# COMPLIANCE REPORT PERIOD: Oct'15 TO March'16

# ENVIRONMENTAL CLEARANCE TO TIRINGPAHAR MANGANESE MINE OF TATA STEEL LIMITED VIDE MoEF's LETTER NO. J-11015/87/2004-1A.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.<br>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. | During the year 2015-16, 120 cum top soil was generated. Most of this top soil has been used for plantation on dumps. Remaining top soil has been stacked properly with proper slope at earmarked site with adequate 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.<br><br>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 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. | OB and other wastes are being dumped as per approved Scheme of Mining.<br><br>The inactive portion of OB dumps area being stabilized by plantation of fast growing species.15400 nos. of saplings of local species (Gambhari, Chakunda, Mahanimba, Kala Sirs, Sisu, etc) were planted during 2015-16 with survival rate of 68%.<br><br>The overall slope angles of OB dumps are maintained within the natural angle of repose of the waste.<br><br>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. |

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|---|---|---|
| 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.<br>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.<br>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.<br>Size, gradient and length of the drains will be adequate to take care of the peak flow.<br><br>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;<br><u>Dimension of the Retaining Wall</u> :<br>Height – 1 to 1.2 mtr. Width – 1 mtr.<br><u>Dimension of the Garland Drain</u> :<br>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 of MOEF this specific monitoring could be discontinued. | Samples have been analyzed in dust fall & soil during post monsoon and winter season.<br><br>The detail analysis result is enclosed as **Annexure-I (Dust Fall ) & II (Soil).** |
| 8 | Mine Mineral and OB transportation shall be in trucks/dumpers covered with tarpaulins.<br><br>Vehicular emissions should be kept under control and regularly monitored.<br><br>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.<br>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.<br>Provision of water sprinkling by mobile water sprinklers to suppress fugitive |

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| | | emission from haul roads has been made.<br>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 1,47,399 nos. of saplings over an area of 38.20 ha with 79% survival rate till 2014-15<br>• During the year 2015-16, 15400 nos. of saplings of local species has been planted.<br>• Tree density is maintained at the rate of 4000 saplings per ha.<br>• 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.<br>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 (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. | 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.<br><br>The ground water level and quality monitoring results are 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.<br><br>The details of analysis result for ground water and surface water with standards are enclosed as **Annexure –V & VI** respectively. |

<table>
<tr><td>14</td><td>"Consent to Operate" should be obtained from SPCB before expanding mining activities.</td><td>“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.</td></tr>
<tr><td>15</td><td>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.</td><td>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.<br><br>Further, Site Specific wildlife management plan has been approved as per the new guidelines.</td></tr>
<tr><td>16</td><td>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.</td><td>A progressive mine closure plan for the period from 2014-15 to 2019-20 has been submitted to IBM and is under approval process.<br>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.</td></tr>
<tr><td>Sl.No.</td><td>B : General Conditions</td><td>Compliance Status</td></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 to:
<table>
<tr><td>2015-16</td><td>Plan</td><td>Actual</td></tr>
<tr><td>Total Excavation (cum)</td><td>735000</td><td>244960</td></tr>
<tr><td>OB (cum)</td><td>693670</td><td>230678</td></tr>
<tr><td>Production (MT)</td><td>85000</td><td>30351</td></tr>
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| 3 | 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.<br><br>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. | Six ambient air quality monitoring stations have been established out of which 2 nos. in core zone (Near Pump House) and Guruda mining area & 4 nos. in buffer zone (at Jaribahal, Langalota, Palasa & Balda).<br>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.<br><br>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.** |
| 4 | Drills should be wet operated or with dust extractors and controlled blasting should be practiced. | Wet drilling concept is already in place.<br>Controlled blasting technique with NONEL is being practiced where ever required. |
| 5 | 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 & unloading points should be provided and properly maintained. | Effective water sprinkling by mobile water tanker is being done on haul roads.<br><br>The Ambient Air Quality Report of Tiringpahar Mine is attached in **Annexure VII.** |
| 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.<br><br>Noise monitoring done during the period Oct'16 to March'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. | There is 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 SS Environics India Pvt. Ltd and Mitra S.K Pvt. Ltd. (Recognized as "A" category consultant as by State Pollution Control Board, Orissa).<br>The type of pollution monitoring and analysis equipment used by M/s Mitra S.K Pvt. Ltd. is enclosed as **Annexure – IX.** |

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| 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.<br><br>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.<br><br>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 2015 IME was done for 14 employees and PME was done for 2 nos. employees.<br><br>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. |
| 10 | 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. | The department is in place and the Head of the department is reporting to General Manager of the division.<br>The organizational structure in place is enclosed as **Annexure-X.** |
| 11 | 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. | Funds allocated for environmental management are spent only for environment related purposes and not diverted to any other purpose.<br><br>The utilization of environment management for FY'15 was Rs. 14,74,498/- (Monitoring – Rs 10,93,403/- & Plantation - Rs. 3,81,094/-) |

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| | | against the budget of Rs 1500000/- (Monitoring - Rs, 15,00,000/- & Plantation - Rs. Nil) for Tiringpahar Manganese Mines. |
| 12 | 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. | We shall extend to full co-operation to the officers of the Regional Office by furnishing the requisite date/information/monitoring reports. |
| 13 | 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. | Copy of the clearance letter marked to Sarpanch, Gram Panchayat, Jajang on 12.01.2006. |
| 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

At/P.O.:BARBIL Ward No-6
Dist.: Keonjhar, Odisha - 758035
CIN: U51909WB1956PTC023037

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MSK TESTING • INSPECTION

Ref. No.BBL/ENV/847

Date:04/01/2016

## DUST FALL ANALYSIS REPORT

**Name of the Mines :** Tiringpahar Manganese Mines

**Period of Sampling:** December'2015

| Sl.No. | Parameters | Location | |
|---|---|---|---|
| | | Guruda Pit | Purunapani Pit |
| 1 | Nickel (as Ni) in % | 0.0033 | <0.0002 |
| 2 | Cobalt (as Co) in % | 0.0019 | <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

Checked by:-

MITRA S.K. (P) LTD. BARBIL

Authorised Signatory

**Annexure – II**


# S.S.Environics (India) Pvt. Ltd.

*(An ISO 9001:2008, 14001:2004 and OHSAS 18001:2007 Certified Company)*

Plot No-361/2314 "Sustenance Tower"
At: Patrapada, P.O: Dumuduma, Dist: Khurda, Bhubaneswar-751 019, Odisha
Tele Fax: 0674-2471574, E-mail : emails@ssenvironics.com


*Ref No:* SSE/15/R-0935

Date: 04.06.2015

## SOIL QUALITY ANALYSIS RESULTS FOR TRACE METALS

**Name of the Mines** : **Tiringpahar Manganese Mine (Tata Steel Ltd)**

Location of Sampling : S1: Guruda pit
S2: Purunapani

Date of Sampling : 26.05.2015

Date of Analysis : 28.05.2015

| Sl. No. | Parameters | S1 | S2 |
|---|---|---|---|
| 1. | Nickel as (Ni) in % | 0.038 | 0.026 |
| 2. | Cobalt as (Co) in % | Nil | Nil |
| 3. | Arsenic as (As) in % | 0.024 | 0.021 |
| 4. | Mercury as (Hg) in % | Nil | Nil |

S.S. Environics (India) Pvt. Ltd. BBSR

For S.S Environics (India) Pvt. Ltd.

## Annexure – III Ground Water Level Monitoring

Mitra S. K. Private Limited

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MSK TESTING • INSPECTION

**Ref. No.BBL/ENV/687**

**Date:14/11/2015**

### 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) |
|---|---|---|
| 07.11.2015 | Well at Palasa Village | 4.5 |
| 07.11.2015 | Well at Palasa Village | 5.7 |

**For Mitra S. K. Private Limited**

**Checked by:-**

**Authorised Signatory**

Mitra S. K. Private Limited

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MSK TESTING • INSPECTION

**Ref. No.BBL/ENV/1090** **Date:04/03/2016**

## 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) |
|---|---|---|
| 12.02.2016 | Well at Palasa Village | 5.5 |
| 12.02.2016 | Well at Palasa Village | 6.3 |

**Checked by:-**

MITRA S. K. (P) LTD. BARBIL

**For Mitra S. K. Private Limited**

**Authorised Signatory**

## Annexure – IV Ground Water Quality Monitoring


Mitra S. K. Private Limited

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MSK TESTING • INSPECTION

**Ref. No.BBL/ENV/678** **Date:14/11/2015**

### CERTIFICATE OF ANALYSIS

This is to certify that a sample of "**Ground Water** " drawn by our representative on 03/11/2015 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) | <1.8 |
| 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 | <1.0 |
| 5 | pH value ($26^0$C) | 6.5 - 8.5 | No Relaxation | 6.9 |
| 6 | Total Hardness(as $CaCO_3$) in mg/l | 300 | 600 | 34.4 |
| 7 | Iron (as Fe) in mg/l | 0.3 | 1.0 | 0.15 |
| 8 | Chloride (as Cl) in mg/l | 250 | 1000 | 6.9 |
| 9 | Fluoride (as F ) in mg/l | 1.0 | 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 | 48 |
| 12 | Calcium (as Ca) in mg/l | 75 | 200 | 5.90 |
| 13 | Magnesium (as Mg) in mg/l | 30 | 100 | 2.36 |
| 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 | <0.5 |
| 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 | 5.0 | 15.0 | <0.02 |
| 26 | Anionic Detergents (as MBAS) in mg/l | 0.2 | 1.0 | <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 | 28.4 |
| 30 | Aluminium (as Al ) in mg/l | 0.03 | 0.2 | <0.01 |
| 31 | Boron (as B) in mg/l | 1.0 | 5.0 | <0.5 |
| 32 | Polynuclear Aromatic Hydrocarbons (as PAH) mg/l | --- | --- | <0.0001 |
| 33 | Pesticide Residue mg/l | --- | --- | <0.00001 |

**Sampling Location :- Bore well at Sandhyaguda Chawk (Tiringpahar)**

MITRA S. K. (P) LTD. BARBIL

**For Mitra S. K. Private Limited**

**Authorised Signatory**

**Checked by:-**

Mitra S. K. Private Limited

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MSK
TESTING • INSPECTION

**Ref. No.BBL/ENV/1086** **DATE:04/03/2016**

## CERTIFICATE OF ANALYSIS

This is to certify that a sample of "**Ground Water** " drawn by our representative on 11/02/2016 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) | 4.9 |
| 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 | <1.0 |
| 5 | pH value ($26^0$C) | 6.5 - 8.5 | No Relaxation | 6.5 |
| 6 | Total Hardness(as $CaCO_3$) in mg/l | 300 | 600 | 20.0 |
| 7 | Iron (as Fe) in mg/l | 0.3 | 1 | <0.05 |
| 8 | Chloride (as Cl) in mg/l | 250 | 1000 | 7.9 |
| 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 | 43 |
| 12 | Calcium (as Ca) in mg/l | 75 | 200 | 4.8 |
| 13 | Magnesium (as Mg) in mg/l | 30 | 100 | 1.92 |
| 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 | 1.06 |
| 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 | 0.06 |
| 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 | 30.52 |
| 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)**

**Checked by:-**

MITRA S. K. (P) LTD. BARBIL

**For Mitra S. K. Private Limited**
**Authorised Signatory**

## Annexure - V Trace Metal Analysis in Ground Water


Mitra S. K. Private Limited

At/P.O.:BARBIL Ward No-6
Dist.: Keonjhar, Odisha - 758035
CIN: U51909WB1956PTC023037

T : +91 94370 09815,94370 09820,94370 75269
E : barbil@mitrask.co.in
W : www.mitrask.com


MSK TESTING • INSPECTION

Ref. No.BBL/ENV/594

DATE:04/11/2015

### CERTIFICATE OF ANALYSIS

This is to certify that a sample of "**Ground Water** " drawn by our representative on 03/10/2015 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:- -

**TRACE METAL 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 | <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 | <0.001 |
| 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 | 5.0 | 15.0 | 0.07 |
| 10 | Manganese (as Mn) in mg/l | 0.1 | 0.3 | <0.02 |

**SAMPLING LOCATION :- Bore well at Guruda**

**Checked by:-**

**For Mitra S. K. Private Limited**

MITRA S. K. (P) LTD. BARBIL

**Authorised Signatory**

Mitra S. K. Private Limited

A/P O :BARBIL Ward No-6
Dist. Keonjhar, Odisha - 758035
CIN: U51909WB1956PTC023037

T : +91 94370 09815,94370 09820,94370 75269
E barbil@mitrask.co.in
W www.mitrask.com

MSK TESTING • INSPECTION

**Ref. No.BBL/ENV/988** **DATE:04/02/2016**

## CERTIFICATE OF ANALYSIS

This is to certify that a sample of "**Ground Water** " drawn by our representative on 11/01/2016 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 | 0.08 |
| 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 | <0.001 |
| 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 | <0.02 |

**SAMPLING LOCATION :- Bore well at Guruda**

MITRA S. K. (P) LTD. BARBIL

**For Mitra S. K. Private Limited**

**Checked by:** **Authorised Signatory**

H. O.: Shrachi Centre (5th Floor), 74B, Acharya Jagadish Chandra Bose Road, Kolkata – 700 016, West Bengal, India
T: 91 33 22172249 / 4014 3000 / 2265 0006 / 2265 0007 F: 91 33 2265 0008 E:info@mitrask.com W: www.mitrask.com

## Annexure – VI : Surface Water Analysis

| TIRINGPAHAR (UPSTREAM) W-1 | | | | Oct'15 | Nov'15 | Dec'15 | Jan'16 | Feb'16 | March'16 |
|---|---|---|---|---|---|---|---|---|---|
| Sl. | Parameters | Unit | Standards as per | 1st Report | 1st Report | 1st Report | 1st Report | 1st Report | 1st Report |
| 1 | Colour | Hazen | 5 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| 2 | Odour | - | Unobjectionable | Unobjectionable | unobjectionable | Unobjectionable | Unobjectionable | Unobjectionable | Unobjectionable |
| 3 | pH at $26^0$C | - | 5.5-9.0 | 7.14 | 7.17 | 6.37 | 7.07 | 7.01 | 7.17 |
| 4 | Total Dissolved Solids | mg/l | - | 60 | 65 | 88 | 60 | 60 | 62 |
| 5 | Copper as Cu | mg/l | 3.0 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| 6 | Fluoride as F | mg/l | 2.0 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | 0.71 |
| 7 | Total Residual Chlorine | mg/l | 1.0 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| 8 | Iron as Fe | mg/l | 3.0 | 1.14 | 0.5 | 0.06 | 0.16 | 0.2 | 0.40 |
| 9 | Manganese as Mn | mg/l | 2.0 | 0.07 | <0.02 | 0.02 | <0.02 | <0.02 | 0.05 |
| 10 | Nitrate as NO3 | mg/l | 10.0 | <0.5 | <0.5 | <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 | <0.001 | <0.001 |
| 12 | Selenium as Se | mg/l | 0.05 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| 13 | Cadmium as Cd | mg/l | 2.0 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| 14 | Cyanide as CN | mg/l | 0.2 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| 15 | Lead as Pb | mg/l | 0.1 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| 16 | Mercury as Hg | mg/l | 0.01 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| 17 | Nickel as Ni | mg/l | 3.0 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| 18 | Arsenic as As | mg/l | 0.2 | <0.01 | <0.01 | <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 | <0.01 | <0.01 |
| 20 | Zinc as Zn | mg/l | 5.0 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | 0.04 |
| 21 | Hexavalent Chromium as $Cr^{+6}$ | mg/l | 0.1 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| 22 | Vanadium as V | mg/l | 0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 |
| 23 | Total Suspended Solids | mg/l | 50 / 100 | 8 | 5 | <2.5 | 2.7 | 7.8 | 6.4 |
| 24 | Temperature | $^0$C | - | 26 | 26 | 23 | 23 | 26 | 28 |
| 25 | Dissolved Oxygen | mg/l | - | 6.1 | 6.4 | 6 | 6 | 6.0 | 6.1 |
| 26 | BOD | mg/l | 30 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 |
| 27 | COD | mg/l | 250 | <4.0 | <4.0 | <4.0 | <4.0 | <4.0 | <4.0 |
| 28 | Oil & Grease | mg/l | 10 | <1.4 | <1.4 | <1.4 | <1.4 | <1.4 | <1.4 |
| 29 | Ammonical Nitrogen as N | mg/l | 50 | <0.1 | <0.1 | <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 | <0.3 | <0.3 |
| 31 | Sulphide as S | mg/l | 2.0 | <0.1 | <0.1 | <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 | <0.1 | <0.1 |
| 33 | Particulate Size of Suspended Solids | mg/l | 850 µm IS Sieve | Passes through 850 µm 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 | Passes through 850 um IS sieve |
| 34 | Bio-assay | mg/l | 90% survival in 100% effluent | All fishes survive in 100% effluent after 96 hrs | 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 | <0.05 | <0.05 |

| TIRINGPAHAR (DOWNSTREAM) W-2 | | | | Oct'15 | Nov'15 | Dec'15 | Jan'16 | Feb'16 | March'16 |
|---|---|---|---|---|---|---|---|---|---|
| Sl. | Parameters | Unit | Standards as per | 1st Report | 1st Report | 1st Report | 1st Report | 1st Report | 1st Report |
| 1 | Colour | Hazen | 5 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| 2 | Odour | - | Unobjectionable | Unobjectionable | unobjectionable | Unobjectionable | Unobjectionable | Unobjectionable | Unobjectionable |
| 3 | pH at $26^0$C | - | 5.5-9.0 | 7.09 | 7.23 | 7.43 | 7.05 | 6.87 | 7.09 |
| 4 | Total Dissolved Solids | mg/l | - | 50 | 69 | 84 | 57 | 73.4 | 58 |
| 5 | Copper as Cu | mg/l | 3.0 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| 6 | Fluoride as F | mg/l | 2.0 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | 0.67 |
| 7 | Total Residual Chlorine | mg/l | 1.0 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| 8 | Iron as Fe | mg/l | 3.0 | 0.45 | 0.8 | 0.12 | 0.26 | 0.56 | 0.42 |
| 9 | Manganese as Mn | mg/l | 2.0 | 0.04 | <0.02 | 0.02 | <0.02 | <0.2 | 0.05 |
| 10 | Nitrate as NO3 | mg/l | 10.0 | <0.5 | <0.5 | <0.5 | <0.5 | 2.6 | <0.5 |
| 11 | Phenolic Compounds as C6H5OH | mg/l | 1.0 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| 12 | Selenium as Se | mg/l | 0.05 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| 13 | Cadmium as Cd | mg/l | 2.0 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| 14 | Cyanide as CN | mg/l | 0.2 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| 15 | Lead as Pb | mg/l | 0.1 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| 16 | Mercury as Hg | mg/l | 0.01 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| 17 | Nickel as Ni | mg/l | 3.0 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| 18 | Arsenic as As | mg/l | 0.2 | <0.01 | <0.01 | <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 | <0.01 | <0.01 |
| 20 | Zinc as Zn | mg/l | 5.0 | <0.02 | <0.02 | <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 | <0.01 | <0.01 |
| 22 | Vanadium as V | mg/l | 0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 |
| 23 | Total Suspended Solids | mg/l | 50 / 100 | 3.9 | 7.7 | <2.5 | <2.5 | 9.0 | 7.4 |
| 24 | Temperature | $^0$C | - | 26 | 26 | 23 | 23 | 26 | 28 |
| 25 | Dissolved Oxygen | mg/l | - | 6.1 | 6.2 | 6 | 6.1 | 5.7 | 6.0 |
| 26 | BOD | mg/l | 30 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 |
| 27 | COD | mg/l | 250 | <4.0 | <4.0 | <4.0 | <4.0 | <4.0 | <4.0 |
| 28 | Oil & Grease | mg/l | 10 | <1.4 | <1.4 | <1.4 | <1.4 | <1.4 | <1.4 |
| 29 | Ammonical Nitrogen as N | mg/l | 50 | <0.1 | <0.1 | <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 | <0.3 | <0.3 |
| 31 | Sulphide as S | mg/l | 2.0 | <0.1 | <0.1 | <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 | <0.1 | <0.1 |
| 33 | Particulate Size of Suspended Solids | mg/l | 850 µm IS Sieve | Passes through 850 µm 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 | Passes through 850 um IS sieve |
| 34 | Bio-assay | mg/l | 90% survival in 100% effluent | All fishes survive in 100% effluent after 96 hrs | 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 | <0.05 | <0.05 |

## Annexure – VII: Ambient Air Quality Monitoring

| 1. Tiringpahar Manganese Mine (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-15** | 47.7 | 27.8 | 4.0 | 11.2 | BDL | 5.6 | 0.2 | BDL | BDL | 0.6 | BDL | 0.6 | BDL |
| **May-15** | 45.2 | 26.5 | 4.0 | 10.7 | BDL | 5.8 | 0.1 | BDL | BDL | 0.5 | BDL | 0.4 | BDL |
| **Jun-15** | 33.8 | 19.7 | 4.0 | 9.5 | BDL | 5.6 | 0.1 | BDL | BDL | 0.5 | BDL | 0.4 | BDL |
| **Jul-15** | 64.9 | 28.5 | 4.7 | 20.6 | 10.6 | 19.62 | 0.19 | 0.02 | 4.0 | 0.03 | 1.0 | 2.08 | 0.4 |
| **Aug-15** | 61.0 | 23.4 | 4.9 | 17.3 | 13.0 | 33.50 | 0.19 | 0.02 | 4.0 | 0.04 | 1.0 | 2.08 | 0.4 |
| **Sep-15** | 60.7 | 24.9 | 5.0 | 19.9 | 13.2 | 19.62 | 0.22 | 0.02 | 4.0 | 0.05 | 1.0 | 2.08 | 0.4 |
| **Oct-15** | 72.2 | 31.1 | 6.0 | 25.0 | 13.9 | 19.62 | 0.24 | 0.02 | 4.0 | 0.11 | 1.0 | 2.08 | 0.4 |
| **Nov-15** | 80.8 | 39.5 | 6.1 | 29.3 | 14.9 | 19.62 | 0.25 | 0.02 | 4.0 | 0.14 | 1.0 | 2.08 | 0.4 |
| **Dec-15** | 79.4 | 42.6 | 6.9 | 29.8 | 13.4 | 19.6 | 0.3 | 0.0 | 4.0 | 0.2 | 1.0 | 2.1 | 0.4 |
| **Jan-16** | 81.8 | 41.8 | 6.7 | 29.2 | 10.6 | 19.62 | 0.31 | 0.02 | 4.0 | 0.28 | 1.0 | 2.08 | 0.4 |
| **Feb-16** | 65.0 | 28.0 | 5.2 | 19.7 | 10.0 | 19.62 | 0.18 | 0.02 | 4.0 | 0.16 | 1.0 | 2.08 | 0.4 |
| **Mar-16** | 65.7 | 33.3 | 5.4 | 21.3 | 10.8 | 19.62 | 0.21 | 0.02 | 4.0 | 0.15 | 1.0 | 2.08 | 0.4 |

**8.TMM (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-15** | 44.1 | 26.0 | BDL | 10.9 | BDL | 5.4 | 0.1 | BDL | BDL | 0.5 | BDL | 0.6 | BDL |
| **May-15** | 40.0 | 23.7 | 4.0 | 10.0 | BDL | 5.7 | 0.1 | BDL | BDL | 0.5 | BDL | 0.5 | BDL |
| **Jun-15** | 29.8 | 17.8 | 4.0 | 9.3 | BDL | 5.1 | 0.1 | BDL | BDL | 0.5 | BDL | 0.4 | BDL |
| **Jul-15** | 40.3 | 17.6 | 4.2 | 16.8 | 10.0 | 19.62 | 0.20 | 0.02 | 4.0 | 0.03 | 1.0 | 2.08 | 0.4 |
| **Aug-15** | 47.8 | 19.1 | 4.5 | 15.5 | 10.0 | 19.62 | 0.16 | 0.02 | 4.0 | 0.04 | 1.0 | 2.08 | 0.4 |
| **Sep-15** | 45.2 | 18.3 | 4.4 | 14.7 | 10.0 | 19.62 | 0.19 | 0.02 | 4.0 | 0.03 | 1.0 | 2.08 | 0.4 |
| **Oct-15** | 58.1 | 24.3 | 5.0 | 19.5 | 10.0 | 19.62 | 0.17 | 0.02 | 4.0 | 0.05 | 1.0 | 2.08 | 0.4 |
| **Nov-15** | 50.4 | 22.9 | 4.7 | 20.0 | 10.0 | 19.62 | 0.15 | 0.02 | 4.0 | 0.02 | 1.0 | 2.08 | 0.4 |
| **Dec-15** | 51.1 | 26.0 | 5.1 | 19.6 | 10.0 | 19.62 | 0.19 | 0.02 | 4.0 | 0.04 | 1.0 | 2.08 | 0.4 |
| **Jan-16** | 57.2 | 27.1 | 5.0 | 20.0 | 10.0 | 19.62 | 0.18 | 0.02 | 4.0 | 0.02 | 1.0 | 2.08 | 0.4 |
| **Feb-16** | 55.0 | 25.0 | 4.9 | 17.9 | 10.0 | 19.62 | 0.17 | 0.02 | 4.0 | 0.01 | 1.0 | 2.08 | 0.4 |
| **Mar-16** | 49.8 | 23.7 | 4.5 | 14.6 | 10.0 | 19.62 | 0.13 | 0.02 | 4.0 | 0.10 | 1.0 | 2.08 | 0.4 |

## Annexure – VIII Noise Monitoring

| Tiringpahar | Nov'15 (Avg.) | Feb'16 (Avg.) |
|---|---|---|
| dB (A) in Day Time | 52.2 | 45.6 |
| dB (A) in Night Time | 39.5 | 40.1 |

## 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**