

COMPLIANCE REPORT PERIOD : Oct'2015 TO Mar'2016

**ENVIRONMENTAL CLEARANCE TO
JODA WEST MANGANESE MINE OF TATA STEEL LIMITED
VIDE MoEF's LETTER NO. J-11015/86/2004-1A.II(M) DATED 13.09.2005
COMMENTS SUBMITTED TO THE
MINISTRY OF ENVIRONMENT & FORESTS,
GOVERNMENT OF INDIA**

Present Status of the Project:-

The Scheme of Mining & Progressive Mine Closure Plan from 2013-14 to 2017-18 over an area of 1437.719 ha. has been approved by Indian Bureau of Mines, Bhubaneswar vide letter no. MS/OTFM/47-ORI/BHU/2012-13, Dt.21.05.2013.

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 the Forest Clearance vide MoEF's letter no. F.No.8-89/2004-FC, dt.10.08.2007 over an area of 436.678 ha of forest land. 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 Oct'15 to Mar'16 due to continuation of mine development within the broken up area only. However, 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.
3	OB and other wastes should be stacked at earmarked sites only and should not be kept active for long periods of time. Plantation should be taken up for soil stabilisation 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 Mine of Joda West Manganese Mine. The inactive portion of OB dumps area being stabilized by plantation of local species. 26100 nos. of plant saplings of local species (Gambhari, Chakunda, Mahanimba, Kala Siris, Sisu, Karanj, Jamun etc) were planted over an area of 2.8 ha during 2015-16 with survival rate of 82%. Apart from this we have distributed 13027 nos. saplings (fruit and timber) free of cost to our surrounding communities including, school children, villagers, clubs and SHGs under guidance of State Pollution Control Board, Odisha. We have also planted 110,000 slips in the year 2015-16 in inactive dump slopes of D & H quarry. The overall slope angles of OB dumps are maintained within the natural angle of repose of the waste.

		The retaining wall and garland drain with sedimentation pit at corners near toe at low lying area and uplift portion of OB dump has been constructed. Their dimensions are matching the requirements to arrest the run off effectively.
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	<p>Catch drains and siltation ponds of appropriate size should be constructed to arrest silt and sediment flows from soil, OB and mineral dumps. The drains should be regularly desilted and maintained properly.</p> <p>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.</p> <p>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.</p>	<p>Existing catch drains and garland drains are covering the entire dump slope at bottom part. The run off of garland drains are collected in settling/sedimentation pits. The catch drains and sedimentation pits are periodically de-silted and maintained properly.</p> <p>Size, gradient and length of the drains are adequate to take care of the peak flow.</p> <p>No Provision of Effluent treatment plant for mine water so no chance of inrush of storm water in to the ETP during high rainfall/super cyclone period</p>
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.	<p>In order to prevent the siltation and check the run-off, retaining wall and garland drain are provided with the dimension as;</p> <p><u>Dimension of the Retaining Wall :</u> Height – 1 to 1.2 mtr. Width – 1 mtr.</p> <p><u>Dimension of the Garland Drain :</u> Depth – 1.20 to 1.5 mtr. Width – 1 to 1.2 mtr.</p> <p>A multi-stage sedimentation basin with check dam had been provided at H'Quarry to prevent direct flow of surface run off to Kundra Nallah, a perennial source of water flowing along the western lease boundary. We have provided 5 nos. multi stage check dams with settling pits to further arrest the run-off and provide effective run-off management considering peak rainfall data.</p> <p>Toewall of length 510.9 m has been constructed in FY 2015-16.</p>

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. It was observed that, The detail analysis result is enclosed as Annexure-I (Dust Fall) & Annexure -II (Soil)
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 located 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 transportation 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. We have also installed fixed-type water sprinklers along haul road at D-Quarry. The processed manganese ore is being transferred manually; hence there less fugitive emission during transfer of ore. The results of Ambient Air Quality done during the period April’15 to Mar’16 is enclosed as Annexure-III.
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 / Agriculture Department. The density of the trees should be not less than 2500 plants per ha.	<ul style="list-style-type: none"> • Reclamation and plantation programmes have been drawn. We have planted 10,56,333 nos. of trees over an area of 216.05 ha with 74 % survival rate up to 2014-15 at OB dump and safety zone. The tree density is maintained at the rate of 3641 saplings per ha. • This year we have planted 26100 nos. of plant saplings over an area of 2.8 ha • Apart from conventional plantation programme we have also planted 2,20,000 of Vetiver slips in inactive dump slopes of D & H quarry till date.
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. 21-4(250)/CGWA/SER/2010-1798, Dt.25.08.2010 for 504 m ³ per day. The ground water is not being used for mining and its allied activities. The mine seepage water is being used

		for nursery development and water sprinkling at mine. The total usage is well within the permissible limit.
11	Mining will not intersect groundwater. Prior permission 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 MoEF & CGWA 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 separate location is being monitored. The ground water level and quality monitoring results are enclosed as Annexure IV & V 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 permissible 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 –VI & VII 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. 3012/IND-I-CON-186 dated 18.02.16 valid 31.03.2021.
15	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/tasks should be earmarked in the Conservation Plan and shall not be diverted for any other purpose. Year.wise status of the implementation	We have deposited Rs.56,30,000/- on 05.07.2006 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. 2,31,24,380 and Rs 3,30,67,537 with DFO, Keonjhar, Orissa towards differential payment for implementation of regional Wildlife Management Plan prepared for Bonai & Keonjhar division. Further, Site Specific wildlife management plan has been approved by the memo no. 7726/1WL-SSP-93/2015 dated 31 Aug 2015.

	of the Plan and the expenditure thereon should be reported to the Ministry of Environment & forests, RO, Bhubaneswar.													
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 2013-14 to 2017-18 has been approved by IBM along with the Scheme of Mining. 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.												
Sl. no	B : General Conditions	Compliance Status												
1	No change in mining technology and scope of working should be made without prior approval of the Ministry of Environment & Forests.	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.												
2	No change in the calendar plan including excavation, quantum of manganese ore and waste should be made.	Excavation plan for total excavation, Manganese ore and waste has been prepared and is being strictly adhered. The actual figure for total excavation, manganese ore and waste for the year 2015-16 is given in table below. Table: Plan vs. Actual for year 2015-16 <table border="1" data-bbox="799 989 1474 1270"> <thead> <tr> <th>Year- 2015-16</th> <th>Plan</th> <th>Actual</th> </tr> </thead> <tbody> <tr> <td>Total Excavation (cum)</td> <td>15,80,000</td> <td>6,36,341</td> </tr> <tr> <td>Production (MT)</td> <td>1,60,000</td> <td>97,398</td> </tr> <tr> <td>OB Removal (cum)</td> <td>15,04,706</td> <td>5,90,507</td> </tr> </tbody> </table>	Year- 2015-16	Plan	Actual	Total Excavation (cum)	15,80,000	6,36,341	Production (MT)	1,60,000	97,398	OB Removal (cum)	15,04,706	5,90,507
Year- 2015-16	Plan	Actual												
Total Excavation (cum)	15,80,000	6,36,341												
Production (MT)	1,60,000	97,398												
OB Removal (cum)	15,04,706	5,90,507												
3	Four ambient air quality-monitoring stations should be established in the core zone as well as in the buffer zone for RPM. SPM, SO ₂ , NO _x . 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, SO ₂ & NO _x .) should be regularly submitted to the Ministry including its	Six ambient air quality monitoring stations have been established out of which 2 nos. in core zone (Near Office close proximity to residential and mining area and near H-Quarry) and 4 nos. in buffer zone (at Khandbondh, Bonaikela, Banspani and Keth Hutting). 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} , SO ₂ , NO _x , CO, Mn NH ₃ , BaP, benzene, As, Ni and Pb.and reports are being submitted to OSPCB every month. It was observed that, a) PM ₁₀ varies from 35.6 µg/m ³ (June'15) to 73.1 µg/m ³ (Jan'16) near Office (close proximity to quarry and residential colony) against the standard 100 µg/m ³ .												

	<p>Regional office at Bhubaneshwar and the State Pollution Control Board / Central Pollution Control Board once in six months.</p>	<p>b) PM₁₀ varies from 42.6 µg/m³ (Jun'15) to 72.3 µg/m³ (Jan'16) near quarry area against the standard 100 µg/m³.</p> <p>c) PM_{2.5} varies from 18.5 µg/m³ (Aug'15) to 38.1 µg/m³ (Jan'16) near Office (close proximity to quarry and residential colony) against the standard 60 µg/m³.</p> <p>d) PM_{2.5} varies from 18.0 µg/m³ (Aug'15) to 38.3 µg/m³ (Dec'15) near quarry area against the standard 60 µg/m³.</p> <p>e) SO₂ varies from 4.1 µg/m³ (April'15) to 7.2 µg/m³ (Jan'16) near office (close proximity to quarry and residential colony) against the standard 80 µg/m³.</p> <p>f) SO₂ varies from 4.1 µg/m³ (June'15) to 6.3µg/m³ (Dec'15) near quarry area against the standard 80 µg/m³.</p> <p>g) NO_x varies from 9.8 µg/m³ (June'15) to 28.0 µg/m³ (Jan'16) near office (close proximity to quarry and residential colony) against the standard 80 µg/m³.</p> <p>h) NO_x varies from 10.5 µg/m³ (June'15) to 27.2 µg/m³ (Jan'16) near quarry area against the standard 80 µg/m³.</p> <p>i) CO varies from 0.11 µg/m³ (June'15) to 0.29 µg/m³ (Nov'15) near office (close proximity to quarry and residential colony) against the standard 2 mg/m³.</p> <p>j) CO varies from 0.12 µg/m³ (June'15) to 0.31 µg/m³ (Dec'15) near quarry area against the standard 2 mg/m³.</p> <p>k) Mn varies from 0.03 µg/m³ (Aug'15) to 0.62 µg/m³ (June'15) near office (close proximity to quarry and residential colony) against the standard 0.25 mg/m³.</p> <p>l) Mn varies from 0.02 µg/m³ (Aug'15) to 0.71 µg/m³ (June'15) near quarry area against the standard 0.25 mg/m³.</p> <p>Abstract of the monthly monitoring data on ambient air quality and Water quality are enclosed as Annexure – III.& VII.</p>
4	<p>Drills should be wet operated or with dust extractors and controlled blasting should be practiced.</p>	<p>Wet drilling concept is already in place. Controlled blasting technique with NONEL is in practice.</p>
5	<p>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</p>	<p>Effective water sprinkling by mobile water tanker is being done on haul roads. Additionally we have also installed fixed-type water sprinklers along haul road at D-Quarry. The results of Ambient Air Quality done during the period Oct'15 to Mar'16 is enclosed as Annexure-III.</p>

	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.	<p>Ear plugs & Ear muffs are provided to the workers working in mining operation & DG operations.</p> <p>Rests of operations are below the noise levels of 80 dBA.</p> <p>The details of noise monitoring for the period Oct'15 to Mar'16 are enclosed as Annexure-VIII.</p>
7	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.	The oil separation system has been provided at workshop and working effectively. This is being centrally used for maintenance of all the equipments running at Joda West & Service equipments of Malda Mn.Mine.
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.	<p>It is being done by M/s Mitra S.K. Pvt. Ltd (Recognized as "A" category consultant as by State Pollution Control Board, Orissa).</p> <p>The type of pollution monitoring and analysis equipment used by M/s by M/s Mitra S.K. Pvt. is enclosed as Annexure – IX.</p>
9.	<p>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.</p> <p>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.</p>	<p>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.</p> <p>Periodical Medical Examination of employees (departmental & contractual) are conducted as per prescribed norms of Mines Rule, 1955. The initial and periodical examination includes blood hematology, 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 the calendar year 2015, 57 nos. of employees under went periodical medical examination (PME) and 13 went under initial medical examination (IME). There are no findings of pneumoconiosis and manganese poisoning which is classified as occupational disease.</p>

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. 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 Bhubaneswar.	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 the year 2015-16 was Rs. 27,48,710/- (Monitoring – Rs 13,35,422/- & Plantation - Rs. 14,13,288/-) against the budget of Rs 14,18,750/- (Monitoring - Rs,12,00,000/- & Plantation - Rs. 2,18,750/-) for Joda West Manganese Mines.
12	The Regional Office of this Ministry located at Bhubaneswar 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 / information / monitoring reports	We are providing full co-operation to the officers of the Regional Office by furnishing the requisite data / 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 Chairman, Municipal Council, Joda 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	A detail of Environmental Clearance with regard to Joda West Manganese Mine was published in Oriya News Papers Dharitri & Sambad 17.10.2005.

	at Bhubaneswar.	
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, Joda West Mn.Mine &
Head (Manganese Group of Mines), Joda

Annexure-I

Joda West Mn Mine (D-Quarry)			
Sl.No.	Parameters	Dec'15	April'16
1	Nickel (as Ni) in %	<0.0002	<0.0002
2	Cobalt (as Co) in %	<0.0002	<0.0002
3	Mercury (as Hg) in %	<0.00001	<0.00001
4	Arsenic (as As) in %	<0.00003	<0.00003
Joda West Mn Mine (H-Quarry)			
Sl.No.	Parameters	Dec'15	April '16
1	Nickel (as Ni) in %	<0.0002	<0.0002
2	Cobalt (as Co) in %	<0.0002	<0.0002
3	Mercury (as Hg) in %	<0.00001	<0.00001
4	Arsenic (as As) in %	<0.00003	<0.00003

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@ssevironics.com

Ref No: SSE/14/R-2697

Date: 04.12.2014

SOIL QUALITY ANALYSIS RESULTS FOR TRACE METALS

Name of the Mines : Joda-west Manganese Mines (Tata Steel Ltd)
Location of Sampling : S1: H- Quarry
: S2: D- Quarry
Date of Sampling : 28.11.2014
Date of Analysis : 30.11.2014

Sl. No.	Parameters	S1	S2
1	Nickel as (Ni) in % 10 to 12mg/kg	0.056	0.041
2	Cobalt as (Co) in % 6.5-7.5mg/kg	Nil	Nil
3	Arsenic as (As) in % 1.3 to 1.9mg/kg	0.033	0.020
4	Mercury as (Hg) in %	Nil	Nil



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



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/14/R-3371

Date: 04.02.2015

SOIL QUALITY ANALYSIS RESULTS FOR TRACE METALS

Name of the Mines : Joda-west Manganese Mines (Tata Steel Ltd)
Location of Sampling : S1: H- Quarry
: S2: D- Quarry
Date of Sampling : 27.01.2015
Date of Analysis : 30.01.2015

Sl. No.	Parameters	S1	S2
1	Nickel as (Ni) in % 10 to 12mg/kg	0.061	0.054
2	Cobalt as (Co) in % 6.5-7.5mg/kg	Nil	Nil
3	Arsenic as (As) in % 1.3 to 1.9mg/kg	0.041	0.029
4	Mercury as (Hg) in %	Nil	Nil



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

Annexure - III AAQ Monitoring

Name of the Mines : JODA WEST MN.MINE, M/S TATA STEEL LTD.

Joda West (Time office)													
Monthly Average	PM ₁₀ (µg/m ³)	PM _{2.5} (µg/m ³)	SO ₂ (µg/m ³)	NO ₂ (µg/m ³)	NH ₃ (µg/m ³)	O ₃ (µg/m ³)	CO (mg/m ³)	Pb (µg/m ³)	Ni (ng/m ³)	Mn (µg/m ³)	As (ng/m ³)	Benzene (µg/m ³)	Benzo(a) pyrene (ng/m ³)
Apr-15	50.1	29.3	4.1	11.5	BDL	5.9	0.16	BDL	BDL	0.61	BDL	0.68	BDL
May-15	49.9	29.0	4.2	11.1	BDL	6.1	0.12	BDL	BDL	0.62	BDL	0.51	BDL
Jun-15	35.6	22.4	BDL	9.8	BDL	5.6	0.11	BDL	BDL	0.55	BDL	0.45	BDL
Jul-15	57.9	30.0	4.4	19.8	11.9	19.62	0.18	0.02	4.0	0.03	1.0	2.08	0.4
Aug-15	52.1	18.5	4.5	15.2	10.0	19.62	0.17	0.02	4.0	0.04	1.0	2.08	0.4
Sep-15	58.9	23.4	5.1	20.0	11.2	19.62	0.21	0.02	4.0	0.06	1.0	2.08	0.4
Oct-15	67.4	29.9	5.8	23.3	13.4	19.62	0.23	0.02	4.0	0.08	1.0	2.08	0.4
Nov-15	72.6	35.3	6.5	25.3	14.4	19.62	0.29	0.02	4.0	0.11	1.0	2.08	0.4
Dec-15	72.9	37.9	7.1	27.5	11.5	20.80	0.23	0.04	7.0	0.20	1.0	2.08	0.4
Jan-16	73.1	38.1	7.2	28.0	10.5	19.62	0.26	0.02	4.0	0.21	1.0	2.08	0.4
Feb-16	62.0	32.0	5.7	21.4	10.4	19.62	0.22	0.02	4.0	0.15	1.0	2.08	0.4
Mar-16	61.3	30.0	5.0	19.4	11.1	19.62	0.19	0.02	4.0	0.13	1.0	2.08	0.4

Joda West H Quarry													
Monthly Average	PM ₁₀ (µg/m ³)	PM _{2.5} (µg/m ³)	SO ₂ (µg/m ³)	NO ₂ (µg/m ³)	NH ₃ (µg/m ³)	O ₃ (µg/m ³)	CO (mg/m ³)	Pb (µg/m ³)	Ni (ng/m ³)	Mn (µg/m ³)	As (ng/m ³)	Benzene (µg/m ³)	Benzo(a) pyrene (ng/m ³)
Apr-15	58.2	32.9	4.5	12.3	BDL	6.61	0.21	BDL	BDL	0.69	BDL	0.77	BDL
May-15	48.3	28.1	4.5	11.8	BDL	7.21	0.15	BDL	BDL	0.71	BDL	0.62	BDL
Jun-15	42.6	25.2	4.1	10.5	BDL	6.34	0.12	BDL	BDL	0.65	BDL	0.53	BDL
Jul-15	46.4	22.1	4.3	18.4	14.3	19.62	0.18	0.02	4.0	0.02	1.0	2.08	0.4
Aug-15	51.8	18.0	4.6	16.8	10.0	19.62	0.14	0.02	4.0	0.04	1.0	2.08	0.4
Sep-15	57.1	21.7	5.3	19.9	12.4	19.62	0.22	0.02	4.0	0.05	1.0	2.08	0.4
Oct-15	67.0	28.1	5.9	24.8	13.5	19.62	0.27	0.02	4.0	0.08	1.0	2.08	0.4
Nov-15	65.3	27.1	5.7	24.0	13.5	19.62	0.26	0.02	4.0	0.07	1.0	2.08	0.4
Dec-15	70.8	38.3	6.3	26.8	14.6	20.40	0.31	0.03	5.3	0.26	1.0	2.08	0.4
Jan-16	72.3	37.1	6.1	27.2	10.6	19.62	0.28	0.02	4.0	0.27	1.0	2.08	0.4
Feb-16	61.0	29.0	5.3	18.1	10.3	19.62	0.17	0.02	4.0	0.17	1.0	2.08	0.4
Mar-16	62.0	31.6	5.0	20.8	10.4	19.62	0.20	0.02	4.0	0.17	1.0	2.08	0.4
ANNUAL AVERAGE	58.57	28.27	5.13	19.29	12.18	16.46	0.21	0.02	4.14	0.27	1.00	1.72	0.40

Annexure – IV: Ground Water Level Monitoring

Mitra S. K. Private Limited

A/P O: BARBIL, Ward No-6
Dist: Keonjhar, Odisha - 758035
CIN: U51909WB1958PTC023037

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E: barbil@mitrask.co.in
W: www.mitrask.com



Ref. No. BBL/ENV/1088

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. Joda West Manganese Mines; P.O: Bichakundi, 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 Kamarjoda Village	11.0
12.02.2016	Well at Dalpahar Village	9.0

Checked by:-

Ananta Kumar Rath.

For Mitra S. K. Private Limited

Authorised Signatory



H. O.: Shraichi Centre (5th Floor), 74B, Acharya Jagadish Chandra Bose Road, Kolkata – 700 016, West Bengal, India
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Mitra S. K. Private Limited



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Ref. No.BBL/ENV/688

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. Bamebari 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 Nimera Village	0.50
07.11.2015	Peizometric test Point at Bamebari	9.4

Checked by:-



Mitra S. K. Private Limited

Authorised Signatory

Annexure – V: Ground Water Quality Monitoring

Mitra S. K. Private Limited

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Dist.: Keonjhar, Odisha - 758035
CIN: U51909WB1956PTC023037



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Ref. No. BBL/ENV/583

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 Joda West Manganese Mines ; P.O: Bichakundi, 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)	4.3
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	<1.0
5	pH value (26°C)	6.5 - 8.5	No Relaxation	6.57
6	Total Hardness(as CaCO ₃) in mg/l	300	600	23.76
7	Iron (as Fe) in mg/l	0.3	1.0	<0.05
8	Chloride (as Cl) in mg/l	250	1000	7.84
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	31.0
12	Calcium (as Ca) in mg/l	75	200	4.75
13	Magnesium (as Mg) in mg/l	30	100	2.85
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	1.51
18	Phenolic Compounds (as C ₆ H ₅ OH) 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	0.07
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	---	---	<0.01
29	Alkalinity (as CaCO ₃) in mg/l	200	600	24.96
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	PAH	---	---	<0.0001
33	Pesticide	---	---	<0.00001

SAMPLING LOCATION :- Tube well at Prem Basti (Joda West)

Checked by:-



For Mitra S. K. Private Limited

Authorized Signatory

H. O.: Shrachi Centre (5th Floor), 74B, Acharya Jagadish Chandra Bose Road, Kolkata – 700 016, West Bengal, India
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Mitra S. K. Private Limited

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Ref. No.BBL/ENV/983

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 Joda West Manganese Mines ; P.O: Bichakundi, 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)	4.2
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 (25°C)	6.5 - 8.5	No Relaxation	6.78
6	Total Hardness(as CaCO ₃) in mg/l	300	600	20.4
7	Iron (as Fe) in mg/l	0.3	1	0.12
8	Chloride (as Cl) in mg/l	250	1000	5.82
9	Fluoride (as F) in mg/l	1	1.5	0.12
10	Residual Free Chlorine in mg/l	0.2(Min.)	---	<0.1
11	Total Dissolved Solids in mg/l	500	2000	41.81
12	Calcium (as Ca) in mg/l	75	200	4.9
13	Magnesium (as Mg) in mg/l	30	100	1.96
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	2.0
17	Nitrate (as NO ₃) in mg/l	45	100	2.4
18	Phenolic Compounds (as C ₆ H ₅ OH) 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	0.22
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	28.84
30	Aluminium (as Al) in mg/l	0.03	0.2	<0.01
31	Boron (as B) in mg/l	1	5	<0.5

SAMPLING LOCATION :- Well at Kamarjora (Joda West)

Checked by:-



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Annexure – VI: Trace Metal Analysis in Ground Water

TRACE METAL ANALYSIS OF WATER AS PER IS: 10500 - 1991 (Bore Well at Bichkundi Camp) Joda					
Sl No.	Test Parameters	Norms as per IS: 10500-1991			
		Desirable Limit	Permissible Limit	Oct'15	Jan'16
1	Iron (as Fe) in mg/l	0.3	1	<0.05	0.07
2	Chromium (as Cr ⁺⁶) in mg/l	0.1	No Relaxation	<0.01	<0.01
3	Copper (asCu) in mg/l	0.05	1.5	<0.02	<0.02
4	Selenium (as Se) in mg/l	0.01	No Relaxation	<0.005	<0.005
5	Arsenic (as As) in mg/l	0.05	No Relaxation	<0.01	<0.01
6	Cadmium (as Cd) in mg/l	0.01	No Relaxation	<0.001	<0.001
7	Mercury (as Hg) in mg/l	0.001	No Relaxation	<0.001	<0.001
8	Lead (as Pb) in mg/l	0.05	No Relaxation	<0.005	<0.005
9	Zinc (as Zn) in mg/l	5	15	0.09	<0.02
10	Manganese (as Mn) in mg/l	0.1	0.3	<0.02	<0.02

Annexure – VII (Water Quality Monitoring) (UPSTREAM)

Oct'15	Nov'15	Dec'15	Jan'16	Feb'16	March'16
<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Unobjecti onable	Unobjectionable	Unobjectionable	Unobjectionable	Unobjectionable	Unobjectionable
7.16	6.94	7.08	7.41	7.2	6.95
50	51	46	64	61	63
<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
<0.1	<0.1	<0.1	<0.1	0.16	0.65
<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1.26	0.39	0.12	0.17	0.16	0.36
<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
9.3	3.5	2.7	<2.5	2.7	10.4
26	26	23	23	26	28
6.2	6.4	6	6.2	6.1	5.9
<2.0	<2.0	<2.0	<2.0	<2.0	2.2
<4.0	<4.0	<4.0	<4.0	7.87	7.8
<1.4	<1.4	<1.4	<1.4	<1.4	<1.4
<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Passes through 850 µm IS Sieve	Passes through 850 um IS sieve				
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
<0.05	<0.05	<0.05	<0.05	<0.05	<0.05

Water Quality Monitoring) (DOWNSTREAM)

Oct'15	Nov'15	Dec'15	Jan'16	Feb'16	March'16
<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Unobjecti onable	unobjectionable	Unobjectionable	Unobjectionable	Unobjectionable	Unobjectionable
7.09	7.23	7.43	7.05	6.87	7.09
50	69	84	57	73.4	58
<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
<0.1	<0.1	<0.1	<0.1	<0.1	0.67
<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
0.45	0.8	0.12	0.26	0.56	0.42
0.04	<0.02	0.02	<0.02	<0.2	0.05
<0.5	<0.5	<0.5	<0.5	2.6	<0.5
<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
3.9	7.7	<2.5	<2.5	9.0	7.4
26	26	23	23	26	28
6.1	6.2	6	6.1	5.7	6.0
<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
<4.0	<4.0	<4.0	<4.0	<4.0	<4.0
<1.4	<1.4	<1.4	<1.4	<1.4	<1.4
<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Passes through 850 µm IS Sieve	Passes through 850 um IS sieve				
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
<0.05	<0.05	<0.05	<0.05	<0.05	<0.05

ANNEXURE - VIII**RESULT OF NOISE LEVEL MONITORING AT DIFFERENT LOCATION**

Joda West Mn Mines			Nov'15	Feb'16
Sl.No.	Sampling Location	Parameter	Avg.	Avg.
1	Township	dB (A) in Day Time	49.8	49.8
2	Hospital	dB (A) in Day Time	48.4	45.8
3	Mines Area	dB (A) in Day Time	50.5	51.6
4	Joda West Rly. Siding	dB (A) in Day Time	56.7	58.9
Joda Mn Mines			Nov'15	Feb'16
Sl.No.	Sampling Location	Parameter	Avg.	Avg.
1	Township	dB (A) in Night Time	38.6	40.1
2	Hospital	dB (A) in Night Time	36.5	37.2
3	Mines Area	dB (A) in Night Time	38.6	38.1
4	Joda West Rly.Siding	dB (A) in Night Time	48.7	49.3

Annexure - IX
LIST OF ENVIRONMENTAL MONITORING EQUIPMENT

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

Annexure – X
Organizational Structure

