vellar flows south of the ITPCL plant. Buckingham canal flows near the western boundary of the ITPCL TPS and meets the Vellar river.

### Other Natural Resources in the Vicinity

Pichavaram mangrove, a RAMZAR site, are located at around 8-9 Km south of the ITPCL TPS in Parangipettai and are spread over an area of 1471.33 ha. The Rapid Cumulative Environmental Impact Assessment Report of the ITPCL TPS notes that "The Pichavaram mangroves are considered among the healthiest mangrove occurrences in the world. They are fed with seawater through the tidal exchange between Vellar River and Coleroon River.

The Pichavaram mangrove biotope, with its peculiar topography and environmental condition, supports the existence of many rare varieties of shell and fine fishes. The Pichavaram mangroves harbor different species of birds, belonging to 15 orders and 41 families, due to availability of different habitat types such as channels, creeks, gullies, mudflats and sand flats and adjacent seashore."

<sup>56</sup> <https://www.indigolearn.com/blogs/IL-FS-Scam-A-Lesson-on-Ethical-Accounting/79dd6005718f4101a8b34564fa63da69>

<sup>57</sup> [http://cgwb.gov.in/AQM/NAQUIM\\_REPORT/TAMILNADU/Vellar%20Paravanar%20Report\\_final.pdf](http://cgwb.gov.in/AQM/NAQUIM_REPORT/TAMILNADU/Vellar%20Paravanar%20Report_final.pdf)

# DOCUMENTATION OF SOCIAL AND ENVIRONMENTAL IMPACTS TILL DATE

## Air Pollution

An article<sup>58</sup> written by Sharadha Narayanan, Citizen consumer and civic Action Group (CAG) dated 7.1.2019 attributed the source of coal dust in the populated areas around the ITPCL plant to the coal storage yard of the TPS, where coal was stacked without adequate safeguards. It also reported spillage of coal during transportation as the coal rakes were not covered.

The article also reported that TNPCB undertook a site visit following several complaints from the community and it confirmed the presence of significant dust pollution around the plant that was affecting the health of residents and school children in the vicinity, and asked the TPS to take remedial action. However, the villagers were unaware of any such remedial actions that may have been undertaken by the TPS.

On 23.1.2019, CAG submitted comments to the Environmental Appraisal Committee (EAC)<sup>59</sup> that was deliberating on the proposed amendment of the EC of ITPCL TPS to change the use of imported Indonesian coal to a blended mix with domestic coal. The CAG submitted that EAC had issued directions to the TPS to submit a compliance report on the directions by TNPCB and District Administration to address the coal dust problem caused by the plant.

As per CAG's observations, the TPS's mitigation measures were unconvincing and halfhearted. The TPS has been using cloth nets as wind barriers between the coal unloading area and Pudukuppam village which proved highly inadequate and ineffective. The local community undertook AAQ monitoring for 30 days and observed 6 days of POOR, 1 day of VERY POOR, only 1 day of SATISFACTORY and remaining days of MODERATELY POOR air.

CAG also highlighted several violations of EC conditions by the TPS, especially with regard to discharge of waste/untreated water and creation of a thick green cover.

A protest was undertaken in Pudukuppam village<sup>60</sup> in 2018 by communities that went on for 106 days where women led a week-long agitation against the pollution caused by coal dust.

In a report of December 2022<sup>61</sup>, women are stated to be the worst sufferers from the coal dust pollution as their time of collecting drinking water and other household chores like cleaning etc. has increased due to coal dust pollution.

<sup>58</sup> <https://climateconnection.org.in/updates/ec-amendment-problematic-proposal-ilfs>

<sup>59</sup> <https://www.cag.org.in/newsletters/public-newsense/ec-amendment-problematic-proposal-ilfs>

<sup>60</sup> <https://site.uit.no/fishercoast/wp-content/uploads/sites/415/2023/02/Cuddalore-report-r6-final-lowres-single.pdf>

<sup>61</sup> <https://site.uit.no/fishercoast/wp-content/uploads/sites/415/2023/02/Cuddalore-report-r6-final-lowres-single.pdf>

## Impact on Fishing Communities

An article written by CAG on 28.03.2019<sup>62</sup> highlights various issues faced by the fishing community of the Pudukuppam village (located just 50 m from the plant). The article reports loss of space to berth boats of the fisherfolk. The boats often also get damaged as they hit the breakwater.

The article also adds that the fisherfolk also complain of high temperature water being discharged into the sea by the TPS that affects temperature sensitive fish species, thereby reducing their catch. There are also complaints of no indication of location of discharge pipes by the TPS which on many instances causes their boats to hit the discharge pipes and damage their nets.

The article adds that the port construction has also reduced the space for drying of fishing nets. The community reported that they have to now venture further into the waters (10 kms) as opposed to earlier (2 kms radius) to do fishing which has increased their per fishing trip cost from 200 Rs to 500 Rs. (The port is now not likely to come up, as noted elsewhere; but the continued transport of coal by trains and other means

may also cause problems to the local communities and so preventive measures are needed to be implemented strictly).

A study titled *“Coastal Transformation and Fisher Wellbeing Perspectives from Cuddalore District, Tamil Nadu, India”* done in December 2022<sup>63</sup>, echoes the fishers’ concerns highlighted in the previous article and adds that two rows of huge iron pillars were erected by ITPCL to use the waterfront fish landing region of the Pudukuppam village in establishing the captive port and desalination plant. During high tides, the boats are susceptible to damage if they hit the pillars.

## Employment

A study titled *“Coastal Transformation and Fisher Wellbeing Perspectives from Cuddalore District, Tamil Nadu, India”* done in December 2022<sup>64</sup>, reported that after operationalisation of the ITPCL TPS, a few residents of neighboring hamlets of V. Panchankuppam, K. Panchankuppam, Karikuppam and Pudupettai got employed as operators, firemen, electricians and fitters. However, as per the general perception of the locals, the industry prefers to employ non-local people as they are less likely to organise and put up fights for better wages and working conditions. The study quotes a young engineer from Pudukuppam who reported that several young engineering graduates from surrounding villages applied for jobs at ITPCL, however none of them got the jobs.

<sup>62</sup> <https://climateconnection.org.in/updates/pudukuppam-brink-ruin>

<sup>63</sup> <https://site.uit.no/fishercoast/wp-content/uploads/sites/415/2023/02/Cuddalore-report-r6-final-lowres-single.pdf>

<sup>64</sup> <https://site.uit.no/fishercoast/wp-content/uploads/sites/415/2023/02/Cuddalore-report-r6-final-lowres-single.pdf>

## Other

Citizen consumer and civic Action Group (CAG) undertook a site visit of ITPCL, Cuddalore on March 15th, 2018<sup>65</sup> and recorded concerns of the local people around the project. The local people had complained of the ongoing construction of captive jetty being disruptive of the movement of Olive Ridley turtles. The team observed decaying Olive Ridley turtle corpses lying on the shore although the EIA report did not mention the presence of Olive Ridley turtles in the area. There was also an outlet drainage pipe going from the plant to the Buckingham canal. The plant claims it to be a storm water pipe, however the local populace complained of skin rashes when they come in contact with the water and death of some goats upon consumption of the water. The local farmers complained of black dust covering the trees and shrubs around the plant and the reduced yield from those trees (especially mango) and highlighted the burnt state of leaves.

Thus, we can see that there have been many serious social and environmental impacts of the ITPCL plant which have been documented by several agencies over the years. This study has confirmed the persistence of many of these issues. We present the findings of our study below.

<sup>65</sup> <https://climateconnection.org.in/sites/default/files/2021-08/IL%20%26%20FS%20TAMIL%20NADU%20POWER%20PLANT%20SITE%20VISIT.pdf>



## EXPERIENCE OF THE IMPACTED COMMUNITIES

We conducted questionnaire surveys in 2 villages in Parangipettai region. The survey was carried out in two parts, one, a village level Focus Group Discussion (FoGD) in 2 villages, and two, interviews with 11 individuals in 2 of these villages. The list of the villages surveyed is given in Table 10. These reveal that the people are facing a huge number of problems due to the operations of ITPCL TPS, many of which have been noted above through other agencies too. Some of the important problems which people face are extracted from the village FoGD and the individual questionnaires and a combined summary of it is presented below.

Table 10: List of Villages where Questionnaire Survey and FoGD was Conducted

Village Name
Pudukuppam
Karikuppam

### Impacts on the Fisherfolk (Pudukuppam Village, Fishing Village)

People reported that ever since the ITPCL plant was made operational, daily fish catch has on average been reduced by 60-70%. The fish variety has reduced from 30 to only 7-8 and the fish quality has also reduced. This reduction in fish catch and variety is attributed to release of hot water into the sea by the ITPCL TPS and very high salinity of the discharge, which people said was 3-4 times more saline than seawater. The people base this on their own observations, mainly that dead fishes are found around TPS discharge point and also that they don't usually go around that area for fishing since the water is hot and the fishes are mostly dead.

Their traditional route to access the sea has also changed as it is now used by the plant. It was highlighted that the community is given a separate area for docking boats and JCBs are used to bring them out of their docking space, which also damages the boats

at times. Income has reduced by 50%, therefore the fisher community that was only dependent on fishing previously has to now opt for alternative ways of securing their livelihood as well.

In terms of developmental activities, people reported that ITPCL has only provided a community center, however that is of no help with the compromised livelihood situation of the fisher community. There have been several protests and complaints made to the collector, but to no avail.

Reports of discharge of hot water with high salinity into the sea are indicative of violation of the EC condition which mandates cooling of water containing brine in ambient temperature in the guard pond before its discharge such that after the same is made to meet the average salinity of the sea water.

## Impacts on Agriculture (Karikuppam Village, Farming Village)

Fly ash and coal dust from the coal handling and coal storage area of the TPS and coal transportation settles on the agricultural land hampering the growth of paddy crop and fertility of the soil. Owing to reduced productivity, yield and therefore the loss of income, many people have stopped farming and migrated or become daily wage laborers. Ground water quality has

degraded. This water was used for irrigation but it has a bad odor now and the soil looks black. People suffer from lung and skin diseases, even cattle often fall sick. People have filed complaints to the authorities, but no steps have been taken to mitigate the situation nor proper record of the damages has been done by them.

## Impacts on Health

Respiratory Issues, kidney disease/failure, skin issues, hair fall, vision related, cancer and blood pressure are the prevalent health issues in the area. People reported an increase in incidence of diseases and attributed it to the operations of ITPCL TPS. People also said they do not have easy access to treatment in hospitals or a medical facility, and one of the major reasons is the distance.

## Impacts from Dust Pollution

People reported deposition of pollutants like coal dust and fly ash outside/inside their homes mostly brought in by air. The pollution was attributed to ash dump/handling/pipeline, fly ash, coal bunker and stack of the ITPCL TPS. Respiratory and skin related issues are common among the people due to pollution. These issues have largely been faced since the operationalisation of the ITPCL TPS. Complaints have been made to the TPS authority/District authority against this pollution, but no steps have been taken by authorities to mitigate the pollution. People also reported not having an adequate green belt around the TPS/ash pond/conveyer.

The dust related issues appear to be in violation of the EC condition that mandates adequate dust extraction systems such as cyclones/bag filters and water spray systems in dusty areas such as in coal handling and ash handling points, transfer areas and other vulnerable dusty areas to control dust pollution.

## FIELD OBSERVATION OF STUDY TEAM

The study team carried out field visits to Parangipettai in December 2022 to see and understand the current status of the pollution issues, including some of those highlighted by various documents. What we found was massive persistence of pollution of all kinds. The key observations are as follows.

Village Karikuppam located adjacent to the ITPCL TPS is a farming village and was visited in December 2022. Locals informed that there are two discharge channels from the TPS. One of them goes directly into the sea and the other one has an outlet into the local canal. Reportedly the ashpond of the TPS is located within plant premises and 100% of fly ash is being utilized. Even though the ash pond is located within plant premises, locals reported some fly ash related issues like fly ash settling on the trees/plants.

Pudukuppam village is located between the TPS and the sea and houses many fishing families. Several locals were informed the team about the coal dust pollution affecting the village. They recalled the time when a 130 days long protest was held by the people demanding mitigation of the issues faced by them which even led to the police filing a case on 40-50 people. It was also reported that the police stopped people from neighboring non-fishing villages from joining the protest to isolate Pudukuppam from others. It's been years since the protest but not much has changed.

It is important to note that the Consent to Operate (CTO) issued to the ITPCL plant on 15.5.2023 is valid subject to controlling all fugitive emissions emanating from coal stock yard, coal conveyance, coal crusher and ash handling by the TPS, with measures like dust suppression, fogging systems, bag filters at silo, bottom ash bins, water sprinkler and the wind barrier system.

However, the experience of dust/ash pollution of the communities living around the ITPCL plant state a different story and question the very basis on which the CTO to the TPS is given.

They also informed that the groundwater has become contaminated after the establishment of the thermal power plant which has led them to resort to other drinking water sources as the plant has rendered groundwater unfit for drinking. The people have to purchase potable water. They informed that they get piped water from Neyveli two days a week, however, that as well is not very fit for drinking and the supply is unreliable.

Adding to the issues, they informed that their original entry route to the fishing area is now closed off so the fisherfolk now have to go around 6 kms to access their fishing area. The fish catch has also reduced. Earlier the catch would fetch them Rs 1500-2000 which has now gone down to Rs 300-400. Further, the indrawn of the water and the discharge by the TPS, both destroy their fishing nets. The discharge of the water from the TPS into the sea has reduced their fish catch. On the movement of coal to the TPS, they informed that the coal comes in rail wagons that are mostly open and rarely covered.

All these issues have been well documented over the years by various civil society groups in their reports and media reports. After hearing all the issues during the site visit, it seems that the situation has not changed.

It's worth noting that ITPCL, in its response against a specific condition in the environment clearance granted to the ITPCL TPS noted that villages Karikuppam and Pudukuppam among others have been "Adopted" by the TPS under their CSR activities under which they have to provide basic amenities like development of roads, drinking water supply, primary health center, primary school etc. to the villages.<sup>66</sup>

Further, against the specific condition in the EC of not hampering the vocation of the fishing community by the TPS operations, the plant has responded affirmatively stating that the plant activities have not impacted the fishing communities around the project site. Additionally, the last publicly available marine report by Annamalai university is of August 2020 which concludes that all physico-chemical parameters of the seawater around ITPCL TPS are in permissible range, indicating no adverse effects on the fish. The field visit observations made by this study team and what the fishing community have reported are in complete contrast to the claims of the TPS.

The study team visited the Buckingham canal which is the second discharge point of the ITPCL TPS. Seemingly the discharge looks like the storm water discharge rather than effluent discharge, and the local people say the discharge happens mostly in the rainy season. However, the presence of an ash pond within plant premises makes the situation more prone to the risk of ash being mixed with the discharged water and being discharged into the canal. Local people have reported that whenever the discharge takes place, a large number of fish die in the canal. They also report that a lot of people in the area suffer from skin problems and kidney stones.

Reportage of reduced fish catch in the sea due to TPS discharge and death of fish in the Buckingham canal after the discharge from the TPS is indicative of a violation of the EC condition that mandates no discharge of untreated wastewater into the sea/backwater/water channels and marshy waters.



<sup>66</sup> <https://www.itpclindia.com/EC%20and%20CRZ%20Conditions%20Compliance%20Status%20Apr-21%20to%20Sep-21.pdf>

# WATER SAMPLING AND RESULTS

In Parangipettai one round of sampling was undertaken, in February 2023, and a total of 6 samples were collected. These consisted of 2 from surface water, 2 from groundwater, 1 from piped water and one soil sample from an agricultural field.

The basic information on the parameters tested and standards used has already been provided under the water sampling section of Neyveli region, and that is also applicable here, so it is not being repeated. Other information specific to Parangipettai has been provided below.

## Characterizing the Locations

These locations included locations where effluents were being discharged directly from TPS, locations where water bodies were thought to be receiving discharges, other ambient water bodies, water bodies from which water was being used for irrigation and other uses, wells and borewells or piped water supply in villages in the region being used for drinking and domestic use, and agricultural fields where coal and ash was depositing or fields being irrigated with local water sources.

All water samples were tested for basic parameters like pH, TDS, alkalinity, TSS as well as for heavy metals, and some of the samples, mainly the effluent discharge samples were additionally tested for COD (Chemical Oxygen Demand) and for Oil and Grease. Soil samples were tested for 12 parameters as per the Soil Health Card<sup>67</sup> and also for heavy metals.

## Findings of Sample Analysis: Summary

Table 11 gives a summary classification of the locations

Table 11: Summary of Findings from Test Results (Classification of Locations)

TPP	Number of Locations
Seriously Contaminated	3
Significantly Contaminated	1
Some Contamination	2
No Contamination	0
<b>TOTAL</b>	<b>6</b>

More details of the sampling locations and test results are given in Table 6

<sup>67</sup> <https://www.soilhealth.dac.gov.in/home>

## Drinking and Domestic Water Use Sources

The water from the borewell at Pudukuppam Village, close to the ITPCL power plant (R1-L21) was found to be contaminated with hardness, alkalinity and TDS exceeding the limits. Other contaminants were found within limits. During the visit, local people had said that the groundwater has been contaminated since the plant came up. They have stopped drinking groundwater, due to contamination, and are now buying water for cooking and drinking water. The hardness, TDS and alkalinity shown in the test may be a factor making it unsuitable for drinking and cooking. Regular testing from time to time would be useful here.

The same village, Pudukuppam also has piped water supply that brings water from Neyveli. We tested this water (R1-L22) and found it was only mildly contaminated with a high value of hardness. The local people said that they get piped water from Neyveli 2 days a week but it's not too good for drinking. Also, it is unreliable. Testing shows it to be hard water, Regular testing from time to time would be useful here.

The water from the borewell at Karikuppam Village (R1-L26), also close to the ITPCL power plant, however was found to be seriously contaminated with turbidity, hardness, alkalinity, TDS, Fluoride, Iron, Calcium, Magnesium and Silicon all exceeding the limits. This water is being used by the people for drinking and domestic use and it is likely to have serious impacts on their health.

The water from the Karikuppam Village Fish Pond (R1-L23) was found to be seriously contaminated, with turbidity, hardness, alkalinity, TDS, Iron, Fluoride, Magnesium and Calcium exceeding the limits. Now, the people have stopped using the water from this pond for drinking due to its bad quality, but continue to use it for washing, bathing, fishing, etc.

Water sample was also collected from a canal near the ITPCL Thermal Power Plant (where water is discharged from the plant from time to time) (R1-L25). This was found to be contaminated with turbidity, high hardness, chlorides, Iron, Fluoride, Magnesium and Boron. The water from this canal comes from upstream but water from ITPCL TPS is discharged into this canal from time to time. It appears that this is mostly storm water discharge but local people have reported fish kills during the ITPCL discharges. Ideally, water should be tested on the occasion when the power plant water

is discharged into this canal to test for any contamination from TPS. At the time of testing, there was no discharge from TPS.

Lastly, we also collected a soil sample from a farm in Karikuppam Village (R1-L24). This was found to be seriously contaminated and soil was high in Boron - with concentrations 30 times the screening levels for agriculture, and low in Organic Carbon. The locals reported that "The farm is affected due to the thermal power plant. Paddy does not survive". Coal dust is also coming on the crops. They also showed banana leaves and coconut leaves which are full of coal dust, the leaves were fully black in colour. They said that paddy does not survive after one month of sowing. So, people have stopped farming. Most of the people changed their occupation and turned into labourers. It is possible that the Boron may be coming from the coal dust/fly ash as this is known to be a source of Boron.

<sup>66</sup> <https://www.itpclindia.com/EC%20and%20CRZ%20Conditions%20Compliance%20Status%20Apr-21%20to%20Sep-21.pdf>

## CONCLUSIONS

The findings from our assessment which includes field visits to the impacted areas, a village based semi-structured individual survey and village based focused group discussions (FoGD) as well as collection of soil and water samples and testing all indicate that the villages around the coastal area of Parangipettai and surrounding villages are reeling under severe pollution and its impacts due to the operations of ITPCL TPS in Parangipettai region. The pollution from the TPS is impacting the health of the people and cattle, agricultural land, air, water and livelihoods.

According to the responses from the areas visited and surveyed, reports of media and official agencies, and experiences of local citizens, the pollution in Parangipettai has been happening since the past 7-8 years when the construction for ITPCL TPS was underway and also after it became operational. The pollution is contaminating the air, soil/land and the natural water resources of the communities that are used for drinking, domestic use and irrigation purposes. This is affecting the health of the people, their livelihoods as the productivity of the land decreases, and so does the income generate from it. Similarly, the livelihood of the fishing community is also affected.

Impacted villages and communities have been raising these issues since long but there has not been a proper response or action to mitigate pollution and related issues. Meaningful action eludes the area, and severe pollution persists. This is in spite of substantial acknowledgement by various agencies, including judicial bodies like the NGT.



# RECOMMENDATIONS FOR WAY FORWARD

Based on our assessment, we would suggest a series of recommendations to address the issues:

## Immediate Actions

### ONE

ITPCL should undertake immediate steps to stop all pollution including dust pollution, dry fly ash pollution and discharges/leakages of untreated waste / contaminants from its facilities in natural water bodies.

#### Specifically, ITPCL should:

- ▶ Stop all dust/dry fly ash pollution from stack, coal handling plant, coal storage area, ash pond and coal transportation from the TPS.
- ▶ Set up a proper monitoring mechanism to ensure that water discharged into the sea follows all the legal norms and EC conditions and the temperature and pollution load is maintained in such a way that there is no adverse impact on the flora and, fauna including fish.

## Medium / Long Term Actions

### TWO

The ITPCL plant should ensure access to the fishing community through their regular fishing routes, landing places, etc. and also ensure that pollutants including high temperature waters or otherwise polluted waters do not impact the fish population in any way.

### THREE

Annual health camps should be conducted by ITPCL in collaboration with the district administration in which proper diagnosis of people's ailments should be done and appropriate treatment and medical aid should be provided free of cost.

### FOUR

TNPCB and MoEFCC should put in place a mechanism to monitor the immediate actions as well as the medium term actions. Firstly, to ensure that ITPCL stops the polluting activities and secondly, to ensure a clean up of any pollution created, restoration of access impeded etc. There should be strict action against the power plant including fines and penalties or temporary suspension of plant operations if the pollution persists.

## FIVE

In order to make the pollution control monitoring and its implementation process more inclusive and participatory, a formal and legally recognized committee of key officials from ITPCL, representatives/ village panchayat heads of the villages in the vicinity, along with representatives of civil society groups and independent experts should be set up to monitor the progress from the local people's point of view. This committee can be under the ambit of TNPCB and MoEFCC's mechanism that needs to be put in place to undertake some immediate remediation measures and do medium term monitoring.

This committee would give suggestions to ITPCL, should carry out field visits and identify predominant areas where pollution is felt, keep tabs on pollution in the villages, make sure that ITPCL are following conditions stipulated in the Environment Clearance (EC) (original and additional conditions) and in the Consent to Operate (CTO) as well as other measures agreed upon to address the issues of pollution and other issues.

## SIX

There must also be a comprehensive assessment of damage already caused to the environment, agriculture, livelihoods and the health of human beings and cattle and compensation for the same, as well as measures for and mitigation and amelioration of the impacts till date. A technical committee consisting of representation from the TNPCB, MoEFCC and with participation of the monitoring committee referred to earlier should be set up and must undertake this assessment of the damages, arrive at a fair compensation and oversee its distribution among the affected communities.

## EIGHT

As mandated by the EC, fish catch along the impacted zone of the sea should be monitored periodically by the Department of Fisheries, Government of Tamil Nadu and the project proponent is to take this up with the fisheries department. This monitoring should be done on priority basis and the resultant report should be made available in the public domain. This monitoring should be done with the involvement of the local fishing community.

## SEVEN

As already mandated by the EC, ITPCL TPS must undertake regular monthly marine monitoring along the impacted sea coast. The reports by Annamalai university (which has been engaged by the plant to undertake the monitoring) must be made available in the public domain/ ITPCL website on a regular basis as they are prepared.

## NINE

All the legally binding conditions of the original EC and additional conditions imposed vide corrigendum to the EC of ITPCL TPS should be complied with on priority. Subject to compliance with these conditions only, the Supreme court had permitted the ITPCL plant to continue operations vide order dt. 17.02.2023. TNPCB and MoEFCC should ensure compliance of partly/non complied with conditions and take quick actions like imposition of fines and penalties, suspension of plant operation, till all conditions of EC are met.

# ANNEXURE I

## Memorandum of Demands Prepared by the NLC Land Acquisition Affected Neglected Welfare Association

### General Demands:

<p><b>ONE</b></p> <p>Those who were affected by land acquisition in 1957 and living in the above area, and have not received land for housing, or land for land, have to be provided with permanent employment, land or compensation for the same firstly. The needful has to be done through CSR funds.</p>	<p><b>TWO</b></p> <p>Agricultural losses caused by the industrial waste should be studied and appropriate compensation should be provided from the CSR fund.</p>	<p><b>THREE</b></p> <p>Our lands for houses should not be acquired again. The reason being that there is not enough coal in the region. Therefore, the administrative permission allowing for acquisition in this area by the government must be revoked.</p>
<p><b>FOUR</b></p> <p>All individuals affected by the loss of land be provided medical treatment at the expense of the NLC Company.</p>	<p><b>FIVE</b></p> <p>The titles of the government lands in the villages should not be transferred to the NLC company by way of alienation before the acquisition of the villages. The lands that have been so transferred must be handed over to their respective villages. This has largely affected the convenience of the villagers.</p>	<p><b>SIX</b></p> <p>In the Resettlement areas of Veppangurichi, Then Vellore, Oomangalam individual land deeds have not been provided even after 32 years. Various petitions have been pending.</p>
<p><b>SEVEN</b></p> <p>In the Vadakku Vellore and Ammeri panchayats and Gengaikondan Municipal ward 1 to 3 of Cuddalore District, the NLC must be prohibited from sub-dividing the survey numbers in some areas as per the land acquisition Tahsildar Letter No. 3.</p>	<p><b>EIGHT</b></p> <p>1977 has been fixed as the threshold year of land acquisition for eligibility in job opportunities, vocational training etc by the NLC Company. This must be changed, and all those who have lost their land should be given opportunity without any time threshold.</p>	<p><b>NINE</b></p> <p>Pollution Control 09.01. Ordering relocation of charcoal storage area in Mine 2.09.02. While coal is transported through lorries / trucks, the charcoal powder mixes with the air affecting the public health. The transportation through lorries/trucks must be regulated. 09.03. Preventing Pollution due to excavation of soil and bombarding in Mine 1.</p>
<p><b>TEN</b></p> <p>Deepening and rejuvenation of the 100 acre Moopan lake in Vadakku Vellore village must be undertaken.</p>		

**ELEVEN**

The supply of purified drinking water to Vadakku Vellore, Ammeri, Kengaikondan Ward 1 to 3 through the CSR Fund must be undertaken.

**TWELVE**

Improvement of street roads, public street lights must be undertaken from CSR Funds.

**THIRTEEN**

Cuddalore district - NLC must send the details of subdivision during the acquisition of lands in Vadakku Vellore, Ammeri panchayats and Gengaikondan Municipal ward 1 to 3 to the concerned district registration offices.

**FOURTEEN**

NLC must appoint the victims of Land acquisition for security jobs in the solar panel installation areas and appointments to these posts from the outside must be prevented.

**FIFTEEN**

The administration of the NLC threatens to remove the heirs of victims of land acquisition and those in contract works if they claim their land rights. The Neyveli Lignite Corporation is asked to be given proper instructions in this regard.

**NLC LAND ACQUISITION AFFECTED NEGLECTED WELFARE ASSOCIATION**

Door No.8/71, 4th, St., Veppankurichi, Neyveli 607802  
email: nlclaanwa912022@gmail.com  
Reg No: SRG/Cuddalore/91/2022

S. Elavarasan, Co-Ordinator, Ex. President, Vadakku Vellore  
T.R.K. Asaithambi, M.Sc.(Agri)., CAIIB., President,



## **POWERing Pollution**

The Environmental Impacts of Thermal  
Power Stations and Mining Operations  
in Neyveli & Parangipettai



# SAMPLING LOCATIONS- NEYVELI

R1-L15

152



R1-L18 R1-L9

NNTPP

Mine I

R2-S5

R2-S7

R1-L16

Fly ash Pond

R1-L4

Neyveli river

Perumal Lake

R1-L13

R1-L14

R1-L17

R2-S10

R1-L3

Mine IA

R1-L11

R1-L20

TPS II 1st exp

R2-S9

R1-L19

R2-S1

TPS II 2nd exp

R2-S3

R2-S4

R1-L7

R2-S8

R2-S2

NLC Water outlet

Mine II

Paravanar Dam

R1-L10

Paravanar River

R1-L6

Walajah Tank

R1-L8

## Legend

Round 1 Sampling Locations

Round 2 Sampling Locations

Water bodies

Paravanar dam

Flyash Pond

Thermal Power plants

Mine Areas

Manimuthar River

0 0.416667 0.833333 1.25 km

Image Source: ESRI Satellite (ArcGIS/World Imagery)

Vellar River

## TITLE



**Sample No: R2 S8**

**Location: Bore water collected from Tholkappier nagar, Vadukka vellur.**

**Location Categorization: Seriously Contaminated**

**Exceeded Parameters: Mercury, Sellinium, Turbidity.**

**Inference:**



Vadakkuvellur Tholkappier Nagar OHT



**Sample No : R2 S2**

**Location : Ramapuri,**

**Mantharakuppam- Vadakkuvellur**

**Location Categorization: Seriously Contaminated**

**Exceeded Parameters: Mercury, Sellinium, Calcium, magnesium, Sulphate, Chloride, TDS, Hardness, Turbidity.**

**Inference:**



**Sample No : R2 S5**

**Location : NNTPS Outlet Near Thropathi Amman Temple**

**Location Categorization: Seriously Contaminated**

**Exceeded Parameters: Mercury, Sellinium, Calcium, magnesium, Hardness, Turbidity.**

**Inference:**



**Sample No : R2 S6**

**Location : Central Store water,**

**Location Categorization: Seriously Contaminated**

**Exceeded Parameters: Mercury, Sellenium,  
Calcium, magnesium, Hardness, Turbidity.**

**Inference:**



**Water coming out of central store and mixed with a stream**



**Sample No : R2 S7**

**Location : TPS Outlet, Karuvetti**

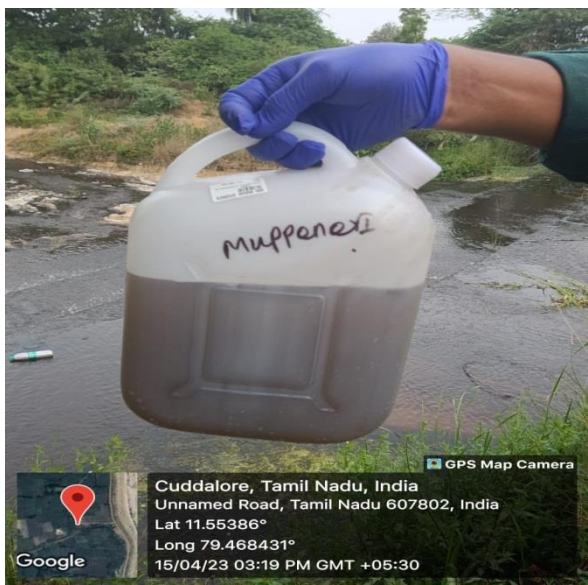
**Location Categorization: Seriously Contaminated**

**Exceeded Parameters: Sellenium, Calcium, Magnesium, Hardness, TSS & Turbidity.**

**Inference:**



**TPS Outlet**



**Sample No : R2 S9**  
**Location : Muppeneri, Surface Water**  
**Location Categorization: Significantly Contaminated**  
**Exceeded Parameters: Sellinium, Hardness, TSS & Turbidity.**



**Sample No : R2 S10**  
**Location : TPS 2 Outlet**  
**Location Categorization: Seriously Contaminated**  
**Exceeded Parameters: Mercury, Sellinium, Calcium, Magnesium, Sulpahate, Hardness, TSS Turbidity**

&





**Sample No : R2 S3**  
**Location : Vadakkuvellur Ammeri**  
**Location Categorization: Seriously Contaminated**  
**Exceeded Parameters: Sellinium, Hardness, TSS, Turbiudity**  
**Inference:**



**Sample No : R2 S4**  
**Location : Karumbu Thottam, Vadakuvellur**  
**Location Categorization: Seriously Contaminated**  
**Exceeded Parametres: Sellinium**



**Sample No : R2 S11**

**Location : Vadakuvelur Bypass**

**Location Categorization: Seriously**

**Contaminated**

**Exceeded Parametres: Sellinium, High pH**

Remarks and Observations	Latitude	Longitude	Category of Location	What is to Sampled (GW or Surface water or Soil or Sediment or Fly ash)	Parameters tested
Oily and Black	11.578447	79.461465	Effluent Discharge	Surface water	10 Basic Parameters, 31 Heavy Metals, Oil and Grease, COD
This location has two streams which meet each other. One is dark black with oil and another seems reasonable unpolluted. Two samples to be taken here	11.560653	79.452651	Effluent Discharge	Surface water	10 Basic Parameters, 31 Heavy Metals, Oil and Grease, COD
As above	11.560572	79.453257	Effluent Discharge	Surface water	10 Basic Parameters, 31 Heavy Metals, Oil and Grease, COD
Dark black polluted water, with oil	11.57557	79.465433	Effluent Discharge	Surface water	10 Basic Parameters, 31 Heavy Metals, Oil and Grease, COD
Discharge from all TPPs coming together (though it looks more like coming from mines)	11.538211	79.458272	Effluent Discharge	Surface water	10 Basic Parameters, 31 Heavy Metals, Oil and Grease, COD
Coal Mine 2 discharge	11.495383	79.51677	Effluent Discharge	Surface water	10 Basic Parameters, 31 Heavy Metals, Oil and Grease, COD
Coal Mine discharge	11.542366	79.46751	Effluent Discharge	Surface water	10 Basic Parameters, 31

					Heavy Metals, Oil and Grease, COD
Parawnar River carrying NLC mine 2 discharge	11.508196	79.567205	Effluent Discharge	Surface water	10 Basic Parameters, 31 Heavy Metals, Oil and Grease, COD
Paddy field within one kilometer from the stock of NNTPS	11.594931	79.446231	Field where ash is being deposited by wind or slurry	Soil	12 Parameters as per Soil health card + 31 Heavy metals
The mine discharge its water into the lake and then lake water is used for irrigation	11.516438	79.561553	Field where mine discharge water is used for irrigation	Surface Water	
Its near to Iyen lake	11.559264	79.561469	Field where overbudern is coming into field due to run off	soil	
Borewell near to Thiravupathi amman temple. It is 300 meters away from ash pond.	11.58168	79.450175	Open dug wells and/or borewells near and around ash pond. <b>Try and take locations all around the ash pond.</b>	Ground water	10 Basic Parameters, 31 Heavy Metals
Pond near to ash pond. Water discharge to the pond sometimes.	11.56803	79.448461	Any stream / water discharge / overflow coming out of ash pond	Surface water	10 Basic Parameters, 31 Heavy Metals, Oil and Grease
The village is present at 100metrers from the mine	11.565568	79.541331	Dugwells used by people a lot and are near polluted water streams	Ground water	10 Basic Parameters, 31 Heavy Metals

We took this point from a borewell located at Vadalur	11.618002	79.6565	Randomly located dugwells / borewells including some wells far off from likely contamination source to act as control point	Ground water	10 Basic Parameters, 31 Heavy Metals
Control point for surface water need to be identified	11.586179	79.609883	Randomly located surface water - river or pond locations- including some far off from likely contamination source to act as control point	Surface water	10 Basic Parameters, 31 Heavy Metals
It is a piped drinking water supplied by NLC management. The people complain about skin diseases and kidney problems.	11.565809	79.541443	Any other locations suggested by community that used a lot, or are suspected to be polluted.	Drinking Water NLC Pipe	10 Basic Parameters, 31 Heavy Metals
	11.594908	79.446215		Drinking Water	10 Basic Parameters, 31 Heavy Metals
	11.552811	79.470046		Fly Ash	
	11.559264	79.561469		Surface Water	

Affected by coal dust, 130 days protests. Stopped drinking water from ground water due to Ground water contamination	11.52492	79.7611	Contaminated Groundwater	Groundwater	10 Basic Parameters, 31 Heavy Metals
Affected by coal dust, 130 days protests. Stopped drinking water from ground water due to Ground water contamination	11.524924	79.761061	Contaminated Groundwater / Piped water from polluted location (Neyveli)	Piped Water	10 Basic Parameters, 31 Heavy Metals
	11.516466	79.750817	Surface Water source near TPP	Surface Water	10 Basic Parameters, 31 Heavy Metals
Farm is affected due to Themal Power Plant. Paddy does not survive	11.517781	79.748818	Agriculture Land Affected by (Coal dust?)	Soil	
The discharges could be storm water drainage as discharges are reported mainly in monsoon. But local people report fish deaths when such water is discharged.	11.518926	79.73962	Water discharge from TPP	Surface Water from canal, and if discharge is going on when sampling is done, then try and take from the discharge itself	10 Basic Parameters, 31 Heavy Metals, Oil and Grease, COD
	11.51628	79.750172		Ground Water	

E-mail : test@mettexlab.com  
Web : www.mettexlab.com

Phone : 044-22323163, 22311034  
42179490, 42179491



## CHENNAI METTEX LAB PRIVATE LIMITED

Jothi Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.



### TEST REPORT

Page No. 1 Of 2

**ISSUED TO :** M/s.ASAR Social Impact Advisors Pvt Ltd.,

**T.C Date :** 02.03.2023

No: 16 , 7 th Temple Street, 15 th Cross Road  
Malleshwaram, Bangalore,  
Karnataka – 560 003.

**T.C No :** CML/22-23/81992

**Cust. Ref :** SRF Dated : 11.02.2023

**Date Of Receipt :** 13.02.2023

**Commenced On :** 13.02.2023

**Lab No :** 2388257

**Completed On :** 18.02.2023

**Sample Description :** Water- (Discharge from Neyveli PCS Store)  
Surface Water - Sample Serial No : 1.

Sl. No.	Test Parameters	Test Methods	Test Results
Discipline : Chemical		Group : Water & Residues in Water	
01	pH at 25°C	IS:3025 Part 11-1983 (Reaff:2017)	7.02
02	Turbidity	IS: 3025 Part 10:1984 (Reaff:2017)	418 NTU
03	Total Hardness as CaCO <sub>3</sub>	IS: 3025 Part 21:2009 (Reaff:2019)	420 mg/l
04	Chloride as Cl	IS: 3025 Part 32:1988 (Reaff:2019)	241.4 mg/l
05	Total Alkalinity as CaCO <sub>3</sub>	IS: 3025 Part 23:1986 (Reaff:2019)	56.6 mg/l
06	Sulphate as SO <sub>4</sub>	IS: 3025 Part 24:1986 (Reaff:2019)	220 mg/l
07	Total Dissolved Solids	IS: 3025 Part 16:1984 (Reaff:2017)	1200 mg/l
08	Nitrate as NO <sub>3</sub>	IS: 3025 Part 34:1988 (Reaff:2019)	14.4 mg/l
09	Total Suspended Solids	IS:3025 Part 17:1984 (Reaff:2017)	277 mg/l
10	Oil & Grease	IS:3025 Part 39:2021	12 mg/l
11	Chemical Oxygen Demand	IS:3025 Part 58:2006 (Reaff:2017)	17.8 mg/l
12	Fluoride as F	APHA 23 <sup>rd</sup> Edn. 2017:4500 F,D	1.14 mg/l
13	Sulphide as S	IS:3025 Part 29:-986 (Reaff:2019)	BDL (DL:0.01 mg/l)
14	Iron as Fe	IS: 3025 Part 53:2003 (Reaff:2019)	1.45 mg/l
15	Calcium as Ca	IS: 3025 Part 40:1991 (Reaff:2019)	112.2 mg/l
16	Magnesium as Mg	IS: 3025 Part 46:1994 (Reaff:2019)	34 mg/l

...Contd....2

NOTE: Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders will be liable for legal action. Unless otherwise stated the submitted results in this test report refer only to the sample(s) tested and such sample(s) are retained for 15 days only from the completion date of testing .. except in case of regulatory samples, which will be retained for a specific period as per statutory requirement; while perishable & environmental testing related remnant samples will be discarded consequent upon completion of testing. Samples are not drawn by us unless otherwise stated. This document cannot be reproduced









E-mail: test@mettexlab.com  
Web : www.mettexlab.com

Phone : 044-22323163, 22311034  
42179490, 42179491



## CHENNAI METTEX LAB PRIVATE LIMITED

Jothi Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.

(Approved/Recognized by APEDA, AGMARK, GAFTA, EIC, FSSAI, BIS & MoEF)

### TEST REPORT

Page No. 1 Of 1

ISSUED TO : M/s.ASAR Social Impact Advisors Pvt Ltd.,

T.C Date : 02.03.2023

No: 16 , 7 th Temple Street, 15 th Cross Road  
Malleshwaram, Bangalore,  
Karnataka – 560 003.

T.C No : CML/22-23/81993-A

Date Of Receipt : 13.02.2023

Cust. Ref : SRF Dated : 11.02.2023

Commenced On : 13.02.2023

Lab No : 2388258

Completed On : 18.02.2023

Sample Description : Water- Discharge from New Neyveli TPS(Polluted Stream)  
Surface Water - Sample Serial No. 2.

Sl. No.	Test Parameters	Test Methods	Test Results
1	Cerium as Ce	IS: 3025 Part 2:2004 (Reaff:2014)	BDL(DL : 0.1 mg/l)
2	Titanium as Ti	IS: 3025 Part 2:2004 (Reaff:2014)	BDL(DL : 0.01 mg/l)
3	Thallium as Tl	IS: 3025 Part 2:2004 (Reaff:2014)	BDL(DL : 0.1 mg/l)

End of Report

For Chennai Mettex Lab Private Limited



*P. Kavitha*  
Reviewed & Authorized By

**P. KAVITHA**  
Technical Manager  
Authorised Signatory

NOTE: Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders will be liable for legal action. Unless otherwise stated the submitted results in this test report refer only to the sample(s) tested and such sample(s) are retained for 15 days only from the completion date of testing., except in case of regulatory samples, which will be retained for a specific period as per statutory requirement; while perishable & environmental testing related remnant samples will be discarded consequent upon completion of testing. Samples are not drawn by us unless otherwise stated. This document cannot be reproduced except in full, without prior written approval of the laboratory. This report is for the exclusive use of Chennai

E-mail : test@mettexlab.com  
Web : www.mettexlab.com

Phone : 044-22323163, 22311034  
42179490, 42179491



# CHENNAI METTEX LAB PRIVATE LIMITED

Jothi Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.



TC-5589

## TEST REPORT

Page No. 1 Of 2

ISSUED TO : M/s.ASAR Social Impact Advisors Pvt Ltd.,

T.C Date : 02.03.2023

No: 16 , 7 th Temple Street, 15 th Cross Road  
Malleshwaram, Bangalore,  
Karnataka – 560 003.

T.C No : CML/22-23/81994

Cust. Ref : SRF Dated : 11.02.2023

Date Of Receipt : 13.02.2023

Lab No : 2388259

Commenced On : 13.02.2023

Completed On : 18.02.2023

Sample Description : Water- Discharge from New Neyveli TPS(UnPolluted Stream)  
Surface Water - Sample Serial No 3.

Sl. No.	Test Parameters	Test Methods	Test Results
Discipline : Chemical		Group : Water & Residues in Water	
01	pH at 25°C	IS:3025 Part 11-1983 (Reaff:2017)	7.18
02	Turbidity	IS: 3025 Part 10:1984 (Reaff:2017)	312 NTU
03	Total Hardness as CaCO <sub>3</sub>	IS: 3025 Part 21:2009 (Reaff:2019)	660 mg/l
04	Chloride as Cl	IS: 3025 Part 32:1988 (Reaff:2019)	394 mg/l
05	Total Alkalinity as CaCO <sub>3</sub>	IS: 3025 Part 23:1986 (Reaff:2019)	31 mg/l
06	Sulphate as SO <sub>4</sub>	IS: 3025 Part 24:1986 (Reaff:2019)	224.6 mg/l
07	Total Dissolved Solids	IS: 3025 Part 16:1984 (Reaff:2017)	1512 mg/l
08	Nitrate as NO <sub>3</sub>	IS: 3025 Part 34:1988 (Reaff:2019)	7.4 mg/l
09	Total Suspended Solids	IS:3025 Part 17:1984 (Reaff:2017)	114 mg/l
10	Oil & Grease	IS:3025 Part 39:2021	BDL(DL:1.0 mg/l)
11	Chemical Oxygen Demand	IS:3025 Part 58:2006 (Reaff:2017)	14.9 mg/l
12	Fluoride as F	APHA 23 <sup>rd</sup> Edn. 2017:4500 F,D	1.19 mg/l
13	Sulphide as S	IS:3025 Part 29:-986 (Reaff:2019)	BDL (DL:0.01 mg/l)
14	Iron as Fe	IS: 3025 Part 53:2003 (Reaff:2019)	2.59 mg/l
15	Calcium as Ca	IS: 3025 Part 40:1991 (Reaff:2019)	200 mg/l
16	Magnesium as Mg	IS: 3025 Part 46:1994 (Reaff:2019)	38.8 mg/l

...Contd....2

*[Signature]*

NOTE: Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders will be liable for legal action. Unless otherwise stated the submitted results in this test report refer only to the sample(s) tested and such sample(s) are retained for 15 days only from the completion date of testing, except in case of regulatory samples, which will be retained for a specific period as per statutory requirement; while perishable & environmental testing related remnant samples will be discarded consequent upon completion of testing. Samples are not drawn by us unless otherwise stated. This document cannot be reproduced for the exclusive use of Chennai Mettex Lab's customer, and is provided in accordance with

E-mail : test@mettexlab.com  
 Web : www.mettexlab.com

Phone : 044-22323163, 22311034  
 42179490, 42179491



# CHENNAI METTEX LAB PRIVATE LIMITED

Jothi Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.



TC-5589

Lab No: 2388259

T.C No: CML/22-23/81994

Dated : 02.03.2023

Page No. 2 of 2

Sl. No.	Test Parameters	Test Methods	Test Results
17	Conductivity @ 25°C	IS: 3025 Part 14:2013 (Reaff:2019)	2218 µmhos/cm
18	Phosphorus as P	IS: 3025: Part:31-1988 (Reaff:2019)	BDL (DL:0.01 mg/l)
19	Silicon as Si	IS: 3025 Part 2:2004 (Reaff:2014)	33.974 mg/l
20	Total Arsenic as As	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.005 mg/l)
21	Boron as B	IS: 3025 Part 65:2014 (Reaff:2019)	0.273 mg/l
22	Cadmium as Cd	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.001 mg/l)
23	Total Chromium as Cr	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.02 mg/l)
24	Lead as Pb	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.05 mg/l)
25	Manganese as Mn	IS: 3025 Part 65:2014 (Reaff:2019)	0.165 mg/l
26	Mercury as Hg	USEPA 200.8	0.004 mg/l
27	Molybdenum as Mo	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.02 mg/l)
28	Selenium as Se	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.005 mg/l)
29	Aluminum as Al	IS: 3025 Part 65:2014 (Reaff:2019)	0.166 mg/l
30	Nickel as Ni	IS: 3025 Part 65:2014 (Reaff:2019)	0.029 mg/l
31	Zinc as Zn	IS: 3025 Part 65:2014 (Reaff:2019)	BDL(DL:0.05 mg/l)
32	Potassium as K	IS: 3025 Part 45:2014 (Reaff:2019)	16 mg/l
33	Copper as Cu	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.02 mg/l)
34	Antimony as Sb	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.003 mg/l)
35	Barium as Ba	IS: 3025 Part 65:2014 (Reaff:2019)	0.154 mg/l
36	Cobalt as Co	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.01 mg/l)
37	Uranium as U	IS: 3025 Part 65:2014 (Reaff:2019)	BDL(DL : 0.001 mg/l)
38	Vanadium as V	IS: 3025 Part 65:2014 (Reaff:2019)	BDL(DL : 0.01 mg/l)
39	Lithium as Li	IS: 3025 Part 2:2004 (Reaff:2014)	BDL(DL : 0.01 mg/l)

End of Report



For Chennai Mettex Lab Private Limited

*P. Kavitha*

Reviewed & Authorized By  
**P. KAVITHA**  
 Technical Manager  
 Authorised Signatory

NOTE: Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders will be liable for legal action. Unless otherwise stated the submitted results in this test report refer only to the sample(s) tested and such sample(s) are retained for 15 days only from the completion date of testing, except in case of regulatory samples, which will be retained for a specific period as per statutory requirement; while perishable & environmental testing related remnant samples will be discarded consequent upon completion of testing. Samples are not drawn by us unless otherwise stated. This document cannot be reproduced without the exclusive use of Chennai Mettex Lab's customer, and is provided in accordance with



E-mail : test@mettexlab.com  
Web : www.mettexlab.com

Phone : 044-22323163, 22311034  
42179490, 42179491



**CHENNAI METTEX LAB PRIVATE LIMITED**

Jothi Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.



TC-5589

**TEST REPORT**

Page No. 1 Of 2

**ISSUED TO :** M/s.ASAR Social Impact Advisors Pvt Ltd.,

**T.C Date :** 02.03.2023

No: 16 , 7 th Temple Street, 15 th Cross Road  
Malleshwaram, Bangalore,  
Karnataka – 560 003.

**T.C No :** CML/22-23/81995

**Date Of Receipt :** 13.02.2023

**Cust. Ref :** SRF Dated : 11.02.2023

**Commenced On :** 13.02.2023

**Lab No :** 2388260

**Completed On :** 18.02.2023

**Sample Description :** Water- Discharge from Nyveli TPS 1 (Direct Discharge)  
Surface Water - Sample Serial No : 4.

Sl. No.	Test Parameters	Test Methods	Test Results
<b>Discipline :</b> Chemical		<b>Group :</b> Water & Residues in Water	
01	pH at 25°C	IS:3025 Part 11-1983 (Reaff:2017)	6.85
02	Turbidity	IS: 3025 Part 10:1984 (Reaff:2017)	Above 500 NTU
03	Total Hardness as CaCO <sub>3</sub>	IS: 3025 Part 21:2009 (Reaff:2019)	140mg/l
04	Chloride as Cl	IS: 3025 Part 32:1988 (Reaff:2019)	35.4 mg/l
05	Total Alkalinity as CaCO <sub>3</sub>	IS: 3025 Part 23:1986 (Reaff:2019)	43.2 mg/l
06	Sulphate as SO <sub>4</sub>	IS: 3025 Part 24:1986 (Reaff:2019)	49 mg/l
07	Total Dissolved Solids	IS: 3025 Part 16:1984 (Reaff:2017)	352 mg/l
08	Nitrate as NO <sub>3</sub>	IS: 3025 Part 34:1988 (Reaff:2019)	15.9 mg/l
09	Total Suspended Solids	IS:3025 Part 17:1984 (Reaff:2017)	302 mg/l
10	Oil & Grease	IS:3025 Part 39:2021	12 mg/l
11	Chemical Oxygen Demand	IS:3025 Part 58:2006 (Reaff:2017)	427 mg/l
12	Fluoride as F	APHA 23 <sup>rd</sup> Edn. 2017:4500 F,D	0.48 mg/l
13	Sulphide as S	IS:3025 Part 29:-986 (Reaff:2019)	BDL (DL:0.01 mg/l)
14	Iron as Fe	IS: 3025 Part 53:2003 (Reaff:2019)	1.51 mg/l
15	Calcium as Ca	IS: 3025 Part 40:1991 (Reaff:2019)	36.8 mg/l
16	Magnesium as Mg	IS: 3025 Part 46:1994 (Reaff:2019)	11.6 mg/l

...Contd....2

*(Signature)*

NOTE: Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders will be liable for legal action. Unless otherwise stated the submitted results in this test report refer only to the sample(s) tested and such sample(s) are retained for 15 days only from the completion date of testing .. except in case of regulatory samples, which will be retained for a specific period as per statutory requirement; while perishable & environmental testing related remnant samples will be discarded consequent upon completion of testing. Samples are not drawn by us unless otherwise stated. This document cannot be reproduced Except in full, without prior written approval of the laboratory. This report is for the exclusive use of Chennai Mettex Lab's customer, and is provided in accordance with

E-mail : test@mettexlab.com  
 Web : www.mettexlab.com

Phone : 044-22323163, 22311034  
 42179490, 42179491



# CHENNAI METTEX LAB PRIVATE LIMITED

Jothi Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.



TC-5589

Lab No: 2388260

T.C No: CML/22-23/81995

Dated : 02.03.2023

Page No. 2 of 2

Sl. No.	Test Parameters	Test Methods	Test Results
17	Conductivity @ 25°C	IS: 3025 Part 14:2013 (Reaff:2019)	469 µmhos/cm
18	Phosphorus as P	IS: 3025: Part:31-1988 (Reaff:2019)	BDL (DL:0.01 mg/l)
19	Silicon as Si	IS: 3025 Part 2:2004 (Reaff:2014)	40.787 mg/l
20	Total Arsenic as As	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.005 mg/l)
21	Boron as B	IS: 3025 Part 65:2014 (Reaff:2019)	0.175 mg/l
22	Cadmium as Cd	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.001 mg/l)
23	Total Chromium as Cr	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.02 mg/l)
24	Lead as Pb	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.005 mg/l)
25	Manganese as Mn	IS: 3025 Part 65:2014 (Reaff:2019)	0.324 mg/l
26	Mercury as Hg	USEPA 200.8	BDL (DL:0.0005 mg/l)
27	Molybdenum as Mo	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.02 mg/l)
28	Selenium as Se	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.005 mg/l)
29	Aluminum as Al	IS: 3025 Part 65:2014 (Reaff:2019)	3.059 mg/l
30	Nickel as Ni	IS: 3025 Part 65:2014 (Reaff:2019)	0.10 mg/l
31	Zinc as Zn	IS: 3025 Part 65:2014 (Reaff:2019)	BDL(DL:0.05 mg/l)
32	Potassium as K	IS: 3025 Part 45:2014 (Reaff:2019)	9 mg/l
33	Copper as Cu	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.02 mg/l)
34	Antimony as Sb	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.003 mg/l)
35	Barium as Ba	IS: 3025 Part 65:2014 (Reaff:2019)	0.080 mg/l
36	Cobalt as Co	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.01 mg/l)
37	Uranium as U	IS: 3025 Part 65:2014 (Reaff:2019)	BDL(DL : 0.001 mg/l)
38	Vanadium as V	IS: 3025 Part 65:2014 (Reaff:2019)	BDL(DL : 0.01 mg/l)
39	Lithium as Li	IS: 3025 Part 2:2004 (Reaff:2014)	BDL(DL : 0.01 mg/l)

End of Report



For Chennai Mettex Lab Private Limited

*P. Kavitha*  
 Reviewed & Authorized By  
**P. KAVITHA**  
 Technical Manager  
 Authorised Signatory

NOTE: Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders will be liable for legal action. Unless otherwise stated the submitted results in this test report refer only to the sample(s) tested and such sample(s) are retained for 15 days only from the completion date of testing, except in case of regulatory samples, which will be retained for a specific period as per statutory requirement; while perishable & environmental testing related remnant samples will be discarded consequent upon completion of testing. Samples are not drawn by us unless otherwise stated. This document cannot be reproduced Except in full, without prior written approval of the laboratory. This report is for the exclusive use of Chennai Mettex Lab's customer, and is provided in accordance with



E-mail : test@mettexlab.com  
 Web : www.mettexlab.com

Phone : 044-22323163, 22311034  
 42179490, 42179491



# CHENNAI METTEX LAB PRIVATE LIMITED

Jothi Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.



TC-5589

## TEST REPORT

Page No. 1 Of 2

**ISSUED TO :** M/s.ASAR Social Impact Advisors Pvt Ltd.,  
 No: 16 , 7 th Temple Street, 15 th Cross Road  
 Malleshwaram, Bangalore,  
 Karnataka – 560 003.

**T.C Date :** 02.03.2023  
**T.C No :** CML/22-23/81996  
**Date Of Receipt :** 13.02.2023  
**Commerced On :** 13.02.2023  
**Completed On :** 18.02.2023

**Cust. Ref :** SRF Dated : 11.02.2023  
**Lab No :** 2388261

**Sample Description :** Water- Discharge from Neyveli TPS 2-Surface Water - Sample Serial No : 5.

SI. No.	Test Parameters	Test Methods	Test Results
<b>Discipline :</b> Chemical			<b>Group :</b> Water & Residues in Water
01	pH at 25°C	IS:3025 Part 11-1983 (Reaff.2017)	7.71
02	Turbidity	IS: 3025 Part 10:1984 (Reaff.2017)	238 NTU
03	Total Hardness as CaCO <sub>3</sub>	IS: 3025 Part 21:2009 (Reaff.2019)	475 mg/l
04	Chloride as Cl	IS: 3025 Part 32:1988 (Reaff.2019)	202 mg/l
05	Total Alkalinity as CaCO <sub>3</sub>	IS: 3025 Part 23:1986 (Reaff.2019)	108 mg/l
06	Sulphate as SO <sub>4</sub>	IS: 3025 Part 24:1986 (Reaff.2019)	184.4 mg/l
07	Total Dissolved Solids	IS: 3025 Part 16:1984 (Reaff.2017)	1123 mg/l
08	Nitrate as NO <sub>3</sub>	IS: 3025 Part 34:1988 (Reaff.2019)	8 mg/l
09	Total Suspended Solids	IS:3025 Part 17:1984 (Reaff.2017)	178 mg/l.
10	Oil & Grease	IS:3025 Part 39:2021	BDL(DL:1.0 mg/l)
11	Chemical Oxygen Demand	IS:3025 Part 58:2006 (Reaff.2017)	23.8 mg/l
12	Fluoride as F	APHA 23 <sup>rd</sup> Edn. 2017:4500 F,D	1.05 mg/l
13	Sulphide as S	IS:3025 Part 29:-986 (Reaff.2019)	BDL (DL:0.01 mg/l)
14	Iron as Fe	IS: 3025 Part 53:2003 (Reaff.2019)	0.77 mg/l
15	Calcium as Ca	IS: 3025 Part 40:1991 (Reaff.2019)	132 mg/l
16	Magnesium as Mg	IS: 3025 Part 46:1994 (Reaff.2019)	35 mg/l

*[Signature]*

...Contd....2

NOTE: Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders will be liable for legal action. Unless otherwise stated the submitted results in this test report refer only to the sample(s) tested and such sample(s) are retained for 15 days only from the completion date of testing .. except in case of regulatory samples, which will be retained for a specific period as per statutory requirement; while perishable & environmental testing related remnant samples will be discarded consequent upon completion of testing. Samples are not drawn by us unless otherwise stated. This document cannot be reproduced Except in full, without prior written approval of the laboratory. This report is for the exclusive use of Chennai Mettex Lab's customer, and is provided in accordance with





E-mail : test@mettexlab.com  
 Web : www.mettexlab.com

Phone : 044-22323163, 22311034  
 42179490, 42179491



# CHENNAI METTEX LAB PRIVATE LIMITED

Jothi Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.



## TEST REPORT

Page No. 1 Of 2

**ISSUED TO :** M/s.ASAR Social Impact Advisors Pvt Ltd.,  
 No: 16 , 7 th Temple Street, 15 th Cross Road  
 Malleshwaram, Bangalore,  
 Karnataka – 560 003.

**T.C Date :** 02.03.2023  
**T.C No :** CML/22-23/81997  
**Date Of Receipt :** 13.02.2023  
**Commenced On :** 13.02.2023  
**Completed On :** 18.02.2023

**Cust. Ref :** SRF Dated : 11.02.2023  
**Lab No :** 2388262

**Sample Description :** Water- Opposite to Main Gate of NLC Mine 2- Kootu Kudineer Thittam Near Valaiyamadevi Coal Mine 2 Discharge -Surface Water - Sample Serial No : 6.

Sl. No.	Test Parameters	Test Methods	Test Results
Discipline : Chemical		Group : Water & Residues in Water	
01	pH at 25°C	IS:3025 Part 11-1983 (Reaff.2017)	7.52
02	Turbidity	IS: 3025 Part 10:1984 (Reaff.2017)	Above 500 NTU
03	Total Hardness as CaCO <sub>3</sub>	IS: 3025 Part 21:2009 (Reaff.2019)	430 mg/l
04	Chloride as Cl	IS: 3025 Part 32:1988 (Reaff.2019)	135.5 mg/l
05	Total Alkalinity as CaCO <sub>3</sub>	IS: 3025 Part 23:1986 (Reaff.2019)	278 mg/l
06	Sulphate as SO <sub>4</sub>	IS: 3025 Part 24:1986 (Reaff.2019)	160.7 mg/l
07	Total Dissolved Solids	IS: 3025 Part 16:1984 (Reaff.2017)	824 mg/l
08	Nitrate as NO <sub>3</sub>	IS: 3025 Part 34:1988 (Reaff.2019)	8 mg/l
09	Total Suspended Solids	IS:3025 Part 17:1984 (Reaff.2017)	1976 mg/l
10	Oil & Grease	IS:3025 Part 39:2021	10 mg/l
11	Chemical Oxygen Demand	IS:3025 Part 58:2006 (Reaff.2017)	56 mg/l
12	Fluoride as F	APHA 23 <sup>rd</sup> Edn. 2017:4500 F,D	0.79 mg/l
13	Sulphide as S	IS:3025 Part 29:-986 (Reaff.2019)	BDL (DL:0.01 mg/l)
14	Iron as Fe	IS: 3025 Part 53:2003 (Reaff.2019)	20.7 mg/l
15	Calcium as Ca	IS: 3025 Part 40:1991 (Reaff.2019)	112.2 mg/l
16	Magnesium as Mg	IS: 3025 Part 46:1994 (Reaff.2019)	36 mg/l

*[Signature]* ...Contd....2

NOTE: Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders will be liable for legal action. Unless otherwise stated the submitted results in this test report refer only to the sample(s) tested and such sample(s) are retained for 15 days only from the completion date of testing, except in case of regulatory samples, which will be retained for a specific period as per statutory requirement; while perishable & environmental testing related remnant samples will be discarded consequent upon completion of testing. Samples are not drawn by us unless otherwise stated. This document cannot be reproduced except in full, without prior written approval of the laboratory. This report is for the exclusive use of Chennai Mettex Lab's customer, and is provided in accordance with Mettex Lab and its Customer.

E-mail : test@mettexlab.com  
Web : www.mettexlab.com

Phone : 044-22323163, 22311034  
42179490, 42179491



# CHENNAI METTEX LAB PRIVATE LIMITED

Jothi Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.



TC-5589

Lab No: 2388262

T.C No: CML/22-23/81997

Dated : 02.03.2023

Page No. 2 of 2

Sl. No.	Test Parameters	Test Methods	Test Results
17	Conductivity @ 25°C	IS: 3025 Part 14:2013 (Reaff:2019)	1266 µmhos/cm
18	Phosphorus as P	IS: 3025 Part:31-1988 (Reaff:2019)	BDL(DL:0.01 mg/l)
19	Silicon as Si	IS: 3025 Part 2:2004 (Reaff:2014)	14.081 mg/l
20	Total Arsenic as As	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.005 mg/l)
21	Boron as B	IS: 3025 Part 65:2014 (Reaff:2019)	0.088 mg/l
22	Cadmium as Cd	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.001 mg/l)
23	Total Chromium as Cr	IS: 3025 Part 65:2014 (Reaff:2019)	0.085 mg/l
24	Lead as Pb	IS: 3025 Part 65:2014 (Reaff:2019)	0.007 mg/l
25	Manganese as Mn	IS: 3025 Part 65:2014 (Reaff:2019)	0.393 mg/l
26	Mercury as Hg	USEPA 200.8	0.003 mg/l
27	Molybdenum as Mo	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.02 mg/l)
28	Selenium as Se	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.005 mg/l)
29	Aluminum as Al	IS: 3025 Part 65:2014 (Reaff:2019)	22.50 mg/l
30	Nickel as Ni	IS: 3025 Part 65:2014 (Reaff:2019)	0.032 mg/l
31	Zinc as Zn	IS: 3025 Part 65:2014 (Reaff:2019)	BDL(DL: 0.05 mg/l)
32	Potassium as K	IS: 3025 Part 45:2014 (Reaff:2019)	5.56 mg/l
33	Copper as Cu	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.02 mg/l)
34	Antimony as Sb	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.003 mg/l)
35	Barium as Ba	IS: 3025 Part 65:2014 (Reaff:2019)	0.263 mg/l
36	Cobalt as Co	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.01 mg/l)
37	Uranium as U	IS: 3025 Part 65:2014 (Reaff:2019)	BDL(DL : 0.001 mg/l)
38	Vanadium as V	IS: 3025 Part 65:2014 (Reaff:2019)	BDL(DL : 0.01 mg/l)
39	Lithium as Li	IS: 3025 Part 2:2004 (Reaff:2014)	BDL(DL : 0.01 mg/l)

End of Report



For Chennai Mettex Lab Private Limited

*P. Kavitha*  
Reviewed & Authorized By  
**P. KAVITHA**  
Technical Manager  
Authorised Signatory

NOTE: Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders will be liable for legal action. Unless otherwise stated the submitted results in this test report refer only to the sample(s) tested and such sample(s) are retained for 15 days only from the completion date of testing .. except in case of regulatory samples, which will be retained for a specific period as per statutory requirement; while perishable & environmental testing related remnant samples will be discarded consequent upon completion of testing. Samples are not drawn by us unless otherwise stated. This document cannot be reproduced Except in full, without prior written approval of the laboratory. This report is for the exclusive use of Chennai Mettex Lab's customer, and is provided in accordance with



E-mail : test@mettexlab.com  
 Web : www.mettexlab.com

Phone : 044-22323163, 22311034  
 42179490, 42179491



# CHENNAI METTEX LAB PRIVATE LIMITED



Jothi Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.

TC-5589

## TEST REPORT

Page No. 1 Of 2

**ISSUED TO :** M/s.ASAR Social Impact Advisors Pvt Ltd.,  
 No: 16 , 7 th Temple Street, 15 th Cross Road  
 Malleshwaram, Bangalore,  
 Karnataka – 560 003.

**T.C Date :** 02.03.2023  
**T.C No :** CML/22-23/81998  
**Date Of Receipt :** 13.02.2023  
**Commenced On :** 13.02.2023  
**Completed On :** 18.02.2023

**Cust. Ref :** SRF Dated: 11.02.2023  
**Lab No :** 2388263

**Sample Description :** Water-Coal Mine Discharge from Mine 1 and going all the way to  
 Bay of Bengal –Surface Water Sample Serial No : 7

Sl. No.	Test Parameters	Test Methods	Test Results
Discipline : Chemical		Group : Water & Residues in Water	
01	pH at 25°C	IS:3025 Part 11-1983 (Reaff:2017)	7.66
02	Turbidity	IS: 3025 Part 10:1984 (Reaff:2017)	277 NTU
03	Total Hardness as CaCO <sub>3</sub>	IS: 3025 Part 21:2009 (Reaff:2019)	200 mg/l
04	Chloride as Cl	IS: 3025 Part 32:1988 (Reaff:2019)	45.3 mg/l
05	Total Alkalinity as CaCO <sub>3</sub>	IS: 3025 Part 23:1986 (Reaff:2019)	47.3 mg/l
06	Sulphate as SO <sub>4</sub>	IS: 3025 Part 24:1986 (Reaff:2019)	60 mg/l
07	Total Dissolved Solids	IS: 3025 Part 16:1984 (Reaff:2017)	324 mg/l
08	Nitrate as NO <sub>3</sub>	IS: 3025 Part 34:1988 (Reaff:2019)	9 mg/l
09	Total Suspended Solids	IS:3025 Part 17:1984 (Reaff:2017)	25 mg/l
10	Oil & Grease	IS:3025 Part 39:2021	BDL(DL:1.0 mg/l)
11	Chemical Oxygen Demand	IS:3025 Part 58:2006 (Reaff:2017)	34.9 mg/l
12	Fluoride as F	APHA 23 <sup>rd</sup> Edn. 2017:4500 F,D	0.54 mg/l
13	Sulphide as S	IS:3025 Part 29:-986 (Reaff:2019)	BDL (DL:0.01 mg/l)
14	Iron as Fe	IS: 3025 Part 53:2003 (Reaff:2019)	1.54 mg/l
15	Calcium as Ca	IS: 3025 Part 40:1991 (Reaff:2019)	56 mg/l
16	Magnesium as Mg	IS: 3025 Part 46:1994 (Reaff:2019)	14.5 mg/l

..Contd....2

NOTE: Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders will be liable for legal action. Unless otherwise stated the submitted results in this test report refer only to the sample(s) tested and such sample(s) are retained for 15 days only from the completion date of testing. Except in full, without prior written approval of the laboratory. This report is for the exclusive use of Chennai Mettex Lab's customer, and is provided in accordance with the agreement between Chennai Mettex Lab and its Customer.

E-mail : test@mettexlab.com  
 Web : www.mettexlab.com

Phone : 044-22323163, 22311034  
 42179490, 42179491



# CHENNAI METTEX LAB PRIVATE LIMITED

Jothi Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.



TC-5589

Lab No: 2388263

T.C No: CML/22-23/81998

Dated : 02.03.2023

Page No. 2 of 2

Sl. No.	Test Parameters	Test Methods	Test Results
17	Conductivity @ 25°C	IS: 3025 Part 14:2013 (Reaff:2019)	589 µmhos/cm
18	Phosphorus as P	IS: 3025: Part:31-1988 (Reaff:2019)	0.063 mg/l
19	Silicon as Si	IS: 3025 Part 2:2004 (Reaff:2014)	34.267 mg/l
20	Total Arsenic as As	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.005 mg/l)
21	Boron as B	IS: 3025 Part 65:2014 (Reaff:2019)	0.163 mg/l
22	Cadmium as Cd	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.001 mg/l)
23	Total Chromium as Cr	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.02 mg/l)
24	Lead as Pb	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.005 mg/l)
25	Manganese as Mn	IS: 3025 Part 65:2014 (Reaff:2019)	0.035 mg/l
26	Mercury as Hg	USEPA 200.8	BDL (DL:0.0005 mg/l)
27	Molybdenum as Mo	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.02 mg/l)
28	Selenium as Se	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.005 mg/l)
29	Aluminum as Al	IS: 3025 Part 65:2014 (Reaff:2019)	1.136 mg/l
30	Nickel as Ni	IS: 3025 Part 65:2014 (Reaff:2019)	BDL(DL:0.005 mg/l)
31	Zinc as Zn	IS: 3025 Part 65:2014 (Reaff:2019)	BDL(DL: 0.05 mg/l)
32	Potassium as K	IS: 3025 Part 45:2014 (Reaff:2019)	2.31 mg/l
33	Copper as Cu	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.02 mg/l)
34	Antimony as Sb	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.003 mg/l)
35	Barium as Ba	IS: 3025 Part 65:2014 (Reaff:2019)	0.082 mg/l
36	Cobalt as Co	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.01 mg/l)
37	Uranium as U	IS: 3025 Part 65:2014 (Reaff:2019)	BDL(DL : 0.001 mg/l)
38	Vanadium as V	IS: 3025 Part 65:2014 (Reaff:2019)	BDL(DL : 0.01 mg/l)
39	Lithium as Li	IS: 3025 Part 2:2004 (Reaff:2014)	BDL(DL : 0.01 mg/l)

End of Report

For Chennai Mettex Lab Private Limited



*P. Kavitha*  
 Reviewed & Authorized By  
**P. KAVITHA**  
 Technical Manager  
 Authorised Signatory

NOTE: Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders will be liable for legal action. Unless otherwise stated the submitted results in this test report refer only to the sample(s) tested and such sample(s) are retained for 15 days only from the completion date of testing, except in case of regulatory samples, which will be retained for a specific period as per statutory requirement; while perishable & environmental testing related remnant samples will be discarded consequent upon completion of testing. Samples are not drawn by us unless otherwise stated. This document cannot be reproduced Except in full, without prior written approval of the laboratory. This report is for the exclusive use of Chennai Mettex Lab's customer, and is provided in accordance with



E-mail : test@mettexlab.com  
 Web : www.mettexlab.com

Phone : 044-22323163, 22311034  
 42179490, 42179491



# CHENNAI METTEX LAB PRIVATE LIMITED

Jothi Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.



TC-5589

## TEST REPORT

Page No. 1 Of 2

**ISSUED TO :** M/s.ASAR Social Impact Advisors Pvt Ltd.,  
 No: 16 , 7 th Temple Street, 15 th Cross Road  
 Malleshwaram, Bangalore,  
 Karnataka – 560 003.

**Cust. Ref :** SRF Dated : 11.02.2023

**Lab No :** 2388264

**Sample Description :** Water- Karikuppam Village Fish Pond  
 Surface Water - Sample Serial No : 23.

**T.C Date :** 02.03.2023

**T.C No :** CML/22-23/81999

**Date Of Receipt :** 13.02.2023

**Commenced On :** 13.02.2023

**Completed On :** 18.02.2023

Sl. No.	Test Parameters	Test Methods	Test Results
<b>Discipline :</b> Chemical		<b>Group :</b> Water & Residues in Water	
01	pH at 25°C	IS:3025 Part 11-1983 (Reaff:2017)	8.27
02	Turbidity	IS: 3025 Part 10:1984 (Reaff:2017)	104 NTU
03	Total Hardness as CaCO <sub>3</sub>	IS: 3025 Part 21:2009 (Reaff:2019)	405 mg/l
04	Chloride as Cl	IS: 3025 Part 32: 1988 (Reaff:2019)	234 mg/l
05	Total Alkalinity as CaCO <sub>3</sub>	IS: 3025 Part 23: 1986 (Reaff:2019)	283 mg/l
06	Sulphate as SO <sub>4</sub>	IS: 3025 Part 24: 1986 (Reaff:2019)	88 mg/l
07	Total Dissolved Solids	IS: 3025 Part 16: 1984 (Reaff:2017)	1005 mg/l
08	Nitrate as NO <sub>3</sub>	IS: 3025 Part 34: 1988 (Reaff:2019)	5.8 mg/l
09	Total Suspended Solids	IS:3025 Part 17:1984 (Reaff:2017)	16 mg/l
10	Fluoride as F	APHA 23 <sup>rd</sup> Edn. 2017:4500 F,D	1.10 mg/l
11	Sulphide as S	IS:3025 Part 29:-986 (Reaff:2019)	BDL (DL:0.01 mg/l)
12	Iron as Fe	IS: 3025 Part 53:2003 (Reaff:2019)	0.89 mg/l
13	Calcium as Ca	IS: 3025 Part 40:1991 (Reaff:2019)	80 mg/l
14	Magnesium as Mg	IS: 3025 Part 46:1994 (Reaff:2019)	49.8 mg/l

...Contd....2

NOTE: Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders will be liable for legal action. Unless otherwise stated the submitted results in this test report refer only to the sample(s) tested and such sample(s) are retained for 15 days only from the completion date of testing .. except in case of regulatory samples, which will be retained for a specific period as per statutory requirement; while perishable & environmental testing related remnant samples will be discarded consequent upon completion of testing. Samples are not drawn by us unless otherwise stated. This document cannot be reproduced Except in full, without prior written approval of the laboratory. This report is for the exclusive use of Chennai Mettex Lab's customer, and is provided in accordance with

E-mail : test@mettexlab.com  
 Web : www.mettexlab.com

Phone : 044-22323163, 22311034  
 42179490, 42179491



# CHENNAI METTEX LAB PRIVATE LIMITED

Jothi Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.



Lab No: 2388264

T.C No: CML/22-23/81999

Dated : 02.03.2023

Page No. 2 of 2

Sl. No.	Test Parameters	Test Methods	Test Results
15	Conductivity @ 25°C	IS: 3025 Part 14:2013 (Reaff:2019)	1488 µmhos/cm
16	Phosphorus as P	IS: 3025: Part:31-1988 (Reaff:2019)	0.32 mg/l
17	Silicon as Si	IS: 3025 Part 2:2004 (Reaff:2014)	10.562 mg/l
18	Total Arsenic as As	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.005 mg/l)
19	Boron as B	IS: 3025 Part 65:2014 (Reaff:2019)	0.097 mg/l
20	Cadmium as Cd	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.001 mg/l)
21	Total Chromium as Cr	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.02 mg/l)
22	Lead as Pb	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.005 mg/l)
23	Manganese as Mn	IS: 3025 Part 65:2014 (Reaff:2019)	BDL(DL:0.02 mg/l)
24	Mercury as Hg	USEPA 200.8	BDL (DL:0.0005 mg/l)
25	Molybdenum as Mo	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.02 mg/l)
26	Selenium as Se	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.005 mg/l)
27	Aluminum as Al	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.005 mg/l)
28	Nickel as Ni	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.005 mg/l)
29	Zinc as Zn	IS: 3025 Part 65:2014 (Reaff:2019)	BDL(DL: 0.05 mg/l)
30	Potassium as K	IS: 3025 Part 45:2014 (Reaff:2019)	30 mg/l
31	Copper as Cu	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.02 mg/l)
32	Antimony as Sb	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.003 mg/l)
33	Barium as Ba	IS: 3025 Part 65:2014 (Reaff:2019)	BDL(DL: 0.05 mg/l)
34	Cobalt as Co	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.01 mg/l)
35	Uranium as U	IS: 3025 Part 65:2014 (Reaff:2019)	BDL(DL : 0.001 mg/l)
36	Vanadium as V	IS: 3025 Part 65:2014 (Reaff:2019)	BDL(DL : 0.01 mg/l)
37	Lithium as Li	IS: 3025 Part 2:2004 (Reaff:2014)	BDL(DL : 0.01 mg/l)

End of Report

For Chennai Mettex Lab Private Limited



*[Signature]*  
 Reviewed & Authorized By  
**P. KAVITHA**  
 Technical Manager  
 Authorised Signatory

NOTE: Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders will be liable for legal action. Unless otherwise stated the submitted results in this test report refer only to the sample(s) tested and such sample(s) are retained for 15 days only from the completion date of testing, except in case of regulatory samples, which will be retained for a specific period as per statutory requirement; while perishable & environmental testing related remnant samples will be discarded consequent upon completion of testing. Samples are not drawn by us unless otherwise stated. This document cannot be reproduced Except in full, without prior written approval of the laboratory. This report is for the exclusive use of Chennai Mettex Lab's customer, and is provided in accordance with



E-mail : test@mettexlab.com  
Web : www.mettexlab.com

Phone : 044-22323163, 22311034  
42179490, 42179491



**CHENNAI METTEX LAB PRIVATE LIMITED**

Jothi Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.



TC-5589

**TEST REPORT**

Page No. 1 Of 2

**ISSUED TO :** M/s.ASAR Social Impact Advisors Pvt Ltd.,

**T.C Date :** 02.03.2023

No: 16 , 7 th Temple Street, 15 th Cross Road  
Malleshwaram, Bangalore,  
Karnataka – 560 003.

**T.C No :** CML/22-23/82000

**Cust. Ref :** SRF Dated : 11.02.2023

**Date Of Receipt :** 13.02.2023

**Commenced On :** 13.02.2023

**Lab No :** 2388265

**Completed On :** 18.02.2023

**Sample Description :** Water- Canal Near the Thermal Power Plant (Water Discharge from the Plant  
Time to Time ) Surface Water - Sample Serial No : 25.

SI. No.	Test Parameters	Test Methods	Test Results
Discipline : Chemical		Group : Water & Residues in Water	
01	pH at 25°C	IS:3025 Part 11-1983 (Reaff:2017)	7.96
02	Turbidity	IS: 3025 Part 10:1984 (Reaff:2017)	94 NTU
03	Total Hardness as CaCO <sub>3</sub>	IS: 3025 Part 21:2009 (Reaff:2019)	350 mg/l
04	Chloride as Cl	IS: 3025 Part 32:1988 (Reaff:2019)	446 mg/l
05	Total Alkalinity as CaCO <sub>3</sub>	IS: 3025 Part 23:1986 (Reaff:2019)	262 mg/l
06	Sulphate as SO <sub>4</sub>	IS: 3025 Part 24:1986 (Reaff:2019)	86 mg/l
07	Total Dissolved Solids	IS: 3025 Part 16:1984 (Reaff:2017)	1315 mg/l
08	Nitrate as NO <sub>3</sub>	IS: 3025 Part 34:1988 (Reaff:2019)	7 mg/l
09	Total Suspended Solids	IS:3025 Part 17:1984 (Reaff:2017)	14 mg/l
10	Oil & Grease	IS:3025 Part 39:2021	BDL(DL:1.0 mg/l)
11	Chemical Oxygen Demand	IS:3025 Part 58:2006 (Reaff:2017)	17 mg/l
12	Fluoride as F	APHA 23 <sup>rd</sup> Edn. 2017:4500 F,D	1.21 mg/l
13	Sulphide as S	IS:3025 Part 29:-986 (Reaff:2019)	BDL (DL:0.01 mg/l)
14	Iron as Fe	IS: 3025 Part 53:2003 (Reaff:2019)	0.93 mg/l
15	Calcium as Ca	IS: 3025 Part 40:1991 (Reaff:2019)	50 mg/l
16	Magnesium as Mg	IS: 3025 Part 46:1994 (Reaff:2019)	54.6 mg/l

...Contd....2

NOTE: Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders will be liable for legal action. Unless otherwise stated the submitted results in this test report refer only to the sample(s) tested and such sample(s) are retained for 15 days only from the completion date of testing .. except in case of regulatory samples, which will be retained for a specific period as per statutory requirement; while perishable & environmental testing related remnant samples will be discarded consequent upon completion of testing. Samples are not drawn by us unless otherwise stated. This document cannot be reproduced Except in full, without prior written approval of the laboratory. This report is for the exclusive use of Chennai Mettex Lab's customer, and is provided in accordance with the agreement between Chennai Mettex Lab and its Customer.

E-mail : test@mettexlab.com  
 Web : www.mettexlab.com

Phone : 044-22323163, 22311034  
 42179490, 42179491



# CHENNAI METTEX LAB PRIVATE LIMITED

Jothi Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.



TC-5589

Lab No: 2388265

T.C No: CML/22-23/82000

Dated : 02.03.2023

Page No. 2 of 2

SI. No.	Test Parameters	Test Methods	Test Results
17	Conductivity @ 25°C	IS: 3025 Part 14:2013 (Reaff:2019)	2025 µmhos/cm
18	Phosphorus as P	IS: 3025: Part:31-1988 (Reaff:2019)	0.47 mg/l
19	Silicon as Si	IS: 3025 Part 2:2004 (Reaff:2014)	10.775 mg/l
20	Total Arsenic as As	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.005 mg/l)
21	Boron as B	IS: 3025 Part 65:2014 (Reaff:2019)	0.526 mg/l
22	Cadmium as Cd	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.001 mg/l)
23	Total Chromium as Cr	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.02 mg/l)
24	Lead as Pb	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.005 mg/l)
25	Manganese as Mn	IS: 3025 Part 65:2014 (Reaff:2019)	BDL(DL:0.02 mg/l)
26	Mercury as Hg	USEPA 200.8	BDL (DL:0.0005 mg/l)
27	Molybdenum as Mo	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.02 mg/l)
28	Selenium as Se	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.005 mg/l)
29	Aluminum as Al	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.005 mg/l)
30	Nickel as Ni	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.005 mg/l)
31	Zinc as Zn	IS: 3025 Part 65:2014 (Reaff:2019)	BDL(DL: 0.05 mg/l)
32	Potassium as K	IS: 3025 Part 45:2014 (Reaff:2019)	20 mg/l
33	Copper as Cu	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.02 mg/l)
34	Antimony as Sb	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.003 mg/l)
35	Barium as Ba	IS: 3025 Part 65:2014 (Reaff:2019)	BDL(DL: 0.05 mg/l)
36	Cobalt as Co	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.01 mg/l)
37	Uranium as U	IS: 3025 Part 65:2014 (Reaff:2019)	BDL(DL : 0.001 mg/l)
38	Vanadium as V	IS: 3025 Part 65:2014 (Reaff:2019)	BDL(DL : 0.01 mg/l)
39	Lithium as Li	IS: 3025 Part 2:2004 (Reaff:2014)	BDL(DL : 0.01 mg/l)

End of Report



For Chennai Mettex Lab Private Limited

*[Signature]*  
 Reviewed & Authorized By  
**P. KAVITHA**  
 Technical Manager  
 Authorised Signatory

NOTE: Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders will be liable for legal action. Unless otherwise stated the submitted results in this test report refer only to the sample(s) tested and such sample(s) are retained for 15 days only from the completion date of testing .. except in case of regulatory samples, which will be retained for a specific period as per statutory requirement; while perishable & environmental testing related remnant samples will be discarded consequent upon completion of testing. Samples are not drawn by us unless otherwise stated. This document cannot be reproduced Except in full, without prior written approval of the laboratory. This report is for the exclusive use of Chennai Mettex Lab's customer, and is provided in accordance with the agreement between Chennai Mettex Lab and its Customer.



E-mail : test@mettexlab.com  
Web : www.mettexlab.com

Phone : 044-22323163, 22311034  
42179490, 42179491



**CHENNAI METTEX LAB PRIVATE LIMITED**

Jothi Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.



TC-5589

**TEST REPORT**

Page No. 1 Of 2

**ISSUED TO :** M/s.ASAR Social Impact Advisors Pvt Ltd.,

**T.C Date :** 02.03.2023

No: 16 , 7 th Temple Street, 15 th Cross Road  
Malleshwaram, Bangalore,  
Karnataka – 560 003.

**T.C No :** CML/22-23/82001

**Cust. Ref :** SRF Dated : 11.02.2023

**Date Of Receipt :** 13.02.2023

**Commenced On :** 13.02.2023

**Lab No :** 2388266

**Completed On :** 18.02.2023

**Sample Description :** Water- Pudukuppam Village- Contaminated Pipe Water from Polluted Location.  
Piped Water - Sample Serial No : 22.

Sl. No.	Test Parameters	Test Methods	Test Results
<b>Discipline : Chemical</b>		<b>Group : Water &amp; Residues in Water</b>	
01	pH at 25°C	IS:3025 Part 11-1983 (Reaff:2017)	7.83
02	Turbidity	IS: 3025 Part 10:1984 (Reaff:2017)	Less than 0.5 NTU
03	Total Hardness as CaCO <sub>3</sub>	IS: 3025 Part 21:2009 (Reaff:2019)	318 mg/l
04	Chloride as Cl	IS: 3025 Part 32:1988 (Reaff:2019)	90.6 mg/l
05	Total Alkalinity as CaCO <sub>3</sub>	IS: 3025 Part 23:1986 (Reaff:2019)	208 mg/l
06	Sulphate as SO <sub>4</sub>	IS: 3025 Part 24:1986 (Reaff:2019)	68.6 mg/l
07	Total Dissolved Solids	IS: 3025 Part 16:1984 (Reaff:2017)	497 mg/l
08	Nitrate as NO <sub>3</sub>	IS: 3025 Part 34:1988 (Reaff:2019)	16 mg/l
09	Total Suspended Solids	IS:3025 Part 17:1984 (Reaff:2017)	BDL(DL:1.0 mg/l)
10	Fluoride as F	APHA 23 <sup>rd</sup> Edn. 2017:4500 F,D	0.59 mg/l
11	Sulphide as S	IS:3025 Part 29:-986 (Reaff:2019)	BDL (DL:0.01 mg/l)
12	Iron as Fe	IS: 3025 Part 53:2003 (Reaff:2019)	0.18 mg/l
13	Calcium as Ca	IS: 3025 Part 40:1991 (Reaff:2019)	81 mg/l
14	Magnesium as Mg	IS: 3025 Part 46:1994 (Reaff:2019)	28 mg/l

...Contd....2

*Handwritten signature*

NOTE: Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders will be liable for legal action. Unless otherwise stated the submitted results in this test report refer only to the sample(s) tested and such sample(s) are retained for 15 days only from the completion date of testing .. except in case of regulatory samples, which will be retained for a specific period as per statutory requirement; while perishable & environmental testing related remnant samples will be discarded consequent upon completion of testing. Samples are not drawn by us unless otherwise stated. This document cannot be reproduced Except in full, without prior written approval of the laboratory. This report is for the exclusive use of Chennai Mettex Lab's customer, and is provided in accordance with the agreement between Chennai Mettex Lab and its Customer.

E-mail : test@mettexlab.com  
 Web : www.mettexlab.com

Phone : 044-22323163, 22311034  
 42179490, 42179491



# CHENNAI METTEX LAB PRIVATE LIMITED

Jothi Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.



TC-5589

Lab No: 2388266

T.C No: CML/22-23/82001

Dated : 02.03.2023

Page No. 2 of 2

Sl. No.	Test Parameters	Test Methods	Test Results
17	Conductivity @ 25°C	IS: 3025 Part 14:2013 (Reaff.2019)	888 µmhos/cm
18	Phosphorus as P	IS: 3025: Part:31-1988 (Reaff.2019)	0.39 mg/l
19	Silicon as Si	IS: 3025 Part 2:2004 (Reaff.2014)	12.569 mg/l
20	Total Arsenic as As	IS: 3025 Part 65:2014 (Reaff.2019)	BDL (DL:0.005 mg/l)
21	Boron as B	IS: 3025 Part 65:2014 (Reaff.2019)	0.070 mg/l
22	Cadmium as Cd	IS: 3025 Part 65:2014 (Reaff.2019)	BDL (DL:0.001 mg/l)
23	Total Chromium as Cr	IS: 3025 Part 65:2014 (Reaff.2019)	BDL (DL:0.02 mg/l)
24	Lead as Pb	IS: 3025 Part 65:2014 (Reaff.2019)	BDL (DL:0.005 mg/l)
25	Manganese as Mn	IS: 3025 Part 65:2014 (Reaff.2019)	0.076 mg/l
26	Mercury as Hg	USEPA 200.8	BDL (DL:0.0005 mg/l)
27	Molybdenum as Mo	IS: 3025 Part 65:2014 (Reaff.2019)	BDL (DL:0.02 mg/l)
28	Selenium as Se	IS: 3025 Part 65:2014 (Reaff.2019)	BDL (DL:0.005 mg/l)
29	Aluminum as Al	IS: 3025 Part 65:2014 (Reaff.2019)	BDL (DL:0.005 mg/l)
30	Nickel as Ni	IS: 3025 Part 65:2014 (Reaff.2019)	BDL (DL:0.005 mg/l)
31	Zinc as Zn	IS: 3025 Part 65:2014 (Reaff.2019)	BDL(DL: 0.05 mg/l)
32	Potassium as K	IS: 3025 Part 45:2014 (Reaff.2019)	8.03 mg/l
33	Copper as Cu	IS: 3025 Part 65:2014 (Reaff.2019)	BDL (DL:0.02 mg/l)
34	Antimony as Sb	IS: 3025 Part 65:2014 (Reaff.2019)	BDL (DL:0.003 mg/l)
35	Barium as Ba	IS: 3025 Part 65:2014 (Reaff.2019)	BDL(DL: 0.05 mg/l)
36	Cobalt as Co	IS: 3025 Part 65:2014 (Reaff.2019)	BDL (DL:0.01 mg/l)
37	Uranium as U	IS: 3025 Part 65:2014 (Reaff.2019)	BDL(DL : 0.001 mg/l)
38	Vanadium as V	IS: 3025 Part 65:2014 (Reaff.2019)	BDL(DL : 0.01 mg/l)
39	Lithium as Li	IS: 3025 Part 2:2004 (Reaff.2014)	BDL(DL : 0.01 mg/l)

End of Report



For Chennai Mettex Lab Private Limited

*(Signature)*

Reviewed & Authorized By  
**P. KAVITHA**  
 Technical Manager  
 Authorised Signatory

NOTE: Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders will be liable for legal action. Unless otherwise stated the submitted results in this test report refer only to the sample(s) tested and such sample(s) are retained for 15 days only from the completion date of testing, except in case of regulatory samples, which will be retained for a specific period as per statutory requirement; while perishable & environmental testing related remnant samples will be discarded consequent upon completion of testing. Samples are not drawn by us unless otherwise stated. This document cannot be reproduced except in full, without prior written approval of the laboratory. This report is for the exclusive use of Chennai Mettex Lab's customer, and is provided in accordance with the agreement between Chennai Mettex Lab and its Customer.



E-mail : test@mettexlab.com  
Web : www.mettexlab.com

Phone : 044-22323163, 22311034  
42179490, 42179491



# CHENNAI METTEX LAB PRIVATE LIMITED

Jothi Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.



TC-5589

## TEST REPORT

Page No. 1 Of 2

**ISSUED TO :** M/s.ASAR Social Impact Advisors Pvt Ltd.,

**T.C Date :** 02.03.2023

No: 16 , 7 th Temple Street, 15 th Cross Road  
Malleshwaram, Bangalore,  
Karnataka – 560 003.

**T.C No :** CML/22-23/82002

**Cust. Ref :** SRF Dated : 11.02.2023

**Date Of Receipt :** 13.02.2023

**Lab No :** 2388267

**Commenced On :** 13.02.2023

**Completed On :** 18.02.2023

**Sample Description :** Water- Pudukuppam Village- Ground Water - Sample Serial No : 21.

Sl. No.	Test Parameters	Test Methods	Test Results
<b>Discipline :</b> Chemical		<b>Group :</b> Water & Residues in Water	
01	pH at 25°C	IS:3025 Part 11-1983 (Reaff:2017)	7.92
02	Turbidity	IS: 3025 Part 10:1984 (Reaff:2017)	Less than 0.5 NTU
03	Total Hardness as CaCO <sub>3</sub>	IS: 3025 Part 21:2009 (Reaff:2019)	282 mg/l
04	Chloride as Cl	IS: 3025 Part 32:1988 (Reaff:2019)	87.7 mg/l
05	Total Alkalinity as CaCO <sub>3</sub>	IS: 3025 Part 23:1986 (Reaff:2019)	249.2 mg/l
06	Sulphate as SO <sub>4</sub>	IS: 3025 Part 24:1986 (Reaff:2019)	52 mg/l
07	Total Dissolved Solids	IS: 3025 Part 16:1984 (Reaff:2017)	508 mg/l
08	Nitrate as NO <sub>3</sub>	IS: 3025 Part 34:1988 (Reaff:2019)	18 mg/l
09	Total Suspended Solids	IS:3025 Part 17:1984 (Reaff:2017)	BDL(DL:1.0 mg/l)
10	Fluoride as F	APHA 23 <sup>rd</sup> Edn. 2017:4500 F,D	0.69 mg/l
11	Sulphide as S	IS:3025 Part 29-986 (Reaff:2019)	BDL (DL:0.01 mg/l)
12	Iron as Fe	IS: 3025 Part 53:2003 (Reaff:2019)	0.23 mg/l
13	Calcium as Ca	IS: 3025 Part 40:1991 (Reaff:2019)	65.7 mg/l
14	Magnesium as Mg	IS: 3025 Part 46:1994 (Reaff:2019)	28.6 mg/l

...Contd....2

NOTE: Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders will be liable for legal action. Unless otherwise stated the submitted results in this test report refer only to the sample(s) tested and such sample(s) are retained for 15 days only from the completion date of testing .. except in case of regulatory samples, which will be retained for a specific period as per statutory requirement; while perishable & environmental testing related remnant samples will be discarded consequent upon completion of testing. Samples are not drawn by us unless otherwise stated. This document cannot be reproduced Except in full, without prior written approval of the laboratory. This report is for the exclusive use of Chennai Mettex Lab's customer, and is provided in accordance with the agreement between Chennai Mettex Lab and its Customer.

E-mail : test@mettexlab.com  
Web : www.mettexlab.com

Phone : 044-22323163, 22311034  
42179490, 42179491



# CHENNAI METTEX LAB PRIVATE LIMITED

Jothi Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.



TC-5589

Lab No: 2388267

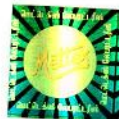
T.C No: CML/22-23/82002

Dated : 02.03.2023

Page No. 2 of 2

SI. No.	Test Parameters	Test Methods	Test Results
17	Conductivity @ 25°C	IS: 3025 Part 14:2013 (Reaff:2019)	908 µmhos/cm
18	Phosphorus as P	IS: 3025: Part:31-1988 (Reaff:2019)	0.080 mg/l
19	Silicon as Si	IS: 3025 Part 2:2004 (Reaff:2014)	10.241 mg/l
20	Total Arsenic as As	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.005 mg/l)
21	Boron as B	IS: 3025 Part 65:2014 (Reaff:2019)	0.062 mg/l
22	Cadmium as Cd	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.001 mg/l)
23	Total Chromium as Cr	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.02 mg/l)
24	Lead as Pb	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.005 mg/l)
25	Manganese as Mn	IS: 3025 Part 65:2014 (Reaff:2019)	0.068 mg/l
26	Mercury as Hg	USEPA 200.8	BDL (DL:0.0005 mg/l)
27	Molybdenum as Mo	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.02 mg/l)
28	Selenium as Se	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.005 mg/l)
29	Aluminum as Al	IS: 3025 Part 65:2014 (Reaff:2019)	0.010 mg/l
30	Nickel as Ni	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.005 mg/l)
31	Zinc as Zn	IS: 3025 Part 65:2014 (Reaff:2019)	BDL(DL: 0.05 mg/l)
32	Potassium as K	IS: 3025 Part 45:2014 (Reaff:2019)	14.16 mg/l
33	Copper as Cu	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.02 mg/l)
34	Antimony as Sb	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.003 mg/l)
35	Barium as Ba	IS: 3025 Part 65:2014 (Reaff:2019)	BDL(DL: 0.05 mg/l)
36	Cobalt as Co	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.01 mg/l)
37	Uranium as U	IS: 3025 Part 65:2014 (Reaff:2019)	BDL(DL : 0.001 mg/l)
38	Vanadium as V	IS: 3025 Part 65:2014 (Reaff:2019)	BDL(DL : 0.01 mg/l)
39	Lithium as Li	IS: 3025 Part 2:2004 (Reaff:2014)	BDL(DL : 0.01 mg/l)

End of Report



For Chennai Mettex Lab Private Limited

*(Signature)*

Reviewed & Authorized By

**P. KAVITHA**  
Technical Manager  
Authorised Signatory

NOTE: Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders will be liable for legal action. Unless otherwise stated the submitted results in this test report refer only to the sample(s) tested and such sample(s) are retained for 15 days only from the completion date of testing, except in case of regulatory samples, which will be retained for a specific period as per statutory requirement; while perishable & environmental testing related remnant samples will be discarded consequent upon completion of testing. Samples are not drawn by us unless otherwise stated. This document cannot be reproduced except in full, without prior written approval of the laboratory. This report is for the exclusive use of Chennai Mettex Lab's customer, and is provided in accordance with the agreement between Chennai Mettex Lab and its Customer.



E-mail : test@mettexlab.com  
Web : www.mettexlab.com

Phone : 044-22323163, 22311034  
42179490, 42179491



## CHENNAI METTEX LAB PRIVATE LIMITED<sup>®</sup>

Jothi Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.



TC-5589

### TEST REPORT

Page No. 1 Of 2

**ISSUED TO :** M/s.ASAR Social Impact Advisors Pvt Ltd.,

**T.C Date :** 02.03.2023

No: 16 , 7 th Temple Street, 15 th Cross Road  
Malleshwaram, Bangalore,  
Karnataka – 560 003.

**T.C No :** CML/22-23/82003

**Cust. Ref :** SRF Dated : 11.02.2023

**Date Of Receipt :** 13.02.2023

**Commenced On :** 13.02.2023

**Lab No :** 2388268

**Completed On :** 18.02.2023

**Sample Description :** Water- Karikuppam Village- Ground Water - Sample Serial No : 26.

Sl. No.	Test Parameters	Test Methods	Test Results
Discipline : Chemical		Group : Water & Residues in Water	
01	pH at 25°C	IS:3025 Part 11-1983 (Reaff:2017)	7.27
02	Turbidity	IS: 3025 Part 10:1984 (Reaff:2017)	18 NTU
03	Total Hardness as CaCO <sub>3</sub>	IS: 3025 Part 21:2009 (Reaff:2019)	415 mg/l
04	Chloride as Cl	IS: 3025 Part 32:1988 (Reaff:2019)	192 mg/l
05	Total Alkalinity as CaCO <sub>3</sub>	IS: 3025 Part 23:1986 (Reaff:2019)	267.8 mg/l
06	Sulphate as SO <sub>4</sub>	IS: 3025 Part 24:1986 (Reaff:2019)	128.7 mg/l
07	Total Dissolved Solids	IS: 3025 Part 16:1984 (Reaff:2017)	902 mg/l
08	Nitrate as NO <sub>3</sub>	IS: 3025 Part 34:1988 (Reaff:2019)	26 mg/l
09	Total Suspended Solids	IS:3025 Part 17:1984 (Reaff:2017)	8 mg/l
10	Fluoride as F	APHA 23 <sup>rd</sup> Edn. 2017:4500 F,D	1.15 mg/l
11	Sulphide as S	IS:3025 Part 29:-986 (Reaff:2019)	BDL (DL:0.01 mg/l)
12	Iron as Fe	IS: 3025 Part 53:2003 (Reaff:2019)	0.39 mg/l
13	Calcium as Ca	IS: 3025 Part 40:1991 (Reaff:2019)	92 mg/l
14	Magnesium as Mg	IS: 3025 Part 46:1994 (Reaff:2019)	44.9 mg/l

...Contd....2

NOTE: Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders will be liable for legal action. Unless otherwise stated the submitted results in this test report refer only to the sample(s) tested and such sample(s) are retained for 15 days only from the completion date of testing .. except in case of regulatory samples, which will be retained for a specific period as per statutory requirement; while perishable & environmental testing related remnant samples will be discarded consequent upon completion of testing. Samples are not drawn by us unless otherwise stated. This document cannot be reproduced Except in full, without prior written approval of the laboratory. This report is for the exclusive use of Chennai Mettex Lab's customer, and is provided in accordance with the agreement between Chennai Mettex Lab and its Customer.





E-mail: test@mettexlab.com  
Web : www.mettexlab.com

Phone : 044-22323163, 22311034  
42179490, 42179491



## CHENNAI METTEX LAB PRIVATE LIMITED

Jothi Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.

(Approved/Recognized by APEDA, AGMARK, GAFTA, EIC, FSSAI, BIS & MoEF)

### TEST REPORT

Page No. 1 Of 2

**ISSUED TO :** M/s.ASAR Social Impact Advisors Pvt Ltd.,

**T.C Date :** 02.03.2023

No: 16 , 7 th Temple Street, 15 th Cross Road  
Malleshwaram, Bangalore,  
Karnataka – 560 003.

**T.C No :** CML/22-23/82004

**Cust. Ref :** SRF Dated : 11.02.2023

**Date Of Receipt :** 13.02.2023

**Lab No :** 2388269

**Commenced On :** 13.02.2023

**Completed On :** 22.02.2023

**Sample Description :** Soil- Karikuppam Village Agri Land Farm Soil Near Thermal Power Plant.  
Soil - Sample Serial No : 24.

S. No	Test Parameters	Protocols	Results
01	pH @ 25°C	IS : 2720 Part 26: 1987 (Reaff: 2016)	6.30
02	Total Phosphorus as P	IS 10158 : 1982 (Reaff: 2019)	499 mg/kg
03	Electrical Conductivity	IS 14767 - 2000 (Reaff : 2016)	166 µmhos/cm
04	Total Nitrogen as N	IS 14684 : 1999 (Reaff:2019)	1661 mg/kg
05	Organic Carbon	IS : 2720 Part 22: 1972 (Reaff: 2020)	0.22 %
06	Sulphur	USEPA 3050 B – 1996 & USEPA 6010 C - 2000	177.7mg/kg
07	Arsenic as As	USEPA 3050 B – 1996 & USEPA 6010 C - 2000	BDL(DL:1.0 mg/kg)
08	Boron as B		59.3 mg/kg
09	Cadmium as Cd		BDL(DL:1.0 mg/kg)
10	Total Chromium as Cr		24.8 mg/kg
11	Iron as Fe		4039 mg/kg
12	Lead as Pb		BDL(DL:1.0 mg/kg)
13	Manganese as Mn		29.3 mg/kg
14	Mercury as Hg		BDL(DL:1.0 mg/kg)
15	Molybdenum as Mo		BDL(DL:1.0 mg/kg)
16	Selenium as Se		BDL(DL:1.0 mg/kg)
17	Aluminium as Al		1936 mg/kg

...Contd....2

NOTE: Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders will be liable for legal action. Unless otherwise stated the submitted results in this test report refer only to the sample(s) tested and such sample(s) are retained for 15 days only from the completion date of testing., except in case of regulatory samples, which will be retained for a specific period as per statutory requirement; while perishable & environmental testing related remnant samples will be discarded consequent upon completion of testing. Samples are not drawn by us unless otherwise stated. This document cannot be reproduced except in full, without prior written approval of the laboratory. This report is for the exclusive use of Chennai Mettex Lab's customer and is provided in accordance with the agreement between Chennai Mettex Lab and its Customer.









E-mail : test@mettexlab.com  
Web : www.mettexlab.com

Phone : 044-22323163, 22311034  
42179490, 42179491



**CHENNAI METTEX LAB PRIVATE LIMITED**

Jothi Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.



TC-5589

**TEST REPORT**

Page No. 1 Of 2

**ISSUED TO :** M/s.ASAR Social Impact Advisors Pvt Ltd.,

**T.C Date :** 16.02.2023

No: 16 , 7 th Temple Street, 15 th Cross Road  
Malleswaram, Bangalore,  
Karnataka – 560 003.

**T.C No :** CML/22-23/78122

**Cust. Ref :** SRF Dated : 02.02.2023

**Date Of Receipt :** 04.02.2023

**Lab No :** 2385545

**Commenced On :** 04.02.2023

**Completed On :** 13.02.2023

**Sample Description :** Water- Pond Near to Ash Pond, Water Discharge to the Pond Sometimes  
(Adhandarkollai) Surface Water - Sample Serial No 14.

Sl. No.	Test Parameters	Test Methods	Test Results
<b>Discipline :</b> Chemical		<b>Group :</b> Water & Residues in Water	
01	pH at 25°C	IS:3025 Part 11-1983 (Reaff:2017)	6.84
02	Turbidity	IS: 3025 Part 10:1984 (Reaff:2017)	38 NTU
03	Total Hardness as CaCO <sub>3</sub>	IS: 3025 Part 21:2009 (Reaff:2019)	330 mg/l
04	Chloride as Cl	IS: 3025 Part 32:1988 (Reaff:2019)	92.2 mg/l
05	Total Alkalinity as CaCO <sub>3</sub>	IS: 3025 Part 23:1986 (Reaff:2019)	15 mg/l
06	Sulphate as SO <sub>4</sub>	IS: 3025 Part 24:1986 (Reaff:2019)	98 mg/l
07	Total Dissolved Solids	IS: 3025 Part 16:1984 (Reaff:2017)	613 mg/l
08	Nitrate as NO <sub>3</sub>	IS: 3025 Part 34:1988 (Reaff:2019)	31 mg/l
09	Total Suspended Solids	IS:3025 Part 17:1984 (Reaff:2017)	6 mg/l
10	Oil & Grease	IS:3025 Part 39:2021	BDL (DL:1.0 mg/l)
11	Chemical Oxygen Demand	IS:3025 Part 58:2006 (Reaff:2017)	8.4 mg/l
12	Fluoride as F	APHA 23 <sup>rd</sup> Edn. 2017:4500 F,D	0.84 mg/l
13	Sulphide as S	IS:3025 Part 29:-986 (Reaff:2019)	BDL (DL:0.01 mg/l)
14	Iron as Fe	IS: 3025 Part 53:2003 (Reaff:2019)	0.34 mg/l
15	Calcium as Ca	IS: 3025 Part 40:1991 (Reaff:2019)	104 mg/l
16	Magnesium as Mg	IS: 3025 Part 46:1994 (Reaff:2019)	17 mg/l

...Contd....2

*(Signature)*

NOTE: Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders will be liable for legal action. Unless otherwise stated the submitted results in this test report refer only to the sample(s) tested and such sample(s) are retained for 15 days only from the completion date of testing .. except in case of regulatory samples, which will be retained for a specific period as per statutory requirement; while perishable & environmental testing related remnant samples will be discarded consequent upon completion of testing. Samples are not drawn by us unless otherwise stated. This document cannot be reproduced Except in full, without prior written approval of the laboratory. This report is for the exclusive use of Chennai Mettex Lab's customer, and is provided in accordance with

E-mail : test@mettexlab.com  
Web : www.mettexlab.com

Phone : 044-22323163, 22311034  
42179490, 42179491



# CHENNAI METTEX LAB PRIVATE LIMITED

Jothi Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.



TC-5589

Lab No: 2385545

T.C No: CML/22-23/78122

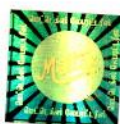
Dated : 16.02.2023

Page No. 2 of 2

Sl. No.	Test Parameters	Test Methods	Test Results
17	Conductivity @ 25°C	IS: 3025 Part 14:2013 (Reaff:2019)	1077 µmhos/cm
18	Phosphorus as P	IS: 3025: Part:31-1988 (Reaff:2019)	BDL (DL:0.01 mg/l)
19	Silicon as Si	IS: 3025 Part 2:2004 (Reaff:2014)	14.58 mg/l
20	Total Arsenic as As	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.005 mg/l)
21	Boron as B	IS: 3025 Part 65:2014 (Reaff:2019)	0.157 mg/l
22	Cadmium as Cd	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.001 mg/l)
23	Total Chromium as Cr	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.02 mg/l)
24	Lead as Pb	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.02 mg/l)
25	Manganese as Mn	IS: 3025 Part 65:2014 (Reaff:2019)	0.731 mg/l
26	Mercury as Hg	USEPA 200.8	BDL (DL:0.0005 mg/l)
27	Molybdenum as Mo	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.02 mg/l)
28	Selenium as Se	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.005 mg/l)
29	Aluminum as Al	IS: 3025 Part 65:2014 (Reaff:2019)	0.164 mg/l
30	Nickel as Ni	IS: 3025 Part 65:2014 (Reaff:2019)	0.034 mg/l
31	Zinc as Zn	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.05 mg/l)
32	Potassium as K	IS: 3025 Part 45:2014 (Reaff:2019)	5.542 mg/l
33	Copper as Cu	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.02 mg/l)
34	Antimony as Sb	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.003 mg/l)
35	Barium as Ba	IS: 3025 Part 65:2014 (Reaff:2019)	0.056 mg/l
36	Cobalt as Co	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.01 mg/l)
37	Uranium as U	IS: 3025 Part 65:2014 (Reaff:2019)	BDL(DL : 0.001 mg/l)
38	Vanadium as V	IS: 3025 Part 65:2014 (Reaff:2019)	BDL(DL : 0.01 mg/l)
39	Lithium as Li	IS: 3025 Part 2:2004 (Reaff:2014)	BDL(DL : 0.01 mg/l)

**Abbreviation:** BDL: Below Detection Limit, DL: Detection Limit.

End of Report



For Chennai Mettex Lab Private Limited

*[Signature]*  
Reviewed & Authorized By  
**P. KAVITHA**  
Technical Manager  
Authorised Signatory

NOTE: Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders will be liable for legal action. Unless otherwise stated the submitted results in this test report refer only to the sample(s) tested and such sample(s) are retained for 15 days only from the completion date of testing, except in case of regulatory samples, which will be retained for a specific period as per statutory requirement; while perishable & environmental testing related remnant samples will be discarded consequent upon completion of testing. Samples are not drawn by us unless otherwise stated. This document cannot be reproduced Except in full, without prior written approval of the laboratory. This report is for the exclusive use of Chennai Mettex Lab's customer, and is provided in accordance with



E-mail : test@mettexlab.com  
 Web : www.mettexlab.com

Phone : 044-22323163, 22311034  
 42179490, 42179491



# CHENNAI METTEX LAB PRIVATE LIMITED

Jothi Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.



TC-5589

## TEST REPORT

Page No. 1 Of 2

**ISSUED TO :** M/s.ASAR Social Impact Advisors Pvt Ltd.,  
 No: 16 , 7 th Temple Street, 15 th Cross Road  
 Malleshwaram, Bangalore,  
 Karnataka – 560 003.

**T.C Date :** 16.02.2023  
**T.C No :** CML/22-23/78121  
**Date Of Receipt :** 04.02.2023  
**Commenced On :** 04.02.2023  
**Completed On :** 13.02.2023

**Cust. Ref :** SRF Dated : 02.02.2023  
**Lab No :** 2385546

**Sample Description :** Water- (The Mine Discharge its Water into the lake and then lake water is used for Irrigation) Surface Water - Sample Serial No 11.

Sl. No.	Test Parameters	Test Methods	Test Results
<b>Discipline :</b> Chemical		<b>Group :</b> Water & Residues in Water	
01	pH at 25°C	IS:3025 Part 11-1983 (Reaff:2017)	6.56
02	Turbidity	IS: 3025 Part 10:1984 (Reaff:2017)	99 NTU
03	Total Hardness as CaCO <sub>3</sub>	IS: 3025 Part 21:2009 (Reaff:2019)	425 mg/l
04	Chloride as Cl	IS: 3025 Part 32:1988 (Reaff:2019)	116 mg/l
05	Total Alkalinity as CaCO <sub>3</sub>	IS: 3025 Part 23:1986 (Reaff:2019)	122 mg/l
06	Sulphate as SO <sub>4</sub>	IS: 3025 Part 24:1986 (Reaff:2019)	74 mg/l
07	Total Dissolved Solids	IS: 3025 Part 16:1984 (Reaff:2017)	670 mg/l
08	Nitrate as NO <sub>3</sub>	IS: 3025 Part 34:1988 (Reaff:2019)	24 mg/l
09	Total Suspended Solids	IS:3025 Part 17:1984 (Reaff:2017)	49 mg/l
10	Fluoride as F	APHA 23 <sup>rd</sup> Edn. 2017:4500 F,D	0.91 mg/l
11	Sulphide as S	IS:3025 Part 29:-986 (Reaff:2019)	BDL (DL:0.01 mg/l)
12	Iron as Fe	IS: 3025 Part 53:2003 (Reaff:2019)	1.12 mg/l
13	Calcium as Ca	IS: 3025 Part 40:1991 (Reaff:2019)	104 mg/l
14	Magnesium as Mg	IS: 3025 Part 46:1994 (Reaff:2019)	40 mg/l

...Contd....2

NOTE: Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders will be liable for legal action. Unless otherwise stated the submitted results in this test report refer only to the sample(s) tested and such sample(s) are retained for 15 days only from the completion date of testing .. except in case of regulatory samples, which will be retained for a specific period as per statutory requirement; while perishable & environmental testing related remnant samples will be discarded consequent upon completion of testing. Samples are not drawn by us unless otherwise stated. This document cannot be reproduced Excent in full, without prior written approval of the laboratory. This report is for the exclusive use of Chennai Mettex Lab's customer, and is provided in accordance with

E-mail : test@mettexlab.com  
Web : www.mettexlab.com

Phone : 044-22323163, 22311034  
42179490, 42179491



# CHENNAI METTEX LAB PRIVATE LIMITED

Jothi Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.



TC-5589

Lab No: 2385546

T.C No: CML/22-23/78121

Dated : 16.02.2023

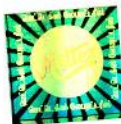
Page No. 2 of 2

Sl. No.	Test Parameters	Test Methods	Test Results
15	Conductivity @ 25°C	IS: 3025 Part 14:2013 (Reaff:2019)	1176 µmhos/cm
16	Phosphorus as P	IS: 3025: Part:31-1988 (Reaff:2019)	BDL (DL:0.01 mg/l)
17	Silicon as Si	IS: 3025 Part 2:2004 (Reaff:2014)	14.43 mg/l
18	Total Arsenic as As	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.005 mg/l)
19	Boron as B	IS: 3025 Part 65:2014 (Reaff:2019)	0.084 mg/l
20	Cadmium as Cd	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.001 mg/l)
21	Total Chromium as Cr	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.02 mg/l)
22	Lead as Pb	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.005 mg/l)
23	Manganese as Mn	IS: 3025 Part 65:2014 (Reaff:2019)	0.121 mg/l
24	Mercury as Hg	USEPA 200.8	BDL (DL:0.0005 mg/l)
25	Molybdenum as Mo	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.02 mg/l)
26	Selenium as Se	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.005 mg/l)
27	Aluminum as Al	IS: 3025 Part 65:2014 (Reaff:2019)	1.610 mg/l
28	Nickel as Ni	IS: 3025 Part 65:2014 (Reaff:2019)	0.093 mg/l
29	Zinc as Zn	IS: 3025 Part 65:2014 (Reaff:2019)	0.097 mg/l
30	Potassium as K	IS: 3025 Part 45:2014 (Reaff:2019)	4.84 mg/l
31	Copper as Cu	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.02 mg/l)
32	Antimony as Sb	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.003 mg/l)
33	Barium as Ba	IS: 3025 Part 65:2014 (Reaff:2019)	0.092 mg/l
34	Cobalt as Co	IS: 3025 Part 65:2014 (Reaff:2019)	0.076 mg/l
35	Uranium as U	IS: 3025 Part 65:2014 (Reaff:2019)	BDL(DL : 0.001 mg/l)
36	Vanadium as V	IS: 3025 Part 65:2014 (Reaff:2019)	BDL(DL : 0.01 mg/l)
37	Lithium as Li	IS: 3025 Part 2:2004 (Reaff:2014)	BDL(DL : 0.01 mg/l)

Abbreviation: BDL: Below Detection Limit, DL: Detection Limit.

End of Report

For Chennai Mettex Lab Private Limited



Reviewed & Authorized By  
**P. KAVITHA**  
Technical Manager  
Authorised Signatory

NOTE: Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders will be liable for legal action. Unless otherwise stated the submitted results in this test report refer only to the sample(s) tested and such sample(s) are retained for 15 days only from the completion date of testing, except in case of regulatory samples, which will be retained for a specific period as per statutory requirement; while perishable & environmental testing related remnant samples will be discarded consequent upon completion of testing. Samples are not drawn by us unless otherwise stated. This document cannot be reproduced in full, without prior written approval of the laboratory. This report is for the exclusive use of Chennai Mettex Lab's customer, and is provided in accordance with

E-mail: test@mettexlab.com  
Web : www.mettexlab.com

Phone : 044-22323163, 22311034  
42179490, 42179491



# CHENNAI METTEX LAB PRIVATE LIMITED

Jothi Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.

(Approved/Recognized by APEDA, AGMARK, GAFTA, EIC, FSSAI, BIS & MoEF)

## TEST REPORT

Page No. 1 Of 1

**ISSUED TO :** M/s.ASAR Social Impact Advisors Pvt Ltd.,  
No: 16 , 7 th Temple Street, 15 th Cross Road  
Malleshwaram, Bangalore,  
Karnataka – 560 003.

**T.C Date :** 16.02.2023  
**T.C No :** CML/22-23/78121-A  
**Date Of Receipt :** 04.02.2023  
**Commenced On :** 04.02.2023  
**Completed On :** 13.02.2023

**Cust. Ref :** SRF Dated : 02.02.2023  
**Lab No :** 2385546

**Sample Description :** Water- (The Mine Discharge its Water into the lake and then lake water is used for Irrigation) Surface Water - Sample Serial No 11.

Sl. No.	Test Parameters	Test Methods	Test Results
1	Cerium as Ce	IS: 3025 Part 2:2004 (Reaff:2014)	BDL(DL : 0.1 mg/l)
2	Titanium as Ti	IS: 3025 Part 2:2004 (Reaff:2014)	BDL(DL : 0.01 mg/l)
3	Thallium as Tl	IS: 3025 Part 2:2004 (Reaff:2014)	BDL(DL : 0.1 mg/l)

**Abbreviation:** BDL: Below Detection Limit, DL: Detection Limit.

End of Report

For Chennai Mettex Lab Private Limited



*[Signature]*  
Reviewed & Authorized By  
**P. KAVITHA**  
Technical Manager  
Authorised Signatory

NOTE: Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders will be liable for legal action. Unless otherwise stated the submitted results in this test report refer only to the sample(s) tested and such sample(s) are retained for 15 days only from the completion date of testing., except in case of regulatory samples, which will be retained for a specific period as per statutory requirement; while perishable & environmental testing related remnant samples will be discarded consequent upon completion of testing. Samples are not drawn by us unless otherwise stated. This document cannot be reproduced except in full, without prior written approval of the laboratory. This report is for the exclusive use of Chennai Mettex Lab and its Customer.

E-mail : test@mettexlab.com  
 Web : www.mettexlab.com

Phone : 044-22323163, 22311034  
 42179490, 42179491



# CHENNAI METTEX LAB PRIVATE LIMITED

Jothi Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.



## TEST REPORT

Page No. 1 Of 2

**ISSUED TO :** M/s.ASAR Social Impact Advisors Pvt Ltd.,  
 No: 16 , 7 th Temple Street, 15 th Cross Road  
 Malleshwaram, Bangalore,  
 Karnataka – 560 003.

**T.C Date :** 16.02.2023  
**T.C No :** CML/22-23/78123  
**Date Of Receipt :** 04.02.2023  
**Commenced On :** 04.02.2023  
**Completed On :** 13.02.2023

**Cust. Ref :** SRF Dated : 02.02.2023  
**Lab No :** 2385547

**Sample Description :** Water- Kanjamandanpettai Pond -Surface Water - Sample Serial No : 17.

Sl. No.	Test Parameters	Test Methods	Test Results
<b>Discipline :</b> Chemical		<b>Group :</b> Water & Residues in Water	
01	pH at 25°C	IS:3025 Part 11-1983 (Reaff:2017)	6.54
02	Turbidity	IS: 3025 Part 10:1984 (Reaff:2017)	158 NTU
03	Total Hardness as CaCO <sub>3</sub>	IS: 3025 Part 21:2009 (Reaff:2019)	30 mg/l
04	Chloride as Cl	IS: 3025 Part 32:1988 (Reaff:2019)	27 mg/l
05	Total Alkalinity as CaCO <sub>3</sub>	IS: 3025 Part 23:1986 (Reaff:2019)	10 mg/l
06	Sulphate as SO <sub>4</sub>	IS: 3025 Part 24:1986 (Reaff:2019)	9.1 mg/l
07	Total Dissolved Solids	IS: 3025 Part 16:1984 (Reaff:2017)	91 mg/l
08	Nitrate as NO <sub>3</sub>	IS: 3025 Part 34:1988 (Reaff:2019)	4.1 mg/l
09	Total Suspended Solids	IS:3025 Part 17:1984 (Reaff:2017)	121 mg/l
10	Fluoride as F	APHA 23 <sup>rd</sup> Edn. 2017:4500 F,D	0.13 mg/l
11	Sulphide as S	IS:3025 Part 29:-986 (Reaff:2019)	BDL (DL:0.01 mg/l)
12	Iron as Fe	IS: 3025 Part 53:2003 (Reaff:2019)	0.89 mg/l
13	Calcium as Ca	IS: 3025 Part 40:1991 (Reaff:2019)	4.4 mg/l
14	Magnesium as Mg	IS: 3025 Part 46:1994 (Reaff:2019)	4.6 mg/l

..Contd....2

NOTE: Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders will be liable for legal action. Unless otherwise stated the submitted results in this test report refer only to the sample(s) tested and such sample(s) are retained for 15 days only from the completion date of testing ., except in case of regulatory samples, which will be retained for a specific period as per statutory requirement; while perishable & environmental testing related remnant samples will be discarded consequent upon completion of testing. Samples are not drawn by us unless otherwise stated. This document cannot be reproduced Except in full, without prior written approval of the laboratory. This report is for the exclusive use of Chennai Mettex Lab's customer, and is provided in accordance with

E-mail : test@mettexlab.com  
 Web : www.mettexlab.com

Phone : 044-22323163, 22311034  
 42179490, 42179491



# CHENNAI METTEX LAB PRIVATE LIMITED

Jothi Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.



TC-5589

Lab No: 2385547

T.C No: CML/22-23/78123

Dated : 16.02.2023

Page No. 2 of 2

Sl. No.	Test Parameters	Test Methods	Test Results
15	Conductivity @ 25°C	IS: 3025 Part 14:2013 (Reaff:2019)	165 µmhos/cm
16	Phosphorus as P	IS: 3025: Part:31-1988 (Reaff:2019)	BDL (DL:0.01 mg/l)
17	Silicon as Si	IS: 3025 Part 2:2004 (Reaff:2014)	16.84 mg/l
18	Total Arsenic as As	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.005 mg/l)
19	Boron as B	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.05 mg/l)
20	Cadmium as Cd	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.001 mg/l)
21	Total Chromium as Cr	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.02 mg/l)
22	Lead as Pb	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.02 mg/l)
23	Manganese as Mn	IS: 3025 Part 65:2014 (Reaff:2019)	0.042 mg/l
24	Mercury as Hg	USEPA 200.8	BDL (DL:0.0005 mg/l)
25	Molybdenum as Mo	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.02 mg/l)
26	Selenium as Se	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.005 mg/l)
27	Aluminum as Al	IS: 3025 Part 65:2014 (Reaff:2019)	2.871 mg/l
28	Nickel as Ni	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.005 mg/l)
29	Zinc as Zn	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.05 mg/l)
30	Potassium as K	IS: 3025 Part 45:2014 (Reaff:2019)	3.154 mg/l
31	Copper as Cu	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.02 mg/l)
32	Antimony as Sb	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.003 mg/l)
33	Barium as Ba	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.05 mg/l)
34	Cobalt as Co	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.01 mg/l)
35	Uranium as U	IS: 3025 Part 65:2014 (Reaff:2019)	BDL(DL : 0.001 mg/l)
36	Vanadium as V	IS: 3025 Part 65:2014 (Reaff:2019)	BDL(DL : 0.01 mg/l)
37	Lithium as Li	IS: 3025 Part 2:2004 (Reaff:2014)	BDL(DL : 0.01 mg/l)

Abbreviation: BDL: Below Detection Limit, DL: Detection Limit.

End of Report



For Chennai Mettex Lab Private Limited

*P. Kavitha*  
 Reviewed & Authorized By  
**P. KAVITHA**  
 Technical Manager  
 Authorised Signatory

NOTE: Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders will be liable for legal action. Unless otherwise stated the submitted results in this test report refer only to the sample(s) tested and such sample(s) are retained for 15 days only from the completion date of testing, except in case of regulatory samples, which will be retained for a specific period as per statutory requirement; while perishable & environmental testing related remnant samples will be discarded consequent upon completion of testing. Samples are not drawn by us unless otherwise stated. This document cannot be reproduced Except in full, without prior written approval of the laboratory. This report is for the exclusive use of Chennai Mettex Lab's customer, and is provided in accordance with

E-mail: test@mettexlab.com  
Web : www.mettexlab.com

Phone : 044-22323163, 22311034  
42179490, 42179491



# CHENNAI METTEX LAB PRIVATE LIMITED

Jothi Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.

(Approved/Recognized by APEDA, AGMARK, GAFTA, EIC, FSSAI, BIS & MoEF)

## TEST REPORT

Page No. 1 Of 1

**ISSUED TO :** M/s.ASAR Social Impact Advisors Pvt Ltd.,  
No: 16 , 7 th Temple Street, 15 th Cross Road  
Malleshwaram, Bangalore,  
Karnataka – 560 003.

**T.C Date :** 16.02.2023  
**T.C No :** CML/22-23/78123-A  
**Date Of Receipt :** 04.02.2023  
**Commenced On :** 04.02.2023  
**Completed On :** 13.02.2023

**Cust. Ref :** SRF Dated : 02.02.2023  
**Lab No :** 2385547

**Sample Description :** Water- Kanjamandanpettai Pond -Surface Water - Sample Serial No : 17.

Sl. No.	Test Parameters	Test Methods	Test Results
1	Cerium as Ce	IS: 3025 Part 2:2004 (Reaff:2014)	BDL(DL : 0.1 mg/l)
2	Titanium as Ti	IS: 3025 Part 2:2004 (Reaff:2014)	BDL(DL : 0.01 mg/l)
3	Thallium as Tl	IS: 3025 Part 2:2004 (Reaff:2014)	BDL(DL : 0.1 mg/l)

**Abbreviation:** BDL: Below Detection Limit, DL: Detection Limit.

End of Report

For Chennai Mettex Lab Private Limited



Reviewed & Authorized By  
**P. KAVITHA**  
Technical Manager  
Authorised Signatory

NOTE: Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders will be liable for legal action. Unless otherwise stated the submitted results in this test report refer only to the sample(s) tested and such sample(s) are retained for 15 days only from the completion date of testing., except in case of regulatory samples, which will be retained for a specific period as per statutory requirement; while perishable & environmental testing related remnant samples will be discarded consequent upon completion of testing. Samples are not drawn by us unless otherwise stated. This document cannot be reproduced except in full, without prior written approval of the laboratory. This report is for the exclusive use of Chennai Mettex Lab and its Customer.

E-mail : test@mettexlab.com  
 Web : www.mettexlab.com

Phone : 044-22323163, 22311034  
 42179490, 42179491



# CHENNAI METTEX LAB PRIVATE LIMITED

Jothi Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.



TC-5589

## TEST REPORT

Page No. 1 Of 2

**ISSUED TO :** M/s.ASAR Social Impact Advisors Pvt Ltd.,  
 No: 16 , 7 th Temple Street, 15 th Cross Road  
 Malleshwaram, Bangalore,  
 Karnataka – 560 003.

**T.C Date :** 16.02.2023  
**T.C No :** CML/22-23/78124  
**Date Of Receipt :** 04.02.2023  
**Commenced On :** 04.02.2023  
**Completed On :** 13.02.2023

**Cust. Ref :** SRF Dated : 02.02.2023  
**Lab No :** 2385548

**Sample Description :** Water- Iyyan Lake -Surface Water - Sample Serial No : 30.

Sl. No.	Test Parameters	Test Methods	Test Results
<b>Discipline :</b> Chemical		<b>Group :</b> Water & Residues in Water	
01	pH at 25°C	IS:3025 Part 11-1983 (Reaff:2017)	6.54
02	Turbidity	IS: 3025 Part 10:1984 (Reaff:2017)	29 NTU
03	Total Hardness as CaCO <sub>3</sub>	IS: 3025 Part 21:2009 (Reaff:2019)	140 mg/l
04	Chloride as Cl	IS: 3025 Part 32:1988 (Reaff:2019)	42.2 mg/l
05	Total Alkalinity as CaCO <sub>3</sub>	IS: 3025 Part 23:1986 (Reaff:2019)	41.8 mg/l
06	Sulphate as SO <sub>4</sub>	IS: 3025 Part 24:1986 (Reaff:2019)	14.8 mg/l
07	Total Dissolved Solids	IS: 3025 Part 16:1984 (Reaff:2017)	264 mg/l
08	Nitrate as NO <sub>3</sub>	IS: 3025 Part 34:1988 (Reaff:2019)	4.1 mg/l
09	Total Suspended Solids	IS:3025 Part 17:1984 (Reaff:2017)	5 mg/l
10	Fluoride as F	APHA 23 <sup>rd</sup> Edn. 2017:4500 F,D	0.45 mg/l
11	Sulphide as S	IS:3025 Part 29:-986 (Reaff:2019)	BDL (DL:0.01 mg/l)
12	Iron as Fe	IS: 3025 Part 53:2003 (Reaff:2019)	0.06 mg/l
13	Calcium as Ca	IS: 3025 Part 40:1991 (Reaff:2019)	36.8 mg/l
14	Magnesium as Mg	IS: 3025 Part 46:1994 (Reaff:2019)	11.6 mg/l

...Contd....2

NOTE: Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders will be liable for legal action. Unless otherwise stated the submitted results in this test report refer only to the sample(s) tested and such sample(s) are retained for 15 days only from the completion date of testing .. except in case of regulatory samples, which will be retained for a specific period as per statutory requirement; while perishable & environmental testing related remnant samples will be discarded consequent upon completion of testing. Samples are not drawn by us unless otherwise stated. This document cannot be reproduced Except in full, without prior written approval of the laboratory. This report is for the exclusive use of Chennai Mettex Lab's customer, and is provided in accordance with

E-mail : test@mettexlab.com  
 Web : www.mettexlab.com

Phone : 044-22323163, 22311034  
 42179490, 42179491



# CHENNAI METTEX LAB PRIVATE LIMITED

Jothi Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.



TC-5589

Lab No: 2385548

T.C No: CML/22-23/78124

Dated : 16.02.2023

Page No. 2 of 2

Sl. No.	Test Parameters	Test Methods	Test Results
15	Conductivity @ 25°C	IS: 3025 Part 14:2013 (Reaff:2019)	480 µmhos/cm
16	Phosphorus as P	IS: 3025: Part:31-1988 (Reaff:2019)	BDL (DL:0.01 mg/l)
17	Silicon as Si	IS: 3025 Part 2:2004 (Reaff:2014)	20.29 mg/l
18	Total Arsenic as As	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.05 mg/l)
19	Boron as B	IS: 3025 Part 65:2014 (Reaff:2019)	0.080 mg/l
20	Cadmium as Cd	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.001 mg/l)
21	Total Chromium as Cr	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.02 mg/l)
22	Lead as Pb	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.005 mg/l)
23	Manganese as Mn	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.02 mg/l)
24	Mercury as Hg	USEPA 200.8	BDL (DL:0.0005 mg/l)
25	Molybdenum as Mo	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.02 mg/l)
26	Selenium as Se	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.005 mg/l)
27	Aluminium as Al	IS: 3025 Part 65:2014 (Reaff:2019)	0.061 mg/l
28	Nickel as Ni	IS: 3025 Part 65:2014 (Reaff:2019)	0.031 mg/l
29	Zinc as Zn	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.05 mg/l)
30	Potassium as K	IS: 3025 Part 45:2014 (Reaff:2019)	3.76 mg/l
31	Copper as Cu	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.02 mg/l)
32	Antimony as Sb	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.003 mg/l)
33	Barium as Ba	IS: 3025 Part 65:2014 (Reaff:2019)	0.052 mg/l
34	Cobalt as Co	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.01 mg/l)
35	Uranium as U	IS: 3025 Part 65:2014 (Reaff:2019)	BDL(DL : 0.001 mg/l)
36	Vandium as V	IS: 3025 Part 65:2014 (Reaff:2019)	BDL(DL : 0.01 mg/l)
37	Lithium as Li	IS: 3025 Part 2:2004 (Reaff:2014)	BDL(DL : 0.01 mg/l)

Abbreviation: BDL: Below Detection Limit, DL: Detection Limit.

End of Report



For Chennai Mettex Lab Private Limited

*P. Kavitha*  
 Reviewed & Authorized By  
**P. KAVITHA**  
 Technical Manager  
 Authorised Signatory

NOTE: Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders will be liable for legal action. Unless otherwise stated the submitted results in this test report refer only to the sample(s) tested and such sample(s) are retained for 15 days only from the completion date of testing., except in case of regulatory samples, which will be retained for a specific period as per statutory requirement; while perishable & environmental testing related remnant samples will be discarded consequent upon completion of testing. Samples are not drawn by us unless otherwise stated. This document cannot be reproduced Except in full without prior written approval of the laboratory. This report is for the exclusive use of Chennai Mettex Lab's customer, and is provided in accordance with



E-mail : test@mettexlab.com  
 Web : www.mettexlab.com

Phone : 044-22323163, 22311034  
 42179490, 42179491



# CHENNAI METTEX LAB PRIVATE LIMITED

Jothi Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.



TC-5589

## TEST REPORT

Page No. 1 Of 2

**ISSUED TO :** M/s.ASAR Social Impact Advisors Pvt Ltd.,  
 No: 16 , 7 th Temple Street, 15 th Cross Road  
 Malleshwaram, Bangalore,  
 Karnataka – 560 003.

**T.C Date :** 16.02.2023

**T.C No :** CML/22-23/78125

**Date Of Receipt :** 04.02.2023

**Cust. Ref :** SRF Dated : 02.02.2023

**Commenced On :** 04.02.2023

**Lab No :** 2385549

**Completed On :** 13.02.2023

**Sample Description :** Water- NLC Pipe Water (Drinking Water Supplied by NLC Management)  
 Drinking Water - Sample Serial No : 18.

Sl. No.	Test Parameters	Test Methods	Test Results
<b>Discipline :</b> Chemical			<b>Group :</b> Water & Residues in Water
01	pH at 25°C	IS:3025 Part 11-1983 (Reaff:2017)	6.54
02	Turbidity	IS: 3025 Part 10:1984 (Reaff:2017)	Less than 0.5 NTU
03	Total Hardness as CaCO <sub>3</sub>	IS: 3025 Part 21:2009 (Reaff:2019)	115 mg/l
04	Chloride as Cl	IS: 3025 Part 32:1988 (Reaff:2019)	39.3 mg/l
05	Total Alkalinity as CaCO <sub>3</sub>	IS: 3025 Part 23:1986 (Reaff:2019)	91.8 mg/l
06	Sulphate as SO <sub>4</sub>	IS: 3025 Part 24:1986 (Reaff:2019)	15.8 mg/l
07	Total Dissolved Solids	IS: 3025 Part 16:1984 (Reaff:2017)	202 mg/l
08	Nitrate as NO <sub>3</sub>	IS: 3025 Part 34:1988 (Reaff:2019)	6.4 mg/l
09	Total Suspended Solids	IS:3025 Part 17:1984 (Reaff:2017)	BDL(DL: 1.0 mg/l)
10	Fluoride as F	APHA 23 <sup>rd</sup> Edn. 2017:4500 F,D	0.48 mg/l
11	Sulphide as S	IS:3025 Part 29:-986 (Reaff:2019)	BDL (DL:0.01 mg/l)
12	Iron as Fe	IS: 3025 Part 53:2003 (Reaff:2019)	BDL (DL:0.01 mg/l)
13	Calcium as Ca	IS: 3025 Part 40:1991 (Reaff:2019)	30.4 mg/l
14	Magnesium as Mg	IS: 3025 Part 46:1994 (Reaff:2019)	9.4 mg/l

...Contd....2

NOTE: Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders will be liable for legal action. Unless otherwise stated the submitted results in this test report refer only to the sample(s) tested and such sample(s) are retained for 15 days only from the completion date of testing, except in case of regulatory samples, which will be retained for a specific period as per statutory requirement; while perishable & environmental testing related remnant samples will be discarded consequent upon completion of testing. Samples are not drawn by us unless otherwise stated. This document cannot be reproduced Except in full, without prior written approval of the laboratory. This report is for the exclusive use of Chennai Mettex Lab's customer, and is provided in accordance with Mettex Lab and its Customer.

E-mail : test@mettexlab.com  
 Web : www.mettexlab.com

Phone : 044-22323163, 22311034  
 42179490, 42179491



# CHENNAI METTEX LAB PRIVATE LIMITED

Jothi Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.



TC-5589

Lab No: 2385549

T.C No: CML/22-23/78125

Dated : 16.02.2023

Page No. 2 of 2

Sl. No.	Test Parameters	Test Methods	Test Results
15	Conductivity @ 25°C	IS: 3025 Part 14:2013 (Reaff:2019)	368 µmhos/cm
16	Phosphorus as P	IS: 3025: Part:31-1988 (Reaff:2019)	BDL (DL:0.01 mg/l)
17	Silicon as Si	IS: 3025 Part 2:2004 (Reaff:2014)	27.78 mg/l
18	Total Arsenic as As	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.005 mg/l)
19	Boron as B	IS: 3025 Part 65:2014 (Reaff:2019)	0.121 mg/l
20	Cadmium as Cd	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.001 mg/l)
21	Total Chromium as Cr	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.02 mg/l)
22	Lead as Pb	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.005 mg/l)
23	Manganese as Mn	IS: 3025 Part 65:2014 (Reaff:2019)	BDL(DL:0.02 mg/l)
24	Mercury as Hg	USEPA 200.8	BDL (DL:0.0005 mg/l)
25	Molybdenum as Mo	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.02 mg/l)
26	Selenium as Se	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.005 mg/l)
27	Aluminium as Al	IS: 3025 Part 65:2014 (Reaff:2019)	0.031 mg/l
28	Nickel as Ni	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.0005 mg/l)
29	Zinc as Zn	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.05 mg/l)
30	Potassium as K	IS: 3025 Part 45:2014 (Reaff:2019)	1.388 mg/l
31	Copper as Cu	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.02 mg/l)
32	Antimony as Sb	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.003 mg/l)
33	Barium as Ba	IS: 3025 Part 65:2014 (Reaff:2019)	0.069 mg/l
34	Cobalt as Co	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.01 mg/l)
35	Uranium as U	IS: 3025 Part 65:2014 (Reaff:2019)	BDL(DL : 0.001 mg/l)
36	Vandium as V	IS: 3025 Part 65:2014 (Reaff:2019)	BDL(DL : 0.01 mg/l)
37	Lithium as Li	IS: 3025 Part 2:2004 (Reaff:2014)	BDL(DL : 0.01 mg/l)

Abbreviation: BDL: Below Detection Limit, DL: Detection Limit.

End of Report



For Chennai Mettex Lab Private Limited

*(Signature)*

Reviewed & Authorized By  
**P. KAVITHA**  
 Technical Manager  
 Authorised Signatory

NOTE: Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders will be liable for legal action. Unless otherwise stated the submitted results in this test report refer only to the sample(s) tested and such sample(s) are retained for 15 days only from the completion date of testing. Except in case of regulatory samples, which will be retained for a specific period as per statutory requirement; while perishable & environmental testing related remnant samples will be discarded consequent upon completion of testing. Samples are not drawn by us unless otherwise stated. This document cannot be reproduced Except in full, without prior written approval of the laboratory. This report is for the exclusive use of Chennai Mettex Lab's customer, and is provided in accordance with the terms and conditions of the Chennai Mettex Lab and its Customer.



E-mail : test@mettexlab.com  
 Web : www.mettexlab.com

Phone : 044-22323163, 22311034  
 42179490, 42179491



# CHENNAI METTEX LAB PRIVATE LIMITED

Jothi Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.



TC-5589

## TEST REPORT

Page No. 1 Of 2

**ISSUED TO :** M/s.ASAR Social Impact Advisors Pvt Ltd.,  
 No: 16 , 7 th Temple Street, 15 th Cross Road  
 Malleshwaram, Bangalore,  
 Karnataka – 560 003.

**T.C Date :** 16.02.2023  
**T.C No :** CML/22-23/78126  
**Date Of Receipt :** 04.02.2023  
**Commenced On :** 04.02.2023  
**Completed On :** 13.02.2023

**Cust. Ref :** SRF Dated : 02.02.2023  
**Lab No :** 2385550

**Sample Description :** Water- Vellankulam –Drinking Water - Sample Serial No : 28.

Sl. No.	Test Parameters	Test Methods	Test Results
<b>Discipline :</b> Chemical			<b>Group :</b> Water & Residues in Water
01	pH at 25°C	IS:3025 Part 11-1983 (Reaff.2017)	6.63
02	Turbidity	IS: 3025 Part 10:1984 (Reaff.2017)	Less than 0.5 NTU
03	Total Hardness as CaCO <sub>3</sub>	IS: 3025 Part 21:2009 (Reaff.2019)	65 mg/l
04	Chloride as Cl	IS: 3025 Part 32:1988 (Reaff.2019)	16.9 mg/l
05	Total Alkalinity as CaCO <sub>3</sub>	IS: 3025 Part 23:1986 (Reaff.2019)	53 mg/l
06	Sulphate as SO <sub>4</sub>	IS: 3025 Part 24:1986 (Reaff.2019)	4.5 mg/l
07	Total Dissolved Solids	IS: 3025 Part 16:1984 (Reaff.2017)	109 mg/l
08	Nitrate as NO <sub>3</sub>	IS: 3025 Part 34:1988 (Reaff.2019)	1.9 mg/l
09	Total Suspended Solids	IS:3025 Part 17:1984 (Reaff.2017)	BDL(DL: 1.0 mg/l)
10	Fluoride as F	APHA 23 <sup>rd</sup> Edn. 2017:4500 F,D	BDL (DL:0.1 mg/l)
11	Sulphide as S	IS:3025 Part 29:-986 (Reaff.2019)	BDL (DL:0.01 mg/l)
12	Iron as Fe	IS: 3025 Part 53:2003 (Reaff.2019)	BDL (DL:0.01 mg/l)
13	Calcium as Ca	IS: 3025 Part 40:1991 (Reaff.2019)	17.6 mg/l
14	Magnesium as Mg	IS: 3025 Part 46:1994 (Reaff.2019)	5.1 mg/l

...Contd....2

NOTE: Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders will be liable for legal action. Unless otherwise stated the submitted results in this test report refer only to the sample(s) tested and such sample(s) are retained for 15 days only from the completion date of testing. Except in case of regulatory samples, which will be retained for a specific period as per statutory requirement; while perishable & environmental testing related remnant samples will be discarded consequent upon completion of testing. Samples are not drawn by us unless otherwise stated. This document cannot be reproduced Except in full, without prior written approval of the laboratory. This report is for the exclusive use of Chennai Mettex Lab's customer, and is provided in accordance with agreement between Chennai Mettex Lab and its Customer.

E-mail : test@mettexlab.com  
 Web : www.mettexlab.com

Phone : 044-22323163, 22311034  
 42179490, 42179491



# CHENNAI METTEX LAB PRIVATE LIMITED

Jothi Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.



Lab No: 2385550      T.C No: CML/22-23/ 78126      Dated : 16.02.2023      Page No. 2 of 2

Sl. No.	Test Parameters	Test Methods	Test Results
15	Conductivity @ 25°C	IS: 3025 Part 14:2013 (Reaff:2019)	198 µmhos/cm
16	Phosphorus as P	IS: 3025: Part:31-1988 (Reaff:2019)	BDL (DL:0.01 mg/l)
17	Silicon as Si	IS: 3025 Part 2:2004 (Reaff:2014)	BDL(DL: 0.01 mg/l)
18	Total Arsenic as As	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.005 mg/l)
19	Boron as B	IS: 3025 Part 65:2014 (Reaff:2019)	0.057 mg/l
20	Cadmium as Cd	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.001 mg/l)
21	Total Chromium as Cr	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.02 mg/l)
22	Lead as Pb	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.005 mg/l)
23	Manganese as Mn	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.02 mg/l)
24	Mercury as Hg	USEPA 200.8	BDL (DL:0.0005 mg/l)
25	Molybdenum as Mo	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.02 mg/l)
26	Selenium as Se	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.005 mg/l)
27	Aluminium as Al	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.005 mg/l)
28	Nickel as Ni	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.005 mg/l)
29	Zinc as Zn	IS: 3025 Part 65:2014 (Reaff:2019)	5.903 mg/l
30	Potassium as K	IS: 3025 Part 45:2014 (Reaff:2019)	2.15 mg/l
31	Copper as Cu	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.02 mg/l)
32	Antimony as Sb	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.003 mg/l)
33	Barium as Ba	IS: 3025 Part 65:2014 (Reaff:2019)	0.058 mg/l
34	Cobalt as Co	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.01 mg/l)
35	Uranium as U	IS: 3025 Part 65:2014 (Reaff:2019)	BDL(DL : 0.001 mg/l)
36	Vandium as V	IS: 3025 Part 65:2014 (Reaff:2019)	BDL(DL : 0.01 mg/l)
37	Lithium as Li	IS: 3025 Part 2:2004 (Reaff:2014)	BDL(DL : 0.01 mg/l)

Abbreviation: BDL: Below Detection Limit, DL: Detection Limit.

End of Report



For Chennai Mettex Lab Private Limited

*[Signature]*  
 Reviewed & Authorized By  
**P. KAVITHA**  
 Technical Manager  
 Authorised Signatory

NOTE: Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders will be liable for legal action. Unless otherwise stated the submitted results in this test report refer only to the sample(s) tested and such sample(s) are retained for 15 days only from the completion date of testing .. except in case of regulatory samples, which will be retained for a specific period as per statutory requirement; while perishable & environmental testing related remnant samples will be discarded consequent upon completion of testing. Samples are not drawn by us unless otherwise stated. This document cannot be reproduced Except in full, without prior written approval of the laboratory. This report is for the exclusive use of Chennai Mettex Lab's customer, and is provided in accordance with



E-mail : test@mettexlab.com  
 Web : www.mettexlab.com

Phone : 044-22323163, 22311034  
 42179490, 42179491



# CHENNAI METTEX LAB PRIVATE LIMITED

Jothi Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.



## TEST REPORT

Page No. 1 Of 2

**ISSUED TO :** M/s.ASAR Social Impact Advisors Pvt Ltd.,  
 No: 16 , 7 th Temple Street, 15 th Cross Road  
 Malleshwaram, Bangalore,  
 Karnataka – 560 003.

**T.C Date :** 16.02.2023

**T.C No :** CML/22-23/78127

**Date Of Receipt :** 04.02.2023

**Commenced On :** 04.02.2023

**Completed On :** 13.02.2023

**Cust. Ref :** SRF Dated : 02.02.2023

**Lab No :** 2385551

**Sample Description :** Water- Aadhandarkollai Borewell Near to Thiravupathi Amman Temple, 300 Meters away from ash Pond – Ground Water - Sample Serial No : 13.

Sl. No.	Test Parameters	Test Methods	Test Results
<b>Discipline :</b> Chemical			<b>Group :</b> Water & Residues in Water
01	pH at 25°C	IS:3025 Part 11-1983 (Reaff:2017)	6.58
02	Turbidity	IS: 3025 Part 10:1984 (Reaff:2017)	56 NTU
03	Total Hardness as CaCO <sub>3</sub>	IS: 3025 Part 21:2009 (Reaff:2019)	725 mg/l
04	Chloride as Cl	IS: 3025 Part 32:1988 (Reaff:2019)	126 mg/l
05	Total Alkalinity as CaCO <sub>3</sub>	IS: 3025 Part 23:1986 (Reaff:2019)	10.2 mg/l
06	Sulphate as SO <sub>4</sub>	IS: 3025 Part 24:1986 (Reaff:2019)	93 mg/l
07	Total Dissolved Solids	IS: 3025 Part 16:1984 (Reaff:2017)	1002 mg/l
08	Nitrate as NO <sub>3</sub>	IS: 3025 Part 34:1988 (Reaff:2019)	34 mg/l
09	Total Suspended Solids	IS:3025 Part 17:1984 (Reaff:2017)	28 mg/l
10	Fluoride as F	APHA 23 <sup>rd</sup> Edn. 2017:4500 F,D	1.11 mg/l
11	Sulphide as S	IS:3025 Part 29-:986 (Reaff:2019)	BDL (DL:0.01 mg/l)
12	Iron as Fe	IS: 3025 Part 53:2003 (Reaff:2019)	0.79 mg/l
13	Calcium as Ca	IS: 3025 Part 40:1991 (Reaff:2019)	252 mg/l
14	Magnesium as Mg	IS: 3025 Part 46:1994 (Reaff:2019)	23 mg/l

...Contd....2

NOTE: Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders will be liable for legal action. Unless otherwise stated the submitted results in this test report refer only to the sample(s) tested and such sample(s) are retained for 15 days only from the completion date of testing, except in case of regulatory samples, which will be retained for a specific period as per statutory requirement; while perishable & environmental testing related remnant samples will be discarded consequent upon completion of testing. Samples are not drawn by us unless otherwise stated. This document cannot be reproduced Except in full, without prior written approval of the laboratory. This report is for the exclusive use of Chennai Mettex Lab's customer, and is provided in accordance with Chennai Mettex Lab and its Customer.

E-mail : test@mettexlab.com  
 Web : www.mettexlab.com

Phone : 044-22323163, 22311034  
 42179490, 42179491



# CHENNAI METTEX LAB PRIVATE LIMITED

Jothi Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.



TC-5589

Lab No: 2385551

T.C No: CML/22-23/78127

Dated : 16.02.2023

Page No. 2 of 2

Sl. No.	Test Parameters	Test Methods	Test Results
15	Conductivity @ 25°C	IS: 3025 Part 14:2013 (Reaff:2019)	1729 µmhos/cm
16	Phosphorus as P	IS: 3025: Part:31-1988 (Reaff:2019)	BDL (DL:0.01 mg/l)
17	Silicon as Si	IS: 3025 Part 2:2004 (Reaff:2014)	11.47 mg/l
18	Total Arsenic as As	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.05 mg/l)
19	Boron as B	IS: 3025 Part 65:2014 (Reaff:2019)	0.251 mg/l
20	Cadmium as Cd	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.001 mg/l)
21	Total Chromium as Cr	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.02 mg/l)
22	Lead as Pb	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.005 mg/l)
23	Manganese as Mn	IS: 3025 Part 65:2014 (Reaff:2019)	0.426 mg/l
24	Mercury as Hg	USEPA 200.8	BDL (DL:0.0005 mg/l)
25	Molybdenum as Mo	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.02 mg/l)
26	Selenium as Se	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.005 mg/l)
27	Aluminium as Al	IS: 3025 Part 65:2014 (Reaff:2019)	0.015 mg/l
28	Nickel as Ni	IS: 3025 Part 65:2014 (Reaff:2019)	0.013 mg/l
29	Zinc as Zn	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.05 mg/l)
30	Potassium as K	IS: 3025 Part 45:2014 (Reaff:2019)	6.22 mg/l
31	Copper as Cu	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.02 mg/l)
32	Antimony as Sb	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.003 mg/l)
33	Barium as Ba	IS: 3025 Part 65:2014 (Reaff:2019)	BDL(DL:0.05 mg/l)
34	Cobalt as Co	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.01 mg/l)
35	Uranium as U	IS: 3025 Part 65:2014 (Reaff:2019)	BDL(DL : 0.001 mg/l)
36	Vandium as V	IS: 3025 Part 65:2014 (Reaff:2019)	BDL(DL : 0.01 mg/l)
37	Lithium as Li	IS: 3025 Part 2:2004 (Reaff:2014)	BDL(DL : 0.01 mg/l)

Abbreviation: BDL: Below Detection Limit, DL: Detection Limit.

End of Report

For Chennai Mettex Lab Private Limited



*P. Kavitha*

Reviewed & Authorized By  
**P. KAVITHA**  
 Technical Manager  
 Authorised Signatory

NOTE: Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders will be liable for legal action. Unless otherwise stated the submitted results in this test report refer only to the sample(s) tested and such sample(s) are retained for 15 days only from the completion date of testing .. except in case of regulatory samples, which will be retained for a specific period as per statutory requirement; while perishable & environmental testing related remnant samples will be discarded consequent upon completion of testing. Samples are not drawn by us unless otherwise stated. This document cannot be reproduced Except in full, without prior written approval of the laboratory. This report is for the exclusive use of Chennai Mettex Lab's customer, and is provided in accordance with Lab and its Customer.

E-mail: test@mettexlab.com  
Web : www.mettexlab.com

Phone : 044-22323163, 22311034  
42179490, 42179491



# CHENNAI METTEX LAB PRIVATE LIMITED

Jothi Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.

(Approved/Recognized by APEDA, AGMARK, GAFTA, EIC, FSSAI, BIS & MoEF)

## TEST REPORT

Page No. 1 Of 1

**ISSUED TO :** M/s.ASAR Social Impact Advisors Pvt Ltd.,  
No: 16 , 7 th Temple Street, 15 th Cross Road  
Malleshwaram, Bangalore,  
Karnataka – 560 003.

**T.C Date :** 16.02.2023  
**T.C No :** CML/22-23/78127-A  
**Date Of Receipt :** 04.02.2023  
**Commenced On :** 04.02.2023  
**Completed On :** 13.02.2023

**Cust. Ref :** SRF Dated : 02.02.2023  
**Lab No :** 2385551

**Sample Description :** Water- Aadhandarkollai Borewell Near to Thiravupathi Amman Temple, 300 Meters away from ash Pond – Ground Water - Sample Serial No : 13.

Sl. No.	Test Parameters	Test Methods	Test Results
1	Cerium as Ce	IS: 3025 Part 2:2004 (Reaff:2014)	BDL(DL : 0.1 mg/l)
2	Titanium as Ti	IS: 3025 Part 2:2004 (Reaff:2014)	BDL(DL : 0.01 mg/l)
3	Thallium as Tl	IS: 3025 Part 2:2004 (Reaff:2014)	BDL(DL : 0.1 mg/l)

**Abbreviation:** BDL: Below Detection Limit, DL: Detection Limit.

End of Report

For Chennai Mettex Lab Private Limited



*[Signature]*  
Reviewed & Authorized By  
**P. KAVITHA**  
Technical Manager  
Authorised Signatory

NOTE: Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders will be liable for legal action. Unless otherwise stated the submitted results in this test report refer only to the sample(s) tested and such sample(s) are retained for 15 days only from the completion date of testing, except in case of regulatory samples, which will be retained for a specific period as per statutory requirement; while perishable & environmental testing related remnant samples will be discarded consequent upon completion of testing. Samples are not drawn by us unless otherwise stated. This document cannot be reproduced except in full, without prior written approval of the laboratory. This report is for the exclusive use of Chennai Mettex Lab and its Customer.

E-mail : test@mettexlab.com  
 Web : www.mettexlab.com

Phone : 044-22323163, 22311034  
 42179490, 42179491



# CHENNAI METTEX LAB PRIVATE LIMITED

Jothi Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.



TC-5589

## TEST REPORT

Page No. 1 Of 2

ISSUED TO : M/s.ASAR Social Impact Advisors Pvt Ltd.,

T.C Date : 16.02.2023

No: 16 , 7 th Temple Street, 15 th Cross Road  
 Malleshwaram, Bangalore,  
 Karnataka – 560 003.

T.C No : CML/22-23/78128

Cust. Ref : SRF Dated : 02.02.2023

Date Of Receipt : 04.02.2023

Lab No : 2385552

Commenced On : 04.02.2023

Completed On : 13.02.2023

Sample Description : Water- Vaanadhirayapuram Village 100 meters from the Mine-Ground Water -  
 Sample Serial No : 15.

Sl. No.	Test Parameters	Test Methods	Test Results
Discipline : Chemical		Group : Water & Residues in Water	
01	pH at 25°C	IS:3025 Part 11-1983 (Reaff:2017)	6.83
02	Turbidity	IS: 3025 Part 10:1984 (Reaff:2017)	Less than 0.5 NTU
03	Total Hardness as CaCO <sub>3</sub>	IS: 3025 Part 21:2009 (Reaff:2019)	190 mg/l
04	Chloride as Cl	IS: 3025 Part 32:1988 (Reaff:2019)	119 mg/l
05	Total Alkalinity as CaCO <sub>3</sub>	IS: 3025 Part 23:1986 (Reaff:2019)	73.4 mg/l
06	Sulphate as SO <sub>4</sub>	IS: 3025 Part 24:1986 (Reaff:2019)	39.6 mg/l
07	Total Dissolved Solids	IS: 3025 Part 16:1984 (Reaff:2017)	459 mg/l
08	Nitrate as NO <sub>3</sub>	IS: 3025 Part 34:1988 (Reaff:2019)	13.5 mg/l
09	Total Suspended Solids	IS:3025 Part 17:1984 (Reaff:2017)	BDL(DL: 1.0 mg/l)
10	Fluoride as F	APHA 23 <sup>rd</sup> Edn. 2017:4500 F,D	0.71 mg/l
11	Sulphide as S	IS:3025 Part 29:-986 (Reaff:2019)	BDL (DL:0.01 mg/l)
12	Iron as Fe	IS: 3025 Part 53:2003 (Reaff:2019)	0.06 mg/l
13	Calcium as Ca	IS: 3025 Part 40:1991 (Reaff:2019)	60.9 mg/l
14	Magnesium as Mg	IS: 3025 Part 46:1994 (Reaff:2019)	9.2 mg/l

...Contd....2

NOTE: Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders will be liable for legal action. Unless otherwise stated the submitted results in this test report refer only to the sample(s) tested and such sample(s) are retained for 15 days only from the completion date of testing .., except in case of regulatory samples, which will be retained for a specific period as per statutory requirement; while perishable & environmental testing related remnant samples will be discarded consequent upon completion of testing. Samples are not drawn by us unless otherwise stated. This document cannot be reproduced Except in full, without prior written approval of the laboratory. This report is for the exclusive use of Chennai Mettex Lab's customer, and is provided in accordance with the Laboratory Chennai Mettex Lab and its Customer.

E-mail : test@mettexlab.com  
 Web : www.mettexlab.com

Phone : 044-22323163, 22311034  
 42179490, 42179491



# CHENNAI METTEX LAB PRIVATE LIMITED

Jothi Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.



TC-5589

Lab No: 2385552      T.C No: CML/22-23/78128      Dated : 16.02.2023      Page No. 2 of 2

Sl. No.	Test Parameters	Test Methods	Test Results
15	Conductivity @ 25°C	IS: 3025 Part 14:2013 (Reaff:2019)	821 µmhos/cm
16	Phosphorus as P	IS: 3025: Part:31-1988 (Reaff:2019)	BDL (DL:0.01 mg/l)
17	Silicon as Si	IS: 3025 Part 2:2004 (Reaff:2014)	19.64 mg/l
18	Total Arsenic as As	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.005 mg/l)
19	Boron as B	IS: 3025 Part 65:2014 (Reaff:2019)	0.056 mg/l
20	Cadmium as Cd	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.001 mg/l)
21	Total Chromium as Cr	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.02 mg/l)
22	Lead as Pb	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.005 mg/l)
23	Manganese as Mn	IS: 3025 Part 65:2014 (Reaff:2019)	BDL(DL:0.02 mg/l)
24	Mercury as Hg	USEPA 200.8	BDL (DL:0.0005 mg/l)
25	Molybdenum as Mo	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.02 mg/l)
26	Selenium as Se	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.005 mg/l)
27	Aluminium as Al	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.005 mg/l)
28	Nickel as Ni	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.005 mg/l)
29	Zinc as Zn	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.05 mg/l)
30	Potassium as K	IS: 3025 Part 45:2014 (Reaff:2019)	5.79 mg/l
31	Copper as Cu	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.02 mg/l)
32	Antimony as Sb	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.003 mg/l)
33	Barium as Ba	IS: 3025 Part 65:2014 (Reaff:2019)	0.059 mg/l
34	Cobalt as Co	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.01 mg/l)
35	Uranium as U	IS: 3025 Part 65:2014 (Reaff:2019)	BDL(DL : 0.001 mg/l)
36	Vandium as V	IS: 3025 Part 65:2014 (Reaff:2019)	BDL(DL : 0.01 mg/l)
37	Lithium as Li	IS: 3025 Part 2:2004 (Reaff:2014)	BDL(DL : 0.01 mg/l)

**Abbreviation:** BDL: Below Detection Limit, DL: Detection Limit.

End of Report



For Chennai Mettex Lab Private Limited

*(Signature)*  
 Reviewed & Authorized By  
**P. KAVITHA**  
 Technical Manager  
 Authorised Signatory

NOTE: Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders will be liable for legal action. Unless otherwise stated the submitted results in this test report refer only to the sample(s) tested and such sample(s) are retained for 15 days only from the completion date of testing, except in case of regulatory samples, which will be retained for a specific period as per statutory requirement; while perishable & environmental testing related remnant samples will be discarded consequent upon completion of testing. Samples are not drawn by us unless otherwise stated. This document cannot be reproduced Except in full, without prior written approval of the laboratory. This report is for the exclusive use of Chennai Mettex Lab's customer, and is provided in accordance with

E-mail : test@mettexlab.com  
Web : www.mettexlab.com

Phone : 044-22323163, 22311034  
42179490, 42179491



**CHENNAI METTEX LAB PRIVATE LIMITED**

Jothis Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.



TC-5589

**TEST REPORT**

Page No. 1 Of 1

**ISSUED TO :** M/s.ASAR Social Impact Advisors Pvt Ltd.,

**T.C Date :** 16.02.2023

No: 16 , 7 th Temple Street, 15 th Cross Road  
Mallechwaram, Bangalore,  
Karnataka – 560 003.

**T.C No :** CML/22-23/78128-A

**Cust. Ref :** SRF Dated : 02.02.2023

**Date Of Receipt :** 04.02.2023

**Lab No :** 2385552

**Commenced On :** 04.02.2023

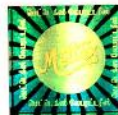
**Completed On :** 13.02.2023

**Sample Description :** Water- Vaanadhirayapuram Village 100 meters from the Mine-Ground Water -  
Sample Serial No : 15.

Sl. No.	Test Parameters	Test Methods	Test Results
1	Cerium as Ce	IS: 3025 Part 2:2004 (Reaff.2014)	BDL(DL : 0.1 mg/l)
2	Titanium as Ti	IS: 3025 Part 2:2004 (Reaff.2014)	BDL(DL : 0.01 mg/l)
3	Thallium as Tl	IS: 3025 Part 2:2004 (Reaff.2014)	BDL(DL : 0.1 mg/l)

**Abbreviation:** BDL: Below Detection Limit, DL: Detection Limit.

End of Report



For Chennai Mettex Lab Private Limited

  
Reviewed & Authorized By  
**P. KAVITHA**  
Technical Manager  
Authorised Signatory

NOTE: Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders will be liable for legal action. Unless otherwise stated the submitted results in this test report refer only to the sample(s) tested and such sample(s) are retained for 15 days only from the completion date of testing .. except in case of regulatory samples, which will be retained for a specific period as per statutory requirement; while perishable & environmental testing related remnant samples will be discarded consequent upon completion of testing. Samples are not drawn by us unless otherwise stated. This document cannot be reproduced Except in full, without prior written approval of the laboratory. This report is for the exclusive use of Chennai Mettex Lab's customer, and is provided in accordance with

E-mail : test@mettexlab.com  
Web : www.mettexlab.com

Phone : 044-22323163, 22311034  
42179490, 42179491



**CHENNAI METTEX LAB PRIVATE LIMITED**

Jothi Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.



TC-5589

**TEST REPORT**

Page No. 1 Of 2

**ISSUED TO :** M/s.ASAR Social Impact Advisors Pvt Ltd.,

**T.C Date :** 16.02.2023

No: 16 , 7 th Temple Street, 15 th Cross Road  
Malleshwaram, Bangalore,  
Karnataka – 560 003.

**T.C No :** CML/22-23/78129

**Cust. Ref :** SRF Dated : 02.02.2023

**Date Of Receipt :** 04.02.2023

**Lab No :** 2385553

**Commenced On :** 04.02.2023

**Completed On :** 13.02.2023

**Sample Description :** Water- Ayikuppam – Kullanchavadi Borewell Water –  
Ground Water - Sample Serial No : 16.

Sl. No.	Test Parameters	Test Methods	Test Results
<b>Discipline :</b> Chemical		<b>Group :</b> Water & Residues in Water	
01	pH at 25°C	IS:3025 Part 11-1983 (Reaff.2017)	6.89
02	Turbidity	IS: 3025 Part 10:1984 (Reaff.2017)	Less than 0.5 NTU
03	Total Hardness as CaCO <sub>3</sub>	IS: 3025 Part 21:2009 (Reaff.2019)	135 mg/l
04	Chloride as Cl	IS: 3025 Part 32:1988 (Reaff.2019)	64 mg/l
05	Total Alkalinity as CaCO <sub>3</sub>	IS: 3025 Part 23:1986 (Reaff.2019)	71.4 mg/l
06	Sulphate as SO <sub>4</sub>	IS: 3025 Part 24:1986 (Reaff.2019)	21.3 mg/l
07	Total Dissolved Solids	IS: 3025 Part 16:1984 (Reaff.2017)	247 mg/l
08	Nitrate as NO <sub>3</sub>	IS: 3025 Part 34:1988 (Reaff.2019)	7.4 mg/l
09	Total Suspended Solids	IS:3025 Part 17:1984 (Reaff.2017)	BDL(DL: 1.0 mg/l)
10	Fluoride as F	APHA 23 <sup>rd</sup> Edn. 2017:4500 F,D	0.59 mg/l
11	Sulphide as S	IS:3025 Part 29:-986 (Reaff.2019)	BDL (DL:0.01 mg/l)
12	Iron as Fe	IS: 3025 Part 53:2003 (Reaff.2019)	0.02 mg/l
13	Calcium as Ca	IS: 3025 Part 40:1991 (Reaff.2019)	31.2 mg/l
14	Magnesium as Mg	IS: 3025 Part 46:1994 (Reaff.2019)	13.2 mg/l

...Contd....2

NOTE: Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders will be liable for legal action. Unless otherwise stated the submitted results in this test report refer only to the sample(s) tested and such sample(s) are retained for 15 days only from the completion date of testing, except in case of regulatory samples, which will be retained for a specific period as per statutory requirement; while perishable & environmental testing related remnant samples will be discarded consequent upon completion of testing. Samples are not drawn by us unless otherwise stated. This document cannot be reproduced Except in full, without prior written approval of the laboratory. This report is for the exclusive use of Chennai Mettex Lab's customer, and is provided in accordance with the agreement between Chennai Mettex Lab and its Customer.

E-mail : test@mettexlab.com  
Web : www.mettexlab.com

Phone : 044-22323163, 22311034  
42179490, 42179491



**CHENNAI METTEX LAB PRIVATE LIMITED**

Jothi Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.



TC-5589

Lab No: 2385553

T.C No: CML/22-23/78129

Dated : 16.02.2023

Page No. 2 of 2

Sl. No.	Test Parameters	Test Methods	Test Results
15	Conductivity @ 25°C	IS: 3025 Part 14:2013 (Reaff:2019)	450 µmhos/cm
16	Phosphorus as P	IS: 3025: Part:31-1988 (Reaff:2019)	BDL (DL:0.01 mg/l)
17	Silicon as Si	IS: 3025 Part 2:2004 (Reaff:2014)	36.73 mg/l
18	Total Arsenic as As	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.005 mg/l)
19	Boron as B	IS: 3025 Part 65:2014 (Reaff:2019)	0.102 mg/l
20	Cadmium as Cd	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.001 mg/l)
21	Total Chromium as Cr	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.02 mg/l)
22	Lead as Pb	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.005 mg/l)
23	Manganese as Mn	IS: 3025 Part 65:2014 (Reaff:2019)	BDL(DL:DL: 0.2 mg/l)
24	Mercury as Hg	USEPA 200.8	BDL (DL:0.0005 mg/l)
25	Molybdenum as Mo	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.02 mg/l)
26	Selenium as Se	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.005 mg/l)
27	Aluminium as Al	IS: 3025 Part 65:2014 (Reaff:2019)	0.013 mg/l
28	Nickel as Ni	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.005 mg/l)
29	Zinc as Zn	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.05 mg/l)
30	Potassium as K	IS: 3025 Part 45:2014 (Reaff:2019)	2.39 mg/l
31	Copper as Cu	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.02 mg/l)
32	Antimony as Sb	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.003 mg/l)
33	Barium as Ba	IS: 3025 Part 65:2014 (Reaff:2019)	0.111 mg/l
34	Cobalt as Co	IS: 3025 Part 65:2014 (Reaff:2019)	BDL (DL:0.01 mg/l)
35	Uranium as U	IS: 3025 Part 65:2014 (Reaff:2019)	BDL(DL : 0.001 mg/l)
36	Vandium as V	IS: 3025 Part 65:2014 (Reaff:2019)	BDL(DL : 0.01 mg/l)
37	Lithium as Li	IS: 3025 Part 2:2004 (Reaff:2014)	BDL(DL : 0.01 mg/l)

Abbreviation: BDL: Below Detection Limit, DL: Detection Limit.

End of Report



For Chennai Mettex Lab Private Limited

*P. Kavitha*

Reviewed & Authorized By

**P. KAVITHA**

Technical Manager

Authorised Signatory

NOTE: Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offensive. Unless otherwise stated the submitted results in this test report refer only to the sample(s) tested and such sample(s) are retained for 15 days only from the completion date of testing .. except in case of regulatory samples, which will be retained for a specific period as per statutory requirement; while perishable & environmental testing related remnant samples will be discarded consequent upon completion of testing. Samples are not drawn by us unless otherwise stated. This document cannot be reproduced Except in full, without prior written approval of the laboratory. This report is for the exclusive use of Chennai Mettex Lab's customer, and is provided in accordance with









E-mail: test@mettexlab.com  
Web : www.mettexlab.com

Phone : 044-22323163, 22311034  
42179490, 42179491



## CHENNAI METTEX LAB PRIVATE LIMITED

Jothi Complex, 83, M.K.N. Road, Guindy, Chennai - 600 032.

(Approved/Recognized by APEDA, AGMARK, GAFTA, EIC, FSSAI, BIS & MoEF)

### TEST REPORT

Page No. 1 Of2

**ISSUED TO :** M/s.ASAR Social Impact Advisors Pvt Ltd.,

**T.C Date :** 16.02.2023

No: 16 , 7 th Temple Street, 15 th Cross Road  
Malleshwaram, Bangalore,  
Karnataka – 560 003.

**T.C No :** CML/22-23/78131

**Cust. Ref :** SRF Dated : 02.02.2023

**Date Of Receipt :** 04.02.2023

**Commenced On :** 04.02.2023

**Lab No :** 2385563

**Completed On :** 22.02.2023

**Sample Description :** Soil- Agri Land Near to Iyyan Lake  
Soil - Sample Serial No : 12.

S. No	Test Parameters	Protocols	Results
01	pH @ 25°C	IS : 2720 Part 26: 1987 (Reaff: 2016)	4.93
02	Total Phosphorus as P	IS 10158 : 1982 (Reaff: 2019)	396 mg/kg
03	Electrical Conductivity	IS 14767 - 2000 (Reaff : 2016)	391 µmhos/cm
04	Total Nitrogen as N	IS 14684 : 1999 (Reaff:2019)	1159 mg/kg
05	Organic Carbon	IS : 2720 Part 22: 1972 (Reaff: 2020)	1.23 %
06	Sulphur	USEPA 3050 B – 1996 & USEPA 6010 C - 2000	BDL(DL:1.0 mg/kg)
07	Arsenic as As	USEPA 3050 B – 1996 & USEPA 6010 C - 2000	BDL(DL:1.0 mg/kg)
08	Boron as B		BDL(DL:1.0 mg/kg)
09	Cadmium as Cd		BDL(DL:1.0 mg/kg)
10	Total Chromium as Cr		78.6 mg/kg
11	Iron as Fe		27100 mg/kg
12	Lead as Pb		BDL(DL:1.0 mg/kg)
13	Manganese as Mn		161 mg/kg
14	Mercury as Hg		BDL(DL:1.0 mg/kg)
15	Molybdenum as Mo		BDL(DL:1.0 mg/kg)
16	Selenium as Se		BDL(DL:1.0 mg/kg)
17	Aluminium as Al		12265 mg/kg

...Contd....2

NOTE: Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders will be liable for legal action. Unless otherwise stated the submitted results in this test report refer only to the sample(s) tested and such sample(s) are retained for 15 days only from the completion date of testing., except in case of regulatory samples, which will be retained for a specific period as per statutory requirement; while perishable & environmental testing related remnant samples will be discarded consequent upon completion of testing. Samples are not drawn by us unless otherwise stated. This document cannot be reproduced except in full, without prior written approval of the laboratory. This report is for the exclusive use of Chennai Mettex Lab's customer, and is provided in accordance with the agreement between Chennai Mettex Lab and its Customer.





## TEST REPORT

TEST REPORT NO: TNTH/M-0275/2023-24

DATE:05.05.2023

### SAMPLE SUBMITTED BY CUSTOMER

SAMPLE SUBMITTED BY	M/s Asar Social Impact Advisors Private Limited,
ADDRESS	No:16, 7th Temple Street, 15th Cross Road, Malleshwaram, Bengaluru-560 003.
SAMPLE DESCRIPTION	S1- Water
LOCATION	Mines 1st Outlet-Veenageni
SAMPLE QUANTITY	5 Litre
PACKING	In Plastic Bottle
SAMPLE RECEIVED ON	17.04.2023
ANALYSIS STARTED ON	18.04.2023
ANALYSIS COMPLETED ON	05.05.2023

### Terms and Conditions

This report in full or in part shall not be published, advertised, used for any legal action, unless prior permission has been secured. This test report pertains only for the sample tested and such samples are retained for 7 days (in case of perishable) and 15 days for all other samples. In case of Complaint received from customers sample will be kept for 30 days. The samples from regulatory bodies are to be retained as specified. This document cannot be reproduced except in full, without prior written approval of the company.

For Tamilnadu Test House Private Limited

Managing Director

Page 1 of 3



# TAMILNADU TEST HOUSE PRIVATE LIMITED

238

[www.tamilnadutesthouse.com](http://www.tamilnadutesthouse.com)

## TEST REPORT

TEST REPORT NO: TNTH/M-0275/2023-24

DATE:05.05.2023

### SAMPLE SUBMITTED BY CUSTOMER

SAMPLE DESCRIPTION S1- Water  
ANALYSIS STARTED ON 18.04.2023  
ANALYSIS COMPLETED ON 05.05.2023

S. NO	PARAMETERS	METHOD	UNITS	RESULT	LIMITS as per 10500:2012
1	pH @ 25°C	IS 3025 (Part 11)-1983 (R.2006)	-	7.71	6.5 TO 8.5
2	Conductivity @ 25 deg C	IS 3025 (part 14): 2013 (RA 2019)	µs/cm	632.00	NA
3	Turbidity	IS 3025(Part 10)-1983(R.2006)	NTU	4.00	Max 1
4	Total Hardness as CaCo3	IS 3025(Part 21)-1983(R.2006)	mg/l	160.00	Max 200
5	Chloride as Cl <sup>-</sup>	IS 3025 (Part 32)-1988 (R.2009)	mg/l	110.07	Max 250
6	Sulphate as SO <sub>4</sub>	IS 3025 (Part 24)-1986 (R.2009)	mg/l	96.02	Max 200
7	Total Alkalinity as CaCo3	IS 3025(Part 23)-1986(R.2009)	mg/l	61.20	Max 200
8	Nitrates as No3	IS 3025 (part 34 ): 1988 (RA 2019)	mg/l	7.40	Max 45
9	Total Dissolved Solids	IS 3025 (Part 16)-1984 (R.2006)	mg/l	372.00	Max 500
10	Total Suspended solids	IS 3025 (P17) : 1984 (Reaff. 2017)	mg/l	10.00	Max 50
11	Chemical Oxygen Demand	IS 3025 (P 58) : 2006 (Reaff. 2017)	mg/l	12.16	Max 250
12	Oil and Grease	IS 3025 (P 39) : 1991 (Reaff.2019)	mg/l	BQL(LOQ:0.1)	Max 10
13	Flouride as F-	IS 3025 PART 35 : 1988 (RA 2003)	mg/l	BQL(LOQ:0.1)	Max 1.0
14	Sulphur	TNTH/SOP/WATER/025	mg/l	0.56	NA
15	Arsenic as As	IS 3025 (Part 37)-1988 (RA.2014)	mg/l	BQL(LOQ:0.005)	Max 0.01
16	Boron as B	APHA 23rd Edn.2017 4500 B B	mg/l	BQL(LOQ:0.1)	Max 0.5
17	Cadmium as Cd	IS 3025 (Part 41)-1992 (RA.2014)	mg/l	BQL(LOQ:0.001)	Max 0.003
18	Chromium as Cr	IS 3025 (Part 52)-2003 (RA.2014)	mg/l	BQL(LOQ:0.01)	Max 0.05
19	Iron as Fe	IS 3025(Part 53)-2003 (R.2009)	mg/l	0.18	Max 0.3
20	Lead as Pb	IS 3025 (Part 47)-1994 (RA.2014)	mg/l	BQL(LOQ:0.005)	Max 0.01
21	Manganese as Mn	IS 3025 (Part 59)-2006 (RA.2012)	mg/l	BQL(LOQ:0.005)	Max 0.1

BQL-Below Quantification Limit, LOQ- Limit of Quantification

For Tamilnadu Test House Private Limited

Verified By

Authorized Signatory

Page 2 of 3



# TAMILNADU TEST HOUSE PRIVATE LIMITED

239

[www.tamilnadutesthouse.com](http://www.tamilnadutesthouse.com)

## TEST REPORT

TEST REPORT NO: TNTH/M-0275/2023-24

DATE:05.05.2023

### SAMPLE SUBMITTED BY CUSTOMER

SAMPLE DESCRIPTION S1- Water

ANALYSIS STARTED ON 18.04.2023

ANALYSIS COMPLETED ON 05.05.2023

S. NO	PARAMETERS	METHOD	UNITS	RESULT	LIMITS as per 10500:2012
22	Mercury as Hg	IS 3025 (Part 48)-1994 (RA.2014)	mg/l	BQL(LOQ:0.0005)	Max 0.001
23	Molybdenum	IS :1622:1981 RA 2014	mg/l	BQL(LOQ:0.005)	Max 0.07
24	Selenium as Se	IS 3025 (Part 56)-2003 (RA.2014)	mg/l	0.002	Max 0.01
25	Thalium	TNTH/SOP/WATER/078	mg/l	BQL(LOQ:0.005)	NA
26	Aluminium as Al	IS 3025 (Part 55)-2003 (RA.2014)	mg/l	BQL(LOQ:0.01)	Max 0.03
27	Nickel	IS 3025 (Part 54)-2003 (RA.2014)	mg/l	BQL(LOQ:0.01)	Max 0.02
28	Zinc as Zn	IS 3025 (Part 49)-1994 (RA.2014)	mg/l	BQL(LOQ:0.1)	Max 500
29	Lithium	TNTH/SOP/WATER/077	mg/l	0.02	NA
30	Calcium as Ca	IS 3025(Part 40)-1991 (R.2014)	mg/l	52.04	Max 75
31	Magnesium as Mg	IS 3025(Part 46)-1994(R.2014)	mg/l	7.29	Max 30
32	Potassium	IS 3025(Part-45)-1993(R.2019)	mg/l	14.20	NA
33	Phosphorous	IS 3025 (Part 31) : 1988	mg/l	1.06	NA
34	Antimony	TNTH/SOP/WATER/062	mg/l	BQL(LOQ:0.005)	NA
35	Barium	Annex F of IS 13428 - 2005 (RA-2014)	mg/l	0.25	Max 0.7
36	Cerium	TNTH/SOP/WATER/054	mg/l	BQL(LOQ:0.005)	NA
37	Cobalt	IS 3025(Part 45) : 1993	mg/l	BQL(LOQ:0.005)	NA
38	Copper	APHA 23rd Edn. 3111B	mg/l	BQL(LOQ:0.005)	Max 0.05
39	Silicon	APHA 23rd edn. 4500	mg/l	2.58	NA
40	Titanium	APHA23rd Edn. 3112D 2017	mg/l	BQL(LOQ:0.001)	NA
41	Vanadium	APHA 23rd Edn. 3111D 2017	mg/l	BQL(LOQ:0.005)	NA

BQL-Below Quantification Limit, LOQ- Limit of Quantification

\*\*\*END OF THE REPORT\*\*\*

For Tamilnadu Test House Private Limited

Verified By

Authorized Signatory



## TEST REPORT

TEST REPORT NO: TNTH/M-0276/2023-24

DATE:05.05.2023

### SAMPLE SUBMITTED BY CUSTOMER

SAMPLE SUBMITTED BY	<b>M/s Asar Social Impact Advisors Private Limited,</b>
ADDRESS	No:16, 7th Temple Street, 15th Cross Road, Malleshwaram, Bengaluru-560 003.
SAMPLE DESCRIPTION	S2- Water
LOCATION	Ramapuri, Mantharakuppam-Vadakkuvellu
SAMPLE QUANTITY	5 Litre
PACKING	In Plastic Bottle
SAMPLE RECEIVED ON	17.04.2023
ANALYSIS STARTED ON	18.04.2023
ANALYSIS COMPLETED ON	05.05.2023

### Terms and Conditions

This report in full or in part shall not be published, advertised, used for any legal action, unless prior permission has been secured. This test report pertains only for the sample tested and such samples are retained for 7 days (in case of perishable) and 15 days for all other samples. In case of Complaint received from customers sample will be kept for 30 days. The samples from regulatory bodies are to be retained as specified. This document cannot be reproduced except in full, without prior written approval of the company.

**For Tamilnadu Test House Private Limited**

**Managing Director**

Page 1 of 3



# TAMILNADU TEST HOUSE PRIVATE LIMITED

241

[www.tamilnadutesthouse.com](http://www.tamilnadutesthouse.com)

## TEST REPORT

TEST REPORT NO: TNTH/M-0276/2023-24

DATE:05.05.2023

### SAMPLE SUBMITTED BY CUSTOMER

SAMPLE DESCRIPTION S2- Water  
ANALYSIS STARTED ON 18.04.2023  
ANALYSIS COMPLETED ON 05.05.2023

S. NO	PARAMETERS	METHOD	UNITS	RESULT	LIMITS as per 10500:2012
1	pH @ 25°C	IS 3025 (Part 11)-1983 (R.2006)	-	8.38	6.5 TO 8.5
2	Conductivity @ 25 deg C	IS 3025 (part 14): 2013 (RA 2019)	µs/cm	2314.28	NA
3	Turbidity	IS 3025(Part 10)-1983(R.2006)	NTU	53.20	Max 1
4	Total Hardness as CaCo3	IS 3025(Part 21)-1983(R.2006)	mg/l	650.00	Max 200
5	Chloride as Cl <sup>-</sup>	IS 3025 (Part 32)-1988 (R.2009)	mg/l	497.72	Max 250
6	Sulphate as SO <sub>4</sub>	IS 3025 (Part 24)-1986 (R.2009)	mg/l	206.24	Max 200
7	Total Alkalinity as CaCo3	IS 3025(Part 23)-1986(R.2009)	mg/l	142.80	Max 200
8	Nitrates as No3	IS 3025 (part 34 ): 1988 (RA 2019)	mg/l	4.26	Max 45
9	Total Dissolved Solids	IS 3025 (Part 16)-1984 (R.2006)	mg/l	1296.00	Max 500
10	Total Suspended solids	IS 3025 (P17) : 1984 (Reaff. 2017)	mg/l	40.00	Max 50
11	Chemical Oxygen Demand	IS 3025 (P 58) : 2006 (Reaff. 2017)	mg/l	24.32	Max 250
12	Oil and Grease	IS 3025 (P 39) : 1991 (Reaff.2019)	mg/l	BQL(LOQ:0.1)	Max 10
13	Flouride as F-	IS 3025 PART 35 : 1988 (RA 2003)	mg/l	BQL(LOQ:0.1)	Max 1.0
14	Sulphur	TNTH/SOP/WATER/025	mg/l	0.78	NA
15	Arsenic as As	IS 3025 (Part 37)-1988 (RA.2014)	mg/l	BQL(LOQ:0.005)	Max 0.01
16	Boron as B	APHA 23rd Edn.2017 4500 B B	mg/l	BQL(LOQ:0.1)	Max 0.5
17	Cadmium as Cd	IS 3025 (Part 41)-1992 (RA.2014)	mg/l	BQL(LOQ:0.001)	Max 0.003
18	Chromium as Cr	IS 3025 (Part 52)-2003 (RA.2014)	mg/l	BQL(LOQ:0.01)	Max 0.05
19	Iron as Fe	IS 3025(Part 53)-2003 (R.2009)	mg/l	0.21	Max 0.3
20	Lead as Pb	IS 3025 (Part 47)-1994 (RA.2014)	mg/l	BQL(LOQ:0.005)	Max 0.01
21	Manganese as Mn	IS 3025 (Part 59)-2006 (RA.2012)	mg/l	BQL(LOQ:0.005)	Max 0.1

BQL-Below Quantification Limit, LOQ- Limit of Quantification

For Tamilnadu Test House Private Limited

Verified By

Authorized Signatory

Page 2 of 3



# TAMILNADU TEST HOUSE PRIVATE LIMITED

242

[www.tamilnadutesthouse.com](http://www.tamilnadutesthouse.com)

## TEST REPORT

TEST REPORT NO: TNTH/M-0276/2023-24

DATE:05.05.2023

### SAMPLE SUBMITTED BY CUSTOMER

SAMPLE DESCRIPTION S2- Water

ANALYSIS STARTED ON 18.04.2023

ANALYSIS COMPLETED ON 05.05.2023

S. NO	PARAMETERS	METHOD	UNITS	RESULT	LIMITS as per 10500:2012
22	Mercury as Hg	IS 3025 (Part 48)-1994 (RA.2014)	mg/l	0.02	Max 0.001
23	Molybdenum	IS :1622:1981 RA 2014	mg/l	BQL(LOQ:0.005)	Max 0.07
24	Selenium as Se	IS 3025 (Part 56)-2003 (RA.2014)	mg/l	0.024	Max 0.01
25	Thalium	TNTH/SOP/WATER/078	mg/l	BQL(LOQ:0.005)	NA
26	Aluminium as Al	IS 3025 (Part 55)-2003 (RA.2014)	mg/l	BQL(LOQ:0.01)	Max 0.03
27	Nickel	IS 3025 (Part 54)-2003 (RA.2014)	mg/l	BQL(LOQ:0.01)	Max 0.02
28	Zinc as Zn	IS 3025 (Part 49)-1994 (RA.2014)	mg/l	BQL(LOQ:0.1)	Max 500
29	Lithium	TNTH/SOP/WATER/077	mg/l	0.12	NA
30	Calcium as Ca	IS 3025(Part 40)-1991 (R.2014)	mg/l	196.39	Max 75
31	Magnesium as Mg	IS 3025(Part 46)-1994(R.2014)	mg/l	38.89	Max 30
32	Potassium	IS 3025(Part-45)-1993(R.2019)	mg/l	58.40	NA
33	Phosphorous	IS 3025 (Part 31) : 1988	mg/l	BQL(LOQ:0.1)	NA
34	Antimony	TNTH/SOP/WATER/062	mg/l	BQL(LOQ:0.005)	NA
35	Barium	Annex F of IS 13428 - 2005 (RA-2014)	mg/l	0.25	Max 0.7
36	Cerium	TNTH/SOP/WATER/054	mg/l	BQL(LOQ:0.005)	NA
37	Cobalt	IS 3025(Part 45) : 1993	mg/l	BQL(LOQ:0.005)	NA
38	Copper	APHA 23rd Edn. 3111B	mg/l	BQL(LOQ:0.005)	Max 0.05
39	Silicon	APHA 23rd edn. 4500	mg/l	1.44	NA
40	Titanium	APHA23rd Edn. 3112D 2017	mg/l	BQL(LOQ:0.001)	NA
41	Vanadium	APHA 23rd Edn. 3111D 2017	mg/l	BQL(LOQ:0.005)	NA

BQL-Below Quantification Limit, LOQ- Limit of Quantification

\*\*\*END OF THE REPORT\*\*\*

For Tamilnadu Test House Private Limited

Verified By

Authorized Signatory



## TEST REPORT

TEST REPORT NO: TNTH/M-0277/2023-24

DATE:05.05.2023

### SAMPLE SUBMITTED BY CUSTOMER

SAMPLE SUBMITTED BY	M/s Asar Social Impact Advisors Private Limited,
ADDRESS	No:16, 7th Temple Street, 15th Cross Road, Malleshwaram, Bengaluru-560 003.
SAMPLE DESCRIPTION	S3- Water
LOCATION	Vadakkuvellur-Ammeri
SAMPLE QUANTITY	5 Litre
PACKING	In Plastic Bottle
SAMPLE RECEIVED ON	17.04.2023
ANALYSIS STARTED ON	18.04.2023
ANALYSIS COMPLETED ON	05.05.2023

### Terms and Conditions

This report in full or in part shall not be published, advertised, used for any legal action, unless prior permission has been secured. This test report pertains only for the sample tested and such samples are retained for 7 days (in case of perishable) and 15 days for all other samples. In case of Complaint received from customers sample will be kept for 30 days. The samples from regulatory bodies are to be retained as specified. This document cannot be reproduced except in full, without prior written approval of the company.

For Tamilnadu Test House Private Limited

Managing Director

Page 1 of 3



# TAMILNADU TEST HOUSE PRIVATE LIMITED

244

[www.tamilnadutesthouse.com](http://www.tamilnadutesthouse.com)

## TEST REPORT

TEST REPORT NO: TNTH/M-0277/2023-24

DATE:05.05.2023

### SAMPLE SUBMITTED BY CUSTOMER

SAMPLE DESCRIPTION S3- Water  
ANALYSIS STARTED ON 18.04.2023  
ANALYSIS COMPLETED ON 05.05.2023

S. NO	PARAMETERS	METHOD	UNITS	RESULT	LIMITS as per 10500:2012
1	pH @ 25°C	IS 3025 (Part 11)-1983 (R.2006)	-	7.70	6.5 TO 8.5
2	Conductivity @ 25 deg C	IS 3025 (part 14): 2013 (RA 2019)	µs/cm	734.00	NA
3	Turbidity	IS 3025(Part 10)-1983(R.2006)	NTU	32.60	Max 1
4	Total Hardness as CaCo3	IS 3025(Part 21)-1983(R.2006)	mg/l	230.00	Max 200
5	Chloride as Cl <sup>-</sup>	IS 3025 (Part 32)-1988 (R.2009)	mg/l	81.36	Max 250
6	Sulphate as SO <sub>4</sub>	IS 3025 (Part 24)-1986 (R.2009)	mg/l	42.08	Max 200
7	Total Alkalinity as CaCo3	IS 3025(Part 23)-1986(R.2009)	mg/l	81.60	Max 200
8	Nitrates as No3	IS 3025 (part 34 ): 1988 (RA 2019)	mg/l	10.24	Max 45
9	Total Dissolved Solids	IS 3025 (Part 16)-1984 (R.2006)	mg/l	410.76	Max 500
10	Total Suspended solids	IS 3025 (P17) : 1984 (Reaff. 2017)	mg/l	51.00	Max 50
11	Chemical Oxygen Demand	IS 3025 (P 58) : 2006 (Reaff. 2017)	mg/l	27.30	Max 250
12	Oil and Grease	IS 3025 (P 39) : 1991 (Reaff.2019)	mg/l	BQL(LOQ:0.1)	Max 10
13	Flouride as F-	IS 3025 PART 35 : 1988 (RA 2003)	mg/l	BQL(LOQ:0.1)	Max 1.0
14	Sulphur	TNTH/SOP/WATER/025	mg/l	1.12	NA
15	Arsenic as As	IS 3025 (Part 37)-1988 (RA.2014)	mg/l	BQL(LOQ:0.005)	Max 0.01
16	Boron as B	APHA 23rd Edn.2017 4500 B B	mg/l	BQL(LOQ:0.1)	Max 0.5
17	Cadmium as Cd	IS 3025 (Part 41)-1992 (RA.2014)	mg/l	BQL(LOQ:0.001)	Max 0.003
18	Chromium as Cr	IS 3025 (Part 52)-2003 (RA.2014)	mg/l	BQL(LOQ:0.01)	Max 0.05
19	Iron as Fe	IS 3025(Part 53)-2003 (R.2009)	mg/l	0.23	Max 0.3
20	Lead as Pb	IS 3025 (Part 47)-1994 (RA.2014)	mg/l	BQL(LOQ:0.005)	Max 0.01
21	Manganese as Mn	IS 3025 (Part 59)-2006 (RA.2012)	mg/l	BQL(LOQ:0.005)	Max 0.1

BQL-Below Quantification Limit, LOQ- Limit of Quantification

For Tamilnadu Test House Private Limited

Verified By

Authorized Signatory

Page 2 of 3



# TAMILNADU TEST HOUSE PRIVATE LIMITED

245

[www.tamilnadutesthouse.com](http://www.tamilnadutesthouse.com)

## TEST REPORT

TEST REPORT NO: TNTH/M-0277/2023-24

DATE:05.05.2023

### SAMPLE SUBMITTED BY CUSTOMER

SAMPLE DESCRIPTION S3- Water  
ANALYSIS STARTED ON 18.04.2023  
ANALYSIS COMPLETED ON 05.05.2023

S. NO	PARAMETERS	METHOD	UNITS	RESULT	LIMITS as per 10500:2012
22	Mercury as Hg	IS 3025 (Part 48)-1994 (RA.2014)	mg/l	BQL(LOQ:0.0005)	Max 0.001
23	Molybdenum	IS :1622:1981 RA 2014	mg/l	BQL(LOQ:0.005)	Max 0.07
24	Selenium as Se	IS 3025 (Part 56)-2003 (RA.2014)	mg/l	0.014	Max 0.01
25	Thalium	TNTH/SOP/WATER/078	mg/l	BQL(LOQ:0.005)	NA
26	Aluminium as Al	IS 3025 (Part 55)-2003 (RA.2014)	mg/l	BQL(LOQ:0.01)	Max 0.03
27	Nickel	IS 3025 (Part 54)-2003 (RA.2014)	mg/l	BQL(LOQ:0.01)	Max 0.02
28	Zinc as Zn	IS 3025 (Part 49)-1994 (RA.2014)	mg/l	BQL(LOQ:0.1)	Max 500
29	Lithium	TNTH/SOP/WATER/077	mg/l	0.01	NA
30	Calcium as Ca	IS 3025(Part 40)-1991 (R.2014)	mg/l	68.14	Max 75
31	Magnesium as Mg	IS 3025(Part 46)-1994(R.2014)	mg/l	14.58	Max 30
32	Potassium	IS 3025(Part-45)-1993(R.2019)	mg/l	18.20	NA
33	Phosphorous	IS 3025 (Part 31) : 1988	mg/l	1.54	NA
34	Antimony	TNTH/SOP/WATER/062	mg/l	BQL(LOQ:0.005)	NA
35	Barium	Annex F of IS 13428 - 2005 (RA-2014)	mg/l	0.25	Max 0.7
36	Cerium	TNTH/SOP/WATER/054	mg/l	BQL(LOQ:0.005)	NA
37	Cobalt	IS 3025(Part 45) : 1993	mg/l	BQL(LOQ:0.005)	NA
38	Copper	APHA 23rd Edn. 3111B	mg/l	BQL(LOQ:0.005)	Max 0.05
39	Silicon	APHA 23rd edn. 4500	mg/l	1.08	NA
40	Titanium	APHA23rd Edn. 3112D 2017	mg/l	BQL(LOQ:0.001)	NA
41	Vanadium	APHA 23rd Edn. 3111D 2017	mg/l	BQL(LOQ:0.005)	NA

BQL-Below Quantification Limit, LOQ- Limit of Quantification

\*\*\*END OF THE REPORT\*\*\*

For Tamilnadu Test House Private Limited

Verified By

Authorized Signatory



## TEST REPORT

TEST REPORT NO: TNTH/M-0278/2023-24

DATE:24.04.2023

### SAMPLE SUBMITTED BY CUSTOMER

SAMPLE SUBMITTED BY **M/s Asar Social Impact Advisors Private Limited,**  
ADDRESS No:16, 7th Temple Street, 15th Cross Road,  
Malleshwaram, Bengaluru-560 003.  
SAMPLE DESCRIPTION S4- Soil  
LOCATION Vadakkuvellur-Karumbu Thottam Soil  
SAMPLE QUANTITY 1 kg  
PACKING In Plastic Bottle  
SAMPLE RECEIVED ON 17.04.2023  
ANALYSIS STARTED ON 18.04.2023  
ANALYSIS COMPLETED ON 24.04.2023

### Terms and Conditions

This report in full or in part shall not be published, advertised, used for any legal action, unless prior permission has been secured. This test report pertains only for the sample tested and such samples are retained for 7 days (in case of perishable) and 15 days for all other samples. In case of Complaint received from customers sample will be kept for 30 days. The samples from regulatory bodies are to be retained as specified. This document cannot be reproduced except in full, without prior written approval of the company.

**For Tamilnadu Test House Private Limited**

**Managing Director**

Page 1 of 3



# TAMILNADU TEST HOUSE PRIVATE LIMITED

247

www.tamilnadutesthouse.com

## TEST REPORT

TEST REPORT NO: TNTH/M-0278/2023-24

DATE:24.04.2023

### SAMPLE SUBMITTED BY CUSTOMER

SAMPLE DESCRIPTION S4- Soil  
ANALYSIS STARTED ON 18.04.2023  
ANALYSIS COMPLETED ON 24.04.2023

S. NO	PARAMETERS	METHOD	UNITS	RESULT
1	pH	FAO 19th Edn.ch3 P36	-	6.29
2	Conductivity	FAO 19th Edn.ch3 P36	µs/cm	149.94
3	Nitrogen as N	FAO 19th Edn. Ch3 P42-44	%	0.44
4	Availabe Phosphorous as P	FAO 19th Edn. Ch3 P50-53	%	1.26
5	Potassium as K	TNTH /SOIL/SOP/022	%	1.42
6	Total Organic Carbon	FAO 19th Edn. Ch3 P38-42	%	10.26
7	Sulphur	TNTH /SOIL/SOP/022	Mg/kg	273.00
8	Zinc as Zn		Mg/kg	78.79
9	Iron as Fe		Mg/kg	1847.25
10	Copper as Cu		Mg/kg	17.12
11	Manganese as Mn		Mg/kg	160.94
12	Boron as B		Mg/kg	0.27
<b>Heavy Metals:</b>				
13	Arsenic	TNTH /SOIL/SOP/022	Mg/kg	BQL(LOQ:0.005)
14	Cadmium		Mg/kg	0.30
15	Chromium		Mg/kg	BQL(LOQ:0.01)
16	Lead		Mg/kg	3.02
17	Mercury		Mg/kg	0.23

BQL-Below Quantification Limit, LOQ- Limit of Quantification

For Tamilnadu Test House Private Limited

Verified By

Authorized Signatory

Page 2 of 3



# TAMILNADU TEST HOUSE PRIVATE LIMITED

248

[www.tamilnadutesthouse.com](http://www.tamilnadutesthouse.com)

## TEST REPORT

TEST REPORT NO: TNTH/M-0278/2023-24

DATE:24.04.2023

### SAMPLE SUBMITTED BY CUSTOMER

SAMPLE DESCRIPTION S4- Soil  
ANALYSIS STARTED ON 18.04.2023  
ANALYSIS COMPLETED ON 24.04.2023

S. NO	PARAMETERS	METHOD	UNITS	RESULT
18	Molybdenum	TNTH/SOP/SOIL/022	Mg/kg	0.02
19	Selenium		Mg/kg	24.12
20	Thalium		Mg/kg	BQL(LOQ:0.005)
21	Alumium		Mg/kg	45.68
22	Nickel		Mg/kg	19.17
23	Lithium		Mg/kg	54.12
24	Calcium		Mg/kg	12.12
25	Magnesium		Mg/kg	9.79
26	Antimony		Mg/kg	1.78
27	Barium		Mg/kg	0.27
28	Cerium		Mg/kg	BQL(LOQ:0.005)
29	Cobalt		Mg/kg	2.45
30	Silicon		Mg/kg	90.05
31	Titanium		Mg/kg	BQL(LOQ:0.001)
32	Uranium		Mg/kg	BQL(LOQ:0.001)
33	Vanadium	Mg/kg	BQL(LOQ:0.005)	

BQL-Below Quantification Limit, LOQ- Limit of Quantification

\*\*\* END OF THE REPORT\*\*\*

For Tamilnadu Test House Private Limited

Verified By

Authorized Signatory

Page 3 of 3



## TEST REPORT

TEST REPORT NO: TNTH/M-0279/2023-24

DATE:05.05.2023

### SAMPLE SUBMITTED BY CUSTOMER

SAMPLE SUBMITTED BY	M/s Asar Social Impact Advisors Private Limited,
ADDRESS	No:16, 7th Temple Street, 15th Cross Road, Malleshwaram, Bengaluru-560 003.
SAMPLE DESCRIPTION	S5- Water
LOCATION	NNTPS Outlet Near Thropathi Amman Temple
SAMPLE QUANTITY	5 Litre
PACKING	In Plastic Bottle
SAMPLE RECEIVED ON	17.04.2023
ANALYSIS STARTED ON	18.04.2023
ANALYSIS COMPLETED ON	05.05.2023

### Terms and Conditions

This report in full or in part shall not be published, advertised, used for any legal action, unless prior permission has been secured. This test report pertains only for the sample tested and such samples are retained for 7 days (in case of perishable) and 15 days for all other samples. In case of Complaint received from customers sample will be kept for 30 days. The samples from regulatory bodies are to be retained as specified. This document cannot be reproduced except in full, without prior written approval of the company.

For Tamilnadu Test House Private Limited

Managing Director

Page 1 of 3



# TAMILNADU TEST HOUSE PRIVATE LIMITED

250

[www.tamilnadutesthouse.com](http://www.tamilnadutesthouse.com)

## TEST REPORT

TEST REPORT NO: TNTH/M-0279/2023-24

DATE:05.05.2023

### SAMPLE SUBMITTED BY CUSTOMER

SAMPLE DESCRIPTION S5- Water  
ANALYSIS STARTED ON 18.04.2023  
ANALYSIS COMPLETED ON 05.05.2023

S. NO	PARAMETERS	METHOD	UNITS	RESULT	LIMITS as per 10500:2012
1	pH @ 25°C	IS 3025 (Part 11)-1983 (R.2006)	-	3.86	6.5 TO 8.5
2	Conductivity @ 25 deg C	IS 3025 (part 14): 2013 (RA 2019)	µs/cm	778.89	NA
3	Turbidity	IS 3025(Part 10)-1983(R.2006)	NTU	42.00	Max 1
4	Total Hardness as CaCo3	IS 3025(Part 21)-1983(R.2006)	mg/l	350.00	Max 200
5	Chloride as Cl <sup>-</sup>	IS 3025 (Part 32)-1988 (R.2009)	mg/l	146.14	Max 250
6	Sulphate as SO <sub>4</sub>	IS 3025 (Part 24)-1986 (R.2009)	mg/l	78.86	Max 200
7	Total Alkalinity as CaCo3	IS 3025(Part 23)-1986(R.2009)	mg/l	30.60	Max 200
8	Nitrates as No3	IS 3025 (part 34 ): 1988 (RA 2019)	mg/l	8.24	Max 45
9	Total Dissolved Solids	IS 3025 (Part 16)-1984 (R.2006)	mg/l	436.18	Max 500
10	Total Suspended solids	IS 3025 (P17) : 1984 (Reaff. 2017)	mg/l	35.00	Max 50
11	Chemical Oxygen Demand	IS 3025 (P 58) : 2006 (Reaff. 2017)	mg/l	28.10	Max 250
12	Oil and Grease	IS 3025 (P 39) : 1991 (Reaff.2019)	mg/l	BQL(LOQ:0.1)	Max 10
13	Flouride as F-	IS 3025 PART 35 : 1988 (RA 2003)	mg/l	BQL(LOQ:0.1)	Max 1.0
14	Sulphur	TNTH/SOP/WATER/025	mg/l	2.14	NA
15	Arsenic as As	IS 3025 (Part 37)-1988 (RA.2014)	mg/l	BQL(LOQ:0.005)	Max 0.01
16	Boron as B	APHA 23rd Edn.2017 4500 B B	mg/l	BQL(LOQ:0.1)	Max 0.5
17	Cadmium as Cd	IS 3025 (Part 41)-1992 (RA.2014)	mg/l	BQL(LOQ:0.001)	Max 0.003
18	Chromium as Cr	IS 3025 (Part 52)-2003 (RA.2014)	mg/l	BQL(LOQ:0.01)	Max 0.05
19	Iron as Fe	IS 3025(Part 53)-2003 (R.2009)	mg/l	0.24	Max 0.3
20	Lead as Pb	IS 3025 (Part 47)-1994 (RA.2014)	mg/l	BQL(LOQ:0.005)	Max 0.01
21	Manganese as Mn	IS 3025 (Part 59)-2006 (RA.2012)	mg/l	BQL(LOQ:0.005)	Max 0.1

BQL-Below Quantification Limit, LOQ- Limit of Quantification

For Tamilnadu Test House Private Limited

Verified By

Authorized Signatory

Page 2 of 3



# TAMILNADU TEST HOUSE PRIVATE LIMITED

251

[www.tamilnadutesthouse.com](http://www.tamilnadutesthouse.com)

## TEST REPORT

TEST REPORT NO: TNTH/M-0279/2023-24

DATE:05.05.2023

### SAMPLE SUBMITTED BY CUSTOMER

SAMPLE DESCRIPTION S5- Water

ANALYSIS STARTED ON 18.04.2023

ANALYSIS COMPLETED ON 05.05.2023

S. NO	PARAMETERS	METHOD	UNITS	RESULT	LIMITS as per 10500:2012
22	Mercury as Hg	IS 3025 (Part 48)-1994 (RA.2014)	mg/l	0.01	Max 0.001
23	Molybdenum	IS :1622:1981 RA 2014	mg/l	BQL(LOQ:0.005)	Max 0.07
24	Selenium as Se	IS 3025 (Part 56)-2003 (RA.2014)	mg/l	0.024	Max 0.01
25	Thalium	TNTH/SOP/WATER/078	mg/l	BQL(LOQ:0.005)	NA
26	Aluminium as Al	IS 3025 (Part 55)-2003 (RA.2014)	mg/l	BQL(LOQ:0.01)	Max 0.03
27	Nickel	IS 3025 (Part 54)-2003 (RA.2014)	mg/l	BQL(LOQ:0.01)	Max 0.02
28	Zinc as Zn	IS 3025 (Part 49)-1994 (RA.2014)	mg/l	BQL(LOQ:0.1)	Max 500
29	Lithium	TNTH/SOP/WATER/077	mg/l	0.12	NA
30	Calcium as Ca	IS 3025(Part 40)-1991 (R.2014)	mg/l	84.17	Max 75
31	Magnesium as Mg	IS 3025(Part 46)-1994(R.2014)	mg/l	34.08	Max 30
32	Potassium	IS 3025(Part-45)-1993(R.2019)	mg/l	4.20	NA
33	Phosphorous	IS 3025 (Part 31) : 1988	mg/l	BQL(LOQ:0.1)	NA
34	Antimony	TNTH/SOP/WATER/062	mg/l	BQL(LOQ:0.005)	NA
35	Barium	Annex F of IS 13428 - 2005 (RA-2014)	mg/l	0.11	Max 0.7
36	Cerium	TNTH/SOP/WATER/054	mg/l	BQL(LOQ:0.005)	NA
37	Cobalt	IS 3025(Part 45) : 1993	mg/l	BQL(LOQ:0.005)	NA
38	Copper	APHA 23rd Edn. 3111B	mg/l	BQL(LOQ:0.005)	Max 0.05
39	Silicon	APHA 23rd edn. 4500	mg/l	1.21	NA
40	Titanium	APHA23rd Edn. 3112D 2017	mg/l	BQL(LOQ:0.001)	NA
41	Vanadium	APHA 23rd Edn. 3111D 2017	mg/l	BQL(LOQ:0.005)	NA

BQL-Below Quantification Limit, LOQ- Limit of Quantification

\*\*\*END OF THE REPORT\*\*\*

For Tamilnadu Test House Private Limited

Verified By

Authorized Signatory



## TEST REPORT

TEST REPORT NO: TNTH/M-0280/2023-24

DATE:05.05.2023

### SAMPLE SUBMITTED BY CUSTOMER

SAMPLE SUBMITTED BY	M/s Asar Social Impact Advisors Private Limited,
ADDRESS	No:16, 7th Temple Street, 15th Cross Road, Malleshwaram, Bengaluru-560 003.
SAMPLE DESCRIPTION	S6- Water
LOCATION	Central Store
SAMPLE QUANTITY	5 Litre
PACKING	In Plastic Bottle
SAMPLE RECEIVED ON	17.04.2023
ANALYSIS STARTED ON	18.04.2023
ANALYSIS COMPLETED ON	05.05.2023

### Terms and Conditions

This report in full or in part shall not be published, advertised, used for any legal action, unless prior permission has been secured. This test report pertains only for the sample tested and such samples are retained for 7 days (in case of perishable) and 15 days for all other samples. In case of Complaint received from customers sample will be kept for 30 days. The samples from regulatory bodies are to be retained as specified. This document cannot be reproduced except in full, without prior written approval of the company.

For Tamilnadu Test House Private Limited

Managing Director

Page 1 of 3



# TAMILNADU TEST HOUSE PRIVATE LIMITED

253

[www.tamilnadutesthouse.com](http://www.tamilnadutesthouse.com)

## TEST REPORT

TEST REPORT NO: TNTH/M-0280/2023-24

DATE:05.05.2023

### SAMPLE SUBMITTED BY CUSTOMER

SAMPLE DESCRIPTION S6- Water  
ANALYSIS STARTED ON 18.04.2023  
ANALYSIS COMPLETED ON 05.05.2023

S. NO	PARAMETERS	METHOD	UNITS	RESULT	LIMITS as per 10500:2012
1	pH @ 25°C	IS 3025 (Part 11)-1983 (R.2006)	-	8.07	6.5 TO 8.5
2	Conductivity @ 25 deg C	IS 3025 (part 14): 2013 (RA 2019)	µs/cm	1950.10	NA
3	Turbidity	IS 3025(Part 10)-1983(R.2006)	NTU	165.00	Max 1
4	Total Hardness as CaCo3	IS 3025(Part 21)-1983(R.2006)	mg/l	490.00	Max 200
5	Chloride as Cl <sup>-</sup>	IS 3025 (Part 32)-1988 (R.2009)	mg/l	344.57	Max 250
6	Sulphate as SO <sub>4</sub>	IS 3025 (Part 24)-1986 (R.2009)	mg/l	159.98	Max 200
7	Total Alkalinity as CaCo3	IS 3025(Part 23)-1986(R.2009)	mg/l	153.00	Max 200
8	Nitrates as No3	IS 3025 (part 34 ): 1988 (RA 2019)	mg/l	12.60	Max 45
9	Total Dissolved Solids	IS 3025 (Part 16)-1984 (R.2006)	mg/l	1092.02	Max 500
10	Total Suspended solids	IS 3025 (P17) : 1984 (Reaff. 2017)	mg/l	165.00	Max 50
11	Chemical Oxygen Demand	IS 3025 (P 58) : 2006 (Reaff. 2017)	mg/l	36.24	Max 250
12	Oil and Grease	IS 3025 (P 39) : 1991 (Reaff.2019)	mg/l	BQL(LOQ:0.1)	Max 10
13	Flouride as F-	IS 3025 PART 35 : 1988 (RA 2003)	mg/l	BQL(LOQ:0.1)	Max 1.0
14	Sulphur	TNTH/SOP/WATER/025	mg/l	0.78	NA
15	Arsenic as As	IS 3025 (Part 37)-1988 (RA.2014)	mg/l	BQL(LOQ:0.005)	Max 0.01
16	Boron as B	APHA 23rd Edn.2017 4500 B B	mg/l	BQL(LOQ:0.1)	Max 0.5
17	Cadmium as Cd	IS 3025 (Part 41)-1992 (RA.2014)	mg/l	BQL(LOQ:0.001)	Max 0.003
18	Chromium as Cr	IS 3025 (Part 52)-2003 (RA.2014)	mg/l	BQL(LOQ:0.01)	Max 0.05
19	Iron as Fe	IS 3025(Part 53)-2003 (R.2009)	mg/l	0.21	Max 0.3
20	Lead as Pb	IS 3025 (Part 47)-1994 (RA.2014)	mg/l	BQL(LOQ:0.005)	Max 0.01
21	Manganese as Mn	IS 3025 (Part 59)-2006 (RA.2012)	mg/l	BQL(LOQ:0.005)	Max 0.1

BQL-Below Quantification Limit, LOQ- Limit of Quantification

For Tamilnadu Test House Private Limited

Verified By

Authorized Signatory

Page 2 of 3



# TAMILNADU TEST HOUSE PRIVATE LIMITED

254

[www.tamilnadutesthouse.com](http://www.tamilnadutesthouse.com)

## TEST REPORT

TEST REPORT NO: TNTH/M-0280/2023-24

DATE:05.05.2023

### SAMPLE SUBMITTED BY CUSTOMER

SAMPLE DESCRIPTION S6- Water

ANALYSIS STARTED ON 18.04.2023

ANALYSIS COMPLETED ON 05.05.2023

S. NO	PARAMETERS	METHOD	UNITS	RESULT	LIMITS as per 10500:2012
22	Mercury as Hg	IS 3025 (Part 48)-1994 (RA.2014)	mg/l	0.03	Max 0.001
23	Molybdenum	IS :1622:1981 RA 2014	mg/l	BQL(LOQ:0.005)	Max 0.07
24	Selenium as Se	IS 3025 (Part 56)-2003 (RA.2014)	mg/l	0.024	Max 0.01
25	Thalium	TNTH/SOP/WATER/078	mg/l	BQL(LOQ:0.005)	NA
26	Aluminium as Al	IS 3025 (Part 55)-2003 (RA.2014)	mg/l	BQL(LOQ:0.01)	Max 0.03
27	Nickel	IS 3025 (Part 54)-2003 (RA.2014)	mg/l	BQL(LOQ:0.01)	Max 0.02
28	Zinc as Zn	IS 3025 (Part 49)-1994 (RA.2014)	mg/l	BQL(LOQ:0.1)	Max 500
29	Lithium	TNTH/SOP/WATER/077	mg/l	0.11	NA
30	Calcium as Ca	IS 3025(Part 40)-1991 (R.2014)	mg/l	140.28	Max 75
31	Magnesium as Mg	IS 3025(Part 46)-1994(R.2014)	mg/l	34.03	Max 30
32	Potassium	IS 3025(Part-45)-1993(R.2019)	mg/l	36.40	NA
33	Phosphorous	IS 3025 (Part 31) : 1988	mg/l	BQL(LOQ:0.1)	NA
34	Antimony	TNTH/SOP/WATER/062	mg/l	BQL(LOQ:0.005)	NA
35	Barium	Annex F of IS 13428 - 2005 (RA-2014)	mg/l	0.08	Max 0.7
36	Cerium	TNTH/SOP/WATER/054	mg/l	BQL(LOQ:0.005)	NA
37	Cobalt	IS 3025(Part 45) : 1993	mg/l	BQL(LOQ:0.005)	NA
38	Copper	APHA 23rd Edn. 3111B	mg/l	BQL(LOQ:0.005)	Max 0.05
39	Silicon	APHA 23rd edn. 4500	mg/l	2.89	NA
40	Titanium	APHA23rd Edn. 3112D 2017	mg/l	BQL(LOQ:0.001)	NA
41	Vanadium	APHA 23rd Edn. 3111D 2017	mg/l	BQL(LOQ:0.005)	NA

BQL-Below Quantification Limit, LOQ- Limit of Quantification

\*\*\*END OF THE REPORT\*\*\*

For Tamilnadu Test House Private Limited

Verified By

Authorized Signatory



## TEST REPORT

TEST REPORT NO: TNTH/M-0281/2023-24

DATE:05.05.2023

### SAMPLE SUBMITTED BY CUSTOMER

SAMPLE SUBMITTED BY	<b>M/s Asar Social Impact Advisors Private Limited,</b>
ADDRESS	No:16, 7th Temple Street, 15th Cross Road, Malleshwaram, Bengaluru-560 003.
SAMPLE DESCRIPTION	S7- Water
LOCATION	TPS Outlet
SAMPLE QUANTITY	5 Litre
PACKING	In Plastic Bottle
SAMPLE RECEIVED ON	17.04.2023
ANALYSIS STARTED ON	18.04.2023
ANALYSIS COMPLETED ON	05.05.2023

### Terms and Conditions

This report in full or in part shall not be published, advertised, used for any legal action, unless prior permission has been secured. This test report pertains only for the sample tested and such samples are retained for 7 days (in case of perishable) and 15 days for all other samples. In case of Complaint received from customers sample will be kept for 30 days. The samples from regulatory bodies are to be retained as specified. This document cannot be reproduced except in full, without prior written approval of the company.

**For Tamilnadu Test House Private Limited**

**Managing Director**

Page 1 of 3



# TAMILNADU TEST HOUSE PRIVATE LIMITED

256

[www.tamilnadutesthouse.com](http://www.tamilnadutesthouse.com)

## TEST REPORT

TEST REPORT NO: TNTH/M-0281/2023-24

DATE:05.05.2023

### SAMPLE SUBMITTED BY CUSTOMER

SAMPLE DESCRIPTION S7- Water  
ANALYSIS STARTED ON 18.04.2023  
ANALYSIS COMPLETED ON 05.05.2023

S. NO	PARAMETERS	METHOD	UNITS	RESULT	LIMITS as per 10500:2012
1	pH @ 25°C	IS 3025 (Part 11)-1983 (R.2006)	-	6.89	6.5 TO 8.5
2	Conductivity @ 25 deg C	IS 3025 (part 14): 2013 (RA 2019)	µs/cm	615.89	NA
3	Turbidity	IS 3025(Part 10)-1983(R.2006)	NTU	175.00	Max 1
4	Total Hardness as CaCo3	IS 3025(Part 21)-1983(R.2006)	mg/l	390.00	Max 200
5	Chloride as Cl <sup>-</sup>	IS 3025 (Part 32)-1988 (R.2009)	mg/l	114.86	Max 250
6	Sulphate as SO <sub>4</sub>	IS 3025 (Part 24)-1986 (R.2009)	mg/l	95.60	Max 200
7	Total Alkalinity as CaCo3	IS 3025(Part 23)-1986(R.2009)	mg/l	102.00	Max 200
8	Nitrates as No3	IS 3025 (part 34 ): 1988 (RA 2019)	mg/l	6.82	Max 45
9	Total Dissolved Solids	IS 3025 (Part 16)-1984 (R.2006)	mg/l	344.89	Max 500
10	Total Suspended solids	IS 3025 (P17) : 1984 (Reaff. 2017)	mg/l	237.00	Max 50
11	Chemical Oxygen Demand	IS 3025 (P 58) : 2006 (Reaff. 2017)	mg/l	32.00	Max 250
12	Oil and Grease	IS 3025 (P 39) : 1991 (Reaff.2019)	mg/l	BQL(LOQ:0.1)	Max 10
13	Flouride as F-	IS 3025 PART 35 : 1988 (RA 2003)	mg/l	BQL(LOQ:0.1)	Max 1.0
14	Sulphur	TNTH/SOP/WATER/025	mg/l	1.25	NA
15	Arsenic as As	IS 3025 (Part 37)-1988 (RA.2014)	mg/l	BQL(LOQ:0.005)	Max 0.01
16	Boron as B	APHA 23rd Edn.2017 4500 B B	mg/l	BQL(LOQ:0.1)	Max 0.5
17	Cadmium as Cd	IS 3025 (Part 41)-1992 (RA.2014)	mg/l	BQL(LOQ:0.001)	Max 0.003
18	Chromium as Cr	IS 3025 (Part 52)-2003 (RA.2014)	mg/l	BQL(LOQ:0.01)	Max 0.05
19	Iron as Fe	IS 3025(Part 53)-2003 (R.2009)	mg/l	0.21	Max 0.3
20	Lead as Pb	IS 3025 (Part 47)-1994 (RA.2014)	mg/l	BQL(LOQ:0.005)	Max 0.01
21	Manganese as Mn	IS 3025 (Part 59)-2006 (RA.2012)	mg/l	BQL(LOQ:0.005)	Max 0.1

BQL-Below Quantification Limit, LOQ- Limit of Quantification

For Tamilnadu Test House Private Limited

Verified By

Authorized Signatory

Page 2 of 3



# TAMILNADU TEST HOUSE PRIVATE LIMITED

257

[www.tamilnadutesthouse.com](http://www.tamilnadutesthouse.com)

## TEST REPORT

TEST REPORT NO: TNTH/M-0281/2023-24

DATE:05.05.2023

### SAMPLE SUBMITTED BY CUSTOMER

SAMPLE DESCRIPTION S7- Water

ANALYSIS STARTED ON 18.04.2023

ANALYSIS COMPLETED ON 05.05.2023

S. NO	PARAMETERS	METHOD	UNITS	RESULT	LIMITS as per 10500:2012
22	Mercury as Hg	IS 3025 (Part 48)-1994 (RA.2014)	mg/l	BQL(LOQ:0.0005)	Max 0.001
23	Molybdenum	IS :1622:1981 RA 2014	mg/l	BQL(LOQ:0.005)	Max 0.07
24	Selenium as Se	IS 3025 (Part 56)-2003 (RA.2014)	mg/l	0.124	Max 0.01
25	Thalium	TNTH/SOP/WATER/078	mg/l	BQL(LOQ:0.005)	NA
26	Aluminium as Al	IS 3025 (Part 55)-2003 (RA.2014)	mg/l	BQL(LOQ:0.01)	Max 0.03
27	Nickel	IS 3025 (Part 54)-2003 (RA.2014)	mg/l	BQL(LOQ:0.01)	Max 0.02
28	Zinc as Zn	IS 3025 (Part 49)-1994 (RA.2014)	mg/l	BQL(LOQ:0.1)	Max 500
29	Lithium	TNTH/SOP/WATER/077	mg/l	0.05	NA
30	Calcium as Ca	IS 3025(Part 40)-1991 (R.2014)	mg/l	104.21	Max 75
31	Magnesium as Mg	IS 3025(Part 46)-1994(R.2014)	mg/l	31.60	Max 30
32	Potassium	IS 3025(Part-45)-1993(R.2019)	mg/l	12.60	NA
33	Phosphorous	IS 3025 (Part 31) : 1988	mg/l	BQL(LOQ:0.1)	NA
34	Antimony	TNTH/SOP/WATER/062	mg/l	BQL(LOQ:0.005)	NA
35	Barium	Annex F of IS 13428 - 2005 (RA-2014)	mg/l	0.25	Max 0.7
36	Cerium	TNTH/SOP/WATER/054	mg/l	BQL(LOQ:0.005)	NA
37	Cobalt	IS 3025(Part 45) : 1993	mg/l	BQL(LOQ:0.005)	NA
38	Copper	APHA 23rd Edn. 3111B	mg/l	BQL(LOQ:0.005)	Max 0.05
39	Silicon	APHA 23rd edn. 4500	mg/l	2.22	NA
40	Titanium	APHA23rd Edn. 3112D 2017	mg/l	BQL(LOQ:0.001)	NA
41	Vanadium	APHA 23rd Edn. 3111D 2017	mg/l	BQL(LOQ:0.005)	NA

BQL-Below Quantification Limit, LOQ- Limit of Quantification

\*\*\*END OF THE REPORT\*\*\*

For Tamilnadu Test House Private Limited

Verified By

Authorized Signatory



## TEST REPORT

TEST REPORT NO: TNTH/M-0282/2023-24

DATE:05.05.2023

### SAMPLE SUBMITTED BY CUSTOMER

SAMPLE SUBMITTED BY	<b>M/s Asar Social Impact Advisors Private Limited,</b>
ADDRESS	No:16, 7th Temple Street, 15th Cross Road, Malleshwaram, Bengaluru-560 003.
SAMPLE DESCRIPTION	S8- Water
LOCATION	Tholacappier Nagar Vadakkuvellur
SAMPLE QUANTITY	5 Litre
PACKING	In Plastic Bottle
SAMPLE RECEIVED ON	17.04.2023
ANALYSIS STARTED ON	18.04.2023
ANALYSIS COMPLETED ON	05.05.2023

### Terms and Conditions

This report in full or in part shall not be published, advertised, used for any legal action, unless prior permission has been secured. This test report pertains only for the sample tested and such samples are retained for 7 days (in case of perishable) and 15 days for all other samples. In case of Complaint received from customers sample will be kept for 30 days. The samples from regulatory bodies are to be retained as specified. This document cannot be reproduced except in full, without prior written approval of the company.

**For Tamilnadu Test House Private Limited**

**Managing Director**

Page 1 of 3



# TAMILNADU TEST HOUSE PRIVATE LIMITED

259

[www.tamilnadutesthouse.com](http://www.tamilnadutesthouse.com)

## TEST REPORT

TEST REPORT NO: TNTH/M-0282/2023-24

DATE:05.05.2023

### SAMPLE SUBMITTED BY CUSTOMER

SAMPLE DESCRIPTION S8- Water  
ANALYSIS STARTED ON 18.04.2023  
ANALYSIS COMPLETED ON 05.05.2023

S. NO	PARAMETERS	METHOD	UNITS	RESULT	LIMITS as per 10500:2012
1	pH @ 25°C	IS 3025 (Part 11)-1983 (R.2006)	-	7.69	6.5 TO 8.5
2	Conductivity @ 25 deg C	IS 3025 (part 14): 2013 (RA 2019)	µs/cm	423.63	NA
3	Turbidity	IS 3025(Part 10)-1983(R.2006)	NTU	7.00	Max 1
4	Total Hardness as CaCo3	IS 3025(Part 21)-1983(R.2006)	mg/l	100.00	Max 200
5	Chloride as Cl <sup>-</sup>	IS 3025 (Part 32)-1988 (R.2009)	mg/l	47.86	Max 250
6	Sulphate as SO <sub>4</sub>	IS 3025 (Part 24)-1986 (R.2009)	mg/l	38.64	Max 200
7	Total Alkalinity as CaCo3	IS 3025(Part 23)-1986(R.2009)	mg/l	102.00	Max 200
8	Nitrates as No3	IS 3025 (part 34 ): 1988 (RA 2019)	mg/l	9.83	Max 45
9	Total Dissolved Solids	IS 3025 (Part 16)-1984 (R.2006)	mg/l	237.23	Max 500
10	Total Suspended solids	IS 3025 (P17) : 1984 (Reaff. 2017)	mg/l	9.00	Max 50
11	Chemical Oxygen Demand	IS 3025 (P 58) : 2006 (Reaff. 2017)	mg/l	31.08	Max 250
12	Oil and Grease	IS 3025 (P 39) : 1991 (Reaff.2019)	mg/l	BQL(LOQ:0.1)	Max 10
13	Flouride as F-	IS 3025 PART 35 : 1988 (RA 2003)	mg/l	BQL(LOQ:0.1)	Max 1.0
14	Sulphur	TNTH/SOP/WATER/025	mg/l	0.87	NA
15	Arsenic as As	IS 3025 (Part 37)-1988 (RA.2014)	mg/l	BQL(LOQ:0.005)	Max 0.01
16	Boron as B	APHA 23rd Edn.2017 4500 B B	mg/l	BQL(LOQ:0.1)	Max 0.5
17	Cadmium as Cd	IS 3025 (Part 41)-1992 (RA.2014)	mg/l	BQL(LOQ:0.001)	Max 0.003
18	Chromium as Cr	IS 3025 (Part 52)-2003 (RA.2014)	mg/l	BQL(LOQ:0.01)	Max 0.05
19	Iron as Fe	IS 3025(Part 53)-2003 (R.2009)	mg/l	0.19	Max 0.3
20	Lead as Pb	IS 3025 (Part 47)-1994 (RA.2014)	mg/l	BQL(LOQ:0.005)	Max 0.01
21	Manganese as Mn	IS 3025 (Part 59)-2006 (RA.2012)	mg/l	BQL(LOQ:0.005)	Max 0.1

BQL-Below Quantification Limit, LOQ- Limit of Quantification

For Tamilnadu Test House Private Limited

Verified By

Authorized Signatory

Page 2 of 3



# TAMILNADU TEST HOUSE PRIVATE LIMITED

260

[www.tamilnadutesthouse.com](http://www.tamilnadutesthouse.com)

## TEST REPORT

TEST REPORT NO: TNTH/M-0282/2023-24

DATE:05.05.2023

### SAMPLE SUBMITTED BY CUSTOMER

SAMPLE DESCRIPTION S8- Water

ANALYSIS STARTED ON 18.04.2023

ANALYSIS COMPLETED ON 05.05.2023

S. NO	PARAMETERS	METHOD	UNITS	RESULT	LIMITS as per 10500:2012
22	Mercury as Hg	IS 3025 (Part 48)-1994 (RA.2014)	mg/l	0.25	Max 0.001
23	Molybdenum	IS :1622:1981 RA 2014	mg/l	BQL(LOQ:0.005)	Max 0.07
24	Selenium as Se	IS 3025 (Part 56)-2003 (RA.2014)	mg/l	0.014	Max 0.01
25	Thalium	TNTH/SOP/WATER/078	mg/l	BQL(LOQ:0.005)	NA
26	Aluminium as Al	IS 3025 (Part 55)-2003 (RA.2014)	mg/l	BQL(LOQ:0.01)	Max 0.03
27	Nickel	IS 3025 (Part 54)-2003 (RA.2014)	mg/l	BQL(LOQ:0.01)	Max 0.02
28	Zinc as Zn	IS 3025 (Part 49)-1994 (RA.2014)	mg/l	BQL(LOQ:0.1)	Max 500
29	Lithium	TNTH/SOP/WATER/077	mg/l	0.02	NA
30	Calcium as Ca	IS 3025(Part 40)-1991 (R.2014)	mg/l	24.05	Max 75
31	Magnesium as Mg	IS 3025(Part 46)-1994(R.2014)	mg/l	9.72	Max 30
32	Potassium	IS 3025(Part-45)-1993(R.2019)	mg/l	14.80	NA
33	Phosphorous	IS 3025 (Part 31) : 1988	mg/l	BQL(LOQ:0.1)	NA
34	Antimony	TNTH/SOP/WATER/062	mg/l	BQL(LOQ:0.005)	NA
35	Barium	Annex F of IS 13428 - 2005 (RA-2014)	mg/l	0.15	Max 0.7
36	Cerium	TNTH/SOP/WATER/054	mg/l	BQL(LOQ:0.005)	NA
37	Cobalt	IS 3025(Part 45) : 1993	mg/l	BQL(LOQ:0.005)	NA
38	Copper	APHA 23rd Edn. 3111B	mg/l	BQL(LOQ:0.005)	Max 0.05
39	Silicon	APHA 23rd edn. 4500	mg/l	1.14	NA
40	Titanium	APHA23rd Edn. 3112D 2017	mg/l	BQL(LOQ:0.001)	NA
41	Vanadium	APHA 23rd Edn. 3111D 2017	mg/l	BQL(LOQ:0.005)	NA

BQL-Below Quantification Limit, LOQ- Limit of Quantification

\*\*\*END OF THE REPORT\*\*\*

For Tamilnadu Test House Private Limited

Verified By

Authorized Signatory



## TEST REPORT

TEST REPORT NO: TNTH/M-0283/2023-24

DATE:05.05.2023

### SAMPLE SUBMITTED BY CUSTOMER

SAMPLE SUBMITTED BY	M/s Asar Social Impact Advisors Private Limited,
ADDRESS	No:16, 7th Temple Street, 15th Cross Road, Malleshwaram, Bengaluru-560 003.
SAMPLE DESCRIPTION	S9- Water
LOCATION	Muppaneri
SAMPLE QUANTITY	5 Litre
PACKING	In Plastic Bottle
SAMPLE RECEIVED ON	17.04.2023
ANALYSIS STARTED ON	18.04.2023
ANALYSIS COMPLETED ON	05.05.2023

### Terms and Conditions

This report in full or in part shall not be published, advertised, used for any legal action, unless prior permission has been secured. This test report pertains only for the sample tested and such samples are retained for 7 days (in case of perishable) and 15 days for all other samples. In case of Complaint received from customers sample will be kept for 30 days. The samples from regulatory bodies are to be retained as specified. This document cannot be reproduced except in full, without prior written approval of the company.

For Tamilnadu Test House Private Limited

Managing Director

Page 1 of 3



# TAMILNADU TEST HOUSE PRIVATE LIMITED

262

[www.tamilnadutesthouse.com](http://www.tamilnadutesthouse.com)

## TEST REPORT

TEST REPORT NO: TNTH/M-0283/2023-24

DATE:05.05.2023

### SAMPLE SUBMITTED BY CUSTOMER

SAMPLE DESCRIPTION S9- Water  
ANALYSIS STARTED ON 18.04.2023  
ANALYSIS COMPLETED ON 05.05.2023

S. NO	PARAMETERS	METHOD	UNITS	RESULT	LIMITS as per 10500:2012
1	pH @ 25°C	IS 3025 (Part 11)-1983 (R.2006)	-	7.80	6.5 TO 8.5
2	Conductivity @ 25 deg C	IS 3025 (part 14): 2013 (RA 2019)	µs/cm	680.30	NA
3	Turbidity	IS 3025(Part 10)-1983(R.2006)	NTU	193.00	Max 1
4	Total Hardness as CaCo3	IS 3025(Part 21)-1983(R.2006)	mg/l	220.00	Max 200
5	Chloride as Cl <sup>-</sup>	IS 3025 (Part 32)-1988 (R.2009)	mg/l	81.36	Max 250
6	Sulphate as SO <sub>4</sub>	IS 3025 (Part 24)-1986 (R.2009)	mg/l	29.64	Max 200
7	Total Alkalinity as CaCo3	IS 3025(Part 23)-1986(R.2009)	mg/l	81.60	Max 200
8	Nitrates as No3	IS 3025 (part 34 ): 1988 (RA 2019)	mg/l	10.18	Max 45
9	Total Dissolved Solids	IS 3025 (Part 16)-1984 (R.2006)	mg/l	387.00	Max 500
10	Total Suspended solids	IS 3025 (P17) : 1984 (Reaff. 2017)	mg/l	88.00	Max 50
11	Chemical Oxygen Demand	IS 3025 (P 58) : 2006 (Reaff. 2017)	mg/l	34.21	Max 250
12	Oil and Grease	IS 3025 (P 39) : 1991 (Reaff.2019)	mg/l	BQL(LOQ:0.1)	Max 10
13	Flouride as F-	IS 3025 PART 35 : 1988 (RA 2003)	mg/l	BQL(LOQ:0.1)	Max 1.0
14	Sulphur	TNTH/SOP/WATER/025	mg/l	0.23	NA
15	Arsenic as As	IS 3025 (Part 37)-1988 (RA.2014)	mg/l	BQL(LOQ:0.005)	Max 0.01
16	Boron as B	APHA 23rd Edn.2017 4500 B B	mg/l	BQL(LOQ:0.1)	Max 0.5
17	Cadmium as Cd	IS 3025 (Part 41)-1992 (RA.2014)	mg/l	BQL(LOQ:0.001)	Max 0.003
18	Chromium as Cr	IS 3025 (Part 52)-2003 (RA.2014)	mg/l	BQL(LOQ:0.01)	Max 0.05
19	Iron as Fe	IS 3025(Part 53)-2003 (R.2009)	mg/l	0.24	Max 0.3
20	Lead as Pb	IS 3025 (Part 47)-1994 (RA.2014)	mg/l	BQL(LOQ:0.005)	Max 0.01
21	Manganese as Mn	IS 3025 (Part 59)-2006 (RA.2012)	mg/l	BQL(LOQ:0.005)	Max 0.1

BQL-Below Quantification Limit, LOQ- Limit of Quantification

For Tamilnadu Test House Private Limited

Verified By

Authorized Signatory

Page 2 of 3



# TAMILNADU TEST HOUSE PRIVATE LIMITED

263

[www.tamilnadutesthouse.com](http://www.tamilnadutesthouse.com)

## TEST REPORT

TEST REPORT NO: TNTH/M-0283/2023-24

DATE:05.05.2023

### SAMPLE SUBMITTED BY CUSTOMER

SAMPLE DESCRIPTION S9- Water

ANALYSIS STARTED ON 18.04.2023

ANALYSIS COMPLETED ON 05.05.2023

S. NO	PARAMETERS	METHOD	UNITS	RESULT	LIMITS as per 10500:2012
22	Mercury as Hg	IS 3025 (Part 48)-1994 (RA.2014)	mg/l	BQL(LOQ:0.0005)	Max 0.001
23	Molybdenum	IS :1622:1981 RA 2014	mg/l	BQL(LOQ:0.005)	Max 0.07
24	Selenium as Se	IS 3025 (Part 56)-2003 (RA.2014)	mg/l	0.047	Max 0.01
25	Thalium	TNTH/SOP/WATER/078	mg/l	BQL(LOQ:0.005)	NA
26	Aluminium as Al	IS 3025 (Part 55)-2003 (RA.2014)	mg/l	BQL(LOQ:0.01)	Max 0.03
27	Nickel	IS 3025 (Part 54)-2003 (RA.2014)	mg/l	BQL(LOQ:0.01)	Max 0.02
28	Zinc as Zn	IS 3025 (Part 49)-1994 (RA.2014)	mg/l	BQL(LOQ:0.1)	Max 500
29	Lithium	TNTH/SOP/WATER/077	mg/l	0.12	NA
30	Calcium as Ca	IS 3025(Part 40)-1991 (R.2014)	mg/l	68.06	Max 75
31	Magnesium as Mg	IS 3025(Part 46)-1994(R.2014)	mg/l	12.16	Max 30
32	Potassium	IS 3025(Part-45)-1993(R.2019)	mg/l	24.60	NA
33	Phosphorous	IS 3025 (Part 31) : 1988	mg/l	1.26	NA
34	Antimony	TNTH/SOP/WATER/062	mg/l	BQL(LOQ:0.005)	NA
35	Barium	Annex F of IS 13428 - 2005 (RA-2014)	mg/l	0.24	Max 0.7
36	Cerium	TNTH/SOP/WATER/054	mg/l	BQL(LOQ:0.005)	NA
37	Cobalt	IS 3025(Part 45) : 1993	mg/l	BQL(LOQ:0.005)	NA
38	Copper	APHA 23rd Edn. 3111B	mg/l	BQL(LOQ:0.005)	Max 0.05
39	Silicon	APHA 23rd edn. 4500	mg/l	1.10	NA
40	Titanium	APHA23rd Edn. 3112D 2017	mg/l	BQL(LOQ:0.001)	NA
41	Vanadium	APHA 23rd Edn. 3111D 2017	mg/l	BQL(LOQ:0.005)	NA

BQL-Below Quantification Limit, LOQ- Limit of Quantification

\*\*\*END OF THE REPORT\*\*\*

For Tamilnadu Test House Private Limited

Verified By

Authorized Signatory



## TEST REPORT

TEST REPORT NO: TNTH/M-0284/2023-24

DATE:05.05.2023

### SAMPLE SUBMITTED BY CUSTOMER

SAMPLE SUBMITTED BY	<b>M/s Asar Social Impact Advisors Private Limited,</b>
ADDRESS	No:16, 7th Temple Street, 15th Cross Road, Malleshwaram, Bengaluru-560 003.
SAMPLE DESCRIPTION	S10- Water
LOCATION	TPS 2 Outlet
SAMPLE QUANTITY	5 Litre
PACKING	In Plastic Bottle
SAMPLE RECEIVED ON	17.04.2023
ANALYSIS STARTED ON	18.04.2023
ANALYSIS COMPLETED ON	05.05.2023

### Terms and Conditions

This report in full or in part shall not be published, advertised, used for any legal action, unless prior permission has been secured. This test report pertains only for the sample tested and such samples are retained for 7 days (in case of perishable) and 15 days for all other samples. In case of Complaint received from customers sample will be kept for 30 days. The samples from regulatory bodies are to be retained as specified. This document cannot be reproduced except in full, without prior written approval of the company.

**For Tamilnadu Test House Private Limited**

**Managing Director**

Page 1 of 3



# TAMILNADU TEST HOUSE PRIVATE LIMITED

265

[www.tamilnadutesthouse.com](http://www.tamilnadutesthouse.com)

## TEST REPORT

TEST REPORT NO: TNTH/M-0284/2023-24

DATE:05.05.2023

### SAMPLE SUBMITTED BY CUSTOMER

SAMPLE DESCRIPTION S10- Water  
ANALYSIS STARTED ON 18.04.2023  
ANALYSIS COMPLETED ON 05.05.2023

S. NO	PARAMETERS	METHOD	UNITS	RESULT	LIMITS as per 10500:2012
1	pH @ 25°C	IS 3025 (Part 11)-1983 (R.2006)	-	7.60	6.5 TO 8.5
2	Conductivity @ 25 deg C	IS 3025 (part 14): 2013 (RA 2019)	µs/cm	1678.57	NA
3	Turbidity	IS 3025(Part 10)-1983(R.2006)	NTU	47.30	Max 1
4	Total Hardness as CaCo3	IS 3025(Part 21)-1983(R.2006)	mg/l	480.00	Max 200
5	Chloride as Cl <sup>-</sup>	IS 3025 (Part 32)-1988 (R.2009)	mg/l	229.72	Max 250
6	Sulphate as SO <sub>4</sub>	IS 3025 (Part 24)-1986 (R.2009)	mg/l	214.60	Max 200
7	Total Alkalinity as CaCo3	IS 3025(Part 23)-1986(R.2009)	mg/l	142.80	Max 200
8	Nitrates as No3	IS 3025 (part 34 ): 1988 (RA 2019)	mg/l	14.36	Max 45
9	Total Dissolved Solids	IS 3025 (Part 16)-1984 (R.2006)	mg/l	940.00	Max 500
10	Total Suspended solids	IS 3025 (P17) : 1984 (Reaff. 2017)	mg/l	448.00	Max 50
11	Chemical Oxygen Demand	IS 3025 (P 58) : 2006 (Reaff. 2017)	mg/l	36.08	Max 250
12	Oil and Grease	IS 3025 (P 39) : 1991 (Reaff.2019)	mg/l	BQL(LOQ:0.1)	Max 10
13	Flouride as F-	IS 3025 PART 35 : 1988 (RA 2003)	mg/l	BQL(LOQ:0.1)	Max 1.0
14	Sulphur	TNTH/SOP/WATER/025	mg/l	0.78	NA
15	Arsenic as As	IS 3025 (Part 37)-1988 (RA.2014)	mg/l	BQL(LOQ:0.005)	Max 0.01
16	Boron as B	APHA 23rd Edn.2017 4500 B B	mg/l	BQL(LOQ:0.1)	Max 0.5
17	Cadmium as Cd	IS 3025 (Part 41)-1992 (RA.2014)	mg/l	BQL(LOQ:0.001)	Max 0.003
18	Chromium as Cr	IS 3025 (Part 52)-2003 (RA.2014)	mg/l	BQL(LOQ:0.01)	Max 0.05
19	Iron as Fe	IS 3025(Part 53)-2003 (R.2009)	mg/l	0.27	Max 0.3
20	Lead as Pb	IS 3025 (Part 47)-1994 (RA.2014)	mg/l	BQL(LOQ:0.005)	Max 0.01
21	Manganese as Mn	IS 3025 (Part 59)-2006 (RA.2012)	mg/l	BQL(LOQ:0.005)	Max 0.1

BQL-Below Quantification Limit, LOQ- Limit of Quantification

For Tamilnadu Test House Private Limited

Verified By

Authorized Signatory

Page 2 of 3



# TAMILNADU TEST HOUSE PRIVATE LIMITED

266

[www.tamilnadutesthouse.com](http://www.tamilnadutesthouse.com)

## TEST REPORT

TEST REPORT NO: TNTH/M-0284/2023-24

DATE:05.05.2023

### SAMPLE SUBMITTED BY CUSTOMER

SAMPLE DESCRIPTION S10- Water  
ANALYSIS STARTED ON 18.04.2023  
ANALYSIS COMPLETED ON 05.05.2023

S. NO	PARAMETERS	METHOD	UNITS	RESULT	LIMITS as per 10500:2012
22	Mercury as Hg	IS 3025 (Part 48)-1994 (RA.2014)	mg/l	0.14	Max 0.001
23	Molybdenum	IS :1622:1981 RA 2014	mg/l	BQL(LOQ:0.005)	Max 0.07
24	Selenium as Se	IS 3025 (Part 56)-2003 (RA.2014)	mg/l	0.021	Max 0.01
25	Thalium	TNTH/SOP/WATER/078	mg/l	BQL(LOQ:0.005)	NA
26	Aluminium as Al	IS 3025 (Part 55)-2003 (RA.2014)	mg/l	BQL(LOQ:0.01)	Max 0.03
27	Nickel	IS 3025 (Part 54)-2003 (RA.2014)	mg/l	BQL(LOQ:0.01)	Max 0.02
28	Zinc as Zn	IS 3025 (Part 49)-1994 (RA.2014)	mg/l	BQL(LOQ:0.1)	Max 500
29	Lithium	TNTH/SOP/WATER/077	mg/l	0.11	NA
30	Calcium as Ca	IS 3025(Part 40)-1991 (R.2014)	mg/l	124.25	Max 75
31	Magnesium as Mg	IS 3025(Part 46)-1994(R.2014)	mg/l	41.32	Max 30
32	Potassium	IS 3025(Part-45)-1993(R.2019)	mg/l	16.00	NA
33	Phosphorous	IS 3025 (Part 31) : 1988	mg/l	BQL(LOQ:0.1)	NA
34	Antimony	TNTH/SOP/WATER/062	mg/l	BQL(LOQ:0.005)	NA
35	Barium	Annex F of IS 13428 - 2005 (RA-2014)	mg/l	0.21	Max 0.7
36	Cerium	TNTH/SOP/WATER/054	mg/l	BQL(LOQ:0.005)	NA
37	Cobalt	IS 3025(Part 45) : 1993	mg/l	BQL(LOQ:0.005)	NA
38	Copper	APHA 23rd Edn. 3111B	mg/l	BQL(LOQ:0.005)	Max 0.05
39	Silicon	APHA 23rd edn. 4500	mg/l	2.28	NA
40	Titanium	APHA23rd Edn. 3112D 2017	mg/l	BQL(LOQ:0.001)	NA
41	Vanadium	APHA 23rd Edn. 3111D 2017	mg/l	BQL(LOQ:0.005)	NA

BQL-Below Quantification Limit, LOQ- Limit of Quantification

\*\*\*END OF THE REPORT\*\*\*

For Tamilnadu Test House Private Limited

Verified By

Authorized Signatory



## TEST REPORT

TEST REPORT NO: TNTH/M-0285/2023-24

DATE:24.04.2023

### SAMPLE SUBMITTED BY CUSTOMER

SAMPLE SUBMITTED BY **M/s Asar Social Impact Advisors Private Limited,**  
ADDRESS No:16, 7th Temple Street, 15th Cross Road,  
Malleswaram, Bengaluru-560 003.  
SAMPLE DESCRIPTION S11- Soil  
LOCATION Vadakkuvellur bypass Soil  
SAMPLE QUANTITY 1 kg  
PACKING In Plastic Bottle  
SAMPLE RECEIVED ON 17.04.2023  
ANALYSIS STARTED ON 18.04.2023  
ANALYSIS COMPLETED ON 24.04.2023

### Terms and Conditions

This report in full or in part shall not be published, advertised, used for any legal action, unless prior permission has been secured. This test report pertains only for the sample tested and such samples are retained for 7 days (in case of perishable) and 15 days for all other samples. In case of Complaint received from customers sample will be kept for 30 days. The samples from regulatory bodies are to be retained as specified. This document cannot be reproduced except in full, without prior written approval of the company.

**For Tamilnadu Test House Private Limited**

**Managing Director**

Page 1 of 3



# TAMILNADU TEST HOUSE PRIVATE LIMITED

268

[www.tamilnadutesthouse.com](http://www.tamilnadutesthouse.com)

## TEST REPORT

TEST REPORT NO: TNTH/M-0285/2023-24

DATE:24.04.2023

### SAMPLE SUBMITTED BY CUSTOMER

SAMPLE DESCRIPTION S11- Soil  
ANALYSIS STARTED ON 18.04.2023  
ANALYSIS COMPLETED ON 24.04.2023

S. NO	PARAMETERS	METHOD	UNITS	RESULT
1	pH	FAO 19th Edn.ch3 P36	-	8.71
2	Conductivity	FAO 19th Edn.ch3 P36	µs/cm	223.7
3	Nitrogen as N	FAO 19th Edn. Ch3 P42-44	%	0.40
4	Availabe Phosphorous as P	FAO 19th Edn. Ch3 P50-53	%	1.78
5	Potassium as K	TNTH /SOIL/SOP/022	%	1.36
6	Total Organic Carbon	FAO 19th Edn. Ch3 P38-42	%	5.05
7	Sulphur	TNTH /SOIL/SOP/022	Mg/kg	256.00
8	Zinc as Zn		Mg/kg	31.39
9	Iron as Fe		Mg/kg	1349.63
10	Copper as Cu		Mg/kg	8.32
11	Manganese as Mn		Mg/kg	77.40
12	Boron as B		Mg/kg	0.56
<b>Heavy Metals:</b>				
13	Arsenic	TNTH /SOIL/SOP/022	Mg/kg	BQL(LOQ:0.005)
14	Cadmium		Mg/kg	BQL(LOQ:0.1)
15	Chromium		Mg/kg	BQL(LOQ:0.01)
16	Lead		Mg/kg	BQL(LOQ:0.1)
17	Mercury		Mg/kg	0.12

BQL-Below Quantification Limit, LOQ- Limit of Quantification

For Tamilnadu Test House Private Limited

Verified By

Authorized Signatory

Page 2 of 3



# TAMILNADU TEST HOUSE PRIVATE LIMITED

269

[www.tamilnadutesthouse.com](http://www.tamilnadutesthouse.com)

## TEST REPORT

TEST REPORT NO: TNTH/M-0285/2023-24

DATE:24.04.2023

### SAMPLE SUBMITTED BY CUSTOMER

SAMPLE DESCRIPTION S11- Soil  
ANALYSIS STARTED ON 18.04.2023  
ANALYSIS COMPLETED ON 24.04.2023

S. NO	PARAMETERS	METHOD	UNITS	RESULT
18	Molybdenum	TNTH/SOP/SOIL/022	Mg/kg	0.12
19	Selenium		Mg/kg	23.56
20	Thalium		Mg/kg	BQL(LOQ:0.005)
21	Alumium		Mg/kg	42.23
22	Nickel		Mg/kg	5.88
23	Lithium		Mg/kg	35.87
24	Calcium		Mg/kg	50.49
25	Magnesium		Mg/kg	12.25
26	Antimony		Mg/kg	0.56
27	Barium		Mg/kg	0.12
28	Cerium		Mg/kg	BQL(LOQ:0.005)
29	Cobalt		Mg/kg	0.56
30	Silicon		Mg/kg	91.12
31	Titanium		Mg/kg	BQL(LOQ:0.001)
32	Uranium		Mg/kg	BQL(LOQ:0.001)
33	Vanadium	Mg/kg	BQL(LOQ:0.005)	

BQL-Below Quantification Limit, LOQ- Limit of Quantification

\*\*\* END OF THE REPORT\*\*\*

For Tamilnadu Test House Private Limited

Verified By

Authorized Signatory

Page 3 of 3

# VADAKUVELLUR, THOLKAPIYAR NAGAR SAMPLE LOCATIONS



TNPCB actual location

**LAT- 11.54790001**  
**LONG- 79.464575**

650 mts

S2- TNPCB

**LAT- 11.546868**  
**LONG- 79.469001**

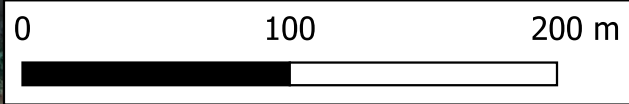
140 mts

2 loc distance

70 mts

S1 - Powering pollution

**LAT- 11.546125**  
**LONG- 79.470123**



**LEGEND**

- Mine boundary
- Distance from mines
- Sample locations

