To,
The Additional Director
Ministry of Environment and Forests
Eastern Regional Office,
A/3, Chandrasekharpur
Bhubaneswar- 751023

Ref No: MGM/P&E/760/2016
Date: 30.11.2016

Sub: Submission of Six monthly compliance report on implementation of environmental safeguards of Tiringpahar Manganese Mine for the period from April'16 to September'16

Ref: Ministry of Environment and Forests Letter No: J-11015/87/2004-IA.II(M) dated 17.11.2005

Dear Sir,

We are herewith submitting the six monthly compliance report in respect of the stipulated environmental clearance conditions of Tiringphar Manganese Mine for the period from April'16 to September'16 as per EIA Notification, 2006.

We trust that the measures taken towards environmental safeguards comply with the stipulated environmental conditions. We look forward to your further guidance which shall certainly help us in our endeavor for further improve upon our Environmental Management practices.

Thanking you,
Yours faithfully
F: TATA STEEL LTD.

Agent, Tiringphar Manganese Mine &
Head (Manganese Group of Mines), Joda

Encl: As above

TATA STEEL LIMITED
Sukinda Chromite Mine PO Kalarangiatta Dist Jajpur Odisha 755026
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Registered Office Bombay House 24 Homi Mody Street Fort Mumbai 400 001 India
Tel 91 22 6665 8282 Fax 91 22 66657724
Corporate Identity Number L27100MH1907PLC000260 Website www.tatasteel.com

COMPLIANCE REPORT PERIOD: April'16 TO September'16

ENVIRONMENTAL CLEARANCE TO TIRINGPAHAR MANGANESE MINE OF TATA STEEL LIMITED VIDE MoEF's LETTER NO. J-11015/87/2004-IA.II (M) DATED 17.11.2005 COMMENTS SUBMITTED TO THE MINISTRY OF ENVIRONMENT & FORESTS, GOVERNMENT OF INDIA

Present Status of the Project:-

The Scheme of Mining and Progressive Mine Closure Plan for Tiringpahar Manganese Mine over an area of 643.710 ha. (RML – 169 ha & ML – 474.710 ha) was submitted under Rule No.12, MCDR 1988 for the period 2015-16 to 2019-20 and was approved by IBM vide letter no. MS/OTFM/34-ORI/BHU/2014-15

Sl. no	A : Specific conditions	Compliance status
1	Mining shall not be undertaken in areas of forestland within the lease without the necessary approvals / forestry clearance.	The mine has obtained forest clearance over 52.348 ha vide MoEF's letter No 8-80/2004-FC dt 28.03.2007. Further, in accordance to the MoEF & CC Circular dated F.No.8-78/1996-FC, dated.10.03.2015, the forest area as on 25.10.1980 (i.e. Sabik Settlement) 64.260ha. within the mining lease of 169 ha is now termed as forest land. Hence, fresh forest diversion proposal over an area of 80.826 ha (Sabik forest+ Balance forest) has been applied on 19.06.2016. The mining operation and allied activities are confined within the approved diverted area only.
2	Topsoil should be stacked properly with proper slope at earmarked site(s) with adequate measures and should be used for reclamation and rehabilitation of mined out area.	No top soil generated during April' 16 to September' 16 due to continuation of mine development within the broken up area only. However, most of the top soil generated earlier is used for development of park and nursery within the lease-hold area and plantation in the inactive dump slopes within the mine. Remaining top soil has been stacked properly with proper slope at earmarked site with adequate measures preservation measures.
3	OB and other wastes should be stacked at eannarked sites only and should not be kept active for long periods of ti me. Plantation should be taken up for soil stabilisali.on along the slopes of the dump and terraced after every 5-6 m of height and overall slope angle shall be maintained not	OB and other wastes are being dumped as per approved Scheme of Mining. The dump is terraced at every 10m and overall slope is maintained well within 28° as per approved Scheme of Mining. The inactive portion of OB dumps area being stabilized by plantation of local species. The inactive portion of OB dumps area being stabilized

	exceeding 28°. Sedimentation pits shall be constructed at the corners of the garland drains. Retention/toe walls shall be provided at the base of the dumps.	by plantation of fast growing species. Around 15400 nos. of saplings of local species (Gambhari, Chakunda, Mahanimba, Kala Sirs, Sisu, etc) were planted during 2015-16 with survival rate of 68%. Similarly during the year 2016-17, 20820 nos. were planted in inactive slope covering an area of 3.5 ha The retaining wall and garland drain with sedimentation pit at corners near toe of OB dump at maximum places has been constructed. Their dimensions are matching the requirements to arrest effectively the run off.
4	Minerals rejects shall be stacked separately at earmarked site/dump only.	The mineral rejects generated during manual processing of manganese ore (i.e. sorting, dressing and sizing) has been stacked separately at earmarked site.
5	Catch drains and siltation ponds of appropriate size should be constructed to arrest silt and sediment flows from soil, 0B and mineral dumps. The drains should be regularly desilted and maintained properly. Garland drains (size, gradient & length) and sump capacity should be designed keeping 50% safety margin over and above the peak sudden rainfall and maximum discharge in the area adjoining the mine site. Sump capacity should also provide adequate retention period to allow proper settling of silt material. Storm water return system should be provided. Storm water should not be allowed to go to the effluent treatment plant during high rainfall/super cyclone period. A separate storm water sump for this purpose should be created.	Existing catch drains and garland drains are covering the entire dump slope at low lying part. The catch drains and sedimentation pits are periodically de-silted and maintained properly. Size, gradient and length of the drains will be adequate to take care of the peak flow. The retaining wall and garland drain with sedimentation pit at corners near toe of OB dump at maximum places has been constructed. Their dimensions are matching the requirements to arrest effectively the run off.
6	Dimension of retaining wall at the toe of OB dumps and benches within the mine to check run-off and siltation should be based on the rainfall data.	In order to prevent the siltation and check the run-off, retaining wall and garland drain are provided with the dimension as; <u>Dimension of the Retaining Wall</u> : Height – 1 to 1.2 mtr. Width – 1 mtr. <u>Dimension of the Garland Drain</u> : Depth – 1.20 to 1.5 mtr. Width – 1 to 1.2 mtr.
7	Trace Metals such as Ni, Co, As and Hg should be analyzed in dust fall and soil samples for at least one year during summer, monsoon and winter seasons. If concentrations of these metals are found below the standards then with prior approval	Samples have been analyzed in dust fall & soil during post monsoon and winter season. The detail analysis result is enclosed as **Annexure-I (Dust Fall) & II (Soil).**

	of MOEF this specific monitoring could be discontinued.	
8	Mine Mineral and OB transportation shall be in trucks/dumpers covered with tarpaulins. Vehicular emissions should be kept under control and regularly monitored. Suitable measures should be taken to check fugitive emissions from haulage roads & transfer points, etc.	The trucks are being covered with tarpaulin during dispatch of manganese ore from mine to Ferro Alloys Plant and Railway Siding at Joda. OB is being transported by shovel – dumper combination from mine face to dumps located near the quarry itself within 1.5 Km. So, it is not in practice to cover the OB transpiration trucks with tarpaulin. All the trucks meant for transportation of mineral from mine to our captive plant & Railway Siding at Joda is bearing the "Pollution under Control' certificate. The emissions are under control. Provision of water sprinkling by mobile water sprinklers to suppress fugitive emission from haul roads has been made. The processed manganese ore is being transferred manually; hence there is no fugitive emission during transfer of ore.
9	A green belt of adequate width should be raised by planting the native species around ML area. Plantation should also be carried out along roads, OB dump sites etc. in consultation with the local DFO *I* Agriculture Department. The density of the trees should be not less than 2500 plants per ha.	• Reclamation and plantation programmes have been drawn. We have planted 1,62,799 nos. of saplings over an area of 39.4 ha in dumps, avenue and as green belt with 79% survival rate till 2015-16 • During the year 2015-16, 15400 nos. of saplings of local species has been planted. • During the year 2016-17, 20820 nos. were planted in inactive slope covering an area of 3.5 ha. • Tree density is maintained at the rate of 4000 saplings per ha. • The plantation includes the local species like Gambhari, Chakunda, Mahanimba, Kala Sirs, Sisu, etc.
10	Groundwater shall not be used for mine operations. Prior approval of CGWA shall be obtained for using groundwater.	Ground water use permission has been obtained from CGWA vide letter no. 21-4498)/CGWA/SER/2010-171, Dt.15.02.2011 for 208 m^3 per day. The ground water is not being used for mining and its allied activities.
11	Mining will not intersect groundwater. Prior pennission of the MOEF and CGWA shall be taken to mine below water table.	Mining is not intersecting the ground water as the Ground water being at lower level in comparison to existing maximum quarry depth.
12	Regular monitoring of ground water level and quality should be carried out by establishing a network of existing wells and constructing new piezometers. The monitoring should be done for quantity four times a year in pre-monsoon (April / May), monsoon	Ground water table is much below the existing mine workings because of mining operations are confined at hilly topography only. However, ground water level & quality at existing well at nearby villages is being monitored. The ground water level and quality monitoring results are

	(August). Post-monsoon (November) and winter (January) seasons and for quality in May. Data thus collected should be submitted to the Ministry of Environment & Forests and the Central Ground Water Authority quarterly.	enclosed as **Annexure III & IV** respectively.
13	Trace metals such as Fe, Cr+6, Cu, Se, As, Cd, Hg, Pb, Zn and Mn at specific locations for both surface water downstream and in ground water at lower elevations from mine area, shall be periodically monitored in consultation with the OSPCB and State Ground Water Board. Suitable treatment measures shall be undertaken in case levels are found to be higher than pennissible limits.	Trace metals such as Fe, Cr+6, Cu, Se, As, Cd, Hg, Pb, Zn and Mn at specific locations for both surface water (downstream & upstream) and ground water at lower elevation is being periodically monitored by referring to the standards as per BIS : 10500. The details of analysis result for ground water and surface water with standards are enclosed as **Annexure –V & VI** respectively.
14	"Consent to Operate" should be obtained from SPCB before expanding mining activities.	"Consent to operate" has been obtained from State Pollution Control Board, Orissa vide Order no.115 No.1482 / IND-I-CON-190 dated 19.01.2016 & valid up to 31.03.2021.
15	A Conservation Plan for conservation of endangered fauna including the Indian Elephant found in and around the mine area shall be prepared and implemented in consultation with identified agencies/institutions and with the State Forest Department. The Plan should be dovetailed with that prepared/under implementation/proposed for the endangered fauna found in the Reserve Forest in the buffer zone of the project site. The costs for the specific activities/taslcs should be earmarked in the Conservation Plan and shall not be diverted for any other purpose. Year.wise status of the implementation of the Plan and the expenditure thereon should be reported to the Ministry of Environment & forests, RO, Bhubaneshwar.	We have deposited Rs.25,20,385/- on 15.12.2005 with DFO, Keonjhar, Orissa being the contribution towards implementation of Wild Life Management Plan prepared for Bonai & Keonjhar division. We have also paid additional amount of Rs. 8,59,615 with DFO, Keonjhar, Orissa towards differential payment for implementation of regional Wildlife Management Plan prepared for Bonai & Keonjhar division. An amount of Rs. 3887000/- has been made on 30.07.2015 towards differential payment for implementation conservation of regional Wildlife management at the rate 43,000/ha. Further, Site Specific wildlife management plan has been approved as per the new guidelines.
16	A Final Mine Closure Plan along with details of Corpus Fund should be submitted to the Ministry of Environment & Forests 5 years in advance of final mine closure for approval.	A progressive mine closure plan for the period from 2014-15 to 2019-20 has been submitted to IBM and is under approval process. The final mine closure plan along with details of Corpus fund will be submitted to the Ministry of Environment & Forests in advance of final mine closure for approval.

<table>
<tr><th>Sl.No.</th><th>B : General Conditions</th><th>Compliance Status</th></tr>
<tr><td>1</td><td>No change in mining technology and scope of working should be made without prior approval of the Ministry of Environment & Forests.</td><td>No change in mining technology and scope of working has been made at the mine. If any changes proposed in technology and scope of workings, prior approval shall be sought from Ministry of Environment & Forests.</td></tr>
<tr><td>2</td><td>No change in the calendar plan including excavation, quantum of manganese ore and waste should be made.</td><td>Plan for production of Manganese Ore and excavation of waste has been prepared and is being strictly adhered. The plan vs actual for the year 2016-17(till September'16) is given below.
<table>
<tr><td>Year 2016-17 (Till Sept'16)</td><td>Plan</td><td>Actual</td></tr>
<tr><td>Total Excavation (cum)</td><td>7,10,000</td><td>16,217</td></tr>
<tr><td>OB (cum)</td><td>6,68,110</td><td>11,692</td></tr>
<tr><td>Production (MT)</td><td>85,000</td><td>10,587</td></tr>
</table></td></tr>
<tr><td>3</td><td>Four ambient air quality-monitoring stations should be established in the core zone as well as in the buffer zone for RPM. SPM, SO2, NOx. monitoring. Location of the stations should be decided based on the meteorological data, topographical features, and environmentally and ecologically sensitive targets in consultation with the State Pollution Control Board.

Data on ambient air quality (RPM, SPM, SO2 & NOx.) should be regularly submitted to the Ministry including its Regional office at Bhubaneshwar and the State Pollution Control Board I Central Pollution Control Board once in six months.</td><td>Six ambient air quality monitoring stations have been established out of which 2 nos. in core zone (Near Purnapani Quarry and Near Guruda mining area) & 4 nos. in buffer zone (at Jaribahal, Langalota, Palasa & Balda).
Samples are drawn twice in a week in core zone and once in a quarter in buffer zone to ascertain the 24 hour monitoring average for $PM_{10,}$ $PM_{2.5}$, So2 & NOx, CO & Mn.

Data on ambient air quality monitoring for every month is being submitted to State Pollution Control Board. Abstract of the monthly monitoring data on ambient air quality is enclosed as Annexure – VII.</td></tr>
<tr><td>4</td><td>Drills should be wet operated or with dust extractors and controlled blasting should be practiced.</td><td>Wet drilling concept is already in place.
Controlled blasting technique with NONEL is being practiced where ever required.</td></tr>
<tr><td>5</td><td>Fugitive dust emissions from all the sources should be controlled regularly monitored and data recorded properly. Water spraying arrangements on haul roads, wagon loading, dumpers/ trucks, loading &</td><td>Effective water sprinkling by mobile water tanker is being done on haul roads.

The Ambient Air Quality Report of Tiringpahar Mine is attached in Annexure VII.</td></tr>
</table>

	unloading points should be provided and properly maintained.	
6	Adequate measures should be taken for control of noise levels below 85 dBA in the work environment. Workers engaged in blasting and drilling operations, operations of HEMM, etc should be provided with ear plugs/ muffs.	Ear plugs & Ear muffs are provided to the workers working in drilling operations & DG operations. Noise monitoring done during the period April'16 to September'16 is attached in **Annexure VIII**
7	In Industrial waste water (workshop and waste water from the mine) should be properly collected, treated so as to conform to the standards prescribed under GSR 422 (E) dated 191b May, 1993 and 31 II December, 1993 or as amended from time to time. Oil and grease trap should be installed before discharge of workshop effluents.	No infrastructural facility has been installed for equipment/ vehicle within the lease hold area. The equipment and vehicles deployed in the mine are maintained at Bamebari Mn. Mines which is under same management control. The oil separation system has been provided at workshop at Bamebari and working effectively.
8	Environmental laboratory should be established with adequate number and type of pollution monitoring and analysis equipment in consultation with the State Pollution Control Board.	It is being done by M/s Visiontek Consultancy Service Pvt. Ltd and M/s Mitra S.K. Pvt. Ltd (Recognized as "A" category consultant as by State Pollution Control Board, Orissa). The type of pollution monitoring and analysis equipment used by M/s Mitra S.K. Pvt. is enclosed as **Annexure – IX.**
9	Personnel working in dusty areas should wear protective respiratory devices and they should also be provided with adequate training and information on safety and health aspects. Occupational health surveillance program of the workers should be undertaken periodically to observe any contractions due to exposure to dust and take corrective measures, if needed.	Suitable dust masks are being provided to employees (departmental & contractual) engaged in dusty operations. It is also ensured that they use the same. Employees are undergoing Periodical Medical Examination which is inclusive of lungs function test and audiometry. All the personnel are trained on safety in work place and continuous awareness programmes are being conducted for all employees to avert manganese poisoning. Periodical Medical Examination of employees (departmental & contractual) are conducted as per prescribed norms of Mines Rule, 1955. The initial and periodical examination includes blood haematology, blood pressure, detailed cardiovascular assessment, neurological examination etc. All chest radiographs are being classified for detection of pneumoconiosis, diagnosis and documentation made in accordance to ILO classifications. During 2011-12, 60 nos. of employees were examined. During 2012-13, a total no. of 240 employees were examined. During 2013-14 a total no. of 72 employees (Departmental-9 and contractor employees-63) were examined. During the calendar year

<table>
<tr><td></td><td></td><td>2015 IME was done for 14 employees and PME was done for 2 nos. employees.

The employees of Bamebari Manganese Mines and Tiringpahar Manganese Mines are shown together. There are no findings of pneumoconiosis and manganese poisoning which is classified as occupational disease.</td></tr>
<tr><td>10</td><td>A separate environmental management cell with suitable qualified personnel should be set up under the control of a Senior Executive, who will report directly to the Head of the Organization.</td><td>The department is in place and the Head of the department is reporting to General Manager of the division.
The organizational structure in place is enclosed as Annexure-X.</td></tr>
<tr><td>11</td><td>The funds earmarked for environmental protection measures should be kept in separate account and should not be diverted for other purpose. Year wise expenditure should be reported to the Ministry and its Regional Office located at Bhubaneshwar.</td><td>Funds allocated for environmental management are spent only for environment related purposes and not diverted to any other purpose.

The utilization of environment management for FY’15 was Rs. 14,74,498/- (Monitoring – Rs 10,93,403/- & Plantation - Rs. 3,81,094/-) against the budget of Rs 1500000/- (Monitoring - Rs, 15,00,000/- & Plantation - Rs. Nil) for Tiringpahar Manganese Mines.

The funds earmarked for environmental protection measures for the year 2016-17 is given below:
<table>
<tr><th>Sl.No.</th><th>Activity during plan period</th><th>Plan for year 2016-17 (Rs)</th></tr>
<tr><td>1</td><td>Construction of parapet wall/ retaining wall at toe of dumps</td><td>494500</td></tr>
<tr><td>2</td><td>Construction of settling ponds (Garland drains etc.).</td><td>51750</td></tr>
<tr><td>3</td><td>Afforestation</td><td>342375</td></tr>
<tr><td>4</td><td>Environmental Monitoring in Core & Buffer Zone</td><td>1500000</td></tr>
<tr><td colspan="2">Total</td><td>2388625</td></tr>
</table>
</td></tr>
<tr><td>12</td><td>The Regional Office of this Ministry located at Bhubaneshwar shall monitor compliance of the stipulated conditions. The project authorities should extend full cooperation to the officer (s) of the Regional Office by furnishing the requisite data I information I monitoring reports.</td><td>We shall extend to full co-operation to the officers of the Regional Office by furnishing the requisite date/information/monitoring reports.</td></tr>
<tr><td>13</td><td>A copy of clearance letter will be marked to the concerned Panchayat/local NGO, if any, from whom suggestion/ representation has been received while processing the proposal.</td><td>Copy of the clearance letter marked to Sarpanch, Gram Panchayat, Jajang on 12.01.2006.</td></tr>
</table>

14	The State Pollution Control Board should display a copy of the clearance letter at the Regional Office, District Industry Centre and Collector's Office/Tehsildar's Office for 30 days.	This is applicable to State Pollution Control Board, Orissa.
15	The project authorities should advertise at least in two local newspapers widely circulated around the project, one of which shall be in the vernacular of the locality concerned within seven days of the issue of the clearance letter informing that the project has been accorded environmental clearance and a copy of the clearance letter is available with the State Pollution Control Board and may also be seen at Web Site of the Ministry of Environment & Forests at http://envfor.nic.in. and a copy of the same should be forwarded to the Regional Office of this Ministry located at Bhubaneswar.	A detail of Environmental Clearance with regard to Tiringpahar Manganese Mine was published in Oriya News Papers Anupam Bharat & Aam Khabar dated 10.01.2006.
16	The Ministry or any other competent authority may stipulate any further condition for environmental protection.	Noted
17	Failure to comply with any of the conditions mentioned above may result in withdrawal of this clearance.	Noted
18	The above conditions will be enforced, inter alia, under the provisions of the Water (Prevention & Control of Pollution) Act, 1974, the Air (Prevention & Control of Pollution) Act, 1991 along with their amendments and rules.	Noted

Yours faithfully
F: TATA STEEL LTD.

Sd/-
Agent, Tiringpahar Mn.Mine &
Head (Manganese Group of Mines), Joda

Annexure – I

Mitra S. K. Private Limited

A/P.O.:BARBIL Ward No-5
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MSK
TESTING • INSPECTION

Ref. No.BBL/ENV/1318 Date:04/05/2016

DUST FALL ANALYSIS REPORT

Name of the Mines: Tiringpahar Manganese Mines

Period of Sampling: April' 2016

Sl.No.	Parameters	Location	
		Guruda Pit	Purunapani Pit
1	Nickel (as Ni) in %	0.0038	<0.0002
2	Cobalt (as Co) in %	0.0016	<0.0002
3	Mercury (as Hg) in %	<0.00001	<0.00001
4	Arsenic (as As) in %	<0.00003	<0.00003

For Mitra S. K. Private Limited

Authorised Signatory

Checked by:

MITRA S. K. (P) LTD. BARBIL

Visiontek Consultancy Services Pvt.Ltd.
(An Enviro Engineering Consulting Cell)
ISO 14001:2004
ISO 9001: 2008
OHSAS 18001:2007

Ref.: VCSPL/16/R-1078

Date: 05.10.2016

DUST FALL MONITORING REPORT FOR THE MONTH OF SEPTEMBER-2016

1. Name of Industry : **Tiringpahar Manganese Mines (M/s TATA Steel Limited)**
2. Sample collected by : VCSPL Representative in presence of TATA Representative

Sl No.	Parameters	Unit	Analysis Results
			DF-1
1.	Cobalt as Co	%	<0.001
2.	Nickel as Ni	%	<0.001
3.	Mercury as Hg	%	<0.001
4.	Arsenic as As	%	<0.001

Total Dust fall for the month of September-2016=0.33 t/km^2/month

For Visiontek Consultancy Services Pvt. Ltd.

VISIONTEK CONSULTANCY SERVICES PVT. LTD.

Plot No-108,District Centre,Chandrasekharpur,Bhubaneswar-16,Tel-91-674-2744594, 3250790
Email:visiontekin@gmail.com,visiontekin@yahoo.co.in,visiontek@vcspl.org, Visit us at: www.vcspl.org
"Committed For The Better Environment"

Annexure – II

Visiontek Consultancy Services Pvt.Ltd.

(An Enviro Engineering Consulting Cell)

ISO 14001:2004
ISO 9001: 2008
OHSAS 18001:2007

Ref.: VCSPL/16/R-1077 Date.: 05.10.2016

SOIL QUALITY ANALYSIS REPORT FOR THE MONTH OF SEPTEMBER-2016

1. Name of Industry : **Tiringpahar Manganese Mines (M/s TATA Steel Limited)**
2. Sampling Location : **S-1:** Guruda Pit
3. Date of Sampling : 22.09.2016
4. Date of Analysis : 23.09.2016 to 26.09.2016
5. Sample collected by : VCSPL Representative in presence of TATA Representative

Sl No.	Parameters	Unit	Analysis Results
			S-1
1.	Cobalt as Co	%	0.0011
2.	Nickel as Ni	%	0.04
3.	Mercury as Hg	%	<0.000002
4.	Arsenic as As	%	<0.000002

For Visiontek Consultancy Services Pvt. Ltd.

VISIONTEK CONSULTANCY SERVICES PVT. LTD.

Plot No-108,District Centre,Chandrasekharpur,Bhubaneswar-16,Tel-91-674-2744594, 3250790
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"Committed For The Better Environment"

Annexure – III Ground Water Level Monitoring

Mitra S. K. Private Limited

A/P O :BARBIL Ward No-6
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CIN. U51909WB1955PTC023037

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MSK TESTING • INSPECTION

Ref. No.BBL/ENV/1395 **DATE: 31/05/2016**

CERTIFICATE OF ANALYSIS

This is to certify that a sample of **"Ground Water Level Monitoring "** reading taken by our representative at **M/s. Tiringpahar Manganese Mines; P.O: Bamebari, Dist: Keonjhar, Odisha**, in the Presence of a representative of and on account of **M/s.Tata Steel Ltd.**,has been analysed with the following results:-

Date of Monitoring	Location	Water Level (Below Ground level, in mtrs)
06.05.2016	Well at Palasa Village	4.0
06.05.2016	Well at Palasa Village	6.5

Checked by:-

For Mitra S. K. Private Limited

Authorised Signatory

Ref.: VCSPL/16/R-906

Date.: 05.09.2016

GROUND WATER (LABEL) QUALITY ANALYSIS REPORT FOR THE MONTH OF AUGUST-2016

1. Name of Industry : **Tiringpahar Manganese Mines (M/s TATA Steel Limited)**
2. Sampling Location : **GW-1:** Palasa GW2- Joribahal
3. Label measured by : VCSPL Representative in presence of TATA Representative

Sl. No	Name of Village	Date	Unit	Result
1	Palasa	04.08.2016	Mt./bgl	3.8
2	Joribahal	20.08.2016	Mt./bgl	3.6

*For **Visiontek Consultancy Services Pvt. Ltd.***

VISIONTEK CONSULTANCY SERVICES PVT. LTD.

Annexure – IV Ground Water Quality Monitoring

Mitra S. K. Private Limited

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MSK TESTING • INSPECTION

Ref. No.BBL/ENV/1397 **DATE: 31/05/2016**

CERTIFICATE OF ANALYSIS

This is to certify that a sample of "**Ground Water** " drawn by our representative on 09/05/2016 at **Tiringpahar Manganeses Mines ; P.O: Bamebari, Dist: Keonjhar, Odisha** in the Presence of a representative of and on account of **M/s. Tata Steel Ltd.**, has been analyzed with the following results:-

MICROBIOLOGICAL ANALYSIS OF WATER AS PER IS: 10500 - 1991

Sl No.	Test Parameters	Norms as per IS:10500-1991	Results
1	Total Coliform Organism MPN/100ml	10 (MAX)	5.3
2	Faecal Coliforms	Absent	Absent
3	E. Coli	Absent	Absent

CHEMICAL ANALYSIS OF WATER AS PER IS: 10500 - 1991

Sl No.	Test Parameters	Norms as per IS: 10500-1991		Results
		Desirable Limit	Permissible Limit	
1	Colour (Hazen Unit)	5	25	<1.0
2	Odour	Unobjectionable	--	Unobjectionable
3	Taste	Agreeable	--	Agreeable
4	Turbidity in NTU	5	10	2
5	pH value (26^0C)	6.5 - 8.5	No Relaxation	6.9
6	Total Hardness(as $CaCO_3$) in mg/l	300	600	46.6
7	Iron (as Fe) in mg/l	0.3	1	0.1
8	Chloride (as Cl) in mg/l	250	1000	20.4
9	Fluoride (as F) in mg/l	1	1.5	<0.1
10	Residual Free Chlorine in mg/l	0.2(Min.)	---	<0.1
11	Total Dissolved Solids in mg/l	500	2000	80
12	Calcium (as Ca) in mg/l	75	200	12.4
13	Magnesium (as Mg) in mg/l	30	100	3.7
14	Copper (asCu) in mg/l	0.05	1.5	<0.02
15	Manganese (as Mn) in mg/l	0.1	0.3	<0.02
16	Sulphate (as SO_4) in mg/l	200	400	<1.0
17	Nitrate (as NO_3) in mg/l	45	100	1.42
18	Phenolic Compounds (as C_6H_5OH) in mg/l	0.001	0.002	<0.001
19	Mercury (as Hg) in mg/l	0.001	No Relaxation	<0.001
20	Cadmium (as Cd) in mg/l	0.01	No Relaxation	<0.001
21	Selenium (as Se) in mg/l	0.01	No Relaxation	<0.005
22	Arsenic (as As) in mg/l	0.05	No Relaxation	<0.01
23	Cyanide (as CN) in mg/l	0.05	No Relaxation	<0.01
24	Lead (as Pb) in mg/l	0.05	No Relaxation	<0.005
25	Zinc (as Zn) in mg/l	5	15	0.03
26	Anionic Detergents (as MBAS) in mg/l	0.2	1	<0.02
27	Chromium (as Cr^{+6}) in mg/l	0.1	No Relaxation	<0.01
28	Mineral Oil mg/l	---	---	<0.01
29	Alkalinity (as $CaCO_3$) in mg/l	200	600	27.2
30	Aluminium (as Al) in mg/l	0.03	0.2	<0.01
31	Boron (as B) in mg/l	1	5	<0.5
32	PAH mg/l	---	---	<0.0001
33	Pesticide mg/l	---	---	<0.00001

SAMPLING LOCATION :- :- Bore well at Sandhyaguda Chawk (Tiringpahar)

For Mitra S. K. Private Limited

Checked by:-

Authorised Signatory

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MITRA S. K. (P) LTD. BARBIL

Visiontek Consultancy Services Pvt.Ltd.

(An Enviro Engineering Consulting Cell)

ISO 14001:2004
ISO 9001: 2008
OHSAS 18001:2007

Ref.: VCSPL/16/R-904

Date.: 05.09.2016

GROUND WATER QUALITY ANALYSIS REPORT FOR THE MONTH OF AUGUST-2016

1. Name of Industry : **Tiringpahar Manganese Mines (M/s TATA Steel Limited)**
2. Sampling Location : **GW-1:**
   GW-2:
3. Date of sampling : 20.08.2016
4. Date of analysis : 22.08.2016 to 26.08.2016
5. Sample collected by : VCSPL Representative in presence of TATA Representative

Sl. No	Parameter	Testing Methods	Unit	Standard as per IS -10500:1991	Analysis Results	
					GW-1	GW-2
Essential Characteristics						
1	Colour	APHA 2120 B, C	Hazen	**5**	CL	CL
2	Odour	APHA 2150 B	--	**U/O**	U/O	U/O
3	Taste	APHA 2160 C	--	**Agreeable**	AL	AL
4	Turbidity	APHA 2130 B	NTU	**5**	<2	<2
5	pH Value	APHA 4500H^+ B	--	**6.5-8.5**	7.22	7.40
6	Total Hardness (as $CaCO_3$)	APHA 2340 C	mg/l	**300**	130	140
7	Iron (as Fe)	APHA 3500Fe, B	mg/l	**0.3**	0.18	0.22
8	Chloride (as Cl)	APHA 4500Cl^- B	mg/l	**250**	28.0	34.0
9	Residual, free Chlorine	APHA 4500Cl, B	mg/l	**0.2**	ND	ND
Desirable Characteristics						
10	Dissolved Solids	APHA 2540 C	mg/l	**500**	190	212
11	Calcium (as Ca)	APHA 3500Ca B	mg/l	**75**	35.3	38.5
12	Magnesium (as Mg)	APHA 3500Mg B	mg/l	**30**	10.2	10.7
13	Copper (as Cu)	APHA 3111 B,C	mg/l	**0.05**	<0.05	<0.05
14	Manganese (as Mn)	APHA 3500Mn B	mg/l	**0.1**	0.012	0.015
15	Sulphate (as SO_4)	APHA 4500 SO_4^{2-} E	mg/l	**200**	4.9	4.8
16	Nitrate (as NO_3)	APHA 4500 NO_3^- E	mg/l	**45**	2.5	2.4
17	Fluoride (as F)	APHA 4500F^- C	mg/l	**1.0**	0.017	0.019
18	Phenolic Compounds (as C_6H_5OH)	APHA 5530 B,D	mg/l	**0.001**	<0.001	<0.001
19	Mercury (as Hg)	APHA 3500 Hg	mg/l	**0.001**	<0.001	<0.001
20	Cadmium (as Cd)	APHA 3111 B,C	mg/l	**0.01**	<0.001	<0.001
21	Selenium (as Se)	APHA 3114 B	mg/l	**0.01**	<0.001	<0.001
22	Arsenic (as As)	APHA 3114 B	mg/l	**0.05**	<0.001	<0.001
23	Cyanide (as CN)	APHA 4500 CN^- C,D	mg/l	**0.05**	ND	ND
24	Lead (as Pb)	APHA 3111 B,C	mg/l	**0.05**	<0.001	<0.001
25	Zinc (as Zn)	APHA 3111 B,C	mg/l	**5**	BDL	BDL
26	Anionic Detergents (as MBAS)	APHA 5540 C	mg/l	**0.2**	ND	ND
27	Chromium (as Cr^{+6})	APHA 3500Cr B	mg/l	**0.05**	<0.05	<0.05
28	Mineral Oil	APHA 5220 B	mg/l	**0.01**	ND	ND
29	Alkalinity	APHA 2320 B	mg/l	**200**	118	128
30	Aluminium as(Al)	APHA 3500Al B	mg/l	**0.03**	<0.001	<0.001
31	Boron (as B)	APHA 4500B, B	mg/l	**1**	<0.01	<0.01
32	Poly Aromatic Hydrocarbon as PAH	APHA 6440 B	µg/l	**–**	<0.0001	<0.0001
33	Pesticide	APHA 6630 B,C	mg/l	**Absent**	Absent	Absent

Note: CL : Colourless, AL: Agreeable, U/O : Unobjectionable, ND:Not Detected.

For Visiontek Consultancy Services Pvt. Ltd.

VISIONTEK CONSULTANCY SERVICES PVT. LTD.

GW1 : Borewell at Sandhyaguda
GW2: Borewell at Palasa Village

Annexure - V Trace Metal Analysis in Ground Water

Mitra S. K. Private Limited

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MSK TESTING • INSPECTION

Ref. No.BBL/ENV/1311

DATE:04/05/2016

CERTIFICATE OF ANALYSIS

This is to certify that a sample of "**Ground Water** " drawn by our representative on 08/04/2016 at **Tiringpahar Manganeses Mines ; P.O: Bamebari, Dist: Keonjhar, Odisha** in the Presence of a representative of and on account of **M/s. Tata Steel Ltd.**, has been analyzed with the following results:-

CHEMICAL ANALYSIS OF WATER AS PER IS: 10500 - 1991

Sl No.	Test Parameters	Norms as per IS: 10500-1991		Results
		Desirable Limit	Permissible Limit	
1	Iron (as Fe) in mg/l	0.3	1	<0.05
2	Chromium (as Cr^{+6}) in mg/l	0.1	No Relaxation	<0.01
3	Copper (asCu) in mg/l	0.05	1.5	<0.02
4	Selenium (as Se) in mg/l	0.01	No Relaxation	<0.005
5	Arsenic (as As) in mg/l	0.05	No Relaxation	<0.01
6	Cadmium (as Cd) in mg/l	0.01	No Relaxation	<0.002
7	Mercury (as Hg) in mg/l	0.001	No Relaxation	<0.001
8	Lead (as Pb) in mg/l	0.05	No Relaxation	<0.005
9	Zinc (as Zn) in mg/l	5	15	<0.02
10	Manganese (as Mn) in mg/l	0.1	0.3	0.04

SAMPLING LOCATION :- Bore well at Guruda

For Mitra S. K. Private Limited

Authorised Signatory

Checked by:-

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MITRA S. K. (P) LTD. BARBIL

Ref.: VCSPL/16/R-905

Date.: 05.09.2016

GROUND WATER (TRESS METAL) QUALITY ANALYSIS REPORT FOR THE MONTH OF AUGUST-2016

1. Name of Industry : **Tiringpahar Manganese Mines (M/s TATA Steel Limited)**
2. Sampling Location : **GW-1:**
3. Date of sampling : 20.08.2016
4. Date of analysis : 22.08.2016 to 24.08.2016
5. Sample collected by : VCSPL Representative in presence of TATA Representative

Sl. No	Parameter	Testing Methods	Unit	Standard as per IS -10500:1991	Analysis Results
					GW-1
1	Iron (as Fe)	APHA 3500Fe, B	mg/l	**0.3**	0.18
2	Copper (as Cu)	APHA 3111 B,C	mg/l	**0.05**	< 0.05
3	Manganese (as Mn)	APHA 3500Mn B	mg/l	**0.1**	0.012
4	Chromium (as Cr^{+6})	APHA 3500Cr B	mg/l	**0.05**	< 0.05
5	Mercury (as Hg)	APHA 3500 Hg	mg/l	**0.001**	< 0.001
6	Cadmium (as Cd)	APHA 3111 B,C	mg/l	**0.01**	< 0.01
7	Selenium (as Se)	APHA 3114 B	mg/l	**0.01**	< 0.001
8	Arsenic (as As)	APHA 3114 B	mg/l	**0.05**	< 0.001
9	Lead (as Pb)	APHA 3111 B,C	mg/l	**0.05**	< 0.01
10	Zinc (as Zn)	APHA 3111 B,C	mg/l	**5**	<0.05

For Visiontek Consultancy Services Pvt. Ltd.

VISIONTEK CONSULTANCY SERVICES PVT. LTD.

GW1 : Bore Well at Palasa Village

Annexure – VI : Surface Water Analysis

TIRINGPAHAR UPSTREAM (Kundra Nallah entering Tiringpahar)				April'16	May'16	June'16	
Sl.	Parameters	Unit	Standards as per	1st Report	1st Report	1st Report	2nd Report
1	Colour	Hazen	5	<1.0	<1.0	<1.0	<1.0
2	Odour	-	Unobjectionable	Unobjectionable	Unobjectionable	Unobjectionable	Unobjectionable
3	pH at 26^0C	-	5.5-9.0	6.9	7.32	7.21	8.5
4	Total Dissolved Solids	mg/l	-	60	92	66	116
5	Copper as Cu	mg/l	3.0	<0.02	<0.02	<0.02	<0.02
6	Fluoride as F	mg/l	2.0	0.17	0.20	0.20	0.35
7	Total Residual Chlorine	mg/l	1.0	<0.1	<0.1	<0.1	<0.1
8	Iron as Fe	mg/l	3.0	0.64	0.72	1.74	1.32
9	Manganese as Mn	mg/l	2.0	<0.02	0.05	0.08	0.13
10	Nitrate as NO3	mg/l	10.0	<0.5	<0.5	<0.5	<0.5
11	Phenolic Compounds as C6H5OH	mg/l	1.0	<0.001	<0.001	<0.001	<0.001
12	Selenium as Se	mg/l	0.05	<0.005	<0.005	<0.005	<0.005
13	Cadmium as Cd	mg/l	2.0	<0.001	<0.001	<0.001	<0.001
14	Cyanide as CN	mg/l	0.2	<0.01	<0.01	<0.01	<0.01
15	Lead as Pb	mg/l	0.1	<0.005	<0.005	<0.005	<0.005
16	Mercury as Hg	mg/l	0.01	<0.001	<0.001	<0.001	<0.001
17	Nickel as Ni	mg/l	3.0	<0.02	<0.02	<0.02	<0.02
18	Arsenic as As	mg/l	0.2	<0.01	<0.01	<0.01	<0.01
19	Total Chromium as Cr	mg/l	2.0	<0.01	<0.01	<0.01	<0.01
20	Zinc as Zn	mg/l	5.0	<0.02	<0.02	<0.02	<0.02
21	Hexavalent Chromium as Cr^{+6}	mg/l	0.1	<0.01	<0.01	<0.01	<0.01
22	Vanadium as V	mg/l	0.2	<0.2	<0.2	<0.2	<0.2
23	Total Suspended Solids	mg/l	50 / 100	3.0	5.4	12.7	13.8
24	Temperature	^{0}C	-	28	28	28	28
25	Dissolved Oxygen	mg/l	-	6.2	6.2	6.4	6.0
26	BOD	mg/l	30	<2.0	<2.0	<2.0	<2.0
27	COD	mg/l	250	<4.0	<4.0	<4.0	<4.0
28	Oil & Grease	mg/l	10	<1.4	<1.4	<1.4	<1.4
29	Ammonical Nitrogen as N	mg/l	50	<0.1	<0.1	<0.1	<0.1
30	Total Kjedahl Nitrogen as N	mg/l	100	<0.3	<0.3	<0.3	<0.3
31	Sulphide as S	mg/l	2.0	<0.1	<0.1	<0.1	<0.1
32	Free Ammonia as NH_3	mg/l	5.0	<0.1	<0.1	<0.1	<0.1
33	Particulate Size of Suspended Solids	mg/l	Passes through 850 um IS sieve	Passes through 850 um IS sieve	Passes through 850 um IS sieve	Passes through 850 um IS sieve	Passes through 850 um IS sieve
34	Bio-assay	mg/l	All fishes survive after 96 hrs in 100% effluent	All fishes survive after 96 hrs in 100% effluent	All fishes survive after 96 hrs in 100% effluent	All fishes survive after 96 hrs in 100% effluent	All fishes survive after 96 hrs in 100% effluent
35	Dissolved Phosphates as PO_4	mg/l	5.0	<0.05	<0.05	<0.05	<0.05

TIRINGPAHAR DOWN DOWNSTREAM (Kundra Nallah leaving Tiringpahar)				April'16	May'16	June'16	
Sl.	Parameters	Unit	Standards as per	1st Report	1st Report	1st Report	2nd Report
1	Colour	Hazen	5	<1.0	<1.0	<1.0	<1.0
2	Odour	-	Unobjectionable	Unobjectionable	Unobjectionable	Unobjectionable	Unobjectionable
3	pH at 26^0C	-	5.5-9.0	7.25	7.4	7.11	8.1
4	Total Dissolved Solids	mg/l	-	69	94	69	107
5	Copper as Cu	mg/l	3.0	<0.02	<0.02	<0.02	<0.02
6	Fluoride as F	mg/l	2.0	<0.1	0.47	0.21	0.41
7	Total Residual Chlorine	mg/l	1.0	<0.1	<0.1	<0.1	<0.1
8	Iron as Fe	mg/l	3.0	0.75	0.41	1.94	1.08
9	Manganese as Mn	mg/l	2.0	<0.02	0.06	0.09	0.11
10	Nitrate as NO3	mg/l	10.0	<0.5	<0.5	<0.5	<0.5
11	Phenolic Compounds as C6H5OH	mg/l	1.0	<0.001	<0.001	<0.001	<0.001
12	Selenium as Se	mg/l	0.05	<0.005	<0.005	<0.005	<0.005
13	Cadmium as Cd	mg/l	2.0	<0.001	<0.001	<0.001	<0.001
14	Cyanide as CN	mg/l	0.2	<0.01	<0.01	<0.01	<0.01
15	Lead as Pb	mg/l	0.1	<0.005	<0.005	<0.005	<0.005
16	Mercury as Hg	mg/l	0.01	<0.001	<0.001	<0.001	<0.001
17	Nickel as Ni	mg/l	3.0	<0.02	<0.02	<0.02	<0.02
18	Arsenic as As	mg/l	0.2	<0.01	<0.01	<0.01	<0.01
19	Total Chromium as Cr	mg/l	2.0	<0.01	<0.01	<0.01	<0.01
20	Zinc as Zn	mg/l	5.0	<0.02	<0.02	<0.02	<0.02
21	Hexavalent Chromium as Cr^{+6}	mg/l	0.1	<0.01	<0.01	<0.01	<0.01
22	Vanadium as V	mg/l	0.2	<0.2	<0.2	<0.2	<0.2
23	Total Suspended Solids	mg/l	50 / 100	6.9	8.4	13.6	14.1
24	Temperature	^{0}C	-	28	28	28	28
25	Dissolved Oxygen	mg/l	-	5.2	6.4	6.1	6.3
26	BOD	mg/l	30	<2.0	<2.0	<2.0	<2.0
27	COD	mg/l	250	<4.0	<4.0	<4.0	<4.0
28	Oil & Grease	mg/l	10	<1.4	<1.4	<1.4	<1.4
29	Ammonical Nitrogen as N	mg/l	50	<0.1	<0.1	<0.1	<0.1
30	Total Kjedahl Nitrogen as N	mg/l	100	<0.3	<0.3	<0.3	<0.3
31	Sulphide as S	mg/l	2.0	<0.1	<0.1	<0.1	<0.1
32	Free Ammonia as NH_3	mg/l	5.0	<0.1	<0.1	<0.1	<0.1
33	Particulate Size of Suspended Solids	mg/l	Passes through 850 um IS sieve	Passes through 850 um IS sieve	Passes through 850 um IS sieve	Passes through 850 um IS sieve	Passes through 850 um IS sieve
34	Bio-assay	mg/l	All fishes survive after 96 hrs in 100% effluent	All fishes survive after 96 hrs in 100% effluent	All fishes survive after 96 hrs in 100% effluent	All fishes survive after 96 hrs in 100% effluent	All fishes survive after 96 hrs in 100% effluent
35	Dissolved Phosphates as PO_4	mg/l	5.0	<0.05	<0.05	<0.05	<0.05

TIRINGPAHAR UPSTREAM (Kundra Nallah entering Tiringpahar)			July'16		Aug '16		Sept '16		Oct '16	
Parameter	Standards as per IS-2296:1992 Class 'C'	Unit	1st Report	2nd Report	1st Report	2nd Report	1st Report	2nd Report	1st Report	2nd Report
Dissolved Oxygen (minimum)	4	mg/l	6.5	6.1	6.4	6.2	5.9	5.8	6.1	5.6
BOD (3) days at 27^0C (max)	3	mg/l	<2	<2	< 1.8	< 1.8	< 1.8	< 1.8	< 1.8	< 1.8
Total Coli form	5000	MPN/100 ml	210	350	350	220	540	410	450	380
pH Value	6.0-9.0		7.1	7.2	7.14	7.02	7.24	7.2	7.19	7.22
Colour (max)	300	Hazen	30	38	18	24	20	13	8	5
Total Dissolved Solids	1500	mg/l	112	115	118	112	120	124	122	126
Copper as Cu (max)	1.5	mg/l	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Iron as Fe (max)	0.5	mg/l	0.46	0.44	0.58	0.62	0.6	0.62	0.56	0.58
Chloride (max)	600	mg/l	18	20	22	18	22	24	18	22
Sulphates (SO_4) (max)	400	mg/l	5.5	5.8	4.8	4.9	4.9	4.7	4.6	5.1
Nitrate as NO_3 (max)	50	mg/l	2.2	2.1	1.8	1.9	1.6	1.5	1.7	1.9
Fluoride as F (max)	1.5	mg/l	0.02	0.018	0.01	0.014	0.015	0.018	0.016	0.024
Phenolic Compounds as C_6H_5OH (max)	0.005	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Cadmium as Cd (max)	0.01	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Selenium as Se (max)	0.05	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Arsenic as As	0.2	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Cyanide as CN (max)	0.05	mg/l	ND	ND	ND	ND	ND	ND	ND	ND
Lead as Pb(max)	0.1	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Zinc as Zn(max)	15	mg/l	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Hexa Chromium as Cr^{+6}	0.05	mg/l	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Anionic Detergents (max)	1	mg/l	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Total Suspended Solids		mg/l			90	88	56	64	51	52
Turbidity in		NTU			110	170	130	100	60	38
E. coli		MPN/100ml			Absent	Absent	Absent	Absent	Absent	Absent

TIRINGPAHAR DOWNSTREAM (Kundra Nallah leaving Tiringpahar)			July'16		Aug '16		Sept '16		Oct '16	
Parameter	Standards as per IS-2296:1992 Class 'C'	Unit	1st Report	2nd Report	1st Report	2nd Report	1st Report	2nd Report	1st Report	2nd Report
Dissolved Oxygen (minimum)	4	mg/l	6.4	6.2	6.5	6	5.7	6	5.8	6
BOD (3) days at 27^0C (max)	3	mg/l	<2	<2	< 1.8	< 1.8	< 1.8	< 1.8	< 1.8	< 1.8
Total Coli form	5000	MPN/100 ml	220	350	280	210	510	450	520	350
pH Value	6.0-9.0		7.2	7.3	7.18	7.1	7.22	7.16	7.24	7.18
Colour (max)	300	Hazen	29	35	22	25	18	12	6	5
Total Dissolved Solids	1500	mg/l	114	116	114	115	118	120	124	128
Copper as Cu (max)	1.5	mg/l	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Iron as Fe (max)	0.5	mg/l	0.42	0.4	0.6	0.65	0.64	0.58	0.54	0.6
Chloride (max)	600	mg/l	16	21	20	19	20	22	20	25
Sulphates (SO_4) (max)	400	mg/l	5.2	5.3	4.6	5.1	4.7	4.5	4.8	5.2
Nitrate as NO_3 (max)	50	mg/l	2.3	2.1	1.7	2	1.8	1.4	1.8	2.1
Fluoride as F (max)	1.5	mg/l	0.02	0.017	0.012	0.015	0.015	0.013	0.018	0.02
Phenolic Compounds as C_6H_5OH (max)	0.005	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Cadmium as Cd (max)	0.01	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Selenium as Se (max)	0.05	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Arsenic as As	0.2	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Cyanide as CN (max)	0.05	mg/l	ND	ND	ND	ND	ND	ND	ND	ND
Lead as Pb(max)	0.1	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Zinc as Zn(max)	15	mg/l	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Hexa Chromium as Cr^{+6}	0.05	mg/l	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Anionic Detergents (max)	1	mg/l	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Total Suspended Solids		mg/l			94	115	48	58	52	44
Turbidity in		NTU			140	190	120	90	42	41
E. coli		MPN/100ml			Absent	Absent	Absent	Absent	Absent	Absent

Annexure – VII: Ambient Air Quality Monitoring

TMM (Near Purunapani)

Monthly Average	PM_{10} ($\mu g/m^3$)	$PM_{2.5}$ ($\mu g/m^3$)	SO_2 ($\mu g/m^3$)	NO_2 ($\mu g/m^3$)	NH_3 ($\mu g/m^3$)	O_3 ($\mu g/m^3$)	CO (mg/m^3)	Pb ($\mu g/m^3$)	Ni (ng/m^3)	Mn ($\mu g/m3$)	As (ng/m^3)	Benzene ($\mu g/m^3$)	Benzo(a) pyrene (ng/m^3)
Apr-16	51.60	24.00	4.80	15.00	10.00	19.62	0.12	<0.02	<4	0.11	<1	<2.08	<0.4
May-16	49.00	22.00	4.90	14.70	10.00	19.62	0.12	<0.02	<4	0.10	<1	<2.08	<0.4
Jun-16	43.50	19.90	4.50	15.20	10.00	19.62	0.14	<0.02	<4	0.06	<1	<2.08	<0.4
Jul-16	32.81	15.22	4.00	9.00	<20	<4	0.11	<0.001	<0.01	<0.001	<0.001	<0.001	<0.002
Aug-16	30.26	14.48	4.00	9.00	<20	<4	0.11	<0.001	<0.01	<0.001	<0.001	<0.001	<0.002
Sep-16	31.16	14.60	4.00	9.10	<20	<4	0.10	<0.001	<0.01	<0.001	<0.001	<0.001	<0.002
ANNUAL AVERAGE	39.72	18.37	4.37	12.00	10.00	19.62	0.12	--	--	0.09	--	--	--

TMM (Near Guruda Pit)

Monthly Average	PM_{10} ($\mu g/m^3$)	$PM_{2.5}$ ($\mu g/m^3$)	SO_2 ($\mu g/m^3$)	NO_2 ($\mu g/m^3$)	NH_3 ($\mu g/m^3$)	O_3 ($\mu g/m^3$)	CO (mg/m^3)	Pb ($\mu g/m^3$)	Ni (ng/m^3)	Mn ($\mu g/m3$)	As (ng/m^3)	Benzene ($\mu g/m^3$)	Benzo(a) pyrene (ng/m^3)
Apr-16	67.4	34.7	5.2	22.4	10.3	20.7	0.22	<0.02	<4	0.16	<1	<2.08	<0.4
May-16	59	31	5.7	22.3	10.4	19.9	0.21	<0.02	<4	0.13	<1	<2.08	<0.4
Jun-16	57.90	29.20	5.20	22.00	10.40	19.90	0.22	<0.02	<4	0.12	<1	<2.08	<0.4
Jul-16	32.67	15.28	4.00	9.00	<20	<4	0.11	<0.001	<0.01	<0.001	<0.001	<0.001	<0.002
Aug-16	30.89	14.96	4.00	9.00	<20	<4	0.11	<0.001	<0.01	<0.001	<0.001	<0.001	<0.002
Sep-16	32.03	15.14	4.00	9.00	<20	<4	0.11	<0.001	<0.01	<0.001	<0.001	<0.001	<0.002
ANNUAL AVERAGE	46.65	23.38	4.68	15.62	10.37	20.17	0.16	--	--	0.14	--	--	--

Annexure – VIII Noise Monitoring

Tiringpahar		Parameter	May'16			Aug16
			Max	Min	Avg.	Avg.
1	Tiringpahar	dB (A) in Day Time	73.1	40.2	53.6	54
2	Tiringpahar	dB (A) in Night Time	52.3	37.6	42.4	34

Annexure - IX

LIST OF ENVIRONMENTAL MONITORING EQUIPMENT

Ambient Air Quality		
Sl.No.	**Name of the Instrument**	**Parameter**
1	Respirable Dust sampler	PM_{10}
2	Fine Particulate Sampler	$PM_{2.5}$
3	Spectrophotometer UV-Visible range	SO_2,NO_x
4	NDIR	CO
5	AAS	Manganese
Other Paraphernalia for analysis of air quality are also available in the laboratory.		
Water Quality		
Sl.No.	**Name of the Instrument**	**Parameter**
1	Analytical weighing Balance	Used for weighing the chemicals
2	Micro Balance	Used for weighing CRMs
3	AAS with VGA and Hallow cathode lamps	All Heavy metals (Arsenic, Mercury, Selenium, Cadmium, Chromium, Cobalt, Iron, Lead, Manganese, Zinc, Aluminium, etc..)
4	Spectrophotometer UV-Visible range	Nitrate, Nitrite, Sulphate, Chromium(VI),Fluoride, Cyanide, Phenolic compounds
5	Flame Photometer	Sodium ,Potassium
6	Ion Analyzer	Fluoride
7	BOD Incubator	BOD
8	COD Digester	COD
9	Furnace	Total volatile solids, Fixed solids
10	Hot Air Oven	Total Suspended Solids, Total Dissolved Solids
11	pH meter	pH
12	Conductivity meter	Conductivity
13	Turbidity Meter	Turbidity
14	Bacteriological Incubator	Total coli form and fecal coli form
15	Autoclave	sterilization
16	Microscope	Bacteriological colony count
17	Magnetic stirrer	Stirring purpose
18	Vacuum filtration unit	Rapid filtration
19	Water Bath	Boiling and evaporation purpose
20	Cadmium reduction column	Nitrate
21	Fluoride distillation unit	Fluoride
22	Kjeldal flask	Ammonia and Organic Nitrogen
23	Hot Plate	Digestion
24	Pizometer	Water level monitoring
25	Aquarium	Bio assay test
Adequate Titration , Distillation and Filtration unit with sufficient glassware required for laboratory analysis are available with us.		

Annexure – X

Organizational Structure