COMPLIANCE REPORT PERIOD : APRIL'2014 TO SEPT'2014

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 April'14 to Sept'14 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 eannarked sites only and should not be kept active for long periods of time. 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 plan and within an area of 75.116 ha. The inactive portion of OB dumps area being stabilized by plantation of local species. 29,125 nos. of plant saplings of local species (Gambhari, Chakunda, Mahanimba, Kala Siris, Sisu, Karanj, Jamun etc) were planted during 2014-15 and the survival rate will be assessed during May'2015. Apart from this we have distributed 5000 no 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 1,22,000 of Vetiver slips in inactive dump slopes of D & H quarry under guidance of IIT, Kharagpur for stabilization of dump slopes during the year. 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	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 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. Size, gradient and length of the drains are adequate to take care of the peak flow. 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
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. 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.
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, a) Presence of Co and Hg was nil. Only Ni & As presence varies from 0.035 %to 0.043% & 0.026 % to 0.018 % at H & D quarry respectively in soil samples during pre monsoon season. b) Presence of Co and Hg was nil. Only Ni & As presence varies from 0.036 to 0.044 & 0.051 to 0.057 % at H & D quarry respectively in Dust fall

		samples during pre monsoon. 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 fugitive dust monitoring done during the period Apr'14 to Sept'14 are being 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 *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 10,27,208 nos. of trees over an area of 212.35 ha with 77 % survival rate up to 2014-15 at OB dump and safety zone. The tree density is maintained at the rate of 3741 saplings per ha. • Apart from conventional plantation programme we have also planted 1,22,000 of Vetiber slips in inactive dump slopes of D & H quarry under guidance of IIT, Kharagpur for stabilization of dump slopes during the year.
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	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.

	four times a year in pre-monsoon (April *I* 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.	It was observed that , the level of ground water , a) During pre-monsoon was 1.32 mtr (at 492.68 mRL) & 8.82 mtr. (at 523.18 mRL) b) During monsoon season it was 0.82 mtr (at 493.18 mRL) & 1.11 mtr (at 530.89 mRL). c) Ground water not encountered upto 80 metres (at 596 mRL) at Peizometric test point at H-Quarry during post-monsoon as well as during winter season. d) The quality of ground water monitored with reference to standard of BIS : 10500 and the qualities are well within the standard. 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. It was observed in ground water samples that, only Fe, Zn and Mn 0.13, 0.26 and 0.021 mg/l during pre-monsoon season and 0.18, 0.24 and 0.019 mg/l during monsoon season. The analysis results are well within the permissible standards while other parameters are below detection level. 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.67 No.8008 / IND-I-CON-186 dated 11.05.2011 & valid up to 31.03.2016.
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/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.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 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 prepared and submitted for approval 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 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.	Plan for excavation of Manganese Ore and waste has been prepared and is being strictly adhered. The production and excavation of waste is given below; Plan 2014-15: Production: 1,50,000 MT OB: 14,19,412 CuM Planned (Apr'14 to Sept'14) Production:- 75,000 MT OB:- 7,09,706 CuM Actual (Apr'14 to Sept'14)- Production (Apr'14 to Sept'14): 62323.00MT OB Removal (Apr'14 to Sept'14): 4,53,527 CuM The plan vs. actual production of Manganese Ore and OB removal during 2013-14 is furnished below: Year - 2014-15 (H-1) | Plan | Actual Production (MT) | 1,50,000 | 62,323 OB Removal (cum) | 7,09,706 | 4,53,527
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. 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 / Central	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 Ketth 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, NOx, CO, Mn NH3, BaP, benzene, As, Ni and Pb.and reports are being submitted to OSPCB every month. It was observed that, a) PM_{10} varies from 30.75 µg/m^3 (Aug-14) to 53.89 µg/m^3 (Apr'14) near Office (close proximity to quarry and residential colony) against the standard 100 µg/m^3. b) PM_{10} varies from 37.50 µg/m^3 (Aug'14) to 60.56 µg/m^3 (Apr'14) near quarry area against the

	Pollution Control Board once in six. months.	standard 100 µg/m^3. c) $PM_{2.5}$ varies from 19.11 µg/m^3 (Aug'14) to 30.76 µg/m^3 (Apr'14) near Office (close proximity to quarry and residential colony) against the standard 60 µg/m^3. d) $PM_{2.5}$ varies from 23.24 µg/m^3 (Aug'14) to 33.82 µg/m^3 (Apr'14) near quarry area against the standard 60 µg/m^3. e) SO_2 varies from 4.04 µg/m^3 (June'14) to 4.13 µg/m^3 (Aug'13) near office (close proximity to quarry and residential colony) against the standard 80 µg/m^3. f) SO_2 varies from 4.13 µg/m^3 (Aug'14) to 4.59 µg/m^3 (Apr'14) near quarry area against the standard 80 µg/m^3. g) NOx varies from 9.28 µg/m^3 (Aug'14) to 11.06 µg/m^3 (Apr'14) near office (close proximity to quarry and residential colony) against the standard 80 µg/m^3. h) NOx varies from 9.8 µg/m^3 (Aug'14) to 11.89 µg/m^3 (Apr'14) near quarry area against the standard 80 µg/m^3. i) CO varies from 0.10 µg/m^3 (Aug'14) to 0.15 µg/m^3 (Apr'14) near office (close proximity to quarry and residential colony) against the standard 2 mg/m^3. j) CO varies from 0.12 µg/m^3 (Aug'14) to 0.20 µg/m^3 (Apr'14) near quarry area against the standard 2 mg/m^3 k) Mn varies from 0.45 µg/m^3 (Aug'14) to 0.62 µg/m^3 (Apr'14) near office (close proximity to quarry and residential colony) against the standard 0.25 mg/m^3. l) Mn varies from 0.52 µg/m^3 (Aug'14) to 0.71 mg/m^3 (Apr'14) near quarry area against the standard 0.25 mg/m^3. Abstract of the monthly monitoring data on ambient air quality and Water quality are enclosed as **Annexure – VII.& VIII**.
4	Drills should be wet operated or with dust extractors and controlled blasting should be practiced.	Wet drilling concept is already in place. Controlled blasting technique with NONEL is in practice.
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. Additionally we have also installed fixed-type water sprinklers along haul road at D-Quarry. The fugitive dust monitoring done during the period Apr'14 to Sept'14 is being enclosed as **Annexure-III**.
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	Ear plugs & Ear muffs are provided to the workers working in drilling operations & DG operations. Rest of operations are below the noise levels of 80 dBA. The details of noise monitoring for the period Apr'14

	provided with ear plugs/ muffs.	to Sept'14 are enclosed as **Annexure-IX**.
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.	It is being done by M/s SS Environics India Pvt.Ltd at Bhubaneswar. (Recognized as "A" category consultant as by State Pollution Control Board, Orissa). The type of pollution monitoring and analysis equipment used by M/s SS Environics India Pvt.Ltd. is enclosed as **Annexure – X**.
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 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 2011-12, 415 nos. of employees were examined while during 2012-13, 301 nos. of employees (contractual and departmental) were examined. During 2013-14 a total no. of 66 employees (Departmental-16 and contractor employees-50) were examined. During 2014-15, for the period of April-14 to Sept-14 a total no. of 139 employees (Departmental-10 and contractor employees-129) were examined. 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. The organizational structure in place is enclosed as **Annexure-XI.**

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 period Apr'14 to Sept'14 was Rs. 13,82,755/- (Monitoring – Rs 9,83,768/- & Plantation - Rs. 3,98,987/-) against the annual budget of Rs 13,87,500/- (Monitoring - Rs, 12,00,000/- & Plantation - Rs. 1,87,500/-) for Joda West 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 / 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 at Bhubaneswar.	A detail of Environmental Clearance with regard to Joda West Manganese Mine was published in Oriya News Papers Dharitri & Sambad 17.10.2005.
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	Noted

	Pollution) Act, 1974, the Air (Prevention & Control of Pollution) Act, 1991 along with their amendments and rules.	

Yours faithfully
F: TATA STEEL LTD.

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

Annexure – I

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-0640 *Date:* 03.05.2014

DUST FALL ANALYSIS RESULTS FOR TRACE METALS

Name of the Mines : **Joda west Manganese Mines (Tata Steel Ltd)**

Location of Sampling: DF1: **H-QUARRY**

DF2: **D- QUARRY**

Period of monitoring : April-2014

Sl. No.	Parameters	DF1	DF2
1.	Nickel as (Ni) in %	0.044	0.036
2.	Cobalt as (Co) in %	Nil	Nil
3.	Arsenic as (As) in %	0.057	0.051
4.	Mercury as (Hg) in %	Nil	Nil

For S.S ENVIRONICS (I) PVT. LTD

Annexure – II

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

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

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Ref No: SSE/14/R-0655 Date: 03.05.2014

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	:	30.04.2014
Date of Analysis	:	01.05.2014

Sl. No.	Parameters	S1	S2
1.	Nickel as (Ni) in %	0.043	0.035
2.	Cobalt as (Co) in %	Nil	Nil
3.	Arsenic as (As) in %	0.026	0.018
4.	Mercury as (Hg) in %	Nil	Nil

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

Annexure – III (Fugitive dust Monitoring)

Mine	Location	Place of Monitoring	Standard	07.04.2014 to 12.04.2014	21.04.2014 to 26.04.2014	05.05.2014 to 10.05.2014	11.06.2014 to 16.06.2014	23.06.2014 to 28.06.2014	07.07.2014 to 12.07.2014	21.07.2014 to 26.07.2014	04.08.2014 to 09.08.2014	25.08.2014 to 30.08.2014	08.09.2014 to 13.09.2014	22.09.2014 to 27.09.2014	Average-H1
Joda West	D-Quarry	Mine Haul Road	Total SPM-1200 µg/m3	312	308	289	276	268	187	169	158	210	187	273	240
		20 m away from Shovel operation	Total SPM-1200 µg/m4	247	187	209	215	186	159	184	156	179	216	206	195
		10 m away from Wagon Drill in Operation	Total SPM-1200 µg/m5	164	159	172	162	158	138	142	146	154	139	172	155
		10 m away from ore unloading point at Stack Yard	Total SPM-1200 µg/m6	193	187	209	188	174	138	147	148	162	187	169	173
	H-Quarry	Mine Haul Road	Total SPM-1200 µg/m7	304	310	228	264	187	172	139	162	148	168	210	208
		20 m away from Shovel operation	Total SPM-1200 µg/m8	254	187	222	236	192	210	183	174	163	159	216	200
		10 m away from Wagon Drill in Operation	Total SPM-1200 µg/m9	184	172	164	153	156	148	153	139	142	146	162	156
		10 m away from ore unloading point at Stack Yard	Total SPM-1200 µg/m10	187	169	172	179	183	156	147	172	169	184	157	170

Annexure – IV

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
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Ref No: SSE/14/R-0647 *Date:* 03.05.2014

GROUND WATER LEVEL MONITORING REPORT
JODA-WEST

Name of the Mines : **Joda-West Manganese Mines, Tata Steel Ltd.**

Monitoring Area & Date	Name of the Location	Top mRL	Water Encountered at mRL	Water Level in mtrs
30.04.2014	W-1: Well at Kamarjoda	494	492.68	1.32
30.04.2014	W-2: Well at Dalpahar	532	523.18	8.82
30.04.2014	W-3: Peizometric test Point at H.Quarry	596	Not encountered up to 80mtrs.	

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"
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Ref No: SSE/14/R-1822 *Date:* 03.09.2014

GROUND WATER LEVEL MONITORING REPORT
JODA-WEST

Name of the Mines : **Joda-West Manganese Mines, Tata Steel Ltd.**

Monitoring Area & Date	Name of the Location	Top mRL	Water Encountered at mRL	Water Level in mtrs
19.08.2014	W-1: Well at Kamarjoda	494	493.18	0.82
27.08.2014	W-2: Well at Dalpahar	532	530.89	1.11

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

Annexure – V

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
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Ref No: SSE/13/R-0650 *Date:* 03.05.2014

GROUND WATER QUALITY ANALYSIS REPORT

Name of the Mines : **Joda West Manganese Mines (Tata Steel Ltd)**
Location of Sampling : GW1: Tube well at Joda west Manganese mine Camp
GW2: Well at Kamarjoda
Date of Sampling : 21.04.2014
Date of Analysis : 23.04.2014

Sl. No	Parameter	Standard as per BIS: 10500	Sampling Locations	
			GW1	GW2
Essential Characteristics				
1	Colour	5	CL	CL
2	Odour	U/O	U/O	U/O
3	Taste	Agreeable	AL	AL
4	Turbidity (NTU), max	1	<1	<1
5	pH Value	6.5-8.5	7.0	7.3
6	Total Hardness (as $CaCO_3$), mg/l, max	300	58	44
7	Iron (as Fe), mg/l, max	0.3	0.17	0.10
8	Chloride (as Cl), mg/l, max	250	11.4	10.1
9	Residual, free Chlorine, mg/l, min	0.2	ND	ND
Desirable Characteristics				
10	Dissolved Solids, mg/l, max	500	157	141
11	Calcium (as Ca), mg/l, max	75	9.9	9.2
12	Copper (as Cu), mg/l, max	0.05	BDL	BDL
13	Manganese (as Mn), mg/l, max	0.1	0.034	0.019
14	Sulphate (as SO_4), mg/l, max	200	19.3	15.7
15	Nitrate (as NO_3), mg/l, max	45	0.31	0.24
16	Fluoride (as F), mg/l, max	1.0	BDL	BDL
17	Phenolic Compounds (as C_6H_5OH), mg/l, max	0.001	ND	ND
18	Mercury (as Hg), mg/l, max	0.001	BDL	BDL
19	Cadmium (as Cd), mg/l, max	0.01	BDL	BDL
20	Selenium (as Se), mg/l, max	0.01	BDL	BDL
21	Arsenic (as As), mg/l, max	0.05	BDL	BDL
22	Cyanide (as CN), mg/l, max	0.05	BDL	BDL
23	Lead (as Pb), mg/l, max	0.05	BDL	BDL
24	Zinc (as Zn), mg/l, max	5	0.24	0.19
25	Anionic Detergents (as MBAS), mg/l, max	0.2	Absent	Absent
26	Chromium (as Cr+6), mg/l, max	0.05	BDL	BDL
27	Polynuclear aromatic hydrocarbons (as PAH), g/l, max	-	ND	ND
28	Mineral Oil, mg/l, max	0.01	ND	ND
29	Pesticides, mg/l, max	Absent	Absent	Absent
30	Alkalinity , mg/l, max	200	24	31
31	Aluminium as Al, mg/l, max	0.03	BDL	BDL
32	Boron mg/l , max	1.0	BDL	BDL

CL – Colourless, U/O – Unobjectionable, ND – Not detectable.
BDL Values: Copper- 0.001mg/l,Flouride-0.001 mg/l, Cadmium- 0.001 mg/l, Mercury- 0.0001 mg/l, Lead- 0.001 mg/l, Arsenic- 0.001 mg/l, Zinc- 0.005 mg/l, Cyanide- 0.001 mg/l, Cr+6- 0.001 mg/l, , Selenium- 0.001 mg/l, Al-0.001 mg/l.

For S.S ENVIRONICS (I) 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-1816 *Date:* 03.09.2014

GROUND WATER QUALITY ANALYSIS REPORT

Name of the Mines : **Joda West Manganese Mines (Tata Steel Ltd)**
Location of Sampling : GW1: Tube well at Joda west Manganese mine Camp
GW2: Well at Kamarjoda
Date of Sampling : 19.08.2014 & 23.08.2014
Date of Analysis : 25.08.2014

Sl. No	Parameter	Standard as per BIS: 10500	Sampling Locations	
			GW1	GW2
Essential Characteristics				
1	Colour	5	CL	CL
2	Odour	U/O	U/O	U/O
3	Taste	Agreeable	AL	AL
4	Turbidity (NTU), max	1	<1	<1
5	pH Value	6.5-8.5	7.1	6.9
6	Total Hardness (as $CaCO_3$), mg/l, max	300	58	65
7	Iron (as Fe), mg/l, max	0.3	0.12	0.15
8	Chloride (as Cl), mg/l, max	250	10.3	9.7
9	Residual, free Chlorine, mg/l, min	0.2	ND	ND
Desirable Characteristics				
10	Dissolved Solids, mg/l, max	500	138	146
11	Calcium (as Ca), mg/l, max	75	9.4	10.1
12	Copper (as Cu), mg/l, max	0.05	BDL	BDL
13	Manganese (as Mn), mg/l, max	0.1	0.008	0.009
14	Sulphate (as SO_4), mg/l, max	200	18.6	20.4
15	Nitrate (as NO_3), mg/l, max	45	0.27	0.33
16	Fluoride (as F), mg/l, max	1.0	BDL	BDL
17	Phenolic Compounds (as C_6H_5OH), mg/l, max	0.001	ND	ND
18	Mercury (as Hg), mg/l, max	0.001	BDL	BDL
19	Cadmium (as Cd), mg/l, max	0.01	BDL	BDL
20	Selenium (as Se), mg/l, max	0.01	BDL	BDL
21	Arsenic (as As), mg/l, max	0.05	BDL	BDL
22	Cyanide (as CN), mg/l, max	0.05	BDL	BDL
23	Lead (as Pb), mg/l, max	0.05	BDL	BDL
24	Zinc (as Zn), mg/l, max	5	0.18	0.20
25	Anionic Detergents (as MBAS), mg/l, max	0.2	Absent	Absent
26	Chromium (as Cr+6), mg/l, max	0.05	BDL	BDL
27	Polynuclear aromatic hydrocarbons (as PAH), g/l, max	-	ND	ND
28	Mineral Oil, mg/l, max	0.01	ND	ND
29	Pesticides, mg/l, max	Absent	Absent	Absent
30	Alkalinity , mg/l, max	200	26	22
31	Aluminium as Al, mg/l, max	0.03	BDL	BDL
32	Boron mg/l , max	1.0	BDL	BDL

CL – Colourless, U/O – Unobjectionable, ND – Not detectable.
BDL Values: Copper- 0.001mg/l,Flouride-0.001 mg/l, Cadmium- 0.001 mg/l, Mercury- 0.0001 mg/l, Lead- 0.001 mg/l, Arsenic- 0.001 mg/l, Zinc- 0.005 mg/l, Cyanide- 0.001 mg/l, Cr+6- 0.001 mg/l, , Selenium- 0.001 mg/l, Al-0.001 mg/l.

For S.S ENVIRONICS (I) PVT. LTD

Annexure – VI

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-0661 *Date:* 03.05.2014

ANALYSIS OF TRACE METALS IN GROUND WATER AT LOWER ELEVATION

Name of the Mines : **JODA WEST Manganese Mines (Tata Steel Ltd)**
Location of Sampling : GW1: Borewell at Bichhakundi Camp
Date of Sampling : 21.04.2014
Date of Analysis : 23.04.2014

Sl. No	Parameter	Standard as per BIS: 10500	Analysis Results
1	Iron (as Fe), mg/l, max	0.3	0.13
2	Chromium (as Cr+6), mg/l, max	0.05	BDL
3	Copper (as Cu), mg/l, max	0.05	BDL
4	Selenium (as Se), mg/l, max	0.01	BDL
5	Arsenic (as As), mg/l, max	0.05	BDL
6	Cadmium (as Cd), mg/l, max	0.01	BDL
7	Mercury (as Hg), mg/l, max	0.001	BDL
8	Lead (as Pb), mg/l, max	0.05	BDL
9	Zinc (as Zn), mg/l, max	5	0.26
10	Manganese (as Mn), mg/l, max	0.1	0.021

BDL Values: Copper- 0.001mg/l, Cadmium- 0.001 mg/l, Mercury- 0.0001 mg/l, Arsenic- 0.001 mg/l,Selenium-0.001 mg/l, Cr+6- 0.001 mg/l.

For S.S ENVIRONICS (I) 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-1825 *Date:* 03.09.2014

ANALYSIS OF TRACE METALS IN GROUND WATER AT LOWER ELEVATION

Name of the Mines : **JODA WEST Manganese Mines (Tata Steel Ltd)**

Location of Sampling : GW1: Borewell at Bichhakundi Camp

Date of Sampling : 19.08.2014

Date of Analysis : 23.08.2014

Sl. No	Parameter	Standard as per BIS: 10500	Analysis Results
1	Iron (as Fe), mg/l, max	0.3	0.18
2	Chromium (as Cr+6), mg/L max	0.05	BDL
3	Copper (as Cu), mg/l, max	0.05	BDL
4	Selenium (as Se), mg/l, max	0.01	BDL
5	Arsenic (as As), mg/l, max	0.05	BDL
6	Cadmium (as Cd), mg/l, max	0.01	BDL
7	Mercury (as Hg), mg/l, max	0.001	BDL
8	Lead (as Pb), mg/l, max	0.05	BDL
9	Zinc (as Zn), mg/L max	5	0.24
10	Manganese (as Mn), mg/l, max	0.1	0.019

BDL Values: Copper- 0.001mg/l, Cadmium- 0.001 mg/l, Mercury- 0.0001 mg/l, Arsenic- 0.001 mg/l,Selenium-0.001 mg/l, Cr+6- 0.001 mg/l.

For S.S ENVIRONICS (I) PVT. LTD.

Annexure – VII (Dust Monitoring)

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

JODA-WEST Monthly Avgs	Location	PM10 µg/m3	PM2.5 µg/m3	SO2 µg/m3	NOx µg/m3	CO mg/m3	Mn µg/m3	O3 µg/m3	Pb µg/m3	NH3 µg/m3	Benzene µg/m3	Benzo(a) Pyrene ng/m3	Arsenic ng/m3	Nickel ng/m3
April'14	Mines Office	53.89	30.76	4.11	11.06	0.15	0.62	6.07	BDL	BDL	0.68	BDL	BDL	BDL
May'14	Mines Office	46.67	27.28	4.08	10.87	0.11	0.59	5.91	BDL	BDL	0.47	BDL	BDL	BDL
June'14	Mines Office	37.63	23.13	4.04	9.96	0.12	0.59	5.96	BDL	BDL	0.47	BDL	BDL	BDL
JULY'14	Mines Office	32.25	19.49	4.06	9.99	0.12	0.55	5.26	BDL	BDL	0.45	BDL	BDL	BDL
AUG'14	Mines Office	30.75	19.11	4.13	9.28	0.10	0.45	5.10	BDL	BDL	0.49	BDL	BDL	BDL
SEP'14	Mines Office	38.11	22.43	4.07	10.12	0.12	0.59	6.27	BDL	BDL	0.49	BDL	BDL	BDL
6 Months Avgs	Mines Office	**39.88**	**23.70**	**4.08**	**10.21**	**0.12**	**0.56**	**5.76**	**BDL**	**BDL**	**0.51**	**BDL**	**BDL**	**BDL**

JODA-WEST Monthly Avgs	Location	PM10 µg/m3	PM2.5 µg/m3	SO2 µg/m3	NOx µg/m3	CO mg/m3	Mn µg/m3	O3 µg/m3	Pb µg/m3	NH3 µg/m3	Benzene µg/m3	Benzo(a) Pyrene ng/m3	Arsenic ng/m3	Nickel ng/m3
April'14	H. Quarry	60.56	33.82	4.59	11.89	0.20	0.71	7.03	BDL	BDL	0.78	BDL	BDL	BDL
May'14	H. Quarry	45.56	27.43	4.36	11.52	0.14	0.69	6.92	BDL	BDL	0.59	BDL	BDL	BDL
June'14	H. Quarry	45.00	27.55	4.25	10.71	0.13	0.67	6.51	BDL	BDL	0.56	BDL	BDL	BDL
JULY'14	H. Quarry	38.00	22.11	4.26	10.76	0.13	0.65	6.03	BDL	BDL	0.54	BDL	BDL	BDL
AUG'14	H. Quarry	37.50	23.24	4.13	9.80	0.12	0.52	5.85	BDL	BDL	0.58	BDL	BDL	BDL
SEP'14	H. Quarry	46.11	26.50	4.31	10.87	0.14	0.68	7.08	BDL	BDL	0.58	BDL	BDL	BDL
6 Months Avgs	H. Quarry	**45.45**	**26.78**	**4.32**	**10.93**	**0.14**	**0.65**	**6.57**	**BDL**	**BDL**	**0.60**	**BDL**	**BDL**	**BDL**

Annexure – VIII(Water Quality Monitoring)

JODA-WEST (UPSTREAM) W1				April'14		May'14		June'14		July'14		Aug'14		Sep'14		Avg 6 months
Sl.	Parameters	Unit	Standard	1st Report	2nd Report	1st Report	2nd Report	1st Report	2nd Report	1st Report	2nd Report	1st Report	2nd Report	1st Report	2nd Report	W-1
1	Colour & Odour	--	300 & $	CL & U/O	CL & U/O	CL & U/O	CL & U/O	16 & U/O	19 & U/O	15 & U/O	15 & U/O	10 & U/O	10 & U/O	15 & U/O	10 & U/O	**10.63& U/O**
2	Suspended Solids	mg/l	$	34	29	26	22	112	94	141	138	134	169	139	155	**99.42**
3	Particular Size of S.S.	µ(micron)	$	<850	<850	<850	<850	<850	<850	<850	<850	<850	<850	<850	<850	**<850**
4	Dissolved Solids	mg/l	1500	121	112	108	101	149	174	187	176	174	182	181	169	**152.83**
5	PH	-	6.5-8.5	7.1	7.2	7.1	7.1	7.3	7.1	6.9	7.2	7.1	7.3	7.3	7.2	**7.16**
6	Temperature	^{0}C	$	25	25	25	25	25	25	25	25	25	25	25	25	**25.00**
7	Oil & Grease	mg/l	0.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**ND**
8	Total Residual Chlorine	mg/l	$	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**ND**
9	Amm. Nitrogen as N	mg/l	$	0.38	0.31	0.29	0.25	0.59	0.58	0.65	0.42	0.56	0.49	0.66	0.42	**ND**
10	Total Kjeldal Nitrogen as N	mg/l	$	0.97	0.91	0.85	0.84	1.33	1.37	1.58	1.22	1.44	1.18	1.53	1.11	**1.19**
11	Free Ammonia as NH_3	mg/l	$	ND	ND	ND	ND	ND	ND	0.003	0.004	0.004	0.005	0.005	0.005	**ND**
12	Dissolved Oxygen	mg/l	4	7.3	7.1	7.2	7.3	7.3	7	7.2	7.3	7.3	7.2	7.2	7.3	**7.23**
13	BOD (3) days at 27^{0}C	mg/l	3	1.12	1.09	1.01	0.95	1.33	1.58	1.25	1.37	1.17	1.26	1.08	1.18	**1.20**
14	COD	mg/l	$	3.3	3.27	3.17	2.87	4.87	4.39	3.68	4.04	3.55	3.71	3.21	3.57	**3.64**
15	Arsenic as As	mg/l	0.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	**BDL**
16	Mercury as Hg	mg/l	$	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	**BDL**
17	Lead as Pb	mg/l	0.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	**BDL**
18	Cadmium as Cd	mg/l	0.01	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	**BDL**
19	Hexa Chromium as Cr^{+6}	mg/l	0.05	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	**BDL**
20	Total Chromium as Cr	mg/l	$	0.13	0.1	0.11	0.074	0.069	0.11	0.078	0.1	0.069	0.12	0.057	0.15	**0.097**
21	Copper as Cu	mg/l	1.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	**BDL**
22	Zinc as Zn	mg/l	15	0.16	0.12	0.13	0.09	0.13	0.14	0.19	0.18	0.16	0.15	0.14	0.2	**0.15**
23	Selenium as Se	mg/l	0.05	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	**BDL**
24	Nickel as Ni	mg/l	$	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	**BDL**
25	Cyanide as CN	mg/l	0.05	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	**BDL**
26	Fluoride as F	mg/l	1.5	0.048	0.041	0.037	0.035	0.09	0.18	0.074	0.11	0.065	0.089	0.048	0.066	**0.07**
27	Diss. Phosphate as P	mg/l	$	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	**BDL**
28	Sulphide as S	mg/l	$	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	**BDL**
29	Phenolic Compounds as C_6H_5OH	mg/l	$	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	**BDL**
30	Bio-assay Test	--	$	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	**98%.**
31	Manganese as Mn	mg/l	$	0.055	0.055	0.042	0.042	0.087	0.16	0.11	0.11	0.1	0.074	0.09	0.065	**0.083**
32	Iron as Fe	mg/l	50	0.27	0.19	0.21	0.14	0.37	0.51	0.84	0.74	0.71	0.69	0.82	0.53	**0.50**
33	Vanadium as V	mg/l	$	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	**BDL**
34	Nitrate as NO_3	mg/l	50	0.18	0.16	0.14	0.13	0.22	0.29	0.28	0.27	0.26	0.22	0.33	0.19	**0.22**

JODA-WEST (DOWN STREAM) W2				April'14		May'14		June'14		July'14		Aug'14		Sep'14		Avg 6 months
Sl.	Parameters	Unit	Standards	1st Report	2nd Report	1st Report	2nd Report	1st Report	2nd Report	1st Report	2nd Report	1st Report	2nd Report	1st Report	2nd Report	W-2
1	Colour & Odour	--	300 & $	CL & U/O	CL & U/O	CL & U/O	CL & U/O	17 & U/O	21 & U/O	15 & U/O	18 & U/O	12 & U/O	10 & U/O	15 & U/O	12 & U/O	**11.38& U/O**
2	Suspended Solids	mg/l	$	39	33	29	28	118	104	153	144	141	171	153	161	**106.17**
3	Particular Size of S.S.	µ(micron)	$	<850	<850	<850	<850	<850	<850	<850	<850	<850	<850	<850	<850	**<850**
4	Dissolved Solids	mg/l	1500	126	117	111	106	156	179	199	188	183	181	194	174	**159.50**
5	pH	-	6.5-8.5	7.2	7.2	7.1	7.2	7.2	6.9	7	7.2	7.1	7.2	7.2	7.2	**7.14**
6	Temperature	^{0}C	$	25	25	25	25	25	25	25	25	25	25	25	25	**25.00**
7	Oil & Grease	mg/l	0.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**ND**
8	Total Residual Chlorine	mg/l	$	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**ND**
9	Amm. Nitrogen as N	mg/l	$	0.41	0.33	0.33	0.29	0.64	0.65	0.71	0.56	0.63	0.53	0.71	0.48	**ND**
10	Total Kjeldal Nitrogen as N	mg/l	$	1.05	0.98	0.92	0.89	1.39	1.46	1.65	1.28	1.52	1.22	1.59	1.17	**1.26**
11	Free Ammonia as NH_3	mg/l	$	ND	ND	ND	ND	ND	ND	0.004	0.005	0.004	0.004	0.005	0.005	**ND**
12	Dissolved Oxygen	mg/l	4	7.2	7.2	7.2	7.3	7.2	6.8	7.2	7.2	7.2	7.2	7.2	7.3	**7.18**
13	BOD (3) days at 27^{0}C	mg/l	3	1.17	1.14	1.1	1.02	1.41	1.74	1.31	1.41	1.24	1.33	1.11	1.21	**1.27**
14	COD	mg/l	$	3.38	3.35	3.22	2.95	4.95	4.56	3.76	4.18	3.62	3.85	3.34	3.64	**3.73**
15	Arsenic as As	mg/l	0.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	**BDL**
16	Mercury as Hg	mg/l	$	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	**BDL**
17	Lead as Pb	mg/l	0.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	**BDL**
18	Cadmium as Cd	mg/l	0.01	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	**BDL**
19	Hexa Chromium as Cr^{+6}	mg/l	0.05	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	**BDL**
20	Total Chromium as Cr	mg/l	$	0.15	0.13	0.12	0.078	0.077	0.12	0.086	0.12	0.075	0.13	0.063	0.18	**0.111**
21	Copper as Cu	mg/l	1.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	**BDL**
22	Zinc as Zn	mg/l	15	0.19	0.16	0.15	0.11	0.16	0.17	0.21	0.21	0.19	0.17	0.17	0.26	**0.18**
23	Selenium as Se	mg/l	0.05	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	**BDL**
24	Nickel as Ni	mg/l	$	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	**BDL**
25	Cyanide as CN	mg/l	0.05	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	**BDL**
26	Fluoride as F	mg/l	1.5	0.053	0.044	0.041	0.039	0.1	0.2	0.082	0.11	0.073	0.095	0.055	0.072	**0.08**
27	Diss. Phosphate as P	mg/l	$	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	**BDL**
28	Sulphide as S	mg/l	$	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	**BDL**
29	Phenolic Compounds as C_6H_5OH	mg/l	$	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	**BDL**
30	Bio-assay Test	--	$	98%	98%	98%	98%	97%	98%	98%	98%	98%	98%	97%	98%	**97.9%.**
31	Manganese as Mn	mg/l	$	0.063	0.061	0.049	0.054	0.09	0.18	0.12	0.13	0.11	0.81	0.1	0.71	**0.206**
32	Iron as Fe	mg/l	50	0.31	0.22	0.25	0.17	0.41	0.56	0.93	0.82	0.76	0.77	0.86	0.59	**0.55**
33	Vanadium as V	mg/l	$	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	**BDL**
34	Nitrate as NO_3	mg/l	50	0.21	0.19	0.18	0.15	0.25	0.32	0.33	0.29	0.29	0.26	0.37	0.22	**0.26**

ANNEXURE - IX

TATA STEEL

MANGANESE GR.OF MINES, JODA

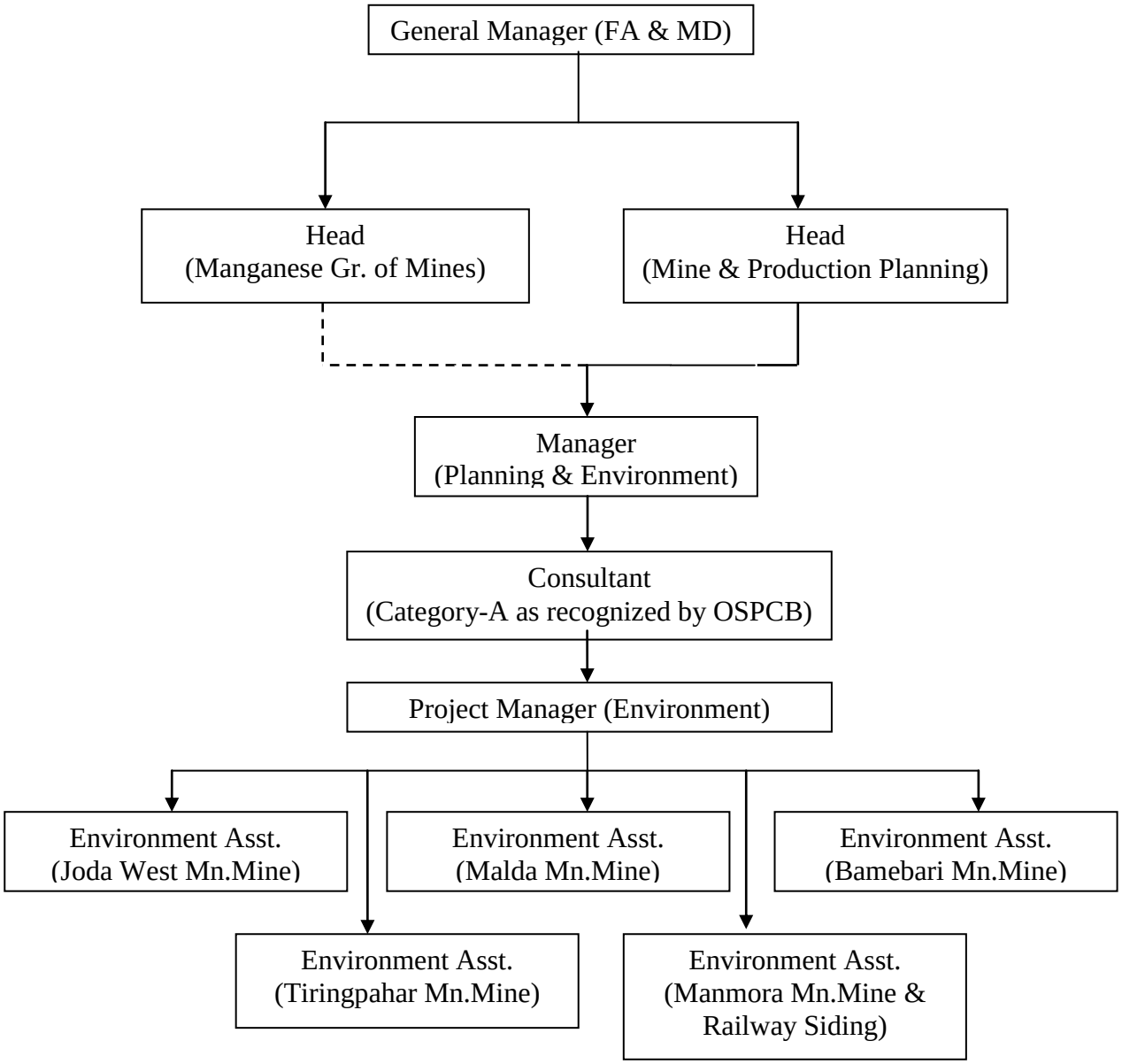
RESULT OF NOISE LEVEL MONITORING AT DIFFERENT LOCATION

Mine	Location	Physical Condition	Period **05.05.2014 to 12.05.2014** Noise Level dB(A)	Period **03.09.2014 to 10.09.2014** Noise Level dB(A)
Joda West	Sampling Shed	During crushing of ore	77	79
Joda West	a) H'Quarry	i) 2 mtr.away from Shovel Operation	72	75
		ii) Inside the Shvel Operator Cabin	53	56
		iii) 1 mtr.away from wagon drill operation	83 *	81*
	b) D'Quarry	i) 2 mtr.away from Shovel Operation	68	71
		ii) Inside the Shvel Operator Cabin	52	55
		iii) 1 mtr.away from wagon drill operation	85 *	82 *

NB : - Prescribed noise level for 8 hr. exposure is 90 dB(A)
*** Ear Muff / Ear Plug has been provided to all the crew members of operation**

Annexure - X

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 – XI
Organizational Structure