

BEFORE THE HON'BLE NATIONAL GREEN TRIBUNAL

PRINCIPAL BENCH, NEWDELHI

IN

ORIGINAL APPLICATION NO. 502 of 2022

Petitioner : Padmakumar

Versus

Respondent(s) : The State of Kerala

REPORT OF THE JOINT COMMITTEE FILED BEFORE THE
HON'BLE NATIONAL GREEN TRIBUNAL, PRINCIPAL BENCH,
NEW DELHI IN THE MATTER OF O.A. NO. 502/2022.

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Dated this the 31st day of January 2023




SREEKALA S.
 Chief Environmental Engineer

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**REPORT OF THE JOINT COMMITTEE FILED BEFORE THE
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NEW DELHI IN THE MATTER OF O.A. NO. 502/2022.**

1. Background

The Hon'ble National Green Tribunal (NGT) Principal Bench, New Delhi has registered O.A No. 502 of 2022 based on a letter petition received from Sri. Padmakumar regarding pollution caused by M/s. Kerala Minerals and Metals Limited (hereafter referred as M/s. KMML) situated in Chavara, Kollam District, Kerala. The Hon'ble NGT vide order dated 29/08/2022 had constituted a Joint Committee comprising of;

1. Principal Secretary, Industries & NORKA
2. Central Pollution Control Board

3. State Pollution Control Board
4. State Wetland Authority
5. District Collector, Kollam

The State Pollution Control Board is the nodal agency for co-ordination and compliance. Mrs. Sreekala S., The Chief Environmental Engineer, KSPCB, Regional Office, Thiruvananthapuram has been nominated as a member of the above Committee and to represent Kerala State Pollution Control Board vide proceedings No. PCB/HO/SEE-1/NGT/O.A.NO.502/2022 dated 15/09/2022.

The Hon'ble NGT has directed the committee to meet within two weeks, undertake visits to the site, look into the grievances of the applicant, associate the applicant and representative of the concerned project proponent, verify the factual position and submit its report within one month.

Kerala State Pollution Control Board being Nodal Agency for ensuring compliance to the Hon'ble NGT order dated 29.08.2022, filed an interim status report before Hon'ble NGT vide email dated 29.11.2022 seeking additional time for filing report of the Joint Committee. Hon'ble NGT further passed order on 13.12.2022 in the said matter and relevant portion of the Hon'ble NGT directions is reproduced below:-

5. *The Joint Committee is directed to submit its further report by 31.01.2023 by email at judicial-ngt@gov.in preferably in the form of searchable PDF/OCR Supported PDF and not in the form of Image PDF.*
11. *List for further consideration on 06.03.2023.*

Copies of the Hon'ble NGT orders dated 29.08.2022 and 13.12.2022 are enclosed as **Annexure-1 and Annexure - 2.**

2. About the M/s. KMML Industry, Process, Effluent Treatment and Waste Management - Overview

M/s. KMML is a fully integrated rutile grade titanium dioxide plant under Government of Kerala and its TiO_2 pigment unit was commissioned in 1984 at Sankaramangalam, Chavara, Kollam, Kerala with a titanium dioxide manufacturing capacity of 1459.125 TPA. Presently, the industry is involved in manufacture of titanium dioxide at 100 TPD (average). Satellite imagery of M/s KMML including the waste disposal area is depicted in **Figure.1** below.

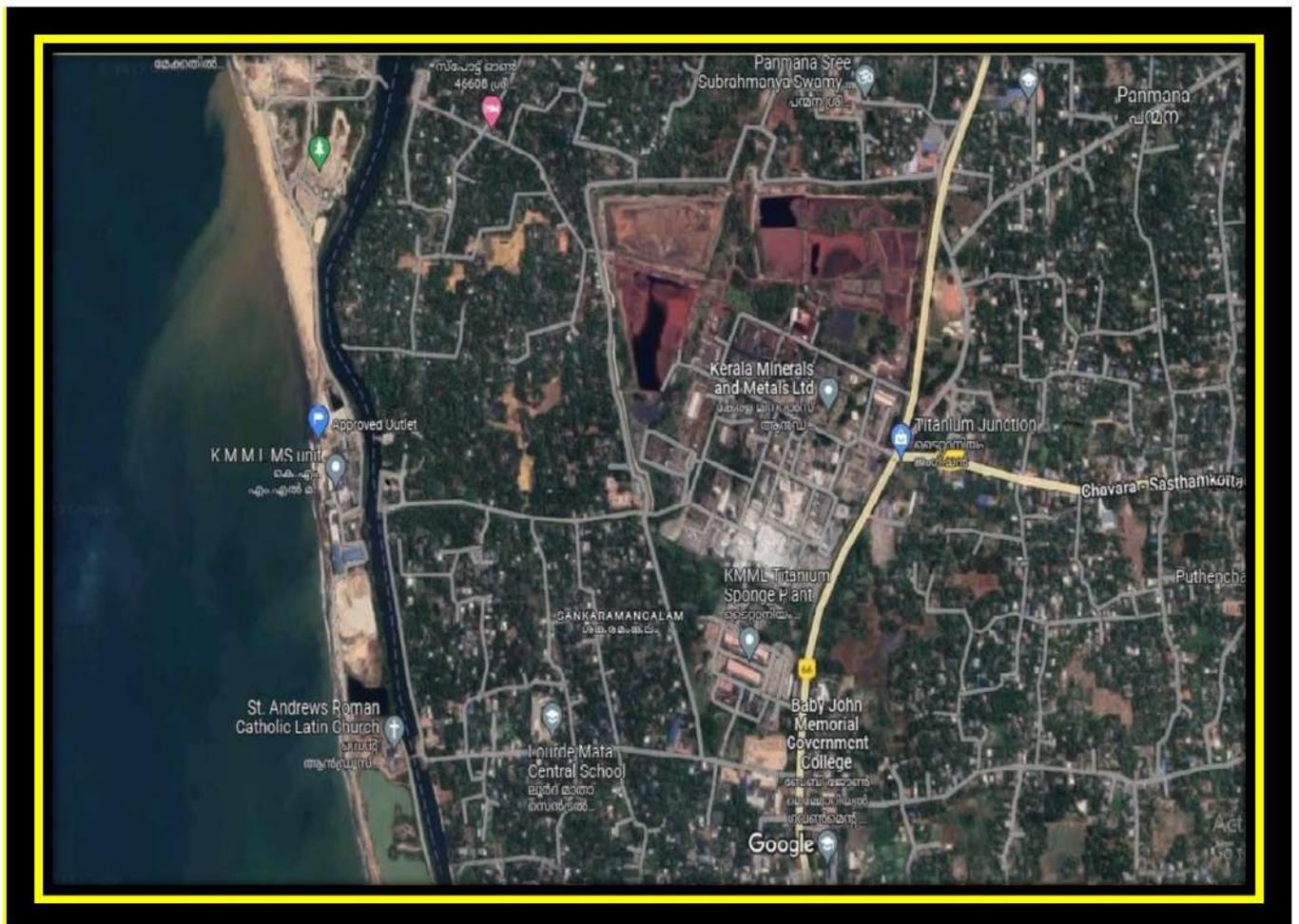


Figure 1. Satellite Imagery of M/s KMML including the Waste Disposal Area

2.1. Titanium Dioxide Manufacturing Process

M/s. KMML produces titanium dioxide from ilmenite mineral ore through the chloride process. The units in the titanium pigment factory include Ilmenite Beneficiation Plant, Chlorination Plant, Oxidation Plant and Pigment Finishing Unit. In the ilmenite beneficiation plant the raw Ilmenite containing 58 -60% of Titanium Dioxide is beneficiated to 90% Titanium Dioxide content. The major operations in Ilmenite Beneficiation Plant include Roasting/ Reduction, Digestion/ Leaching and Calcination. In the acid regeneration plant the spent leach liquor from digester is processed in a spray roaster in which the liquid spray entering the furnace is atomized at high temperature (650 to 850⁰C) in presence of air. The spent liquor then decomposes to solid metallic oxides and Hydrochloric Acid. The acid is absorbed in water and pumped back for digestion. The metallic oxides, mainly iron oxide, are slurried and stored in secured ponds. In the chlorination plant Beneficiated Ilmenite from Ilmenite Beneficiation Plant is chlorinated to produce Titanium Tetra Chloride. In the oxidation plant the Titanium Tetra Chloride is vaporized, preheated and oxidized with oxygen to produce raw Titanium Dioxide pigment at high temperature (1050⁰C). The by-product chlorine is recycled to the chlorination plant. Raw titanium dioxide is slurried and pumped to the pigment finishing unit. In the pigment finishing unit the treated slurry is then washed and filtered. The filter cake is then subjected to drying to drive off the moisture followed by micronization. The micronized final pigment is then bagged using an automatic bagging machine. At present, for production of TiO₂ pigment, raw materials consumption i.e., ilmenite mineral ore (1.65 MT of raw ilmenite/ MT of Beneficiated Ilmenite (BI) -120 TPD of BI), Chlorine (0.115 MT of makeup chlorine/MT of TiCl₄ – 270 TPD of TiCl₄), Hydrochloric acid (0.85 MT of makeup acid/ MT of Beneficiated ilmenite- 120 TPD of BI). Water

consumption (6912 m³/day). TiO₂ pigment Manufacturing process details is given in **Figure.2**.

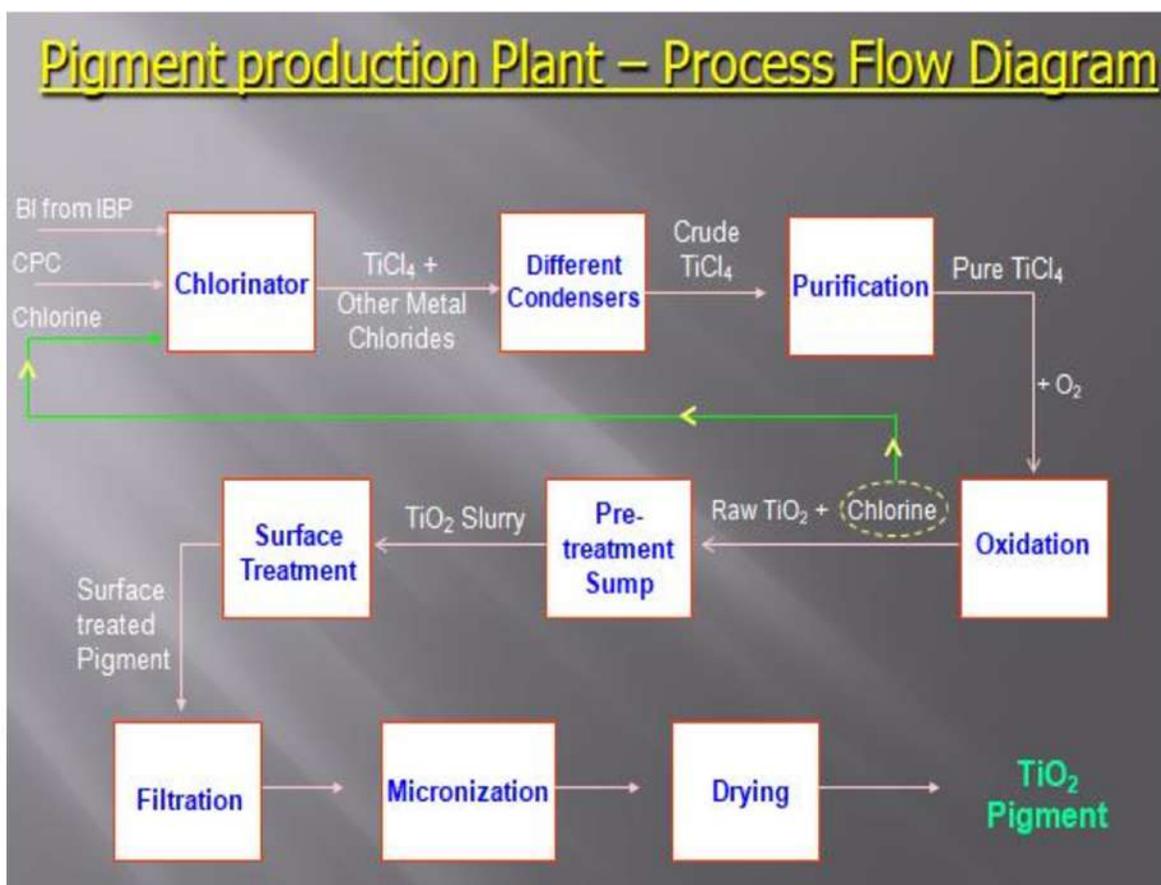


Figure.2. TiO₂ pigment Manufacturing Process

2.2. Status of Integrated Consent to Operate issued to M/s. KMML under The Environment (Protection) Act, 1986

The unit is having an integrated consent to operate including authorisation renewed on 13/09/2021 with validity up to 31/07/2025 for TiO₂ production of 120 tonnes/day (TPD). As per integrated Consent issued to M/s.KMML, the industrial unit is categorised as Red Category, total water consumption is 11,728 m³/day from 14 tube wells located within the industry premises and the maximum quantity

of treated effluent discharged into the sea shall not exceed 4800m³/day. Also, as per the consent condition, the unit shall install pH online measurement facility at the outlet, water meters shall be fixed to record consumption of water. Also, the process sludge i.e., iron oxide sludge (21.1 Category) quantity 50 TPD shall be stored in secured lined ponds and thereafter dewatered and disposed in Common Treatment Storage and Disposal Facility (CTSDF) at Kochi. CAAQMS (Continuous Ambient Air Quality Monitoring Station) and OCEEMS (Online Continuous Effluent and Emission Monitoring System) shall be installed and record maintained. The discharge norms of treated effluent prescribed under the Integrated Consent to Operate issued to M/s. KMML is given in the **Table 1** below.

Table 1. Tolerance Limit of Treated Effluent Prescribed to M/s.KMML

Sl. No.	Characteristics	Unit	Tolerance Limit
1	pH	mg/l (Max)	5.50 to 9.0
2	Suspended Solids	mg/l (Max)	100
3	Oil & Grease	mg/l (Max)	20
4	Total Residual Chlorine (as Cl)	mg/l (Max)	1.0
5	Total Chromium(as Cr)	mg/l (Max)	2.0
6	Zinc (as Zn)	mg/l (Max)	15.0
7	Titanium (as Ti)	mg/l (Max)	5.0
8	Lead (as Pb)	mg/l (Max)	2.0
9	Vanadium (as V)	mg/l (Max)	0.2
10	Manganese (as Mn)	mg/l (Max)	2.0
11	Iron (as Fe)	mg/l (Max)	3.0
12	Total Heavy Metals	mg/l (Max)	7.0

2.3. Water Consumption and Wastewater Effluent Treatment

As per the information provided by M/s KMML, there are 14 ground water tube wells within the industry premises of M/s. KMML. Presently, the water consumption is reported to be about 6912 m³/day. Waste water generation is 3642 m³/day (Maximum) and a maximum of 1200 m³/day of treated effluent from the existing ETP is discharged through the approved outlet into the sea from the ETP settling pond. The details of water consumption and material balance are submitted as **Annexure 3 & Annexure 4** respectively. The flow diagram of ETP operated by M/s. KMML is shown in **Figure. 3**.

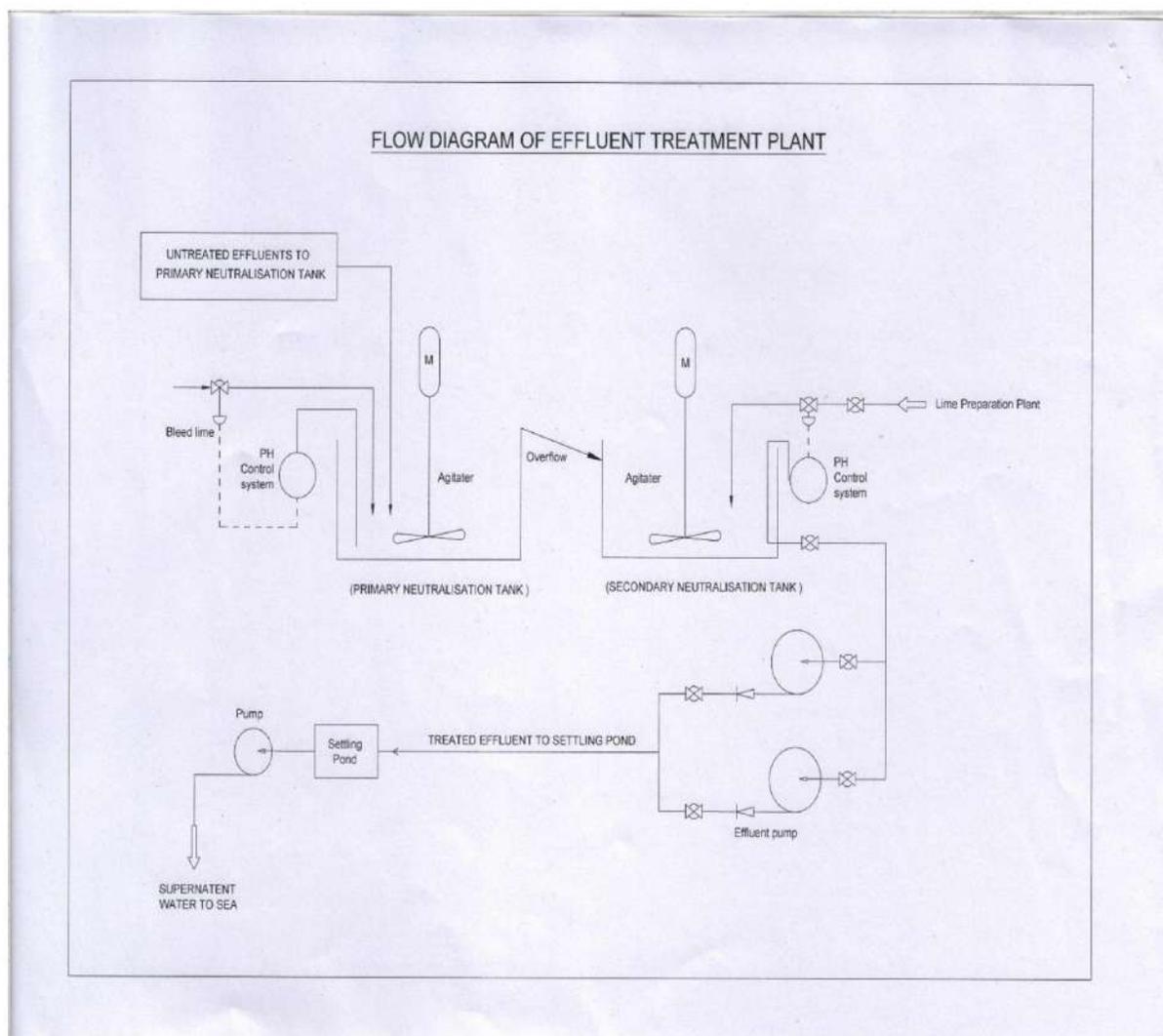


Figure 3. Flow Diagram of Effluent Treatment Plant operated by M/s.KMML

As per the information provided by M/s.KMML, at present the wastewater effluent is generated at about 3642 m³/day, as a part of the TiO₂ manufacturing process. Effluent from all the process units (i.e., mainly ilmenite beneficiation plant, acid regeneration plant, and pigment production plant) are pumped to the primary neutralization tank (PNT) and neutralized with the lime scrubber provided. pH is monitored in the PNT and is maintained around 4-5 by the addition of lime solution and the retention time is about 60 minutes. The liquid in the primary

neutralization tank overflows into the secondary neutralization tank. In addition to the overflow from the primary neutralization tank, the effluents from various units of the pigment production plant (pH less than 4.5) are fed into the secondary neutralization tank. Overflow from primary neutralization tank, bleed lime from scrubber, effluent from area sump, effluent from solid waste tank and lime from lime preparation plant are the effluents neutralized in secondary neutralization tank. The retention time of the contents in the tank is around 25 minutes to 35 minutes and pH is maintained at 7-8. Neutralized Effluent is pumped to holding ponds. The treated effluent in the pond is periodically pumped to sea. It was reported by the industry that the quantity of lime added is about 40-50 MT/day. *However, pH meter and neither OCEEMS including flow meter not installed to the outlet before discharging of treated effluent in to the sea, for real time assessment of compliance to effluent discharge norms and total effluent discharged in to sea.*

2.4. ETP Waste and Iron Oxide Waste Management Scenario

M/s. KMML used to generate iron oxide sludge from acid regeneration plant at about 1451 TPA in the year 1985 and ETP sludge from the Effluent Treatment Plant, at around 729 TPA in the year 1984 and the generated wastes were stored within the industry premises in two number of old iron oxide ponds (claimed to have single LDPE liner with brick lining beneath) as well as two old ETP sludge ponds, which have already been filled and are not capped (as per CPCB guidelines issued in February 2001). As per M/s.KMML total quantum of iron oxide sludge stored in two old ponds was about 2,00,000 MT generated during the period 1985-2008 and ETP sludge from the Effluent Treatment Plant stored about 2,00,000 Metric Tonnes generated during the period 1984-2008, within the industry premises. As per information provided by M/s. KMML, the dimensions of the old ponds are given in the **Table 2** below

Table 2: Dimensions of Old Ponds within M/s. KMML Premises

Sl.No	Pond	Dimensions in metres	Area	Waste Stored Depth in metres
1	Iron oxide pond I	80x168	13440 sq.m.	4.5
2	Iron oxide pond II	71x174	12354 sq.m.	4.5
3	ETP settling pond I	69x267	18423 sq.m.	4.5
4	ETP settling pond II	77x246	18942 sq. m.	4.5

At present, as informed by M/s.KMML, TiO₂ pigment production is about 100 TPD and in the process, the iron oxide sludge from acid regeneration plant is generated (around 75 Tonnes per day (TPD) and ETP sludge from the Effluent Treatment Plant (around 50 TPD). Both iron oxide and ETP sludge are presently stored separately in two ponds constructed above the ground level with a liner system, in the year 2008. Capacity of the iron oxide pond constructed above the ground level is 1,35,200 m³ and whereas the ETP pond capacity is 2,76,560 m³ and at present, the capacity of the iron oxide and ETP sludge ponds are almost exhausted.

As per the records of District Office , Kollam, during the late 80's and early 90's due to failure of the liner of the iron oxide pond of the industry, acid from sludge pond had leaked into soil causing pollution of the soil and groundwater of the nearby area. Following this, a number of cases were filed against the industry before the Hon'ble Court of Kerala and the Hon'ble NGT. These underground ponds were abandoned in 2008 and a new pond (pond 3) was constructed. The details of the new ponds constructed in the year 2008 shown in **Table 3** below.

Table 3: Details of New Iron Oxide Sludge Pond and ETP Pond Constructed in the year 2008

Details	Iron Oxide Pond	ETP Pond
Area	33800 m ²	34570 m ²
Depth	4 m	8 m
Solid storage capacity	101400 m ³	241990 m ³
Total capacity of pond	135200 m ³	276560 m ³

M/s. KMML vide letter dated 08/01/2018 had requested Chairman, Kerala SPCB to temporarily transfer and store the iron oxide sludge from new pond (after neutralization maintaining a pH around 5) to the old ponds providing proper lining (with HDPE) and other precautionary measures and the Kerala SPCB had granted in principle clearance for the removal and transfer of iron oxide from pond no. 3 to pond no. 1 in strict compliance with directions issued in May 2018. Meanwhile, the company had obtained Integrated Consent to Establish (ICE) on 3/10/2018 for construction of a new iron oxide pond, but the work is not yet started. The company again requested for the temporary transfer of iron oxide from pond 3 to pond1 and pond 2. As per the meeting held on 06/11/2019, it was decided that the request cannot be permitted as pH of the slurry in the old pond was around 2 as per the report from Environmental Engineer, District Office, Kollam. During March 2020, the industry again requested to issue sanction for iron oxide sludge to M/s Miracle Sand and Chemicals, Tuticorin for processing the same in their facility at Tuticorin, Tamil Nadu. But the Board denied their request on 26/06/2020 as the

iron oxide sludge is not exempted from Hazardous waste category. Later as per the request from KMML, the Board had issued In- Principle Clearance vide letter dated 05/04/2021, for the removal and transfer of iron oxide from new pond to old pond, existing within the company premises, in strict compliance with the following directions.

- 1 The storage capacity and safety aspects of old pond shall be assessed and quantity beyond the capacity shall not be transferred.
- 2 The pH of transferring material from new pond shall be checked and neutralized at each time of transfer.
- 3 While transferring, the structural stability of the tanks shall not be affected.
- 4 The material shall be transported in leak proof vehicle and shall not spill over the plant premises.
- 5 The safety aspect shall be ensured at each stage by the Concerned Safety Department.

Since the third pond is reported to be almost completely filled and in the light of the upcoming monsoon season, the Board restricted the permission, for transfer of iron oxide sludge, to the monsoon season as per the decision in the meeting held on 16/05/2022. After receiving repeated complaints from nearby residence of Panmana, Chittoor and nearby areas of M/s. KMML, the Board had inspected the unit and not permitted the transfer of iron oxide sludge from new pond to old pond. It was reported by industry that 22500 MT of iron oxide is transferred from new pond to old ponds till now. The Board Vide letter dated 23/08/2022, issued directions to transfer the iron oxide slurry to M/s. Kerala Enviro Infrastructure Limited (M/s.KEIL) for scientific disposal in accordance with the Hazardous and Other Waste (Management & Transboundary Movement) Rules 2016 as well as

guidelines issued by CPCB. But the industry has reported that they have not initiated disposal of iron oxide to common TSDF as this activity was kept in abeyance from 08/08/2014 as directed by the Kerala State Government and presently awaiting reply from Principal Secretary regarding the review of transportation and disposal of iron oxide from M/s. KMML to Common Hazardous Waste Treatment and Disposal Facility (CHWTSDF) of M/s. KEIL located at Ambalamugal.

It was reported that about 1,70,454 MT of ETP sludge generated from April 2011 to March 2022. M/s. KMML had obtained permission from Kerala SPCB vide letter No. PCB/HO/KLM/ICO/08/08 dated 26/06/2020 for transfer 50,000 MT of ETP sludge to M/s. Miracle Sands & Chemicals, Tuticorin for processing and utilization. 10000 MT was already transferred during the month of June 2020, but they could not transfer the entire quantity due to Covid pandemic situation. Permission was granted by the Hon'ble Chairman vide letter No. PCB/HO/KLM/MIRACLE SANDS & CHEMICALS/2020 dated 22/08/2022 to M/s. Miracle Sands & Chemicals, Tuticorin for collection and transportation of the remaining 40000 MT of ETP sludge from M/s. KMML before 31/03/2023 without causing any environmental pollution and by taking necessary precautionary measures following the guidelines as applicable.

3. Initiatives of Kerala State Pollution Control Board including Joint Committee Meetings and the Field Visit

In compliance with the Hon'ble NGT order dated 29.08.2022 passed in O.A. No. 502/2022, Kerala State Pollution Control Board organised **first meeting** of the joint committee on **11/10/2022** through Video Conference in the chamber of Chief Environmental Engineer, KSPCB, Regional Office, Thiruvananthapuram.

As per the decisions taken in the first meeting, **joint committee visit to M/s KMML** industry and its premises was organised on **17/10/2022** to hear the complainant and the industry representatives. *During the visit , the joint committee also gave an opportunity to Sri. Padmakumar, the applicant in O.A. No. 502/2022 and heard the grievances of the applicant and the nearby residents. The Joint Committee also visited the affected areas such as Panmana, Chittoor, near the storm water discharge point of M/s. KMML, a nearby canal leading to Ashtamudi Estuary and Porookkara and the Vattakkayal and nearby affected residential areas in the presence of the applicant (Sri. Padmakumar).* During the visit of Joint Committee to the surrounding affected residential areas, the officials of Kerala State Pollution Control Board also collected 18 number of water samples which include surface water/stagnant water/ground water and the sampling locations are shown in **Figure 4**.

Location details of the water samples collected during the visit of Joint Committee is given in the **Table 4** below.

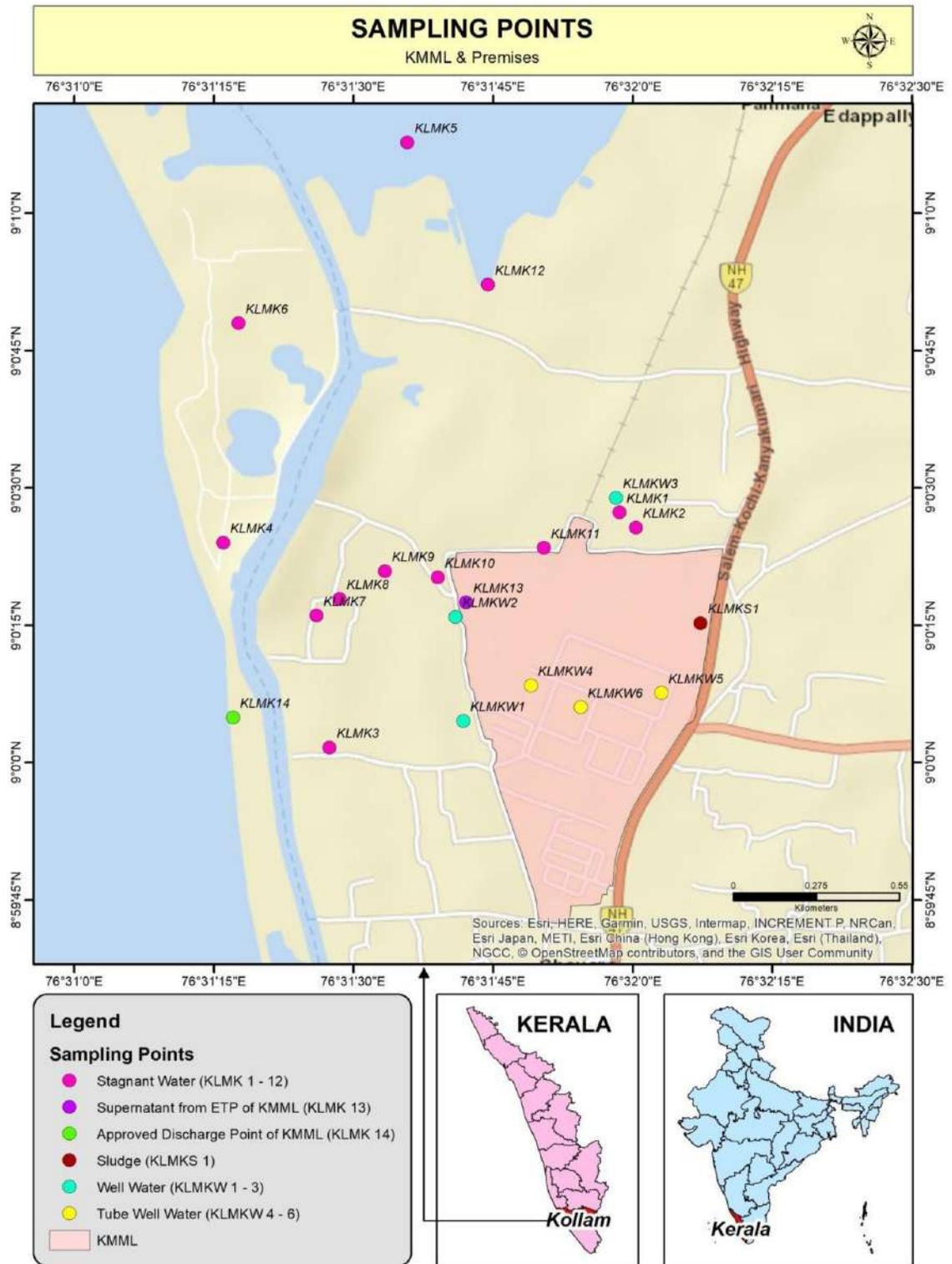


Figure 4. Water Sampling Locations dated 17.10.2022

Table 4. Location Details of the water samples collected during the visit of Joint Committee on 17/10/2022.

SAMPLE NUMBER	LOCATION POINT	LATITUDE	LONGITUDE
KLMK1	Stagnant water at north side of KMML ,backside of Hind Erectors Engineering Workshop(near home) in Panmana ward	9.007583	76.532935
KLMK2	Stagnant water at north side of KMML (backside Hind Erectors Engineering Workshop) in Panmana ward	9.007121	76.533434
KLMK3	Canal near MS Plant (drainage joining point) in Mekkad ward	9.000452	76.524285
KLMK4	T S Canal (while boating)	9.00666667	76.5211111
KLMK5	Stagnant water in Chittoor ward	9.018808333	76.5266111
KLMK6	Stagnant water near the house of Mr. Benedict,Mary Mandiram ,Chittoor,Panmana	9.013319	76.521565
KLMK7	Stagnant water near the house of Mr.Anandan, Vaishnokripa,Chittoor,Panmana	9.004451	76.5238962
KLMK8	Drainage water in frontof the house of Mr. Ajikumar,Aji Nivas,Chittoor,Panmana	9.004957	76.52458
KLMK9	Front side of Karungayil temple,Chittor,Panmana.	9.0058	76.525936
KLMK10	Right side of Gurumandiram, Chittoor, Panmana	9.005607	76.527518
KLMK11	North side outside KMML(storm water drain pipe from KMML compound	9.006509	76.530682
KLMK12	Point near Vattakayal	9.014487	76.52901
KLMK13	Supernatent from ETP of KMML	9.00485	76.52836
KLMK14	Approved discharge point of KMML (sea discharge)	9.001358	76.521407
KLMKS1	Sludge from KMML near ETP pond	9.004221	76.535363
KLMKW1	Well water from SasidharanPillai,Thengumpally, Chittoor,Chavara.	9.00125	76.52828

SAMPLE NUMBER	LOCATION POINT	LATITUDE	LONGITUDE
KLMKW2	Well water from Babu,BabuSadhanam,Chittoor ,Chavara	9.004408	76.528048
KLMKW3	Well water from Mohanan Pillai,Edapallil,Panmana,Chavara	9.008018	76.532833
KLMKW4	KMML Tube Well no-2	9.002332	76.530296
KLMKW5	KMML Tube Well no-4	9.002102	76.534188
KLMKW6	KMML Tube Well no-8	9.001671	76.531779

The stagnant water samples were collected from North side of M/s KMML in Panmana, Chittoor, near the house of Mr. Benedict and Mr. Anandan in Chittoor, front side of Karungayil temple and right side of Gurumandiram, Chittoor. The samples were collected from Canal near MS plant in Mekkad ward, T S canal (while boating), drainage in front of the house of Mr. Ajikumar, North side of M/s. KMML (storm water drain pipe from M/s.KMML compound), point near Vattakkayal. The committee also inspected the industrial unit and the samples from the ETP pond (supernatant), Iron Oxide Sludge pond and approved effluent discharge outlet point of M/s. KMML were also collected. Photographs taken during the site visit and sampling in the vicinity of human habitation around M/s. KMML on 17.10.2022 are depicted in **Figure 5 to Figure 9** below.



Figure 5. Meeting with the Officials of M/s. KMML held on 17.10.2022



Figure 6. Interaction with local public on 17.10.2022 by the Joint Committee



Figure 7. Sampling of stagnant water and well water near M/s KMML on 17.10.2022



Figure 8. Sampling Location near Vattakkayal



Figure 9. Sample collected at the effluent discharge outlet of M/s. KMML in to sea on 17.10.2022

The water and sludge samples collected were forwarded to Central Laboratory, KSPCB, Ernakulum and the digested samples were sent to Regional Lab of Regional Directorate, CPCB, Bengaluru for further analysis of general parameters

and heavy metals respectively. The analysis results of the samples collected during the Joint Committee visit on 17.10.2022 are given in **Table 5, 6, 7 &8** in subsequent paras.

Table 5. The Analysis Results of the stagnant water samples collected on 17/10/2022.

SL No	Sample code	Sample Location	Parameter	Observed Value	Limits as per MoEF guidelines**
1	KLMK 1	Stagnant water at north side of KMML ,backside of Hind Erectors Engineering Workshop (near home) in Panmana ward	pH	2.30	5.5 - 9.0
			Total Suspended solids	708.00	Nil
			Oil & Grease	BDL	Nil
			Total Residual Chlorine	BDL	Nil
			Copper	BDL	3 mg/L
			Cadmium	BDL	2 mg/L
			Total Chromium	BDL	2 mg/L
			Iron	1424.00	3 mg/L
			Manganese	30.90	2 mg/L
			Nickel	BDL	3 mg/L
			Lead	BDL	0.1mg/L
			Zinc	7.00	5 mg/L
			Arsenic	BDL	0.2 mg/L
			Vanadium	0.57	0.2 mg/L
Titanium	BDL	Nil			
2	KLMK 2	Stagnant water at north side of KMML (backside Hind Erectors Engineering Workshop) in Panmana ward	pH	2.10	5.5 - 9.0
			Total Suspended solids	520.00	Nil
			Oil & Grease	BDL	Nil
			Total Residual Chlorine	BDL	Nil
			Copper	BDL	3 mg/L
			Cadmium	BDL	2 mg/L
			Total Chromium	BDL	2 mg/L

SL No	Sample code	Sample Location	Parameter	Observed Value	Limits as per MoEF guidelines**
			Iron	3528.00	3 mg/L
			Manganese	102.00	2 mg/L
			Nickel	BDL	3 mg/L
			Lead	BDL	0.1mg/L
			Zinc	BDL	5 mg/L
			Arsenic	BDL	0.2 mg/L
			Vanadium	0.89	0.2 mg/L
			Titanium	BDL	Nil
3	KLMK 3	Canal near MS Plant (drainage joining point) in Mekkad ward	pH	2.40	5.5 - 9.0
			Total Suspended solids	187.00	Nil
			Oil & Grease	BDL	Nil
			Total Residual Chlorine	BDL	Nil
			Copper	BDL	3 mg/L
			Cadmium	BDL	2 mg/L
			Total Chromium	BDL	2 mg/L
			Iron	294.00	3 mg/L
			Manganese	14.70	2 mg/L
			Nickel	BDL	3 mg/L
			Lead	BDL	0.1mg/L
			Zinc	BDL	5 mg/L
			Arsenic	BDL	0.2 mg/L
			Vanadium	0.17	0.2 mg/L
Titanium	BDL	Nil			
4	KLMK 4	T S Canal (while boating)	pH	2.90	5.5 - 9.0
			Total Suspended solids	193.00	Nil
			Oil & Grease	BDL	Nil
			Total Residual Chlorine	BDL	Nil
			Copper	BDL	3 mg/L
			Cadmium	BDL	2 mg/L

SL No	Sample code	Sample Location	Parameter	Observed Value	Limits as per MoEF guidelines**
			Total Chromium	BDL	2 mg/L
			Iron	78.23	3 mg/L
			Manganese	3.02	2 mg/L
			Nickel	BDL	3 mg/L
			Lead	BDL	0.1mg/L
			Zinc	0.34	5 mg/L
			Arsenic	BDL	0.2 mg/L
			Vanadium	0.41	0.2 mg/L
			Titanium	BDL	Nil
5	KLMK 5	Stagnant water in Chittor ward	pH	2.40	5.5 - 9.0
			Total Suspended Solids	174.00	Nil
			Oil & Grease	BDL	Nil
			Total Residual Chlorine	BDL	Nil
			Copper	BDL	3 mg/L
			Cadmium	BDL	2 mg/L
			Total Chromium	BDL	2 mg/L
			Iron	286.00	3 mg/L
			Manganese	14.60	2 mg/L
			Nickel	BDL	3 mg/L
			Lead	BDL	0.1mg/L
			Zinc	1.19	5 mg/L
			Arsenic	BDL	0.2 mg/L
Vanadium	0.17	0.2 mg/L			
Titanium	BDL	Nil			
6	KLMK 6	Stagnant water near the house of Mr. Benedict, Mary Mandiram, Chittor, Panmana	pH	2.40	5.5 - 9.0
			Total Suspended Solids	351.00	Nil
			Oil & Grease	BDL	Nil
			Total Residual Chlorine	BDL	Nil
			Copper	BDL	3 mg/L

SL No	Sample code	Sample Location	Parameter	Observed Value	Limits as per MoEF guidelines**
			Cadmium	BDL	2 mg/L
			Total Chromium	BDL	2 mg/L
			Iron	279.00	3 mg/L
			Manganese	12.50	2 mg/L
			Nickel	BDL	3 mg/L
			Lead	BDL	0.1mg/L
			Zinc	2.59	5 mg/L
			Arsenic	BDL	0.2 mg/L
			Vanadium	0.14	0.2 mg/L
			Titanium	BDL	Nil
7	KLMK 7	Stagnant water near the house of Mr.Anandan, Vaishnokripa, Chittor,Panmana	pH	2.50	5.5 - 9.0
			Total Suspended Solids	310.00	Nil
			Oil & Grease	BDL	Nil
			Total Residual Chlorine	BDL	Nil
			Copper	BDL	3 mg/L
			Cadmium	BDL	2 mg/L
			Total Chromium	BDL	2 mg/L
			Iron	200.00	3 mg/L
			Manganese	9.70	2 mg/L
			Nickel	BDL	3 mg/L
			Lead	BDL	0.1mg/L
			Zinc	1.39	5 mg/L
			Arsenic	BDL	0.2 mg/L
			Vanadium	0.17	0.2 mg/L
Titanium	BDL	Nil			
8	KLMK 8	Drainage water in front of the house of Mr. Ajikumar, Aji Nivas,Chittor, Panmana	pH	2.30	5.5 - 9.0
			Total Suspended Solids	2033.00	Nil
			Oil & Grease	BDL	Nil
			Total Residual Chlorine	BDL	Nil
			Copper	BDL	3 mg/L

SL No	Sample code	Sample Location	Parameter	Observed Value	Limits as per MoEF guidelines**
			Cadmium	BDL	2 mg/L
			Total Chromium	BDL	2 mg/L
			Iron	416.00	3 mg/L
			Manganese	15.20	2 mg/L
			Nickel	BDL	3 mg/L
			Lead	BDL	0.1mg/L
			Zinc	BDL	5 mg/L
			Arsenic	BDL	0.2 mg/L
			Vanadium	0.24	0.2 mg/L
			Titanium	BDL	Nil
9	KLMK 9	Stagnant water in front side of Karungayil temple,Chittoor, Panmana.	pH	2.50	5.5 - 9.0
			Total Suspended Solids	407.00	Nil
			Oil & Grease	BDL	Nil
			Total Residual Chlorine	BDL	Nil
			Copper	BDL	3 mg/L
			Cadmium	BDL	2 mg/L
			Total Chromium	BDL	2 mg/L
			Iron	182.00	3 mg/L
			Manganese	6.34	2 mg/L
			Nickel	BDL	3 mg/L
			Lead	BDL	0.1mg/L
			Zinc	0.31	5 mg/L
			Arsenic	BDL	0.2 mg/L
Vanadium	0.12	0.2 mg/L			
Titanium	BDL	Nil			
10	KLMK 10	Stagnant water in right side of Gurumandiram, Chittoor, Panmana	pH	3.10	5.5 - 9.0
			Total Suspended Solids	316.00	Nil
			Oil & Grease	BDL	Nil
			Total Residual Chlorine	BDL	Nil

SL No	Sample code	Sample Location	Parameter	Observed Value	Limits as per MoEF guidelines**
			Copper	BDL	3 mg/L
			Cadmium	BDL	2 mg/L
			Total Chromium	BDL	2 mg/L
			Iron	624.00	3 mg/L
			Manganese	19.20	2 mg/L
			Nickel	BDL	3 mg/L
			Lead	BDL	0.1mg/L
			Zinc	2.60	5 mg/L
			Arsenic	BDL	0.2 mg/L
			Vanadium	0.56	0.2 mg/L
			Titanium	BDL	Nil
11	KLMK 11	North side outside KMML(storm water drain pipe from KMML compound	pH	2.50	5.5 - 9.0
			Total Suspended Solids	115.00	Nil
			Oil & Grease	BDL	Nil
			Total Residual Chlorine	BDL	Nil
			Copper	BDL	3 mg/L
			Cadmium	BDL	2 mg/L
			Total Chromium	BDL	2 mg/L
			Iron	378.00	3 mg/L
			Manganese	15.80	2 mg/L
			Nickel	BDL	3 mg/L
			Lead	BDL	0.1mg/L
			Zinc	2.90	5 mg/L
			Arsenic	BDL	0.2 mg/L
			Vanadium	0.47	0.2 mg/L
Titanium	BDL	Nil			
12	KLMK 12	Point near Vattakayal	pH	3.00	5.5 - 9.0
			Total Suspended Solids	194.00	Nil
			Oil & Grease	BDL	Nil
			Total Residual	BDL	Nil

SL No	Sample code	Sample Location	Parameter	Observed Value	Limits as per MoEF guidelines**
			Chlorine		
			Copper	BDL	3 mg/L
			Cadmium	BDL	2 mg/L
			Total Chromium	BDL	2 mg/L
			Iron	132.00	3 mg/L
			Manganese	5.00	2 mg/L
			Nickel	BDL	3 mg/L
			Lead	BDL	0.1mg/L
			Zinc	120.00	5 mg/L
			Arsenic	BDL	0.2 mg/L
			Vanadium	0.19	0.2 mg/L
			Titanium	BDL	Nil

*** Guidance document for assessment and remediation of contaminated sites in India*

Table 6: Analysis results of Supernatant from ETP pond and at the effluent discharge outlet point of M/s. KMML into sea on 17/10/2022

SL No	Sample code	Sample Location	Parameter	Observed Value	Limits as per Consent issued to M/s KMML
1	KLMK 13	Supernatant from ETP settling pond	pH	7.40	5.5-9.0
			Total Suspended Solids	80273	100 mg/l
			Oil & Grease	BDL	20 mg/l
			Total Residual Chlorine	BDL	1 mg/l
			Copper	BDL	nil
			Cadmium	BDL	nil
			Total Chromium	22.40	2 mg/l
			Iron	1818	3 mg/l
			Manganese	20.90	2 mg/l

SL No	Sample code	Sample Location	Parameter	Observed Value	Limits as per Consent issued to M/s KMML
			Nickel	2.40	nil
			Lead	0.90	2
			Zinc	6.10	15
			Arsenic	BDL	nil
			Vanadium	3.12	0.2
			Titanium	268.0	5
2	KLMK 14	Approved discharge point of KMML (sea discharge)	pH	7.00	5.5-9.0
			Total Suspended Solids	4515	100 mg/l
			Oil & Grease	BDL	20 mg/l
			Total Residual Chlorine	BDL	1 mg/l
			Copper	BDL	nil
			Cadmium	BDL	nil
			Total Chromium	5.61	2 mg/l
			Iron	301	3 mg/l
			Manganese	4.20	2 mg/l
			Nickel	BDL	nil
			Lead	BDL	2
			Zinc	2.20	15
			Arsenic	BDL	nil
			Vanadium	5.87	0.2
Titanium	41.60	5			

Table 7: Analysis results of open well water collected near M/s KMML on 17.10.2022

SL No	Sample code	Sample Location	Parameters	Value	Acceptable Limit as per BIS Drinking Water Specification IS 10500-2012
1	KLMKW1	Well water from Sasidharan Pillai, Thengumpally,	pH	7.10	6.5-8.5
			Total Suspended Solids	26.00	Nil

SL No	Sample code	Sample Location	Parameters	Value	Acceptable Limit as per BIS Drinking Water Specification IS 10500-2012
		Chittoor,Chavara.	Oil & Grease	BDL	Nil
			Total Residual Chlorine	BDL	0.2 mg/L
			Copper	BDL	0.05 mg/L
			Cadmium	BDL	0.003 mg/L
			Total Chromium	BDL	0.05 mg/L
			Iron	0.79	0.3 mg/L
			Manganese	BDL	0.1 mg/L
			Nickel	BDL	0.02 mg/L
			Lead	BDL	0.01 mg/L
			Zinc	BDL	5 mg/L
			Arsenic	BDL	0.01 mg/L
			Vanadium	BDL	Nil
			Titanium	BDL	Nil
2	KLMKW2	Well water from Babu, Babu Sadhanam, Chittoor, Chavara	pH	3.10	6.5-8.5
			Total Suspended Solids	BDL	Nil
			Oil & Grease	BDL	Nil
			Total Residual Chlorine	BDL	0.2 mg/L
			Copper	BDL	0.05 mg/L
			Cadmium	BDL	0.003 mg/L
			Total Chromium	B DL	0.05 mg/L
			Iron	5.70	0.3 mg/L
			Manganese	2.43	0.1 mg/L
			Nickel	BDL	0.02 mg/L
			Lead	BDL	0.01 mg/L
			Zinc	0.11	5 mg/L
			Arsenic	BDL	0.01 mg/L
Vanadium	0.10	Nil			
Titanium	BDL	Nil			
3	KLMKW3	Well water from Mohanan Pillai, Edapallil, Panmana, Chavara	pH	7.10	6.5-8.5
			Total Suspended Solids	4191.0 0	Nil
			Oil & Grease	BDL	Nil
			Total Residual	BDL	0.2 mg/L

SL No	Sample code	Sample Location	Parameters	Value	Acceptable Limit as per BIS Drinking Water Specification IS 10500-2012
			Chlorine		
			Copper	BDL	0.05 mg/L
			Cadmium	BDL	0.003 mg/L
			Total Chromium	BDL	0.05 mg/L
			Iron	225.00	0.3 mg/L
			Manganese	1.00	0.1 mg/L
			Nickel	BDL	0.02 mg/L
			Lead	BDL	0.01 mg/L
			Zinc	BDL	5 mg/L
			Arsenic	BDL	0.01 mg/L
			Vanadium	BDL	Nil
			Titanium	BDL	Nil

Table 8: Analysis results of tube well water collected inside M/s KMML

SL No	Sample code	Sample Location	Parameter	Value	Acceptable Limit as per BIS Drinking Water Specification IS 10500-2012
1	KLMKW4	KMML Tube Well no-2	pH	6.70	6.5-8.5
			Total Suspended Solids	BDL	Nil
			Oil & Grease	BDL	Nil
			Total Residual Chlorine	BDL	0.2 mg/L
			Copper	BDL	0.05 mg/L
			Cadmium	BDL	0.003 mg/L
			Total Chromium	BDL	0.05 mg/L
			Iron	2.70	0.3 mg/L
			Manganese	BDL	0.1 mg/L
			Nickel	BDL	0.02 mg/L
			Lead	BDL	0.01 mg/L
			Zinc	BDL	5 mg/L
			Arsenic	BDL	0.01 mg/L

SL No	Sample code	Sample Location	Parameter	Value	Acceptable Limit as per BIS Drinking Water Specification IS 10500-2012
			Vanadium	BDL	Nil
			Titanium	BDL	Nil
3	KLMKW5	KMML Tube Well no-4	pH	6.70	6.5-8.5
			Total Suspended Solids	11.0	Nil
			Oil & Grease	BDL	Nil
			Total Residual Chlorine	BDL	0.2 mg/L
			Copper	BDL	0.05 mg/L
			Cadmium	BDL	0.003 mg/L
			Total Chromium	BDL	0.05 mg/L
			Iron	1.20	0.3 mg/L
			Manganese	BDL	0.1 mg/L
			Nickel	BDL	0.02 mg/L
			Lead	BDL	0.01 mg/L
			Zinc	BDL	5 mg/L
			Arsenic	BDL	0.01 mg/L
			Vanadium	BDL	Nil
			Titanium	BDL	Nil
6	KLMKW6	KMML Tube Well no-8	pH	7.00	6.5-8.5
			Total Suspended Solids	BDL	Nil
			Oil & Grease	BDL	Nil
			Total Residual Chlorine	BDL	0.2 mg/L
			Copper	BDL	0.05 mg/L
			Cadmium	BDL	0.003 mg/L
			Total Chromium	BDL	0.05 mg/L
			Iron	0.49	0.3 mg/L
			Manganese	BDL	0.1 mg/L
			Nickel	BDL	0.02 mg/L
			Lead	BDL	0.01 mg/L
			Zinc	BDL	5 mg/L
			Arsenic	BDL	0.01 mg/L
			Vanadium	BDL	Nil
			Titanium	BDL	Nil

Table 9: Analysis results of Iron Oxide Sludge sample collected on 17/10/2022

SL No	Sample code	Sample Location	Parameter	Observed Value (in mg/Kg except pH)
1	KLMKS1	Iron Oxide Sludge from KMML near ETP pond	pH	1.80
			Copper	BDL
			Cadmium	BDL
			Total Chromium	377.85
			Iron	173613.50
			Manganese	2306.89
			Nickel	BDL
			Lead	BDL
			Zinc	BDL
			Arsenic	BDL
			Vanadium	544.90
			Titanium	BDL

The analysis results of the samples collected during the visit of Joint Committee to the affected residential areas on 17/10/2022 reveal that all the stagnant water samples collected from the nearby premises of the industry, the canal near MS plant, TS canal and near Vattakkayal had acidic pH in the order of 2-3. The parameters such as Iron and Manganese were exceeding the limits in all these locations. Zinc exceeded in Northern side of M/s. KMML in Panmana and near Vattakkayal and Vanadium exceeded in some of the locations. The highest value of Iron is found as 3528 mg/l at North side of M/s.KMML in Panmana ward. The parameters such as Oil and grease, Total residual chlorine, Copper, Cadmium, Total chromium, Nickel, Lead, Arsenic and Titanium for all the samples collected outside the industry were Below Detectable Limit (BDL).

The samples collected from the ETP pond (supernatant) and treated effluent discharge outlet point of M/s. KMML shows neutral p^H whereas the parameters such as Total Suspended Solids, Total Chromium, Iron, Manganese, Vanadium, and Titanium were exceeding the limits prescribed under the Integrated Consent to Operate issued to M/s. KMML, which clearly indicates that the existing effluent treatment plant is not adequate to comply to effluent discharge norms.

One of the well water sample (i.e., KLMKW2- Well water from Babu, Babu Sadhanam, Chittoor, Chavara) shows an acidic pH of 3.1 and the parameters such as Iron and Manganese are exceeding the limits of BIS Drinking Water Specifications i.e., IS 10500:2012. The other two well water samples shows neutral pH and the value of Iron exceeds BIS Drinking Water Specification.

The tube well water samples collected from M/s. KMML shows a neutral pH of nearly 7 and also shows iron content. The tube wells are considerably deep and could be the reason for neutral pH of the water.

The parameters such as Iron, Manganese, and Vanadium were present in the iron oxide sludge sample. All these parameters were exceeding the limits (as per MoEF guidelines) in the stagnant samples collected from the nearby premises. It may be inferred that there is every possibility of leakage or runoff from iron oxide sludge from the company to the nearby premises.

Kerala State Pollution Control Board organised meeting of the joint committee on 01/12/2022 to discuss the analysis results of the samples collected during the visit to affected areas on 17.10.2022. Kerala State Pollution Control Board officials apprised the Joint Committee that

- The analysis results of stagnant water collected on 17/10/2022 is compared with MoEF&CC Guidance document for assessment and remediation of

contaminated sites in India, with respect to surface water and the parameters of well water is compared with the BIS Drinking Water Specifications (I.S. 10500:2012).

- The analysis of the stagnant water samples collected from the nearby area of the company show acidic pH and presence of heavy metals. All the three well water samples also show high concentration of iron and one sample shows acidic pH. It is understood that the nearby area is polluted and the well water are not fit for drinking purpose.
- The storm water sample (KLMK11) of the industry show acidic pH and presence of Iron, Manganese and Vanadium which implies that the land inside the industry is either polluted or there is a possibility of leakage / spillage of iron oxide sludge into nearby area including Vattakayal.
- The treated effluent sample from the industry shows total suspended solids and heavy metals above the limit specified which implies that the present treatment system is not adequate enough to comply with the effluent discharge standards and requires upgradation.
- The analysis of the stagnant water samples collected from the nearby area of the company show acidic pH and presence of heavy metals.
- All the three well water samples also show high concentration of iron and one sample shows acidic pH.
- It is understood that the nearby area are polluted and the wells are not fit for drinking purpose.
- The treated effluent sample from the industry shows total suspended solids and heavy metals above the limit specified which implies that the present treatment system is to be modified.
- The analysis results of the collected effluent discharge sample revealed that the parameters are exceeding the limits permissible under the consent norms,

and also existing effluent treatment system consisting of neutralization using lime followed by settling tank, which is not adequate for removal of heavy metals and also to comply with the effluent discharge norms. Therefore, the existing effluent treatment system should be upgraded to ensure compliance to the consent discharge norms.

- Based on the observations made during the visit that there is every chance of runoff from the existing iron oxide pond area especially during monsoon resulting pollution of nearby land. In order to avoid this, scientific approach should be followed in line with the guidelines issued by CPCB from time to time.
- KSPCB and the Members of the Joint Committee were of the view that proper sign boards should be placed at all the suitable places to avoid human/ animal contact with the polluted stagnant water bodies in the vicinity of the human habitation.

As a follow-up of the decision taken in the Joint Committee meeting held on 01/12/2022, the basic findings of the committee regarding the matter were shared with the company authorities, in compliance to the Hon'ble NGT order dated 29.08.2022. Joint Committee meeting was also convened on 09/12/2022 at M/s KMML and the Joint Committee held discussions with the officials of M/s. KMML on the status of remedial measures (both short term and long term measures) to curtail the pollution. The representatives of M/s. KMML apprised Joint Committee in the meeting that

- A German company viz., M/s Tetrabic, approached to construct a plant inside the M/s.KMML for converting the ETP sludge and iron oxide sludge into usable products and this project is pending for State Government Approval. At present, the ETP sludge (about 50000 Tonnes) is being

transferred to M/s. Miracle Sands and Chemicals in Tamilnadu for processing and further utilization with the approval of the Kerala State Pollution Control Board (KSPCB). As on date, about 10000 Tonnes of ETP sludge already transferred to M/s. Miracle Sands and Chemicals in Tamilnadu.

- An internal R & D team of M/s. KMML has developed a new technology of converting acidic iron oxide sludge into neutral metallic iron and the samples are sent to some steel industries and waiting for their response for utilizing as raw material.
- The R & D wing of M/s. KMML also came up with additional techniques which are under trial run. One technique was tested within the company and found successful. About 2 to 3% of their profit is presently spent towards social commitment.
- Under the social responsible and commitment activities, which include welfare activities in 7 wards including the drinking water supply, sanitation and also conducting of regular medical camps etc.
- As a short term measure, trial for remediation of affected land is under progress and the same will be implemented to remediate the land outside the company premises, upon successful results. However, the permanent solution for this issue is acquisition of 76 acres of affected land around the company. Earlier 183 acres were identified and out of that 76 acres were the most affected area and the company have active plan to take up that land. The capping of the existing ponds can also be done to avoid contaminated runoff.

The minutes of the Joint Committee meetings held on 01/12/2022 and 09/12/2022 are annexed as **Annexure 5 & Annexure 6**.

Subsequent to the Joint Committee meeting on 9.12.2022, Kerala State Pollution Control Board also collected samples from 14 tube wells, waste samples from the old iron oxide pond, new iron oxide pond, ETP Pond area located within M/s. KMML. The locations detail of the tube well samples is given in **Table 10** and analysis results of the tube well samples collected on 9.12.2022 detailed in **Table 11**.

Table 10. Location details of the tube well samples inside M/s KMML collected on 9.12.2022

SL.NO.	SAMPLE ID	LOCATION	LATITUDE	LONGITUDE
1	KLM KW1	Near PSP Canteen	8.9958171	76.5311603
2	KLM KW2	Near Central store(right side)	9.0022353	76.5307499
3	KLM KW3	North side of KMML Employees co-operative society	9.002393	76.536141
4	KLM KW4	Near Civil Building	9.0020000	76.534424
5	KLM KW5	South side of LPG,near NH	8.9979492	76.5325786
6	KLM KW7	Right side of Water Treatment Plant	9.000892	76.531338
7	KLM KW8	Near boiler plant	9.001637	76.531758
8	KLM KW9	PPP area workshop(right side)	8.9991211	76.5310168
9	KLM KW11	Opposite to KMML parking area	9.000303	76.535438
10	KLM KW12	KMML guest house	8.996231	76.533472
11	KLM KW13	Ponnumvila Thahasildar office , Idappallikkotta	9.011124	76.532256
12	KLM KW14	Outside of KMML(near NH road working area)	9.009141	76.532201
13	KLM KW15	Near fire station	9.006237	76.537187
14	KLM KW16	South side of unit 400	8.9972399	76.5330382

Table 11. Analysis results of the tube well samples collected inside M/s KMML on 9.12.2022

Sl. No	Sample code	Sample Location	Parameters	Unit	Observed Values	Acceptable limits as per BIS Drinking Water Specifications IS:10500-2012
1	KLMKW1	Near PSP Canteen	pH	-	6.40	6.5-8.5
			Colour	CU	10.00	5
			Turbidity	NTU	BDL	1.0
			Conductivity	µS	153.00	Nil
			Alkalinity	mg/L	50.00	200
			Total Hardness as CaCO ₃	mg/L	29.00	200
			Calcium Hardness	mg/L	0.10	-
			Magnesium Hardness	mg/L	28.90	-
			Sulphate	mg/L	0.84	200
			Fluoride	mg/L	0.22	1
			Total Dissolved Solids	mg/L	96.00	500
			Nitrate	mg/L	4.98	45
			Residual Chlorine	mg/L	BDL	0.2 mg/L
			Chloride	mg/L	11.90	250
			Copper	mg/L	BDL	0.05
			Cadmium	mg/L	BDL	0.003
			Total Chromium	mg/L	BDL	0.05
			Iron	mg/L	0.77	0.3
			Manganese	mg/L	BDL	0.1
			Nickel	mg/L	BDL	0.02
Lead	mg/L	BDL	0.01			
Zinc	mg/L	BDL	5			

Sl. No	Sample code	Sample Location	Parameters	Unit	Observed Values	Acceptable limits as per BIS Drinking Water Specifications IS:10500-2012
			Arsenic	mg/L	BDL	0.01
			Vanadium	mg/L	BDL	Nil
			Titanium	mg/L	BDL	Nil
2	KLMKW2	Near Central store(right side)	pH	-	5.70	6.5-8.5
			Colour	CU	10.00	5
			Turbidity	NTU	0.20	1.0
			Conductivity	µS	122.00	Nil
			Alkalinity	mg/L	54.00	200
			Total Hardness as CaCO ₃	mg/L	32.00	200
			Calcium Hardness	mg/L	6.00	-
			Magnesium Hardness	mg/L	26.00	-
			Sulphate	mg/L	2.25	200
			Fluoride	mg/L	0.211	1
			Total Dissolved Solids	mg/L	93.00	500
			Nitrate	mg/L	2.51	45
			Residual Chlorine	mg/L	BDL	0.2 mg/L
			Chloride	mg/L	10.90	250
			Copper	mg/L	BDL	0.05
			Cadmium	mg/L	BDL	0.003
			Total Chromium	mg/L	B DL	0.05
			Iron	mg/L	0.81	0.3
			Manganese	mg/L	BDL	0.1
			Nickel	mg/L	BDL	0.02
			Lead	mg/L	BDL	0.01
			Zinc	mg/L	BDL	5
			Arsenic	mg/L	BDL	0.01
			Vanadium	mg/L	BDL	Nil

Sl. No	Sample code	Sample Location	Parameters	Unit	Observed Values	Acceptable limits as per BIS Drinking Water Specifications IS:10500-2012
			Titanium	mg/L	BDL	Nil
3	KLMKW3	North side of KMML Employees co-operative society	pH	-	6.60	6.5-8.5
			Colour	CU	10.00	5
			Turbidity	NTU	2.50	1.0
			Conductivity	µS	168.00	Nil
			Alkalinity	mg/L	68.00	200
			Total Hardness as CaCO ₃	mg/L	51.00	200
			Calcium Hardness	mg/L	17.00	-
			Magnesium Hardness	mg/L	34.00	-
			Sulphate	mg/L	3.09	200
			Fluoride	mg/L	0.306	1
			Total Dissolved Solids	mg/L	106.00	500
			Nitrate	mg/L	3.07	45
			Residual Chlorine	mg/L	BDL	0.2 mg/L
			Chloride	mg/L	10.90	250
			Copper	mg/L	BDL	0.05
			Cadmium	mg/L	BDL	0.003
			Total Chromium	mg/L	BDL	0.05
			Iron	mg/L	1.50	0.3
			Manganese	mg/L	BDL	0.1
			Nickel	mg/L	BDL	0.02
Lead	mg/L	BDL	0.01			
Zinc	mg/L	BDL	5			
Arsenic	mg/L	BDL	0.01			
Vanadium	mg/L	BDL	Nil			
Titanium	mg/L	BDL	Nil			
4	KLMKW4	Near Civil	pH	-	7.00	6.5-8.5
			Colour	CU	20.00	5

Sl. No	Sample code	Sample Location	Parameters	Unit	Observed Values	Acceptable limits as per BIS Drinking Water Specifications IS:10500-2012
		Building	Turbidity	NTU	16.50	1.0
			Conductivity	µS	244.00	Nil
			Alkalinity	mg/L	72.00	200
			Total Hardness as CaCO ₃	mg/L	100.00	200
			Calcium Hardness	mg/L	61.00	-
			Magnesium Hardness	mg/L	39.00	-
			Sulphate	mg/L	3.23	200
			Fluoride	mg/L	0.231	1
			Total Dissolved Solids	mg/L	163.00	500
			Nitrate	mg/L	3.30	45
			Residual Chlorine	mg/L	BDL	0.2 mg/L
			Chloride	mg/L	12.90	250
			Copper	mg/L	BDL	0.05
			Cadmium	mg/L	BDL	0.003
			Total Chromium	mg/L	BDL	0.05
			Iron	mg/L	5.50	0.3
			Manganese	mg/L	0.12	0.1
			Nickel	mg/L	BDL	0.02
			Lead	mg/L	BDL	0.01
			Zinc	mg/L	BDL	5
Arsenic	mg/L	BDL	0.01			
Vanadium	mg/L	BDL	Nil			
Titanium	mg/L	BDL	Nil			
5	KLMKW5	South side of LPG, near NH	pH	-	7.60	6.5-8.5
			Colour	CU	10.00	5
			Turbidity	NTU	BDL	1.0
			Conductivity	µS	447.00	Nil
			Alkalinity	mg/L	72.00	200

Sl. No	Sample code	Sample Location	Parameters	Unit	Observed Values	Acceptable limits as per BIS Drinking Water Specifications IS:10500-2012
			Total Hardness as CaCO ₃	mg/L	152.00	200
			Calcium Hardness	mg/L	29.00	-
			Magnesium Hardness	mg/L	123.00	-
			Sulphate	mg/L	1.54	200
			Fluoride	mg/L	0.689	1
			Total Dissolved Solids	mg/L	370.00	500
			Nitrate	mg/L	62.50	45
			Residual Chlorine	mg/L	BDL	0.2 mg/L
			Chloride	mg/L	13.90	250
			Copper	mg/L	BDL	0.05
			Cadmium	mg/L	BDL	0.003
			Total Chromium	mg/L	BDL	0.05
			Iron	mg/L	0.93	0.3
			Manganese	mg/L	BDL	0.1
			Nickel	mg/L	B DL	0.02
			Lead	mg/L	BDL	0.01
			Zinc	mg/L	BDL	5
			Arsenic	mg/L	BDL	0.01
			Vanadium	mg/L	BDL	Nil
Titanium	mg/L	BDL	Nil			
6	KLMKW7	Right side of Water treatment plant	pH	-	7.40	6.5-8.5
			Colour	CU	10.00	5
			Turbidity	NTU	BDL	1.0
			Conductivity	µS	196.00	Nil
			Alkalinity	mg/L	62.00	200
			Total Hardness as CaCO ₃	mg/L	44.00	200
			Calcium Hardness	mg/L	16.00	-
			Magnesium	mg/L	28.00	-

Sl. No	Sample code	Sample Location	Parameters	Unit	Observed Values	Acceptable limits as per BIS Drinking Water Specifications IS:10500-2012
			Hardness			
			Sulphate	mg/L	1.96	200
			Fluoride	mg/L	0.276	1
			Total Dissolved Solids	mg/L	133.00	500
			Nitrate	mg/L	0.51	45
			Residual Chlorine	mg/L	BDL	0.2 mg/L
			Chloride	mg/L	12.90	250
			Copper	mg/L	BDL	0.05
			Cadmium	mg/L	BDL	0.003
			Total Chromium	mg/L	BDL	0.05
			Iron	mg/L	0.82	0.3
			Manganese	mg/L	BDL	0.1
			Nickel	mg/L	BDL	0.02
			Lead	mg/L	BDL	0.01
			Zinc	mg/L	BDL	5
			Arsenic	mg/L	BDL	0.01
			Vanadium	mg/L	BDL	Nil
			Titanium	mg/L	BDL	Nil
7	KLMKW8	Near boiler plant	pH	-	6.20	6.5-8.5
			Colour	CU	10.00	5
			Turbidity	NTU	1.00	1.0
			Conductivity	µS	134.00	Nil
			Alkalinity	mg/L	52.00	200
			Total Hardness as CaCO ₃	mg/L	43.00	200
			Calcium Hardness	mg/L	15.00	-
			Magnesium Hardness	mg/L	28.00	-
			Sulphate	mg/L	2.53	200
			Fluoride	mg/L	0.251	1
			Total Dissolved Solids	mg/L	97.00	500

Sl. No	Sample code	Sample Location	Parameters	Unit	Observed Values	Acceptable limits as per BIS Drinking Water Specifications IS:10500-2012
			Nitrate	mg/L	5.43	45
			Residual Chlorine	mg/L	BDL	0.2 mg/L
			Chloride	mg/L	15.90	250
			Copper	mg/L	BDL	0.05
			Cadmium	mg/L	BDL	0.003
			Total Chromium	mg/L	BDL	0.05
			Iron	mg/L	0.95	0.3
			Manganese	mg/L	BDL	0.1
			Nickel	mg/L	BDL	0.02
			Lead	mg/L	BDL	0.01
			Zinc	mg/L	BDL	5
			Arsenic	mg/L	BDL	0.01
			Vanadium	mg/L	BDL	Nil
			Titanium	mg/L	BDL	Nil
8	KLMKW9	PPP area workshop (right side)	pH	-	7.50	6.5-8.5
			Colour	CU	10.00	5
			Turbidity	NTU	2.00	1.0
			Conductivity	µS	730.00	Nil
			Alkalinity	mg/L	98.00	200
			Total Hardness as CaCO ₃	mg/L	278.00	200
			Calcium Hardness	mg/L	84.00	-
			Magnesium Hardness	mg/L	194.00	-
			Sulphate	mg/L	2.25	200
			Fluoride	mg/L	0.479	1
			Total Dissolved Solids	mg/L	487.00	500
			Nitrate	mg/L	18.63	45
			Residual Chlorine	mg/L	BDL	0.2 mg/L
			Chloride	mg/L	13.90	250

Sl. No	Sample code	Sample Location	Parameters	Unit	Observed Values	Acceptable limits as per BIS Drinking Water Specifications IS:10500-2012
			Copper	mg/L	BDL	0.05
			Cadmium	mg/L	BDL	0.003
			Total Chromium	mg/L	BDL	0.05
			Iron	mg/L	1.10	0.3
			Manganese	mg/L	BDL	0.1
			Nickel	mg/L	BDL	0.02
			Lead	mg/L	BDL	0.01
			Zinc	mg/L	BDL	5
			Arsenic	mg/L	BDL	0.01
			Vanadium	mg/L	BDL	Nil
			Titanium	mg/L	BDL	Nil
9	KLMKW1 1	Opposite to KMML parking area	pH	-	6.10	6.5-8.5
			Colour	CU	5.00	5
			Turbidity	NTU	1.00	1.0
			Conductivity	µS	159.00	Nil
			Alkalinity	mg/L	44.00	200
			Total Hardness as CaCO ₃	mg/L	31.00	200
			Calcium Hardness	mg/L	23.00	-
			Magnesium Hardness	mg/L	8.00	-
			Sulphate	mg/L	1.83	200
			Fluoride	mg/L	0.196	1
			Total Dissolved Solids	mg/L	140.00	500
			Nitrate	mg/L	17.79	45
			Residual Chlorine	mg/L	BDL	0.2 mg/L
			Chloride	mg/L	10.90	250
			Copper	mg/L	BDL	0.05
			Cadmium	mg/L	BDL	0.003
Total Chromium	mg/L	BDL	0.05			
Iron	mg/L	0.86	0.3			

Sl. No	Sample code	Sample Location	Parameters	Unit	Observed Values	Acceptable limits as per BIS Drinking Water Specifications IS:10500-2012
			Manganese	mg/L	BDL	0.1
			Nickel	mg/L	BDL	0.02
			Lead	mg/L	0.27	0.01
			Zinc	mg/L	BDL	5
			Arsenic	mg/L	BDL	0.01
			Vanadium	mg/L	BDL	Nil
			Titanium	mg/L	BDL	Nil
10	KLMKW1 2	KMML guest house	pH	-	6.60	6.5-8.5
			Colour	CU	10.00	5
			Turbidity	NTU	BDL	1.0
			Conductivity	µS	258.00	Nil
			Alkalinity	mg/L	100.00	200
			Total Hardness as CaCO ₃	mg/L	85.00	200
			Calcium Hardness	mg/L	21.00	-
			Magnesium Hardness	mg/L	64.00	-
			Sulphate	mg/L	5.20	200
			Fluoride	mg/L	0.312	1
			Total Dissolved Solids	mg/L	161.00	500
			Nitrate	mg/L	7.71	45
			Residual Chlorine	mg/L	BDL	0.2 mg/L
			Chloride	mg/L	7.90	250
			Copper	mg/L	BDL	0.05
			Cadmium	mg/L	BDL	0.003
			Total Chromium	mg/L	BDL	0.05
			Iron	mg/L	0.43	0.3
			Manganese	mg/L	BDL	0.1
			Nickel	mg/L	BDL	0.02
Lead	mg/L	BDL	0.01			
Zinc	mg/L	BDL	5			

Sl. No	Sample code	Sample Location	Parameters	Unit	Observed Values	Acceptable limits as per BIS Drinking Water Specifications IS:10500-2012
			Arsenic	mg/L	BDL	0.01
			Vanadium	mg/L	BDL	Nil
			Titanium	mg/L	BDL	Nil
11	KLMKW13	Ponnumvila Thahasildar office, Idappallickotta	pH	-	7.20	6.5-8.5
			Colour	CU	20.00	5
			Turbidity	NTU	0.80	1.0
			Conductivity	µS	184.00	Nil
			Alkalinity	mg/L	42.00	200
			Total Hardness as CaCO ₃	mg/L	26.00	200
			Calcium Hardness	mg/L	19.00	-
			Magnesium Hardness	mg/L	7.00	-
			Sulphate	mg/L	7.20	200
			Fluoride	mg/L	0.27	1
			Total Dissolved Solids	mg/L	154.00	500
			Nitrate	mg/L	21.66	45
			Residual Chlorine	mg/L	BDL	0.2 mg/L
			Chloride	mg/L	6.90	250
			Copper	mg/L	BDL	0.05
			Cadmium	mg/L	BDL	0.003
			Total Chromium	mg/L	BDL	0.05
			Iron	mg/L	0.10	0.3
			Manganese	mg/L	0.22	0.1
			Nickel	mg/L	BDL	0.02
			Lead	mg/L	BDL	0.01
Zinc	mg/L	BDL	5			
Arsenic	mg/L	BDL	0.01			
Vanadium	mg/L	BDL	Nil			
Titanium	mg/L	BDL	Nil			
12	KLMKW1	Outside	pH	-	7.00	6.5-8.5

Sl. No	Sample code	Sample Location	Parameters	Unit	Observed Values	Acceptable limits as per BIS Drinking Water Specifications IS:10500-2012
	4	of KMML(near NH road working area)	Colour	CU	10.00	5
			Turbidity	NTU	0.70	1.0
			Conductivity	µS	146.00	Nil
			Alkalinity	mg/L	20.00	200
			Total Hardness as CaCO ₃	mg/L	39.00	200
			Calcium Hardness	mg/L	18.00	-
			Magnesium Hardness	mg/L	21.00	-
			Sulphate	mg/L	5.30	200
			Fluoride	mg/L	0.234	1
			Total Dissolved Solids	mg/L	104.00	500
			Nitrate	mg/L	12.50	45
			Residual Chlorine	mg/L	BDL	0.2 mg/L
			Chloride	mg/L	12.00	250
			Copper	mg/L	BDL	0.05
			Cadmium	mg/L	BDL	0.003
			Total Chromium	mg/L	BDL	0.05
			Iron	mg/L	0.14	0.3
			Manganese	mg/L	BDL	0.1
			Nickel	mg/L	BDL	0.02
			Lead	mg/L	BDL	0.01
Zinc	mg/L	BDL	5			
Arsenic	mg/L	BDL	0.01			
Vanadium	mg/L	BDL	Nil			
Titanium	mg/L	BDL	Nil			
13	KLMKW15	Near fire station	pH	-	6.80	6.5-8.5
			Colour	CU	10.00	5
			Turbidity	NTU	0.80	1.0
			Conductivity	µS	199.00	Nil
			Alkalinity	mg/L	80.00	200

Sl. No	Sample code	Sample Location	Parameters	Unit	Observed Values	Acceptable limits as per BIS Drinking Water Specifications IS:10500-2012
			Total Hardness as CaCO ₃	mg/L	63.00	200
			Calcium Hardness	mg/L	41.00	-
			Magnesium Hardness	mg/L	22.00	-
			Sulphate	mg/L	5.62	200
			Fluoride	mg/L	0.326	1
			Total Dissolved Solids	mg/L	150.00	500
			Nitrate	mg/L	12.56	45
			Residual Chlorine	mg/L	BDL	0.2 mg/L
			Chloride	mg/L	7.90	250
			Copper	mg/L	BDL	0.05
			Cadmium	mg/L	BDL	0.003
			Total Chromium	mg/L	BDL	0.05
			Iron	mg/L	0.66	0.3
			Manganese	mg/L	BDL	0.1
			Nickel	mg/L	BDL	0.02
			Lead	mg/L	BDL	0.01
			Zinc	mg/L	BDL	5
			Arsenic	mg/L	BDL	0.01
			Vanadium	mg/L	BDL	Nil
			Titanium	mg/L	BDL	Nil
14	KLMKW1 6	South side of unit 400	pH	-	6.20	6.5-8.5
			Colour	CU	10.00	5
			Turbidity	NTU	0.70	1.0
			Conductivity	µS	168.00	Nil
			Alkalinity	mg/L	52.00	200
			Total Hardness as CaCO ₃	mg/L	57.00	200
			Calcium Hardness	mg/L	35.00	-
			Magnesium	mg/L	22.00	-

Sl. No	Sample code	Sample Location	Parameters	Unit	Observed Values	Acceptable limits as per BIS Drinking Water Specifications IS:10500-2012
			Hardness			
			Sulphate	mg/L	4.40	200
			Fluoride	mg/L	0.249	1
			Total Dissolved Solids	mg/L	115.00	500
			Nitrate	mg/L	6.30	45
			Residual Chlorine	mg/L	BDL	0.2 mg/L
			Chloride	mg/L	19.90	250
			Copper	mg/L	BDL	0.05
			Cadmium	mg/L	BDL	0.003
			Total Chromium	mg/L	BDL	0.05
			Iron	mg/L	2.40	0.3
			Manganese	mg/L	BDL	0.1
			Nickel	mg/L	BDL	0.02
			Lead	mg/L	BDL	0.01
			Zinc	mg/L	BDL	5
			Arsenic	mg/L	BDL	0.01
			Vanadium	mg/L	BDL	Nil
			Titanium	mg/L	BDL	Nil

The analysis results of the 14 tube well samples reveal that the pH of the tube well water samples were within a range of 5.7-7.6 and iron content is present in all the samples in the ranges of 0.1 mg/L to 5.5 mg/L and exceeding the prescribed limits of BIS Drinking Water Specification (IS 10500:2012) except at two locations (i.e., KLMKW 13 & KLMKW 14). Manganese is present in two tube well water samples (i.e., KLMKW4 & KLMKW 13) whereas Lead (0.27 mg/L) is present in one of the sample of ground water (i.e., KLMKW 11) and exceeding the prescribed limit of BIS Drinking Water Specification (IS 10500:2012).

As per M/s. KMML, the depth of ground water in the tube well located within industry premises is around 250- 300 feet below ground level and probably this could be the reason, all the tube well water do not show much contamination.

The analysis results of sludge samples from new and old iron oxide ponds as well as ETP sludge sample collected on 9.12.2022 is given in the **Table 12** below.

Table 12. The analysis results of sludge samples collected from new and old iron oxide ponds as well as ETP sludge collected on 9.12.2022

Sl. No	Sample code	Sample Location	Parameter	Observed Values (in mg/kg except pH)
1	KLMKE1	Old Iron Oxide Pond	pH	10.0
			Copper	BDL
			Cadmium	BDL
			Total Chromium	453.87
			Iron	123532.3
			Manganese	2289.09
			Nickel	BDL
			Lead	BDL
			Zinc	BDL
			Arsenic	BDL
			Titanium	670.94
Vanadium	513.07			
2	KLMKE2	ETP Pond	pH	6.0
			Copper	BDL
			Cadmium	BDL
			Total Chromium	399.31
			Iron	24757.4
			Manganese	379.34
			Nickel	BDL
			Lead	BDL

Sl. No	Sample code	Sample Location	Parameter	Observed Values (in mg/kg except pH)
			Zinc	BDL
			Arsenic	BDL
			Titanium	4312.58
			Vanadium	339.41
3	KLMKE3	New Iron Oxide Pond	pH	1.0
			Copper	BDL
			Cadmium	BDL
			Total Chromium	285.29
			Iron	134084.58
			Manganese	1658.22
			Nickel	BDL
			Lead	BDL
			Zinc	463.59
			Arsenic	BDL
			Titanium	909.35
			Vanadium	499.25

The analysis results of the sludge samples of old iron oxide pond, new iron oxide pond and ETP pond reveal that the parameters such as Copper, Cadmium, Nickel, Lead, Arsenic are observed as 'Below Detection Limit' and parameters such as Iron, Manganese, Total Chromium, Titanium and Vanadium are present in all three sludge samples collected on 9.12.2022. Zinc is also present in the sludge sample of new iron oxide pond.

The analysis results also reveal that pH value of sludge from new iron Oxide pond observed as 1 which is highly acidic and falls under the hazardous waste category and requires pre-treatment for disposal into secured landfill in accordance with the Hazardous and Other Waste (Management and Transboundary Movement) Rules, 2016 as amended, whereas the pH value of ETP sludge and sludge from old iron oxide pond observed as 6 and 10 respectively.

4. Status on Implementation of Time Bound Action Plans as submitted by M/s.KMML

A petition was filed by Sri. Joy Kaitharnath against M/s KMML regarding the pollution issues of the industry (O.A 142/2013, 290/2013 and 453/2013 in Hon'ble NGT southern zone). Hon'ble NGT vide order dated 31/08/2017 had directed M/s. Kerala Minerals and Metals Limited (KMML), to prepare short term and long term measures through competent and expert developers/contractors and such processes should be completed within the time frame. Hon'ble NGT vide order dated 31/08/2017 also directed the industry to prepare an appropriate scientific scheme through Expert/Contractor with specific timeframe for soil remediation and ground water remediation and also to supply adequate potable water to the people residing in and around its industrial premises.

Hon'ble Tribunal vide order dated 31/08/2017 had directed the industry *“to deposit a sum of Rs. 1,00,00,000/- (Rupees One Crore Only) under “Polluter Pays Principle” in favour of Chairman, Kerala State Pollution Control Board” who shall keep the said amount in separate account named as “Environmental Relief Fund for remediation of Chavara Region due to pollution caused by Kerala Minerals and Metals Limited (KMML). The said amount shall be managed by the Chief Secretary, Government of Kerala and Chairman, Kerala State Pollution Control Board jointly and shall be utilised for remediation and/or for distribution to the affected persons either as per the direction of this Tribunal or as per the decision of the State Government.”*

The Kerala State Pollution Control Board is also directed to monitor the implementation of the scheme and also directions issued by this Tribunal to be carried out by the unit and if there is any violation found, they are directed to take

appropriate action against the unit including imposition of environmental compensation for the damage caused to the environment, if any, due to further non-compliance of directions issued by the Tribunal. The status on time bound action plan submitted by M/s. KMML is detailed in subsequent paras.

4.1. Short Term Measures

Item	Work status	Target	Remarks	Remarks of the Joint Committee
Construction of Garland drain around the iron oxide (IOP)/ETP ponds	After open e-tendering work order for the Construction of Garland drain around new ETP/IOP and old ETP/IOP was issued to M/s Ravi Kumar & M/s Biohomes on 08/10/2019 and 08/04/2021 respectively. The period of contract was extended due to events viz. adverse climatic condition, restriction imposed as part of pandemic COVID19 lock down, local labour issues, ETP sludge shifting process etc. The works are now progressing at site.	Jan 2023 (NEW ETP) Mar 2023 (OLD ETP/IOP)	About 75% of garland drain Construction around New ETP and 40% around old ETP/IOP has been completed.	The runoff through proposed garland drain construction around the existing iron oxide pond need to be connected to the suitable treatment system to avoid acid bearing surface runoff into the nearby low lying areas or human habitation. The other option is that the entire existing iron oxide dump yard should be covered with suitable liner (s) temporarily till zero waste policy is adopted, to avoid contaminated run off. If no solution is found by the industry, entire iron oxide sludge dump yards to be capped permanently in line with the guidelines issued by CPCB or disposed off through a TSDF located in Kerala in accordance with the Hazardous and Other Waste (Management &

Item	Work status	Target	Remarks	Remarks of the Joint Committee
				Transboundary Movement) Rules, 2016 as amended
Remediation of affected land near KMML Premises	<p>E-Tender was invited for the Test patch for remediation of contaminated area inside KMML Premises and its consultancy works on 09/07/2019. No parties quoted. Action for limited tender for consultancy work taken on 07/08/2019. Two parties quoted the tender. Work order was issued to M/s FEDO on 05/12/2019 for consultancy and supervision of the test patch area for contaminated land in KMML premises.</p> <p>M/s FEDO have submitted a detailed project report with schematic drawing and lay out of the contaminated land remediation work. Tendering for test patch done in three occasions ie, 25/02/2020 (only single offer received),</p>	Time Frame set is one year for test patch (March 2023)	Land preparation for the test patch unit completed and tendering activities for the remediation of the test patch area is in progress.	The remediation of surrounding area is not an easy task and industry should come out with the alternate options for utilization of generated process sludge, in a time bound manner. Industry should assess the contaminated areas through an institute of repute and remedial measures to be taken in accordance with the Hazardous and Other Waste (Management & Transboundary Movement) Rules, 2016 as amended

Item	Work status	Target	Remarks	Remarks of the Joint Committee
	<p>24/06/2020 & 19/08/2020 (no party quoted).</p> <p>Due to non receipt of offers, action for doing the activity on trial basis has been initiated by inviting open e-tender. Accordingly land preparatory works for the test patch area completed and tendering activities for the remediation of the test patch area is in progress.</p>			
<p>Solid waste management in KMML (In situ/Ex-situ storage) - Geotube as a trial implementation</p>	<p>Considering the constraint for shifting the entire quantity of sludge to newly proposed containment system and limitation of vacant land availability, another technological option was identified by KMML through US based Titanium technology consultant.</p> <p>The new technology involves dewatering</p>	<p>Time set is one year after getting approval from CPCB/KS PCB and subsequent ordering</p>	<p>Stage- 1 of this work can be completed in a period of 8-10 months, upon receipt of requisite approvals</p>	<p>Need approval from KSPCB and CPCB for adopting geotube technology. Hence, this method may be reviewed as the ultimate safe disposal of waste is required and the unit may explore to adopt alternate technology so as to convert iron oxide sludge into useful products.</p>

Item	Work status	Target	Remarks	Remarks of the Joint Committee
	<p>and storage of solid waste using GEOTUBES which was presented to KSPCB in the meeting held on 10/12/2018. In principle approval was received and directed to submit details of the proposal. Tendering action for the Geotube iron oxide containment from new elevated iron oxide pond was done, received two offers & the same got placed before Board of Directors meeting for approval.</p> <p>Subsequently, Geotube suppliers had intimated KMML to get environmental clearance to submit offer for the tender. KMML submitted a request letter to KSPCB on 23/02/2022 for Environmental clearance approval to go ahead with the collection and</p>			

Item	Work status	Target	Remarks	Remarks of the Joint Committee
	<p>containment of Iron oxide slurry in Geotube from the elevated new iron oxide pond as trial phase activity. Dewatered Iron oxide solids can safely be transferred to offsite after the containment. A presentation of solid waste management using Geotubes was conducted at the chamber of Chairman, KSPCB on 16/05/2022 and 14/10/2022. KMML officials visited CPCB, New Delhi on 28/11/2022 and handed over the request letter for obtaining authorization for conducting trial geotube filling and containment of iron oxide from new elevated iron oxide pond.</p> <p>Work can be started only with the technical concurrence of CPCB/KSPCB</p>			

4.2. Long Term Measures

Item	Work status	Target	Remarks	Remarks of the Joint Committee
<p>Acid Regeneration plant (ARP) technology modification to generate saleable iron oxide</p>	<p>Tender was invited and opened in September 2019 & only one party quoted. Tender was closed on December 2019 and after evaluation of the proposal, the file was put up to the Board for approval. 243rd Board meeting of the company held on 21/05/2020 had accorded approval for seeking final Government sanction.</p> <p>The file was put up to the Government on 01/06/2020, for getting final sanction. However as per the direction given by Government of Kerala, retendering done on June 2021.</p> <p>Global Tender was invited from technology providers for the process modification of existing Acid Regeneration plant on 10/06/2019. The offer submitted by M/s INDROX GLOBAL PVT. LTD. Is evaluated, approved in the 250th Board of meeting held on 15/01/2022 and submitted for Government approval. A meeting was convened under the chairmanship of</p>	<p>18 months from order</p>	<p>Awaiting Government approval</p>	<p>Technology modification shall be implemented soon to result in toxic constituent and acidic free iron oxide sludge generation and to facilitate converting to saleable products.</p>

Item	Work status	Target	Remarks	Remarks of the Joint Committee
	<p>Hon'ble Minister for Industries, Law & coir on 09/06/2022 and in the meeting, it was decided to work out the price reasonableness & submit report to Government of Kerala. Accordingly, FEDO had done the cost analysis study & the report got submitted to Government for approval to place order.</p>			
<p>Value addition of by products (Iron oxide/ETP sludge)</p>	<p>KMML identified M/s Renuka Equipments Pvt. LTD, Nagpur, with the help of M/s NEERI as the competent technology provider for the management of iron oxide stored in the old pond, by converting the same in to usable product. 234th Board meeting held on 04/04/2018 had given permission in principle for receiving a detailed techno-commercial offer for setting up a pilot plant from M/s REPL. We have received offer from M/s REPL and evaluated. It is noticed that the proposed technology is not field proven one and also involves investment around Rs.400 Crores on commercial scale set up.</p> <p>In order to select potential agencies to carry out value</p>	<p>18-24 months from the date of order/statutory clearance.</p>	<p>Board approval obtained, awaiting Govt, approval for final agreement.</p>	<p>Necessary approval from Kerala State Pollution Control Board and CPCB shall be obtained for trial run as per Hazardous and Other Waste (Management & Transboundary Movement) Rules, 2016 as amended as well as adopting the technology and it is the most recommended method for disposing the existing iron oxide sludge.</p>

Item	Work status	Target	Remarks	Remarks of the Joint Committee
	<p>addition of iron oxide & ETP sludge on a total responsibility basis with suitable technology, we have published a global expression of Interest and the last date to offer was 15/03/2022. Offers are received from parties and CSIR-NIIST, TVM was appointed as consultant to carry the technical evaluation of the proposal and they have submitted their study report. Tender was invited, Board approval obtained for awarding order to the selected parties obtained, awaiting Govt approval for final agreement.</p>			<p>R&D team shall come up with more and more feasible technologies in this field.</p>

4.3. Other Initiatives of M/s. KMML

Item	Action	Target	Remarks	Remarks of Joint Committee
Iron Oxide residue sales	<p>KMML invited e-tender for the sales of iron oxide residue for further process/value addition at end user on 19/12/2019. M/s Miracle sands and Chemicals, Tuticorin quoted for the tender and sales order was issued to the party on 09/06/2020, for shifting 10,000 MT to the end user end.</p> <p>Sales order of iron oxide sludge was extended for obtaining statutory approvals from TNPCB and KSPCB. M/s Miracle sands and chemicals, Tuticorin has already submitted a detailed project proposal for manufacturing Iron oxide concrete bricks along with the consent order from TNPCB valid up to March 2025 and the sale order of Iron oxide residue (10,000 MT) issued by KMML on 09/06/2020.</p> <p>In the meeting held on 19/09/2022 in KSPCB, Head Office, TVM, KMML requested KSPCB sanction to shift 10,000</p>	18-24 months from the date of statutory clearance	CPCB concurrence to transfer trial quantity is in progress.	Necessary approval from Kerala State Pollution Control Board shall be obtained in accordance with the Hazardous and Other Waste (Management & Transboundary Movement) Rules, 2016 as amended

Item	Action	Target	Remarks	Remarks of Joint Committee
	<p>MT of iron oxide to carry out trial runs as per Hazardous and Other Waste (Management and Transboundary Movement) Rules 2016 chapter II, Section No.9, Sub division 2. KSPCB informed KMML that a letter has forwarded to CPCB on 24/09/2022 for seeking their advice on conducting a trial.</p> <p>KMML officials visited CPCB on 28/11/2022 and made follow up for obtaining authorization for trial production of Iron oxide bricks by M/s Miracle Sands and Chemicals, Tuticorin. CPCB officials informed that authorization request from KMML will be included in the next committee meeting held in January 2023.</p>			
ETP sludge sales	E-tender was invited by KMML for shifting 10,000 MT of ETP sludge from ETP pond on 04/02/2020 and subsequently the quantity enhanced from 10000MT to 50000 MT on	Ongoing	8658.60 MT has been shifted and balance quantity shifting is in	Progress shall be reported by M/s KMML periodically to Kerala SPCB.

Item	Action	Target	Remarks	Remarks of Joint Committee
	<p>17/02/2020. Sales order was issued to M/s Miracle sands and Chemicals on 09/06/2020 for 10,000 MT. A new sales order was issued to M/s Miracle sands and Chemicals for 40,000 MT on 08/04/2022. About 8658.60 MT of ETP sludge has been shifted by the party from KMML. Permission granted to M/s Miracle Sands & Chemicals from KSPCB for collection and transportation of ETP sludge from KMML valid up to 31/03/2023.</p>		<p>progress valid up to 31/03/2023.</p>	
<p>ETP Revamping/ Modernization</p>	<p>E tendering of ETP revamping / modernization DPR done on 10/02/2022. No offer received. Contacted parties for budgetary quote. The parties conveyed that they can proceed further only after signing an MOU. Being a public sector unit, KMML decided to go for retendering. E-tendering done for DPR preparation of ETP revamping/modernization. Three offers received and</p>	<p>Time frame set for draft DPR submission- DECEMBER 2022</p>	<p>After finalization of DPR, E-tendering will be done for ETP revamping/modernization with necessary approvals.</p>	<p>Proposal for ETP upgradation as suggested by the Joint Committee need to be submitted to Kerala SPCB for approval.</p>

Item	Action	Target	Remarks	Remarks of Joint Committee
	work order was awarded to M/s SBA Enviro System, Delhi and draft report will be submitted within a week.			
Capping of existing storage ponds	Tendering activities for capping of settling pond 1 eastern side area is under progress.	Time frame for tendering and capping Feb- 2023.	Tendering activities in progress.	Capping (as per guidelines of CPCB) Progress shall be reported periodically
Utilization of Iron oxide by making Iron sinter- value addition of iron oxide.	<p><u>In-house value addition of Iron oxide</u></p> <p>Plant trial for a quantity 10 MT of iron oxide conducted on 23rd Nov 2022. The trial was found successful and we were able to produce iron sinters.</p> <p>The sinters produced are chloride free and agglomerated, which was confirmed by outsourcing analysis at NIIST and STIC.</p> <p>The quality has to be confirmed by the prospective iron industry for using as raw material for iron industry.</p>	Time frame for setting up of a plant in KMML December 2023.	We are providing samples to the different Iron industry for checking the suitability. Patent filed in 2022.	Necessary approvals from KSPCB/CPCB shall be obtained as required under the Hazardous and Other Waste (Management & Transboundary Movement) Rules, 2016 as amended
Utilization of Iron oxide by making	Another plant trial for the production of DRI pellets from the iron oxide is	Time frame to be decided after the	Patent filed in 2022.	Necessary approvals from KSPCB/CPCB

Item	Action	Target	Remarks	Remarks of Joint Committee
DRI/Sponge pellets-value addition of iron oxide.	planned. If successful, further value addition of iron oxide is possible. Trial scheduled for third week of December 2022.	trial.		shall be obtained as required under the Hazardous and Other Waste (Management & Transboundary Movement) Rules, 2016 as amended

5. Observations and Recommendations of the Joint Committee

As per observations of the Joint Committee, M/s KMML is not complying to the conditions of Integrated Consent issued under The Environment (Protection) Act 1986.

Also, M/s KMML is still in the process of compliance to the directions issued on April 12, 2012, by CPCB under Section 5 of The Environment (Protection) Act 1986.

Further, M/s KMML is still in the process of implementation of short term and long term measures.

Based on the appraisal of M/s. KMML on the status of implementation of the actions plans submitted earlier by M/s. KMML and additional measures are suggested for implementation in a time bound manner by M/s.KMML as detailed below :-

1. The remedial measures both short term and long term already proposed by M/s KMML shall be implemented ***within the committed time limit.***

2. The existing effluent treatment system shall be upgraded to ensure compliance to the effluent discharge norms prescribed under the consent conditions- *within one year.*
3. Integrated Consent to Operate issued to M/s KMML by Kerala SPCB shall be amended suitably with the necessary effluent discharge norms and hazardous waste management in accordance with the prevailing rules notified under The Environment (Protection) Rules, 1986- *within a month.*
4. Proper sign boards should be placed at all the suitable places to avoid human/ animal contact with the polluted stagnant water bodies in the vicinity of the human habitation- *within a month.*
5. Permanent capping of the existing storage ponds or shifting of entire hazardous waste to the CHWTSDF located nearby should be done in accordance with the Hazardous & Other Waste (Management and Transboundary Movement) Rules, 2016 as amended as well as guidelines issued by CPCB for capping of hazardous waste, if iron oxide sludge is not utilised completely.
Till such time, the existing old iron oxide ponds should be capped temporarily using LDPE liner (s) to avoid contaminated run off flow into the nearby low lying and residential areas. Suitable chemical dosage provision to neutralise run off also be made at all the end points of drains carrying run off, within the industry premises *before next monsoon or by May 2023.*
6. Untreated effluent generated from industry premises shall not be discharged into any drain or natural drain. Also, surface run off from old iron oxide

ponds located within the industry premises should be stopped completely by way of constructing suitable size of a garland drain all along the industry premises and same may be connected to rainwater holding pond and excess flow to TS canal, provided free from contamination, ***within a period of nine months*** and along the periphery of old iron oxide ponds ***by March 2023***. Also, the runoff should be neutralised if required, and ensured if required suitable and proper treatment, before its discharge.

7. Among the process changes, feasibility of inclusion of wash water option for recovery of acid (which should be recycled in the process) and neutralisation of iron oxide sludge using suitable chemicals prior to the disposal of iron oxide sludge into storage tank –***within three months***.
8. Lime treatment in the existing dump yards and surface water contaminated areas as temporary measures shall be continued-***on going***.
9. Regular water supply and periodical health camps should be ensured by the company to the affected people-***on going***.
10. Existing iron oxide pond capacity is exhausted, the industry is required to take immediate action for temporary storage and its safe disposal in accordance with the Hazardous and Other Waste (Management and Transboundary Movement) Rules, 2016 as amended ***with immediate effect***.
11. The R & D Options for utilisation of iron oxide sludge for recovery of iron through steel manufacturers required to be implemented within three months by obtaining requisite approvals from KSPCB and CPCB following the manifest as required under the Hazardous and Other Waste (Management and Transboundary Movement) Rules, 2016 as amended, for which suitable

conditions to be imposed and amended under the approvals granted to the industry by KSPCB. Also, M/s.KMML may explore the option of recovery of red oxide from iron oxide sludge presently being followed by M/s DCW in Tamilnadu, *within a period of three months*.

12. Detailed assessment of affected areas in the vicinity of M/s. KMML need to be ascertained through institute of repute and option of remediation of contaminated site as well as ground water as well as feasibility of acquisition of affected land i.e., contaminated land nearby premises of M/s.KMML also be explored and implemented, *for which time bound action plan to be submitted by M/s.KMML*.
13. M/s. KMML also ensure compliance to the CPCB directions issued under Section 5 of The Environment (Protection) Act, 1986 in April 2012, for environmentally sound management of hazardous waste in accordance with the Hazardous and Other Waste (Management and Transboundary Movement) Rules, 2016 as amended.
14. All the tube wells located within the industry premises shall be connected with tamper proof flow meter to record total water consumption of natural resources **within three months** and proper records to be maintained and submitted to Kerala SPCB on quarterly basis.
15. M/s. KMML is required to install OCEMS and also a flow meter at the effluent outlet discharge into sea to assess compliance to the effluent discharge norms prescribed under the Integrated Consent to Operate issued by Kerala SPCB under The Environment (Protection) Act, 1986. Also, OCEMS should be connected to Kerala SPCB server and also displayed at the entrance

of the industry for information of general public, **within five months.**

M/s. KMML shall ensure implementation of all the action plans as per time bound action plan suggested by the Joint Committee and Kerala State Pollution Control Board shall monitor periodically.

Submitted for kind consideration of this Hon'ble National Green Tribunal.



(Suman Billa)
Principal Secretary
Industries and NORKA Department



(S.Sreekala)
Chief Environmental Engineer
KSPCB, Thiruvananthapuram



(Afsana Perween)
District Collector
Kollam



(J.Chandra Babu)
Regional Director
CPCB, Bengaluru



(Dr. John C. Mathew)
Environment Programme Manager,
Directorate of Environment and Climate Change
Representing State Wetland Authority Kerala

Item No.11

(Court No. 2)

**BEFORE THE NATIONAL GREEN TRIBUNAL
PRINCIPAL BENCH**

(By Video Conferencing)
Original Application No.502/2022

Padmakumar ...Applicant

Versus

State of Kerala ...Respondent

Date of hearing: 29.08.2022

**CORAM: HON'BLE MR. JUSTICE ARUN KUMAR TYAGI, JUDICIAL MEMBER
HON'BLE DR. AFROZ AHMAD, EXPERT MEMBER**

Application is registered based on a Letter Petition received by Email.

ORDER

1. Padmakumar S resident of Kochuveetil, Mullakkeri Panmana, Manayil PO, Kannathu District, Kollam, Kerala has sent the present letter petition, which is treated and registered as original application, complaining that Kerala Minerals and Metals Ltd. (KMML) Chavara in village Pamana of Kollam District of Kerala is polluting the land and water bodies for about 30 years by discharging acid water. The area surrounding the factory has become unfit for any purpose. 15 families are residing close to the acid collecting tank of company. The villagers were forced to close drinking water wells which were filled with acid. Cultivation is also not possible in the area. Lots of coconut trees fell due to corroded land. The industry is pumping acid waste directly to sea and connected lake through canals. Vattakkayal, a part of Ashtmudi, Vembanad lake in Porookkara is now filled with the acid clay waste polluting the environment and endangering life of the villagers.



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SREEKALA S.
 Chief Environmental Engineer

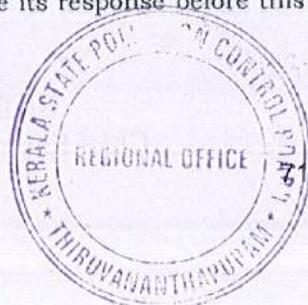
2. This Tribunal is empowered to *suo moto* take cognizance of the cases involving questions relating to environment arising out of the implementation of enactments specified in First Schedule of the National Green Tribunal Act, 2010 as held by Hon'ble Supreme Court in **Municipal Corporation of Greater Mumbai V/s. Ankita Sinha and others 2021 SSC Online SC 897.**

This Tribunal can also take cognizance of such cases on the basis of letter petitions in accordance with settled principles of law governing Public Interest Litigation.

3. *Prima facie*, the allegations made in the application raise questions relating to environment arising out of the implementation of the enactments specified in Schedule I to the National Green Tribunal Act, 2010. In view of the allegations made in the application, we consider it appropriate that a Joint Committee be constituted to verify the factual position. Accordingly, we constitute a Joint Committee comprising of Principal Secretary (Industries & NORKA), Government of Kerala, CPCB, State PCB, State Wet Land Authority and Collector, Kollam and direct the same to meet within two weeks, undertake visits to the site, look into the grievances of the applicant, associate the applicant and representative of the concerned project proponent, verify the factual position and submit its report within one month by e-mail at judicial-ngt@gov.in preferably in the form of searchable PDF/OCR Supported PDF and not in the form of Image PDF. The State PCB will be the nodal agency for coordination and compliance.

4. In case the Joint Committee observes any violation of consent conditions/environmental norms then it shall forward a copy of its report to

- (i) Project Proponent to enable it to comply with the recommendations in its report or file objections against the observations/recommendations in the report of the Joint Committee and file its response before this Tribunal as desired within one month




SREEKALA S.
Chief Environmental Engineer

from the date of receipt of a copy of the report of the Joint Committee;
and

(ii) Principal Secretary (Industries & NORKA), Government of Kerala, State PCB, State Wet Land Authority and Collector, Kollam to enable them to take appropriate remedial action by giving notice to/hearing the project proponent and following due process of law in accordance with Statutory provisions mandating them to take remedial action for prevention, control and abatement of environmental pollution/degradation and protection and improvement of environment and submit their action taken report within one month from the date of receipt of a copy of the report of the Joint Committee.

5. List for further consideration on 13.12.2022.
6. A copy of this order, along with a copy of the application and documents attached with the same, be forwarded to the Principal Secretary (Industries & NORKA), Government of Kerala, CPCB, State PCB, State Wet Land Authority and Collector, Kollam by e-mail for compliance.

Arun Kumar Tyagi, JM

Dr. Afroz Ahmad, EM

August 29, 2022
AG




SREEKALA S.
Chief Environmental Engineer

Item No.2

(Court No. 2)

**BEFORE THE NATIONAL GREEN TRIBUNAL
PRINCIPAL BENCH, NEW DELHI**

(Through Physical Hearing with Hybrid VC Option)
Original Application No.502/2022

Padmakumar

...Applicant

Versus

State of Kerala

...Respondent

Date of hearing: 13.12.2022

**CORAM: HON'BLE MR. JUSTICE ARUN KUMAR TYAGI, JUDICIAL MEMBER
HON'BLE DR. AFROZ AHMAD, EXPERT MEMBER**

Applicant: Mr. Arun Chand, Advocate (through VC).

Respondents: Mr. Nishe Rajen Shonker and Mr. Alim Anuar, Advocates
for State of Kerala.
Mr. Keerthi Priyan. E, Advocate for Mr. Jogy Scaria,
Advocate for Kerala State Pollution Control Board.

Application is registered based on a Letter Petition received by Email.

ORDER

1. Padmakumar S resident of Kochuveettil, Mullakkeri Panmana, Manayil PO, Kannathu District, Kollam, Kerala has sent the present letter petition, which is treated and registered as original application, complaining that Kerala Minerals and Metals Ltd. (KMML) Chavara in village Pamana of Kollam District of Kerala is polluting the land and water bodies for about 30 years by discharging acid water. The area surrounding the factory has become unfit for any purpose. 15 families are residing close to the acid collecting tank of company. The villagers were forced to close drinking water wells which were filled with acid. Cultivation is also not possible in the area.




SREEKALA S.
 Chief Environmental Engineer

Lots of coconut trees fell due to corroded land. The industry is pumping acid waste directly to sea and connected lake through canals. Vattakkayal, a part of Ashtmudi, Vembanad lake in Porookkara is now filled with the acid clay waste polluting the environment and endangering life of the villagers.

2. Vide order dated 29.08.2022, this Tribunal constituted a Joint Committee comprising of Principal Secretary (Industries & NORKA), Government of Kerala, CPCB, State PCB, State Wet Land Authority and Collector, Kollam and directed the same to submit factual and action taken report within one month and send the copies of the report of the Joint Committee to the Project Proponent/Statutory Authorities.

3. In compliance thereof, Mr. Sreekala S, Chief Environmental Engineer has submitted report of the Joint Committee vide email dated 29.11.2022.

4. In its report, the Joint Committee has submitted that the water and sludge samples taken from the industrial unit and its premises were taken to Central Laboratory, KSPCB, Ernakulam for processing and thereafter digested samples (21 Nos) were sent to Regional Lab of Regional Directorate, CPCB, Bengaluru for further analysis. As per the decision of the Joint Committee, the final report shall be prepared and submitted before this Tribunal at the earliest after obtaining the analysis result of the samples, sludge samples and samples of stagnant water near the industry premises collected during the visit of Joint Committee on 17.10.2022.

5. The Joint Committee is directed to submit its further report by 31.01.2023 by email at judicial-ngt@gov.in preferably in the form of searchable PDF/OCR Supported PDF and not in the form of Image PDF.

6. In view of the averments made in the application and observations made in the report of the Joint Committee, we consider it appropriate to




SREEKALA S.
Chief Environmental Engineer

have response of (1) State of Kerala through Chief Secretary, Government of Kerala, (2) Principal Secretary, Department of Industries & NORKA, State of Kerala, (3) State PCB, (4) Member Secretary, Kerala State Wetland Authority, (5) the District Collector, Kollam, and (6) the Project Proponent- M/s Kerala Minerals and Metals Ltd., who stand impleaded as respondents No. 1 to 6. The Registry is directed to prepare and attach memo of parties to the application and issue notices to respondents No. 1 to 6.

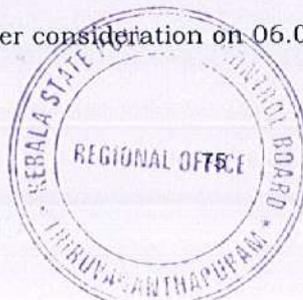
7. Notice requiring filing of reply/response within two months be served on the Project Proponent- M/s Kerala Minerals and Metals Ltd. through the District Collector, Kollam and for this purpose notice issued to the Project Proponent be sent to the District Collector, Kollam by E-mail for getting service of the same effected on it and sending his report in this regard.

8. Mr. Nishe Rajen Shonker and Mr. Alim Anuar, Advocates accept notice on behalf of respondents no. 1, 2, 4 and 5 and Mr. Keerthi Priyan. E, Advocate accepts notice on behalf of respondent no. 3 and they seek time to file reply/response on behalf of respondents no. 1 to 5.

9. Reply/response by respondents no. 1 to 6 be filed within two months by email at judicial-ngt@gov.in preferably in the form of searchable PDF/OCR Supported PDF and not in the form of Image PDF.

10. In view of the observations made in the report of the Joint Committee and environmental statutory enactments casting obligations on the State and its instrumentalities and State Pollution Control Board to protect and improve environment, the respondents no. 1 to 5 are also directed to take appropriate remedial measures and also file Action Taken Report alongwith their reply/response within two months as directed above.

11. List for further consideration on 06.03.2023.




SREEKALA S.
Chief Environmental Engineer

12. A copy of this order be sent to the District Collector, Kollam for requisite compliance for effecting service of notice on the project proponent and sending his report to this Tribunal

Arun Kumar Tyagi, JM

Dr. Afroz Ahmad, EM

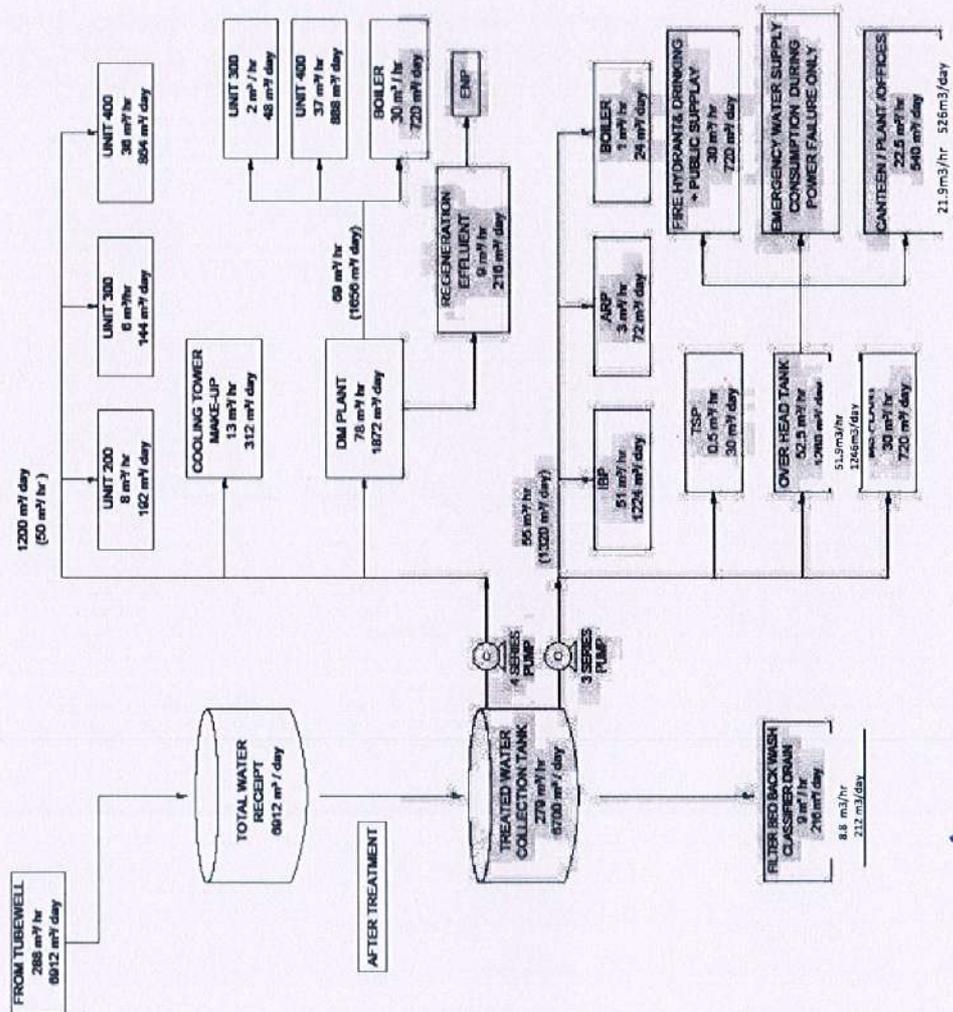
December 13, 2022
AG




SREEKALA S.
Chief Environmental Engineer

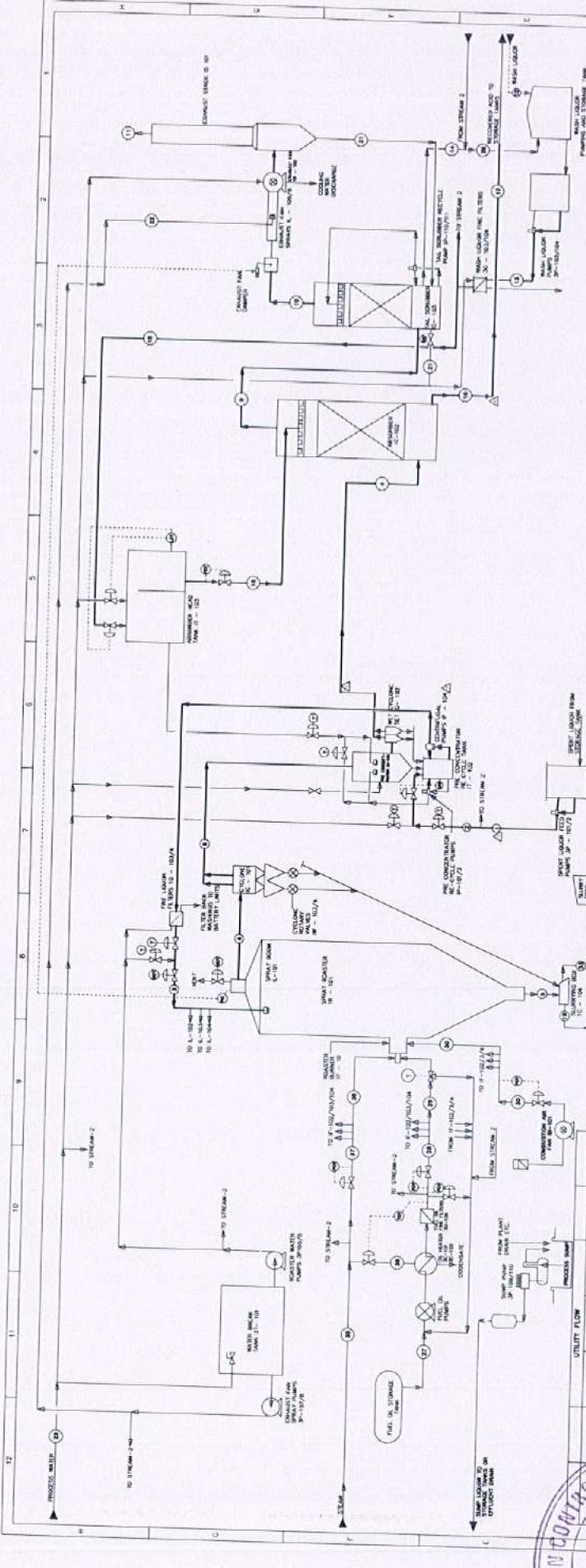
WATER CONSUMPTION DIAGRAM

6



SREEKALA S.
Chief Environmental Engineer





LINE NUMBER	DESCRIPTION	UNIT	FLOW RATE	TEMPERATURE	PHASE	TYPE	LOCATION
1
2
3
4
5
6
7
8
9
10
11
12

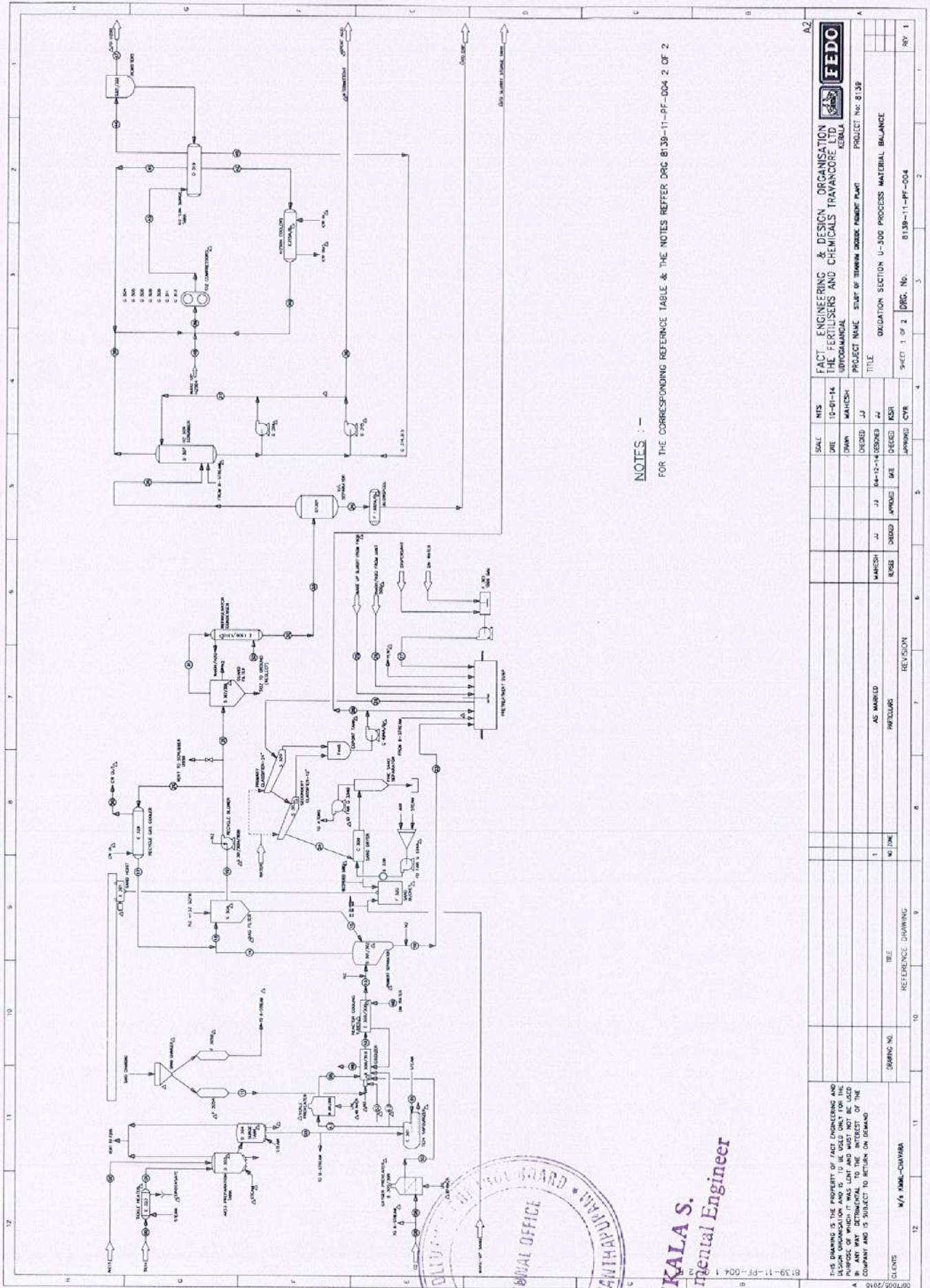
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DATE: 10-01-14
 DRAWN BY: M/S KAMU-CHAVARA
 CHECKED BY: M/S KAMU-CHAVARA
 APPROVED BY: M/S KAMU-CHAVARA

PROJECT NAME: FERTILISERS AND CHEMICALS TRANSCORE LTD
 PROJECT LOCATION: KERALA
 SHEET NO: 8139-11-PF-002



SREEKAAA S.
 Chief Environmental Engineer



NOTES :-

FOR THE CORRESPONDING REFERENCE TABLE & THE NOTES REFER TO DRG 8139-11-PF-004 2 OF 2



FACT ENGINEERING & DESIGN ORGANISATION
 THE FERTILISERS AND CHEMICALS TRAVANCORE LTD
 (HYDROCARBONAL)
 PROJECT NAME: STAFF OF TITANIUM DIOXIDE FERTILIZER PLANT
 PROJECT No: 8139

SCALE: NTS
 DATE: 10-01-14
 DRAWN: MANISHA
 CHECKED: JJ
 DESIGNED: JJ
 APPROVED: CVR

TITLE: OXIDATION SECTION U-100 PROCESS MATERIAL BALANCE
 SHEET 1 OF 2
 DRG. NO. 8139-11-PF-004
 REV 1

AS MARKED
 MANISHA
 REUSE
 DELETED
 APPROVED
 DATE
 APPROVED
 DATE

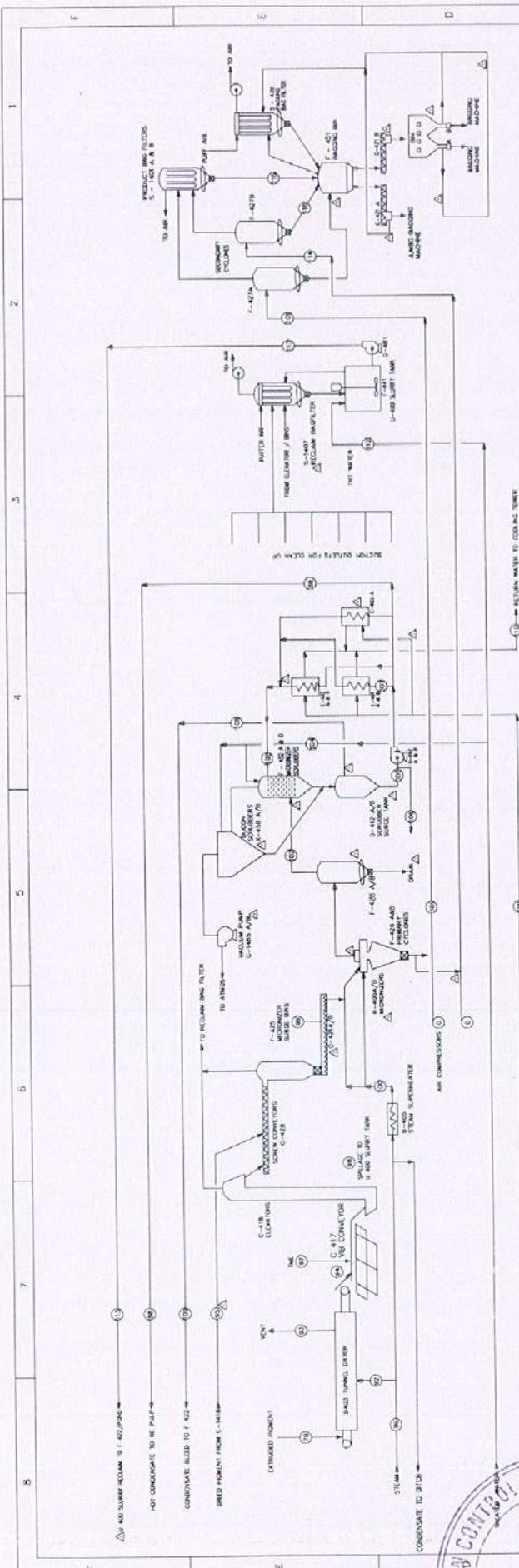
REVISION

REFERENCE DRAWING

CLIENTS: M/s. TANK-CHEMISA



Sreekala S.
SREEKALA S.
 Chief Environmental Engineer



CAKE TO DRYER	REPULP	SAT STEAM	VENT	DRY PIG	DRY PIG	LOSSES	MIC FEED SUPPLY	MIC PG AIR	STM TO SCR	TRTW	HTXC	BLEED	RECLAIM	TRTW	RECLAIM	SEC CYC	IN BAGS	
79	88	92	93	94	95	98	99	101	102	104	105	106	109	111	112	113	114	117
kg/h	kg/h	kg/h	kg/h	kg/h	kg/h	kg/h	kg/h	kg/h	kg/h	kg/h	kg/h	kg/h	kg/h	kg/h	kg/h	kg/h	kg/h	kg/h
654.21	9972.89	5000.64	102.64	171.07	4.92	268.79	14787.36	4005.88	15018.40	5804.08	317284.44	296371.54	109339.75	4.92	257.34	257.34	1.22	36.12
102	147.30		1853.34	3088.89	88.95	4553.28	308.75	4544.52	4586.43	4539.33	4377.67	161.45	88.95	88.95	88.95	183.79	4544.52	
3.75			47.15	78.57	2.27	123.46	7.86	119.25	119.25	11.39	4.11	2.27	2.27	2.27	2.27	3.91	115.60	
13539.58			49.11	81.84	2.36	128.59	8.18	120.41	124.21	120.31	116.02	4.29	2.36	2.36	2.36	4.08	120.41	
TOTAL	11553.11	10282.79	5000.64	2052.23	3420.36	98.5009	5374.11	14787.36	15343.2	5894.08	4774.94	4605.09	169.85	93.58	257.34	350.92	4780.53	4816.65



SREEKANTH
 Chief Environmental Officer

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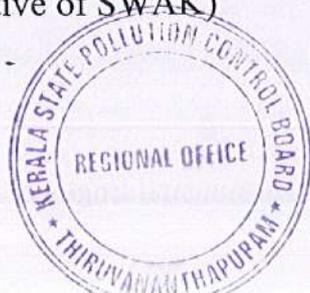
SCALE	NIS	DATE	10-01-14	DESIGNED	JJ	CHECKED	KSR	APPROVED	CVR	DATE	04-12-14	DESIGNED	JJ	CHECKED	KSR	APPROVED	CVR
PROJECT NAME	STUDY OF TITANIUM DIOXIDE PIGMENT PLANT PROJECT No: 8139																
TITLE	UNIT-400 PROCESS MATERIAL HEAT BALANCE																
SHEET NO	3 OF 3																
DRG. No.	8139-11-PF-005																
REV. 1																	

Minutes of the Joint Committee meeting (V. C.) held on 01/12/2022 in the chamber of Chief Environmental Engineer, Regional Office, Thiruvananthapuram

The Hon'ble NGT vide order in OA 502/2022 dated 29/08/2022 constituted a Joint Committee to verify the factual position with respect to Kerala Minerals and Metals Ltd (M/s KMML), Chavara, Kollam. Accordingly a joint committee meeting on 11/10/2022 and site visit on 17/10/2022 were conducted and samples were collected from M/s KMML and its premises.

A Joint Committee meeting was convened on 01/12/2022 through VC to discuss the analysis results of the samples collected on 17.10.2022 in and around the premises of M/s. KMML, under the Chairmanship of Principal Secretary, Industries & NORKA Department, Government of Kerala. Mrs. Sreekala, The Chief Environmental Engineer, Kerala SPCB welcomed all the members and the officials to the meeting. The following members of the Joint Committee and the officers attended the meeting.

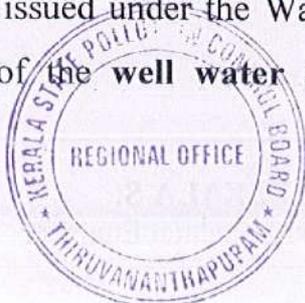
1. Sri. Suman Billa.,
Principal Secretary,
Industries & NORKA Department. - Member
2. Sri. J. Chandra Babu.,
The Regional Director,
Regional Directorate,
Central Pollution Control Board,
Bengaluru, Karnataka- 560079. - Member
3. Sri. Mukund Thakur I.A.S.,
Sub Collector, Kollam. - (on behalf of District Collector)
4. Dr. John C. Mathew
Environment Programme Manager
Directorate of Environment and Climate Change
Thampanoor, Thiruvananthapuram - Member
(Representative of SWAK)



SREEKALA S.
Chief Environmental Engineer

5. Mrs. S. Sreekala, - Nodal Officer
 Chief Environmental Engineer,
 Kerala State Pollution Control Board
 Regional Office, Thiruvananthapuram
6. Dr. Deepesh V.
 Scientist 'C'
 Central Pollution Control Board
 Regional Directorate (South), Bengaluru.
7. Smt. Rachel Thomas
 Environmental Engineer,
 District Office, Kollam
8. Smt. Sreetha A. M.,
 Assistant Environmental Engineer,
 Regional Office, Thiruvananthapuram.
9. Smt. Asha J.S.,
 Assistant Engineer,
 Regional Office, Thiruvananthapuram.

The Chief Environmental Engineer detailed about the analysis report of the samples collected. All the **stagnant water samples** collected from the nearby premises of the industry, the canal near MS plant, TS canal and near Vattakkayal had acidic pH in the range of 2-3. The parameters such as Iron and Manganese were exceeding the limits in all these locations. Zinc exceeded in two locations and Vanadium exceeded in some of the locations. The parameters such as Oil and grease, Total residual chlorine, Copper, Cadmium, Total chromium, Nickel, Lead, Arsenic and Titanium for all the samples collected outside the industry were Below Detectable Limit (BDL). The samples from the **ETP pond (supernatant) and approved discharge point of KMML** shows neutral pH whereas the parameters such as Total Suspended Solids, Total Chromium, Iron, Manganese, Vanadium, and Titanium were exceeding the limits prescribed under the Consent issued under the Water (Prevention and Control of Pollution) Act, 1974. One of the **well water sample** shows an acidic pH of 3.1 and the



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parameters such as Iron and Manganese are exceeding the limits prescribed for Drinking Water Specifications i.e., IS 10500:2012. The other two well water samples shows neutral pH and the value of Iron exceeding the limits prescribed for Drinking Water Specifications i.e., IS 10500:2012 and suspended solids were also present. The parameters such as Iron, Manganese, and Vanadium were present in the iron oxide sludge sample. All these parameters were exceeding the limits (as per MoEF guidelines) in the stagnant samples collected from the nearby premises. It may be inferred that there is every possibility of leakage or runoff from iron oxide sludge from the company to the nearby premises. The analysis of the stagnant water samples collected from the nearby area of the company show acidic pH and presence of heavy metals. All the three well water samples also show high concentration of iron and one sample shows acidic pH. It is understood that the nearby area is polluted and the wells are not fit for drinking purpose. The storm water sample (KLMK11) of the industry show acidic pH and presence of Iron, Manganese and Vanadium which implies that the land inside the industry is either polluted or there is a possibility of leakage / spillage of iron oxide sludge into nearby area including Vattakayal. The treated effluent sample from the industry shows total suspended solids and heavy metals above the limit specified which implies that the present treatment system is not adequate enough to comply with the effluent discharge standards and requires upgradation. The graphical representation of the analysis results were also presented during the meeting. Chief Environmental Engineer pointed out that the parameters of stagnant water is compared with MoEF guidelines with respect to surface water and the parameters of well water is compared with the drinking water specifications (I S 10500:2012)

Sri. J Chandra Babu, Regional Director CPCB Bengaluru was of the view that the analysis results of the collected effluent discharge sample reveal that the effluent discharge sample is exceeding limits permissible under the consent



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norms, and also existing effluent treatment system consisting of neutralization using lime followed by settling tank, which is not adequate for removal of heavy metals and also to comply with the effluent discharge norms. Therefore, he opined that existing effluent treatment system should be upgraded to ensure compliance to the consent discharge norms. Regional Director also added that there is every chance of runoff from the existing iron oxide pond area specially during monsoon resulting pollution of nearby land. In order to avoid this, scientific approach should be followed in line with the guidelines issued by CPCB from time to time. Regional Director also pointed out that proper sign boards should be placed at all the suitable places to avoid human/ animal contact with the polluted stagnant water bodies in the vicinity of the human habitation.

Members of the Joint Committee were of the view that actual problems associated with M/s. KMML need to be identified, both short term and long term remedial measures to be suggested to comply the same in a time bound manner by M/s KMML. Therefore, Committee members suggested for seeking extension of time for filing the final report through the KSPCB advocate.

The Regional director and Principal Secretary, Government of Kerala pointed out that the basic findings of the committee regarding the matter shall be shared with the company authorities and a meeting shall be scheduled to discuss the status and to further proceed in the matter. Kerala SPCB being nodal agency in the matter, necessary information to be collected from M/s. KMML authorities and draft Joint Committee report need to be prepared and circulated to the committee members at an early date seeking comments or views for its finalization and for filing before Hon'ble NGT for consideration.

The meeting ended with vote of thanks to the Chair.



SREEKALA S.⁴

Chief Environmental Engineer

CHIEF ENVIRONMENTAL ENGINEER

Minutes of the Joint Committee meeting held on 09/12/2022 at Kerala Minerals and Metals Ltd. (M/s KMML), Chavara, Kollam

The Joint Committee meeting was convened on 09/12/2022 at Kerala Minerals and Metals Ltd (M/s KMML), Chavara, Kollam premises to ensure compliance to the Hon'ble NGT order dated 29/08/2022 passed in OA No. 502/2022. At the outset, Mrs. Sreekala, The Chief Environmental Engineer, Kerala SPCB, Nodal Officer welcomed all the members of the Joint Committee and the officials attended the meeting. The following Joint Committee members and officers attended the meeting.

Joint Committee Members:-

1. Sri. Suman Billa.,
Principal Secretary,
Industries & NORKA Department. - Member (via V.C.)
2. Sri. J. Chandra Babu.,
The Regional Director,
Regional Directorate,
Central Pollution Control Board, - Member
3. Sri. Roy Kumar F.
Deputy Collector LA,
Collectorate, Kollam -- (on behalf of District Collector)
4. Dr. John C. Mathew
Environment Programme Manager
Directorate of Environment and Climate Change
Thampanoor, Thiruvananthapuram - Member
(Representative of SWAK)
5. Mrs. S. Sreekala, - Nodal Officer
Chief Environmental Engineer,
Kerala State Pollution Control Board
Regional Office, Thiruvananthapuram



1 **SREEKALA S.**
Chief Environmental Engineer

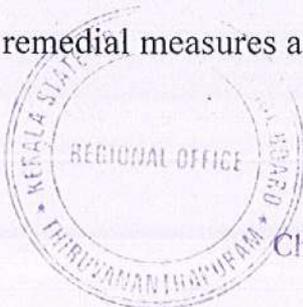
Officials attended the meeting: -

6. Smt. Rachel Thomas
Environmental Engineer, KSPCB
District Office, Kollam
7. Smt. Sreetha A. M.,
Assistant Environmental Engineer,
Regional Office, KSPCB, Thiruvananthapuram.
8. Smt. Asha J.S.,
Assistant Engineer,
Regional Office, KSPCB, Thiruvananthapuram.

Representatives of M/s KMML

1. Sri. Chandra Bose
Managing Director
Kerala Minerals and Metals Limited
2. Sri. Manikkuttan P.K.
HOU (TP/TSP)
Kerala Minerals and Metals Limited
3. Sri. Anilkumar K. S.
HOD (Environment)
Kerala Minerals and Metals Limited
4. Sri. Sahil M.
HOD (Projects)
Kerala Minerals and Metals Limited
5. Sri. Ajesh Chandran B.C.
Manager (Civil)
Kerala Minerals and Metals Limited

With the concurrence of committee, Sri. Chandra Bose, Managing Director, M/s.KMML made a presentation on the status of short term and long term remedial measures as detailed below:-



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- One of the short term remedial measure is construction of garland drain around the existing old dumpsite of Iron Oxide Sludge and is reported to be completed 75% around the new ETP and same expected to be completed by January 2023 and whereas around old ETP, about 40% of work completed and expected to be completed fully before by March 2023.
- Regarding the remediation of affected land around the company premises, test patches were carried out and expected to be completed by March 2023.
- As part of waste management, Geotube technology is proposed and is waiting to get approval from State Government as well as Central Pollution Control Board.
- Proposed modification of Acid Recovery plant as long term measure is pending for approval from Government of Kerala. After the modification of this plant, the iron oxide expected to be generated free from acid content and in saleable form. Another suggestion by NEERI was the value addition of the iron oxide sludge to saleable products.
- Managing Director also added that, one German company, M/s Tetrabic, approached to construct a plant inside the M/s.KMML for converting the ETP sludge and iron oxide sludge into usable products and this project is pending for State Government Approval.
- The ETP sludge (50000 Tonnes) is being transferred to M/s. Miracle Sands and Chemicals in Tamilnadu for processing and further utilization with the approval of the Kerala State Pollution Control Board (KSPCB). As on date, about 10000 Tonnes of ETP sludge already transferred to M/s. Miracle Sands and Chemicals in Tamilnadu.
- The Managing Director also apprised the committee that the internal R & D team has developed a new technology of converting acidic iron oxide sludge into neutral metallic iron and the samples are sent to some steel



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industries and waiting for their response for utilizing as raw material. The R & D wing has also come up with additional techniques which are under trial run. The production of DRI pellets from the iron oxide was also found successful within the company.

- About 2 to 3% of their profit is presently spending towards the company's corporate social commitment. The social commitment activities by the company include welfare activities in 7 wards including the drinking water supply, sanitation and also conducting of regular medical camps etc.

The Principal Secretary enquired whether these remedial measures are adequate for mitigating the defects noticed by the committee as part of the study. The Managing Director agreed that the water samples outside the company premises are found to be acidic in nature which is mainly due to the runoff from the existing iron oxide old dump site. As a short term measure, trial for remediation of affected land is under progress and same will be implemented to remediate the land outside the company premises, upon successful results. However, he expressed that permanent solution for this issue is acquisition of 76 acres of affected land around the company. Earlier 183 acres were identified and out of that, 76 acres were most affected area and the company have active plan to acquire that land.

To the query of The Principal Secretary regarding the adequacy of the proposed remedial measures suggested by the company to mitigate the pollution issues, Mr. Manikuttan, representative of KMML replied that even though the long term and short term measures were suggested, the acquisition of affected land is the final solution for this problem. Test patch study itself cost huge amount and about 2-3 km near the company needs to be remediated and it will become a huge burden for the company. He added that once the R & D study of the

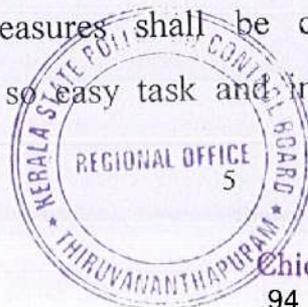


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company becomes successful the entire iron oxide sludge can be converted into value added products. The capping of the existing ponds can also be done to avoid overflow.

The Chief Environmental Engineer mentioned that there is no fruitful remedial measures put forwarded by the company to remediate the affected land near the industry. The patch test for the remediation of land and replication of it into the surrounding area will take long time.

The Regional Director, CPCB stated that some of the remedial measures by the company is as per recommendations of the expert institute of repute. The feasibility of the measures suggested by the company has to be examined in detail. Among the process change, one of the suggestions is that a wash water provision as option for recovery of acid (which should be recycled in the process) and the iron oxide sludge to be neutralized using suitable chemicals before disposal of iron oxide sludge into storage tank. The Regional Director also added that the runoff through proposed garland drain construction around the existing iron oxide pond need to be connected to the suitable treatment system to avoid acid bearing surface runoff into the nearby low lying areas or human habitation. He is of the view that better solution is that the entire existing iron oxide dump yard should be covered with suitable liners temporarily till zero waste policy is adopted. If no solution is found by the industry, entire iron oxide sludge yards to be capped permanently in line with the guidelines issued by CPCB. The Ground water monitoring has to be carried out in and all around the areas to check the contamination and for taking remedial measures if required. Also, signboards boards at all the salient points shall be placed where the contaminated stagnant water is present. Lime treatment in the existing dump yards as temporary measures shall be continued. The remediation of surrounding area is not so easy task and industry should come out with the



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alternate options for utilization of generated process sludge. The regular water supply and periodical health camps should be ensured by the company to the affected people. The R & D options to be implemented at an early date by taking requisite approvals from KSPCB and CPCB following the manifest as required under the Hazardous and Other Waste Transboundary Movement Rules, 2016 as amended, for which suitable conditions to be imposed and amended under the approvals granted to the industry by KSPCB. The company has to submit a time bound action plan covering all the feasible options for resolving all the associated problems. Regional Director also added that the tube well samples are being collected and analyzed and will come out with further suggestions, if required.

The committee also heard the applicant over telephone. The applicant Mr. Padmakumar informed that the acquisition of land near the temple area is not included due to political issues. He added that the committee also not visited the area on the southern side of the temple which is highly affected. There is no aim to close down the company. But the company is not at all complying with the directions of NGT. During the flood in 2018, red coloured water entered the nearby residents and polluted drinking water. Most of the affected areas are not considered even for land acquisition. In response, The Principal Secretary mentioned that the committee had made some additional recommendations to the company and the company will submit the action plan and it will be communicated to the complainant.

The Principal Secretary concluded that the company has to come up with detailed action plan as per the recommendations made by the committee and time bound action plan to be submitted to the Nodal Officer within a week to enable to take action for preparation of draft report of the Joint Committee by



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The Chief Environmental Engineer informed that the matter is listed for hearing on 13.12.2022 and additional time for filing final report of the Joint Committee before the Hon'ble NGT, would be sought through KSPCB legal Counsel.

The meeting ended with Vote of Thanks to all.


CHIEF ENVIRONMENTAL ENGINEER




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Chief Environmental Engineer