

Date.17.06.2026

To

**The Deputy Director General of Forests (C),
Ministry of Environment and Forest and Climate Change, Integrated Regional office,
(Eastern Zone)
A/3, Chandrasekharpur,
Bhubaneswar-751023**

Sub: Certification for the status of compliance conditions stipulated in the Environment Clearance obtained for the production capacity of **5.988** MTPA and as per EIA Notification **7(ii) a** & MoEF&CC, O.M. F. No. IA3-22/10/2022-IA.III [E-177258] Date-11.04.2022, seeking enhancement of production under scenario 'III' of the said OM upto 40%, after successful compliance of environmental clearance of up to 20% of previous environmental safeguard conditions vide EC Identification No. EC25B0000OR5972294N Dated. 16/06/2025, related to production of Iron Ore in respect of Raikela Iron ore mines of M/s Geetarani Mohanty over an area of 67.586Ha at Raikela village in Koira Tahasil of Sundargarh District of Odisha.

Ref: 1. EC Identification No. EC25B0000OR5972294N Dated. **16/06/2025**
2. F.No. 523021/28-MINB1/02-2025

Sir,

This is with the above cited subject and reference, we would like to inform you that the Environment Clearance from SEIAA, Odisha, has been accorded for the production capacity of **5.988** MTPA. We are proposing for enhancement capacity for the production from **4.99** MTPA up to 40% i.e. **6.986** MTPA with existing 1000TPH crushing and screening facility over 67.586 Ha at village -Raikela, Tahasil - Koira, District- Sundargarh of M/s Geetarani Mohanty Raikela Iron Ore Mines, as per the above referred MoEF&CC Office Memorandum.

In this regard, the Project Proponent need to obtain a certified report of the status of compliance of conditions stipulated in the Environment Clearance for the existing operations of the project from the regional office of the Ministry of Environment, Forest and Climate Change.

Complying to the EC conditions stipulated in the Environment clearance vide EC identification.
EC25B0000OR5972294N Dated. **16/06/2025**

This is for your kind consideration and necessary action please.

**For M/s Geetarani Mohanty
Raikela Iron Ore Mines**



M/S GEETARANI MOHANTY
MANAGING PARTNER

Managing Partner

Enc:

Copy of Existing Environmental Clearance letter vide No.EC25B0000OR5972294N Dated. 16/06/2025
Compliance report of conditions in environment clearance accorded EC ID No. EC25B0000OR5972294N dated.16/06/2025 in respect of M/s. Geetarani Mohanty, Raikela iron ore mines in for production of iron ore 5.988 MTPA at -Raikela, Koira in the district of Sundargarh, Odisha.

- 1. Annexures**
- 2. Photographs**

Compliance to the EC conditions of EC ID EC25B0000OR5972294N Dated 16/06/2025, of M/s Geetarani Mohanty Raikela Iron Ore Mines, Raikela, Koira, Sundargarh, for the production of 5.988 MTPA Iron Ore.

1. Specific Condition		
S.No	EC Conditions	Compliance made by PP
1.1	i) The project proponent needs to preserve or utilize the ore and fine's containing Fe between 35-45%, following IBM guidelines.	Low grade ore and fines containing 35-45% Fe is being stacked separately for future use . Photograph Attached as Pic 1
	ii) The project proponent shall maintain adequate greenbelt in the lease area.	7.5 m greenbelt of 2.523 ha around the lease area and plantation along the dump slope is being maintained Attached as Pic 2
	iii) OB dump sites shall be managed properly as proposed.	OB dump is managed with Masonry retaining wall, reinforced RCC retaining wall, steel gabion nets, slopes covered with coir matting and plantation was done over it. Attached as Pic 3
	iv) The additional fines generated due to proposed enhancement shall be managed properly.	The additional fines generated during the expansion is being sold to pellet plants / beneficiation plants and below Fe 45% is being stacked separately to prevent contamination and allow for future recovery/ sale by proper blending. Attached as Pic 4
	v) Proper Air Pollution Control measures shall be provided to control dust emission and local dust generation.	Proper tools are used during excavation, chutes of crushers are covered with hood , wet drilling practised during drilling of blast holes , fixed sprinklers and 3 nos. water tankers are used for wetting of haul road, dry fog system is installed in crushers and screen plants and mist canon is being used in the parking area to prevent dust generation and control Air pollution. Attached as Pic 5
	vi) The Project Proponent shall get the Final Mine Closure Plan along with Financial Assurance approved from Indian Bureau of Mines/Department of Mining & Geology as required under the Provision of the MMDR Act, 1957 and Rules/ Guidelines made there under. A copy of approved final mine closure plan shall be submitted within 2 months of the approval of the same from the competent authority to the concerned Regional Office of the Ministry of Environment, Forest and Climate Change for record and verification.	The Project Proponent will get the Final Mine Closure Plan along with Financial Assurance approved from Indian Bureau of Mines as required under the Provision of the MMDR Act, 1957 and Rules Guidelines made there under before expiry of Mining Lease.. A copy of approved final mine closure plan will be submitted within 2 months of the approval of the same from the competent authority to the Regional Office of MoEFCC.

vii) Traffic management shall be done as per recommendation of Traffic Management Study Report duly vetted by a domain expert from an institute of repute.	The Traffic Management study has been done by NIT Rourkela and the report is enclosed as Annexure I.
viii) As a part of six-monthly compliance, the PP shall submit the status of Tailing Pond and its annual make-up to ascertain its capacity to take care of expansion in production including mineralogical & chemical analysis of excavated ore, dump materials and rejects. Also, actual layout after expansion may be submitted as a part of six-monthly compliance to the SEIAA, Odisha and Regional Office, MoEF&CC, Govt. of India, Bhubaneswar.	Not envisaged as beneficiation of Iron Ore is not included in the project
ix) Adequate measures shall be adopted for management of noise, vibration and fly rocks based on scientific studies.	Scientific studies for controlled blasting, noise, vibration and fly rocks was conducted by NIT, Rourkela and the recommendations are implemented . Report attached as Annexure XVI
x) The PP shall ensure proper surface runoff management based on scientific studies by an Institute of repute and adopt adequate water conservation measures to augment the water resources of the area.	Surface runoff management based on scientific studies by Manav Rachna International Institute of Research & Studies, Faizabad an institute of repute and adopt adequate water conservation measures to augment the water resources of the area. Annexure XX
xi) The efficiency of the pollution control measures shall be evaluated at regular intervals.	Water Quality: Effluent parameters (pH, COD, BOD, TSS, TDS, Oil & Grease) is being monitored once every fortnight.
	Ground Water & Surface Water tested quarterly by NABL Accredited Laboratory. Attached as Annexure XI
	Air Quality: Fugitive emissions at dust-generating points (such as crushing and screening plants) is being monitored daily. Attached as Annexure IX
	Noise Levels: Noise level maintained within permissible limits (e.g., 75 dB during the day and 70 dB during night and monitored daily, and report is being prepared fortnightly. Attached as Annexure XII
	Pollution control & monitoring equipment are calibrated periodically. Attached as Annexure XII A
Standard EC Conditions for (Mining of minerals)	

1.1	The Project Authorities should widely advertise about the grant of this EC letter by printing the same in at least two local newspapers, one of which shall be in vernacular language of the concerned area. The advertisement shall be done within 7 days of the issue of the clearance letter mentioning that the instant project has been accorded EC and copy of the EC letter is available with the State Pollution Control Board and web site of the Ministry of Environment, Forest and Climate Change (www.parivesh.nic.in). A copy of the advertisement may be forwarded to the concerned MoEFCC Regional Office for compliance and record.	Paper advertisement about grant of EC has been published in Odia newspaper "The Sambad" on 19.06.2025 and national daily "The New Indian Express" on 19.06.2025. A copy of the same is enclosed as Annexure II
1.2	The Project Proponent shall inform the MoEF&CC for any change in ownership of the mining lease. In case there is any change in ownership or mining lease is transferred. PP needs to apply for transfer of EC as per provisions of the para 11 of EIA Notification, 2006 as amended from time to time.	Shall be intimated if there is any change in ownership of the mining lease as per the Provisions of the para 11 of EIA notification, 2006 as amended from time to time.
1.3	The State Government concerned shall ensure that mining operation shall not be commenced till the entire compensation levied, if any, for illegal mining paid by the Project Proponent through their respective Department of Mining & Geology in strict compliance of Judgment of Hon'ble Supreme Court dated 2nd August, 2017 in Writ Petition (Civil) No. 114 of 2014 in matter of Common Cause versus Union of India & Ors.	Necessary permission accorded from State Government for undertaking mining operation after paying compensation amount as demanded from the respective department in compliance to the Judgment of Hon'ble Supreme Court in W.P(c) No.114 of 2014, dated 02.08.2017. A copy of the order is enclosed herewith as Annexure III
1.4	State Pollution Control Board/Committee shall be responsible for display of this EC letter at its regional office, District Industries Centre and Collector's office/ Tehsildar's Office for 30 days.	EC Copies submitted to OSPCCB
1.5	The Project Proponent shall follow the mitigation measures provided in MoEFCC's Office Memorandum No. Z-11013/57/2014-IA.II (M), dated 29th October, 2014, titled "Impact of mining activities on Habitations-Issues related to the mining Projects wherein Habitations and villages are the part of mine lease areas or Habitations and	1. A safety barrier of 50 metres is maintained from habitation or village boundary with a green belt. 2.No blasting is done within 300 metres of the habitation 3. fixed-type water sprinkler has been installed on all haul roads . 4.Mineral transportation is ensured through covered trucks (tarpaulin) Photograph Attached as PIC 6

	villages are surrounded by the mine lease area."	5.Real-time Monitoring: Installation of Continuous Ambient Air Quality Monitoring Stations (CAAQMS) at the village boundary, with data linked to the SPCB/CPCB servers has been done.Photograph attached as PIC 7 6.Community Health: Regular health camps and medical check-ups for villagers is being conducted .Attached as PIC
1.6	A copy of EC letter will be marked to concerned Panchayat / local NGO etc. if any, from whom suggestion I representation has been received while processing the proposal.	The EC letter has been intimated to local Gram Panchayat, Municipality, Zila Parishad, etc. and a copy has been uploaded in the company's website i.e., www.grmmine.in
1.7	The project proponent shall prepare a Site-Specific Conservation Plan & Wildlife Management Plan and approved by the Chief Wildlife Warden. The recommendations of the approved Site-Specific Conservation Plan / Wildlife Management Plan shall be implemented in consultation with the State Forest Department. The implementation report shall be furnished along with the six-monthly compliance report. (in case of the presence of Schedule-I species in the study area).	Approved SSWLCP has been implemented. Annexure IV
1.8	The project proponent shall obtain Consent to Establish / Operate under the provisions of Air (Prevention & Control of Pollution) Act, 1981 and the Water (Prevention & Control of Pollution) Act, 1974 from the concerned State Pollution Control Board/ Committee.	The Consent to Establish has been obtained vide letter No. 15169 IND- II-CTE-7495 Dt 12.08.2025 from State Pollution Control Board, Odisha for production of iron ore of 5.988 MTPA. The copy of the order is enclosed as Annexure V . The Consent to Operate has been obtained vide letter No. 1586 IND- I-CON-2572 Dt 26.09.2025 after grant of EC and the conditions stipulated in the CTO are effectively implemented. Copy of the Consent to Operate order is enclosed as Annexure VI
1.9	The project proponent shall obtain clearance from the National Board for Wildlife, if applicable.	Not Envisaged for this project as no National Park & WLS is situated within 15 km radius.
1.1	The project proponent shall obtain forest clearance under the provisions of Forest (Conservation) Act, 1986, in case of the diversion of forest land for non-forest purpose involved in the project.	Forest Clearance has been accorded from MoEFCC, GoI, vide File No. F. No. 8-37/2007-FC dated 22.10.2014.Stage II attached as Annexure VIII

1.11	The project proponent shall obtain the necessary permission from the Central Ground Water Authority, in case of drawl of ground water / from the competent authority concerned in case of drawl of surface water required for the project.	Necessary permission (NoC) has been accorded by CGWA for withdrawal of 170cum day of ground water vide NOC Letter NOC/ MIN/OD/2024/932/R-2 Attached as Annexure XIX
1.12	This Environmental Clearance (EC) is subject to orders/ judgment of Honble Supreme Court of India, Honble High Court, Honble NGT and any other Court of Law, Common Cause Conditions as may be applicable.	There is no case pending before any court of law.
1.13	The Project proponent complies with all the statutory requirements and judgment of Hon'ble Supreme Court dated 2nd August, 2017 in Writ Petition (Civil) No. 114 of 2014 in matter of Common Cause versus Union of India &Ors before commencing the mining operations.	The Project proponent have complied with all the statutory requirements and judgment of Hon ble Supreme Court dated 2nd August, 2017 in Writ Petition (Civil) No. 114 of 2014 in matter of Common Cause versus Union of India Ors before commencing the mining operations Annexure III
1.14	The project proponent shall obtain authorization under the Hazardous and other Waste Management Rules, 2016 as amended from time to time.	The Hazardous Waste Authorization has been obtained vide authorization No.IND-IV-HW-1360 13597 Dt 19.07.2025 from State Pollution Control Board, Odisha. The copy of the authorization is enclosed as Annexure-VII
2		
2.1	The Project Proponent shall carryout plantation/ afforestation in backfilled and reclaimed area of mining lease, around water body, along the roadsides, in community areas etc. by planting the native species in consultation with the State Forest Department/ Agriculture Department/ Rural development department/ Tribal Welfare Department/ Gram Panchayat such that only those species be selected which are of use to the local people. The CPCB guidelines in this respect shall also be adhered. The density of the trees should be around 2500 saplings per Hectare. Adequate budgetary provision shall be made for protection and care of trees.	Project proponent has carried out plantation all along the safety zone, dump slope and outside lease area .Plantation of local species has been carried out at the said locations @ 2500 nos of saplings per hectare. The details of plantation area as follows Area covered 2.523 Ha over safety Zone.Attached as PIC 2

2.2	The Project Proponent shall make necessary alternative arrangements for livestock feed by developing grazing land with a view to compensate those areas which are coming within the mine lease. The development of such grazing land shall be done in consultation with the State Government. In this regard, Project Proponent should essentially implement the directions of the Hon'ble Supreme Court with regard to acquisition of grazing land. The sparse trees on such grazing ground, which provide mid-day shelter from the scorching sun, should be scrupulously guarded/ protected against felling and plantation of such trees should be promoted.	There is no grazing land within the lease area. Hence, no alternative arrangement for livestock feed by developing grazing land is required for this project. The Project Proponent has paid all the levies as per Stage I, Stage II forest diversion and SSWLCP.
3. Air Quality Monitoring And Preservation		
3.1	The project proponent shall monitor fugitive emissions in the lease area premises at least once in every quarter through labs recognized under Environment (Protection) Act, 1986. 9) The project proponent shall install system to carryout Continuous Ambient Air Quality monitoring for common/criterion parameters relevant to the main pollutants released (e.g., PM IO and PM2.5 in reference to PM emission, and SO2 and NOx in reference to SO2 and NOx emissions) within and outside the lease area at least at four locations (one within and three outside the lease area at an angle of 120 each). covering upwind and downwind directions.	Fugitive Emission and Continuous Ambient Air Quality monitoring for (e.g., PM10 , PM2.5 , SO2, NOX and CO emission) within and outside the lease area (three nos of CAAQMS are within the lease area at an angle of 120° each). covering upwind and downwind directions. Photographs of the three AAQMS attached as PIC 5
3.2	The project proponent use leak proof trucks/dumpers carrying ore and other raw materials and cover them with tarpaulin.	Trucks with fitness certificates and after physiscal checking are allowed for transportation and covered with tarpaulin before leaving the lease area.
3.3	The project proponent shall submit monthly summary report of continuous stack emission and air quality monitoring and results of manual stack monitoring and manual monitoring of air quality /fugitive emissions to Regional Office of MoEF&CC, Zonal office of CPCB and Regional Office of SPCB along with six-monthly monitoring report.	Project proponent has installed online CAAQMS , RDS and FDS and the results of manual monitoring of air quality, fugitive emissions is being submitted to Regional Office of MoEF & CC, and Regional Office of SPCB along with six-monthly monitoring report.

3.4	Wind shelter fence shall be provided on the raw material stock piles.	No stock piles of raw materials are maintained. Iron ore processed are stacked for despatch which are temporary in nature.
3.5	Effective safeguard measures for prevention of dust generation and subsequent suppression (like regular water sprinkling, metalled road construction etc.) shall be carried out in areas prone to air pollution wherein high levels of PM 10 and PM2.5 are evident such as haul road, loading and unloading point and transfer points. The Fugitive dust emissions from all sources shall be regularly controlled by installation of required equipments/ machineries and preventive maintenance. Use of suitable water-soluble chemical dust suppressing agents may be explored for better effectiveness of dust control system. It shall be ensured that air pollution level conform to the standards prescribed by the MoEFCC/ Central Pollution Control Board.	Effective safeguard measures for prevention of dust generation and subsequent suppression like regular water sprinkling with the help of water tanker, fixed sprinklers, mist canon, dry fog system are maintained and 300 mtr CC road has been constructed along the haul road, loading and unloading point and transfer points. Suitable water-soluble chemical dust suppressing agents is being used for better effectiveness of dust control .Wet drilling is practised during drilling of blast holes. Attached as PIC 11 Environmental monitoring is being regularly carried out by NABL Accredited Lab . Reports attached as Annexure IX .
3.6	The Project Proponent shall install a minimum of 3 (three) online Ambient Air Quality Monitoring Stations with 1 (one) m upwind and 2 (two) in downwind direction based on long term climatological data about wind direction such that an angle of 120° is made between the monitoring locations to monitor critical parameters, relevant for mining operations, of air pollution viz. PM 10, PM2.5, NOX, CO and SO2 etc. as per the methodology mentioned in NAAQS Notification No. B-29016/20/90/PCI/1, dated 18.11.2009 covering the aspects of transportation and use of heavy machinery in the impact zone. The ambient air quality shall also be monitored at prominent places like office building, canteen etc. as per the site condition to ascertain the exposure characteristics at specific places. The above data shall be digitally displayed within 03 months in front of the main Gate of the mine site.	The Project Proponent have already installed 3 nos. of online monitoring stations for air pollution viz. PM10, PM2.5, NOx ,CO and SO2 etc. with 1 (one) in upwind and 2 (two) in downwind direction at an angle of 120° as per the methodology mentioned in NAAQS 2009 standard covering the aspects of transportation and use of heavy machinery in the impact zone as per the conditions stipulated. The photographs of online continuous ambient air monitoring is attached herewith. Manual AAQ is being monitored in buffer area through NABL Accredited Lab. The data of AAQMS is being digitally displayed in front of the main Gate of the mine site. PIC 9
4. Water Quality Monitoring And Preservation		

4.1	De-silting of agricultural lands in buffer zone and beyond including nearby Nalas/rivers perennially periodically and perpetually caused due to wash up of minerals/OB/dumps shall be done as per SOP submitted. Retaining wall shall be constructed to ensure that no silt after wash up is escaped from the core / buffer zone of the mines.	De-silting of agricultural lands in buffer zone and beyond including nearby Nalas, rivers, perennially periodically and perpetually caused due to wash off loose soil OB dumps is done as per SOP submitted . In this regard, a legal affidavit is submitted as Annexure X . De-Siltation photographs attached as PIC 15
4.2	The project proponent shall monitor regularly ground water quality at least twice a year (pre and post monsoon) at sufficient numbers of piezometers/sampling wells of adjacent areas through labs recognized under Environment (Protection) Act, 1986 and NABL accredited laboratories	Ground water quality from sample wells and ground water level by piezometer is being monitored through NABL accredited laboratory .Attached as Annexure XI
4.3	The Project Proponent shall undertake regular monitoring of natural water course/ water resources/ springs and perennial nallas existing/ flowing in and around the mine lease including upstream and downstream. Sufficient number of gullies shall be provided at appropriate places within the lease for management of water. The parameters to be monitored shall include their water quality vis-a-vis suitability for usage as per CPCB criteria and flow rate. It shall be ensured that no obstruction and/ or alteration be made to water bodies during mining operations without justification and prior approval of MoEFCC. The monitoring of water courses/ bodies existing in lease area shall be carried out four times in a year viz. pre- monsoon (April May), monsoon (August), post-monsoon (November) and winter (January) and the record of monitored data may be sent regularly to the Regional Office of Ministry, Central Ground Water Authority and Regional Director, Central Ground Water Board, State Pollution Control Board and Central Pollution Control Board. Clearly showing the trend analysis on six-monthly basis.	Surface water quality is being monitored of both upstream and down stream. There is no natural water course/ water resources/ springs and perennial nallahs existing/ flowing within the lease area. But monitoring of water quality and flow rate is being carried out of near by regularly. Annexure IX, XI & XII

4.4	The water balance/water auditing shall be carried out and measure for reducing the consumption of water shall be taken up and reported to the Regional Office of the MoEF&CC and State Pollution Control Board/Committee	Water balance is provided in the EIA report for 170 KLD for the production of 5.988 MTPA. Water audit was carried by FICCI . Report attached as Annexure XXII
4.5	Industrial waste water (workshop and waste water from the mine) should be properly collected and treated so as to conform to the notified standards prescribed from time to time. The standards shall be prescribed through Consent to Operate (CTO) issued by concerned State Pollution Control Board (SPCB). The workshop effluent shall be treated after its initial passage through Oil and grease trap.	Industrial wastewater generated from workshop during vehicle washing is properly collected and treated through 12 KLD capacity ETP constructed by PP. The standards are as per Consent to Operate (CTO) issued by concerned State Pollution Control Board (SPCB). The workshop effluents are being treated after its initial passage through Oil and grease trap and recycled for vehicle washing. Wheel Washing attached as PIC 16 & PIC 20 (OWC)
4.6	Sewage Treatment Plant shall be provided for treatment of domestic wastewater to meet the prescribed standards.	Sewage Treatment Plant with ozo bioxy system having capacity of 100 KLD has been installed and used for treatment of domestic waste water and recycled and later use in dust suppression and plantation. Photographs of STP attached as PIC 12
4.7	Garland drains and collection pits shall be provided for each stock pile to arrest the run-off in the event of heavy rains and to check the water pollution due to surface run off.	The project proponent has constructed retaining wall and garland drain with settling pond to retain the wash off of dump materials. A total of 1942 m of retaining wall, 1635m garland drain and 3nos of settling pond has been constructed at strategic locations to retain the wash off from dump materials. Photographs attached as PIC 13
4.8	Quality of polluted water generated from mining operations which include Chemical Oxygen Demand (COD) in mines run-off; acid mine drainage and metal contamination in runoff shall be monitored along with Total Suspended Solids (TDS), Dissolved Oxygen (DO), pH and Total Suspended Solids (TSS). The monitored data shall be uploaded on the website of the company as well as displayed at the project site in public domain, on a display board, at a suitable location near the main gate of the Company. The circular No. J-20012/1/2006-IA.II (M) dated 27.05.2009 issued by Ministry of Environment, Forest and Climate Change may also be referred in this regard.	The runoff from mine during rainy season is treated in settling pond, tested for TDS, DO, pH, and TSS and then routed to natural water course. There is no natural water course, water resources, springs and perennial nallas existing/flowing within the ML area. However, monitoring is being carried out from the near by nalla. A copy of runoff mines water quality monitoring report is attached as Annexure XI

4.9	Project Proponent shall plan, develop and implement rainwater harvesting measures on long term basis to augment ground water resources in the area in consultation with Central Ground Water Board/ State Groundwater Department. A report on amount of water recharged needs to be submitted to Regional Office MoEFCC annually.	Project Proponent has developed and implement rainwater harvesting measures to augment ground water during lean season in the area in consultation with an insitute if repute. Photograph of the harvesting structure is attached for reference. PIC
4.1	The project proponent shall submit monthly summary report of continuous effluent monitoring and results of manual effluent testing and manual monitoring of ground water quality to Regional Office of MoEF&CC, Zonal office of CPCB and Regional Office of SPCB along with six-monthly monitoring report.	The project proponent is submitting monthly summary report of continuous effluent monitoring and results of manual effluent testing and manual monitoring of ground water quality. Report attached as Annexure XI
4.11	Project Proponent shall regularly monitor and maintain records w.r.t. ground water level and quality in and around the mine lease by establishing a network of existing wells as well as new piezo-meter installations during the mining operation in consultation with Central Ground Water Authority/ State Ground Water Department. The Report on changes in Ground water level and quality shall be submitted on six-monthly basis to the Regional Office of the Ministry, CGWA and State Groundwater Department I State Pollution Control Board.	Monitoring of the ground water quality at 3 locations namely Mines office, PTA bore well Well, Tentuldihi & Raikela dug well has been undertaken and the records are maintained. The results are within the permissible limit. Piezo-meter has already been installed in consultation with Central Ground Water Authority. Report attached as Annexure XI. Photographs of Piezometer Attached as PIC 21
4.12	In case, immediate mining scheme envisages intersection of ground water table, then Environmental Clearance shall become operational only after receiving formal clearance from CGWA. In case, mining operation involves intersection of ground water table at a later stage, then PP shall ensure that prior approval from CGWA and MoEFCC is in place before such mining operations. The permission for intersection of ground water table shall essentially be based on detailed hydro- geological study of the area.	The depth of mine at present is at 640m.RL. During plan period, it is planned to work up to 630m.RL. Hence, ground water intersection will not be taken place as the water table is at 609 m.RL. As and when ground water intersection will take place, the project proponent will take prior approval from CGWA and MoEFCC before mining operations.
4.13	Adhere to Zero Liquid Discharge	No wastewater is released untreated. The waste water is being recycled in STP, ETP and reused in plantation and dust suppression.

4.14	The project proponent shall practice rainwater harvesting to maximum possible extent	Suitable Rain water Harvesting measures along with Rain Water Harvesting structures has been implemented .
5. Noise And Vibration Monitoring And Prevention		
5.1	The Project Proponent shall take measures for control of noise levels below 85 dBA in the work environment. The workers engaged in operations of HEMM, etc. should be provided with ear plugs /muffs. All personnel including laborers working in dusty areas shall be provided with protective respiratory devices along with adequate training, awareness and information on safety and health aspects. The PP shall be held responsible in case it has been found that workers/ personals/ laborers are working without personal protective equipment.	The workers engaged in operations of HEMM, etc. are provided with ear plugs muffs. All measures for control of noise levels are being implemented. All personnel including laborers working in dusty areas are provided with protective respiratory devices along with adequate training, awareness and information on safety and health aspects. Use of personal protective equipment is mandatory for all in the mines are checked regularly . Entry restricted to persons without PPE.
5.2	The peak particle velocity at 500m distance or within the nearest habitation, whichever is closer shall be monitored periodically as per applicable DGMS guidelines.	Blasting vibration study has been carried out by NIT, Rourkela. As per the study, the peak particle velocity at 500m distance or within the nearest habitation is within threshold limit as per applicable DGMS guidelines. The study report along with controlled blasting is attached as Annexure XVI
5.3	The illumination and sound at night at project sites disturb the villages in respect of both human and animal population. Consequent sleeping disorders and stress may affect the health in the villages located close to mining operations. Habitations have a right for darkness and minimal noise levels at night. PPs must ensure that the biological clock of the villages is not disturbed; by orienting the floodlights/ masks away from the villagers and keeping the noise levels well within the prescribed limits for day /night hours.	Illumination of the mine does not affect the the habitation for right to darkness . The noise level during the night is well within the limit of prescribed limits which is being monitored daily.
6. Noise Monitoring And Prevention		
6.1	The ambient noise levels should conform to the standards prescribed under E(P)A Rules, 1986 viz. 75 dB(A) during day time and 70 dB(A) during night time.	Online noise monitoring is installed at mine and monitoring regularly and the results are within the prescribed limit. Photograph attached as PIC 14
6.2	Noise level survey shall be carried as per the prescribed guidelines and report in this regard shall be submitted to Regional Officer of the Ministry as a part of six-monthly compliance report.	Noise level survey is being done regularly and the result is being submitted in the six monthly compliance report Noise Monitoring Report attached Annexure XII

7. Energy Conservation Measures		
7.1	Provide LED lights in their offices and residential areas	LED lights are provided in the office area, residential area and mines area. PIC 18 LED
7.2	Provide solar power generation on roof tops of buildings, for solar light system for all common areas, parking around project area and maintain the same regularly;	The project proponent has already commissioned 30 KW solar power plant and is in operation within the lease hold area. Attached as PIC 17
8. Mining Plan		
8.1	The land-use of the mine lease area at various stages of mining scheme as well as at the end-of-life shall be governed as per the approved Mining Plan. The excavation vis-a-vis backfilling in the mine lease area and corresponding afforestation to be raised in the reclaimed area shall be governed as per approved mining plan. PP shall ensure the monitoring and management of rehabilitated areas until the vegetation becomes self-sustaining. The compliance status shall be submitted half-yearly to the MoEF&CC and its concerned Regional Office.	The land-use of the mine lease area at various stages of mining plan scheme as well as at the end- of-life is being governed as per the approved Mining Plan and will be continued till the end of the life of the mine. The excavation vis-a-vis backfilling in the mine lease area and corresponding afforestation will be raised in the reclaimed area as per approved mining plan. The monitoring and management of rehabilitated areas will be done until the vegetation becomes self- sustaining. The compliance status is being submitted half-yearly to the MoEF&CC and its concerned Regional Office SEIAA, Odisha. Budget for Afforestation is Attached as Annexure XXVI
8.2	The project proponent shall adhere to approved mining plan, inter alia, including, total excavation (quantum of mineral, waste, over burden, inter burden and topsoil etc.) mining technology lease area scope of working (method of mining, overburden dump management, O.B dump mining, mineral transportation mode, ultimate depth of mining, concurrent reclamation and reclamation at mine closure land use of the mine lease area at various stages of mining scheme as well as at the end of life etc).	Is being followed as approved mining plan
8.3	The project proponent shall obtain permissions from DGMS under 106(2b) to carry out blasting operation within the lease area, as applicable.	Necessary permission has been accorded from DGMS to carryout blasting operation within the lease hold area under 106(2b). A copy of the permission letter is enclosed herewith as Annexure XIV.
8.4	The Project Proponent shall prepare digital map (land use & land cover) of the entire lease area once in five years purpose of monitoring land use pattern and submit a report to concerned Regional office of the MoEF &CC.	Digital map using drone survey is being prepared for necessary monitoring.

9. Land Reclamation		
9.1	Catch drains, settling tanks and siltation ponds of appropriate size shall be constructed around the mine working, mineral yards and Top Soil/OB/Waste dumps to prevent run off of water and flow of sediments directly into the water bodies (Nallah/ River/ Pond etc.). The collected water should be utilized for watering the mine area, roads, green belt development, plantation etc. The drains/ sedimentation sumps etc. shall be de-silted regularly, particularly after monsoon season, and maintained properly.	The project proponent has constructed retaining wall and garland drain with settling pond to retain the wash offs of dump materials. A total of 1942 m of retaining wall, 1635m garland drain and 3nos of settling pond has been constructed at strategic locations to retain the wash offs of dump materials. Photographs attached as PIC 13
9.2	The Overburden (O.B.), waste and topsoil generated during the mining operations shall be stacked at earmarked OB dump site(s) only and it should not be kept active for a long period of time. The physical parameters of the OB I waste dumps I topsoil dump like height, width and angle of slope shall be governed as per the approved Mining Plan and the guidelines/circulars issued by D.G.M.S. The topsoil shall be used for land reclamation and plantation.	The over burden dumping is being carried as per the approved mining plan. The physical parameters of the OB dumps like height, width and angle of slope are being undertaken as per approved Mining Plan based on the guidelines circulars issued by DGMS w.r.t. safety in mining operations. No top soil is generated at this stage of mining.
9.3	Check dams of appropriate size, gradient and length shall be constructed around mine pit and OB dumps to prevent storm run-off and sediment flow into adjoining water bodies. A safety margin of 50% shall be kept for designing of sump structures over and above peak rainfall (based on 50 years data) and maximum discharge in the mine and its adjoining area which shall also help in providing adequate retention time period thereby allowing proper settling of sediments/ silt material. The sedimentation pits/ sumps shall be constructed at the comers of the garland drains.	Check dam is already constructed around mine pit and OB dumps to prevent storm run-off and sediment flow into adjoining water bodies. A safety margin of 50% is being kept for designing of sump structures over and above peak rainfall and maximum discharge in the mine and its adjoining area which shall also help in providing adequate retention time period thereby allowing proper settling of sediments silt material. The sedimentation pits sumps are being constructed at the comers of the garland drains, Photograph of Check dam cum RWH is attached as PIC 19

9.4	The slope of dumps shall be vegetated in scientific manner with suitable native species to maintain the slope stability, prevent erosion and surface run off. The selection of local species regulates local climatic parameters and help in adaptation of plant species to the microclimate. The gullies formed on slopes should be adequately taken care of as it impacts the overall stability of dumps. The dump mass should be consolidated with the help of dozer/ compactors thereby ensuring proper filling/ leveling of dump mass. In critical areas, use of geo textiles/ geo-membranes / clay liners / Bentonite etc. shall be undertaken for stabilization of the dump.	Coir matting has been done along the slope of dumps for stabilisation and vegetation. RCC concrete wall, masonry cemented walls and boulder wall with wire netting has been constructed to arrest the surface run off. Plantation of native species provided by Forest department has been done for stabilisation . The dump mass is stabilised with the help of dozer and excavator. Proper maintenance of dump slope is being undertaken to avoid formation of gullies for better stability of dump. Photographs of Coir Matting is attached as PIC 3
9.5	The reject/waste generated during the mining operations shall be stacked at earmarked waste dump site(s) only. The physical parameters of the waste dumps like height, width and angle of slope shall be governed as per the approved Mining Plan as per the guidelines/circulars issued by DGMS w.r.t. safety in mining operations shall be strictly adhered to maintain the stability of waste dumps.	The reject/waste generated during the mining operations have been stacked at earmarked waste dump site(s) only. The physical parameters of the waste dumps like height, width and angle of slope is being maintained as per the approved Mining Plan, as per the guidelines/circulars issued by DGMS w.r.t. safety in mining operations shall be strictly adhered to maintain the stability of waste dumps.
9.6	The project proponent shall carry out slope stability study in case the dump height is more than 60 meters. The slope stability study report shall be submitted to concerned Regional Office of MoEFCC, Govt. of India, Bhubaneswar as well as SEIAA, Odisha	The existing dump has not attended the height of 60m. However, slope stability study has already been undertaken by CIMFR, Dhanbad. The copy of the report has already been submitted to concerned Regional Office of MoEFCC, Govt. of India, Bhubaneswar as well as SEIAA, Odisha Slope Study Report Attached as Annexure XXIII
9.7	The Project Proponent shall make necessary alternative arrangements for livestock feed by developing grazing land with a view to compensate those areas which are coming within the mine lease. The developing of such grazing land shall be done in consultation with the State Government. In this regard, Project Proponent should essentially implement the directions of the Hon ble Supreme Court with regard to acquisition of grazing land. The sparse trees on such grazing ground, which provide mid-day shelter from the scorching sun, should be scrupulously guarded protected against	There is no grazing land within the lease area. Hence, no alternative arrangement for livestock feed by developing grazing land is required for this project. The Project Proponent has paid all the levies as per Stage I, Stage II forest diversion and SSWLCP.

	felling and plantation of such trees should be promoted.	
10. Waste Management		
10.1	The waste oil, grease and other hazardous waste shall be disposed of as per the Hazardous & Other waste (Management & Transboundary Movement) Rules, 2016.	Is being followed as per Hazardous Other waste (Management Transboundary Movement) Rules, 2016.Attached as Annexure VII
11. Transportation		
11.1	The Main haulage road within the mine lease should be provided with a permanent water sprinkling arrangement for dust suppression. Other roads within the mine lease should be wetted regularly with tanker-mounted water sprinkling system. The other areas of dust generation like crushing zone, material transfer points, material yards etc. should invariably be provided with dust suppression arrangements. The air pollution control equipments like bag filters, vacuum suction hoods, dry fogging system etc. shall be installed at Crushers, belt-conveyors and other areas prone to air pollution. The belt conveyor should be fully covered to avoid generation of dust while transportation. PP shall take necessary measures to avoid generation of fugitive dust emissions	Fixed water sprinkler has already been installed in main haulage roads. The other haul roads within mine lease is being wetted through three nos water tankers having 20 KL capacity.The other areas of dust generation like crushing zone, material transfer points, material yards etc. have been provided with dust suppression arrangements. The air pollution control equipments like dry fogging system has been installed at Crushers, belt-conveyors and other areas prone to air pollution. The belt conveyors are fully covered to avoid generation of dust while transportation. All necessary measures have been taken to avoid generation of fugitive dust emissions. The photographs of fixed water sprinkler are attached. Photographs attached as PIC 5

11.2	No Transportation of the minerals shall be allowed in case of roads passing through villages/ habitations. In such cases, PP shall construct a 'bypass' road for the purpose of transportation of the minerals leaving an adequate gap (say at least 200 meters) so that the adverse impact of sound and dust along with chances of accidents could be mitigated. All costs resulting from widening and strengthening of existing public road network shall be borne by the PP in consultation with nodal State Govt. Department. Transportation of minerals through road movement in case of existing village/ rural roads shall be allowed in consultation with nodal State Govt. Department only after required strengthening such that the carrying capacity of roads is increased to handle the traffic load. The pollution due to transportation load on the environment will be effectively controlled and water sprinkling will also be done regularly. Vehicular emissions shall be kept under control and regularly monitored. Project should obtain Pollution Under Control (PUC) certificate for all the vehicles from authorized pollution testing centers. [If applicable in case of road transport].	The transportation of mineral through vehicles is being carried out through CC road passing in the mines. The PP is taking necessary measures to monitor that the vehicles carrying minerals from the mines are having vehicular emission under control. However, dust suppression is being carried out regularly by deploying water tankers at haulage roads. Photographs attached as PIC 5
12. Green Belt		
12.1	The Project Proponent shall develop greenbelt in 7.5m wide safety zone all along the mine lease boundary as per the guidelines of CPCB in order to arrest pollution emanating from mining operations within the lease. The whole Green belt shall be developed within first 5 years starting from windward side of the active mining area. The development of greenbelt shall be governed as per the EC granted by the SEIAA irrespective of the stipulation made in approved mine plan.	Green belt has been developed in 7.5 m wide safety zone all along the mine lease boundary as per the guidelines of CPCB in order to arrest pollution emanating from mining operations within the lease. The Project Proponent has already undertaken plantation within lease area at Safety Zone, covering 2.523 ha. Photographs of Green Belt is attached as PIC 11

12.2	The PP shall plant "Ek Ped Maa Ke Naam" and the plantation shall be carried out in the earmarked greenbelt area as a part of tree plantation campaign and the details of the same shall be uploaded in the MeriLiFE Portal (https://merilife.nic.in).	The PP has actively taken part in "Ek Ped Maa Ke Naam" and the plantation carried out in the earmarked greenbelt area as a part of tree plantation campaign and the details of the same has been uploaded in the MeriLiFE Portal (https://merilife.nic.in). Photograph attached as PIC 11
12.3	The Project Proponent shall make the actual count on the saplings planted and its survival rate and in case of failure of achievement of 95% survival rate, action plan for achieving the target survival rate shall be submitted to the Ministry's Regional Office.	Complied. Wherever survival rate has been reduced the PP has taken gap plantation in the subsequent years.
12.4	The Project Proponent needs to complete the entire peripheral plantation under green belt, safety barrier plantation and gap plantation within three years from the start of mining operations. The PP should plant quality sampling of appropriate height of native and fruit bearing species. Plantation shall be undertaken in consultation with the State Forest Dept. PP needs to undertake the adequate bench plantation and on the terrace of the waste dumps to prevent the soil erosion.	The Project Proponent is continuing peripheral plantation both inside and outside the lease under green belt, safety barrier plantation and gap plantation in consultation with Forest department. Photographs attached as PIC 10
13. Public Hearing And Human Health Issues		
13.1	Occupational health surveillance of the workers shall be done on a regular basis and records maintained as per the Factories Act.	The occupational health surveillance of the workers like Initial Medical Examination, Periodical Medical Examination is being done on regular basis and records are maintained as per the act. IME & PME Attached as Annexure XIII
13.2	The project proponent shall carry out heat stress analysis for the workmen who work in high. emperature work zone and provide Personal Protection Equipment (PPE) as per the norms of Factory Act.	No such high temperature work zone related job is being done in the mines now. The project proponent will follow the norms as and when situation arises.
13.3	Emergency preparedness plan based on the Hazard identification and Risk Assessment (HIRA) and Disaster Management Plan shall be implemented	Emergency preparedness plan based on the Hazard identification and Risk Assessment (HIRA) and Disaster Management Plan has been implemented. Plan Attached as Annexure XXVII

13.4	Provision shall be made for the housing of construction labour within the site with all necessary infrastructure and facilities such as fuel for cooking, mobile toilets, mobile SIP, safe drinking water, medical health care, creche etc. The housing may be in the form of temporary structures to be removed after the completion of the project.	Is being followed. For the time being no such activity is being carried out. But it will be implemented as and when arises.
13.5	Project Proponent shall make provision for the housing for workers/labors or shall construct labor camps within/outside (company owned land) with necessary basic infrastructure/ facilities like fuel for cooking, mobile toilets, mobile STP, safe drinking water, medical health care, creche for kids etc. The housing may be provided in the form of temporary structures which can be removed after the completion of the project related infrastructure. The domestic waste water should be treated with STP in order to avoid contamination of underground water.	The accommodation facilities for the employees have been provided with a residential colony with basic infrastructure facilities like fuel for cooking, toilets, STP, safe drinking water, dispensary for medical health care etc. The domestic effluents are being treated through STP of 100 KLD capacity. Photographs attached as PIC 12
13.6	The project proponent shall augment infrastructure on drinking water, health care and education in nearby villages as per time bound action plan submitted.	Is being followed as per CSR activity, Drinking water facility through borewell with overhead tank and pipe supply has been provided to nearby villages like, Raikela, Dengula, Tentulidih, Kula, Rengma, Bonai etc. Every year a mega health camp is being organised where more than 1000 people directly are being benefitted and free medicine is distributed through our dispensary where we have employed a doctor and two numbers pharmacists. One ambulance has been dedicated to villagers for any emergency. 8 numbers of teachers have been employed for improvement in the quality of education in the local periphery villages. Photographs of CSR is attached.
14. Corporate Environment Responsibility		
14.1	Self-environmental audit shall be conducted annually. Every three years third party environmental audit shall be carried out.	Is being carried out.

14.2	The company shall have a well laid down environmental policy duly approved by the Board of Directors. The environmental policy should prescribe for standard operating procedures to have proper checks and balances and to bring into focus any infringements/deviation/violation of the environmental / forest /wildlife norms/ conditions. The company shall have defined system of reporting infringements / deviation / violation of the environmental / forest / wildlife norms /conditions and / or shareholders / stake holders. The copy of the board resolution in this regard shall be submitted to the Regional Office of MoEF&CC as a part of six-monthly report.	Environmental policy is established with compatible with the strategic direction and the context of the organization.
14.3	The Project Proponent shall submit the time-bound action plan to the concerned regional office of the Ministry within 6 months from the date of issuance of environmental clearance for undertaking the activities committed during public consultation by the project proponent and as discussed by the SEAC, in terms of the provisions of the MoEF&CC Office Memorandum No.22-65/2017-IA.III dated 30 September, 2020. The action plan shall be implemented within three years of commencement of the project. The status report on implementation of action plan shall be submitted to the concerned Regional Office of the Ministry along with District Administration.	Action plan as per the commitment during the public consultation has been implemented and work is in progress. CER Expenses attached as Annexure XVIII
14.4	A separate Environmental Cell both at the project and company head quarter level, with qualified personnel shall be set up under the control of senior Executive, who will directly to the head of the organization. Adequate number of qualified Environmental Scientists and Mining Engineers shall be appointed and submit a report to RO, MoEF&CC.	An Environment Cell is established with suitable qualified personnel under the control of a Senior Executive, who is reporting directly to the Head of the Organization. Organizational Chart is Attached as Annexure XV

14.5	Action plan for implementing EMP and environmental conditions along with responsibility matrix of the company shall be prepared and shall be duly approved by competent authority. The year wise funds earmarked for environmental protection measures shall be kept in separate account and not to be diverted for any other purpose. Year wise progress of implementation of action plan shall be reported to the Regional Office of Ministry along with the Six Monthly Compliance Report.	Project Proponent has kept the funds earmarked for environmental protection measures in a separate account. Account Details is attached as Annexure XXIV
15. Miscellaneous		
15.1	In pursuant to Ministry's O.M No 22-34/2018-IA.IIT dated 16.01.2020 to comply with the direction made by Hon'ble Supreme Court on 8.01.2020 in W.P. (Civil) No 114/2014 in the matter Common Cause vs Union of India, the mining lease holder shall after ceasing mining operations, undertake regrassing the mining area and any other area which may have been disturbed due to other mining activities and restore the land to a condition which is fit for growth of fodder, flora, fauna etc.	An additional Supplementary Lease deed has been executed with state government to take up re- grassing the mining area and any other area which may have been disturbed due to their mining activities, after ceasing mining operations and restore the land to a condition which is fit for growth of fodder, flora, fauna, etc. Supplementary Lease Deed attached as Annexure XVII

15.2	It shall be mandatory for the project management to submit six (06) monthly compliance reports on post environmental monitoring in respect of the stipulated terms and conditions in this Environmental Clearance to the State Environment Impact Assessment Authority (SEIAA), Odisha, SPCB & Integrated Regional Office of the Ministry of Environment & Forest, Odisha, the respective Zonal Office of CPCB and the SPCB in soft copies on 1st June and 1st December of each calendar year. No hard copy of six (06) monthly compliance reports shall be accepted by SEIAA. The proponent shall upload the compliance report including results of monitored data, as applicable in the Parivesh website of the Ministry for monitoring of EC Conditions, failing which EC is liable to be revoked. The concerned Regional Office of the MoEF&CC shall randomly monitor compliance of the stipulated conditions. The project authorities should extend full cooperation to the MoEF&CC officer(s) by furnishing the requisite data information monitoring reports.	The half yearly EC compliance report is being regularly submitted on 1st June and 1st December of every year through online portal.
15.3	The Project Authorities should inform to the Regional Office & SPCB regarding date of financial closures and final approval of the project by the concerned authorities and the date of start of land development work.	Date of financial closures and final approving of the project is not applicable at present because it is an ongoing project. And will be intimated as and when arises.
15.4	The copies of the environmental clearance shall be submitted by the project proponents to the Heads of local bodies, Panchayats and Municipal Bodies in addition to the relevant offices of the Government who in turn has to display the same for 30 days from the date of receipt.	
15.5	The project proponent shall monitor the criteria pollutants level namely; PM10, SO2, NOx (ambient levels as well as stack emissions) or critical sectoral parameters, indicated for the projects and display the same at a convenient location for disclosure to the public and put on the website of the company	Continuous AAQ monitoring is being conducted and the results are displayed at the main gate of the mine. attached as PIC 9

15.6	The project proponent shall upload the status of compliance of the stipulated environment clearance conditions, including results of monitored data on their website and update the same on half-yearly basis	It is being uploaded in half yearly basis.
15.7	No further expansion or modifications in the project shall be carried out without prior approval of the SEIAA, Odisha.	We will abide that no expansion or modification in the project shall be carried out without prior approval of the SEIAA, Odisha
15.8	The project proponent shall abide by all the commitments and recommendations made in the EIA/EMP report, commitment made during Public Hearing and also that during their presentation to the State Expert Appraisal Committee.	Compliance to commitment during Public Hearing has been accomplished successfully. Details of expensed is attached as Annexure XXI
15.9	The project authorities must strictly adhere to the stipulations made by the State Pollution Control Board and the State Government.	We agree to adhere by the stipulations made by the State pollution Control board and the State Government.
15.1	The project proponent shall submit the environmental statement for each financial year in Form-V to the concerned State Pollution Control Board as prescribed under the Environment (Protection) Rules, 1986, as amended subsequently and put on the website of the company.	Is being uploaded on the portal of the Board as prescribed under the Environment (Protection) Rules, 1986, is attached as Annexure XXV
15.11	Concealing factual data failure to comply with any or submission of false/ fabricated data and of the conditions mentioned above may result in withdrawal of this clearance and attract action under the provisions of Environment (Protection) Act, 1986.	The PP will abide to the said condition.
15.12	The SEIAA, Odisha may alter/modify the above conditions or stipulate any further condition in the interest of environment protection.	The PP will abide to the said condition.
15.13	The concerned Regional Office of the MoEF&CC shall randomly monitor compliance of the stipulated conditions. The project authorities should extend full cooperation to the MoEF&CC officer(s) by furnishing the requisite data I information I monitoring reports.	The project authorities will extend their full cooperation to the MoEF CC officer(s) and will furnish the requisite data information monitoring reports as and when asked.

15.14	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, 1981, the Environment (Protection) Act, 1986 and the Public Liability Insurance Act, 1991 along with their amendments and rules made there under and also any other orders passed by the Hon'ble Supreme Court of India/High Court and any other Court of Law relating to the subject matter.	The Project Proponent agrees to this condition.
15.15	Any appeal against this environmental clearance shall lie with the National Green Tribunal, if preferred, within a period of 30 days as prescribed under Section 16 of the National Green Tribunal Act, 2010.	The Project Proponent agrees to the said condition

M/S GEETARANILMOHANTY

 MANAGING PARTNER



Pradeep Biswal
General Manager (Commercial)

Reference: WO No- GMR/2024-25/1354
Dated: 25/09/2024

M/s Geetarani Mohanty,
The World Group Raikela Iron Ore Mines
Near Tensa, PO: Dengula, Sundergarh-770048, Odisha

Subject: Authentication of Traffic Study at Raikela Iron Ore Mines, M/s Geetarani Mohanty, Sundargarh, Odisha.

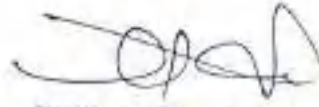
Subject: Authentication of Traffic Study at Raikela Iron Ore Mines, M/s Geetarani Mohanty, Sundargarh, Odisha.

Ref: 1. Your letter dated 09.08.2024
2. Final report on study for feasibility of mineral transportation at Raikela, Sundargarh, Odisha submitted reference WO No-GMR/2024-25/135

Sir,

With reference to the above cited subject and your request vide letter dated 09/08/2024, we here with authenticate that traffic study report specific to Raikela Iron Ore Mines, M/s Geetarani Mohanty, in district Sundargarh of Odisha, is the extract of report on **"study for feasibility of mineral transportation at Raikela, Sundargarh, Odisha"** conducted by **NIT Rourkela, Odisha**. While preparing the report authentic information/ data from various govt. authorities like NHAI, real time traffic data from integrated mines and mineral management system, department of steel and mines, Govt. of Odisha, Regional Transport Office of the Govt. of Odisha was taken into consideration.

Thanking
You, Yours
Sincerely,


Dr. Santos Kumar Das
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Encl: As above

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Consultancy Project Report Submitted to

RAIKELA IRON ORE MINES

of

M/S Geetarani Mohanty

on

TRAFFIC STUDY

by

**Dr. Santos Kumar Das,
Dept. of EC, NIT Rourkela
Principal Investigator**



**National Institute of Technology Rourkela
Odisha - 769 008
September 2024**

CHAPTER-1

1.0 PROJECT BACKGROUND

Raikela Iron Ore Mines over 67.586Ha of M/s Geetarani Mohanty is in the Raikela village, Koira Tahasil of Sundargarh district of Odisha.

NEED FOR THE PROJECT & ITS IMPORTANCE

Raikela Iron Ore Mines of M/s Geetarani Mohanty is a working mine for the last two decades with good approachability and availability of various facilities. There are potential buyers in our country and also abroad to sign long term supply agreement of quality iron ore. Exploration in the part of the ML area itself revealed the presence of good iron ore deposit. From the geological trend, more reserves are expected in the adjacent area and thus the overall iron ore reserve potential in the total mine lease area is expected to be more.

Considering all these aspects, it is identified now to go for this expansion with crushing and screening facilities.

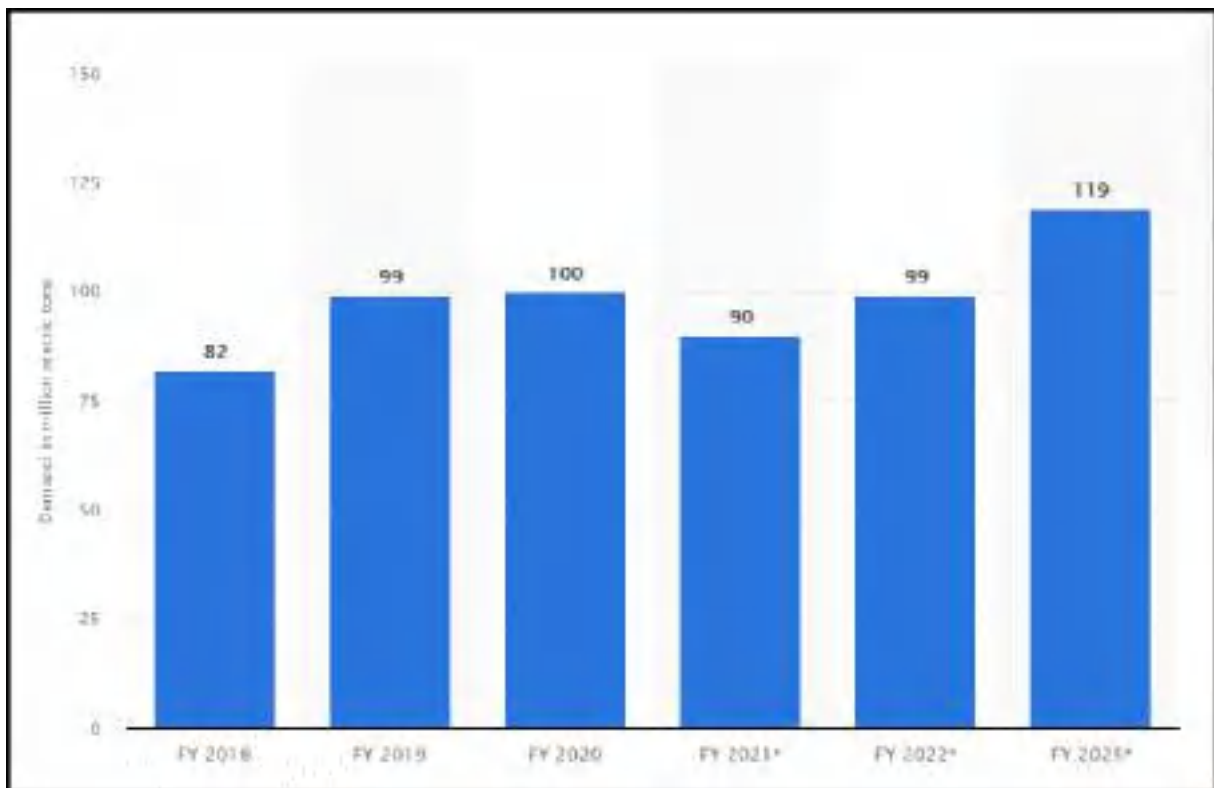
JUSTIFICATION FOR EXPANSION

It is proposed to expand the iron ore mining capacity in Raikela Iron ore mine lease from 4.99 MTPA to 5.988 MTPA (ROM) considering the following reasons:

- ❖ India's current steel producing capacity of is ~140 MTPA and the figure is anticipated to rise to 300 MTPA by 2030-31. Proportionately there will be huge demand for Iron ore, which is the major raw material for steel industry.
- ❖ The Indian steel industry to experience robust growth, with future demand boosting India's per capita consumption of steel from a low base of around 54kg to far higher levels. Steel is expected to remain a key sector for the Indian Government, with the Government encouraging further growth with its increased approval rate of Greenfield projects.

- ❖ As earlier mentioned, domestic steel demand is expected to grow by around 10%–12% annually. Crude steel production in India as per IBM data in the year 2011-12 is 88.4 Million tonnes. As per Steel ministry estimates, by the year 2025, steel production will get scaled up to 119 MTPA. And subsequently it will be enhanced upto 300 MTPA by 2030.

Volume of steel demand in India from financial year 2016 to 2020, with estimates until 2025(million metric tons)



Contribution of Raikela Iron Ore mine towards steel industry:

- ❖ Presence of more than 90 Million ton of resources within the recently explored mine area and possibility of more reserves if go for further exploration.
- ❖ Present production capacity of 2.99 MTPA is being utilized by nearby steel industries.

- ❖ The mine has all favourable conditions to expand its production to 4.99 MTPA. It will help to increase GDP growth of the nation.
- ❖ No rehabilitation or other social issues involved in this project.
- ❖ Considering all the above said favourable factors it is practically possible to achieve the proposal within the planned period.

As the government is planning massive investments in the infrastructural sectors, more and more infrastructural projects are being encouraged to be put up by private players. Towards fulfilment of such Government targets, this project will contribute its own share.

CHAPTER-2

2.0 SITE ANALYSIS

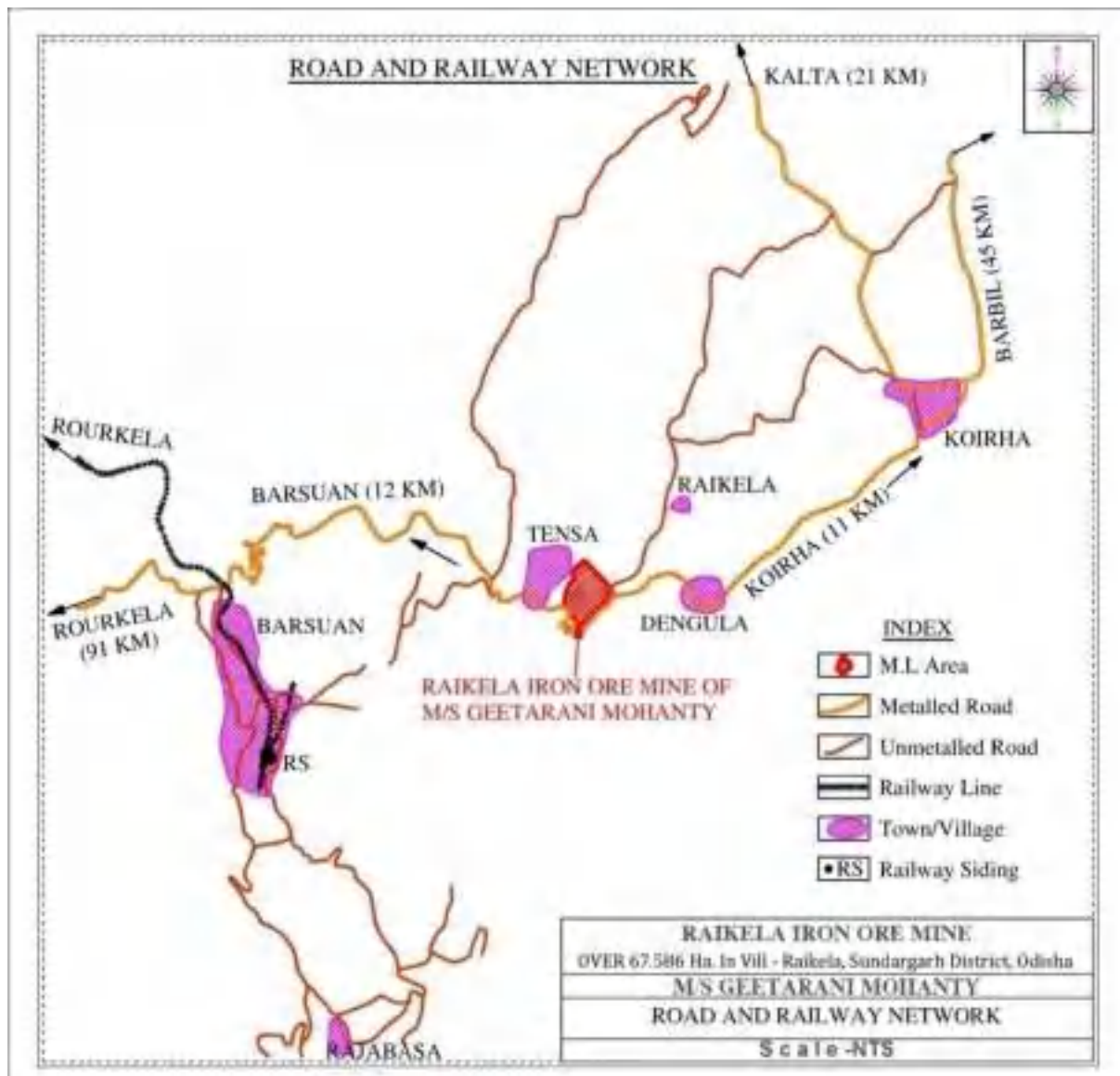
Location and Analysis

The ML area falls within the toposheet no F45N1 and bounded by the latitude and longitude as furnished below:

Latitude $21^{\circ} 51' 54.47556''$ to $21^{\circ} 52' 35.39676''$ N

Longitude $85^{\circ} 10' 32.27952''$ to $85^{\circ} 11' 05.16660''$ E.

Location Map showing the ML area on Toposheet





ACCESSIBILITY

The mining lease area is approachable from Koira town covering a distance of 8 km by Bhadrasahi – Rourkela NH-520. The area can also be approachable from Tensa town ship which is on NH – 520 at a distance of 2 km. Nearest Rail Head is at Barsuan (both Passenger and goods train) located adjacent to several working mines connected by road from Bhadrasahi-Koira-Rajamunda NH-520. District HQ is at Sundargarh – 110 km from lease area.

TOPOGRAPHY

The ML area occurs part of the Tensa hill. The total ML area is situated slope of hill. The trend of the hill is NE-SW sloping down towards east and southeast. The maximum elevation of the area is 840m a. MSL at NW part of the area whereas the lowest elevation is 630m aMSL at eastern part.

Regarding the topography of the buffer zone, in the south and western part there is hilly terrain and in eastern and north eastern part there is occurrence of valley area.

EXISTING INFRASTRUCTURE:

This is being a working mine all the infrastructural facilities required like approach road, office, stores, etc are already developed. However, for the proposed expansion project all these facilities will be suitably upgraded.

SOCIAL INFRASTRUCTURE AVAILABLE

Tensa is the nearest major human habitation (about 2.0 km from site). The town is provided with all basic civic amenities. SAIL quarters are present near the Tensa hill top area. Suitably maintained pitched roads are present in the town. Major source of water in the area is the Karo River. Most of the important locations are provided with water supply and electricity. Other important places in the study area are Barbil, Bolani, Thakurani Colony and Barajamda village. The areas are developed with basic facilities.

DETAILS OF ALTERNATE SITES CONSIDERED & THE BASIS OF SELECTING THE PROPOSED SITE:

As far as mine expansion is concerned, since this is an expansion project in the existing mining lease area for which lease already granted, question of alternate site does not arise. The expansion of the project will be done along with crushing and screening facilities. The enhancement of the project is proposed considering the following reasons:

- ❖ Availability of good quality iron ore resources within the lease area.
- ❖ Proximity of the mines and hence logistical advantage for transportation of material from mine to the Railway siding.
- ❖ Better road connectivity and approachability
- ❖ Better communication to ParadIp port.
- ❖ Availability of ground water source without putting constraints on the existing

water system of the locality.

- ❖ No additional infrastructure /transport system for handling the ROM feed /dispatch and hence no further strain on the infrastructure.
- ❖ Absence of any ecologically sensitive features in the region.
- ❖ The operation is economic, cost effective with leased land usage within the mining lease area.

CHAPTER-3

3.0 PROPOSED EVACUATION SYSTEM OF IRON ORE FROM THE LEASE AREA

Mineral industries in the areas of Joda and Koira circle are gradually augmenting their capacity with widening of roads, increased supply of wagons by Railways, increase in private railway sidings in the districts of Sundargarh and Kendujhar in Odisha state. The proposed mining activities are going to influence and impact the surrounding areas interims of increasing traffic congestion and other ill effects. In view of this, there is a need of proper traffic and transportation study to investigate the feasibility of mineral transportation by considering the future demand of Iron ore especially. Concerned with the prevailing and anticipated problems of mineral transportation at Koira, the study has been done to conduct Traffic and Transportation Study for estimating the impact of Raikela iron ore mines on the Koira Road Network of Odisha.

Existing Road Network

The Sundargarh district emerged as one of the district on 1st January,1948. The district is bounded by Jharkhand and Chattisgarh to the east and north, Jharsuguda, Sambalpur, Angul and Deogarh districts to the south, Mayurbhanj and Kendujhar district to the west. Covering a geographical area of 9 sq km. The existing road network in Sundargarh district includes 168 kms length of National Highway, 218 kms of State Highways and 297kms of major district roads, 516 kms of otherdistrict roads and 688 km of forest roads. All blocks of Sundargarh district except Gurundia and Koira blocks are well connected by roads. Rourkela is the main town of the district. NH-23 and NH-520 pass through the district and connect the district to Jharkhand State and Angul district of Odisha



Mineral Evacuation from Mines

About 5.988 MTPA of ROM will be produced from the mine after expansion. Out of this about 70% i.e. 3.493 MTPA of high grade iron ore will be directly sold in the market. About 30% i.e. 1.497 MTPA will be generated as mineral reject/sub-grade ore. As per the approved Mining plan it has been envisaged that about 70% of mineral reject/sub-grade ore i.e. 1.047 MTPA will be blended with high grade iron ore to make it saleable. Remaining 30% of sub-grade to be generated will be kept temporarily within the lease area and subsequently blended and sold to the consumer. The materials after blending will be marketed to the steel plant, Sponge iron plant, & pelletisation plant. Besides some quantity can be exported also.

Major part of the material will be transported by Barsuan Railway sidings located at a distance of 22km from the project. This siding are having surplus capacity to take care of the expansion needs. The siding is connected from the mines by Koira-Barsuan Road which has been developed as RCC. Part of the material i.e. about 20% can be transported through NH- 520. connecting Panikolli and Rajamunda which is the main ore transporting link connecting Paradeep port, Dhamra port and other iron ore consuming industries in the region namely Kalinganagar, Rourkela, Jharsugura, etc., The NH 520 is being converted in to 4 lane road and the work has already been commenced and most part of the road has been completed. Widening will reduce the traffic congestion and will also increase the carrying capacity of the NH-520 road. Hence, the existing connectivity facilities i.e. Koira-Barsuan road and NH-520 will be adequate enough to take care of expansion needs.

Detail Flow sheet of evacuation system of iron ore from Raikela Iron ore Mines

ROM stockyard —→ Internal road within mines Final stock yard Koira-Barsuan —→ Road(Adjacent to the lease) —→ About 80% of the material towards Barsuan Railway Siding (22km) —→ About 20% through NH-520 —→ Final destination.

PRESENT TRUCK GENERATION FROM MINES

Sl.no	Particulars of activity	Iron ore (Additional) (A)
A	Material transported	4990000 ton
B	No of days in a year	350
C	Daily Material to be transported in TPD (A/B)	13686
D	Transport hours per day	24
E	Hourly Material to be transported in TPH (C/D)	570
F	Truck capacity in T	28
	No of truck Trips per hour	20

ADDITIONAL TRUCK GENERATION FROM MINES AFTER EXPANSION

Sl.no	Particulars of activity	Iron ore (Additional) (A)
A	Material transported	988000 ton
B	No of days in a year	350
C	Daily Material to be transported in TPD (A/B)	2823
D	Transport hours per day	24
E	Hourly Material to be transported in TPH (C/D)	11
F	Truck capacity in T	28
	No of truck Trips per hour	5

G



GRM MAIN GATE

CHAPTER-4.0

4.1 TRAFFIC STUDIES & ANALYSIS

Concerned with the prevailing and anticipated problems of mineral transportation at Koira sector, in the study area M/s Geetarani Mohanty has approached **National Institute of Technology (NIT) Rourkela** to carry out the study. Accordingly, NIT, Rourkela has done the study in to know the Traffic and for estimating the impact of Raikela Iron ore mines of M/s Geetarani Mohanty on the Koira -Barsuan Road Network and NH-520.

As witnessed in the field, one part of the NH-520 i.e. from Panikoili to Rimuli is almost completed with proper drainage and plantation along the road. The other part i.e; from Rimuli to Rajamunda is under progress and expected to be completed shortly. Widening will reduce the traffic congestion and will also increase the carrying capacity of the NH-520 road. Further, Re- enforced Cement Concreting work of Koira-Barsuan road is about to be completed. As a matter of fact this will enhance the carrying capacity of raw material.

To capture traffic flow characteristics and travel pattern of users passing through the road and other characteristics related to miscellaneous requirements the following primary traffic surveys were conducted.

- ❖ Manual Classified Traffic Volume Count (MCC)
- ❖ Junction Volume or Intersection Turning Movement Count Survey (TMC)
- ❖ Origin-Destination and Commodity Movement Survey (OD)

4.2 Details of Traffic Survey Locations

During the field visit, NIT Rourkela team, has done reconnaissance survey on study road network and observed the traffic movement considering the operational issues in each of the components of the various road corridors which included various facilities available for Public Vehicles, Private Vehicles and Vulnerable road users. Traffic survey was conducted at different location as furnished below:

1. Koira Intersection
2. Near Raikela Junction
3. Barsuan Junction

**PCU Factors for Various Types of Vehicles on Urban Roads
(Ref IRC: 64-1990)**

Sl.No	Vehicle Type	Equivalent PCU Factors
Fast Moving Vehicles		
1	Two Wheelers Motor Cycle or Scooter	0.5
2	Cars, Pickup Van, Jeep, Auto-Rickshaw	1.0
3	Light Commercial Vehicles(LCV)	1.5
4	Truck (2 Axial and 3 Axial) or Bus	3.0
5	Truck Trailer, Agricultural Tractors-Trailer	4.5
Slow Moving Vehicles		
6	Cycle	0.5
7	Cycle Rickshaw	2.0
8	Hand Cart	3.0
9	Horse-Drawn Vehicle	4.0
10	Bullock Cart*	5.0

* For smaller bullock carts a value of 5 will be appropriate

4.3 METHODOLOGY ADOPTED FOR STUDY:

Now the iron ore is being transported by road to Barsuan siding as well as only by road towards Rourkela. Sometimes the iron ore is also transported towards Barbil/Keonjhar side also. After the enhancement of production about 70% of the produced material will be transported through road and 30% by Railway Siding (As per NEERI recommendation). The approach to achieve the envisaged objectives of the study as presented in the subsequent section.

(i) Reconnaissance Survey:

The reconnaissance survey was carried out to understand the study requirements of the selected intersections and road corridors, site constraints, available carriageway and Right of Way (ROW) width and physical inspection of encroachment if any.

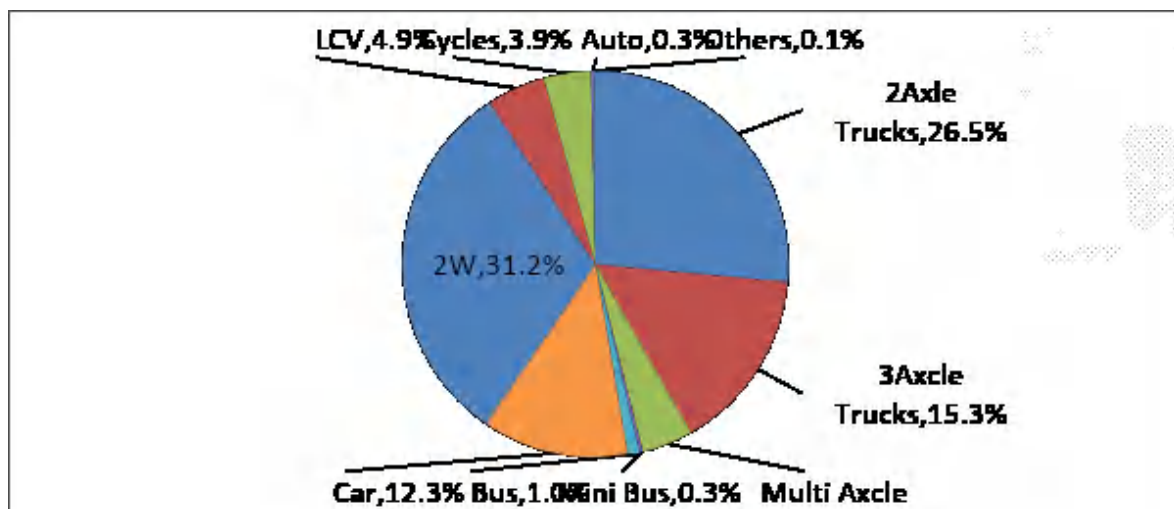
(ii) Traffic Surveys Conducted:

Various traffic studies required for junction improvements like classified traffic volume, speed and delay surveys and video graphic surveys were carried out to assess the existing traffic situations on identified intersection of study road network.

(iii) Traffic data

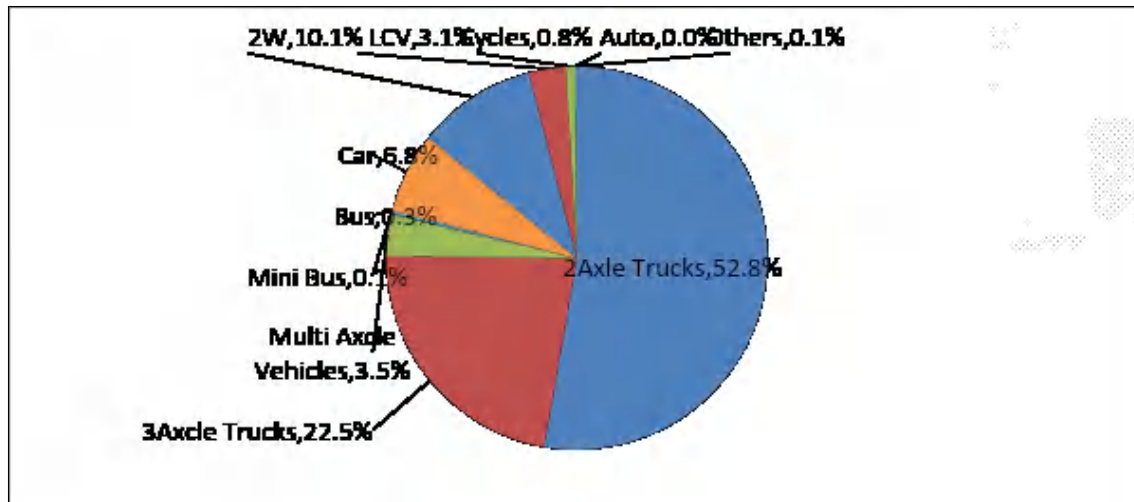
collection: Koira Intersection

This is major three arm T- shaped intersection falling on Gandhalpada road, located near Koira town. One of its arm goes towards Tensa makes this intersection busy due to the movement of truck throughout the day especially in the evening hours. Total Traffic Volume at this intersection is 19742 in vehicles and 36719 in PCUs.



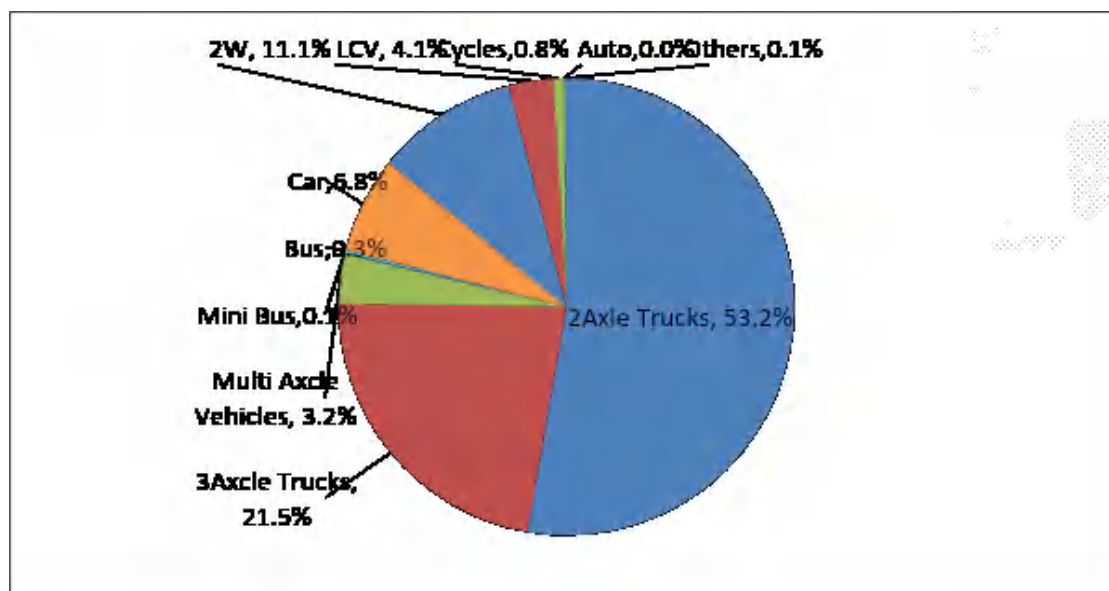
Geetarani Mines Intersection

This is mid-block section near PTA mines on State Highway. The truck traffic coming from PTA mines and other mines will merge at this point. The study location was considered at this point is to collect truck traffic at this point. Total Traffic Volume at this midblock is 6604 in vehicles and 17166 in PCUs.



Barsuan siding Intersection

This is major three arm T- shaped intersection falling on Tensa-Rourkela road, located near Koira town. One of its arm goes towards Rourkela makes this intersection busy due to the movement of truck throughout the day especially in the evening hours. Total Traffic Volume at this intersection is 17652 in vehicles and 32831 in PCUs.



Traffic data projection

SUMMARY OF BASE AND HORIZON YEAR TRAFFIC (PCU)

Sl. No	Name of Study Location	Base year Total Traffic	Horizon Year (future) Total Traffic
1	Koira Intersection	36719	44062
2	Raikela Junction	17166	20599
3	Barsuan Junction	17845	21414

SUMMARY OF BASE AND HORIZON YEAR PEAK TRAFFIC (PCU)

Sl. No	Name of Study Location	Base Year Peak Hour Traffic (PCU)	Horizon Year(future) Peak Hour Traffic (PCU)
1	Koira Intersection	3367	4041
2	Raikela Mines junction	2200	2640
3	Barsuan Junction	1629	1955

It is observed that the total traffic coming from all the arms at Koira intersection for the Base year is less than 0.50 Lakh PCUs. The total peak hour traffic at all study corridor on study road network in Koira-Raikela-Barsuan stretch is less than 4,000 PCUs in present base year as well as horizon year. It implies that there is no need for grade separated facility in these intersections as per IRC SP 41 and IRC 62-1976. Further, based on the traffic at each intersection at grade junction improvements were proposed at these study intersections. The main influencing parameters such as traffic volume and composition, turning movement's volume, design speeds were considered while proposing the at grade improvements intersections.

Estimated Truck Traffic study report

Truck traffic assignment models are used to estimate the flow of truck traffic on a network. These models take as input matrix of flow that indicates the volume of traffic between Origin and Destination pairs. The flows for each O-D pair are loaded on the network based upon the travel time or impedance of the alternate path that could carry this traffic. In this study, a truck traffic assignment model is developed so as to evaluate the network performance in the current scenario and for the future scenario. Widely used traffic assignment models such as User Equilibrium (UE) methods are considered to carry out the truck traffic assignment.



PERFORMANCE EVALUATION OF ROAD NETWORK

In this study performance evaluation of study road network has been done by considering the Volume by Capacity ratio. The ratio of volume to capacity was established using the field data for the base year and horizon year by considering the projected data. These are discussed in the following sections.

Estimation of Volume by Capacity Ratio for Base Year (2024-25)

The volume by capacity ratio for base year 2024-25 is estimated by considering capacity volume of each study corridor as discussed under study area. It can be inferred that the V/C ratio is less than 0.7 on all the corridors in the study area for base year traffic. The average Volume to capacity ratio is for the study road network is 0.30. This indicates that LOS on the above road links in the influence region of the study area falls under LOS category 'B'. As Per IRC 64:1990, LOS B indicates that the V/C value is less than 0.50.

Corridor No	Name of the Corridor	Width of Carriageway	Peak hour Volume (PCU)	Capacity (PCU)	V/C
C-1	Koira intersection	7.5	1065	3000	0.40
C-2	Koira-Raikela Mines	7.5	1377	3000	0.50
C-3	Tensa-Barsuan	7.5	1410	3000	0.50



Volume- Capacity Ratio considering 4.99 MTPA production:

After expansion of Geetarani Mines from 4.99 MTPA to 4.988 MTPA, maximum 5 (additional) trucks/hour will be added to the existing Koira-Tensa-Barsuan road network. So there will be no such impact on average Volume to Capacity (V/C) ratio. The V/C ratio will remain below 0.50. This indicates that LOS on the above road links in the influence region of the study area falls under LOS category 'B'. As Per IRC 64:1990.

As per the CRRRI study report in recent past which has been mentioned in NEERI carrying capacity study, the additional allowable Iron ore is estimated for base year as per maximum V/C threshold (0.70) is about 96.26 Million Tons Per Annum (MTPA) for study road network. In the implementation of bypass on NH-520 and completion of 4-lanning this may be about 150 Million Tons Per Annum

CHAPTER-5.0

5.1 Recommendation

The following recommendations are proposed based on the results of the various field inventories and traffic studies and results obtained from these studies.

- The following recommendations are suggested based on the results obtained from truck demand for base year and horizon year.
 - Widening of NH 520 from Two Lane to Four Lane divided Carriageway (About 80% of the widening work completed)
 - Widening of Koira-Barsuan road (State Highway).
 - Provision of Bypass Road from Tensa to kalta (Connectivity of NH 520 and State Highway)
- It is recommended to provide At-Grade intersection improvement at Koira and Block chowk intersections. In both the intersections traffic island are not available. Hence it is an immediate requirement to provide adequate traffic island as per IRC Guidelines at all the intersections.
- Road signs and road markings are main guiding factors for the road users which is essentially required to be adequate and placed at appropriate places on the road. In all most all intersections road markings not provided/ dilapidated condition. Hence it is immediate requirement to install the sign boards and markings at all intersections.
- Proper traffic signal has to be designed for Koira intersection to avoid traffic accidents at this intersection.
- It was observed that on-street parking is a common phenomenon of trucks near the mines area. It is recommended to provide proper truck Lay byes near to mines.
- All most all the intersection side drains are not available, it is recommended provision of side drains on major corridors of study area.
- Foot paths are not available at Koira intersection, it is recommended foot paths having minimum width of 1.5 mts 2.5 mts (Depends on available Right of way) at Koira and Block Chowk intersection.

**SCHEMATIC REPRESENTATIONS OF RECOMMENDATIONS FOR WIDENING OF
THE MAJOR ROAD CORRIDORS ON STUDY ROAD NETWORK**



Koira Junction Traffic data

Time	Autos	Two Wheelers	Cars	Buses and Mini Buses	Goods Vehicles	Bicycles	Others
12.00-13.00	2	98	102	12	420	2	7
13:00-14:00	3	258	122	16	428	3	3
14:00-1500	2	455	222	55	610	2	1
15:00-1600	4	389	141	67	624	4	3
16:00-17:00	5	353	168	42	522	5	0
17:00-18:00	1	296	170	54	412	7	0
18:00-19:00	2	420	188	27	480	2	0
19:00-20:00	1	479	178	27	579	1	3
20:00-21:00	1	302	151	28	504	1	0
21:00-22:00	0	160	43	42	223	5	0
22.00-23.00	0	80	24	2	114	0	0
23.00-00.00	0	27	16	7	48	4	0
00.00-01.00	0	8	13	5	24	0	0
01.00-02.00	0	2	7	8	10	0	0
02.00-03.00	0	2	7	4	17	0	0
03.00-04.00	0	5	8	12	10	0	0
04.00-05.00	0	6	14	54	27	0	0
05.00-06.00	0	31	12	22	61	2	0
06.00-07.00	3	100	17	25	128	3	0
07.00-08.00	2	102	44	25	90	2	4
08.00-09.00	5	108	105	40	498	5	0
9:00-10:00	6	98	129	25	420	6	2
10:00-11:00	2	117	87	21	240	2	3
11:00-12:00	3	88	98	48	280	18	0
Total	42	3984	2066	668	6769	74	26
PCU Value	42	1992	2066	2004	30461	37	117

Raikela Mines Junction Traffic Data

Time	Autos	Two Wheelers	Cars	Buses and Mini	Goods Vehicles	Bicycles	Others
				Buses			
15:00-16:00	0	34	20	2	305	1	1
16:00-17:00	0	37	28	115	402	0	0
17:00-18:00	3	38	34	106	195	0	3
18:00-19:00	8	38	22	137	87	0	0
19:00-20:00	0	18	28	161	63	0	0
20:00-21:00	0	38	65	131	127	0	0
21:00-22:00	0	4	15	44	25	0	2
22:00-23:00	7	1	3	61	5	0	0
23:00-00:00	0	0	8	67	10	0	0
00:00-01:00	0	0	4	84	15	0	0
01:00-02:00	0	0	5	69	14	0	0
02:00-03:00	5	0	1	20	27	0	4
03:00-04:00	0	1	1	8	18	0	0
04:00-05:00	0	1	0	5	22	0	0
05:00-06:00	0	7	12	22	10	0	0
06:00-07:00	0	19	9	42	38	0	0
07:00-08:00	0	43	12	35	62	0	0
08:00-09:00	1	44	16	31	98	1	2
9:00-10:00	0	82	32	61	139	0	0
10:00-11:00	0	64	31	5	106	0	1
11:00-12:00	1	28	14	18	382	2	2
12:00-13:00	0	27	10	13	382	1	0
13:00-14:00	0	42	17	10	145	3	0
14:00-15:00	2	28	18	9	121	0	3
Total	27	594	405	1256	2798	8	18
PCU Value	20.25	297	405	3768	12591	4	81

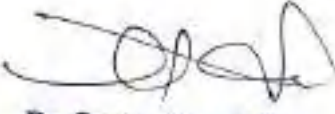
Barsuan Junction Traffic data

Time	Autos	Two Wheelers	Cars	Buses and Mini Buses	Goods Vehicles	Bicycles	Others
15:00-1600	0	33	23	3	341	2	2
16:00-17:00	0	36	28	162	229	0	0
17:00-18:00	0	42	35	103	278	0	3
18:00-19:00	0	39	22	137	160	0	0
19:00-20:00	0	15	28	171	63	0	0
20:00-21:00	1	52	65	134	127	0	0
21:00-22:00	0	5	41	44	49	0	0
22:00-23:00	0	1	28	68	52	0	0
23:00-00:00	1	0	22	67	10	0	0
00:00-01:00	0	5	18	81	52	0	0
01:00-02:00	0	0	5	72	61	0	0
02:00-03:00	0	0	12	22	72	0	0
03:00-04:00	0	0	1	8	25	0	0
04:00-05:00	0	1	8	5	48	0	0
05:00-06:00	0	7	21	38	21	0	0
06:00-07:00	0	19	9	42	30	0	0
07:00-08:00	0	43	11	41	62	0	0
08:00-09:00	1	44	16	31	172	1	0
9:00-10:00	0	80	30	61	142	0	0

10:00-11:00	0	66	31	90	106	0	1
11:00-12:00	0	63	39	81	126	0	3
12:00-13:00	1	64	40	65	129	1	0
13:00-14:00	0	57	26	131	103	0	0
14:00-1500	0	12	16	84	133	0	0
Total	4	684	575	1741	2591	4	9
PCU Value	3	342	575	5223	11659.5	2	40

CONCLUSION:

By adhering to the outlined logistics, the proposed expansion of the **M/S Geetarani Mohanty iron mines**, Raikela is not expected to exert any adverse load stress on the existing road and rail network. This synchronization ensures that there will be no significant hardship or major impact on the transportation network during this period. As per the detailed traffic study conducted, it is concluded that the existing infrastructure is adequate enough to facilitate the transportation.



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RAIKELA IRON ORE MINES

M/S. GEETARANI MOHANTY

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grm@IIKWorld.rn.in

Raikela Iron Ore Mines

Station Road, Barbil. Keonjhar. Odisha . Pin
758035

WORK ORDER

DATE-09-08-
2024

WO NO-GRM/2024-25/135
INDENT NO- MAIL Dt.09.08.24

To,
NATIONAL INSTITUTE OF TECHNOLOGY,
ROURKELA,
ODISHA-769008.
Email-dassk@nitrkl.ac.in
REFNO- MAIL, DT.09.08.2024

Dear Sir,

With reference to the above, we are pleased to confirm acceptance of your above said offer for
Consultancy Charges regarding Traffic Study at our Raikela Iron Ore Mines,
Raikela with the following terms and conditions.

DESCRIPTION	RATE	AMOUNT
Institute Overhead, Consultancy Fees, Charges for estimation of Traffic Study, Contingency and		168000.00
	Total:	168000.00

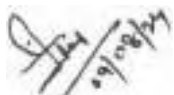
TERMS & CONDITIONS:

1. All the tools and tackles, consumables required for the above job shall be arranged by you.
2. GST@18% shall be paid by us extra. Our GST No is 21AADFG1692D2ZW. TDS shall be deducted as per provision of Income Tax Act, 1961 and TDS certificate shall be issued after completion of quarter.
3. During your stay at our premises, you shall abide by all the rules and regulations of M/s GRM, which are in force and may come into force from time to time. You shall take the complete responsibility of your Engineers.
4. Safety: All your Engineers must wear PPA like hand gloves, shoes, helmet, safety belt, safety goggles, safety jacket etc. as applicable to the job. You will adopt all safety measures during the course of all operations under this work order.
5. Payment terms: - Advance payment of 50% value of invoice shall be made before start of the study on submission of Performa Invoice. The balance payment of 50% shall be made within 30
;
days after submission of Final Invoice.
6. The company has reserved the right to terminate this contact at any time



without furnishing any reason.

7. Jurisdiction: For any legal disputes the courts at Bhubaneswar (Orissa) shall have complete Jurisdiction.



Mines: At-Raikela, Near Tensa, P.O. Dengula, Dist Sundargarh-770048, Odisha
Head Office: Plot No. 380, Bomikhal, Near Durga Mandap, Bhubaneswar-751010





ସମ୍ବାଦ

ବିଜ୍ଞପ୍ତି

ଏଠାରେ ସମସ୍ତ ସମ୍ପୃକ୍ତଙ୍କୁ ଜଣାଇ ଦିଆଯାଉଛି ଯେ ସୁନ୍ଦରଗଡ଼ ଜିଲ୍ଲାର ରାଇକେଲା ଗ୍ରାମଠାରେ ୬୭.୫୮ ୬ ହେକ୍ଟର ପରିମିତ କ୍ଷେତ୍ରଫଳରେ ମେସର୍ସ ଗୀତାରାଣୀ ମହାଦିଙ୍କ ରାଇକେଲା ଲୁହାପଥର ଖଣିକୁ ରାଜ୍ୟ ପରିବେଶ ପ୍ରଭାବ ମୂଲ୍ୟାଙ୍କନ ପ୍ରାପ୍ତିକରଣ (SEIAA), ଓଡ଼ିଶା ଦ୍ୱାରା ଫାଇଲ୍ ନମ୍ବର - 523021/28-MINB1/02-2025 ଏବଂ EC ପରିଚୟ ସଂଖ୍ୟା - EC25B0000OR5972294N, ତାରିଖ ୧୭.୦୭.୨୦୨୫ ପତ୍ର ମାଧ୍ୟମରେ ପରିବେଶଗତ ମଞ୍ଜୁରୀ ପ୍ରଦାନ କରାଯାଇଛି। ଉପାଦାନ କ୍ଷମତା ବର୍ଷକୁ ୪.୯୯ ମିଲିଅନ ଟନରୁ ୫.୯୮୮ ମିଲିଅନ ଟନକୁ ବୃଦ୍ଧି କରିବାର ପ୍ରସ୍ତାବକୁ ମଞ୍ଜୁର କରାଯାଇଛି। ପରିବେଶଗତ ମଞ୍ଜୁରୀର ବିବରଣୀ ପରିବେଶ, ଜଙ୍ଗଲ ଏବଂ ଜଳବାୟୁ ପରିବର୍ତ୍ତନ ମନ୍ତ୍ରାଳୟର ୱେବସାଇଟ୍ www.environmentalclearance.nic.in ରେ ଉପଲବ୍ଧ। ଏହି ପରିପ୍ରେକ୍ଷୀରେ, ଆମେ ରାଜ୍ୟ ପରିବେଶ ପ୍ରଭାବ ମୂଲ୍ୟାଙ୍କନ ପ୍ରାପ୍ତିକରଣ, ଓଡ଼ିଶା ଏବଂ ରାଜ୍ୟ ପ୍ରଦୂଷଣ ନିୟନ୍ତ୍ରଣ ବୋର୍ଡ଼ର ସମସ୍ତ ସଦସ୍ୟଙ୍କ ନିକଟରେ କୃତଜ୍ଞତା ଜ୍ଞାପନ କରୁଛୁ।

ସ୍ୱା/- ପରିଚାଳନା ସହଯୋଗୀ,
ମେସର୍ସ ଗୀତାରାଣୀ ମହାଦି

BHUBANESWAR Edition
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ENROLL NOW

OFFICE OF THE DEPUTY DIRECTOR OF MINES, KOIRA CIRCLE

No. 5054 / Mines, Dt. 02/09/2017

DEMAND NOTICE

To

M/s Geetarani Mohanty

Raikela Iron Mines

Station Road, Barbil, Distt.- Keonjhar

Whereas, it has been observed that M/s Geetarani Mohanty, the mining lease holder of Raikela Iron Mines over an area of 67.586 ha has undertaken production of Iron Ore from the above referred mining lease hold area without or in excess of the approved limit of production under Environmental Clearance during 2000-01 to 2010-11.

2. And Whereas pursuant to the interim order dt.16.05.2014 of Hon'ble Supreme Court in the matter of W.P.(C) No.114 of 2014 Common Cause Vrs. Union of India and others, the CEC has dealt among others, the issue of production without or in excess of EC and has submitted its final report on dt.16.10.2014 before the Hon'ble Supreme Court. In the said report the CEC under Para 34 has calculated the notional value of the total quantities of iron and manganese produced without EC / beyond EC by all the lessees in the State of Odisha during the years 2000-01 to 2010-2011. The details of year wise production of Iron Ore in the Raikela mining leasehold area along with the approved limit of production under EC, the excess production, price of mineral and the notional value (price of minerals) of total quantities of 2774964.040 MT of Iron Ore produced without E.C./beyond the EC by you during the years 2000-01 to 2010-11 as have been indicated in the said report is annexed herewith.

3. Whereas the Hon'ble Supreme Court in its Judgment dated 2.8.2017 in the W.P.(C)No.114 of 2014 has observed under para 128 that

"..... the holder of a mining lease is required to adhere to the terms of the mining scheme, the mining plan and the mining lease as well as the statutes such as the ERPA, the PCA, the Water (Prevention and Control of Pollution) Act, 1974 and the Air (Prevention and Control of Pollution) Act, 1981. If any mining operation is conducted in violation of any of these requirements, then that mining operation is illegal or unlawful. Any extraction of a mineral through an illegal or unlawful mining operation would become illegally or unlawfully extracted mineral".

4. Whereas, the Hon'ble Supreme Court in the said Judgment has further observed under Para 150 that

"In our opinion, Section 21(5) of the MMDR Act is applicable when any person raises, without any lawful authority, any mineral from any land. In the event, the State Government is entitled to recover from such person the mineral so raised or where the mineral has already been disposed of, the price thereof as compensation. The words 'any land' are not confined to the mining lease area. As far as the mining lease area is

o/c

concerned, extraction of a mineral over and above what is permissible under the mining plan or under the EC undoubtedly attracts the provisions of Section 21(5) of the MMDR Act being extraction without lawful authority.

5. Whereas, the Hon'ble Supreme Court in the said Judgement has further held in Para 156 that

"Since the recommendation made by the CEC in this regard is not totally unreasonable, we accept that the compensation should be payable from 2000-2001 onwards at 100% of the price of the mineral, as rationalized by the CEC."

6. Whereas considering the above excess production as production ~~without~~ lawful authority, you are liable to pay a sum of Rs.185,94,55,009.88 (Rupees One hundred eighty five crores Ninety four lakh Fifty five thousand Nine & Eighty eight paise) only, being the price thereof towards compensation under Section 21(5) of MMDR Act, 1957 for production without/in excess of the environmental clearance as rationalized the CEC, in pursuance to the Judgement dt.02.08.2017 of Hon'ble Supreme Court in the matter of W.P. (C) No.114/14 Common Cause Vrs Union of India and Others.

Now therefore, you are hereby directed that you shall pay the compensation of Rs.185,94,55,009.88 (Rupees One hundred eighty five crores Ninety four lakh Fifty five thousand Nine & Eighty eight paise) only as detailed in Annexure-I on or before 31.12.2017 in pursuance to the Para 225 of the Order dt.02.08.2017 of Hon'ble Supreme Court, following the mode of payment as detailed out under Annexure II.

It is also made clear that the aforesaid demand is relatable to recovery of price of minerals produced without/beyond the EC alone under Section 21(5) of MMDR Act, 1957 as adjudicated vide Para 156 of the Judgement as referred above and does not include recoveries under Section 21(5) of the said act for violation of mining plan, consent requirements under Air/Water Act and Forest violations, for which the demands, if any would be raised separately.

Memo No. 555/DM, dt. 21/9/2017

Copy forwarded Director of Mines, Odisha, Bhubaneswar for favour of kind information and necessary action.

SB 21/9/2017
DEPUTY DIRECTOR OF MINES

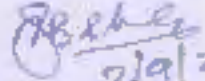
SB 21/9/2017
Deputy Director of Mines
Koraput, Dist. Sundargarh

SB 21/9/2017
DEPUTY DIRECTOR OF MINES

SB 21/9/2017
Deputy Director of Mines
Koraput, Dist. Sundargarh

Name of the Lease :M/s. G.R. Mohanty (Raikela & Tantra Iron & Mn Mines)

Sl. No.	Mineral	Year of Production	Production In MT	Approved limit of production In MT under EC as considered by CEC	Excess Production In MT as assessed by CEC	Price of Minerals as considered by CEC (in Rs/Tonne)	Cost of excess minerals produced in Rs. to be recovered towards compensation
<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>
1	Iron	2000-01	96500	5117.37	91382.63	230.43	21057299.43
2	Iron	2001-02	112910	5117.37	107792.63	241.05	25983413.45
3	Iron	2002-03	40717	5117.37	35599.63	300.33	10691636.88
4	Iron	2003-04	131700	5117.37	126582.63	487.81	51748272.74
5	Iron	2004-05	445906	5117.37	440788.63	562.41	247903933.4
6	Iron	2005-06	678100	5117.37	672982.63	690.93	464983888.5
7	Iron	2006-07	1144700	5117.37	1139582.63	749	853547389.9
8	Iron	2007-08	165370	5117.37	160252.63	1082.91	173539175.6
9	Iron	2008-09	174410	648000		1317.21	0
10	Iron	2009-10	444990	864000		1184.33	0
11	Iron	2010-11	863364	864000		1982.29	0
Total			4298667.00	2416938.96	2774964.04	8828.70	1859455009.88


 29/12/2017
 Deputy Director of Mines
 Kaira, Dist Sundargarh

Mode of Payment of compensation under section 21(5) of MMDR Act, 1957

1. The payment is to be made through the online portal of Directorate of Steel & Mines (I3MS) and the Treasury Application (IFMS, Odisha) into the designated banking account in the Public Account of the State Government under the Account Head "8443 Civil Deposits -00- 106-Personal Deposits- 3275- Banking Account of Odisha Mineral Bearing Areas Development Corporation(OMBADC) - ~~00000~~ Compensation under Section-21(5) of MMDR Act and other provisions of MMDR Act as per orders of Hon'ble Supreme Court".
2. The Lessee will log into the portal of Directorate of Mines i.e. www.orissaminerals.gov.in and access the link to BMS. The lessee may register him / herself to make the online payment of Compensation under Section-21(5) of MMDR Act, if not registered earlier.
3. The Lessee will access the "compensation" payment link in the login page and click the make payment option. The personal details of the lessee will be auto populated in the payment screen of I3MS. Along with the amount due to be paid in pursuance to the demand notice. She/he will provide the details about the amount of payment to be made by him/her in the current transaction.
4. The Lessee will then be redirected to IFMS, Odisha (www.odishatreasury.gov.in) where she/he will choose the Bank through which he/she wants to make the payment and the mode of payment.
5. The payment can be made through the following modes: Net Banking, Debit Card or Over the Counter. In case of Net Banking and Debit Card, the system will be redirected to the portal of the concerned Bank, wherein he/she will authenticate the payment request using the credentials of the Bank. Response of successful payment will be received from the Bank in the Treasury Portal and I3MS instantaneously. In case the payment is made using Over the Counter mode, a pre-populated challan will be generated in the online portal of IFMS, Odisha. The payer will take the printout of the challan and visit the designated Bank branch to make the remittance.
6. The authorised Banks will report the receipt of the remittances to the Reserve Bank of India on T+1 or T+2 working day, as the case may be. The RBI, PAD, Bhubaneswar will report the receipt of the remittances to the Cyber Treasury electronically using the e-Kuber platform.
7. The Cyber Treasury will import the credit information from the RBI and account for the receipt in their books. The challan no. generated will be made available in the login page of the lessee in I3MS.
8. In case of any difficulty in making the online payment, the Lessee may contact the Project Management Unit of Directorate of Mines through mail ID: itpnu@orissaminerals.gov.in or the Help Desk of IFMS, Odisha Tollfree No. 18003456739 or email ID: helpdesk@orissatreasury.gov.in.

M/s. Geetarani Mohanty

SI No	Date	Name of Bank	Challan Amount	Challan No.	Internet Transaction No.
1	29.12.17	SBI Corporate Banking	5000000.00	27DE0E0FB2	CKE5429792
2	29.12.17	SBI Corporate Banking	5000000.00	27DE0E0FD5	CKE5430846
3	29.12.17	SBI Corporate Banking	5000000.00	27DE0E1046	CKE5434825
4	29.12.17	SBI Corporate Banking	5000000.00	27DE0E030B	CKE5436468
5	29.12.17	SBI Corporate Banking	5000000.00	27DE0E0300	CKE5436048
6	30.12.17	SBI Corporate Banking	5000000.00	27DE1D4BDE	CKE5482184
7	30.12.17	SBI Corporate Banking	5000000.00	27DE1D4BFB	CKE5483426
8	30.12.17	SBI Corporate Banking	5000000.00	27DE1D4C23	CKE5485227
9	30.12.17	SBI Corporate Banking	5000000.00	27DE1D583A	CKE5484403
10	28.06.18	SBI Corporate Banking	10000000.00	2A0E536955	CKG3227126
11	02.08.18	SBI Corporate Banking	100000000.00	2A18A5949D	CKG6805644
12	02.08.18	SBI Corporate Banking	50000000.00	2A18A5A097	CKG6810940
13	02.08.18	SBI Corporate Banking	50000000.00	2A18A59548	CKG6811496
14	03.08.18	SBI Corporate Banking	100000000.00	2A18B4E559	CKG6855132
15	03.08.18	SBI Corporate Banking	10000000.00	2A18B4F2F0	CKG6873708
16	03.08.18	SBI Corporate Banking	90000000.00	2A18B4E6E5	CKG6879076
17	03.08.18	SBI Corporate Banking	80000000.00	2A18B4E733	CKG6886087
18	03.08.18	SBI Corporate Banking	80000000.00	2A18B4E741	CKG6887428
19	03.08.18	SBI Corporate Banking	80000000.00	2A18B4F3E!	CKG6888281
20	03.08.18	SBI Corporate Banking	100000000.00	2A18B4F2AA	CKG6870201
21	03.08.18	SBI Corporate Banking	60000000.00	2A18B4E75D	CKG6889914
22	03.08.18	SBI Corporate Banking	90000000.00	2A18B4F40A	CKG6891086
23	03.08.18	SBI Corporate Banking	70000000.00	2A18B4F417	CKG6892725
24	03.08.18	SBI Corporate Banking	490000000.00	2A18B4E849	CKG6910225
25	04.08.18	SBI Corporate Banking	90000000.00	2A18C43AD5	CKG6945617
26	04.08.18	SBI Corporate Banking	484442000.00	2A18C43DFD	CKG6960092
		Total Paid	2079442000.00		

M/s. Geetarani Mohanty

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2	29.12.17	SBI Corporate Banking	5000000.00	27DE0E0FD5	CKE5430846
3	29.12.17	SBI Corporate Banking	5000000.00	27DE0E1046	CKE5434825
4	29.12.17	SBI Corporate Banking	5000000.00	27DE0E030B	CKE5436468
5	29.12.17	SBI Corporate Banking	5000000.00	27DE0E0300	CKE5436048
6	30.12.17	SBI Corporate Banking	5000000.00	27DE1D4BDE	CKE5482184
7	30.12.17	SBI Corporate Banking	5000000.00	27DE1D4BFB	CKE5483426
8	30.12.17	SBI Corporate Banking	5000000.00	27DE1D4C23	CKE5485227
9	30.12.17	SBI Corporate Banking	5000000.00	27DE1D583A	CKE5484403
10	28.06.18	SBI Corporate Banking	10000000.00	2A0E536955	CKG3227126
11	02.08.18	SBI Corporate Banking	100000000.00	2A18A5949D	CKG6805644
12	02.08.18	SBI Corporate Banking	50000000.00	2A18A5A097	CKG6810940
13	02.08.18	SBI Corporate Banking	50000000.00	2A18A59548	CKG6811496
14	03.08.18	SBI Corporate Banking	100000000.00	2A18B4E559	CKG6855132
15	03.08.18	SBI Corporate Banking	10000000.00	2A18B4F2F0	CKG6873708
16	03.08.18	SBI Corporate Banking	90000000.00	2A18B4E6E5	CKG6879076
17	03.08.18	SBI Corporate Banking	80000000.00	2A18B4E733	CKG6886087
18	03.08.18	SBI Corporate Banking	80000000.00	2A18B4E741	CKG6887428
19	03.08.18	SBI Corporate Banking	80000000.00	2A18B4F3E!	CKG6888281
20	03.08.18	SBI Corporate Banking	100000000.00	2A18B4F2AA	CKG6870201
21	03.08.18	SBI Corporate Banking	60000000.00	2A18B4E75D	CKG6889914
22	03.08.18	SBI Corporate Banking	90000000.00	2A18B4F40A	CKG6891086
23	03.08.18	SBI Corporate Banking	70000000.00	2A18B4F417	CKG6892725
24	03.08.18	SBI Corporate Banking	490000000.00	2A18B4E849	CKG6910225
25	04.08.18	SBI Corporate Banking	90000000.00	2A18C43AD5	CKG6945617
26	04.08.18	SBI Corporate Banking	484442000.00	2A18C43DFD	CKG6960092
		Total Paid	2079442000.00		

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4	29.12.17	SBI Corporate Banking	5000000.00	27DE0E030B	CKE5436468
5	29.12.17	SBI Corporate Banking	5000000.00	27DE0E0300	CKE5436048
6	30.12.17	SBI Corporate Banking	5000000.00	27DE1D4BDE	CKE5482184
7	30.12.17	SBI Corporate Banking	5000000.00	27DE1D4BFB	CKE5483426
8	30.12.17	SBI Corporate Banking	5000000.00	27DE1D4C23	CKE5485227
9	30.12.17	SBI Corporate Banking	5000000.00	27DE1D583A	CKE5484403
10	28.06.18	SBI Corporate Banking	10000000.00	2A0E536955	CKG3227126
11	02.08.18	SBI Corporate Banking	100000000.00	2A18A5949D	CKG6805644
12	02.08.18	SBI Corporate Banking	50000000.00	2A18A5A097	CKG6810940
13	02.08.18	SBI Corporate Banking	50000000.00	2A18A59548	CKG6811496
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18	03.08.18	SBI Corporate Banking	80000000.00	2A18B4E741	CKG6887428
19	03.08.18	SBI Corporate Banking	80000000.00	2A18B4F3E!	CKG6888281
20	03.08.18	SBI Corporate Banking	100000000.00	2A18B4F2AA	CKG6870201
21	03.08.18	SBI Corporate Banking	60000000.00	2A18B4E75D	CKG6889914
22	03.08.18	SBI Corporate Banking	90000000.00	2A18B4F40A	CKG6891086
23	03.08.18	SBI Corporate Banking	70000000.00	2A18B4F417	CKG6892725
24	03.08.18	SBI Corporate Banking	490000000.00	2A18B4E849	CKG6910225
25	04.08.18	SBI Corporate Banking	90000000.00	2A18C43AD5	CKG6945617
26	04.08.18	SBI Corporate Banking	484442000.00	2A18C43DFD	CKG6960092
		Total Paid	2079442000.00		

M/s. Geetarani Mohanty

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24	03.08.18	SBI Corporate Banking	490000000.00	2A18B4E849	CKG6910225
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		Total Paid	2079442000.00		

RAIKELA IRON ORE MINES

M/S. GEETARAM MOHAWY

H.O. Elston Road, Barab, 780001, Dist. Kamrup, Assam
 Telephone No. : 9876789000 / 9801 000
 Email : sahoo.geetaram@gmail.in



Dated: 02-2014

To
 The Divisional Forest Officer
 Bonga Forest Division
 Bonga, Namerbari

SUB-Regarding balance of infrastructure as expended (5 nos heavy duty

Ref:- office memo no-4175 dt-10-03-2013, 348/27-01-2014 and office letter dated
 23-04-2013

Sir,

We are submitting herewith 5 nos heavy duty search lights towards the balance of the
 infrastructure damaged vide the above said letter in respect of our Raikela Iron Ore Mine of
 M/s Geetaram Mohawy.

This is for favour of your kind information and necessary action.

Thanking you,

Yours faithfully


 For M/s Geetaram Mohawy

Attn: (Pst)

Address: Barab, Elston Road, Barab, 780001, Dist. Kamrup, Assam

Tel: 9876789000 / 9801 000 Fax: 9876789000 / 9801 000

E-mail: sahoo.geetaram@gmail.in Web: www.geetaram.com

RAIKELA IRON ORE MINES
M/S. GEETARANI MOHANTY

H.O. : Station Road, Barbil, Keonjhar, Orissa
Tel/Fax No. - (06767) - 275520/275795/275896
E-Mail - sahu_ore@yahoo.co.in



Dt: 23.04.13

To

The Divisional Forest Officer,
Bonai Division.

Sub: - Implementation of Site Specific Wildlife Conservation Plan of Raikela
Iron Ore Mines

Ref: - Your Letter No.1175 dt.19.2.2013,

Dear Sir,

In reference to your above letter, we are hereby submitting following
equipment at your Bonai office as per following details.

- ✓ 1. BOLERO 1 No. of Mahindra & Mahindra make (Model SLX) vide Invoice
No INV14A000145 dt.22.4.2013.
- ✓ 2. 5 Nos. of Garmin GPS.

Kindly acknowledge the receipt of above materials and official procedure
may kindly be followed.

Yours faithfully,


For M/s Geetarani Mohanty
Authorized Signatory

*Received the above information as per
as instructed for Ronda, S. Chk
Divisional Forest Officer 23.4.2013
Bonai Division*

**SITE SPECIFIC CONSERVATION PLAN
&
WILDLIFE MANAGEMENT PLAN OF
RAIKELA IRON ORE MINES
IN SUNDARGARH DISTRICT OF ORISSA**

**OF
M/S GEETARANI MOHANTY
BARBIL, KEONJHAR, ORISSA**

Prepared by
**SRI B.R. PATNAIK IFS (Retd.)
SRI P.K. SARANGI IFS (Retd.)**

B.K.Patnaik IFS (Retd.)

PREFACE

Raikela Iron Ore Mines of M/s Geetarani Mohanty . in the District of Sundargarh spreads over an area of 67.586Ha out of which 66.671ha comes under Forest KISSAM land and the balance 0.915Ha is non-Forest land. The entire lease area is under the control of Revenue Department. There are 50 villages situated within the Zone of Influence with population of 30415. Due to diversion of this area for non forestry activities there will be additional pressure on the adjoining Forest. The Mining activities in the area will affect the Wild-life of the lease hold area as well as the adjoining forest areas and will pose various threats to the Wild animals. As various Mines are in operation adjoining the lease area the problem can be properly addressed only if a comprehensive wild-life Management plan is prepared for the entire belt which will help in protecting the wild-life as well as their habitat. In this Plan therefore it is left to the discretion of the DFO/ Forest Department to alter the proposal depending on the field demand and necessity.

This plan aims at minimizing the threats posed by mining activities and to improve the Wild-life Habitat in the adjoining Forest area such as the Zone of Influence and beyond.

Proper implementation of the Plan will definitely improve the Wild-life Habitat in the area and will reduce man-wild animal conflict.

Our thanks are due to Sri P. K. Sethi IFS, DFO Bonai Forest Division and his staff for providing relevant information for the plan.


B.K.Patnaik.

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Plates

01	Location Map on Toposheet	Plate No. 1
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Annexures

01	Copy of letter No.2840 /6F-dt.29.6.07 of D F O Bonai Forest Division.	<i>Annexure-I</i>
02	Copy of letter No.8-37/2007 Dt.25 th Aug,2008 of MoEF, Govt. of India.	<i>Annexure-II</i>
03	Copy of Letter No. J-11015/ 380/ 2006- IA.II(M) Dated the 2 nd July,2008 of MoEF, Govt. of India.	<i>Annexure-III</i>
04	Copy of Site inspection Report of DFO, Bonai Forest Division.	<i>Annexure-IV</i>
05	Copy of letter No.10F(Cons)120/2006- 6879/F&E Dated 5/5/07 of Govt of Orissa	<i>Annexure-V</i>

EXECUTIVE SUMMARY

0.0.0 This Wild-Life Management Plan is prepared as a partial fulfillment of the requirements of MoEF, Govt. of India for diversion of Forest land for mining activities.

0.1.0 Raikela Iron Ore Mines has been leased out to M/S Geetarani Mohanty for a period of 20 years from Dt.02.07.1991 to Dt.01.07.2011.

The total area of the mine is 67.568ha out of which 66.67ha is Forest kissam Land. Diversion proposal has been submitted for 64.148ha excluding safety Zone. The safety Zone has not been included in the Diversion proposal as the said area will be maintained as such

Different types of Land involved are:

Forest Kissam Land	- 66.671 ha
Non Forest Land	- 0.915 ha
Total	- 67.586 ha

0.2.1 The net Reserve of Iron ore in the lease area has been estimated to be, 17.611 million Tons out of which Mineable reserve has been estimated to be 16.952million Tons. The production target has been fixed at 0.864million Tons per annum which is proposed to be enhanced to 1.50 million Tons per annum.

0.2.2 The lease area of Raikela Iron Ore Mines can be located on Topo sheet No.73G/1 and is bounded by

Latitude – 21° 00' 17" N and 21° 03' 50" N.

Longitude – 85° 01' 50" E and 85° 02' 30" E.

This area is situated at a distance of 2.5kms from Tensa and at a distance of 17kms from Barsuan. The area is highly undulating and mountainous. The altitudes vary from 300 mt. to 1020 mtr. above MSL. The general slope of the area is towards south-west and the drainage ultimately leads to river Baitarani.

M/s GEETARANI MOHANTY

0.2.3 The climate is Tropical with a very hot summer, the temperature rising up-to 42°C, a moderate to cool winter and well defined rainy season. The minimum temperature during winter is as low as 7°C.

0.2.4 The existing forest standing on the nearby Reserved Forest as well as the Forest kissam lands can be classified as Moist peninsular valley Sal.

0.3.1 The lease area does not form a part of any National Park or Sanctuary or Critical Wild Life habitat. No protected area is situated in the vicinity or with in the zone of Influence.

0.3.2 The common wild life occasionally noticed in the area is limited to Monkeys, Jackal, Hyena, Kufura, Wild Pig, Porcupine, Neulia etc.

0.4.1 There is no population within the lease area. There are 50 villages within the zone of influence with total population of 30415, with 69.93% Tribal population.

0.4.2 The major employment of the population is mining. The proposed mine will directly employ 194 persons in various mining activities. Besides several other persons will be engaged in scores of related activities on contract basis such as Ore crushing, Transportation etc.

0.5.1 The process of mining will be opencast mechanized method with drilling and blasting.

0.6.1 The threats perceived due to operation of the mine are:

- (a) Reduction of wild life habitat
- (b) Soil erosion
- (c) Water pollution & water scarcity
- (d) Dust pollution

- (e) Noise pollution
- (f) Lighting problems
- (g) Garbage problems
- (h) Physical threats such as fall of animals in the pits, poaching etc.
- (i) Forest fire

0.6.2 The management plan has addressed all the above threats and tried to minimize such threats.

- (a) Restoration of habitat will be done by planting 33850 nos of seedlings within the lease area. It is also proposed to raise 40 ha plantation and develop 5 ha grass land within the Zone of Influence and to maintain Forest Cover in the safety zone.. The lessee will contribute Rs. 22.50 lakhs for this purpose.
- (b) Soil conservation measures will be taken up by constructing check Dams. The lessee has proposed to contribute Rs.5.00 lakhs for this purpose.
- (c) Sub-soil and ground water recharge will be done through a series of percolation Pits. For this the lessee will contribute Rs.2.50lakhs.
- (d) One large water body will be created at a cost of Rs. 5.00 lakhs to provide water to animals throughout the year.
- (e) Water pollution will be checked by diverting the water to pass through garland drains and settling tanks and treating the water generated in the mine .
- (f) Dust pollution is controlled by regular spray of water on haul roads and the mine product.
- (g) Garbage will be disposed of through efficient garbage management methods.
- (h) Man animal conflict will be reduced by quick payment of compassionate amounts.

(h) The proposed cost for implementation of this plan is Rs.86.80 lakhs out of which the lessee will take up the activities for Rs. 24.10 lakhs and the Forest Department will take up various measures for Rs.62.70 lakhs. This amount of Rs.62.70 lakhs will be deposited with the Forest Department.

0.6.3 Besides the proposed amount indicated above, the lessee proposes to extend logistic support in shape of equipments, Vehicles etc. as required by the implementing DFO. The lessee further proposes to incur expenditure of up-to Rs.6.00 lakhs for the purpose.

M/s GEETARANI MOHANTY

CHAPTER- I

INTRODUCTION

Raikela Iron Ore Mines is being operated by M/S Geetarani Mohanty in the District of Sundargarh.

- 0.2.0 The mining lease was granted on Dt.02.07.1991 for a period of 20years over an area of 67.586ha. The lessee is also proposing to seek further extension of the lease. The total area included ,

Forest Kissam Land	-	66.671 ha
Non Forest Land	-	0.915 ha
		67.586 ha

The Forest Diversion Proposal for 64.148 ha in the year 2007 which has been forwarded by Govt. of Orissa to Govt. of India in letter No 10F(Cons)120/2006-6879/F&E, Dated 5/5/07.

- 0.3.0 The lease area of Raikela Iron Ore Mines can be located on Topo sheet No.73G/1 and is bounded by

Latitude – 21° 00' 17" N and 21° 03'50" N.

Longitude – 85° 01' 50" E and 85° 02' 30" E.

- 1.3.0 The mining plan has been approved by the Indian Bureau of Mines and being renewed from time to time. The last renewal being in the year 2009. The production capacity of the mine as approved is 0.864 million Tons and the lessee proposes to enhance the production capacity to 1.50 million tons per annum. The total mineral resource was estimated to be 24.64 million Tons out of which the present available is 11.60 million Tons proved category and 0.64 million Tons possible category. Therefore the life of the mine is estimated to be 8 years.

Extraction at the enhanced rate is proposed to start immediately after approval by the appropriate authority. All the required infrastructures are available for the enhanced target.

- 1.5.0 The Environment Management plan has been prepared as a part of Mining Plan.
- 1.6.0 Sundargarh District is very rich in Forest as well as wild life. This district is a part of Eastern Ghats and is a continuation of famous Saranda Forest. Various Wild Life species including Elephants are present in this District.
- 1.7.0 The lease area is a part of Bonai Forest Division adjoining Keonjhar District. The entire belt is very rich in mineral deposits such as Iron Ore and Manganese Ore.
- 1.8.0 Sundargarh District is also an Industrial Belt. A number of Industries have come up in the District. Presence of Wild-Life along with Industries and Mining activities create a conflicting situation.
- Hence this Plan aims at minimizing the conflict to the extent it relates with the Mining activities.
- 1.9.0 This plan (Wild Life Management Plan and Site Specific Conservation Plan) is prepared as a partial fulfillment of the conditions as required by the MoEF, Govt. of India for diversion of Forest Land for the Mining activities.
- 1.10.0 This Plan is prepared for a period of 8 years (ie. the proposed life of the mine) after which the same can be reviewed.

CHAPTER – II

DETAILS OF THE PROJECT AREA

2.0.1 This Raikela mining lease for extraction of Iron Ore has been granted in favour of M/S Geetarani Mohanty, with Registered Office at Station Road, Barbil, Dist – Keonjhar, Orissa – 758035.

2.0.2 **Brief of the lease area.**

Raikela mining lease area falls almost at the junction of Sundargarh and Keonjhar Districts. The total area for which the lease has been granted is 67.586 ha including Forest area (forest kissam land) of 66.671ha. Diversion proposal has been submitted for 64.148Ha of Forest land excluding the safety zone of 2.523Ha.

The mining lease area covers portions of non Forest land of 0.915ha.

2.1.0 **Location**

District and State	—	Sundargarh, Orissa
Sub-Division	-	Bonai
Village in the vicinity	-	Raikela
Mining lease area	-	67.586Ha.
Forest land (under control of Revenue Deptt.)	-	66.671Ha
Non Forest land (Sarbasadharan)	-	0.915 Ha

This area can be located on Topo Sheet No.73G/1 with

Latitude – 21° 00' 17" N and 21° 03' 50" N.

Longitude – 85° 01' 50" E and 85° 02' 30" E.

- (a) The lease area does not come under any Reserve Forest or Protected Forest. The nearby Reserved Forests are, *Sarkunda* Reserved Forest in the North, *Torha* Reserved Forest extending from west to South, *Karo & Kathamala* Reserved Forests are located in the North- East direction of the lease area.

- (b) This area comes within the Village limit of Raikela, at a distance of 1.5 kms from the settlement. Other Revenue villages situated at the vicinity of the lease area are, Dengula- 4 kms, Bandhal- 2.5 kms, Tantra- 5 kms.
- (c) There are several operating mines around the lease area. Precisely within a radius of 5kms 10active mines are in operation.
- (d) This area can be approached from Koida of Sundargarh District or from Joda of Keonjhar District through a series of mines. The distance of the lease area is 2.5 kms from Tensa, around 17kms from Barsuan.
- (e) The nearest Township are Barsuan, Koida and Joda where all the market facilities, transport and excellent health care are available.
- (f) The nearest Railway Stations is Barsuan which is situated at a distance of 17 kms from the lease area where excellent loading facilities are available. Road Transport facilities at Barsuan, Joda and Koida are also excellent.

The nearest port is Paradeep, situated at a distance of around 370 km. and the Airport at Bhubaneswar at a distance of around 310 kms. from the mining area.

2.1.1 Land use Pattern

The land schedule as per Revenue Department record is as follows

Khata No.	Plot No.	Kissam	Land classification	Area in Acres	Remarks
592	66	Pahad	Abad Ajogya Anabadi (AAA)	0.27	Classified as Forest by DLC
593	66	Pahad	AAA	14.28	Classified as Forest by DLC
594	64	Village Road	Sarbasadharan	2.24	
595	66	Pahad	AAA	35.53	Classified as Forest by DLC
596	66	Pahad	AAA	23.90	Classified as Forest by DLC
607	66	Nayanjori	Sarbasadharan	0.02	
608	66	Pahad	AAA	23.67	Classified as Forest by DLC

M/s GEETARANI MOHANTY

608	66	Pahad	AAA	18.11	Classified as Forest by DLC
610	66	Pahad	AAA	40.00	Classified as Forest by DLC
611	66	Pahad	AAA	10.88	Classified as Forest by DLC
593/793	66	Pahad	AAA	02.08	Classified as Forest by DLC
Total				167.00Ac or 67.588Ha	

The lease area is mostly broken up area and devoid of any human habitation. The actual land use pattern against the proposed land use till date and proposed during the conceptual plan period is as follows.

	Purpose	Target land use in Ha	Actual land use in Ha	Proposed during the Conceptual period in Ha
1	Mining Pit	36.893	29.893	50.893
2	Over Burden Dump	3.000	2.000	3.000
3	Mineral Storage	4.568	3.568	4.568
4	Infrastructure	0.200	0.200	0.200
5	Roads	2.900	2.900	2.985
6	Crushing Plant	1.890	1.890	2.422
7	Green Belt	2.603	2.603	2.603
8	Undisturbed area	15.532	24.532	0.915
	Total	67.586	67.586	67.588

The conceptual plan has been prepared for the next three years and the proposed land use pattern of the lease area is as follows.

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towns. There is availability of Electric Power, Water Source with in the lease hold area.

2.1.3 Topographical Features

The Mining lease area lies in the southern continuation of Bonai-Keonjhar Belt of Ranchi Plateau. The area is deeply dissected with rugged topography and distinctly marked by narrow hill ranges and flattops with prominent peaks. The elevation of the lease area varies from 615mt. above MSL to 790mt. above MSL. The highest altitude in the vicinity is 1010mts above MSL.

2.1.4 Climate

The lease are falls with in the Tropical region which is marked by very hot and prominent summer. There are three distinct seasons, a prominent summer season from March to mid June. Well defined rainy season from mid June to October and moderate winter from November to February.

The average annual rainfall is 1370 mm. Maximum rainfall is received due to South West Monsoon. About 80% of the rainfall is received during the month of June to August. The number of rainy days varies from 65 to 80 days during the year.

The temperature during summer rises very high. The maximum temperature rises to 42°C in hot summer where as the minimum temperature is 7°C during winter months.

2.1.5 Drainage

Due to the high altitude the lease area does not contain any perennial water source. There is only one seasonal Nala in the lease area running from NNE to SSW which is along the general slope of the area. There is another seasonal nala situated along the waste of the lease area. During rainy season the surface run off drainage takes place through these two seasonal nalas. The drainage from this area ultimately leads to river Baitarani.

upper shales. Economic mineral deposits of iron & manganese are confined to BIF and shales respectively. The host rocks which forms a part of the eastern limb of the famous horse-shoe shaped, Bonai synclinalorium are in consonance with the disposition of the synclinalorium.

The latest regional stratigraphy of the area is given as below :

	Ultramafic Intrusions	
	Kulhan Group	
	----- Unconformity -----	
Dhanajori Group	Jaganathpur	
	Lavas	
	Quartzite, Conglomerates	
	----- Unconformity -----	
	Chaibasa Formations	
	----- Unconformity -----	
	Singbhum Granite	
	----- Iron Ore Orogeny -----	
	Iron Ore Group	
	----- Unconformity -----	
	Older Metamorphic Gneiss	
	----- O.M. Orogeny -----	
	Older Metamorphic Group	

In this area Lateritisation is a common feature affecting almost all the rock types.

2.2.1 Forest and Forest type :

As per the India State of Forest Report 2009 the total forest area in the district of Sundargarh is as follows.

1. Geographical area	-	9712 sq.km.
2. Very dense forest	-	1047 sq.km
3. Moderately Dense Forest	-	1773 sq.km
4. Open Forest	-	1243 sq.km
5. Total forest	-	4063 sq.km

As per the Orissa forest status report 2003-04 the total forest area in the district of Sundargarh is as follows.

1. Geographical area	-	9712 sq.km.
2. Reserved forests	-	2651.88 sq.km
3. Demarcated Protected forest (DPF)	-	836.85 sq.km
4. Other forest under the control of	-	1466.87 sq.km

Rev. Deptt.

Total Forest area 4955.60 sq.km

Thus around 900 sq.kms of Forest land is either barren or utilized for other purpose.

The Forest type of the lease area can be classified as

Group 3C: Northern Tropical Moist Deciduous Forest.

Sub-group-3C/C. (ii) Moist peninsular valley Sal.

The area contains open crop with very low density.

2.2.2 Working Plan Prescription :

The lease area is under the control of Revenue Department, therefore it is not covered under Forest Working plan.

2.2.3 Flora Fauna :



The lease area doesn't form part of any National Park, Wild Life Sanctuary, Elephant Reserve, Biosphere Reserve or any critical wildlife habitat. In this context The D.F.O, Bonai Forest Division has issued a certificate in his letter No.2840/6F Dated 29.6.07 (Copy enclosed as Annexure). As per the enumeration conducted jointly by the Forest and Revenue Departments along with the lessee the trees have been enumerated. However on field enquiries some of the common species of Flora and Fauna available in the area are as follows.

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CORE ZONE (M.L. AREA)**FLORA**

Local Name	Botanical Name	Family Name
TREES		
Achu	<i>Morinda tinctoria</i>	Rubiaceae
Amba	<i>Mangifera indica</i>	Anacardiaceae
Asan	<i>Terminalia tomentosa</i>	Combretaceae
Bahada	<i>Terminalia belerica</i>	Combretaceae
Bheru	<i>Chloroxylon swietenia</i>	Meliaceae
Bija	<i>Pterocarpus marsupium</i>	Papilionaceae
Char	<i>Buchnanan lanzan</i>	Anacardiaceae
Dhaura	<i>Anogeissus latifolia</i>	Combretaceae
Dhobi	<i>Dalbergia paniculata</i>	Papilionaceae
Gambhari	<i>Gmelina arborea</i>	Verbinaceae
Haldu	<i>Adina cordifolia</i>	Rubaceae
Harida	<i>Terminalia chebula</i>	Combretaceae
Jamun	<i>Syzygium cumini</i>	Myrtaceae
Kangada	<i>Xylia xylocarpa</i>	Mimosaceae
Kashi	<i>Bridelia retusa</i>	Euphorbiaceae
Kendu	<i>Diospyrus melanoxylon</i>	Ebenaceae
Khakada	<i>Casearia tomentosa</i>	Flacourtiaceae
Kumbhi	<i>Careya arborea</i>	Myrtaceae
Kusum	<i>Schleichera oleosa</i>	Sapindaceae
Mahul	<i>Madhuca indica</i>	Sapotaceae
Moi	<i>Lannea grandis</i>	Anacardiaceae
Pipal	<i>Ficus religiosa</i>	Moraceae
Rai	<i>Dillenia pentagyna</i>	Dilleniaceae
Sal	<i>Shorea robusta</i>	Dipterocarpaceae
Sidha	<i>Lagerstroemia parviflora</i>	Lythraceae
Siris	<i>Albizzia lebbek</i>	Mimosaceae
Teak	<i>Tectona grandis</i>	Verbinaceae
Tentuli	<i>Tamarindus indica</i>	Cesalpiniaceae
GRASSES		
Khara grass	<i>Imperata cylindrical</i>	Gramineae
Phulabandhuni	<i>Thysanolaena maxima</i>	Gramineae
SHRUBS / HERBS		
Anantamula	<i>Hemidesmus indicus</i>	Asclepidaceae
Arakha	<i>Calotropis gigantia</i>	Asclepidaceae
Basanga	<i>Adhatoda vasica</i>	Acanthaceae
Dhatki	<i>Woodfordia fruticosa</i>	Lythraceae
Kurei	<i>Holarrhena antidysenterica</i>	Apcynaceae
CLIMBERS		
Atundi	<i>Combretum decandrum</i>	Combretaceae
Baidanka	<i>Mucuna monosperma</i>	Papilionaceae
Bichhuati	<i>Urtica dioica</i>	Euphorbiaceae
Mututri	<i>Smylax macrophylla</i>	Liliaceae

Local Name	Botanical Name	Family Name
Siali	<i>Bauhinia valii</i>	Papilionaceae
Satabari	<i>Asparagus racemosus</i>	Liliaceae

The lease area being an old lease is devoid of any Wild-life. As per the information collected locally, some of the occasionally stray away from the nearby forest areas and move in the lease area.

FAUNA

Local Name	English Name	Zoological Name	Schedule
MAMMALS			
Barha	Wild Boar	<i>Sus scrofa</i>	III
Bilua	Jackal	<i>Canis aureus</i>	II
Heta	Hyaena	<i>Hyaena hyaena</i>	III
Jhinka	Porcupine	<i>Hystrix indica</i>	IV
Kutura	Barking deer	<i>Muntiacus muntjak</i>	III
Neula	Mongoose	<i>Herpestes edwardsii</i>	II
BIRDS			
Bana Kukuda	Jungle fowl	<i>Gallus gallus</i>	IV
Kapta	Ring Dove	<i>Streptopelia chinensis</i>	IV
Koel	Cuckoo	<i>Eudynamis scolopacea</i>	IV
Kumbhatua	Crow pheasant	<i>Centropus sinensis</i>	IV
Gunduri	Partridge	<i>Perdica asiatica</i>	IV
Kathahana	Wood pecker	<i>Picoides nanus</i>	IV
REPTILES			
Ajagar	Python	<i>Python molurus</i>	I
Dhamana	Rat snake	<i>Ptyas mucosus</i>	II

The Zone of Influence extending over various Reserve Forests is a rich source of Forest and Wild Life. The important Flora and Fauna found in the ZoI are as follows:

BUFFER ZONE (ZONE OF INFLUENCE)

FLORA

Local Name	Botanical Name	Family Name
TREES		
Achu	<i>Morinda tinctoria</i>	Rubiaceae
Amba	<i>Mangifera indica</i>	Anacardiaceae
Amla	<i>Emblica officinalis</i>	Euphorbiaceae
Ankula	<i>Alangium lamarckii</i>	Cornaceae
Asan	<i>Terminalia tomentosa</i>	Combretaceae
Bahada	<i>Terminalia bellerica</i>	Combretaceae
Bara	<i>Ficus bengalensis</i>	Moraceae
Barakoji	<i>Zizyphus mauritiana</i>	Rhamnaceae
Baruna	<i>Crateva religiosa</i>	Capparidaceae

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Local Name	Botanical Name	Family Name
Bandhan	<i>Ougeinia oojenensis</i>	Papilionaceae
Bel	<i>Aegle marmelos</i>	Rutaceae
Bana Bhalia	<i>Semicarpus anacardium</i>	Anacardiaceae
Behenta	<i>Lemonia acidissima</i>	Rutaceae
Bheru	<i>Chloroxylon swietenia</i>	Meliaceae
Bija	<i>Pterocarpus marsupium</i>	Papilionaceae
Char	<i>Buchnanania lanzan</i>	Anacardiaceae
Chhatian	<i>Alstonia scholaris</i>	Apocynaceae
Dhaman	<i>Grewia tillaefolia</i>	Tiliaceae
Dhaura	<i>Anogeissus latifolia</i>	Combretaceae
Dimiri	<i>Ficus glomerata</i>	Moraceae
Gambhari	<i>Gmelina arborea</i>	Verbinaceae
Genduli	<i>Sterculia urens</i>	Sterculiaceae
Haldu	<i>Adina cordifolia</i>	Rubaceae
Harida	<i>Terminalia chebula</i>	Combretaceae
Jamun	<i>Syzygium cumini</i>	Myrtaceae
Kalucha	<i>Glochidion lanceolarium</i>	Euphorbiaceae
Kanchan	<i>Bauhinia variegata</i>	Cesalpiniaceae
Kangada	<i>Xylia xylocarpa</i>	Mimosaceae
Karada	<i>Cleistanthus collinus</i>	Euphorbiaceae
Kasi	<i>Bridelia retusa</i>	Euphorbiaceae
Katrang	<i>Gardenia latifolia</i>	Rubiaceae
Kendu	<i>Diospyrus melanoxylon</i>	Ebenaceae
Khair	<i>Acacia catechu</i>	Mimosaceae
Kumbhi	<i>Careya arborea</i>	Myrtaceae
Kusum	<i>Schleichera oleosa</i>	Sapindaceae
Mahaneem	<i>Melia azadirachta</i>	Meliaceae
Mahul	<i>Madhuca indica</i>	Sapotaceae
Moi	<i>Lannea grandis</i>	Anacardiaceae
Palas	<i>Butea monosperma</i>	Papilionaceae
Pipal	<i>Ficus religiosa</i>	Moraceae
Rai	<i>Dillenia indica</i>	Dilleniaceae
Rohini	<i>Mallotus philippensis</i>	Euphorbiaceae
Sal	<i>Shorea robusta</i>	Dipterocarpaceae
Semul	<i>Bombax ceiba</i>	Bombacaceae
Sidha	<i>Lagerstroemia parviflora</i>	Lythraceae
Siris	<i>Albizia lebbek</i>	Mimosaceae
Sissoo	<i>Dalbergia sissoo</i>	Papilionaceae
Sunari	<i>Cassia fistula</i>	Cesalpiniaceae
Teak	<i>Tectona grandis</i>	Verbinaceae
Tentuli	<i>Tamarindus indica</i>	Cesalpiniaceae
GRASSES		
Bamboo	<i>Bambusa arundinacea</i>	Bambusaceae
Dhantwary	<i>Cymbopogon martini</i>	Gramineae
Khara grass	<i>Imperata cylindrical</i>	Gramineae
Phulabandhuni	<i>Thysanolaena maxima</i>	Gramineae

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Local Name	Botanical Name	Family Name
Sabai	<i>Eulaliopsis binata</i>	Gramineae
SHRUBS / HERBS		
Anantamula	<i>Hemidesmus indicus</i>	Asclepidaceae
Arakha	<i>Calotropis gigantea</i>	Asclepidaceae
Basanga	<i>Adhatoda vasica</i>	Acanthaceae
Dhatki	<i>Woodfordia fruticosa</i>	Lythraceae
Kurei	<i>Holarrhena antidysenterica</i>	Apocynaceae
CLIMBERS		
Atundi	<i>Combretum decandrum</i>	Combretaceae
Baidanka	<i>Mucuna monosperma</i>	Papilionaceae
Bichhuati	<i>Urta dioica</i>	Euphorbiaceae
Mututri	<i>Smylax macrophylla</i>	Liliaceae
Siali	<i>Bauhinia valii</i>	Papilionaceae
Satabari	<i>Asparagus racemosus</i>	Liliaceae

FAUNA

Local Name	English Name	Zoological Name	Schedule
MAMMALS			
Bana bilei	Jungle cat	<i>Felis chausaffinis</i>	II
Barha	Wild Boar	<i>Sus scrofa</i>	III
Bilua	Jackal	<i>Canis aureus</i>	II
Bhalu	Sloth bear	<i>Melur susursinus</i>	I
Harin	Spotted deer	<i>Axis axis</i>	III
Hati	Elephant	<i>Elephas maximus</i>	I
Heta	Hyaena	<i>Hyaena hyaena</i>	III
Jhinka	Porcupine	<i>Hystrix indica</i>	IV
Kutura	Barking deer	<i>Muntiacus muntjak</i>	III
Mankad	Langoor	<i>Presbytis entellus</i>	II
Neula	Mongoose	<i>Herpestes edwardsii</i>	II
Sambar	Sambar	<i>Cervus unicolor</i>	II
Thekua	Hare	<i>Lepus nigricollis</i>	IV
Udanta musha	Bandicoot	<i>Bandicoot indica</i>	V
BIRDS			
Bana Kukuda	Jungle fowl	<i>Gallus gallus</i>	IV
Gunduri	Partridge	<i>Francolinus pondicerianus</i>	IV
Kapta	Ring Dove	<i>Streptopelia decaocto</i>	IV
Koel	Cuckoo	<i>Eudynamis scolopaceus</i>	IV
Kumbhatua	Crow pheasant	<i>Centropus sinensis</i>	IV
Kathahana	Wood peacker	<i>Picoides nanus</i>	IV
Sari	Hill myna	<i>Gracula ptilogenis</i>	IV
Sua	Indian myna	<i>Acridotheres tristis</i>	IV
REPTILES			
Dhamana	Rat snake	<i>Ptyas mucosus</i>	II
Godhi	Yellow monitor	<i>Varanus monitor</i>	I
Ajagar	Python	<i>Python molurus</i>	I

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2.2.4 Population :

Lease area :- Although the lease area falls within the village limits of Raikela, there is no human settlement within the area.

Zone of Influence :

The Zone of Influence within a radius of 10kms spread over fifty villages either fully or partially. The total no of household in these villages is 6531 and total population of this area is 30415.

The details are:

Male Population - 15463 (50.84%)

Female Population - 14952 (49.16%)

Scheduled Caste

Total - 1957 (6.4%)

Male - 989

Female - 968

Scheduled Tribe

Total - 21268 (69.93%)

Male - 10798

Female - 10470

Total Workers - 11653

Male workers - 7947

Female workers - 3706

Total Non Workers - 18732

Male non workers - 7516

Female non workers - 11216

Male literacy is 63% while Female literacy is 31%.

The Village wise details is enclosed in Annexure.

The literacy rate is high because it includes the town area of Barsuan. The total work force is also substantially high.

- 2.2.5 **Employment:** The lease area as well as the zone of influence comes within the industrial and mining belt of Sundargarh District. The major employment of the population is Mining, and some are however Industrial Workers.

This mine will provide direct employment to 194 persons besides a large number of people will be engaged in various ancillary operations.

- 2.2.6 **Agriculture:** In the villages situated within the Zone of influence the Agriculture land is only 18.66% of the total land area. Therefore only few people depend on Agriculture alone. Crops like Paddy, maize, millets such as bajara , jawar, cowpea, barsim etc. are raised for their own domestic consumption. At places where there is water availability the people also grow vegetables. The agricultural products are mostly used by people for their own bona-fide consumption.

- 2.2.7 **Industries:** A number of industries are situated around the lease area. The most important Industry is the Ferro-chrome Plant of TATA Steels. Several Iron Ore Crushers are also situated in the nearby areas. Rourkela Steel Plant is also situated within the same district at a distance of about 70 kms.

CHAPTER – III

MINING PROCESS

- 3.1.0 **Process** : The mining process is open cast mechanized mining method with deployment of mechanized shovel and high capacity dumper of matching size. Drilling and blasting activities will also be taken up. The method is called as shovel dumper system. The Ore will be transported through road, to the crusher unit for crushing. The transport will be by high capacity dumpers and Mechanised, loading arrangements are made at the mine area. Transportation to the Railway siding will also be done through high capacity dumpers. Several high capacity Dumpers are utilized for such transportation. For excavation of the mineral 10 high capacity Dumpers (10 MT capacity) are being utilized.
- 3.2.0 **Overburden**: The over burden will be drilled and blasted by using Air Compressor Wagon Drills and Jack hammer Drills. Volvo Loaders of 2.3Cum capacity shall be used for Loading of the Ore and removal of over burden. The overburden will be removed by dumpers. Total generation of overburden during the last five years has been as follows.

Year	Target in Cum		Achievement in Cum	
	Waste	Sub grade	Waste	Sub grade
2004-05	130380	43460	244347	137410
2005-06	129804	43268	342000	101400
2006-07	132660	44220	417207	136515
2007-08	143820	47940	82842	27321
2008-09	143940	47980	85461	28548
Total	680604	226868	1171857	431194

The production of Waste (Overburden) and Sub-grade Ore during the Last 5years has been almost double of the estimated target while the production of Ore has been 53% of the target

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During the conceptual period total waste generation will be as follows

Year	OB	Sub-grade	Waste to be re-handled	Total
2009-10	44240	110600	40000	154840
2010-11	44280	110725	140000	155015
2011-12	15360	38400	40000	53760
Total	103890	259725	220000	383615

Waste generation during the conceptual period – 103890Cum

Re-handling of existing Waste will be - 222000 Cum

On an average annual Waste generation has been estimated to be 45000Cum and total generation of Waste to be 11.24Cum. These Waste will be efficiently managed to create minimum problem to the local people as well as Wild-life.

3.2.1 Waste Management: At present 3Ha area has been set out for OB

Dump, and during the conceptual period an area of 7Ha has been proposed to be used as OB Dump. This area can accommodate 16,00,000Cum of loose material or 13,33,00Cum of compact materials. Hence there will be no problem in accommodating the entire Over Burden. Two dump benches of 10mtr each height will be maintained. Average dump slope will be maintained at 28°
The Dump site will be surrounded by garland drains which will prevent washing away of the dump materials.



Retaining wall is being provided around the dump area to prevent erosion.

3.3.0 **Production of Ore:** During the 5years the target and production of Iron Ore has been as follows:

Year	Target of Ore Extraction in Tons	Achievements in Tons
2004-05	782280	445907
2005-06	778824	595300
2006-07	795960	794285
2007-08	862920	165370
2008-09	863640	174410
Total	4083624	2175272

Thus only 53% of the Target has been achieved during the last 5years.

3.4.0 **Size of the Benches :** The height and width of the Benches shall be maintained at 6mts and 10mts each respectively.

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The overall bench slopes is proposed to be 35° with the horizontal.

- 3.5.0 **Drilling & Blasting** : The proposed mining will have 6 m height benches and will be drilled for blast holes by 32mm compressed air operated Jack hammers and 100mm Wagon Drill. Sequential blasting with delayed detonators, proper spacing, usage of optimum explosives etc. will be adopted to reduce fly rock and vibrations.



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The in-situ massive ore will be dislodged by drilling followed by blasting prior to excavation and loading. The most common type of explosives readily available and will be used for the mine are as under:

- Slurry based explosives,
- Ammonium nitrate fuel oil mixture (ANFO)

3.5.0 **Extent of mine pits** : The lease area at present has pit size of 900m x 400m extending over 49.451 Ha and during the conceptual period the Pit size will be 923m x 590m extending an area of 50.893Ha.

3.6.0 **Ore Crushing Unit** : The ore obtained from the mines will be transported to the crushing unit and the crushed materials will be transported by dumpers to the Railways siding.

3.7.0 **Water Management** : The Ground water table in the lease area is very low and therefore the mine will generate very small amount of water. However during rains there will be accumulation of some water. The rain water will be channelized through gariand drains provided around the dumps and mine pits to the settling tanks provided along the drains. The rain water dewatering process if required will involve channelizing the water along with slurry to pass through these gariand drains and settling tanks. The treated water will be utilized for spraying the haul road for suppression of dust and the surplus treated water will be released to the natural drainage system.



Photograph of Check Dam and Settling Tank

3.8.0 Vehicles and machineries: The major mining activity will involve excavation and transportation of the Ore. For this purpose large numbers of vehicles will be used in the mining process besides use of drilling machines, generator operated-trolley mounted lighting systems and other required machineries like shovel loaders etc. The following machineries are proposed to be put in operation for the Mining purpose.

1. L&T Poclain CK 90- 0.9Cum	-	1 no
2. P C 200 – 0.9 Cum	-	2 no
3. Kamatsu 180 - 1.7Cum	-	2 no
4. VOLVO Loader - 2.3 Cum	-	1 no
5. L&T 580 – 2	-	1 no
6. Dumper 10MT	-	10 no
7. Air compressor 4" Wagon drill	-	2 no
8. Jack Hammer Drill	-	1 n o
9. Tractor with air compressor	-	1 no

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10. Jeeps	-	2 no
11. Dust screening Plant 200TPH	-	1no
12. ROM Plant	-	1 no

3.8.0 Engagement of Staff: The following persons will be directly employed in the Mining Process.

1. Mines Manager	- 1
2. 2 nd class Manager	- 2
3. Foreman	- 4
4. Supervisors	- 10
5. Mechanical Engineer	- 1
6. Mining Engineer	- 1
7. Electrical Engineer	- 1
8. Geologist	- 1
9. Surveyors	- 2
10. Blaster	- 2
11. Clerical Staff	- 6
12. Supporting Staff	- 11
13. Other Workers	- 152
Total	- 194

Besides the above numbers of staff directly employed in the Mining activities, around 2000 persons will be indirectly benefited in other ancillary works.

3.8.0 Salient Features of mode of working: The Mining can be called as opencast Mechanized method. The mining operation such as excavation, blasting, loading and ore crushing will be mechanized. The overburden transportation will be done through dumpers.

The mine product will be transported through high capacity dumpers to the Railway siding

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CHAPTER IV

THREATS TO WILDLIFE AND ITS HABITAT

4.0.1 The lease area of Raikela Iron Ore mines is spread over 67.586Ha. Out of the total area of 67.586Ha, 66.671Ha area is Forest Kissam land which is under the control of Revenue Department.

The vegetation in the Lease hold area is sparse. This area does not form a part of any Sanctuary or National Park. It is also not covered under any Forest Working Plan. No wild animals are present in this area. This area is also surrounded by various mines and mining activities.

This lease area being surrounded by various mining leases is not a good habitat for wild life.

The Forests around the lease area are disturbed due to various Mining activities and therefore the presence of Wild-life is very sparse. As per the information collected the following important Wild life species are occasionally found in the Forests areas within the Zone of Influence.

<i>Local Name</i>	<i>English Name</i>	<i>Zoological Name</i>	<i>Schedule</i>
MAMMALS			
Bana Bilei	Jungle Cat	<i>Felis chausaffinis</i>	II
Barha	Wild Boar	<i>Sus scrofa</i>	III
Bhalu	Sloth bear	<i>Melur susursinus</i>	I
Bilua	Jackal	<i>Canis aureus</i>	II
Gunduchi	Squirrel	<i>Funambullus penanti</i>	IV
Hati	Elephant	<i>Elephas maximus</i>	I
Harin	Spotted deer	<i>Axis axis</i>	III
Heta	Hyaena	<i>Hyaena hyaena</i>	III
Jhinka	Porcupine	<i>Hystyrix indica</i>	IV
Kutura	Barking deer	<i>Muntiacus muntjak</i>	III
Mankad	Monkey	<i>Presbytes entellus</i>	II
Neula	Mongoose	<i>Herpestes edwardsii</i>	II
Neula	Hill Mongoose	<i>Herpestes javanicus</i>	IV

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<i>Local Name</i>	<i>English Name</i>	<i>Zoological Name</i>	<i>Schedule</i>
Sambar	Sambar	<i>Cervus unicolor</i>	II
Thekua	Hare	<i>Lepus nigricollis</i>	IV
Udanta Musa	Giant Squirrel	<i>Ratufa indica</i>	II
BIRDS			
Bana Kukuda	Jungle fowl	<i>Gallus gallus</i>	IV
Kapta	Ring Dove	<i>Streptopelia chinensis</i>	IV
Koel	Cuckoo	<i>Eudynamis Scolopaceus</i>	IV
Kumbhatua	Crow pheasant	<i>Centropus sinensis</i>	IV
Gunduri	Partridge	<i>Perdica asiatica</i>	IV
Kathahana	Wood peacker	<i>Picoides nanus</i>	IV
Kumbhatua	Crow Pheasant	<i>Centopus sinensis</i>	IV
Petcha	Owl	<i>Athenebrama indica</i>	IV
Sari	Indian Moyna	<i>Acridotheres tristis</i>	IV
REPTILES			
Ajagar	Python	<i>Python molurus</i>	I
Boda	Common Boa	<i>Erix conicus</i>	IV
Naga	Cobra	<i>Naja naja naja</i>	II
Dhamana	Rat snake	<i>Ptyas mucosus</i>	II
Godhi	Yellow monitor	<i>Varanus monitor</i>	I

Non of the Endangered or Endemic Wild-Life species are found here. Even though this area does not form a part of any National Park or Sanctuary or Critical Wild Life Habitat, the following threats are anticipated to the wild life and its habitat.

1. Threats within the mining area.
2. Threats within the Zone of Influence.

4.1.0 Threats within the Mining area.

Mining operation in the area will involve various activities such as Drilling, Blasting, Crushing the Ore, movement of large number of Machineries, Vehicles and Workers. Such activities may cause the following threats.

4.1.1 Reduction in wildlife habitats

Due to the mining activities 66.671Ha. forest area will not be available for general purpose such as collection of fuel, small timber and other NTFP items by the local population. This area will also not be available for use by the wild animals however occasional it may

be. Thus Wild-Life Habitat to the extent of lease Will be reduced.

4.1.2 Soil erosion

The mining activity will involve removal of all the forest cover and top Soil and digging of large pits. Major part of the forest land will come under the mining pit setting aside the safety zone. The Topographical features of the lease area puts it in high erosion prone area. Therefore Large scale soil erosion is bound to take place which may cause formation of Gullies and Ravines leading to further destruction of adjoining Forest as well as wild-life habitat. The possibility of land slide also cannot be ruled out.

4.1.3 Water availability

- (a) **Loss of Moisture:-** Due to mining activity there will be large scale evaporation from the exposed soil and moisture retention capacity of the soil along the periphery of the mine pits will reduce. The sub-soil water will also be reduced which may lead to destruction of some more vegetation due to desiccation. The process of dewatering and releasing huge quantities of water in to the natural drainage system may reduce the recharge of Sub-soil water and ground water, resulting in water scarcity.
- (b) **Water accumulation:-** Digging of large pits will accumulate huge quantities of water which will lure the Wild animals and ultimately may trap them in the pits which will be fatal for them.

4.1.4 Water pollution

The water source available within the mining area is likely to be muddy due to presence of large amount of dust and broken up soil and mineral particles. It is also likely to be contaminated due to excessive plying and cleaning of heavy vehicles and machineries. Use of Slurry pumps for de-watering purpose and releasing the said water along with Slurry in the natural drainage system will contaminate the natural streams and pose health hazards for the human population, as well as animals.

4.1.5 Dust pollution

The mining process includes Blasting, Drilling, movement of
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heavy vehicles and machineries etc. These activities will produce large amount of dust. There will also be some Ore Crushing and Dressing Units which will generate dust along with some mineral powder. The process of internal transportation, unloading, reloading etc. may spread large amount of dust. Such dust mixed with mineral powder is likely to cause air pollution. This will create respiratory problems in wild animals. Large amount of Dust will settle on the Grasses and other fodder plants which when taken by animals will cause Digestive problems.

4.1.6 **Noise pollution**

The Environmental Management Plan sets out that, there will be no impact of Noise produced in the Mining process. The Noise Levels are proposed to be kept within permissible limits. However operation of heavy machinery and Blasting in the mining area will produce large amount of sound which may cause disturbance to wild animals within the nearby Wild-life habitat. Movement of large numbers of heavy vehicles in and around the lease area will disturb the wild animals and create panic.

4.1.7 **Lighting**

The entire lease area will be lighted for safety reasons and convenience. Such lighting will create panic in wild animals surrounding the lease area. However due to such lighting the wild-animals will try to avoid the mining area.

Movement of large number of vehicles at night with their lights on in and around the lease area will disturb the Wild animals.

4.1.8 **Accumulation of Garbage**

Due to various activities in the mining process, movement of large number of work force and vehicles within the mining area, a large quantity of garbage will be generated within the mining area.

The Garbage include Solid Wastes such as Over burden, Mine

Waste, Sub-grade Ore etc.

Besides some amount of non Bio degradable Waste and Hazardous waste such as used oil, used batteries, oily sludge, filter materials containing oil are likely to be generated within the lease area.

These dangerous materials will create various health problems for both human population as well as animal population including wild animals.

4.1.9 Fall of animals in Mine pits

The mining pits are dug with very steep slopes. The bench height will be 6mts with slope of 70° and bench width of 12mts makes the overall slope 26° . Usually no physical barrier is provided around the mine pits. Any accidental fall of the animals in those pits may be fatal for the animals.

4.1.10 Poaching

The poachers may also drive the animals and lead them in to the mining pits using the same as animal traps.

4.2.0 Threats in the Zone of Influence.

Due to the mining operation there will be some disturbance in the surrounding area, particularly in the Zone of Influence.

4.2.1 Destruction of wildlife habitat.

Due to mining activity over the lease area, the biotic pressure which was exerted over the lease area will be shifted to the surrounding areas. Collection of fuel wood, small timber and other NTFP by the local people will also be shifted to the surrounding area which will create additional pressure on the surrounding area. Grazing pressure of the local Cattle will also be shifted to these Forests. Therefore the wildlife habitat in these Forest areas is likely to be disturbed.

4.2.2 Water pollution

Large quantities of water produced in the process of mining which are highly polluted will be released in to the natural drainage system, thereby contaminating natural water sources. The slurry generated in the mining process will also be pumped out in to the natural drainage system making the natural water source unfit for consumption by animals as well as human beings. Besides large amount of Garbage will be generated in the mining area and will contaminate the water. These contaminated water will create health problems within the Zone of Influence as well as beyond.

4.2.3 Dust pollution

The mining process, Ore Crushing/dressing and transportation will spread large quantities of dust in the surrounding area. There will be heavy air pollution in and around the lease area creating various problems for the animals.

4.2.4 Man-animal conflict.

Due to reduction of habitat, additional biotic interference will be exerted in the Zone of Influence which will create disturbance. There will be also shortage of food. The animals are therefore likely to invade cultivated lands and human habitation which will result in man-animal conflict.

4.2.5 Accidental killing of animals

Due to plying of large number of vehicles the animals will be scared and in the process some animals may be killed accidentally by vehicles.

4.2.6 Forest Fire

Forest fire is a common phenomena in almost all forests areas irrespective of mining activity. But due to mining activity such as movement of large number of vehicles, people etc. the incidence of accidental fire is likely to increase. The wildlife habitat is destroyed along with important flora and fauna due to forest fire. The small

animals including reptiles are usually killed in the forest fire. Sometimes the large animals are also trapped in the fire. Increased Biotic pressure in the Zone of Influence will also increase the incidence of fire hazard.

CHAPTER V

WILDLIFE MANAGEMENT PLAN



5.0.0 Although there are no Wild animals within the lease area their occasional movement in the area can not be ruled out. Due to grant of lease and operation of various mining activities the Wild life movement within the lease area will be threatened. Besides the Wild-life habitat is reduced to the extent of lease. The Wildlife Management Plan therefore aims at improving the habitat in the surrounding areas. Certain measures are also required to be taken within the mining area.

The proposed measures can be taken within the mining area by the lessee and beyond the lease area by the Government (Forest Department) with the financial support provided by the lessee.

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5.0.1 **Management Plan**

Basing on the perceived threats to wildlife as per the foregoing chapter, the Management Plan is prepared to address almost all such threats. The lease hold area as well as the Zone of Influence will be treated for habitat improvement so that, more fodder and water will be available for the wild animals.

The life of the mine has been estimated to last beyond 2018-19. But this plan is proposed for a period of 5 years on the presumption that, the habitat improvement in the adjoining area i.e. the Zone of Influence can be achieved to the desired level.

5.1.0 **Measures to be taken within the mining Lease area.**

The activities taken up in the lease area will pose maximum threat to wildlife. It is therefore necessary to minimise such threats. The following steps will be taken within the lease area.

5.1.1 **Safe passage to Existing Wild-life**

Even though Wild animals are not found in the lease area it is probable that, some reptiles and small animals might be living in the area. It is therefore very important to save the existing wild animals available within the lease area and to divert them to safer locations. It can be possible to achieve such objective by commencing the mining activities from locations situated away from the Forest areas. Thereby the Wild animals present within the Lease area will find their way to nearby Forest areas.

5.1.2 **Restoration of habitat**

In the mining lease area the lessee has already planted 17900 seedlings of different species within the lease area over an area of 7.62Ha from the year 2004-05 to 2008-09 and 9550 seedlings planted outside the lease area during the said period. It is further proposed to plant another 6400 seedlings during the next three

years. The safety zone of 7mts around the mining lease area will be maintained with good vegetation creating a green belt around the lease area which will control spreading of dust. This belt will also act as a buffer zone between the mine and the Wild-life habitat. This aspect has been proposed in the approved Mining Plan, hence no additional funds are proposed for this.

Besides the above proposed steps the overburden will be filled back in the mine pits and plantations will be taken up as per Mine Closure Plan.

The major steps taken in regard to restoration of habitat within the lease area are:

- (i) Existing plantation of 17900 seedlings.
- (ii) Proposed plantation of 6400 seedlings in next 3years.
- (iii) Maintain Forest Growth along the safety zone.
- (iv) Planting of grasses and other species on the OB Dumps.

5.1.3 **Soil and water conservation**

There will be substantial loss of moisture as well as occurrence of soil erosion due to mining activity. For enhancing seepage of water and to reduce soil erosion the rain water will be channallised through garland drains provided around the dumps to the settling tanks provided along the drains. The rain water dewatering process if required will involve channallising the water along with slurry to pass through these garland drains and settling tanks. The treated water will be utilized for spraying the haul road for suppression of dust.

In the safety zone the rain water will be diverted through easy gradient drains to minimise soil erosion. Check-dams will be provided on the natural channels in order to prevent soil erosion in the safety zone. These activities have been proposed in the Mining Plan, hence no separate provision is made on this account.

5.1.4 Control of Dust



Dust hazards affect more to the human beings and the workers engaged in the mining activity, besides creating problems for the wild animals. Therefore dust control is a major activity in the mining process. Dust pollution cannot be completely eliminated, but attempt is made to reduce the quantum of dust pollution.

The Haul Road in the mining area are regularly sprinkled with water so that, dust is minimised due to movement of vehicles.

The Ore at the time of loading, transportation and unloading in and around the mining area will also be sprinkled with water to reduce Dust pollution.

Dust control measures have been proposed as a requirement in the approved Mining Plan and therefore special provision is not made for this activity in this Plan.

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5.1.6 Control of water pollution

Water pollution is the most important factor in mining process. Huge quantities of water will be produced every day along with slurry which are to be removed from the mining pits and released to the natural drainage system. Besides contaminated water due to cleaning of vehicles and machineries, dumping of Garbage etc. will flow to the natural water sources creating health hazards.

The water pollution will be controlled by treatment of water before releasing the same to the natural drainage system

Since the lease area is situated on higher altitude the generation of water from the mine pit will be minimum which can be easily handled.

The discharged water will be collected in sump pits and channelled to treatment plant. The treatment plant will consist of :

- (i) Oil, Grease trap,
- (ii) Sedimentation pond,
- (iii) Chemical dosing arrangement to arrest suspended Solid, oil and Grease.

The treated water instead of releasing to the natural drainage system will be used in dust suppression on haul roads, washing of dumpers and dozers etc.

Oil and Grease recovered in the process will be stored in drums and auctioned.

Surface runoff will be collected through garland drains and diverted to sedimentation tanks. There after the overflow will be diverted to the natural drainage system.

All these measures are required to be complied in the approved Mining Plan, therefore special provision is not made for this in this Plan.

5.1.7 Noise control

The following measures will be taken to keep the noise at the minimum possible level.

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- Proper designing of plant & machinery by providing in-built mechanisms like silencers, mufflers and enclosures for noise generating parts and shock absorbing pads at the foundation of vibrating equipment.
- Routine maintenance of equipment.
- Enclosures for Ore Crushing/dressing units etc.
- Rational deployment of noise generating plant and machinery.
- Greenbelts around the quarry, infrastructure sites, service building area
- Provision of isolation for vibrating equipment (both fixed and mobile) foundation.
- Regular monitoring of noise levels at various points.

5.1.8 Lighting



The core area of the mining activity is sufficiently illuminated. Such illumination detracts the animals from the core mining area, which would otherwise be dangerous to their lives. Care will be taken to focus the lights to the mine pits from the safety zone.

The use of vehicular Headlights which disturbs the animals is restricted and only dippers are allowed within the mining area.

These activities have been included in the mining process and hence no special funds are required .

5.1.9 **Garbage Management**

Garbage not only creates problems for the wild life but also creates problems for mining activity. Particularly non-degradable materials like polythene bags etc. pose a lot of problem for the machineries as well as Wild animals. Hence proper Garbage Management is also an important activity in Mining process. Some of the steps to be taken in the Mining area have been indicated under water pollution.

During the next three years of this Plan period the Solid Waste generation is estimated to be 1,03,890Cum. along with 2,20,000Cum. of rehandled waste. An area of 3.00Ha has been set out for the Waste Dump. It is estimated that, the proposed Dump site will be full within a period of 4 years. There after it is proposed to back fill the exhausted and abandoned mine pits so as to generate adequate space for the Waste. The Dump site will be surrounded by retaining walls followed by a series of garland drains. The size of the garland drains will be 1m wide and 0.5m deep. The water percolated through the wastes will be drained to the garland drains and then to settling tanks.

Besides the above steps, the additional steps which are to be taken for Garbage management are as follows.

M/s GEETARANI MOHANTY

- (a) Entry of non-biodegradable materials which are likely to produce Garbage such as Polythene bags, Aluminium foils, Tin foils etc. are restricted in to the Mining area.
- (b) The Garbage generated in the Mining area are regularly collected and segregated in-to Bio-degradable and non-degradable materials.
- (c) The non-degradable materials if any are sent for recycling.
- (d) The Bio-degradable substances are put in the Compost pits of size 10' x 10' x 6' for conversion in-to manure. The Manure obtained from these pits will be utilised for plantation purpose.

Two persons will be engaged on regular basis for collection, segregation of Garbage and putting the same at proper place. The expenditure on this account is proposed to be (2x4000x12x5=Rs.4,80,000/- + Compost pits Rs.50000/-) = Rs5.30lakhs.

5.1.10 Fall of animals in the mining pits.

In order to prevent accidental fall of animals in the mine pits the following steps shall be taken:

- (a) Two persons will be exclusively engaged in the mining area during night who will keep a watch on straying wild animals and drive them away to safe distance. The total expenditure for the animal watcher during the proposed 5 years period will be (2x4000x12x5=) Rs.4,80,000/-.
- (b) Solar electric fencing will be provided at strategic locations where possibility of entry of wild animals in to the mining area is there particularly towards the forest area. It is proposed to provide Solar Electric fence over 2Kms., at a cost of Rs.6.00lakhs.
- (c) The mining area will be sufficiently illuminated so that the wild animals will avoid the area.
- (d) In-spite of the precautions taken, in case of accidental fall of any wild animal in the mining pit, the workers will be educated to inform the local Forest authorities and act as per their advise.

M/s GEETARANI MOHANTY

5.1.11 Prevention of poaching

The mining area is well guarded and sufficiently illuminated. Hence no poaching can be possible within this area.

5.1.12 Creation of awareness

The lessee will also create awareness around the lease area regarding protection of wild life and its habitat through distribution of leaflets, organising Essay Competition, Debate Competition in the Schools etc. For this purpose the lessee will incur expenditure of Re.2.00lakh.

5.2.0 Measures to be taken within the Zone of Influence.

Due to diversion of Forest area of 66.671Ha for mining purpose the wild-life habitat to this extent will be reduced. The congregation of wild animals in the Zone of Influence is likely to increase. These animals will therefore be susceptible to greater threats. There will also be additional Biotic pressure on the Zone of Influence. The Management Plan therefore aims at reducing such threats. These activities beyond the Mining lease area and beyond the control of the Lessee will be undertaken by the Forest Department.

5.2.1 Habitat Improvement

It is proposed to improve the wild life habitat within the Zone of Influence with the following activities.

(a) Plantation :- Creation of cover for the wildlife by planting of suitable species in degraded forest areas. It is proposed to take up plantation over 40 ha. within 5 years period at a cost of Rs.20.00 lakhs.

(b) Grass Land development:- The natural blanks in the forest areas are to be developed as grass lands. It is proposed to create 5 Ha Grass land during the initial two years period at a cost of Rs.2.50 lakh.

(c) Soil and moisture conservation:- Check dams of random rubble

stones are to be provided to prevent soil erosion and conserve moisture. It is proposed to provide Rs.5.00 lakhs for the activity.

(d) It is also proposed to recharge the ground water and sub-soil water by providing a series of percolation pits. These percolation Pits will also arrest soil erosion by reducing surface run-off. The lessee proposes to contribute Rs.2.50 lakhs for the purpose.

(e) **Creation of Water body** :- In order to contain the wild animals in a safe habitat, it is proposed to make provision for availability of water during summer season. It is proposed to create one water body at a strategic location at a cost of Rs.5.00 lakhs.

5.2.2 **Control of Water pollution.**

Release of untreated water to the natural drainage system will create health hazards for the animals as well as human beings. All the water including slurry generated in the mining process will be treated. Attempt will be made to utilize the total quantity of water generated in the mine itself for suppression of dust and irrigation of the plantation. Only some surplus treated water will be released to the natural drainage system. This aspect has been dealt in the Mine plan and hence no separate provision is made in this Plan.

5.2.3 **Reducing Man-animal conflict**

In the lease area as well as the areas within the Zone of Influence the man-animal conflict is found to be minimum. Most important man-animal conflict is Man-Elephant conflict. Such conflict will be reduced by creating awareness in the forest fringe villages about the behaviour of the animals and the procedure to tackle the emergency. The local people can be educated regarding the wild-animal habits and how to tackle the emergency situations. It is proposed to engage two motivators for a period of five years. The cost on this account will be $(5 \times 2 \times 4000/- \times 12 \text{ months}) =$ Rs.4.80 lakhs. This amount is proposed to be borne by the lessee.

5.2.4 **Forest Fire prevention**

Forest fire is the greatest threat, not only to the wild life but also to the

forest itself. Repeated forest fire destroys the ground vegetation and the humus. The wild animals do not get adequate food and cover due to such repeated forest fire.

The Wildlife Management Plan therefore lays maximum emphasis on prevention of forest fire. The following measures are therefore proposed to be taken to prevent forest fire:

(a) Engagement of Fire watchers.

Fire watcher shall be engaged in the area from the month of March to June every year for a period of 5 years. The lessee proposes to bear the cost of 3(three) fire watchers during the summer months every year. The total cost on this account will be $(3 \times 4000 \times 4 \times 5) = \text{Rs. } 2.40 \text{ lakhs}$. These Fire watchers will also be equipped with certain tools to attend to emergencies. The lessee therefore proposes to contribute Rs.1.00 lakh for such fire fighting equipments.

(b) Provision of incentive to fringe villages.

Awareness will be created among the forest fringe villages to prevent forest fire. The village which can successfully prevent forest fire in the specified patch of the forest near their village will be rewarded with incentive. It is proposed to reward such villages with Rs.10,000/- annually. The lessee proposes to bear the cost of incentive for 5 such villages within the Zol and the amount will be deposited with the D.F.O. The cost will therefore be Rs2.50lakhs.

(c) Fire lines

Fire lines is an effective means to prevent spreading of Forest fire. The lessee proposes to share the cost of 10 kms. of fire line @4,000/- per kms. annually during the proposed period of five years with a total cost of Rs2.00lakh.

5.2.5 Solar Electric Fencing

At important places solar electric fencing can be taken up to prevent the animals from entering in to human habitation. This can be done at the discretion of the Forest Department. The Lessee proposes to contribute Rs.5.00 lakhs for this purpose.

M/s GEETARANI MOHANTY

5.2.6 Provision of Corpus fund

Usually any damage to human life and property by wild-animals are compensated through Compassionate Grants released by Govt. But at times delayed payment of compassionate amount leads to revengeful attitude of local people. It is therefore proposed to create a revolving fund for quick payment of compassionate grants. The lessee proposes to contribute Rs.5.00 lakhs for this purpose.

5.2.7 Collection of Intelligence.

In-order to properly address the problem of Wild Animal Poaching . It is necessary to keep track of the local Poachers and to collect information regarding their movement. For this it is proposed to reward the Informers and Decoys. The reward can be paid to the Informer or Decoy either on regular wage basis or lump sum basis at the discretion of the Forest Department. The VSS or Eco-Development Committees can also be involved with an assured reward system. The lessee proposes to deposit Rs.5.00 lakhs in Fixed Deposit Account in favour of the DFO and the annual interest can be drawn by the DFO and utilized for this purpose.

5.2.8 Provision of equipments & Logistics.

Certain equipments such as Computers, GPS, four wheeler, Motor-cycles, Crackers, Search lights etc, as per the requirement and specification of the Implementing DFO/ Forest Department, will be supplied by the lessee . It is proposed to provide Rs.6.00 lakh for this purpose.

5.3.0 Discretion of Forest Department

Although the above proposals are submitted for the mitigation of various threats to Wild-life and its habitat, the Forest Department is free to make alteration of the proposal or to divert the proposed activities to any other suitable locations.

M/S GEETARANI MOHANTY

CHAPTER-VI FINANCIAL FORECAST

- 6.4 Based on activities suggested in the Chapter-V broad financial estimate for activities within the lease hold area and in the adjoining forest etc. areas.
- 6.5 The activities proposed to be taken up inside the leasehold area are to be executed by the User agency under the supervision and monitoring of DFO, Bonai Forest Division.
- 6.6 The following table indicates the cost estimate for measures to be taken inside & outside the project area within 10-years. The cost of activities to be taken up in the project impact area (ZoI) i.e. outside leasehold area shall be deposited with the Forest Department to be utilized by the Divisional Forest Officer, Bonai Division for execution of works under the guidance of Conservator of Forests, Rourakela Circle. User agency will deposit Rs.72 lakhs with DFO, Bonai Division under CAMPA for implementation of the plan.

6.1.0 Activities within the Project area.

(Rs. In lakhs)

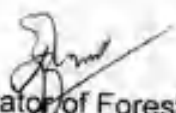
Sl. No.	Item of work	Amount approved by CWLW
1	Garbage Management- Wages Compost pits	To be approved by Pollution control board as per their norms.
2	Wild animal watchers- 2nos.	5.00
3	Solar electric fencing- Fencing should be confined to mining pits and proper corridor and passage should be left for passing wild animals including Elephants moving in the area.	6.00
4	Awareness promotion, livelihood activities, signages, animal and health camps.	2.00
5	Soil & Moisture conservation measures with contour trenches/ series of check dams on nalas & rivulets/ brushwood dams/ especially to avoid choking of nalas/soil erosion etc.	3.00
6	Creation of Water sources in the forest area for the residual wild life including small mammals, reptiles, Avifauna etc in the area for 10 years including artificial refilling if necessary during hot summer months HDPE troughs, ponds etc.	2.00
7	General provision for equipments, such as GPS, Computers, Vehicle, Motor Cycles, Crackers, Search lights etc. as per specification of the DFO.	10.00
	TOTAL	28.00

6.2.0. Activities within the Project Impact area (zone of influence).

Sl. No.	Item of work	Amount proposed for approval by CWLW
1.	Habitat improvement both in project impact area including with Fodder & fruit bearing species block plantations and ANR with gap plantations with above species, meadow development, Bamboo plantations/bamboo clumps silvicultural operations etc.,	23.00
2	Soil & Moisture conservation measures/percolation pits, with contour trenches/ series of check dams on nalas & rivulets/ brushwood dams/ especially to avoid choking of nalas/soil erosion etc.	8.00
3	Creation of Water Body	5.00
4	Fire watchers-3nos.	2.50
5	Fire fighting equipments	1.00
6	Incentive for fire prevention	2.50
7	Fire line tracing	2.00
8	Solar electric fencing	5.00
9	Corpus fund	5.00
10	Intelligence collection	5.00
11	Biodiversity monitoring & Development of communication network / GIS based maps Satellite maps on GIS domain should be procured every year to know the changing profile of the project area in both dry season and wet season for 10 years preferably using the GIS lab of PCCF(WL), Orissa	5.00
12	Awareness promotion, livelihood activities, signages, animal and health camps.	6.00
13	Unforeseen expenditure	2.00
TOTAL		72.00

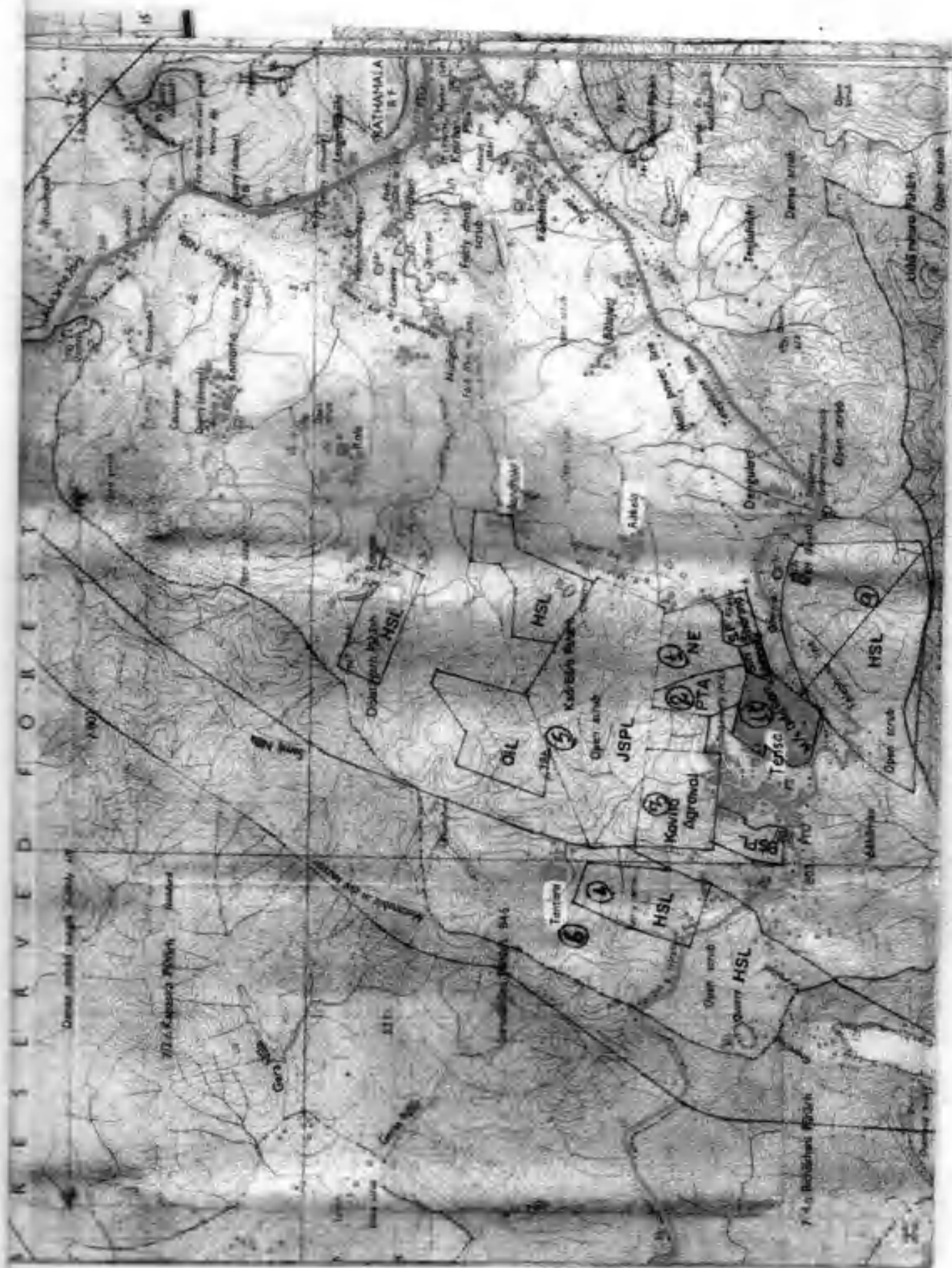
N.B: All measures for dump reclamation, dust suppression, garbage bins, soil erosion measures should be taken up including retaining walls, plantation, plantations in the safety zone etc. as per the reclamation plan/safety zone plantation scheme etc to be prepared in terms of the approved plans and other guidelines. These components are to be dealt separately as per the above guidelines and to be approved by competent authority. Hence no financial forecast on this account is indicated in the conservation plan.

Approved by PCCF(WL)& CWLW, Orissa.


 Conservator of Forests (WL)
 Conservation of Forests (WL)
 CCF, Wildlife Division
 Orissa, Bhubaneswar

REFERENCES

1. Mining Plan of Raikela Iron Ore Mines.
2. India State of Forest Report 2009
3. Orissa Forest Status Report 2003-2004
4. Working Plan of Bonai Forest Division.
5. District Census Hand Book.



OFFICE OF THE DIVISIONAL FOREST OFFICER: BONAI DIVISION
Ph/Fax-06626-244434 Email: dfo_bonai@sancharnet.in

No. 2840 /6F-dt. 29.6.07

To,

Sri Srinibas Sahu,
Managing Partner,
M/s Geetarani Mohanty,
Station Road, At/Po-Barbil,
Dist-Keonjhar.

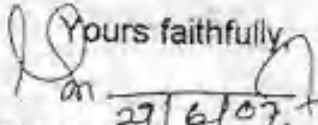
Sub:- Environmental Clearance of Project of Raikela Iron Ore
Mines of M/s Geetarani Mohanty over an area of 67.586 Ha
in village Raikela of Sundargarh District.

Ref:- Your letter No. 45 dt.25.6.2007.

Sir,

With reference to your letter cited above, the Certificate
required for Environmental clearance of your Raikela Iron Ore Mines is
furnished below.

" Certified that the lease-hold area of Raikela Iron Ore Mines
does not form part of any National Park, Wild Life Sanctuary, Bio-sphere
Reserve, Tiger Reserve or, Elephant Corridor."

Yours faithfully,

29/6/07
Divisional Forest Officer,
Bonai Division.

D No. B-37/2007-FC
Government of India
Ministry of Environment and Forests
(F.C. Division)

Paryavaran Bhawan,
CGO Complex, Lodhi Road,
New Delhi - 110 003.

Dated: 25th August, 2008.

To

The Principal Secretary (Forests),
Government of Orissa,
Bhubaneshwar.

Sub: Diversion of 64.148 ha of forest land for Iron Ore mining in favour of M/s Geetarani Mohanty in village Raikela of Bonai Tahasil in Sundargarh district of Orissa.

Sir,

I am directed to refer to the State Government's letter No. 10P(Cons)120/2006.6879/F&E dated 05.05.2007 on the above mentioned subject, wherein prior approval of the Central Government for the diversion of 64.148 ha of forest land for Iron Ore mining in favour of M/s Geetarani Mohanty in village Raikela of Bonai Tahasil in Sundargarh district of Orissa, was sought, in accordance with Section 2 of the Forest (Conservation) Act, 1980. The said proposal has been examined by the Forest Advisory Committee constituted by the Central Government under Section 3 of the aforesaid Act.

2. After careful consideration of the proposal of the State Government of Orissa and on the basis of the recommendations of the Forest Advisory Committee, the Central Government hereby agrees in principle for the diversion of 64.148 ha of forest land for Iron Ore mining in favour of M/s Geetarani Mohanty in village Raikela of Bonai Tahasil in Sundargarh district of Orissa, subject to the fulfilment of the following conditions:-

1. Legal status of the diverted forest land shall remain unchanged.
2. (i) The User Agency shall identify and acquire non-forest land equal in extent to the area to be diverted (64.148 ha) for Compensatory Afforestation, which shall be mutated in favour of the State Forest Department.
- (ii) The land identified for the purpose of Compensatory Afforestation shall be clearly depicted on a Survey of India toposheet of 1:50,000 scale.
- (iii) The User Agency shall transfer the cost of Compensatory Afforestation to the State Forest Department at an enhanced rate of 2.5 times of the proposed rates.

- (iv) Clarification regarding proximity of CA land for proper management shall be furnished by the State Government.
- (v) The non-forest land identified for raising Compensatory Afforestation shall be notified by the State Government as RF under Section-4 or PF under Section-29 of the Indian Forest Act, 1927 or under the relevant Section(s) of the land Forest Act, as the case may be, within a period of six months. The Nodal Officer (Forest Conservation) shall report compliance in their regard.

3. Fencing, protection and regeneration of the safety zone area (7.5 metre strip all along the outer boundary of the mining lease area) shall be done at the project cost. Besides this, afforestation on degraded forest land, to be selected elsewhere, measuring one and a half times the area under safety zone, shall also be done at the project cost.

All measures should be taken to prevent pollution of tanks, rivers and nallas, etc. The desilting of adjoining villages in radius of 5 Km may also be taken up by the User agency from time to time.

Following activities shall be undertaken by the State Forest Department at the project cost:

- (i) Proper mitigative measures to minimize soil erosion and choking of streams shall be prepared and implemented.
- (ii) Planting of adequate drought hardy plant species and sowing of seeds to arrest soil erosion.
- (iii) Construction of check dams, retention/toe walls to arrest sliding down of the excavated material along the contour.

Wherever possible and technically feasible, the User Agency shall undertake by involving local community, the Afforestation measures in the blanks within the lease area, as well as along the roads outside the lease area diverted under this approval, in consultation with the State Forest Department at the project cost.

7. The period of diversion under this approval shall be twenty (20) years subject to possession of valid lease by User Agency under the MMDR Act, 1957.

8. The State Government shall charge the Net Present Value of the forest area diverted under this proposal from the User Agency as per the Orders of the Hon'ble Supreme Court of India dated 30.10.2002, 01.08.2003, 28.03.2008 and 09.05.2008 in WP(C) No. 202/1995 and as per the guidelines issued by this Ministry vide letters No. 5-1/1998-FC(Pt II) dated 18.09.2003 and 22.09.2003 in this regard.

9. At the time of payment of the Net Present Value (NPV) at the present rate, the User Agency shall furnish an undertaking to pay the additional NPV, if so determined as per the final decision of Hon'ble Supreme Court of India.

10. All the funds received from the User Agency under the project shall be transferred to in Account No. 344901010070128 of Union Bank of India, Sunder Nagar, New Delhi-110003.

11. The User Agency will bear the cost of Penal Compensatory Afforestation over equivalent degraded forest land for violating the Forest (Conservation) Act from 1986 to 1996.

- After receipt of the compliance report or fulfillment of the conditions mentioned above, the proposal shall be considered for final approval under Section-2 of the Forest (Conservation) Act, 1980.
13. Transfer of forest land shall not be affected till final approval is granted by the Central Government in this regard.
 14. The lease will remain in the name of M/s Geeta Rani Mohanty and if any change has to be done, it will require prior approval of the Central Government as per guidelines.
 15. Any other condition that the CCF (Central), Regional Office, Bhubaneswar / the State Forest Department may impose from time to time for protection and improvement of flora and fauna in the forest area, shall also be applicable.
 16. All other conditions under different rules, regulations and regulations including environmental clearance shall be complied with before transfer of forest land.

Yours faithfully,


(B.K. Singh)

Sr. Assistant Inspector General of Forests

Copy to:

1. The PCCF, Government of Orissa, Bhubaneswar.
2. The Nodal Officer, O/o PCCF, Bhubaneswar.
3. The Chief Conservator of Forests (Central), Regional Office, Bhubaneswar.
- ✓ 4. The User Agency.
5. The Monitoring Cell, FC Division, MoEF, New Delhi.
6. Guard File.


(B.K. Singh)

Sr. Assistant Inspector General of Forests

Ministry of Environment & Forests
Government of India
Ministry of Environment & Forests

Paryavaran Bhavan,
C.G.O. Complex, Lodi Road,
New Delhi-110003.

Dated the 2nd July, 2008

M/s Geetarani Mohanty
Station Road, Barbil,
Keonjhar,
ORISSA-758 035
E: mail: sahoo_ore@yahoo.co.in

Subject: Expansion of Raikela Iron Ore Mining Project of M/s Geetarani Mohanty located in Village Raikela, Tehsil Bonai, District Sundergarh, Orissa-environmental clearance reg.

Sir,

This has reference to your letter No. 231/GRM/MoEF/05-06 dated 17.03.2006 and subsequent letters dated 05.12.2006, 27.07.2007, 15.10.2007, 17.12.2007, 23.03.2008 and 02.04.2008 on the subject mentioned above. The proposal is for enhancement of production of iron ore from 0.142 million tonnes per annum (million TPA) to 0.864million TPA. The total mine lease area of the project is 67.586ha, out of which 66.671ha is forestland and 0.915ha is others (Sarba Sadharana). Area proposed for mining is 50.893ha, an area of 3ha is kept for over burden dump, 4.568ha for mineral storage, 0.2ha for infrastructure, 2.985ha for roads, 2.603ha for green belt, 2.422ha for mineral separation plant and 0.915ha is others. It has been proposed that the Sarba Sadharana land of 0.915ha will not be acquired. The Suna Nallah is located at a distance of 1km toward North West boundary of mine lease area. The Karo River is reported to be located at a distance of 7.5km in South West of the mine lease. No national park/wildlife sanctuary/biosphere reserve/tiger reserve/elephant reserve etc. is reported to be located in the core and buffer zone of the mine and that the area does not report to form corridor for Schedule-I fauna. In support of this, the project proponent has furnished a map duly authenticated by DFO and Wildlife Warden, Boani Division. The Torha RF and Amrohi RF are in the buffer zone of the mine. The mine working will be opencast by semi-mechanised method involving drilling and blasting. The targetted production capacity of the mine is 0.864million TPA of iron ore and life of mine is 15years. Approximately 3000TPD of mineral will be transported through road. Mineral beneficiation is not a part of the project; however, sizing and screening of the ore will be carried out in the lease area. The topography of the area is hilly at an

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elevation ranging from 300m-840m AMSL. The ultimate working depth of mine will be 658m RL. The ground water table reported to prevail at 670m RL and the mine working will, therefore, go beyond water table. The water requirement of the project is estimated as 64.5m³ per day, out of which 14m³ per day will be sourced from the groundwater and remaining 50.5m³ per day

will be met from the surface water (pale revenue village namely Raikela having no population is in the core zone of the mine, however, displacement of population and R&R is involved. Approximately $16,000\text{m}^3$ per month of solid waste comprising $12,000\text{m}^3$ per month of over burden (ferruginous laterite) $4,000\text{m}^3$ per month of sub grade ore will be generated, which will be stacked in the earmarked areas. It is estimated that $21,44,567\text{m}^3$ of waste will be generated during the mine life, out of which $8,17,002\text{m}^3$ will be disposed off in the form of external dump and $13,27,565\text{m}^3$ will be backfilled in 7ha of mined out area. Plantation will be raised in an area of 20.276ha at the end of the mine life. The public hearing of the project was held on 20.10.2005. The consent to establish from the State Pollution Control Board, Orissa obtained on 31.01.2006 for production of 72000TPM of iron ore involving lease area of 64.068ha. The Indian Bureau of Mines had approved scheme of mining along with the progressive mine closure plan of the project on 17.02.2005 for lease area of 67.586ha. The capital cost of the project is Rs.981.4Lakhs.

2. The Ministry of Environment and Forests has examined the application in accordance with Section 12 of the EIA Notification, 2006 read with para 1.2 of the Circular No. J-11013/41/2006-IA.II(I) dated 13.10.2006 and hereby accords environmental clearance under the provisions thereof to the above mentioned Raikela Iron Ore Mining Project of M/s Geetarani Mohanty for an annual production capacity of 0.864million tonnes of iron ore(ROM) by opencast semi-mechanized method involving mining lease area of 67.586ha, subject to implementation of the following conditions and environmental safeguards.

A. Specific conditions

- (i) All the conditions stipulated by the State Pollution Control Board, Orissa in their consent to establish shall be effectively implemented.
- (ii) Necessary forestry clearance under the Forest (Conservation) Act, 1980 for an area of 66.671ha is forestland shall be obtained before starting mining operation in that area. Environmental clearance is subject to grant of forestry clearance.
- (iii) The mining operations shall be restricted to 2m above the reported water table i.e. 672m RL and it should not intersect groundwater table.

..3/-

In case of working below ground water table, prior approval of the Ministry of Environment and Forests and Central Ground Water Authority shall be obtained, for which a detailed hydro-geological study shall be carried out.

अनुमोदित

- (iv) The project proponent shall ensure that no natural watercourse and/or water resources shall be obstructed due to any mining operations.
- (v) The top soil, if any, shall temporarily be stored at earmarked site(s) only and it should not be kept unutilized for a period more than 3years. The

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Water shall be used for land reclamation and plantation.

The over burden (OB) generated during the mining operation shall be stacked at earmarked dump site(s) only and should not be kept active for long period of time. Proper terracing of OB dump shall be carried out so that the overall slope shall not exceed 28 degree. Out of the total 21,44,567m³ of waste to be generated during the mine life, 8,17,002m³ shall be disposed off in the form of external dump and 13,27,565m³ shall be backfilled in 7ha of mined out area. The backfilled area shall be afforested. The over burden dumps shall be scientifically vegetated with suitable native species to prevent erosion and surface run off. In critical areas, use of geo textiles shall be undertaken for stabilization of the dumps. Monitoring and management of rehabilitated areas should continue until the vegetation becomes self-sustaining. Compliance status should be submitted to the Ministry of Environment & Forests and its Regional Office located at Bhubaneswar on six monthly basis.

- (vii) Catch drains and siltation ponds of appropriate size shall be constructed around the working pit(s), mineral and OB dumps to prevent run off of water and flow of sediments directly into the Suna Nallah, Karo nallah, rivers and water bodies. The water so collected should be utilized for watering the mine area, roads, green belt development etc. The drains should be regularly desilted particularly after monsoon and maintained properly.

Garland drains, settling tanks and check dams of appropriate size, gradient and length shall be constructed both around the mine pit and temporary over burden dumps to prevent run off of water and flow of sediments directly into the Suna Nallah, Karo nallah, rivers and water bodies and sump capacity should be designed keeping 50% safety margin over and above peak sudden rainfall (based on 50 years data) 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. Sedimentation pits should be constructed at the corners of the garland drains and desilted at regular intervals.

..4/-

- (viii) Dimension of the retaining wall at the toe of over burden dump and over burden benches within the mine to check run-off and siltation shall be based on the rain fall data.
- (ix) Plantation shall be raised in an area of 20.276ha including a 7.5m wide green belt in the safety zone around the mining lease, backfilled area, quarry benches, roads etc. by planting the native species in consultation with the local DFO/Agriculture Department. The density of the trees should be around 2500 plants per ha.

APPROVED

- (x) Regular water sprinkling shall be carried out in critical areas prone to air pollution and having high levels of SPM and RPM such as around crushing and screening plant, loading and unloading point and transfer points. Extensive water sprinkling should be carried out on haul roads. It shall be ensured that the Ambient Air Quality parameters conform to the norms

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prescribed by the Central Pollution Control Board.

- (x) Regular monitoring of water quality upstream and downstream of Nallah and Karo nallah shall be carried out and record of monitoring data should be maintained and submitted to Ministry of Environment and Forests, its Regional Office, Bhubaneswar, Central Groundwater Authority, Regional Director, Central Ground Water Board, State Pollution Control Board and Central Pollution Control Board.
 - (xi) The project authority should implement suitable conservation measures to augment ground water resources in the area in consultation with the Regional Director, Central Ground Water Board.
 - (xii) Regular monitoring of ground water level and quality should be carried out in and around the mine lease by establishing a network of existing wells and constructing new piezometers during the mining operation. The monitoring should be carried out four times in a year - pre-monsoon (April-May), monsoon (August), post-monsoon (November) and winter (January) and the data thus collected may be sent regularly to Ministry of Environment and Forests and its Regional Office Bhubaneswar, Central Ground Water Authority and Regional Director, Central Ground Water Board.
 - (xiv) The project proponent shall obtain necessary prior permission of the competent authorities for drawl of requisite quantity of water (surface water and ground water) for the project.
 - (xv) Suitable rainwater harvesting measures on long term basis shall be planned and implemented in consultation with Regional Director, Central Ground Water Board.
- ..5/-
- (xvi) Appropriate mitigative measures should be taken to prevent pollution of Karo River in consultation with the State Pollution Control Board.
 - (xvii) Minerals handling plant shall be provided with adequate number of high efficiency dust extraction system. Loading and unloading areas including all the transfer points should also have efficient dust control arrangements. These shall be properly maintained and operated.
 - (xviii) Vehicular emissions shall be kept under control and regularly monitored. Measures shall be taken for maintenance of vehicles used in mining operations and in transportation of mineral. The mineral transportation shall be carried out through covered trucks only and the vehicles carrying the mineral shall not be overloaded.
 - (xix) Blasting operation shall be carried out only during the daytime. Controlled blasting shall be practiced. The mitigative measures for control of ground vibrations and to arrest fly rocks and boulders should be implemented.
 - (xx) Drills shall either be operated with dust extractors or equipped with water

Injection = 45 ft

- (xxi) Consent to operate shall be obtained from the State Pollution Control Board prior to start of enhanced production from the mine
- (xxii) Sewage treatment plant should be installed for the colony. ETP should also be provided for workshop and wastewater generated during mining operation.
- (xxiii) The project proponent should take all precautionary measures during mining operation for conservation and protection of endangered fauna, if any spotted in the study area and contribute towards the cost of implementation of the plan and/or Regional Wildlife Management Plan for conservation of flora and fauna so prepared by the State Forest and Wildlife Department. The amount so contributed shall be included in the project cost. A copy of action plan may be submitted to the Ministry and its Regional Office, Bhubaneswar within 3 months.
- (xxiv) 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.

B. General conditions

- (i) No change in mining technology and scope of working should be made without prior approval of the Ministry of Environment & Forests.
- (ii) No change in the calendar plan including excavation, quantum of mineral iron ore and waste should be made.
- (iii) Four ambient air quality-monitoring stations should be established in the core zone as well as in the buffer zone for RPM, SPM, SO₂ & NO_x monitoring. Location of the stations should be decided based on the meteorological data, topographical features and environmentally and ecologically sensitive targets and frequency of monitoring should be undertaken in consultation with the State Pollution Control Board.
- (iv) Data on ambient air quality (RPM, SPM, SO₂ & NO_x) should be regularly submitted to the Ministry including its Regional office located at Bhubaneswar and the State Pollution Control Board / Central Pollution Control Board once in six months.
- (v) Fugitive dust emissions from all the sources should be controlled regularly. Water spraying arrangement on haul roads, loading and unloading and at transfer points should be provided and properly maintained.
- (vi) Measures should be taken for control of noise levels below 85 dBA in the work environment. Workers engaged in operations of HEMM, etc. should be provided with ear plugs / muffs.

(vi) Industrial waste water (workshop effluent) waste water from the plant should be properly collected, treated so as to conform to the standards prescribed under GSR 422 (E) dated 19th May, 1993 and 11th December 1993 or as amended from time to time. Oil and grease trap should be installed before discharge of workshop effluents.

(viii) 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.

(ix) 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.

(x) 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.

..7/-

(xi) The project authorities should inform to the Regional Office located at Bhubaneswar regarding date of financial closures and final approval of the project by the concerned authorities and the date of start of land development work.

(xii) 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.

(xiii) The project proponent shall submit six monthly report on the status of the implementation of the stipulated environmental safeguards to the Ministry of Environment and Forests, its Regional Office, Bhubaneswar, Central Pollution Control Board and State Pollution Control Board.

(xiv) A copy of clearance letter will be marked to concerned Panchayat / local NGO, if any, from whom suggestion / representation has been received while processing the proposal.

(xv) 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.

(xvi) The project authorities should advertise at least in two local newspapers widely circulated, one of which shall be in the vernacular language of the locality concerned, within 7 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 also at web site of the Ministry of Environment and

Forwards at <http://envfor.nic.in> and also in the same manner to the Regional Office of this Ministry located at Bhubaneswar.

3. The Ministry or any other competent authority may alter/modify the above conditions or stipulate any further condition in the interest of environment protection.

4. Failure to comply with any of the conditions mentioned above may result in withdrawal of this clearance and attract action under the provisions of Environment (Protection) Act, 1986.

5. 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, 1981, the Environment (Protection) Act, 1986 and the Public Liability Insurance Act, 1991 along with their amendments and rules made thereunder and also any other orders passed by any Court of Law relating to the subject matter.

..8/-

6. Any appeal against this environmental clearance shall lie with the National Environment Appellate Authority, if preferred within a period of 30 days as prescribed under Section 11 of the National Environment Appellate Act, 1997.

(SATISH C. GARKOTI)
Additional Director (S)

Copy to:

- (i) The Secretary, Ministry of Mines, Government of India, Shastri Bhawan, New Delhi.
- (ii) The Secretary, Department of Environment, Government of Orissa, Secretariat, Bhubaneswar.
- (iii) The Secretary, Department of Mines and Geology, Government of Orissa, Secretariat, Bhubaneswar.
- (iv) The Secretary, Department of Forests, Government of Orissa, Secretariat, Bhubaneswar.
- (v) The Chief Wildlife Warden, Government of Orissa, Bhubaneswar.
- (vi) The Chairman, Central Pollution Control Board, Parivesh Bhawan, CBD-cum-Office Complex, East Arjun Nagar, Delhi-110032.
- (vii) The Chief Conservator of Forests, Regional Office (EZ), Ministry of Environment and Forests, A-3 Chandrashekharapur, Bhubaneswar-751023.
- (viii) The Chairman, Orissa State Pollution Control Board, Parivesh Bhawan, A/118 Nilakantha Nagar, Unit-VIII, Bhubaneswar-751012.
- (ix) The Member Secretary, Central Ground Water Authority, A2, W3 Curzon Road Barracks, K.G. Marg, New Delhi-110001.

5/5

- (x) The District Collector, Sundergarh District, Government of Orissa.
- (xi) EI Division, Ministry of Environment & Forests, EI Division, New Delhi.
- (xii) Monitoring File.
- (xiii) Guard File.
- (xiv) Record File.

(SATISH C. GARKOTI)
Additional Director (S)

अनुमोदित
APPROVED

1. Name of the Project :- Diversion of 64.148 Ha. of forest land for Mining of Iron Ore in village Raikela in Bonai Division.
2. Name of the District/Division :- Sundargarh District / Bonai Forest Division.
3. Date of Inspection :- 28/06/2005.
4. Name and designation of Inspecting Officer :- Sri K.C.Hansda, I.F.S.
Divisional Forest Officer, Bonai Division.
5. Name and Designation of other officers who attended the inspection including representative of User Agency :- 1. Sri A.C.Patra, Range Officer, Barsuan Range.
2. Sri Maheswar Behera, Senior Manager, Raikela Iron Ore Mines, M/s Geetarani Mohanty.
6. Legal Status of forest land with area proposed for diversion :- D.L.C. - 64.148 Ha. - *Govt. not forest land included in 8th level Committee rep!*
(Deemed forest land)
7. If area required for diversion has been demarcated on the ground :- Yes

8. Item-wise break-up of forest land proposed for diversion.

The item-wise break-up of forest land proposed for diversion is as follows :

i)	Mining	...	...	...	...	...	50.893 Ha.
ii)	Storing Mineral / Ore	...	...	...	...	...	4.568 Ha.
iii)	Dumping of overburden	...	...	...	...	...	3.000 Ha.
iv)	Const. of Building, Power Station, Workshop etc.	...	...	...	...	...	NIL
v)	Storing tools & machinery	...	...	...	...	...	2.422 Ha.
vi)	Const. of Road / Ropeway / Railway line	...	...	...	...	...	3.065 Ha.
vii)	Township / Housing Colony	...	...	...	...	...	0.200 Ha.
viii)	Const. of Magazine	...	...	...	...	...	NIL
	Sub-Total:-	...	...	...	...	...	64.148 Ha.
ix)	Safety Zone area	...	...	...	...	...	2.523 Ha.
	Grand Total :-	...	...	...	...	...	66.671 Ha.

9. Condition of vegetation and type of forest in applied area :- Vegetation in the applied area is sparse and scattered.

Contd. 122

10. Position of Wildlife in general

The following migratory animals and birds occur in the applied area.

Animals	English Name	Zoological Name
1. Bhalu	Slack bear	Melursus ursinus
2. Bilua	Jackal	Canis aureus
3. Banabilei	Jungle cat	Felis chaus
4. Thekua	Hare	Ruficaudatus
5. Muga	Rat	Rattus rattus
6. Neula	Mongoose	Herpestes eudardsi
Birds	English Name	Zoological Name
1. Bani	Indian myna	Acridotheres tristis
2. Baga	Little arget	Eggatta garzetta
3. Kau	Common crow	Corvus splendens
4. Pecha	Spotted owl	Anthena brama
5. Kajalapati	Common dronge	Dicurus macrocerus
6. Kapta	Ring Dove	Strepto pelia dactylocten
7. Damara Kau	Jungle crow	Corvus macrorhynchos
8. Kathahana chadei	Pigmy wood picker	Picodes nank

11. Whether the applied area is involved with any eco-sensitive zone/ National Park/Sanctuary
 - The applied area does not involved with any eco-sensitive zone / National Park / Sanctuary.
12. Number of trees to be felled and its impact on the eco-system
 - 633 Nos. of trees are to be felled, which will not have any impact on the eco-system.
13. Details of broken-up area and reclamation done, if any. (Mining cases)
 - Out of total 64.148 Ha. applied for diversion, 43.054 Ha has been treated as broken land vide DDM'S memo No 4065 dt 27.7.98 (Annexure-6c) Reclamation shall be undertaken by the User Agency as per reclamation plan enclosed vide Annexure-17.
14. Position of displacement of people and adequacy of rehabilitation, if any
 - Displacement of people is not involved, and hence no rehabilitation.
15. Position of rare and endangered species available or importance of area from eco-social point of view
 - There is no rare and endangered species in the applied area. The area is also not important from eco-social point of view.
16. Non-forest land used in the project, and non-forest land selected for Comp. Affn. is included in the D.L.C. report or not
 - Non-forest land required to be used in the project, i.e., 0.835 Ha., as well as the non-forest land selected for Comp. Affn. are not included in the D.L.C. report.
17. Suitability of the identified non-forest land / degraded forest land for Comp. Affn.
 - The non-forest land identified is suitable for Comp. Affn.
18. Violation of F.C. Act, if any, and action taken thereon
 - There is no violation under the F.C. Act.

Divisional Forest Officer,
 Bonal Division.

Government of Orissa
Forest & Environment Department

-0-

No. 10F(Cons)120/2006. 6879 /F&E, Bhubaneswar, dated. 5/5/07

From

Sri P.N. Padhi, IFS,
Special Secretary to Government.

To

The Assistant Inspector General of Forests,
Govt. of India, Ministry of Environment & Forest,
(F.C. Division), Paryavaran Bhawan,
C.G.O. Complex, Lodhi Road,
New Delhi -110003

Sub: Proposal for diversion of 64.148 ha. of forest land in Village- Raikela of Bonai Tahasil in Sundargarh district, Orissa for Iron Ore mining by M/s Geetarani Mohanty.

Sir,

I am directed to send herewith a proposal received from the PCCF, Orissa for diversion of 64.148 ha. of forest land in Village- Raikela of Bonai Tahasil, Sundargarh district for Iron Ore mining by M/s Geetarani Mohanty as required under the provisions of Forest (Conservation) Act, 1980.

1. **Brief Description.**

Govt. of Orissa in Department of Steel & Mines granted a Mining lease over 67.586 ha. non-forest land for Iron ore mining in village Raikela of Bonai Tahasil in favour of Smt. Geetarani Mohanty for 20 years with effect from 2.7.1991 to 1.7.2011. This lease deed was executed on 02.07.1991 (Page-21/DP). Subsequently this lease was transferred in favour of M/s Geetarani Mohanty a registered firm bearing registration No.5/92, Cuttack (Page-76/DP) with due permission of Govt. of India followed by the permission of State Govt. in Department of Steel & Mines vide Proceeding No.IV(B)SM-8/92-11868 Dt.17.10.1992 (Page-72/DP). This transfer lease deed was executed on 13.01.1993 (Page-75/DP). But consequent upon resignation of one of the partner Smt. Geetarani Mohanty from this firm and joining of two more partners with effect from 01.04.1993 (Page-243-A & 243-B/DP) a partnership deed was reconstituted on 01.04.1996 among three partners viz. Sri Srinibash Sahoo, Sri Dushasan Sahoo and Smt. Suprasanna Sahoo (Page-244/DP). As per Page-1 of the Reconstituted partnership deed (Page-244 of DP) the name and style of the firm continues to be M/s Geetarani Mohanty.

Originally the lease area comprised of 66.671 ha. of non-forest land and 0.915 ha. of Sarbasadharan land. A Mining Plan was also approved by I.B.M. vide their letter No QP/CAL/006/87/A/MO-94 Dt.27.6.1990 which was valid up to 1999. Accordingly the mining operation started on 23.8.1993 on the non-forest land.

Subsequently the above non-forest land over 66.671 ha was included as Deemed Forest land in D.L.C. report of Sundargarh Dist. during 1997 but the Sarbasadharan land remained as such. The land schedule of ML area has been furnished at Page-188/DP. The joint verification report Dt.6.6.1998 reveals that 43.054 ha. has been broken (Page-1902/DP & Plate-VIII). Thus the lease area comprises of 43.054 ha of broken land, 23.617 ha of virgin land and 0.915 of Sarbasadharan land. Since the entire broken and virgin lands are Deemed Forest land included in DLC report, out of this the User Agency has now applied for diversion of 64.148 ha. under section 2 of Forest (Conservation) Act, 1980 and balance 2.523 ha. Deemed Forest land has been set aside for Safety Zone.

		Broken	Virgin	Total	Land (Ha)	Total (Ha)
01	Mining	29.893	21.000	50.893	Nil	50.893
02	Storing of minerals	3.568	1.000	4.568	Nil	4.568
03	Dumping of over burden	2.656	0.344	3.000	Nil	3.000
04	Storing of tools & machinery	1.890	0.532	2.422	Nil	2.422
05	Building Power station & Workshop etc.	Nil	Nil	Nil	Nil	Nil
06	Township/ Housing colony	0.200	Nil	0.200	Nil	0.200
07	Road & Railway etc.	2.900	0.165	3.065	0.835	3.900
	Sub Total	41.107	23.041	64.148	0.835	64.983
08	Safety Zone	1.947	0.576	2.523	0.080	2.603
	Grand Total	43.054	23.617	66.671	0.915	67.586

4. Flora & Fauna

Tree Species which are commonly noticed in this area are Sal, Gambhar, Bija, Kurum, Kumbhi, Kendu, Mango, Dhaura, Kusum, Harida, Bahada, Bheru, Kasi, Char, Mai & Mahul etc. Fauna noticed in this locality are Bear, Jackal, Jungle Cat, Hare, Mongoose, Myna, Jungle fowl, Egret, Owl and Drongo etc. No rare or endangered flora or fauna is noticed in this area.

5. Wildlife Management

Though the area does not form a part of National Park/Wildlife Sanctuary or Elephant Corridor, due care is to be taken for conservation of Wildlife. For this purpose a comprehensive Wildlife Management Plan covering the entire mining belt of Bonai and Keonjhar Division has been prepared. Accordingly the User Agency has to pay @-Rs. 15,000/- per hectare of leasehold area as per norm approved by Govt. of Orissa. The lessee has furnished undertaking to bear the cost of Wildlife management (Page-224/D?).

6. Tree enumeration

Total enumeration has been carried out over the entire area applied for diversion and it has been recorded that, 432 trees are standing over the virgin forest land (Page-214/DP) and 201 trees (Page-220/DP) over the broken up forest land. Thus, in total 633 trees will be felled in phases during the process of mining. Besides, 164 trees are existing over the land earmarked for Safety Zone. The canopy density has been reported to be 0.03 over broken up forest land and 0.1 over virgin forest land (Page-7/DP).

7. Compensatory afforestation

In lieu of Deemed Forest land applied for diversion, Tahasildar, Bonai has identified equivalent non-forest land of 65.46 ha for Compensatory Afforestation. This non-forest land includes plot No.1,2/Part,3/Part,4/Part,5/part,7/Part & 9 Part of Khata No.1 of village-Sanathalakudar in Bonai Tahasil of Sundergarh district. The land suitability certificate, non-encroachment and non-encumbrance certificate have been furnished at Page-205 & 207/DP. The D.F.O., Bonai Divn. has prepared a site specific scheme in R.D.F. model with provision for soil conservation and stonewall fencing. The species to be planted in gaps are Karanj, Mahul, Harida, Bahada, Sissoo, Amla, Teak and Bamboo. The total financial outlay of

15. Others

The Basic Information of Bonai Division, District Profile of Sundergarh District and the State profile have been furnished at Page-260, 261 and 262/DP respectively. The Site Inspection Report of DFO has been furnished at Page-10/DP.

Conservator of Forests, Rourkela Circle has also furnished the Site Inspection Report at Page 12/D.P.

N.P.V. is applicable to this proposal. The User Agency has furnished undertaking to pay the NPV at Page 224/DP.

The PCCF, Orissa has recommended the proposal.

All the parts of the statutory proforma has been duly filled in.

In view of the above, I would request you to kindly convey the approval of GOI, MoEF for diversion of 64.148ha of forest land (Virgin 23.041 ha. + Broken 41.107 ha) for mining purposes in Sundargarh district of Orissa under Sec.2 of Forest (Conservation) Act, 1980 in favour of the user agency to this Department at an early date with the following stipulations.

- i) The user agency shall implement a 'Conservation Plan' in their leasehold area as per guidelines of the Chief Wildlife Warden, Orissa,
- ii) The user agency shall pay the evaluated royalty of 633 enumerated trees before commencement of work on Stage-II approval.
- iii) The user agency shall furnish an undertaking to abide by the policy decision of State Government issued vide Steel and Mines Department Notification bearing SRO No 37/2004 dated 15.1.2004.

Yours faithfully,

Memo No. 6880 /F&E., Dated- 5/5/07 Special Secretary to Government.

Copy alongwith copy of the enclosure forwarded to the Chief Conservator of Forests (Central), Government of India, Ministry of Environment & Forests, Eastern Regional Office, A-3, C.S.Pur., Bhubaneswar for information & necessary action.

Memo No. 6881 /F&E., Dated- 5/5/07 Special Secretary to Government.

Copy forwarded to the Pr. C.C.F., Orissa / PCCF (WL) & CWLW, Orissa for information & necessary action.

Memo No. 6882 /F&E., Dated- 5/5/07 Special Secretary to Government.

Copy forwarded to the C.F., Rourkela / DFO, Bonai for information & necessary action.

Memo No. 6883 /F&E., Dated- 5/5/07 Special Secretary to Government.

Copy forwarded to Steel & Mines Department for information & necessary action.

Memo No. 6884 /F&E., Dated- 5/05/07 Special Secretary to Government.

Copy forwarded to M/S Gitarani Mohanty, Station Road, At/Post- Barbil-758035 for information & necessary action.

Special Secretary to Government

Villages within 10 Kms. Radius from the mine site

Sl. No.	Name of Village	Area of Village in (Ha)	No of House holds	Population			SC		ST		Total Workers		Non-Workers		Literacy rate %	
				Total	M	F	M	F	M	F	M	F	M	F	M	F
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1	Basada	312.77	22	104	56	48	00	00	56	48	30	04	26	44	39.5	08.1
2	Kusumdihi	662.68	133	678	313	365	03	03	241	274	151	133	162	232	46.3	20.1
3	Reserve forest	N.A.														
4	Krakudar	202.75	70	324	148	170	00	00	144	170	70	02	78	174	16.7	05.4
5	Beechilada	235.19	71	315	156	159	00	00	154	157	105	97	51	62	55.6	29.8
6	Talali	727.90	63	261	132	129	00	00	125	121	66	46	66	83	74.8	11.4
7	Meharda	4,816.28	38	187	95	92	00	00	94	88	46	37	49	55	46.5	13.0
8	Tada	656.13	555	2,387	1,278	1,109	35	44	1060	938	622	59	656	1050	66.3	34.0
9	Kalla	247.26	519	2,329	1,275	1,054	103	112	758	654	573	49	702	1005	78.6	57.4
10	Kamanda	700.21	209	944	471	473	38	38	365	156	249	65	222	408	71.1	22.8
11	Kula	332.10	112	638	307	331	11	09	165	193	131	48	176	283	59.8	25.0
12	Rengua	265.14	47	235	111	124	00	00	111	124	63	10	48	114	40.2	19.4
13	Dandai	437.14	78	391	195	196	15	08	178	185	116	59	79	137	65.2	17.5
14	Tandra	1,136.12	170	781	419	362	11	06	256	272	262	67	157	295	77.2	44.0
15	Rakela	683.00	252	1,093	539	554	31	27	488	505	322	232	217	322	47.4	15.1
16	Dangua	3,496.11	172	947	513	434	62	39	387	326	189	62	324	372	74.5	28.6
17	Tarauli	465.60	59	284	148	136	00	00	148	136	72	18	76	118	39.7	13.4
18	Nuagaun	432.23	79	391	185	206	00	00	185	206	86	38	99	168	91.0	42.1
19	Kadexila	230.15	125	643	301	342	91	97	151	180	159	102	142	240	77.0	37.3
20	Sidimba(A)	378.00	38	160	89	71	00	00	64	49	52	43	37	28	09.7	01.7
21	Jaladi	1,104.49	57	226	105	120	03	03	44	48	69	79	37	41	55.1	24.0
22	tanigram	56.60	36	181	82	99	00	00	77	95	51	50	31	49	36.2	07.3

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
23	Kalmanga	410.24	252	1091	552	539	72	66	333	329	277	140	275	399	57.4	25.0
24	Baldhi	508.26	74	327	176	151	78	61	98	90	73	23	103	128	59.4	20.3
25	Teherej	544.21	147	602	280	322	04	02	211	249	134	53	146	269	53.9	26.7
26	Sanua	273.20	65	266	132	134	21	25	33	33	60	18	72	116	44.6	23.0
27	Kasira	777.00	173	835	389	446	45	64	307	335	216	171	173	275	61.5	22.7
28	Bhanjapali	554.18	171	659	356	303	26	33	225	221	184	87	172	216	55.4	26.8
29	Segasahi	400.12	58	255	122	133	00	00	117	130	67	68	55	65	29.5	4.8
30	Harischandrapur	122.62	151	682	353	329	69	76	236	212	187	147	166	182	56.7	24.5
31	Choredhara	1763.28	355	1713	869	844	07	06	784	757	489	440	380	404	37.6	17.4
32	Nuatnra	417.30	98	445	225	220	00	00	224	220	152	138	73	82	41.8	12.7
33	Phalatangara	804.00	160	598	295	303	01	00	294	303	178	175	117	128	51.5	17.4
34	Antedola	197.09	53	196	98	98	04	04	87	82	54	44	44	54	53.9	11.7
35	Tinko	504.55	87	432	214	218	02	01	67	58	104	50	110	168	76.5	39.3
36	Rakela	602.51	114	48	241	239	00	00	135	123	128	34	113	205	61.9	31.3
37	Kusumdhil	292.67	30	122	62	60	00	00	62	60	29	20	33	40	44.4	13.5
38	Baurkela	260.67	22	98	45	53	00	00	45	53	22	13	23	40	57.9	13.2
39	Saskela	603.39	396	1714	862	852	19	09	335	368	457	235	405	617	69.8	39.6
40	Barsuan	514.40	675	2798	1449	1349	158	160	489	464	706	121	743	1,228	80.2	62.5
41	Sannuagaon	1,004.82	136	680	340	340	00	00	328	327	159	87	181	253	47.5	28.2
42	Damatu	730.00	85	405	196	209	07	08	125	147	82	49	114	160	53.9	28.1
43	Randa	402.28	52	189	99	90	01	04	86	79	58	40	41	50	37.5	13.6
44	Rania	1,165.20	154	588	291	297	22	18	210	222	150	79	141	218	49.1	32.8
45	Batagaon	735.63	33	141	78	63	00	00	78	63	35	06	43	57	05.9	00.0
46	Raisuan	479.93	50	221	113	108	11	08	95	93	54	06	59	102	28.6	04.1
47	Bhutuda	1,057.56	153	599	313	286	32	31	201	200	157	110	156	167	49.4	28.5
48	Lasi	1,021.16	127	509	267	242	07	05	235	216	177	20	90	222	24.4	07.7
49	Kensara	1,334.87	28	145	75	70	00	00	72	67	47	02	28	68	08.5	00.0
50	Choda	148.57	10	52	22	30	00	00	09	13	10	04	12	26	28.6	18.8
51	Siliguda	454.44	17	74	30	44	00	00	26	33	17	17	13	27	18.2	09.7



E-mail: paribesh1@ospcbboard.org
Website: www.ospcbboard.org

STATE POLLUTION CONTROL BOARD, ODISHA

[DEPARTMENT OF FOREST, ENVIRONMENT & CLIMATE CHANGE, GOVERNMENT OF ODISHA]

Paribesh Bhawan, A/118, Nilakantha Nagar, Unit - VIII
Bhubaneswar - 751012

No. 15169 /

IND-II-CTE-7495

Date: 12-08-2025

Through online/
By speed post

To,

The Managing Partner
Raikela Iron Ore Mines of M/s Geetarani Mohanty
At: Station Road, PO: Barbil,
District: Keonjhar – 758035

Sub: **Environmental Safeguards for enhancement of production of Iron Ore of capacity from 4.99 MTPA to 5.988 MTPA (20%) along with crushing & screening plants over existing mining lease area of 67.586 Ha. Located at Raikela, Tahsil- Koira, District- Sundargarh**

- Ref: 1. SEIAA, Environmental Clearance vide EC25B000OR5972294N; File No. 523021/28-MINIB1/02-2025 dated 16.06.2025
2. MoEF&CC, Government of India, Office Memorandum, Dt. 14.01.2025 on streamlining the implementation of Notification G.S.R 702 (E) and G.S.R 703 (E), Dt. 12-11-2024

Sir,

In consideration of the online application no. **8500722** read with MoEF&CC, Government of India Office Memorandum dtd. 14.01.2025, the State Pollution Control Board is pleased to issue Environmental Safeguards in place of its Consent to Establish under section 25 of Water (Prevention & Control of Pollution) Act, 1974 and section 21 of Air (Prevention & Control of Pollution) Act 1981 for **enhancement of production of Iron Ore of capacity from 4.99 MTPA to 5.988 MTPA (20%) along with existing mobile Crusher 2x400 TPH, static crusher 1x1000 TPH, mobile screen 2x400 TPH and mobile screen 2x300 TPH** over existing mining lease area of 67.586 Ha. At- Raikela, Tahsil- Koira in the district of Sundargarh with the following conditions:

A. GENERAL SAFEGUARD:

1. The proponent shall comply with the stipulations and carry out mining activity as per the Environmental Clearance granted by SEIAA vide EC ID No. EC25B000OR5972294N; File No. 523021/28-MINIB1/02-2025 dated 16.06.2025 for **enhancement in Production Capacity of Iron Ore from 4.99 MTPA to 5.988 MTPA (20%) from Raikela Iron Ore Mines (ML Area - 67.586Ha) along with Crushing & Screening Plants.**
2. The mine shall apply for grant of Consent to Operate under section 25/26 of Water (Prevention & Control of Pollution) Act, 1974 & under section 21 of Air (Prevention & Control of Pollution)

Act, 1981 at least 3 (three) months before the commencement of production and obtain Consent to Operate from this Board.

3. The mine shall implement the Pollution Control Measures and safeguards as proposed in the Environment Management Plan (EMP) of Environment Impact Assessment (EIA) report.
4. The proponent shall abide by the Wildlife Management Plan or wildlife clearance wherever applicable.
5. The proponent shall obtain Forest Clearance for the forest land which is involved in the leasehold area.
6. The proponent shall comply the recommendation of study conducted by NEERI, Nagpur on provision of parking plaza for vehicles used for transportation of ore and also ore transportation.
7. The mine shall implement the pollution control measures and safeguards as proposed in the Environment Management Plan (EMP) of the Environment Impact Assessment (EIA) report.
8. The project proponent shall obtain requisite permission from the CGWA for withdrawal/use of ground water for the project.
9. The project proponent shall obtain requisite permission from the Water Resources Department, Govt. of Odisha for drawl of surface water and ground water.
10. The construction and demolition waste to be generated from the proposed project shall be disposed of in accordance with the provision under "Construction & Demolition Wastes Management Rules 2016".
11. The proponent shall comply to the provisions of E-Waste (Management) Rules, 2022 and shall handover e-waste to authorized collection centres / register dismantlers/ recyclers for proper disposal of e-waste.
12. The proponent shall comply with the provision made under Plastic Waste Management Rules, 2016 and amendment made thereafter and shall ensure prohibition on use of Single Use Plastics within the premises.
13. All the plastic waste generated from the premises shall be collected and sent for co-processing to the nearby cement kilns and / or registered recyclers under Plastic Waste Management Rules, 2016.
14. The construction shall be carried out with the fly ash bricks. If the fly ash bricks are not available locally the construction may be carried out with other bricks with prior intimation to the concerned Regional Office of SPCB. A statement indicating use of fly ash bricks during construction period shall be submitted to the Board quarterly for record.
15. The project proponent shall develop greenbelt in 7.5 m wide safety zone all along the mine lease boundary as per the guidelines of CPCB in order to arrest pollution emanating from mining operations within the lease.
16. The project proponent shall carryout plantation / afforestation in backfilled and reclaimed area of mining lease, around water body, along the roadsides, in community areas etc. by planting the native species in consultation with the State Forest Department / Agriculture Department / Rural Development Department / Tribal Welfare Department / Gram Panchayat such that only those species be selected which are of use to the local people. The CPCB guidelines in this

respect shall also be adhered. The density of the trees shall be around 2500 saplings per hectare. Adequate budgetary provision shall be made for protection and care of trees.

17. A separate environmental management cell with suitable qualified personnel shall be set up under a Senior Executive, who will report directly to the Head of the organization.
18. The Board may impose further conditions or modify the conditions stipulated in this order during installation and/or at the time of obtaining consent to operate.
19. The above conditions will be enforced, inter-alia, under the provisions of the water (Prevention & Control of pollution) Act, 1974 and Air (Prevention & Control of Pollution) Act, 1981 and Environment (Protection) Act, 1986 and the Public Liability Insurance Act, 1991 along with their amendments and Rule.
20. The project shall abide by Environment (Protection) Act, 1986 and the rules framed thereunder.
21. The grant of this Environmental Safeguard Order is issued in accordance with the Office Memorandum dated 14.01.2025 by the Ministry of Environment, Forest and Climate Change (MoEF&CC), Government of India, and is subject to compliance with any subsequent guidelines or directions that may be issued by the MoEF&CC, Govt. of India, New Delhi in this regard.

B. WATER POLLUTION SAFEGUARD:

22. The domestic wastewater generated from the township shall be treated in sewage treatment plant. The treated water shall be reused for gardening and dust suppression and the surplus water if any shall be discharged to outside after meeting the following prescribed standards as notified by the MoEF&CC, Govt. of India vide G.S.R. 1265 (E), dated 13.10.2017.

Sl. No.	Parameters	Standards
1.	pH	6.5-9.0
2.	BOD(mg/l)	≤30
3.	TSS(mg/l)	<100
4.	Fecal Coliform (MPN/100ml)	< 1000

23. Garland drains along with settling pit shall be provided around the iron ore fines stock yard to control washout of fines from the stockyard along with surface runoff.
24. Surface run-off from OB dump area, mineral stock yard, top soil storage area and rain water to be pumped from quarry shall be routed through adequate settling pond (designed maximum hourly rain fall basis) to meet prescribed standard of SS - 100 mg/l and Oil & Grease-10 mg/l before discharge into natural stream/water courses during monsoon.
25. At stockpile and loading plant area, a network of drains shall be constructed at a depth of 1.5 meter below the lowest level on the sites parallel to the stockpile area with interconnected box culverts. The sloping of surface shall be given inward to the stockpiles so that surface water will only infiltrate in to the drain.
26. The unit shall provide storm water drain around raw material stock yard and product stock yard. Surface run-off generated from this area shall be treated in settling tanks of adequate capacity and same shall be stored in rain water harvesting pond for reuse in dust suppression, green belt etc.

27. The unit shall provide high pressure water spraying nozzle at the iron ore fines and stock yards and feeding section.
28. All the permanent internal roads along the crusher and screening plant shall be concreted or black topped. Permanent high pressure water sprinkling system shall be installed for regular spraying of water on roads to minimize fugitive dust emission.
29. Rain water harvesting shall be followed by utilizing the rain water collected from the roof of the administrative buildings for recharging of ground water within the premises as per the concept and practices prescribed by CPCB.
30. The Mine shall provide mechanized wheel washing system along with effluent treatment and recycling facilities at the exit point of the mine.

C. AIR POLLUTION SAFEGUARD:

31. Ambient Air Quality shall be maintained as per National Ambient Air Quality standard prescribed for industrial and mixed used area under E (P) Act, 1986.
32. Fugitive and AAQ monitoring shall be carried out and report shall be submitted to the Board regularly.
33. Drill shall be wet operated or with dust extractors and controlled blasting shall be practices. Pre-wetting of blasting site shall be practiced.
34. The primary crusher, screen and secondary crusher shall be placed in covered shed. All the conveyor shall be covered with corrugated GI Sheets.
35. Dust suppression (dry fog) for mobile units and both extraction (bag filter) system and dust suppression system for fixed units shall be provided at all dust generating sources of mineral handling plants such as crushing, screening & material transfer points etc. such that, particulate matter concentration in ambient air shall not be more than $1200 \mu\text{g}/\text{m}^3$ at a distance of 25.0 ± 2.0 m from the source of fugitive emission in the predominant down wind direction as per MoEF&CC, Govt. of India notification No. G.S.R. 809(E), dated 04.10.2010 (copy enclosed as Annexure - f).
36. The proponent shall engage truck mounted fog cannons for dust suppression in dust prone areas in the mine for strengthening dust suppression measures.
37. Dust suppression on mine haul roads, active OB dumps and mine working benches shall be done by spraying water through water sprinklers along with chemical binders/wetting agents at frequent interval in order to reduce water consumption and to improve retention and re-absorption capacity of water. Water sprinklers of fixed type shall also be provided at the mine HEMM maintenance shop, other service centers and approach roads from mines to raw material handling & product handling area to prevent the generation of dust to be air borne.
38. Adequate measures shall be taken for control of noise levels in the work environment of mine area so that noise levels at the boundary line of mining lease area shall not exceed 75 dB (A) during day time (06:00 AM to 10:00 PM) and 70 dB(A) during night time (10:00 PM to 06:00 AM).
39. Adequate noise barriers shall be provided surrounding the crushing and screening plants to control noise pollution and avoid impact on wildlife due to operation of crushing and screening plants during night hours.

40. Online noise monitoring system shall be installed to monitor noise level during night hours.
41. Protective barriers shall be provided for the lights to prevent illumination towards the forest area during night hours.
42. Fixed auto sprinklers on both sides of major haul road and approach roads of the mine shall be installed and frequency of water sprinkling through mobile water tankers shall be enhanced at the said areas till installation of fixed auto sprinklers.
43. Regular water sprinkling through mobile water tankers shall be carried out at mineral stockpile area, mines approach road and transportation road to avoid generation of dust during movement of vehicles.
44. Necessary preventive measures shall be taken during construction as well as operational period so that the ambient air quality including noise at the boundary shall conform to National Ambient Air Quality Standards and standards for noise in industrial area as per **Annexure- II and III**.
45. Ambient Air Quality shall be monitored at three locations within core zone and three locations within buffer zone of ML area as per NAAQS standards. Fugitive emission shall also be monitored at relevant locations as specified in the Condition No. 14. The location of the monitoring stations shall be decided in consultation with Regional Officer, SPCB, Odisha.
46. The proponent shall install 03 nos. of Online Continuous Ambient Air Quality Monitoring Station (CAAQMS) inside the mining lease area order to monitor PM_{10} , $PM_{2.5}$, SO_2 , NO_x , CO for online real time data transmission through GPRS system to SPCB RTDAS server and also upload data to CPCB.
47. IP Cameras shall be installed at major dust prone areas of mine such as mine quarry, mineral/fines stock yards, haul roads, transportation roads, mineral handling plants etc. and they shall be connected to SPCB Server.
48. Dry fog system shall be provided at the point of loading to the conveyor to minimize fugitive emission.
49. The trucks carrying fines shall be covered with tarpaulin and over loading shall be avoided to minimize fugitive emission.
50. The permanent internal roads used for transportation shall be made block topped/ Concreted. Fixed type water sprinklers shall be provided along these internal roads to minimize fugitive emission.
51. Regular collection of spilled over fines from haul roads shall be practiced to prevent the generation of dust to be air borne.

D. SOLID & HAZARDOUS WASTE SAFEGUARD:

52. Solid waste to be generated during course of mining shall be dumped in the earmarked dump area as per approved mining plan.
53. The OB/waste dumps shall be properly dressed benched at low angle with terracing in the slopes. Vegetation should be carried out over dump slopes and hydro seedling technique or use of geo-tiles mat embedded with seed shall be adopted.
54. Hazardous waste storage area shall be earmarked before disposal of hazardous waste as per guidelines.

55. Top soil should be stacked separately with proper slope at earmarked site (s) with adequate measures and shall be used for reclamation and rehabilitation of mined out areas.
56. The OB/waste dumps shall be properly dressed benched stopped at low angle (30°) with terracing and coir matting in the slopes making retaining walls stone barriers at the toe of the dumps gully plugging etc. to prevent the soil erosion during monsoon, besides establishing vegetation on dump top as well as its slope surface. In difficult cases, hydro-seedling technique or use of geo-files mat embedded with seeds shall be adopted.
57. The proponent shall comply to the provisions of Hazardous and Other Wastes (Management and Trans boundary Movement) Rules, 2016 and amended thereafter.
58. The industry shall obtain authorization under provisions of Hazardous and Other Wastes (Management and Trans-boundary Movement) Rules, 2016 as amended from time to time and dispose hazardous waste as per authorization.

Enc.: Annexure I, II & III


MEMBER SECRETARY

Memo No. _____ / Date: _____

Copy forwarded to the Member Secretary, Ministry of Environment, Forest and Climate Change, Government of India (IA Division), At- Indira Paryavaran Bhawan, Jorbagh Road, New Delhi – 110003 for information. This letter for Environmental Safeguard is issued in compliance with Office Memorandum dated 14.01.2025 of MoEF&CC, Government of India for streamlining the implementation of Notification G.S.R 702 and G.S.R 703 Dt. 12th Nov 2024. (Para-E: Projects which have been already been granted EC after 12th November 2024 but for which CTE has not been granted)

ADDL. CHIEF ENV. ENGINEER

Memo No. _____ / Date: _____

Copy forwarded to:

1. The Collector and District Magistrate, Sundargarh
2. The DDM, Koira
3. The Regional Officer, SPCB, Odisha, Rourkela
4. CTO Cell (Mines), SPCB, Odisha, Bhubaneswar
5. HWM Cell, SPCB, Odisha, Bhubaneswar
6. Guard file



ADDL. CHIEF ENV. ENGINEER

MINISTRY OF ENVIRONMENT AND FORESTS

NOTIFICATION

New Delhi, the 4th October, 2010

G.S.R. 309(E).—In exercise of the powers conferred by Sections 6 and 25 of the Environment (Protection) Act, 1986 (29 of 1986), the Central Government hereby makes the following Rules further to amend the Environment (Protection) Rules, 1986 namely :-

1. (1) These rules may be called the Environment (Protection) (Sixth Amendment) Rules, 2010

(2) They shall come into force on the date of their publication in the Official Gazette.

2. In the Environment (Protection) Rules, 1986, in schedule I, after serial number 17 and the existing entries relating thereto, the following serial number and entries shall be inserted, namely :-

S. No.	Industry	Parameter	Standard
(1)	(2)	(3)	(4)
18	Iron Ore Mining and Ore Processing	A. Emission Standards for Stack for De-dusting Unit	
		Particulate matter	100 mg/ Nm ³
		Stack height **	15.0 m
		** Stack height for De-dusting unit shall be calculated as $H=7.4 Q^{0.27}$, where H and Q are stack height in metre and particulate matter (PM) emission in tonne/hr respectively, i.e	
		Q (kg/hr)	H (metre)
		up to 2.71	15
		2.72 - 7.86	20
		7.87 - 17.96	25
		17.97 - 35.29	30
		Note - Stack attached to De-dusting unit shall have minimum height of 15.0 metres and would be atleast 2.50 metres above the top-most point of the nearby building/shed or plant in the mine	
		B. Fugitive Emission Standards	
		Particulate matter	1200 µg/m ³
		Note - Fugitive emission shall be monitored in the predominant downwind direction at a distance 25.0±2.0 metres from the source of fugitive emission as per following	

1	2	3	4
		Area	Monitoring location
		Mine face/ Benches	Drilling, excavation and loading applicable for operating benches above water table
		Haul Roads/ Service Roads	Haul roads to ore processing plant, waste dumps and loading areas and service road
		Crushing plant	Run-off mine unloading at hopper, crushing areas, screens and transfer points
		Screening Plant	Screens, conveying and transportation of ore discharge points
		Ore Storage & Loading	Intermediate stock bin/pile areas, ore stock bin/pile areas, wagon/truck loading areas
		Waste dump	Active waste/reject dumps
		C. Effluent Standards	
		pH	5.5-9.0
		Suspended solids (non-rainy day)	50 mg/l
		Suspended solids (rainy day)	100 mg/l
		Oil & grease	10 mg/l
		Note:-	
		(i) All efforts shall be made to reuse and re-circulate the treated effluent	
		(ii) The aforesaid effluent standards shall be complied with for sewage, service water, beneficiation of ore washwater and surface run-off put together."	

(F No Q-15017/21/2007-CPW)

RAJNEESH DUBE, Jt Secy

Note : The principal rules were published in the Gazette of India vide number S.O. 844 (E) 19th November 1986, and subsequently amended vide S.O. 433 (E) dated 18th April 1987, S.O. 64 (E), dated the 18th January 1988 and recently amended vide G.S.R. 97(E) dated the 18th February, 2009; G.S.R. 149 (E), dated the 4th March, 2009, G.S.R. 512(E) dated the 9th July, 2009; G.S.R. 543 (E), dated the 22nd July, 2009; G.S.R. 595(E) dated the 21st August, 2009; G.S.R. 794 (E), dated the 4th November, 2009, G.S.R. 826 (E), dated the 16th November, 2009, G.S.R. 01 (E), dated the 01st January, 2010, G.S.R. 61 (E), dated the 5th February, 2010, GSR 485(E), dated the 9th June, 2010; GSR 608 (E), dated the 21st July, 2010 and GSR 739 (E), dated, the 9th September 2010.

NATIONAL AMBIENT AIR QUALITY STANDARDS

CENTRAL POLLUTION CONTROL BOARD

NOTIFICATION

New Delhi, the 18th November, 2009

No. B-29016/20/90/PC-1-E.—In exercise of the powers conferred by Sub-section (2) (b) of section 16 of the Air (Prevention and Control of Pollution) Act, 1981 (Act No.14 of 1981), and in supersession of the Notification No(s). S.O. 384(E), dated 11th April, 1994 and S.O. 935(E), dated 14th October, 1998, the Central Pollution Control Board hereby notify the National Ambient Air Quality Standards with immediate effect, namely:-

NATIONAL AMBIENT AIR QUALITY STANDARDS

S. No.	Pollutant	Time Weighted Average	Concentration in Ambient Air		
			Industrial, Residential, Rural and Other Area	Ecologically Sensitive Area (notified by Central Government)	Methods of Measurement
(1)	(2)	(3)	(4)	(5)	(6)
1	Sulphur Dioxide (SO ₂), µg/m ³	Annual* 24 hours**	50 80	20 30	- Improved Wink and Gaskin - Ultraviolet fluorescence
2	Nitrogen Dioxide (NO ₂), µg/m ³	Annual* 24 hours**	40 80	30 60	- Modified Jacob & Hochheiser (Na-Arsenite) - Chemiluminescence
3	Particulate Matter (size less than 10µm) or PM ₁₀ , µg/m ³	Annual* 24 hours**	60 100	60 100	- Gravimetric - TOEM - Beta attenuation
4	Particulate Matter (size less than 2.5µm) or PM _{2.5} , µg/m ³	Annual* 24 hours**	40 60	40 60	- Gravimetric - TOEM - Beta attenuation
5	Ozone (O ₃), µg/m ³	8 hours** 1 hour**	100 160	100 160	- UV photometric - Chemiluminescence - Chemical Method
6	Lead (Pb), µg/m ³	Annual* 24 hours**	0.50 1.0	0.50 1.0	- AAS RCP method after sampling on EPM 2000 or equivalent filter paper - ED-XRF using Teflon filter
7	Carbon Monoxide (CO), mg/m ³	8 hours** 1 hour**	02 04	02 04	- Non Dispersive Infra Red (NDIR) spectroscopy
8	Ammonia (NH ₃), µg/m ³	Annual* 24 hours**	100 400	100 400	- Chemiluminescence - Indophenol blue method

(1)	(2)	(3)	(4)	(5)	(6)
9	Benzene (C ₆ H ₆) µg/m ³	Annual*	05	05	- Gas chromatography based continuous analyzer • Adsorption and Desorption followed by GC analysis
10	Benzene(a,p)-pyrene (BaP) - particulate phase only, ng/m ³	Annual**	01	01	• Solvent extraction followed by HPLC/GC analysis
11	Arsenic (As), ng/m ³	Annual**	06	06	- AAS /ICP method after sampling on EPM 2000 or equivalent filter paper
12	Nickel (Ni), ng/m ³	Annual*	20	20	- AAS /ICP method after sampling on EPM 2000 or equivalent filter paper

* Annual arithmetic mean of minimum 104 measurements in a year at a particular site taken twice a week 24 hourly at uniform intervals.

** 24 hourly or 08 hourly or 01 hourly monitored values, as applicable, shall be complied with 98% of the time in a year. 2% of the time, they may exceed the limits but not on two consecutive days of monitoring.

Note. — Whenever and wherever monitoring results on two consecutive days of monitoring exceed the limits specified above for the respective category, it shall be considered adequate reason to initiate regular or continuous monitoring and further investigation.

SANT PRASAD GAUTAM, Chairman
[ADVT-III/19409/2dy.]

Note: The notifications on National Ambient Air Quality Standards were published by the Central Pollution Control Board in the Gazette of India, Extraordinary vide notification No(s). S.O. 384(E), dated 11th April, 1994 and S.O. 935(E), dated 14th October, 1998.

ANNEXURE-II

SCHEDULE (see rule 3(I) and 4(I))

Ambient Air Quality Standards in respect of Noise

Area Code	Category of Area/Zone	Limits in dB(A) Leq *	
		Day Time	Night Time
(A)	Industrial area	75	70
(B)	Commercial area	65	55
(C)	Residential area	65	45
(D)	Silence Zone	50	40

Note

1. Day time shall mean from 06:00 A.M. to 10:00 P.M.
2. Night time shall mean from 10:00 P.M. to 06:00 A.M.
3. Silence zone is defined as an area comprising not less than 100 meters around hospitals, educational institutions and courts. The silence zones are zones which are declared as such by the competent authority.
4. Mixed categories of areas may be declared as one of the four above mentioned categories by the competent authority.

*dB(A) Leq denotes the time weighted average of the level of sound in decibels on scale A which is relatable to human hearing.

A "decibel" is a unit in which noise is measured.

"A", in dB(A) Leq, denotes the frequency weighting in the measurement of noise and corresponds to frequency response characteristics of the human ear.

Leq : It is an energy mean of the noise level, over a specified period.

Signature Not Verified

VIJAI R. Secy.

Digitally Signed by : KALPANA BEHERA

Date: 2025.08.11 12:23:59 IST



BY REGD. POST WITH AO

STATE POLLUTION CONTROL BOARD, ODISHA

[DEPARTMENT OF FOREST, ENVIRONMENT & CLIMATE CHANGE, GOVERNMENT OF ODISHA]

A/118, Nilakantha Nagar, Unit-VIII, Bhubaneswar-751012

Phone-2561909, Fax: 2362822, 2560955 E-mail: paribesh1@ospcbodisha.org, Website: www.ospcbodisha.org

CONSENT ORDER

No. 17698 / IND-I-CON- 2572 DL 26-09-2025 /

CONSENT ORDER NO. 1586

Sub: Consent for discharge of sewage and trade effluent under section 25/26 of Water (PCP) Act, 1974 and for existing / new operation of the plant under section 21 of Air (PCP) Act, 1981.

Ref: Your online application No. 6640095, dated 13/08/2025 and online reply dated 29/08/2025.

Consent to operate is hereby granted under section 25/26 of Water (Prevention & Control of Pollution) Act, 1974 and under section 21 of Air (Prevention & Control of Pollution) Act, 1981 and rules framed thereunder to

Name of the Industry: RAIKELA IRON ORE MINE OF M/S. GEETARANI MOHANTY.

Name of the Occupier & Designation: SRI SRINIBASH SAHOO, MANAGING PARTNER

Address: AT: RAIKELA, PO: DENGULA, DIST: SUNDARGARH.

This consent order is valid for the period upto 31.03.2027.

This consent order supersedes the earlier consent order issued vide letter No.4185, dated 22.03.2024.

Details of Products Manufactured:

Sl. No	Product	Quantity
01.	Iron Ore	5.988 MTPA

Details of Mineral Handling Plants /Units:

01.	Mobile Crushing Plant of capacity 2 x 400 TPH
02.	Mobile Screening Plant of capacity 2 x 300 TPH & 2 x 400 TPH
03.	Fixed Crushing and Screening Plant of capacity 1 x 1000 TPH

This consent order is valid for the specified outlets, discharge quantity and quality, specified chimney/stack, emission quantity and quality of emissions as specified below. This consent is granted subject to the general and special conditions stipulated therein.



A. Discharge permitted through the following outlet subject to the standard

Outlet No.	Description of outlet	Point of discharge	Quantity of discharge KLD or KL/hr	Prescribed Standard				
				pH	TSS (mg/l)	BOD (mg/l)	Oil & Grease (mg/l)	Fecal Coliform (MPN/100 ml)
01	Outlet of STP (Domestic effluent)	Used for plantation	60 KLD	6.5-9.0	<100	30	--	<1000
02	Outlet of ETP of workshop	Re-used in vehicle washing	0.25	6.5-8.5	50	—	10	--
03	Mine drainage water/ surface runoff/ other wastewater	On land /Inland surface water body	7076	5.5-9.0	100 (Rainy days) 50 (Non-rainy days)	-	10	—

B. Fugitive Emission Standards

Particulate Matter	1200 $\mu\text{g}/\text{m}^3$
Note : Fugitive emission shall be monitored in the predominant downwind direction at a distance 25.0 + 2.0 metres from the source of fugitive emission as per following :	
Area	Monitoring Location
Mine face / Benches	Drilling, excavation and loading applicable for operating benches above water table
Haul Roads/ Service Roads	Haul roads to ore processing plant, waste dumps and loading areas and service road.
Crushing plant	Run-off mine unloading at hopper, crushing areas, screens and transfer points.
Screening plant	Screens, conveying and transportation of ore discharge points.
Ore storage and loading	Intermediate stock bin / pile areas, ore stock bin / pile areas, wagon / truck loading areas
Waste dump	Active waste / reject dumps

C. Disposal of solid waste permitted in the following manner

Sl. No.	Type of Solid waste	Quantity generated (TPD)	Quantity to be reused on site(TPD)	Quantity to be reused off site(TPD)	Quantity disposed off (TPD)	Description of disposal site.
01	Top soil/ over burden	As per approved mining plan	—	—	—	As per approved mining plan



D. GENERAL CONDITIONS FOR ALL UNITS

1. The consent is given by the Board in consideration of the particulars given in the application. Any change or alternation or deviation made in actual practice from the particulars furnished in the application will also be the ground for liable to review/variation/revocation of the consent order under section 27 of the Water (Prevention & Control of Pollution) Act, 1974 and section 21 of Air (Prevention & Control of Pollution) Act, 1981 and to make such variations as deemed fit for the purpose of the Acts.
2. The occupier would immediately submit revised application for consent to operate to this Board in the event of any change in the quantity and quality of raw material / products / manufacturing process or quantity / quality of the effluent rate of emission / air pollution control equipment / system etc.
3. The applicant shall not change or alter either the quality or quantity or the rate of discharge or temperature or the route of discharge without the previous written permission of the Board.
4. The application shall comply with and carry out the directives/orders issued by the Board in this consent order without any negligence on his/her part. In case of non-compliance of any order/directives issued at any time and/or violation of the terms and conditions of this consent order, the applicant shall be liable for legal action as per the provisions of the Law.
5. The applicant shall make an application for grant of fresh consent at least 90 days before the date of expiry of this consent order.
6. The issuance of this consent does not convey any property right in either real or personal property or any exclusive privileges nor does it authorize any injury to private property or any invasion of personal rights, nor any infringement of Central, State laws or regulation.
7. This consent does not authorize or approve the construction of any physical structure or facilities or the undertaking of any work in any natural water course.
8. The applicant shall display this consent granted to him in a prominent place for perusal of the public and inspecting officers of this Board.
9. An inspection book shall be opened and made available to Board's Officers during the visit to the factory.
10. The applicant shall furnish to the visiting officer of the Board any information regarding the construction, installation or operation of the plant or of effluent treatment system / air pollution control system / stack monitoring system any other particulars as may be pertinent to preventing and controlling pollution of Water / Air.
11. The applicant shall display suitable caution board at the place where the effluent is entering into any water-body or any other place to be indicated by the Board, indicating therein that the area into which the effluents are being discharged is not fit for the domestic use/bathing.
12. Storm water shall not be allowed to mix with the trade and/or domestic effluent on the upstream of the terminal manholes where the flow measuring devices will be installed.
13. The applicant shall maintain good house-keeping both within the factory and the premises. All pipes, valves, sewers and drains shall be leak-proof. Floor washing shall be admitted into the effluent collection system only and shall not be allowed to find their way in storm drains or open areas.
14. The applicant shall at all times maintain in good working order and operate as efficiently as possible all treatment or control facilities or systems install or used by him to achieve with the term(s) and conditions of the consent.
15. Care should be taken to keep the anaerobic lagoons, if any, biologically active and not utilized as mere stagnation ponds. The anaerobic lagoons should be fed with the required nutrients for effective digestion. Lagoons should be constructed impervious.
16. The utilization of treated effluent on factory's own land, if any, should be completed and there should be no possibility of the effluent gaining access into any drainage channel or other water courses either directly or by overflow.
17. The effluent disposal on land, if any, should be done without creating any nuisance to the surroundings or inundation of the lands at any time.
18. If at any time the disposal of treated effluent on land becomes incomplete or unsatisfactory or create any problem or becomes a matter of dispute, the occupier must adopt alternate satisfactory treatment and disposal measures.
19. The sludge from treatment units shall be dried in sludge drying beds and the drained liquid shall be taken to equalization tank.
20. The effluent treatment units and disposal measures shall become operative at the time of commencement of production.
21. The applicant shall provide port holes for sampling the emissions and access platform for carrying out stack sampling and provide electrical outlet points and other arrangements for chimneys/stacks and other sources of emissions so as to collect samples of emission by the Board or the applicant at any time in accordance with the provision of the Acts or Rules made therein.
22. The applicant shall provide all facilities and render required assistance to the Board staff for collection of samples / stack monitoring / inspection.



CONSENT ORDER
RAIKELA IRON ORE MINE OF M/S. GEETARANI MOHANTY,

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23. The applicant shall not change or alter either the quality or quantity or rate of emission or install, replace or alter the air pollution control equipment or change the raw material or manufacturing process resulting in any change in quality and/or quantity of emissions, without the previous written permission of the Board.
 24. No control equipments or chimney shall be altered or replaced or as the case may be erected or re-erected except with the previous approval of the Board.
 25. The liquid effluent arising out of the operation of the air pollution control equipment shall be treated in the manner so as to meet the standards prescribed by the Board in accordance with the provisions of Water (Prevention and Control of Pollution) Act, 1974 (as amended).
 26. The stack monitoring system employed by the applicant shall be opened for inspection to this Board at any time.
 27. There shall not be any fugitive or episodal discharge from the premises.
 28. In case of such episodal discharge/emissions the occupier shall take immediate action to bring down the emission within the limits prescribed by the Board and stop the operation of the plant if required. Report of such accidental discharge /emission shall be brought to the notice of the Board within 24 hours of occurrence.
 29. The applicant shall keep the premises and air pollution control equipments clean and make all hoods, pipes, valves, stacks/chimneys leak proof. The air pollution control equipments, location, inspection chambers, sampling port holes shall be made easily accessible at all times.
 30. Any upset condition in any of the plant/plants of the factory which is likely to result in increased effluent discharge/emission of air pollutants and / or result in violation of the standards mentioned shall be reported to the Headquarters and Regional Office of the Board by E-mail within 2 hours of its occurrence.
 31. The occupier has to ensure that minimum three varieties of trees are planted at the density of not less than 1000 trees per acre. The trees may be planted along boundaries of the premises. This plantation is stipulated over and above the bulk plantation of trees in that area.
 32. The solid waste such as sweeping, wastage packages, empty containers residues, sludge including that from air pollution control equipments collected within the premises of the shall be disposed off scientifically to the satisfaction of the Board.
 33. All solid wastes arising in the premises shall be properly classified and disposed off to the satisfaction of the Board by :
 - i) Land fill in case of inert material, care being taken to ensure that the material does not give rise to leachate which may percolate into ground water or carried away with storm run-off.
 - ii) Controlled incineration, wherever possible in case of combustible organic material.
 - iii) Composting, in case of bio-degradable material.
 34. Any toxic material shall be detoxicated if possible, otherwise be sealed in steel drums and buried in protected areas after obtaining approval of this Board in writing. The detoxication or sealing and burying shall be carried out in the presence of Board's authorized persons only. Letter of authorization shall be obtained for handling and disposal of hazardous wastes.
 35. If due to any technological improvement or otherwise this Board is of opinion that all or any of the conditions referred to above requires variation (including the change of any control equipment either in whole or in part) this Board shall after giving the applicant an opportunity of being heard, vary all or any of such condition and thereupon the applicant shall be bound to comply with the conditions so varied.
 36. The applicant, his/heirs/legal representatives or assignees shall have no claim whatsoever to the condition or renewal of this consent after the expiry period of this consent.
 37. The Board reserves the right to review, impose additional conditions or condition, revoke change or alter the terms and conditions of this consent.
 38. Notwithstanding anything contained in this conditional letter of consent, the Board hereby reserves to it the right and power under section 27(2) of the Water (Prevention & Control of Pollution) Act, 1974 to review any and/or all the conditions imposed herein above and to make such variations as deemed fit for the purpose of the Act by the Board.
 39. The conditions imposed as above shall continue to be in force until revoked under section 27(2) of the Water (Prevention & Control of Pollution) Act, 1974 and section 21 A of Air (Prevention & Control of Pollution) Act, 1981.
 40. The occupier shall comply to the conditions stipulated in CTE order issued by Odisha State Pollution Control Board and conditions stipulated in Environmental Clearances issued by MoEF&CC, Govt. of India.
 41. The occupier shall abide by E(P) Act, 1986 and Rules framed there-under.
 42. In case the consent fee is revised upward during this period, the industry shall pay the differential fees to the Board (for the remaining years) to keep the consent order in force. If they fail to pay the amount within the period stipulated by the Board the consent order will be revoked without prior notice.
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CONSENT ORDER
RAIKELA IRON ORE MINE OF M/S. GEETARANI MOHANTY

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**GENERAL CONDITIONS FOR UNITS WITH INVESTMENT OF MORE THAN Rs 50 CRORES, AND 17 CATEGORIES OF
HIGHLY POLLUTING INDUSTRIES (RED A).**

1. The applicant shall analyse the emissions every month for the parameters indicated in TABLE B & C as mentioned in this order and shall furnish the report thereof to the Board by the 10th of the succeeding month.
2. The applicant shall provide and maintain at his own cost three ambient air quality monitoring stations for monitoring Suspended Particulate Matter, Sulphur Dioxide, Oxides of Nitrogen, Hydro-Carbon, Carbon-Monoxide and monitor the same once in a day/week/fortnight/month. The data collected shall be maintained in a register and a monthly extract be furnished to the Board.
3. The applicant shall provide and maintain at his own cost a meteorological station to collect the data on wind velocity, direction, temperature, humidity, rainfall, etc. and the daily reading shall be recorded and the extract sent to the Board once in a month.
4. The applicant shall forward the following information to the Member Secretary, State Pollution Control Board, Odisha, Bhubaneswar regularly.
 - a) Report of analysis of stack monitoring, ambient air quality monitoring meteorological data as required every month
 - b) Progress on planting of trees quarterly.
5. The applicant shall install mechanical composite sampling equipment and continuous flow measuring / recording devices on the effluent drains of trade as well as domestic effluent. A record of daily discharge shall be maintained.
6. The following information shall be forwarded to the Member Secretary on or before 10th of every month.
 - a) Performance / progress of the treatment plant.
 - b) Monthly statement of daily discharge of domestic and/or trade effluent.
7. Non-compliance with effluent limitations
 - a) If for any reason the applicant does not comply with or is unable to comply with any effluent limitations specified in this consent, the applicant shall immediately notify the consent issuing authority by telephone and provide the consent issuing authority with the following information in writing within 5 days of such notification.
 - i) Causes of non-compliance
 - ii) A description of the non-compliance discharge including its impact on the receiving waters.
 - iii) Anticipated time of continuance of non-compliance if expected to continue or if such condition has been corrected the duration or period of non-compliance.
 - iv) Steps taken by the applicant to reduce and eliminate the non-complying discharge and
 - v) Steps to be taken by the applicant too prevent the condition of non-compliance.
 - b) The applicant shall take all reasonable steps to minimize any adverse impact to natural waters resulting from non-compliance with any effluent limitation specified in this consent including such accelerated or additional monitoring as necessary to determine the nature and impact of the non-complying discharge.
 - c) Nothing in this consent shall be construed to relieve the applicant from civil or criminal penalties for non-compliance whether or not such non-compliance is due to factors beyond his control, such as break-down, electric failure, accident or natural disaster.
8. The applicant shall at his own cost get the effluent samples collected both before and after treatment and get them analysed at an approval laboratory every month for the parameters indicated in Part-D and shall submit in duplicate the report thereof to the Board.
9. The addition of various treatment chemicals should be done only with mechanical dozers and proper equipment for regulation of correct dosages determined daily and for proper uniform feeding. Crude practices such as dumping of chemicals in drains or sumps or trucking of acids or alkalis arbitrarily and utilizing poles for stirring etc. should not be resorted to.
10. In the disposal of treated effluent on land for irrigation, the industry shall keep in view of the need for,
 - a) Rotation of crops
 - b) Change of point of application of effluent on land
 - c) A portion of land kept fallow.
11. The adoption of these would avoid soil becoming sick or stale, the industry may ensure this in consultation with the Agriculture Department.
12. It is the sole responsibility of the industry to ensure that there are no complaints at any time from the ryots in the surrounding areas as a result of discharge of sewage or trade effluent if any.
13. Proper housekeeping shall be maintained by a dedicated team.
14. The industry must constitute a team of responsible and technically qualified personnel who will ensure continuous operation of all pollution control devices round the clock (including night hours) and should be in a position to explain the status of operation of the pollution control measures to the inspecting officers of the Board at any point of time. The name of these persons with their contact telephone numbers shall be intimated to the concerned, Regional Officer and Head Office of the Board and in case of any change in the team it shall be intimated to the Board immediately.



E. SPECIAL CONDITIONS:

- 1) This consent order is subject to compliance of orders of the Hon'ble Supreme Court of India in the matter of W. P. (Civil) 114/2014.
 - 2) This consent order is subject to permission from Steel and Mines Department, Government of Odisha for continuing of mining operation.
 - 3) Mining operation is subject to availability of all other statutory clearances.
 - 4) The quantity of production shall be determined on a monthly pro-rata basis from the date of issue of this order. If the date of issue is 15th of the month, or earlier, then the entire month will be considered for calculation, otherwise the quantity shall be determined from the next month on pro-rata basis.
 - 5) Drills shall either be operated with dust extractors or equipped with water injection system to minimize dust generation in the work environment.
 - 6) Controlled blasting shall be practiced to minimize generation of dust and fly rocks.
 - 7) Regular water sprinkling shall be carried out in critical areas prone to air pollution such as around crushing and screening plant, haul roads, approach road, active OB dumps and mine benches at frequent interval so that it should always remain in wet condition.
 - 8) Effort shall be made to use chemical binders/wetting agents alongwith sprinkled water in order to reduce water consumption and to improve retention and re-absorption capacity of water.
 - 9) A truck parking plaza shall be developed with its runoff management facilities.
 - 10) Haulage roads shall be devoid of ruts and potholes and shall be maintained properly to avoid generation of dust during movement of vehicles.
 - 11) The air pollution control measures shall be revisited or augmented to bring down the concentration of PM₁₀ within stipulated standard. The action taken report in this regard shall be submitted to the Board for verification.
 - 12) Fog canons shall be deployed at the haul roads and mineral handling area for strengthening of dust suppression measures.
 - 13) Dust suppression measures (preferably dry fog system) shall be provided at all appropriate places of mineral handling plants (crusher & screening plant). Loading and unloading areas including all the transfer points shall also have efficient dust suppression arrangements (dry fog system). These shall be properly maintained and operated.
-



- 14) Mechanized wheel washing facility for the ore transport vehicles shall be provided at the exit point of the mine. The wheel washing facility shall be integrated with complete recirculation system.
 - 15) The vehicles carrying ore for transportation from the mine shall be covered with tarpaulin (both bottom & top).
 - 16) Regular water sprinkling on mineral transportation roads passing through the habitation area as well as other strategic point on the National Highway shall be done jointly by the mining lessees in consultation with the Regional Officer.
 - 17) Three continuous real time Ambient Air Quality Monitoring Stations shall be established in core zone and buffer zone with data transfer facility to SPCB server and location of these stations shall be decided based on the meteorological data, topographical features and environmentally and ecologically sensitive targets in consultation with the Regional Officer, State Pollution Control Board.
 - 18) The CAAQMS shall be properly maintained and calibrated from time to time to ensure that spurious data are not transformed to the SPCB server.
 - 19) Fugitive Dust Emission Monitoring shall be carried out at the places as stated in Part-B of this order. The monitoring of fugitive dust shall be carried out twice in a week (24 hourly) at a particular site and consolidated data shall be submitted to the State Pollution Control Board, once in a year.
 - 20) The top soil generated shall be stored at earmarked site (s) only and stabilized with plantation or shall be used for land reclamation and plantation.
 - 21) The over burden generated during the course of mining shall be stacked at earmarked dump site (s) and stabilized with plantation or used for reclamation of excavated land followed by plantation.
 - 22) The project proponent shall ensure that no natural watercourse and / or water resources are obstructed due to any mining operations. In case of diversion of natural watercourse, this shall be done with prior permission of the competent authority.
 - 23) Check dams and check weirs shall be constructed at appropriate places of the mine lease area to prevent direct flow of runoff to nearby water bodies. The surface run off water from the existing runoff management system shall meet the prescribed standards as stated in Part A (Sl. No. 3) of the consent order.
 - 24) Retention wall shall be constructed at the toe of topsoil dump and OB dump. Garland drain shall be constructed around topsoil dumps, over burden dumps
-



and mineral stock yards terminating at settling pit to prevent direct disposal of runoff to nearby water bodies.

- 25) Garland drain and sedimentation pit shall be de-silted after monsoon or as and when required. The runoff discharge quality from runoff management system shall meet the prescribed standards as stated in Part A (Sl No. 3) of the consent order.

- 26) Domestic effluents shall be treated in a sewage treatment plant (STP) and or shall be discharged to soak pit via septic tank constructed as BIS specification. The treated wastewater quality of STP shall remain within the following standards and shall be used for plantation:

pH	-	6.5 -9.0
TSS	-	<100 mg/l
BOD	-	30 mg/l
Fecal Coliform	-	<1000 MPN/100 ml.

- 27) ETP comprising of oil and grease trap with sedimentation pit shall be provided for treatment of workshop effluent and treated effluent shall remain within the following prescribed standards and shall be re-used for washing of vehicles:

pH	-	6.5 -8.5
TSS	-	50 mg/l
Oil & grease	-	10 mg/l
COD	-	150 mg/l

- 28) Regular monitoring of water quality of upstream and downstream of surface water bodies existed if any within 5 Km shall be carried out once in every month and record shall be maintained and submitted to the State Pollution Control Board once in every year. Monitoring shall be carried out through MoEF & CC accredited laboratory.

- 29) Regular monitoring of ground water level and quality should be carried out by establishing a network of existing wells. The monitoring should be done four times a year in pre-monsoon (April/May), monsoon (August), post-monsoon (November) and winter (January) seasons. Data thus collected should be submitted to the Board quarterly.

- 30) The mine shall take necessary action for compliance with the air and water quality standards as stipulated in Part-A and Part-B of this order.

- 31) Adequate measures shall be taken for control of noise levels in the work environment of mine area so that noise levels at the boundary line of mining lease
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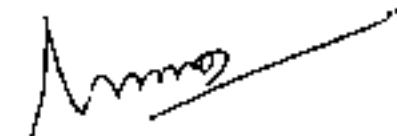


area shall not exceed 75 dB(A) during day time (6.00 AM to 9.00 PM) and 70 dB(A) during night time (9.00 PM to 6 AM).

- 32) Adequate noise barriers shall be provided surrounding the crushing and screening plants to control noise pollution and avoid impact on wildlife due to operation of crushing and screening plants during night hours.
 - 33) Online noise monitoring system shall be installed to monitor noise level during night hours.
 - 34) Protective barriers shall be provided for the lights to prevent illumination towards the forest area during night hours.
 - 35) Ambient air quality monitoring data, noise monitoring data and water / wastewater quality monitoring data shall be electronically displayed at the entry point of the mine or at a suitable location of the mine.
 - 36) The height of the stack connected to DG sets of capacity more than 800 KW (1000 KVA) shall conform to the following:
 - i) $14Q^{0.3}$, Q = Total SO₂ emission from the plant in kg/hr.
 - ii) Minimum 6m. above the building where generator set is installed.
 - iii) 30 m.
 - 37) The height of the stack connected to DG set of capacity less than and upto 800 KW (1000 KVA) shall conform to the following:
 - i) $H = h + 0.2\sqrt{KVA}$
 - ii) h = Height of the building where it is installed in meter
 - iii) KVA = Capacity of DG set
 - iv) H = Height of the stack in meter above ground level.
 - 38) All DG sets installed before 1.7.2004 shall be scrapped. DG sets complying with either Stage-I or Stage-II emission norms shall reduce Particulate Matter Emission by 70% by installing RECD without affecting any other emission parameters as per the CPCB guidelines and Board's letter vide No.17927, dated 14.11.2023 and letter No.7148, dated 10.05.2024, in this regard.
 - 39) Plantation of trees shall be undertaken in the colony/ township, over top soil dumps, OB dumps, along the side of haul road and in other areas of the mines not being utilized for mining activities. The mine shall take up avenue plantation and plantation in nearby village areas in consultation with DFO/Horticulture Department. The plantation details shall be submitted to the Board before end of April every year.
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- 40) A copy of the annual return (annual return submitted to IBM, Govt. of India/ Directorate of Mines, Govt. of Odisha) shall be submitted to this Board every year.
- 41) The environmental statement report for the financial year ending 31st March shall be submitted to the Board in Form-V on or before 30th September every year.



MEMBER SECRETARY

STATE POLLUTION CONTROL BOARD, ODISHA

TO,

THE MANAGING PARTNER,
RAIKELA IRON ORE MINE OF M/S. GEETARANI MOHANTY,
STATION ROAD, BARBIL,
DIST: KEONJHAR, PIN-758035

Memo No. 17699 /Dt. 26.09.2025

Copy forwarded to :

- i) Regional Officer, State Pollution Control Board, Rourkela.
- ii) District Collector, Sundargarh
- iii) Director of Mines, Govt. of Odisha, Bhubaneswar
- iv) Director, Environment-cum-Special Secretary, F, E & CC Deptt., Govt. of Odisha, Bhubaneswar.
- v) D.F.O, Bonai, Sundargarh
- vi) Deputy Director of Mines, Koira, Sundargarh.
- vii) Chief Env. Scientist, Central Lab. SPCB, Bhubaneswar
- viii) Consent Register



CHIEF ENV. ENGINEER (M)

STATE POLLUTION CONTROL BOARD, ODISHA



CONSENT ORDER
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GENERAL STANDARDS FOR DISCHARGE OF ENVIRONMENTAL POLLUTANTS



**GENERAL STANDARDS FOR DISCHARGE OF
ENVIRONMENTAL POLLUTANTS PART – A : EFFLUENTS**

Sl. No.	Parameters	Standards			
		Inland surface	Public sewers	Land for irrigation	Marine Coastal Areas
		(a)	(b)	(c)	(d)
1	Colour & odour	Colourless/ Odourless as far as practicable	--	See 6 of Annex-1	See 6 of Annex-1
2	Suspended Solids (mg/l)	100	600	200	a. For process wastewater – 100 b. For cooling water effluent 10% above total suspended matter of influent.
3	Particular size of SS	Shall pass 850	--	—	--
5	pH value	5.5 to 9.0	5.5 to 9.0	5.5 to 9.0	5.5 to 9.0
6	Temperature	Shall not exceed 5°C above the receiving water temperature	--	—	Shall not exceed 5°C above the receiving water temperature
7	Oil & Grease mg/l max.	10	20	10	20
8	Total residual chlorine	1.0	--	—	1.0
9	Ammonical nitrogen (as N) mg/l max.	50	50	—	50
10	Total Kjeldahl nitrogen (as NH ₃) mg/l max.	100	--	—	100
11	Free ammonia (as NH ₃) mg/l max	5.0	--	--	5.0
12	Biochemical Oxygen Demand (5 days at (20°C) mg/l max	30	350	100	100
13	Chemical Oxygen Demand mg/l max	250	--	—	250
14	Arsenic (as As) mg/l max	0.2	0.2	0.2	0.2
15	Mercury (as Hg) mg/l max	0.01	0.01	--	0.001



CONSENT ORDER
RAIKELA IRON ORE MINE OF M/S. GEETARANI MOHANTY

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Sl. No.	Parameters	Standards			
		Inland surface	Public sewers	Land for irrigation	Marine Coastal Areas
		(a)	(b)	(c)	(d)
16.	Lead (as pb) mg/l max.	1.0	1.0	--	2.0
17.	Cadmium (as Cd) mg/l max.	2.0	1.0	--	2.0
18.	Hexavalent Chromium (as Cr + 6) mg/l max.	0.1	2.0	--	1.0
19.	Total Chromium (as Cr) mg/l max.	2.0	2.0	--	2.0
20.	Copper (as Cu) mg/l max.	3.0	3.0	--	3.0
21.	Zinc (as Zn) mg/l max.	5.0	15	--	15
22.	Selenium (as Se) mg/l max.	0.05	0.05	--	0.05
23.	Nickel (as Ni) mg/l max.	3.0	3.0	--	5.0
24.	Cyanide (as CN) mg/l max.	0.2	2.0	0.2	0.02
25.	Fluoride (as F) mg/l max.	2.0	15	--	15
26.	Dissolved Phosphates (as P) mg/l max.	5.0	--	--	--
27.	Sulphide (as S) mg/l max.	2.0	--	--	5.0
28.	Phenolic compounds as (C ₆ H ₅ OH) mg/l max.	1.0	5.0	--	5.0
29.	Radioactive materials				
	a. Alpha emitter micro curie/ml.	10 ⁷	10 ⁷	10 ⁶	10 ⁷
	b. Beta emitter micro curie/ml.	10 ⁶	10 ⁶	10 ⁷	10 ⁶
30.	Bio-assay test	90% survival of fish after 96 hours in 100% effluent	90% survival of fish after 96 hours in 100% effluent	90% survival of fish after 96 hours in 100% effluent	90% survival of fish after 96 hours in 100% effluent
31.	Manganese (as Mn)	2 mg/l	2 mg/l	--	2 mg/l
32.	Iron (Fe)	3 mg/l	3 mg/l	--	3 mg/l
33.	Vanadium (as V)	0.2 mg/l	0.2 mg/l	--	0.2 mg/l
34.	Nitrate Nitrogen	10 mg/l	--	--	20 mg/l



NATIONAL AMBIENT AIR QUALITY STANDARDS

Sl. No.	Pollutants	Time Weighted Average	Concentrate of Ambient Air		
			Industrial Residential, Rural and other Area	Ecologically Sensitive Area (notified by Central Government)	Methods of Measurement
(1)	(2)	(3)	(4)	(5)	(6)
1	Sulphur Dioxide (SO ₂), $\mu\text{g}/\text{m}^3$	Annual * 24 Hours **	50 80	20 80	-Improved wet and Gaeke - Ultraviolet fluorescence
2	Nitrogen Dioxide (NO ₂), $\mu\text{g}/\text{m}^3$	Annual * 24 Hours **	40 80	30 80	- Modified Jacob & Hochheiser (Na-Arsenite) - Chemiluminescence
3	Particulate Matter (size less than 10 μm) or PM ₁₀ , $\mu\text{g}/\text{m}^3$	Annual * 24 Hours **	60 100	60 100	-Gravimetric - TOEM - Beta Attenuation
4	Particulate Matter (size less than 2.5 μm) or PM _{2.5} , $\mu\text{g}/\text{m}^3$	Annual * 24 Hours **	40 60	40 60	-Gravimetric - TOEM - Beta Attenuation
5	Ozone (O ₃), $\mu\text{g}/\text{m}^3$	8 Hours ** 1 Hours **	100 180	100 180	- UV Photometric - Chemiluminescence - Chemical Method
6	Lead (Pb), $\mu\text{g}/\text{m}^3$	Annual * 24 Hours **	0.50 1.0	0.50 1.0	-AAS/ICP method after sampling on EMP 2000 or equivalent filter paper. - ED-XRF using Teflon filter
7	Carbon Monoxide (CO), mg/m^3	8 Hours ** 1 Hours **	02 04	02 04	- Non Dispersive Infra Red (NDIR) Spectroscopy
8	Ammonia (NH ₃), $\mu\text{g}/\text{m}^3$	Annual* 24 Hours**	100 400	100 400	-Chemiluminescence - Indophenol Blue Method
9	Benzene (C ₆ H ₆), $\mu\text{g}/\text{m}^3$	Annual *	05	05	-Gas Chromatography based continuous analyzer - Adsorption and Desorption followed by GC analysis
10	Benzo (a) Pyrene (BaP)-Particulate phase only, ng/m^3	Annual*	01	01	-Solvent extraction followed by HPLC/GC analysis
11	Arsenic (As), ng/m^3	Annual*	06	06	-AAS/ICP method after sampling on EPM 2000 or equivalent filter paper
12	Nickel (Ni), ng/m^3	Annual*	20	20	-AAS/ICP method after sampling on EPM 2000 or equivalent filter paper

* Annual arithmetic mean of minimum 104 measurements in a year at a particular site taken twice a week 24 hourly at uniform intervals

** 24 hourly or 06 hourly or 01 hourly monitored values, as applicable, shall be complied with 95% of the time in a year, 2% of the time they may exceed the limit but not on two consecutive days of monitoring.



EPABX : 2653800 / Tel : 2562368
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paribesh1@ospcboard.org
Website: www.ospcboard.odisha.gov

STATE POLLUTION CONTROL BOARD, ODISHA

(FOREST, ENVIRONMENT AND CLIMATE CHANGE DEPARTMENT, GOVERNMENT OF ODISHA)

Paribesh Bhawan, A/118, Nilakantha Nagar, Unit - VIII

Bhubaneswar - 751012, INDIA

BY SPEED POST

FORM 2

[See rule 6(2)]

RENEWAL OF AUTHORISATION BY STATE POLLUTION CONTROL BOARD, ODISHA TO THE OCCUPIER UNDER HAZARDOUS AND OTHER WASTES (MANAGEMENT AND TRANSBOUNDARY MOVEMENT) RULES, 2016

**(This Authorization Order supersedes the previous
Authorization order no. 6133, dt.24-04-2024)**

1. Number of authorization: IND-IV-HW-1360/ 13597 and date of issue: 19-07-2025
2. Reference of application (No. and date): 5881492, dt. 09-07-2025.
3. **Raikela Iron Ore Mines of M/s Geetaram Mohanty** is hereby granted an authorization based on the enclosed signed inspection report for generation, storage, transport, reuse, utilization, disposal or any other use of hazardous or other wastes or both in the premises situated At - Raikela, Po - Dengula, Dist - Sundargarh, Odisha - 770048.

Details of Authorization

Sl. No.	Category of Hazardous Waste as per the Schedules I, II and III of these Rules	Waste Description	Quantity	Authorized Mode of Disposal or Recycling or utilization or Co-processing, etc.
1.	Schedule - I Stream - 5.1	Used Oil	50 T/A	Storage in containers over impervious floor under well ventilated covered shed followed by disposal through Actual Users authorized by SPCB, Odisha
2.	Schedule - I Stream - 5.2	Wastes / Residue Containing Oil	3 T/A	Storage in impervious pits / containers under well ventilated covered shed followed by Co-processing in Cement Kilns Authorized by SPCB, Odisha / disposal in Authorized Hazardous Waste Incinerator / Common Hazardous Waste Treatment Storage Disposal Facility (CHWTSDF)

Sl. No.	Category of Hazardous Waste as per the Schedules I, II and III of these Rules	Waste Description	Quantity	Authorized Mode of Disposal or Recycling or utilization or Co-processing, etc.
3.	Schedules - I Stream - 33.1	Empty barrels/containers /liners contaminated with hazardous chemicals / wastes	5 T/A	Storage on impervious floor under well ventilated covered shed followed by captive reuse / disposal through original supplier / Actual Users authorized by SPCB, Odisha.
4.	Schedules - I Stream - 33.2	Contaminated cotton rags or other cleaning materials	1 T/A	Storage in impervious pits / containers under well ventilated covered shed followed by Co-processing in Cement Kilns Authorized by SPCB, Odisha / disposal in Authorized Hazardous Waste Incinerator / CHWTSDF.

(1) The authorization shall be valid up to ~~31-03-2027~~.

(2) The authorization is subject to the following general and specific conditions.

A. General Conditions of authorization:

1. The authorized person shall comply with the provisions of the Environment (Protection) Act, 1986, and the rules made there under.
2. The authorization or its renewal shall be produced for inspection at the request of an officer authorized by the State Pollution Control Board.
3. The person authorized shall not rent, lend, sell, transfer or otherwise transport the hazardous and other wastes except what is permitted through this authorization.
4. Any unauthorized change in personnel, equipment or working conditions as mentioned in the application by the person authorized shall constitute a breach of his authorization.
5. The person authorized shall implement Emergency Response Procedure (ERP) for which this authorization is being granted considering all site specific possible scenarios such as spillages, leakages, fire etc. and their possible impacts and also carry out mock drill in this regard at regular interval of time.
6. The person authorized shall comply with the provisions outlined in the Central Pollution Control Board guidelines on "Implementing Liabilities for Environmental Damages due to Handling and Disposal of Hazardous Waste and Penalty"
7. It is the duty of the authorized person to take prior permission of the State Pollution Control Board to close down the facility.
8. The imported hazardous and other wastes shall be fully insured for transit as well as for any accidental occurrence and its clean-up operation.

9. The record of consumption and fate of the imported hazardous and other wastes shall be maintained.
10. The hazardous and other waste which gets generated during recycling or reuse or recovery or pre-processing or utilization of imported hazardous or other wastes shall be treated and disposed of as per specific conditions of authorization.
11. The importer or exporter shall bear the cost of import or export and mitigation of damages if any.
12. An application for the renewal of an authorization shall be made as laid down under these Rules.
13. Any other conditions for compliance as per the Guidelines issued by the Ministry of Environment, Forest and Climate Change or Central Pollution Control Board from time to time.
14. Annual return shall be filed by June 30th for the period ensuring 31st March of the year.

B. Specific Conditions:

1. Authorization granted herewith does not relieve you in complying with other provision laid down under Water (PCP) Act, 1974, Air (PCP) Act, 1981 and Environment (Protection) Act, 1986, and the Rules made there under.
2. This authorization is subject to statutory and other clearances from Govt. of Odisha and / or Govt. of India as and when applicable.
3. In case the quantity of generation of hazardous Waste exceeds the Authorized quantity, the mine shall apply for amendment of Authorization order.
4. The mine shall strictly comply to the provisions of Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016 and amendments made thereafter.
5. Annual returns in Form - 4 (See Rules- 6 (5), 13 (8), 16 (6) & 20 (2)) shall be submitted to the Board for the financial year by 30th June of every year. It shall contain the detail quantities of generation, storage and disposal of different type of hazardous wastes such as recyclable, incinerable, land disposable.
6. Steps shall be taken for reduction and prevention of the hazardous waste generated or for recycling or reuse.
7. Environmental Information with respect to Air, Water, Hazardous Waste and Hazardous Chemicals shall be displayed at the main gate for public view.

8. The transport of the hazardous and other waste shall be in accordance with the provisions of the Rule, 2016 and the rules made by the Central Government under the Motor Vehicles Act, 1988 and the guidelines issued by the Central Pollution Control Board from time to time in this regard.
9. The occupier shall provide the transporter with the relevant information in Form 9, regarding the hazardous nature of the wastes and measures to be taken in case of an emergency and shall label the hazardous and other wastes containers as per Form 8.
10. In case of transportation of hazardous waste and other wastes for recycling or utilization including co-processing to outside the state, the sender shall intimate both the State Pollution Control Boards before handing over the waste to the transporter.
11. Manifest system (Movement document) shall be strictly followed as per Rule-19 and to be submitted to this office as per the Rule. The mine shall check the authenticity of the way bill of the transport vehicle to ensure supply of hazardous waste to the authorized destination.
12. The hazardous waste shall be sold if required only to Actual User having valid authorization from the State Pollution Control Board, Odisha and concerned SPC Board. Details of such wastes shall be entered in the passbook issued by respective SPCB.
13. All the hazardous waste shall be stored in impervious pits / containers / floors under cover shed with adequate capacity having spill containment facility. The spilled hazardous waste shall be re-collected and stored in impervious pits / containers / floors under cover shed prior to sale / disposal.
14. The schedule of hazardous waste and the quantity as specified shall only be disposed off as per the stipulation prescribed in this authorisation.
15. This authorization does not permit you to either receive and process or generate hazardous waste in case validity of Consent to Operate of your mine ceases. However you can carry out handling, storage, treatment, transport and disposal of hazardous waste and other wastes generated previously during such period to avoid accumulation of hazardous waste.
16. The mine shall store the accumulated hazardous waste for a period not exceeding 90 days and shall dispose as per the stipulation prescribed in this authorisation order. In case, generation of any category of Hazardous Waste is less than 10 T/A, then such waste can be stored up to a period of 180 days before disposal. In case of any violation, authorization granted shall be suspended / cancelled.
17. The mine shall apply for renewal of authorization in Form - 1, 120 days before expiry of this authorization order enclosing Annual Return in Form - 4, Manifest copies in Form - 10 and compliance to the conditions stipulated in this order along with adequate processing fees.

18. In case of transportation of hazardous and other waste, the responsibility of safe transport shall be either of the sender or the receiver whosoever arranges the transport and has the necessary authorisation for transport from the concerned State Pollution Control Board. This responsibility should be clearly indicated in the manifest.
19. Hazardous Wastes having calorific value of more than 2500 Kcal/Kg shall not be landfilled. It can only be disposed through authorized Actual Users or incinerated in authorized Hazardous Waste incinerator or co-processing in authorized cement kiln.
20. The mine shall follow On-site and Off-site Emergency plan during all activities involving hazardous wastes to avert accidents, fire and other environmental damages.
21. The mine shall follow all safety protocols during handling, transportation and disposal of hazardous wastes.
22. The mine shall register on National Hazardous Wastes Tracking System (NHWTS) Portal of CPCB to manage the manifest, daily records of quantity generated, disposed, etc. of hazardous and other wastes.


Member Secretary



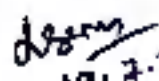
To

The Managing Partner
Raikela Iron Ore Mines of M/s Geetarani Mohanty
A1 - Raikela, Po - Deugula,
Dist - Sundargarh, Odisha - 770048

Memo No. 13598
Copy to the :

Di. 19-07-2025

1. Collector & District Magistrate, Sundargarh.
2. Director, Factories & Boilers, Odisha, Bhubaneswar.
3. Regional Officer, State Pollution Control Board, Odisha, Bhubaneswar.
4. Guard file.


19.7.2025
Additional Chief Environmental Engineer

o/c



F. No. 8-37/2007-FC
Government of India
Ministry of Environment, Forests and Climate Change
(Forest Conservation Division)

Indira Paryavaran Bhawan
Aliganj, Jorbagh Road
New Delhi - 110 003
Dated: 22nd October, 2014

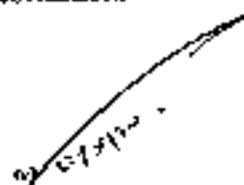
To,
The Principal Secretary (Forests)
Government of Odisha
Bhubaneswar.

Subj: Diversion of 64.148 hectares of forest land for Iron Ore Mining in Village Raikela by Geetarani Mohanty of Bonai Forest Division in the district of Sundargarh, Odisha.

Sir,

I am directed to refer to the Government of Odisha's letter No 10F (Cons) 38/ 2013-7190/ F & E dated 22nd April 2014 on the above-mentioned subject, wherein prior approval of the Central Government for diversion of (i) 64.148 hectares of forest land for Iron Ore Mining in village Raikela by M/s. Geetarani Mohanty of Bonai Forest Division in the district of Sundargarh, Odisha during the original Mining lease period which has already expired on 1.7.2011 and (ii) the entire forest land of 66.671 hectares including 2.523 hectares of forest land within the safety zone within the ML area of 67.586 hectares during 1st RML for a period, co-terminus with lease period to be granted by the State Government, not exceeding twenty years *w.e.f.* 02.07.2011, was sought, in accordance with section-2 of the Forest (Conservation) Act, 1980. After careful consideration of the proposal by the Forest Advisory Committee constituted by the Central Government under section 3 of the said Act, in-principle approval for the said diversion was granted vide this Ministry's letter of even number dated 29th August 2014, subject to fulfillment of certain conditions. The State Government has furnished compliance report in respect of the conditions stipulated in the in-principle approval and has requested the Central Government to grant final approval.

2. In this connection, I am directed to say that on the basis of the compliance report furnished by the Government of Odisha vide letter No. 10F (Cons) -38/2013-18032/ F & E dated 29th September 2014, approval of the Central Government is hereby granted under section 2 of the Forest (Conservation) Act, 1980 for diversion of (i) 64.148 hectares of forest land for Iron Ore Mining in village Raikela by M/s. Geetarani Mohanty of Bonai Forest Division in the district of Sundargarh, Odisha during the original Mining lease period which has already expired on 1.7.2011 and (ii) for entire forest land of 66.671 hectares including 2.523 hectares of forest land within the safety zone within the ML area of 67.586 hectares during 1st RML for a period, co-terminus with lease period to be granted by the State Government, not exceeding twenty years *w.e.f.* 02.07.2011, subject to fulfillment of the following conditions:


22/10/14

- (i) Legal status of the diverted forest land shall remain unchanged;
- (ii) State Government shall create and maintain from funds already realised the user agency, compensatory afforestation over non-forest land equal in extent to 64.148 hectares of forest land diverted in favour of the user agency for mining and allied activities, transferred and mutated in favour of the State Forest Department;
- (iii) State Government shall undertake, from funds already realised from the user agency, fencing, protection and regeneration of the safety zone area (7.5 metre strip all along the outer boundary of the mining lease area). Besides this, State Government shall also undertake, from funds already realised from the user agency, afforestation on degraded forest land, to be selected elsewhere, measuring one and a half times the area under safety zone;
- (iv) User agency shall undertake appropriate measures as per the plan duly approved by the Divisional Forest Officer, Bonai Forest Division to prevent pollution of tanks, rivers and *nalas*, etc. and de-silting of adjoining villages located within 5 kilometers from the project site;
- (v) Following activities shall be undertaken by the State Forest Department from funds already realised from the user agency as per the Plan duly approved by the Regional Chief Conservator of Forests, Rourkela:
 - (a) Proper mitigative measures to minimize soil erosion and choking of stream;
 - (b) Planting of adequate drought hardy plant species and sowing of seeds to arrest soil erosion; and
 - (c) Construction of check dams, retention/toe walls to arrest sliding down of the excavated material along the contour.
- (vi) Wherever possible and technically feasible, the user agency shall undertake by involving local community, afforestation measures, as per the plan duly approved by the DFO, Bonai Forest Division, in the blanks within the lease area, as well as along the roads outside the lease area diverted under this approval;
- (vii) The State Government shall realise from the user agency additional NPV, if so determined as per the final decision of Hon'ble Supreme Court of India and transfer the same to the Ad-hoc CAMPA;
- (viii) State Government shall create and maintain from funds already realised from the user agency, penal compensatory afforestation over degraded forest land equal in extent to the 43.056 hectares of DLC forest land utilised for mining and allied activities without obtaining requisite approval under the Forest (Conservation) Act, 1980;



- (ix) The lease will remain in the name of M/s Geeta Rani Mohanty. For transfer of the said lease to any other firm or person prior approval of Central Government under the Forest (Conservation) Act, 1980 shall be obtained;
- (x) User agency shall surrender from the mining lease, as per the schedule submitted to this Ministry, the fully (biologically) reclaimed mined out forest land. The summary of the said schedule is as below:

(in hectares)

Phase/ Financial year	Mined out area at the beginning	Addt. Area	Total Area	Area to be reclaimed and rehabilitated	Year of reclamation	Mined out land at the end of the phase	Schedule of surrender
1 st Phase 2011- 2016	29.893	7.00	36.893	Nil	—	36.893	—
2 nd Phase 2016- 2021	36.893	3.00	39.993	Nil	—	39.993	—
3 rd Phase 2021- 2026	39.993	3.00	42.893	10.000	0 th Year	32.893	10 th Year 2031-2036
4 th Phase 2026- 2031	32.893	3.00	35.893	10.000	5 th Year	25.893	10 th Year 2036-2041
5 th Phase 2031- 2036	25.893	3.00	28.893	10.000	10 th Year	18.893	10 th Year 2041-2046
6 th Phase 2036-2041	18.893	2.00	20.893	10.000	15 th Year	10.893	10 th Year 2046-2051
7 th Phase 2041- 2046	10.893	Nil	10.893	10.893	20 th Year	Nil	10 th Year 2051-2056

- (xi) Any other condition that the concerned Regional Office of this Ministry of the State Forest Department may impose from time to time for protection and improvement of flora and fauna in the forest area;

[Handwritten signature]

- (xii) User agency shall submit annual report on compliance to conditions stipulated in this approval to the State Forest Department and the concerned Regional office of this Ministry; and
- (xiii) User agency and the State Government shall comply with all other conditions, as applicable to this project, under different rules, regulations and regulations including environmental clearance.

Yours faithfully,

(H. C. Chaudhary)
Director

Copy to:

1. The Principal Chief Conservator of Forests, Government of Odisha, Bhubaneswar.
2. The Nodal Officer, the Forest (Conservation) Act, 1980, O/o the Principal Chief Conservator of Forests, Government of Odisha, Bhubaneswar.
3. The Addl. Principal Chief Conservator of Forests (Central), Regional Office (Eastern Zone), Bhubaneswar.
4. User agency.
5. Monitoring Cell, FC Division, MoEF, New Delhi.
6. Guard File.

(H. C. Chaudhary)
Director

Format No.: WCS/QR/7.8/02

Report No.:

NABL ULR No.:

Name of the Client:

Address:

Co-Ordinate:

Sampling Location:

Sample Description:

Sampling Plan & Method:

Environmental Condition:

Sample Collected by:

Test Performed at:

Month of Sampling:

WCS251109A

TC11225250000399F

Raikola Iron Ore Mines (M/S Geetarani Mohanty)

Raikola, Near Tessa, P.O.-Dengala, Dist.- Sundargarh- 751048, Odisha

21°53'52.24" N 85°11'57.31" E

Nungano

Ambient Air Quality Monitoring

WCS/QSP/SLAMP (AIR)

Light Rain

Debendra Kumar Biswal

WCS Laboratory

October-2025

TEST REPORT

Issue Date : 03.11.2025

Quantity of Sample : 9

Sample Condition : Good

Sl. No.	Date Of Sampling	PM10 in ($\mu\text{g}/\text{m}^3$)	PM2.5 in ($\mu\text{g}/\text{m}^3$)	SO ₂ in ($\mu\text{g}/\text{m}^3$)	NO _x in ($\mu\text{g}/\text{m}^3$)
1	03.10.2025	43.3	21.9	4.9	13.6
2	06.10.2025	31.2	15.8	3.5	9.8
3	10.10.2025	42.0	23.7	5.3	14.7
4	14.10.2025	56.5	28.5	6.3	17.7
5	17.10.2025	64.1	32.4	7.2	20.1
6	21.10.2025	59.8	30.2	6.7	18.7
7	24.10.2025	36.2	28.4	6.3	17.6
8	27.10.2025	52.7	26.6	5.9	16.5
9	31.10.2025	45.9	23.2	5.1	14.1
Average		50.7	25.6	5.7	15.9
NAAQ Standard 2009		100	60	80	80
Testing Method		IS-5182 (Part-23) 2006 RA 2017	IS-5182 (Part-23) 2019	IS-5182 (Part-2) 2001 RA 2017	IS-5182 (Part-6) 2006 RA 2017


 Reviewed by
 (Miss. Luxmi Sabon)


 Authorized Signatory
 (Mr. Bijaya Kumar Chahatary)

***** END OF REPORT *****

NOTE:

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- Above Results related only to the Item Tested.



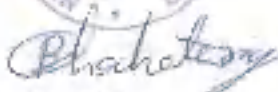
Form No: WCSQR/7.8/02

TEST REPORT

Report No. : WCS251109A Issue Date : 03.11.2025
 Name of the Client : Raikela Iron Ore Mines (M/S Geetural Mahanty)
 Address : Raikela, Near Teesa, P.O.-Denguli, Dist- Sundargarh- 770048, Odisha
 Co-Ordinate : 21°53'32.24" N 85°14'57.31" E
 Sampling Location : Nuagaon
 Sample Description : Ambient Air Quality Monitoring
 Sampling Plan & Method : WCSQSP/SAMP (AIR)
 Environmental Condition : Light Rain
 Sample Collected by : Dehendra Kumar Bisoi
 Test Performed at : WCS Laboratory Quantity of Sample : 0
 Month of Sampling : October-2025 Sample Condition : Good

Sl. No.	Date of Sampling	CO in (µg/m ³)
1	03.10.2025	0.182
2	06.10.2025	0.131
3	10.10.2025	0.198
4	14.10.2025	0.237
5	17.10.2025	0.269
6	21.10.2025	0.251
7	24.10.2025	0.236
8	27.10.2025	0.221
9	31.10.2025	0.193
Average		0.213
NAAQ Standard 2009		40
Testing Method		CPCB Guidelines of Ambient Air Pollutants Volume-I&II


 Reviewed by
 (Miss. Laxmi Sahoo)



 Authorized Signatory
 (Mr. Bijaya Kumar Chahatary)

***** END OF REPORT *****

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Fictual No: WCSQR/7,802

TEST REPORT

Report No. : WTS25140919

Issue Date : 03.11.2025

NABL ULR No. : TC112252500000399F

 Name of the Client : **Raikela Iron Ore Mines (M/S Geetaruji Mohanty)**

Address : Raikela, Near Tansa, P.O.-Danguda, Dist- Sundargarh- 770048, Odisha

Co-Ordinate : 21°52'43.37" N 85°12'08.49" E

 Sampling Location : **Tentulidih**

Sample Description : Ambient Air Quality Monitoring

Sampling Plan & Method : WCSQSPYSAMP (AIR)

Environmental Condition : Light, Rain

Sample Collected by : Debdutta Kumar Biswal

Test Performed at : WCS Laboratory

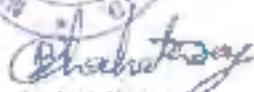
Quantity of Sample : 9

Month of Sampling : October-2025

Sample Condition : Good

Sl. No.	Date Of Sampling	PM10 in ($\mu\text{g}/\text{m}^3$)	PM2.5 in ($\mu\text{g}/\text{m}^3$)	SO ₂ in ($\mu\text{g}/\text{m}^3$)	NOx in ($\mu\text{g}/\text{m}^3$)
1	03.10.2025	44.4	22.4	5.0	13.9
2	06.10.2025	32.0	16.2	3.6	10.0
3	10.10.2025	48.2	24.4	5.4	13.1
4	14.10.2025	57.9	29.2	6.5	18.1
5	17.10.2025	63.7	33.2	7.4	20.6
6	21.10.2025	61.3	31.0	6.9	19.2
7	24.10.2025	57.6	29.1	6.5	18.1
8	27.10.2025	54.0	27.3	6.1	16.9
9	31.10.2025	47.1	23.8	5.3	14.8
Average		52.0	26.3	5.8	16.3
NAAQ Standard 2009		100	60	80	80
Testing Method		IS-5182 (Part-23) 2006 RA 2017	IS-5182 (Part-23) 2019	IS-5182 (Part-2) 2003 RA 2017	IS-5182 (Part-6) 2006 RA 2017


 Reviewed by
 (Miss. Luxmi Sahoo)



 Authorized Signatory
 (Mr. Bijaya Kumar Chaharany)

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- Above Results related only to the Item Tested.



Format No: WCS/QR/7.8/02

Report No.

Name of the Client

Address

Co-Ordinate

Sampling Location

Sample Description

Sampling Plan & Method

Environmental Condition

Sample Collected by

Test Performed at

Month of Sampling

WCS25110915

Raikela Iron Ore Mines (M/S Geetarani Mahanty)

Raikela, Near Tansa, P.O.-Dengula, Dist- Sundargarh- 770048, Odisha

21°52'03.37" N 85°12'08.49" E

Tenu Udibl

Ambient Air Quality Monitoring

WCS/QSPSAMP (AIR)

Light Rain

Debendra Kumar Biswal

WCS Laboratory

October-2025

Issue Date : 03.11.2025

Quantity of Sample : 9

Sample Condition : Good

Sl. No.	Date of Sampling	CO in (mg/m ³)
1	03.10.2025	0.187
2	06.10.2025	0.134
3	10.10.2025	0.203
4	14.10.2025	0.243
5	17.10.2025	0.276
6	21.10.2025	0.258
7	24.10.2025	0.242
8	27.10.2025	0.227
9	31.10.2025	0.198
Average		0.219
NAAQ Standard 2009		4.0
Testing Method		CPCB Guidelines of Ambient Air Pollutants Volume-I&II

Reviewed By
(Miss. Luxmi Sahoo)



Authorized Signatory
(Mr. Bijaya Kumar Chhataraya)

***** END OF REPORT *****

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- Above Results related only to the Item Tested.



WCS
MY WORLD CONSULTANCY SERVICES

MY WORLD CONSULTANCY SERVICES PRIVATE LIMITED
(Testing Laboratory)
Plot No. 385, Telangapentha, Cuttack, Odisha - 754001
NABL (ISO/IEC 17025:2025) ACCREDITED LABORATORY



Form No: WCS/OR/7.002

Report No.

NABL ULR No.

Name of the Client

Address

Co-Ordinate

Sampling Location

Sample Description

Sampling Plan & Method

Environmental Condition

Sample Collected by

Test Performed at

Month of Sampling

WCS251106C

IC1:2252100000390F

Raikela Iron Ore Mines (M/S Geetaranj Mohanty)

Raikela, Near Tenda, P.O.-Dengula, Dist- Sundergarh- 770018, Odisha

21°52'31.23" N 85°12'12.03" E

Dengula

Ambient Air Quality Monitoring

WCS/QST/SAMP (AIR)

Eight Rain

Debanda Kumar Biswal

WCS Laboratory

October-2025

TEST REPORT

Issue Date : 03.11.2025

Quantity of Sample : 9
Sample Condition : Good

Sl. No.	Date Of Sampling	PM10 in ($\mu\text{g}/\text{m}^3$)	PM2.5 in ($\mu\text{g}/\text{m}^3$)	SO ₂ in ($\mu\text{g}/\text{m}^3$)	NOx in ($\mu\text{g}/\text{m}^3$)
1	03.10.2025	42.6	21.3	4.8	13.4
2	06.10.2025	30.7	15.5	3.4	9.6
3	10.10.2025	46.2	23.4	5.2	14.5
4	14.10.2025	55.5	28.0	6.2	17.4
5	17.10.2025	63.0	31.8	7.1	19.8
6	21.10.2025	58.8	29.7	6.6	18.4
7	24.10.2025	55.3	27.9	6.2	17.3
8	27.10.2025	51.8	26.2	5.8	16.2
9	31.10.2025	45.2	22.8	5.1	14.2
Average		49.9	25.2	5.6	15.6
NAAQ Standard 2009		100	60	80	80
Testing Method		IS-5182 (Part-23) 2006 RA 2017	IS-5182 (Part-23) 2019	IS-5182 (Part-2) 2001 RA 2017	IS-5182 (Part-6) 2006 RA 2017

LS

Reviewed by
(Miss. Luxmi Sahoo)

Bhujaya

Authorized Signatory
(Mr. Bijaya Kumar Chahauray)

***** END OF REPORT *****

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Format No: WCS/QR/7.8/02

TEST REPORT

Report No. : WCS251109C **Issue Date** : 03.11.2025

Name of the Client : Raikela Iron Ore Mines (M/S Geetarani Mahantya)

Address : Raikela, Near Tessa, P.O.-Denguli, Dist- Sundargarh- 770048, Odisha

Co-Ordinate : 21°52'21.22" N 85°12'12.03" E

Sampling Location : Denguli

Sample Description : Ambient Air Quality Monitoring

Sampling Plan & Method : WCS/QSP/SAMP (AIR)

Environmental Condition : Light Rain

Sample Collected by : Dehendra Kumar Biswal

Test Performed at : WCS Laboratory **Quantity of Sample** : 9

Month of Sampling : October-2025 **Sample Condition** : Good

Sl. No.	Date of Sampling	CO In (mg/m ³)
1	03.10.2025	0.179
2	06.10.2025	0.129
3	10.10.2025	0.194
4	14.10.2025	0.233
5	17.10.2025	0.265
6	21.10.2025	0.247
7	24.10.2025	0.232
8	27.10.2025	0.218
9	31.10.2025	0.190
Average		0.210
NAAQ Standard 2009		4.0
Testing Method		CPCB Guidelines of Ambient Air Pollutants Volume-I&II


Reviewed by
(Miss. Luxmi Sahoo)



Authorized Signatory
(Mr. Bijay Kumar Chahatara)

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Formal No: WCS/OR/7.6/02

TEST REPORT

Issue Date : 03.11.2025

Report No. : WCS251109D
NABL CER No. : TC112352500003991
Name of the Client : **Railbela Iron Ore Mines (M/S Geetani Mahanty)**
Address : Railbela, Near Jenua, P.O., -Bengula, Dist- Sundargarh- 753042, Odisha
Co-Ordinate : 21°52'15.44" N 85°14'04.36" E
Sampling Location : **Office**
Sample Description : Ambient Air Quality Monitoring
Sampling Plan & Method : WCSAQSP/SAMP (AIR)
Environmental Condition : Light Rain
Sample Collected by : Debendra Kumar Biswal
Test Performed at : WCS Laboratory
Month of Sampling : October-2025

Quantity of Sample : 9
Sample Condition : Good

Sl. No.	Date Of Sampling	PM10 in ($\mu\text{g}/\text{m}^3$)	PM2.5 in ($\mu\text{g}/\text{m}^3$)	SO ₂ in ($\mu\text{g}/\text{m}^3$)	NO _x in ($\mu\text{g}/\text{m}^3$)
1	03.10.2025	48.2	24.3	5.4	15.1
2	06.10.2025	34.7	17.5	3.9	10.9
3	10.10.2025	52.3	26.4	5.9	16.4
4	14.10.2025	62.8	31.7	7.0	19.7
5	17.10.2025	71.3	36.0	8.0	22.3
6	21.10.2025	66.5	33.6	7.4	20.8
7	24.10.2025	62.5	31.6	7.0	19.6
8	27.10.2025	58.6	29.6	6.0	18.4
9	31.10.2025	51.1	25.8	5.7	16.0
Average		56.4	28.5	6.3	17.7
NAAQ Standard 2009		100	60	80	80
Testing Method		IS-5182 (Part-23) 2006 RA 2017	IS-5182 (Part-23) 2019	IS-5182 (Part-2) 2001 RA 2017	IS-5182 (Part-6) 2006 RA 2017


Reviewed by
(Miss. Laxmi Sahoo)



Authorized Signatory
(Mr. Bijaya Kumar Chuluvatray)

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Format No: WCS/QR/7.3/02

TEST REPORT

Report No.

WCS25110913

Issue Date : 03.11.2025

Name of the Client

Railkaly Iron Ore Mines (M/S Geetarani Minhanty)

Address

Railkaly, Near Tansa, P.O.-Jengula, Dist- Sundargarh- 750048, Odisha

Co-Ordinate

23°52'15.44" N 85°01'04.36" E

Sampling Location

Office

Sample Description

Ambient Air Quality Monitoring

Sampling Plan & Method

WCS/QSP/SAMP (AIR)

Environmental Condition

Light Rain

Sample Collected by

Debdutta Kumar Biswal

Test Performed at

WCS Laboratory

Quantity of Sample : 9

Month of Sampling

October-2025

Sample Condition : Good

Sl. No.	Date of Sampling	CO ₂ in (mg/m ³)
1	03.10.2025	0.203
2	06.10.2025	0.146
3	10.10.2025	0.220
4	14.10.2025	0.364
5	17.10.2025	0.300
6	21.10.2025	0.279
7	24.10.2025	0.263
8	27.10.2025	0.246
9	31.10.2025	0.215
Average		0.237
NAAQ Standard 2009		4.0
Testing Method		CPCB Guidelines of Ambient Air Pollutants Volume-I&II

Reviewed by:
(Miss. Laxmi Sahoo)



Authorized Signature
(Mr. Bijay Kumar Chahakany)

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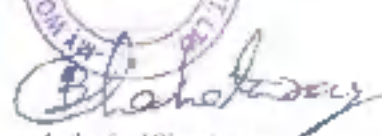
Format No: WCS/QR/7.8/02

TEST REPORT

Report No.	WCS251233A	Issue Date	04.12.2025
NABL ULR No.	TC1122325010000442F		
Name of the Client	Kalkoti Iron Ore Mines (M/S Geetarami Mahanty)		
Address	Kalkoti, Near Tansa, P.O.-Dangula, Dist- Sundergarh- 770048, Odisha		
Co-Ordinate	21°53'52.247" N 85°11'57.311" E		
Sampling Location	Nuggaan		
Sample Description	Ambient Air Quality Monitoring		
Sampling Plan & Method	WCS/QSP/SAMP (AIR)		
Environmental Condition	Clear Weather		
Sample Collected by	Debdendra Kumar Biswal		
Test Performed at	WCS Laboratory	Quantity of Sample	8
Month of Sampling	November-2025	Sample Condition	Good

Sl. No.	Date Of Sampling	PM10 in ($\mu\text{g}/\text{m}^3$)	PM2.5 in ($\mu\text{g}/\text{m}^3$)	SO ₂ in ($\mu\text{g}/\text{m}^3$)	NOx in ($\mu\text{g}/\text{m}^3$)
1	04.11.2025	60.1	30.3	6.7	18.8
2	07.11.2025	57.1	28.8	6.4	17.9
3	11.11.2025	56.1	28.3	6.3	17.6
4	14.11.2025	63.1	31.9	7.1	19.8
5	18.11.2025	62.2	31.4	7.0	19.5
6	20.11.2025	59.7	30.1	6.7	18.7
7	24.11.2025	56.6	28.6	6.3	17.7
8	28.11.2025	60.3	30.5	6.8	18.9
Average		59.4	30.0	6.7	18.6
NAAQ Standard 2009		100	60	80	80
Testing Method		IS-5182 (Part-23) 2006 RA 2017	IS-5182 (Part-23) 2019	IS-5182 (Part-2) 2001 RA 2017	IS-5182 (Part-6) 2006 RA 2017


 Reviewed by
 (Miss. Luxmi Sahoo)


 Authorized Signatory
 (Mr. Bijaya Kumar Chahakray)

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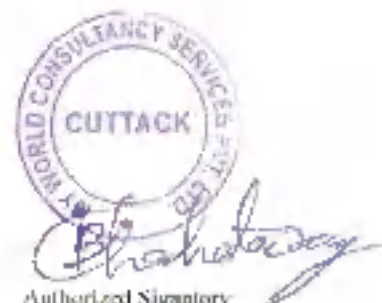
Form No: WCSQR/7.802

TEST REPORT

Report No. : WCS250233A Issue Date : 04.12.2025
Name of the Client : **Railela Iron Ore Mines (M/S Geetarni Mohanty)**
Address : Railela, Near Teosa, P.O.-Dengula, Dist- Sandargarh- 770048, Odisha
Co-Ordinate : 21°43'32.24" N 85°11'57.31" E
Sampling Location : **Nurgan**
Sample Description : Ambient Air Quality Monitoring
Sampling Plan & Method : WCSQSP/SAMP(AIR)
Environmental Condition : Clear Weather
Sample Collected by : Debendra Kumar Biswal
Test Performed at : WCS Laboratory
Month of Sampling : November-2025
Quantity of Sample : 8
Sample Condition : Good

Sl. No.	Date of Sampling	CO in (mg/m ³)
1	04.11.2025	0.252
2	07.11.2025	0.240
3	11.11.2025	0.236
4	14.11.2025	0.265
5	18.11.2025	0.261
6	20.11.2025	0.257
7	24.11.2025	0.238
8	28.11.2025	0.253
Average		0.250
NAAQ Standard 2009		4.0
Testing Method		CPCB Guidelines of Ambient Air Pollutants Volume-I&II


Reviewed by
(Mr. Laxmi Sahoo)


Authorized Signatory
(Mr. Bijaya Kumar Chhatuany)

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Formal No: WCS/QR/7.8492

Report No.

WCS25123310

Issue Date 04.12.2025

NABL QLR No.

IC1122525000000442F

Name of the Client

Raikela Iron Ore Mines (M/S Geetarani Mahanty)

Address

Raikela, Near Tensa, P.O., Denguli, Dist- Sundargarh- 759018, Odisha

Co-Ordinate

21°52'03.37" N 85°12'08.49" E

Sampling Location

Tentalidibi

Sample Description

Ambient Air Quality Monitoring

Sampling Plan & Method

WCS/QSP/SAMP (AIR)

Environmental Condition

Clear Weather

Sample Collected by

Debendra Kumar Biswal

Test Performed at

WCS Laboratory

Quantity of Sample 8

Month of Sampling

November-2025

Sample Condition

Good

SL No.	Date Of Sampling	PM10 in ($\mu\text{g}/\text{m}^3$)	PM2.5 in ($\mu\text{g}/\text{m}^3$)	SO ₂ in ($\mu\text{g}/\text{m}^3$)	NOx in ($\mu\text{g}/\text{m}^3$)
1	04.11.2025	64.6	31.1	6.9	19.3
2	07.11.2025	58.5	29.6	6.6	18.3
3	11.11.2025	57.5	29.1	6.4	18.0
4	14.11.2025	61.7	32.7	7.2	20.3
5	18.11.2025	63.8	32.2	7.1	20.0
6	20.11.2025	61.2	30.9	6.9	19.3
7	24.11.2025	58.1	29.3	6.5	18.2
8	28.11.2025	61.9	31.2	6.9	19.4
Average		60.9	30.8	6.8	19.1
NAAQ Standard 2009		100	60	80	80
Testing Method		IS-5182 (Part-23) 2006 RA 2017	IS-5182 (Part-23) 2010	IS-5182 (Part-2) 2001 RA 2017	IS-5182 (Part-6) 2006 RA 2017

Reviewed by
(Miss. Luxmi Sahoo)

Authorized Signatory
(Mr. Bijaya Kumar Chhakar)

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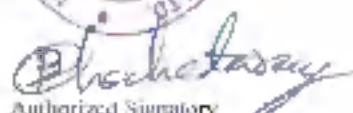
TEST REPORT

Report No. : WCS2512336 Issue Date : 04.12.2025
 Name of the Client : **Raikela Iron Ore Mines (M/S. Geetaranj Mohanty)**
 Address : Raikela, Near Tensa, P.O.-Denguli, Dist- Sundargarh- 750048, Odisha
 Co-Ordinate : 21°52'03.37" N 85°12'38.49" E
 Sampling Location : **Tentulitili**
 Sample Description : Ambient Air Quality Monitoring
 Sampling Plan & Method : WCS/QSP/SAMP (AIR)
 Environmental Condition : Clear Weather
 Sample Collected by : Debendra Kumar Biswal
 Test Performed at : WCS Laboratory
 Month of Sampling : November-2025

Quantity of Sample : 8
 Sample Condition : Good

Sl. No.	Date of Sampling	CO in (mg/m ³)
1	04.11.2025	0.259
2	07.11.2025	0.246
3	11.11.2025	0.242
4	14.11.2025	0.272
5	18.11.2025	0.268
6	20.11.2025	0.257
7	24.11.2025	0.244
8	28.11.2025	0.260
Average		0.256
NAAQ Standard 2009		4.0
Testing Method		CPCB Guidelines of Ambient Air Pollutants Volume-I&II


 Reviewed by
 (Miss. Laxmi Sahoo)



 Authorized Signatory
 (Mr. Bijaya Kumar Chaturaray)

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Format No: WCS/Q/R/7.8/02

Report No.

NABL ULR No.

Name of the Client

Address

Co-Ordinate

Sampling Location

Sample Description

Sampling Plan & Method

Environmental Condition

Sample Collected by

Test Performed at

Month of Sampling

WCS251233C

PC112252500000412F

Raikela Iron Ore Mines (M/S Cestrawli Mahanty)

Raikela, Near Tenua P.O.-Dungun, Dist- Sundargarh- 750048, Odisha

21°52'21.22" N 85°12'12.43" E

Dungun

Ambient Air Quality Monitoring

WCS/Q/SP/SAMP (AIR)

Clear Weather

Debendra Kumar Hissal

WCS Laboratory

November-2025

Issue Date : 04.12.2025

Quantity of Sample : 8

Sample Condition : Liquid

Sl. No.	Date Of Sampling	PM10 in ($\mu\text{g}/\text{m}^3$)	PM2.5 in ($\mu\text{g}/\text{m}^3$)	SO ₂ in ($\mu\text{g}/\text{m}^3$)	NOx in ($\mu\text{g}/\text{m}^3$)
1	04.11.2025	59.1	29.8	6.6	18.5
2	07.11.2025	56.1	28.4	6.3	17.6
3	11.11.2025	55.2	27.9	6.2	17.3
4	14.11.2025	62.1	31.3	6.9	19.4
5	18.11.2025	61.2	30.9	6.9	19.2
6	20.11.2025	58.7	29.6	6.6	18.4
7	24.11.2025	55.7	28.1	6.2	17.5
8	28.11.2025	59.3	30.0	6.6	18.6
Average		58.4	29.5	6.5	18.5
NAAQ Standard 2009		100	60	80	80
Testing Method		IS-5182 (Part-23) 2006 RA 2017	IS-5183 (Part-23) 2019	IS-5182 (Part-2) 2001 RA 2017	IS-5182 (Part-6) 2006 RA 2017



 Reviewed by
 (Miss. Lavani Sahoo)



 Authorized Signatory
 (Mr. Bijaya Kumar Chakraborty)

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Format No: WCS-QR/7.8-02

TEST REPORT

Report No. : WCS251233C Issue Date : 04.11.2025
Name of the Client : **Raikela Iron Ore Mines (M/S Geetaranal Mohanty)**
Address : Raikela, Near Tenda, P.O.-Dengula, Dist- Sundargarh- 750008, Odisha
Co-ordinate : 21°52'21.22" N 85°12'12.03" E
Sampling Location : **Dengula**
Sample Description : Ambient Air Quality Monitoring
Sampling Plan & Method : WCS/QSP/SAMP (AIR)
Environmental Condition : Clear Weather
Sample Collected by : Debendra Kumar Biswal
Test Performed at : WCS Laboratory
Month of Sampling : November-2025
Quantity of Sample : 8
Sample Condition : Good

Sl. No.	Date of Sampling	CO in (mg/m ³)
1	04.11.2025	0.248
2	07.11.2025	0.236
3	11.11.2025	0.232
4	14.11.2025	0.261
5	18.11.2025	0.257
6	20.11.2025	0.247
7	24.11.2025	0.234
8	28.11.2025	0.249
Average		0.245
NAAQ Standard 2009		4.0
Testing Method		CPCB Guidelines of Ambient Air Pollutants Volume-I&II


Reviewed by
(Miss. Laxmi Saboo)



Authorized Signatory
(Mr. Bijaya Kumar Chakraborty)

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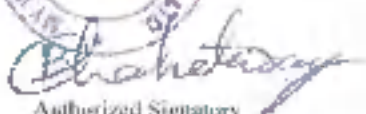
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Format No: WUSQR/7.892
Report No. : WCS251233D
NABL LCR No. : TC112252500000442P
Name of the Client : **Raikela Iron Ore Mines (M/S Geobarani Mahanty)**
Address : Raikela, Near Tansa, P.O.-Dengda, Dist- Sundargarh- 750048, Odisha
Co-Ordinate : 21°52'15.44"N 85°11'04.36"E
Sampling Location : **Office**
Sample Description : Ambient Air Quality Monitoring
Sampling Plan & Method : WCSQSP/SAMP (AIR)
Environmental Condition : Clear Weather
Sample Collected by : Deben/Dr. Kumar Biswal
Test Performed at : WCS Laboratory
Month of Sampling : November-2025
Issue Date : 04.12.2025
Quantity of Sample : 8
Sample Condition : Good

Sl. No.	Date Of Sampling	PM10 in ($\mu\text{g}/\text{m}^3$)	PM2.5 in ($\mu\text{g}/\text{m}^3$)	SO ₂ in ($\mu\text{g}/\text{m}^3$)	NO _x in ($\mu\text{g}/\text{m}^3$)
1	04.11.2025	66.8	33.7	7.5	20.9
2	07.11.2025	63.5	32.1	7.1	19.9
3	11.11.2025	62.4	31.5	7.0	19.6
4	14.11.2025	70.2	31.5	7.9	22.0
5	18.11.2025	69.2	34.9	7.7	21.7
6	20.11.2025	66.4	33.5	7.4	20.8
7	24.11.2025	63.0	31.8	7.1	19.7
8	28.11.2025	67.1	33.9	7.5	21.0
Average		66.4	33.4	7.4	20.7
NAAQ Standard 2009		100	60	80	80
Testing Method		IS-5182 (Part-23) 2006 RA 2017	IS-5182 (Part-23) 2019	IS-5182 (Part-2) 2001 RA 2017	IS-5182 (Part-6) 2006 RA 2017


Reviewed by
(Mr. Laxmi Sahoo)



Authorized Signatory
(Mr. Bijaya Kumar Chhapra)

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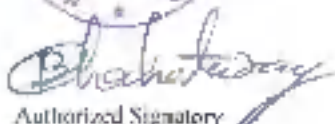
Formal No: WCS/QP/7.8/02

TEST REPORT

Report No : WCS25423101 Issue Date : 04.12.2025
Name of the Client : **Rakkela Iron Ore Mines (M/S Geetpran Mohanty)**
Address : Bailkela, Near Pansa, P.O.-Dengala, Dist- Sundergarh- 730048, Odisha
Co-Ordinate : 24°52'15.44" N 85°14'04.36" E
Sampling Location : **Offlee**
Sample Description : Ambient Air Quality Monitoring
Sampling Plan & Method : WCS/QSP/SAMP (AIR)
Environmental Condition : Clear Weather
Sample Collected by : Debendra Kumar Biswal
Test Performed at : WCS Laboratory
Month of Sampling : November-2025
Quantity of Sample : 8
Sample Condition : Good

Sl. No.	Date of Sampling	CO in (mg/m ³)
1	04.11.2025	0.281
2	07.11.2025	0.267
3	11.11.2025	0.262
4	14.11.2025	0.293
5	18.11.2025	0.291
6	20.11.2025	0.279
7	24.11.2025	0.265
8	28.11.2025	0.282
Average		0.278
NAAQ Standard 2009		4.0
Testing Method		CPCB Guidelines of Ambient Air Pollutants Volume-I&II


Reviewed by
(Miss. Lakshmi Salunkhe)



Authorized Signatory
(Mr. Bijaya Kumar Chakraborty)

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Format No: WCS/OR/7.8/02

Report No.

NABL ULR No.

Name of the Client

Address

Co-Ordinate

Sampling Location

Sample Description

Sampling Plan & Method

Environmental Condition

Sample Collected by

Test Performed at

Month of Sampling

WCS260135A

TC112252600000030P

Rajkela Iron Ore Mines (M/S Geetarani Mahanty)

Rajkela, Near Tensa, P.O.-Dengula, Dist- Sundergarh- 770048 Odisha

11°53'52.14" N 85°11'57.31" E

Neagana

Ambient Air Quality Monitoring

WCS/QSP/SAMP (AIR)

Clear Weather

Debendra Kumar Biswal

WCS Laboratory

December-2025

Issue Date : 05.01.2026

Quantity of Sample : 9

Sample Condition : Good

TEST REPORT

Sl. No.	Date Of Sampling	PM10 in ($\mu\text{g}/\text{m}^3$)	PM2.5 in ($\mu\text{g}/\text{m}^3$)	SO ₂ in ($\mu\text{g}/\text{m}^3$)	NOx in ($\mu\text{g}/\text{m}^3$)
1	01.12.2025	73.7	37.2	8.3	23.1
2	04.12.2025	71.2	36.0	8.0	22.3
3	08.12.2025	67.8	34.2	7.6	21.2
4	11.12.2025	69.6	35.1	7.8	21.8
5	16.12.2025	72.2	36.5	8.1	22.6
6	19.12.2025	69.8	35.2	7.8	21.9
7	22.12.2025	72.4	36.6	8.1	22.7
8	25.12.2025	74.3	37.5	8.3	23.3
9	29.12.2025	67.8	34.2	7.6	21.2
Average		71.0	35.8	7.9	22.2
NAAQ Standard 2009		100	60	80	80
Testing Method		IS-5182 (Part-23) 2006 RA 2017	IS-5182 (Part-23) 2019	IS-5182 (Part-2) 2004 RA 2017	IS-5182 (Part-6) 2006 RA 2017

hs

Reviewed by
(Miss. Laxmi Sahoo)



Bijaya Kumar Chakrabarty

Authorized Signatory
(Mr. Bijaya Kumar Chakrabarty)

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NABL (ISO/IEC 17025:2017 ACCREDITED LABORATORY



WCS
MY WORLD CONSULTANCY SERVICES

Form No: WCS/QB/7.R/02

TEST REPORT

Report No.

WCS260135A

Issue Date : 05.01.2026

Name of the Client

Raibela Iron Ore Mine (M/S Gosthani Minants)

Address

Raibela, Near Tansa, P.O.-Deegula, Dist- Sundargarh- 770048, Odisha

Co-Ordinate

21°43'52.24" N 85°11'37.31" E

Sampling Location

Nagaon

Sample Description

Ambient Air Quality Monitoring

Sampling Plan & Method

WCS/QSP/SAMP (AIR)

Environmental Condition

Clear Weather

Sample Collected by

Debanda Kumar Biswal

Test Performed at

WCS Laboratory

Quantity of Sample

9

Month of Sampling

December-2025

Sample Condition

Good

Sl. No.	Date of Sampling	CO in (mg/m ³)
1	01.12.2025	0.310
2	04.12.2025	0.299
3	08.12.2025	0.285
4	11.12.2025	0.292
5	16.12.2025	0.303
6	19.12.2025	0.293
7	22.12.2025	0.304
8	25.12.2025	0.312
9	29.12.2025	0.285
Average		0.298
NAAQ Standard 2009		4.0
Testing Method		CPCB Guidelines of Ambient Air Pollutants Volume-I&II

Reviewed by
(Miss. Laxmi Sahoo)



Authorized Signatory
(Mr. Bijaya Kumar Chahatany)

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WCS
MY WORLD CONSULTANCY SERVICES

Format No: WCS/QR/7.8/02

Report No.

NABL ULR No.

Name of the Client

Address

Co-Ordinate

Sampling Location

Sample Description

Sampling Plan & Method

Environmental Condition

Sample Collected by

Test Performed at

Month of Sampling

WCS26011511

TC/112252601100010305

Raikela Iron Ore Mines (W/S Geecarani Mohanty)

Raikela, Near Tensa, P.O.-Dengula, Dist- Sundargarh- 750048, Odisha

21°52'03.37" N 85°12'08.49" E

Tentulidih

Ambient Air Quality Monitoring

WCS/QSP/SAMP (AIR)

Clear Weather

Debendra Kumar Biswal

WCS Laboratory

December-2025

TEST REPORT

Issue Date : 05.01.2026

Quantity of Sample : 9

Sample Condition : Good

SL No.	Date Of Sampling	PM10 in ($\mu\text{g}/\text{m}^3$)	PM2.5 in ($\mu\text{g}/\text{m}^3$)	SO ₂ in ($\mu\text{g}/\text{m}^3$)	NOx in ($\mu\text{g}/\text{m}^3$)
1	01.12.2025	75.6	38.2	8.5	23.7
2	04.12.2025	73.0	36.9	8.2	22.9
3	08.12.2025	69.5	35.1	7.8	21.8
4	11.12.2025	71.4	36.0	8.0	22.4
5	16.12.2025	74.0	37.4	8.3	23.2
6	19.12.2025	71.5	36.1	8.0	22.4
7	22.12.2025	74.2	37.5	8.3	23.3
8	25.12.2025	76.2	38.5	8.5	23.9
9	29.12.2025	69.5	35.1	7.8	21.8
Average		72.8	36.8	8.1	22.9
NAAQ Standard 2009		100	60	80	80
Testing Method		IS-5182 (Part-23) 2006 RA 2017	IS-5182 (Part-23) 2019	IS-5182 (Part-2) 2004 RA 2017	IS-5182 (Part-6) 2006 RA 2017

Reviewed by
(Miss. Laxmi Saboo)

Authorized Signatory
(Mr. Bijaya Kumar Chahalary)

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Plot No. 766, Telengapentha, Cuttack-754001
NABL ISO/IEC 17025:2017 ACCREDITED LABORATORY



WCS
MY WORLD CONSULTANCY SERVICES

Format No: WCS/QR/7.8/02

TEST REPORT

Report No. : WCS260135B Issue Date : 05.01.2026
Name of the Client : **Raikela Iron Ore Mines (M/S Geetarani Mohapaty)**
Address : Raikela, Near Tessa, P.O.-Dengula, Dist- Sandargarh- 770048, Odisha
Co-Ordinate : 21°52'03.37" N 85°12'08.49" E
Sampling Location : **Tentulidih**
Sample Description : Ambient Air Quality Monitoring
Sampling Plan & Method : WCS/QSP/SAMP (AIR)
Environmental Condition : Clear Weather
Sample Collected by : Debendra Kumar Biswal
Test Performed at : WCS Laboratory
Month of Sampling : December-2025
Quantity of Sample : 9
Sample Condition : Good

Sl. No.	Date of Sampling	CO in (mg/m ³)
1	01.12.2025	0.318
2	04.12.2025	0.307
3	08.12.2025	0.292
4	11.12.2025	0.300
5	16.12.2025	0.311
6	19.12.2025	0.301
7	22.12.2025	0.312
8	25.12.2025	0.320
9	29.12.2025	0.292
Average		0.306
NAAQ Standard 2009		4.0
Testing Method		CPCB Guidelines of Ambient Air Pollutants Volume-I&II


Reviewed by
(Miss. Laxmi Subhoi)



Authorized Signatory
(Mr. Bijaya Kumar Chaharary)

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WCS
MY WORLD CONSULTANCY SERVICES

Format No: WCS/QR/7.8/02

Report No.

NABL ULR No.

Name of the Client

Address

Co-Ordinate

Sampling Location

Sample Description

Sampling Plan & Method

Environmental Condition

Sample Collected by

Test Performed at

Month of Sampling

WCS260135C

FCF122526000000304

Raikela Iron Ore Mines (M/S Geetarani Mohanty)

Raikela, Near-Tensa, P.O.-Dengula, Dist- Sundargarh- 770048, Odisha

21°52'21.22" N 85°17'12.03" E

Dengula

Ambient Air Quality Monitoring

WCS/QSP/SAMP (AIR)

Clear Weather

Debdanu Kumar Biswal

WCS Laboratory

December-2025

Issue Date 05.01.2026

Quantity of Sample : 0
Sample Condition : Good

TEST REPORT

Sl. No.	Date Of Sampling	PM10 in ($\mu\text{g}/\text{m}^3$)	PM2.5 in ($\mu\text{g}/\text{m}^3$)	SO ₂ in ($\mu\text{g}/\text{m}^3$)	NO _x in ($\mu\text{g}/\text{m}^3$)
1	01.12.2025	72.5	36.6	8.1	22.7
2	04.12.2025	70.0	35.4	7.6	21.9
3	08.12.2025	66.7	33.7	7.3	20.9
4	11.12.2025	68.4	34.6	7.7	21.4
5	16.12.2025	71.0	35.9	7.9	22.2
6	19.12.2025	68.6	34.6	7.7	21.5
7	22.12.2025	71.2	35.9	8.0	22.0
8	25.12.2025	73.0	36.9	8.2	22.9
9	29.12.2025	66.7	33.7	7.5	20.9
Average		69.8	35.2	7.8	21.9
NAAQ Standard 2009		100	60	80	80
Testing Method		IS-5182 (Part-23) 2006 RA 2017	IS-5182 (Part-23) 2019	IS-5182 (Part-3) 2001 RA 2017	IS-5182 (Part-6) 2006 RA 2017

Reviewed by
(Miss. Laxmi Suhan)

Authorized Signatory
(Mr. Bijaya Kumar Chhabaray)

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WCS
MY WORLD CONSULTANCY SERVICES

Form No: WCS-QR/7.8/02

TEST REPORT

Report No. : WCS260135C Issue Date : 05.01.2026
Name of the Client : **Raikela Iron Ore Mines (M/S Geetarani Mohanty)**
Address : Raikela, Near Jensa, P.O.-Dengula, Dist- Sengupta, 770048, Odisha
Co-Ordinate : 21°42'31.32" N 85°12'12.03" E
Sampling Location : **Dengula**
Sample Description : Ambient Air Quality Monitoring
Sampling Plan & Method : WCS/QSP/SAMP (AIR)
Environmental Condition : Clear Weather
Sample Collected by : Debendra Kumar Biswal
Test Performed at : WCS Laboratory
Month of Sampling : December-2025
Quantity of Sample : 9
Sample Condition : Good

Sl. No.	Date of Sampling	CO In (ng/m ³)
1	01.12.2025	0.303
2	04.12.2025	0.294
3	08.12.2025	0.280
4	11.12.2025	0.287
5	16.12.2025	0.298
6	19.12.2025	0.288
7	22.12.2025	0.299
8	25.12.2025	0.307
9	29.12.2025	0.280
Average		0.293
NAAQ Standard 2009		4.0
Testing Method		CPCB Guidelines of Ambient Air Pollutants Volume-I&II

Reviewed by
(Miss. Laxmi Sahoo)



Authorized Signatory
(Mr. Bijay Kumar Chakraborty)

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Plot No. 766, Telengapentha, Cuttack-754001
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WCS
MY WORLD CONSULTANCY SERVICES

Format No: WCS/QIU/7.8/02

Report No.

NABL ULR No.

Name of the Client

Address

Co-ordinate

Sampling Location

Sample Description

Sampling Plan & Method

Environmental Condition

Sample Collected by

Test Performed at

Month of Sampling

WCS2601350

FC1122526000000030F

Raikela Iron Ore Mines (M/S Gutarani Mahanty)

Raikela, Near Genda, P.O.-Dengula, Dist- Sundargarh- 750048, Odisha

21°52'15.44" N 85°11'04.36" E

Office

Ambient Air Quality Monitoring

WCS/QSP/SAMP1/AIR1

Clear Weather

Dehendra Kumar Biswal

WCS Laboratory

December-2025

TEST REPORT

Issue Date 05.01.2026

Quantity of Sample 9

Sample Condition Good

Sl. No.	Date Of Sampling	PM10 in ($\mu\text{g}/\text{m}^3$)	PM2.5 in ($\mu\text{g}/\text{m}^3$)	SO ₂ in ($\mu\text{g}/\text{m}^3$)	NOx in ($\mu\text{g}/\text{m}^3$)
1	01.12.2025	82.0	41.4	9.2	25.7
2	04.12.2025	79.2	40.0	8.9	24.8
3	08.12.2025	75.4	38.1	8.4	23.6
4	11.12.2025	77.4	39.1	8.7	24.3
5	16.12.2025	80.3	40.6	9.0	25.2
6	19.12.2025	77.6	39.2	8.7	24.3
7	22.12.2025	80.5	40.7	9.0	25.2
8	25.12.2025	82.6	41.7	9.2	25.9
9	29.12.2025	75.4	38.1	8.4	23.6
Average		78.9	39.9	8.8	24.7
NAAQ Standard 2009		100	60	80	80
Testing Method		IS-5182 (Part-13) 2006 RA 2017	IS-5182 (Part-23) 2019	IS-5182 (Part-2) 2001 RA 2017	IS-5182 (Part-6) 2006 RA 2017

Reviewed by
(Miss. Lavani Sahoo)

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Authorized Signatory
(Mr. Bijaya Kumar Chahalanay)

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Plot No. 766, Telengapentha, Cuttack-754001
NABL (ISO/IEC 17025:2017) ACCREDITED LABORATORY



WCS
MY WORLD CONSULTANCY SERVICES

Form No: WCSQR/7.1/02

TEST REPORT

Report No. : WCS26011510 Issue Date : 01.01.2026
Name of the Client : Raikela Iron Ore Mines (M/S Geetarnai Mohanty)
Address : Raikela, Near Tensa, P.O.-Dengula, Dist- Sundargarh- 770048, Odisha
Co-Ordinate : 21°32'15.44" N 85°11'04.36" E
Sampling Location : Office
Sample Description : Ambient Air Quality Monitoring
Sampling Plan & Method : WCS/QSP/SAMP (AIR)
Environmental Condition : Clear Weather
Sample Collected by : Debendra Kumar Biswal
Test Performed at : WCS Laboratory Quantity of Sample : 9
Month of Sampling : December-2025 Sample Condition : Good

Sl. No.	Date of Sampling	CO in (mg/m ³)
1	01.12.2025	0.345
2	04.12.2025	0.331
3	08.12.2025	0.317
4	11.12.2025	0.325
5	16.12.2025	0.337
6	19.12.2025	0.326
7	22.12.2025	0.338
8	25.12.2025	0.347
9	29.12.2025	0.347
Average		0.332
NAAQ Standard 2009		4.0
Testing Method		CPCB Guidelines of Ambient Air Pollutants Volume-I&II

Reviewed by
(Miss. Easmi Sahoo)



Authorized Signatory
(Mr. Bijaya Kumar Chohanaray)

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Plot No. 766 Telengapentha, Cuttack-754001
NABL (ISO/IEC 17025:2017) ACCREDITED LABORATORY



WCS
MY WORLD CONSULTANCY SERVICES

Form No. WCS/CM/7.8/02

TEST REPORT

Report No. : WCS260210A
NABL LTR No. : TC112257600000076P
Name of the Client : **Raikelu Iron Ore Mines (M/S Centaroni Mahanty)**
Address : Raikelu, Near Tansa, P.O.-Derpula, Dist- Sandargarh- 751018, Odisha
Co-Ordinate : 21°51'52.24" N 85°11'57.31" E
Sampling Location : **Nungum**
Sample Description : Ambient Air Quality Monitoring
Sampling Plan & Method : WCS/QSP/SAMP (AIR)
Environmental Condition : Clear Weather
Sample Collected by : Dheendra Kumar Biswal
Test Performed at : **WCS Laboratory**
Month of Sampling : January-2026

Issue Date : 03.02.2026

Quantity of Sample : 9
Sample Condition : Good

Sl. No.	Date Of Sampling	PM10 in ($\mu\text{g}/\text{m}^3$)	PM2.5 in ($\mu\text{g}/\text{m}^3$)	SO _x in ($\mu\text{g}/\text{m}^3$)	NO _x in ($\mu\text{g}/\text{m}^3$)
1	01.01.2026	75.8	38.1	8.5	23.7
2	06.01.2026	75.0	36.9	8.2	22.9
3	09.01.2026	77.9	39.4	8.7	24.4
4	12.01.2026	74.2	37.5	8.3	23.2
5	15.01.2026	71.5	36.1	8.0	22.4
6	19.01.2026	73.4	37.0	8.2	23.0
7	22.01.2026	70.2	35.5	7.9	22.0
8	27.01.2026	72.7	36.7	8.1	22.8
9	30.01.2026	69.4	35.1	7.8	21.7
Average		73.1	36.9	8.2	22.9
NAAQ Standard 2009		100	60	80	80
Testing Method		IS-5182 (Part-23) 2006 RA 2017	IS-5182 (Part-23) 2019	IS-5182 (Part-2) 2001 RA 2017	IS-5182 (Part-6) 2006 RA 2017

Reviewed by
(Miss. Lavani Subhoj)



Authorized Signatory
(Mr. Bijaya Kumar Chakraborty)

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- Above Results related only to the Item Tested.



MY WORLD CONSULTANCY SERVICES PRIVATE LIMITED
(Testing Laboratory)

Plot No. 766, Telengapentha, Cuttack-754001
NABL (ISO/IEC 17025:2017) ACCREDITED LABORATORY



WCS
MY WORLD CONSULTANCY SERVICES

Forma No: WCSQR/7.8/02

TEST REPORT

Report No. : WCS260210A Issue Date : 03.02.2026
Name of the Client : Raikola Iron Ore Mines (M/S Geetarani Mahanty)
Address : Raikola, Near Tensat, P.O.-Durgula, Dist- Sundargarh- 750048, Odisha
Co-Ordinate : 21°53'52.24" N 85°11'57.31" E
Sampling Location : Nagason
Sample Description : Ambient Air Quality Monitoring
Sampling Plan & Method : WCS/QSP/SAMP (AIR)
Environmental Condition : Clear Weather
Sample Collected by : Debarupa Kumar Biswal
Test Performed at : WCS Laboratory Quantity of Sample : 9
Month of Sampling : January-2026 Sample Condition : Good

Sl. No.	Date of Sampling	CO in (mg/m ³)
1	01.01.2026	0.318
2	06.01.2026	0.307
3	09.01.2026	0.327
4	12.01.2026	0.312
5	15.01.2026	0.340
6	19.01.2026	0.308
7	22.01.2026	0.293
8	27.01.2026	0.306
9	30.01.2026	0.292
Average		0.307
NAAQ Standard 2009		4.0
Testing Method		CPCB Guidelines of Ambient Air Pollutants Volume-I&II


Reviewed by
(Mr. Laxmi Sahoo)




Authorized Signatory
(Mr. Bijaya Kumar Chahatray)

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(Testing Laboratory)

Plot No. 766, Telengapentha, Cuttack-754001
NABL (ISO/IEC 17025:2017) ACCREDITED LABORATORY



WCS
MY WORLD CONSULTANCY SERVICES

Form No: WCS-QR/7.8/02

TEST REPORT

Report No.

WCS260210H

Issue Date : 03.02.2026

Name of the Client

Raikela Iron Ore Mines (M/S Geetarani Mahanty)

Address

Raikela, Near Tansa, P.O.-Denguli, Dist- Sundargarh- 750048, Odisha

Co-Ordinate

21°52'08.37" N 85°12'08.49" E

Sampling Location

Tentulidih

Sample Description

Ambient Air Quality Monitoring

Sampling Plan & Method

WCS/QSP/SAMP (AIR)

Environmental Condition

Clear Weather

Sample Collected by

Dehendra Kumar Biswal

Test Performed at

WCS Laboratory

Quantity of Sample : 9

Month of Sampling

January-2026

Sample Condition : Good

Sl. No.	Date of Sampling	CO in (ng/m ³)
1	01.01.2026	0.327
2	06.01.2026	0.315
3	09.01.2026	0.336
4	12.01.2026	0.330
5	15.01.2026	0.308
6	19.01.2026	0.316
7	22.01.2026	0.303
8	27.01.2026	0.313
9	30.01.2026	0.299
Average		0.315
NAAQ Standard 2009		4.0
Testing Method		CPCB Guidelines of Ambient Air Pollutants Volume-I&II

Reviewed by
(Miss. Laxmi Subho)



Authorized Signatory
(Mr. Bijay Kumar Chakrabarty)

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WCS
MY WORLD CONSULTANCY SERVICES

Form No: WCS/OR/7.8/02

TEST REPORT

Test Date : 03.02.2026

Report No.

WCS260310C

NABL LIR No.

ITC112252600000000076J

Name of the Client

Railela Iron Ore Mines (M/S Geetanshi Mahanty)

Address

Railela, Near Tansa, P.O.-Dengula, Dist- Sundargarh- 751048, Odisha

Co-Ordinate

21°52'21.23" N 85°12'12.03" E

Sampling Location

Dengula

Sample Description

Ambient Air Quality Monitoring

Sampling Plan & Method

WCS/QSP/SAMP (AIR)

Environmental Condition

Clear Weather

Sample Collected by

Dobendra Kumar Biswal

Test Performed at

WCS Laboratory

Quantity of Sample : 9

Month of Sampling

January-2026

Sample Condition : Good

Sl. No.	Date Of Sampling	PM10 in ($\mu\text{g}/\text{m}^3$)	PM2.5 in ($\mu\text{g}/\text{m}^3$)	SO ₂ in ($\mu\text{g}/\text{m}^3$)	NOx in ($\mu\text{g}/\text{m}^3$)
1	01.01.2026	74.3	37.6	8.3	23.4
2	06.01.2026	71.8	36.3	8.0	22.5
3	09.01.2026	76.6	38.7	8.6	24.0
4	12.01.2026	72.9	36.8	8.2	22.9
5	15.01.2026	70.3	35.5	7.9	22.0
6	19.01.2026	72.1	36.4	8.1	22.6
7	22.01.2026	69.0	34.9	7.7	21.6
8	27.01.2026	71.5	36.1	8.0	22.4
9	30.01.2026	68.2	34.5	7.6	21.4
Average		71.9	36.3	8.1	22.5
NAAQ Standard 2009		100	60	80	80
Testing Method		IS-5182 (Part-23) 2006 RA 2017	IS-5182 (Part-23) 2019	IS-5182 (Part-2) 2001 RA 2017	IS-5182 (Part-6) 2006 RA 2017


Reviewed by
(Miss. Laxmi Sahoo)




Authorized Signatory
(Mr. Bijaya Kumar Chahatanty)

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WCS
MY WORLD CONSULTANCY SERVICES

Format No: WCSQR/7.8/02

TEST REPORT

Report No. : WCS260210C Issue Date : 03.02.2026
Name of the Client : **Raikela Iron Ore Mines (M/S Geetaran Mohanty)**
Address : Raikela, Near Tansa, P.O.-Dengula, Dist- Sundargarh- 770048, Odisha
Co-Ordinate : **21°52'21.32" N 85°12'12.03" E**
Sampling Location : **Dengula**
Sample Description : **Ambient Air Quality Monitoring**
Sampling Plan & Method : **WCS/QSP/SAMP (AIR)**
Environmental Condition : **Clear Weather**
Sample Collected by : **Debendra Kumar Biswa**
Test Performed at : **WCS Laboratory** Quantity of Sample : **9**
Month of Sampling : **January-2026** Sample Condition : **Good**

Sl. No.	Date of Sampling	CO in (mg/m ³)
1	01.01.2026	0.311
2	06.01.2026	0.302
3	09.01.2026	0.322
4	12.01.2026	0.306
5	15.01.2026	0.295
6	19.01.2026	0.303
7	22.01.2026	0.290
8	27.01.2026	0.300
9	30.01.2026	0.287
Average		0.302
NAAQ Standard 2009		4.0
Testing Method		CPCB Guidelines of Ambient Air Pollutants Volume-I&II


Reviewed by
(Miss. Luxmi Sahoo)




Authorized Signatory
(Mr. Bijaya Kumar Chaudhary)

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TEST REPORT

Formal No: WCS/QSP/7,840

Report No:

WUS2602101

Issue Date : 03.02.2026

NABL UJR No:

TC112232610000076J

Name of the Client :

Raikela Iron Ore Mines (M/S Geetarani Mahanty)

Address :

Raikela, Near Tansa, P.O.-Dengula, Dist- Sundargarh- 750048, Odisha

Co-ordinate :

21°52'15.44" N 85°11'04.36" E

Sampling Location :

Office

Sample Description :

Ambient Air Quality Monitoring

Sampling Plan & Method :

WCS/QSP/SAM/ (AIR)

Environmental Condition :

Clear Weather

Sample Collected by :

Debendra Kumar Biswal

Test Performed at :

WCS Laboratory

Quantity of Sample :

9

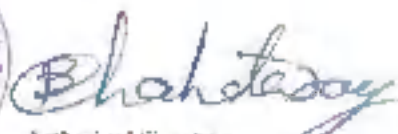
Sample Condition :

Good

SL No.	Date Of Sampling	PM10 in ($\mu\text{g}/\text{m}^3$)	PM2.5 in ($\mu\text{g}/\text{m}^3$)	SO ₂ in ($\mu\text{g}/\text{m}^3$)	NOx in ($\mu\text{g}/\text{m}^3$)
1	01.01.2026	81.3	42.6	9.4	26.4
2	06.01.2026	81.2	41.0	9.1	25.4
3	09.01.2026	86.7	43.8	9.7	27.2
4	12.01.2026	82.5	41.7	9.2	25.9
5	15.01.2026	79.5	40.2	8.9	24.9
6	19.01.2026	81.6	41.2	9.1	25.6
7	22.01.2026	78.1	39.4	8.7	24.5
8	27.01.2026	80.9	40.9	9.1	25.4
9	30.01.2026	77.2	39.0	8.6	24.2
Average		81.1	41.1	9.1	25.5
NAAQ Standard 2009		100	60	80	80
Testing Method		IS-5182 (Part-23) 2006 RA 2017	IS-5182 (Part-23) 2019	IS-5182 (Part-2) 2001 RA 2017	IS-5182 (Part-6) 2006 RA 2017


Reviewed by
(Mr. Laxmi Sahoo)




Authorized Signatory
(Mr. Bijaya Kumar Chahatray)

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WCS
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Formal No: WCS/QR/7.8/02

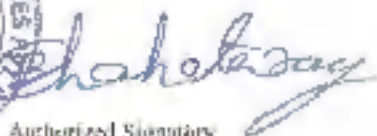
TEST REPORT

Report No. : WCS26021007 Issue Date : 03.02.2026
Name of the Client : **Raikela Iron Ore Mines (M/S Geetarani Mohanty)**
Address : Raikela, Near Tansa, P.O.-Dergula, Dist- Sundargarh- 758048, Odisha
Co-Ordinate : 21°52'13.44" N 85°11'04.36" E
Sampling Location : Office
Sample Description : Ambient Air Quality Monitoring
Sampling Plan & Method : WCS/QSP/SAMP (AIR)
Environmental Condition : Clear Weather
Sample Collected by : Debendra Kumar Biswal
Test Performed at : WCS Laboratory
Month of Sampling : January-2026
Quantity of Sample : 9
Sample Condition : Good

Sl. No.	Date of Sampling	CO in (mg/m ³)
1	01.01.2026	0.354
2	06.01.2026	0.341
3	09.01.2026	0.364
4	12.01.2026	0.347
5	15.01.2026	0.334
6	19.01.2026	0.343
7	22.01.2026	0.328
8	27.01.2026	0.340
9	30.01.2026	0.324
Average		0.342
NAAC Standard 2004		4.0
Testing Method		CPCB Guidelines of Ambient Air Pollutants Volume-4&5


Reviewed by
(Miss. Laxmi Sahoo)




Authorized Signatory
(Mr. Bijaya Kumar Chahalagury)

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Format No: WCS/OR/7.802

Report No.

NABL ULR No.

Name of the Client

Address

Co-Ordinate

Sampling Location

Sample Description

Sampling Plan & Method

Environmental Condition

Sample Collected by

Test Performed at

Month of Sampling

WCS260341A

TC1122526000000140F

Raikela Iron Ore Mines (M/S Geetarani Mohanty)

Raikela, Near Tensa, P.O.-Dangula, Dist- Sundargarh- 770048, Odisha

21°53'52.24" N 85°11'57.31" E

Nuagan

Ambient Air Quality Monitoring

WCS/QSP/SAMP (AIR)

Clear Weather

Tapas Ranjan Patel

WCS Laboratory

February-2026

TEST REPORT

Issue Date : 03.03.2026

Quantity of Sample

8

Sample Condition

Good

Sl. No.	Date Of Sampling	PM10 in ($\mu\text{g}/\text{m}^3$)	PM2.5 in ($\mu\text{g}/\text{m}^3$)	SO ₂ in ($\mu\text{g}/\text{m}^3$)	NOx in ($\mu\text{g}/\text{m}^3$)
1	03.02.2026	72.3	36.6	8.1	22.7
2	05.02.2026	70.9	35.8	7.9	22.2
3	10.02.2026	66.7	33.7	7.5	20.9
4	13.02.2026	74.2	37.5	8.3	23.2
5	16.02.2026	69.8	35.2	7.8	21.9
6	19.02.2026	71.4	36.1	8.0	22.4
7	23.02.2026	68.5	34.6	7.7	21.5
8	26.02.2026	67.4	34.1	7.6	21.1
Average		70.2	35.4	7.9	22.0
NAAQ Standard 2009		100	60	80	80
Testing Method		IS-5182 (Part-23) 2006 RA 2017	IS-5182 (Part-23) 2019	IS-5182 (Part-2) 2001 RA 2017	IS-5182 (Part-6) 2006 RA 2017

Reviewed by
(Miss. Laxmi Suboo)



Authorized Signatory
(Mr. Bijaya Kumar Chahelary)

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WCS
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Format No: WCS/QR/7.8/02

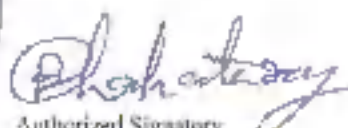
TEST REPORT

Report No. : WC/5260341A Issue Date : 03.03.2026
Name of the Client : Raikela Iron Ore Mines (M/S Geetarani Mohanty)
Address : Raikela, Near Tensa, P.O.-Dengula, Dist- Sundergarh- 770048, Odisha
Co-Ordinate : 21°53'52.24" N 85°11'57.31" E
Sampling Location : Nuagaon
Sample Description : Ambient Air Quality Monitoring
Sampling Plan & Method : WCS/QSP/SAMP (AIR)
Environmental Condition : Clear Weather
Sample Collected by : Tapas Ranjan Patel
Test Performed at : WCS Laboratory
Month of Sampling : February-2026
Quantity of Sample : 8
Sample Condition : Good

Sl. No.	Date of Sampling	CO in (mg/m ³)
1	02.02.2026	0.104
2	03.02.2026	0.298
3	10.02.2026	0.280
4	13.02.2026	0.312
5	16.02.2026	0.293
6	19.02.2026	0.300
7	23.02.2026	0.288
8	26.02.2026	0.283
Average		0.295
NAAQ Standard 2009		4.0
Testing Method		CPCB Guidelines of Ambient Air Pollutants Volume-I&II


Reviewed by
(Miss. Laxmi Sahoo)




Authorized Signatory
(Mr. Bijaya Kumar Chahutary)

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WCS
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Format No: WCSQR/7.0/02

TEST REPORT

Issue Date : 03.03.2026

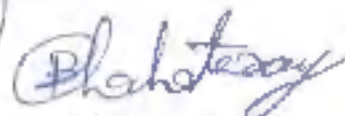
Report No. : WCS260341B
NABL ULR No. : 1C1122526000000140F
Name of the Client : **Raikela Iron Ore Mines (M/S Geetarani Mohanty)**
Address : Raikela, Near Tensa, P.O.-Dengula, Dist- Sundargarh- 758048, Odisha
Co-Ordinate : 21°52'03.37" N 85°12'08.49" E
Sampling Location : **Tentulidih**
Sample Description : Ambient Air Quality Monitoring
Sampling Plan & Method : WCS/QSP/SAMP (AIR)
Environmental Condition : Clear Weather
Sample Collected by : Tapas Ranjan Patel
Test Performed at : WCS Laboratory
Month of Sampling : February-2026

Quantity of Sample : 8
Sample Condition : Good

Sl. No.	Date Of Sampling	PM10 in ($\mu\text{g}/\text{m}^3$)	PM2.5 in ($\mu\text{g}/\text{m}^3$)	SO ₂ in ($\mu\text{g}/\text{m}^3$)	NOx in ($\mu\text{g}/\text{m}^3$)
1	02.02.2026	74.3	37.5	8.3	23.3
2	03.02.2026	72.7	36.7	8.1	22.8
3	04.02.2026	68.4	34.6	7.7	21.4
4	13.02.2026	76.1	38.4	8.5	23.8
5	16.02.2026	71.5	36.1	8.0	22.4
6	19.02.2026	73.2	37.0	8.2	22.9
7	23.02.2026	70.3	35.5	7.9	22.0
8	26.02.2026	69.2	34.9	7.7	21.7
Average		73.0	36.3	8.1	22.6
NAAQ Standard 2009		100	60	80	80
Testing Method		IS-5182 (Part-23) 2006 RA 2017	IS-5182 (Part-23) 2019	IS-5182 (Part-2) 2001 RA 2017	IS-5182 (Part-6) 2006 RA 2017


Reviewed by
(Miss. Laxmi Sahoo)




Authorized Signatory
(Mr. Bijaya Kumar Chahatary)

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Format No- WCS/QR/7.8/02

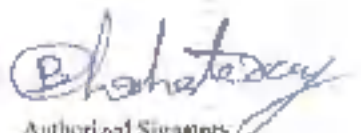
TEST REPORT

Report No. : WCS260341H Issue Date : 03.03.2026
Name of the Client : Raikela Iron Ore Mines (M/S Grestarnai Mohanty)
Address : Raikela, Near Fenna, P.O.-Dengula, Dist- Sundargarh- 758048, Odisha
Co-Ordinate : 21°52'03.37" N 85°12'08.49" E
Sampling Location : Tentulidih
Sample Description : Ambient Air Quality Monitoring
Sampling Plan & Method : WCS/QSP/SAMP (AIR)
Environmental Condition : Clear Weather
Sample Collected by : Tapas Ranjan Patel
Test Performed at : WCS Laboratory Quantity of Sample : 8
Month of Sampling : February-2026 Sample Condition : Good

Sl. No.	Date of Sampling	CO in (mg/m ³)
1	02.02.2026	0.312
2	05.02.2026	0.306
3	10.02.2026	0.287
4	13.02.2026	0.320
5	16.02.2026	0.301
6	19.02.2026	0.308
7	23.02.2026	0.295
8	26.02.2026	0.291
Average		0.302
NAAQ Standard 2009		4.0
Testing Method		CPCB Guidelines of Ambient Air Pollutants Volume-I&II


Reviewed by
(Miss. Laxmi Saloni)




Authorized Signatory
(Mr. Bijaya Kumar Chahatary)

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WCS
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Format No: WCS-QR-7.8/02

Report No.

NABL ULR No.

Name of the Client

Address

Co-Ordinate

Sampling Location

Sample Description

Sampling Plan & Method

Environmental Condition

Sample Collected by

Test Performed at

Month of Sampling

WCS260341C

TC1122526000000140F

Raikela Iron Ore Mines (M/S Geetaranil Mohanty)

Raikela, Near Tensa, P.O.-Dengula, Dist- Sundargarh- 750048, Odisha

21°52'21.22" N 85°12'12.63" E

Dengula

Ambient Air Quality Monitoring

WCS/QSP/SAMP (AIR)

Clear Weather

Tapas Ranjan Patel

WCS Laboratory

February-2026

TEST REPORT

Issue Date : 03.03.2026

Quantity of Sample : 8

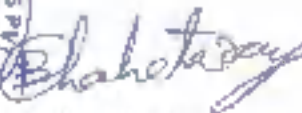
Sample Condition : Good

Sl. No.	Date Of Sampling	PM10 in ($\mu\text{g}/\text{m}^3$)	PM2.5 in ($\mu\text{g}/\text{m}^3$)	SO ₂ in ($\mu\text{g}/\text{m}^3$)	NOx in ($\mu\text{g}/\text{m}^3$)
1	02.02.2026	71.3	36.0	8.0	22.3
2	05.02.2026	69.7	35.2	7.8	21.9
3	10.02.2026	65.6	33.1	7.3	20.6
4	13.02.2026	72.9	36.8	8.2	22.9
5	16.02.2026	68.6	34.6	7.7	21.5
6	19.02.2026	70.2	33.4	7.9	22.0
7	23.02.2026	67.4	34.0	7.5	21.1
8	26.02.2026	66.3	33.5	7.4	20.8
Average		69.0	34.8	7.7	21.6
NCAQ Standard 2009		100	60	80	80
Testing Method		IS-5182 (Part-23) 2006 RA 2017	IS-5182 (Part-23) 2019	IS-5182 (Part-2) 2001 RA 2017	IS-5182 (Part-6) 2006 RA 2017


Reviewed by
(Miss. Laxmi Sahoo)

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Authorized Signatory
(Mr. Bijaya Kumar Chahalaray)

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WCS
MY WORLD CONSULTANCY SERVICES

Format No: WCS/QR/7.8/02

TEST REPORT

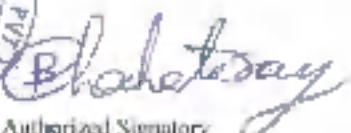
Report No. : WCS260341C Issue Date : 03/03/2026
Name of the Client : Raikela Iron Ore Mines (M/S Geetarani Mohanty)
Address : Raikela, Near Tensa, P.O.-Dengula, Dist- Sandargarh- 770048, Odisha
Co-Ordinate : 21°52'21.22" N 85°12'12.00" E
Sampling Location : Dengula
Sample Description : Ambient Air Quality Monitoring
Sampling Plan & Method : WCS/QSP/SAMP (AIR)
Environmental Condition : Clear Weather
Sample Collected by : Tapas Ranjan Patel
Test Performed at : WCS Laboratory
Month of Sampling : February-2026

Quantity of Sample : 8
Sample Condition : Good

Sl. No.	Date of Sampling	CO in (mg/m ³)
1	02.02.2026	0.299
2	05.02.2026	0.293
3	10.02.2026	0.276
4	13.02.2026	0.306
5	16.02.2026	0.288
6	19.02.2026	0.295
7	23.02.2026	0.281
8	26.02.2026	0.279
Average		0.290
NAAQ Standard 2009		4.0
Testing Method		CPCB Guidelines of Ambient Air Pollutants Volume-1&II


Reviewed by
(Miss. Laxmi Sahoo)




Authorized Signatory
(Mr. Bijaya Kumar Chahatary)

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WCS
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Format No: WCS/QM/7.802

Report No.

NABL ULR No.

Name of the Client

Address

Co-Ordinate

Sampling Location

Sample Description

Sampling Plan & Method

Environmental Condition

Sample Collected by

Test Performed at

Month of Sampling

WCS260341D

TC1121526000009140F

Raikela Iron Ore Mines (M/S Geetarani Mohanty)

Raikela, Near Tensa, P.O.-Dengula, Dist- Sundargarh- 770048, Odisha

21°52'15.44"N 85°11'04.36"E

Office

Ambient Air Quality Monitoring

WCS/QSP/SAMP (AIR)

Clear Weather

Tapas Ranjan Patel

WCS Laboratory

February-2026

Issue Date : 03.03.2026

Quantity of Sample : 8

Sample Condition : Good

TEST REPORT

Sl. No.	Date Of Sampling	PM10 in ($\mu\text{g}/\text{m}^3$)	PM2.5 in ($\mu\text{g}/\text{m}^3$)	SO ₂ in ($\mu\text{g}/\text{m}^3$)	NO _x in ($\mu\text{g}/\text{m}^3$)
1	02.02.2026	80.6	40.7	9.0	25.3
2	05.02.2026	78.9	39.8	8.8	24.7
3	10.02.2026	74.2	37.5	8.3	23.3
4	13.02.2026	82.5	41.7	9.1	25.9
5	16.02.2026	77.6	39.1	8.7	24.3
6	19.02.2026	79.4	40.1	8.9	24.9
7	23.02.2026	76.2	38.5	8.5	23.9
8	26.02.2026	75.0	37.9	8.4	23.5
Average		78.1	39.4	8.7	24.5
NAAQ Standard 2009		100	60	80	80
Testing Method		IS-5182 (Part-3) 2006 RA 2017	IS-5182 (Part-3) 2019	IS-5182 (Part-2) 2001 RA 2017	IS-5182 (Part-6) 2006 RA 2017


Reviewed by
(Miss. Laxmi Sahoo)




Authorized Signatory
(Mr. Bijaya Kumar Chahatray)

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WCS
MY WORLD CONSULTANCY SERVICES

Format No: **WCS-QR/7.8/02**

TEST REPORT

Report No. : **WCS2003411D** Issue Date : **03.03.2026**
Name of the Client : **Raikela Iron Ore Mines (M/S Geetarani Mohanty)**
Address : **Raikela, Near Tensa, P.O.-Dengula, Dist- Sundargarh- 770048, Odisha**
Co-Ordinate : **21°52'15.44" N 85°11'04.36" E**
Sampling Location : **Office**
Sample Description : **Ambient Air Quality Monitoring**
Sampling Plan & Method : **WCS/QSP/SAMP (AIR)**
Environmental Condition : **Clear Weather**
Sample Collected by : **Tapas Ranjan Patel**
Test Performed at : **WCS Laboratory** Quantity of Sample : **8**
Month of Sampling : **February-2026** Sample Condition : **Good**

Sl. No.	Date of Sampling	CO in (mg/m ³)
1	02.02.2026	0.339
2	05.02.2026	0.332
3	10.02.2026	0.312
4	13.02.2026	0.347
5	16.02.2026	0.326
6	19.02.2026	0.334
7	23.02.2026	0.326
8	26.02.2026	0.315
Average		0.328
NAAQ Standard 2009		4.0
Testing Method		CPCB Guidelines of Ambient Air Pollutants Volume-I&II

Reviewed by
(Miss. Laxmi Sahoo)



Authorized Signatory
(Mr. Bijaya Kumar Chahatany)

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WCS
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Format No: WCS/OR/7.8/02

TEST REPORT

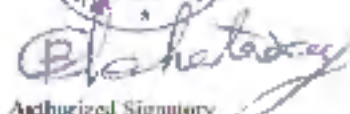
Report No. : WCS260438A
NABL ULR No. : TC112252600000205F
Name of the Client : **Raikela Iron Ore Mines (M/S Geetarani Mohanty)**
Address : Raikela, Near Tensa, P.O.-Dengula, Dist- Sundargarh- 770048, Odisha
Co-Ordinate : 21°53'52.24" N 85°11'57.31" E
Sampling Location : **Nungson**
Sample Description : Ambient Air Quality Monitoring
Sampling Plan & Method : WCS/QSP/SAMP (AIR)
Environmental Condition : Clear Weather
Sample Collected by : Tapas Ranjan Patel
Test Performed at : WCS Laboratory
Month of Sampling : March-2026

Issue Date : 03.04.2026

Quantity of Sample : 9
Sample Condition : Good

Sl. No.	Date Of Sampling	PM10 in ($\mu\text{g}/\text{m}^3$)	PM2.5 in ($\mu\text{g}/\text{m}^3$)	SO ₂ in ($\mu\text{g}/\text{m}^3$)	NO _x in ($\mu\text{g}/\text{m}^3$)
1	02.03.2026	73.4	37.0	8.2	23.0
2	05.03.2026	71.4	36.1	8.0	22.4
3	10.03.2026	68.1	34.4	7.6	21.4
4	13.03.2026	72.1	36.4	8.1	22.6
5	16.03.2026	50.8	25.7	5.7	15.9
6	19.03.2026	60.6	30.6	6.8	19.0
7	23.03.2026	62.2	31.4	7.0	19.5
8	26.03.2026	66.6	33.6	7.5	20.9
9	30.03.2026	73.7	37.2	8.3	23.1
Average		66.5	33.6	7.5	20.9
NAAQ Standard 2009		100	60	80	80
Testing Method		IS-5182 (Part-23) 2006 RA 2017	IS-5182 (Part-23) 2019	IS-5182 (Part-23) 2001 RA 2017	IS-5182 (Part-6) 2006 RA 2017


Reviewed by
(Miss. Laxmi Sahoo)



Authorized Signatory
(Mr. Bijaya Kumar Chahatray)

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WCS
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Format No: WCS/QR/7.8/02

TEST REPORT

Report No. : WCS260438A Issue Date : 03.04.2026
Name of the Client : Raikela Iron Ore Mines (M/S Geelarani Mohanty)
Address : Raikela, Near Tensa, P.O.-Dengula, Dist- Sundargarh- 770048, Odisha
Co-Ordinate : 21°53'52.24" N 85°11'57.31" E
Sampling Location : Nuagaon
Sample Description : Ambient Air Quality Monitoring
Sampling Plan & Method : WCS/QSP/SAMP (AIR)
Environmental Condition : Clear Weather
Sample Collected by : Tapas Ranjan Patel
Test Performed at : WCS Laboratory
Month of Sampling : March-2026
Quantity of Sample : 9
Sample Condition : Good

Sl. No.	Date of Sampling	CO in (mg/m ³)
1	02.03.2026	0.308
2	05.03.2026	0.300
3	10.03.2026	0.286
4	13.03.2026	0.303
5	16.03.2026	0.213
6	19.03.2026	0.255
7	23.03.2026	0.261
8	26.03.2026	0.280
9	30.03.2026	0.310
Average		0.280
NAAQ Standard 2009		4.0
Testing Method		CPCB Guidelines of Ambient Air Pollutants Volume-I&II

Reviewed by
(Miss. Luxmi Sahoo)



Authorized Signatory
(Mr. Bijaya Kumar Chakrabarty)

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WCS
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Formul No: WCS/OR/7.8/02

TEST REPORT

Report No. : WCS260438B Issue Date : 03.04.2026
NABL LDR No. : TC1122526000000305F
Name of the Client : **Raikela Iron Ore Mines (M/S Geetarani Mahanty)**
Address : Raikela, Near Tensa, P.O.-Dengula, Dist- Sundargarh- 770048, Odisha
Co-Ordinate : 21°52'03.37" N 85°12'08.49" E
Sampling Location : **Tentulidih**
Sample Description : Ambient Air Quality Monitoring
Sampling Plan & Method : WCS/QSP/SAMP(AIR)
Environmental Condition : Clear Weather
Sample Collected by : **Tapas Ranjan Patel**
Test Performed at : **WCS Laboratory** Quantity of Sample : 9
Month of Sampling : **March-2026** Sample Condition : **Good**

SL No.	Date Of Sampling	PM ₁₀ in ($\mu\text{g}/\text{m}^3$)	PM _{2.5} in ($\mu\text{g}/\text{m}^3$)	SO ₂ in ($\mu\text{g}/\text{m}^3$)	NO _x in ($\mu\text{g}/\text{m}^3$)
1	02.03.2026	75.2	38.0	8.4	23.6
2	05.03.2026	73.2	37.0	8.2	22.9
3	10.03.2026	69.9	35.3	7.8	21.9
4	13.03.2026	73.9	37.3	8.3	23.2
5	16.03.2026	51.1	26.3	5.8	16.3
6	19.03.2026	62.1	31.4	7.0	19.5
7	23.03.2026	63.8	32.2	7.1	20.0
8	26.03.2026	68.3	34.5	7.7	21.4
9	30.03.2026	75.6	38.2	8.5	23.7
Average		68.2	34.5	7.6	21.4
NAAQ Standard 2009		100	60	80	80
Testing Method		IS-5182 (Part-23) 2006 RA 2017	IS-5182 (Part-23) 2019	IS-5182 (Part-2) 2001 RA 2017	IS-5182 (Part-6) 2006 RA 2017


Reviewed by
(Miss. Laxmi Sahoo)


Authorized Signatory
(Mr. Bijaya Kumar Chahatary)

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WCS
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Format No: WCS/QR/7.8/02

TEST REPORT

Report No. : WCS26438B Issue Date : 01.04.2026
Name of the Client : **Raikela Iron Ore Mines (M/S Grestarani Mohanty)**
Address : Raikela, Near Tensa, P.O.-Dengula, Dist- Sundargarh- 770048, Odisha
Co-Ordinate : 21°52'03.37" N 85°12'08.49" E
Sampling Location : **TentulMihl**
Sample Description : Ambient Air Quality Monitoring
Sampling Plan & Method : WCS/QSP/SAMP (AIR)
Environmental Condition : Clear Weather
Sample Collected by : Tapas Ranjan Patel
Test Performed at : WCS Laboratory
Month of Sampling : March-2026
Quantity of Sample : 9
Sample Condition : Good

Sl. No.	Date of Sampling	CO in (mg/m ³)
1	02.03.2026	0.316
2	05.03.2026	0.308
3	10.03.2026	0.294
4	13.03.2026	0.311
5	16.03.2026	0.219
6	19.03.2026	0.261
7	23.03.2026	0.268
8	26.03.2026	0.287
9	30.03.2026	0.318
Average		0.287
NAAQ Standard 2009		4.0
Testing Method		CPCB Guidelines of Ambient Air Pollutants Volume-I&II

Reviewed by
(Miss. Laxmi Sahoo)



Authorized Signatory
(Mr. Bijaya Kumar Chahumary)

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Format No: WCS-QR/7.0/02

Report No.

NABL LIR No.

Name of the Client

Address

Co-Ordinate

Sampling Location

Sample Description

Sampling Plan & Method

Environmental Condition

Sample Collected by

Test Performed at

Month of Sampling

WCS260438C

TC11225264K000002051

Raikola Iron Ore Mines (M/S Geetaraai Mohanty)

Raikola, Near Tansa, P.O.-Dengula, Dist- Sundargarh- 750048, Odisha

21°52'21.22" N 85°12'12.03" E

Dengula

Ambient Air Quality Monitoring

WCS/QSP/SAMP(AIR)

Clear Weather

Tapas Ranjan Patel

WCS Laboratory

March-2026

TEST REPORT

Issue Date : 03.04.2026

Quantity of Sample : 9

Sample Condition : Good

Sl. No.	Date Of Sampling	PM10 in ($\mu\text{g}/\text{m}^3$)	PM2.5 in ($\mu\text{g}/\text{m}^3$)	SO ₂ in ($\mu\text{g}/\text{m}^3$)	NOx in ($\mu\text{g}/\text{m}^3$)
1	02.03.2026	72.1	36.4	8.1	22.6
2	05.03.2026	70.2	35.4	7.9	22.0
3	10.03.2026	67.0	33.8	7.5	21.0
4	13.03.2026	70.9	35.8	7.9	22.2
5	16.03.2026	49.9	23.2	5.6	15.7
6	19.03.2026	59.6	30.1	6.7	18.7
7	23.03.2026	61.2	30.9	6.9	19.2
8	26.03.2026	65.5	33.1	7.3	20.5
9	30.03.2026	71.3	36.6	8.1	22.7
Average		65.4	33.0	7.3	20.3
NAAQ Standard 2009		100	60	80	80
Testing Method		IS-5182 (Part-23) 2006 RA 2017	IS-5182 (Part-23) 2019	IS-5182 (Part-2) 2001 RA 2017	IS-5182 (Part-6) 2006 RA 2017

Reviewed by
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WCS
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Format No: WCS/QR/7.8/02

TEST REPORT

Report No. : WCS260438C Issue Date : 03.04.2026
Name of the Client : **Raikela Iron Ore Mines (M/S Geetarani Mohanty)**
Address : Raikela, Near Tensa, P.O.-Dengula, Dist- Sundargarh- 770048, Odisha
Co-Ordinate : 21°52'21.22" N 85°12'12.03" E
Sampling Location : Dengula
Sample Description : Ambient Air Quality Monitoring
Sampling Plan & Method : WCS/QSP/SAMP (AIR)
Environmental Condition : Clear Weather
Sample Collected by : Tapas Ranjan Patel
Test Performed at : WCS Laboratory
Month of Sampling : March-2026
Quantity of Sample : 9
Sample Condition : Good

Sl. No.	Date of Sampling	CO in (mg/m ³)
1	02.03.2026	0.303
2	05.03.2026	0.295
3	10.03.2026	0.282
4	11.03.2026	0.298
5	16.03.2026	0.210
6	19.03.2026	0.250
7	23.03.2026	0.257
8	26.03.2026	0.275
9	30.03.2026	0.305
Average		0.275
NAAQ Standard 2009		4.0
Testing Method		CPCB Guidelines of Ambient Air Pollutants Volume-I&II


Reviewed by
(Miss. Laxmi Sahoo)



Authorized Signatory
(Mr. Bijaya Kumar Chaitanya)

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TC-11225



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WCS
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Format No: WCS/OR/7.8/02

TEST REPORT

Report No.

WCS261438D

Issue Date : 03.04.2026

NABL UIR No.

TC1122526000000205F

Name of the Client

Raikela Iron Ore Mines (M/S Geetarani Mohanty)

Address

Raikela, Near Tansa, P.O.-Dengula, Dist- Sundargarh- 753048, Odisha

Co-Ordinate

21°52'15.44" N 85°11'04.36" E

Sampling Location

Office

Sample Description

Ambient Air Quality Monitoring

Sampling Plan & Method

WCS/QSP/SAMP (AIR)

Environmental Condition

Clear Weather

Sample Collected by

Tapas Ranjan Patel

Test Performed at

WCS Laboratory

Quantity of Sample : 9

Month of Sampling

March-2026

Sample Condition : Good

Sl. No.	Date Of Sampling	PM10 in ($\mu\text{g}/\text{m}^3$)	PM2.5 in ($\mu\text{g}/\text{m}^3$)	SO ₂ in ($\mu\text{g}/\text{m}^3$)	NOx in ($\mu\text{g}/\text{m}^3$)
1	02.03.2026	81.6	41.2	9.1	25.6
2	05.03.2026	79.4	40.1	8.9	24.9
3	10.03.2026	75.8	38.3	8.5	23.8
4	13.03.2026	80.2	40.5	9.0	25.1
5	16.03.2026	56.5	28.5	6.3	17.7
6	19.03.2026	67.4	34.0	7.5	21.1
7	23.03.2026	69.2	34.9	7.1	21.7
8	26.03.2026	74.1	37.4	8.3	23.2
9	30.03.2026	82.0	41.4	9.2	25.7
Average		74.0	37.4	8.1	23.2
NAAQ Standard 2009		100	60	80	60
Testing Method		IS-4182 (Part-23) 2006 RA 2017	IS-5182 (Part-23) 2019	IS-5182 (Part-2) 2001 RA 2017	IS-5182 (Part-6) 2006 RA 2017

Reviewed by
(Miss. Laxmi Sahoo)

Authorized Signatory
(Mr. Bijaya Kumar Chaharary)

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WCS
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Format No: WCSQR/7.8/02

TEST REPORT

Report No. : WCS260438D Issue Date : 03.04.2026
Name of the Client : Raikela Iron Ore Mines (M/S Geetaranj Mohanty)
Address : Raikela, Near Tensa, P.O.-Dengula, Dist- Sundargarh- 750048, Odisha
Co-Ordinate : 21°52'15.44" N 85°11'04.36" E
Sampling Location : Office
Sample Description : Ambient Air Quality Monitoring
Sampling Plan & Method : WCS/QSP/SAMP (AIR)
Environmental Condition : Clear Weather
Sample Collected by : Tapas Ranjan Patel
Test Performed at : WCS Laboratory
Month of Sampling : March-2026
Quantity of Sample : 9
Sample Condition : Good

Sl. No.	Date of Sampling	CO In (mg/m ³)
1	02.03.2026	0.343
2	05.03.2026	0.334
3	10.03.2026	0.318
4	13.03.2026	0.337
5	16.03.2026	0.237
6	19.03.2026	0.283
7	23.03.2026	0.291
8	26.03.2026	0.311
9	30.03.2026	0.345
Average		0.311
NAAQ Standard 2009		4.0
Testing Method		CPCB Guidelines of Ambient Air Pollutants Volume-I&II


Reviewed by
(Miss. Laxmi Sahoo)


Authorized Signatory
(Mr. Bijaya Kumar Chaharany)

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Form No: WCS/QR/7.8/02

TEST REPORT

Issue Date : 03.11.2025

Report No. : WCS231088A
NABL ULR No. : TCT12252508000398F
Name of the Client : **Raikola Iron Ore Mines (M/S Coetarani Mahanty)**
Address : Raikola, Near Tamsa, P.O.-Dengulu, Dist- Sunabagarh- 756048, Odisha
Co-Ordinate : 22°00'27.88" N 85°44'38.11" E
Sampling Location : **Mines Face**
Sample Description : Fugitive Emission
Sampling Plan & Method : WCS/QSP/SAMP (AIR)
Environmental Conditions : Light Rain
Sample Collected by : Debendra Kumar Biswal
Test Performed at : WCS Laboratory
Month of Sampling : October-2025

Quantity of Sample : 9
Sample Condition : Good

Sl. No.	Date Of Sampling	SPM in ($\mu\text{g}/\text{m}^3$)
1	03.10.2025	284
2	06.10.2025	170
3	10.10.2025	256
4	14.10.2025	308
5	17.10.2025	349
6	21.10.2025	326
7	24.10.2025	306
8	27.10.2025	287
9	31.10.2025	250
Average		282
Standard		1200.0
Testing Method		IS-5182 (Part-4) 1999 ISA 2019

Reviewed by
(Miss. Lakshmi Sahoo)

Authorized Signatory
(Mr. Bijaya Kumar Lohakortany)

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Form No: WCS/QR-7.8/02

Report No.

NABL DIR No.

Name of the Client

Address

Co-Ordinate

Sampling Location

Sample Description

Sampling Plan & Method

Environmental Condition

Sample Collected by

Test Performed at

Month of Sampling

WCS2511080

IC1122424000003988

Raikela Iron Ore Mines (M/S Gopuram) Mahanty)

Raikela, Near Tansa, P.O.-Dhangala, Dist- Sundergarh- 770048, Odisha

22°00'62.59" N 85°44'69.34" E

Haul Road

Fugitive Emission

WCS/QSP/SAMP (AIR)

Light Rain

Dehendry Kumar Biswal

WCS Laboratory

October-2023

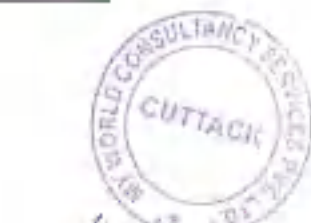
TEST REPORT

Issue Date : 03.11.2023

Quantity of Sample : 9
Sample Condition : Cooled

Sl. No.	Date Of Sampling	SPM In ($\mu\text{g}/\text{m}^3$)
1	03.10.2023	270
2	06.10.2023	104
3	10.10.2023	293
4	14.10.2023	352
5	17.10.2023	399
6	21.10.2023	372
7	24.10.2023	350
8	27.10.2023	328
9	31.10.2023	286
Average		316
Standard		1200.0
Testing Method		IS-5182 (Part-4) 1999 RA 2019

Reviewed by
(Miss. Laxmi Saboo)



Authorized Signatory
(Mr. Bijaya Kumar Chahalaray)

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Format No. WCS/QR/7.8/02

TEST REPORT

Issue Date : 03.11.2025

Report No. : WCS251108C

NABL ULR No. : FCEI 22525000003481

Name of the Client : **Raikela Iron Ore Mines (M/S Geelaraal Mohanty)**

Address : Raikela, Near Tansa, P.O.-Dengola, Dist- Sundargarh- 750048, Odisha

Co-Ordinate : 22°09'33.75"N 85°44'32.07"E

Sampling Location : **Crushing & Screening Plant**

Sample Description : Fugitive Emission

Sampling Plan & Method : WCS/QSE/SAMP (AIR)

Environmental Condition : Light Rain

Sample Collected by : Debidutta Kumar Biswal

Test Performed at : WCS Laboratory

Month of Sampling : October-2025

Quantity of Sample : 9

Sample Condition : Good

Sl. No.	Date Of Sampling	SPM In ($\mu\text{g}/\text{m}^3$)
1	03.10.2025	202
2	06.10.2025	146
3	10.10.2025	220
4	14.10.2025	264
5	17.10.2025	299
6	21.10.2025	279
7	24.10.2025	263
8	27.10.2025	246
9	31.10.2025	215
Average		237
Standard		1200.0
Testing Method		IS-5182 (Part-6) (1999) RA 2010

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Reviewed by
(Miss. Lasmi Sahoo)



Bijaya Kumar Choudhary

Authorized Signatory
(Mr. Bijaya Kumar Choudhary)

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Formal No. : WCS/QR/7.8/02

Report No. :

NABL LTR No. :

Name of the Client :

Address :

Co-Ordinate :

Sampling Location :

Sample Description :

Sampling Plan & Method :

Environmental Condition :

Sample Collected by :

Test Performed at :

Month of Sampling :

WCS2540080

TC112252500003981

Raikela Iron Ore Mines (M/S Gaelarani Mohanty)

Raikela, Near Tansa, P.O.-Dengula, Dist- Sundargarh- 770048, Odisha

22°00'16.91" N 85°44'51.51" E

Mines Gate

Fugitive Emission

WCS/QSP/SAMP (AIR)

Light Rain

Debdendra Kumar Biswal

WCS Laboratory

October-2025

TEST REPORT

Issue Date : 03.11.2025

Quantity of Sample : 9
Sample Condition : Good

Sl. No.	Date Of Sampling	SPM in ($\mu\text{g}/\text{m}^3$)
1	03.10.2025	188
2	06.10.2025	135
3	10.10.2025	204
4	14.10.2025	245
5	17.10.2025	278
6	21.10.2025	259
7	24.10.2025	344
8	27.10.2025	229
9	31.10.2025	199
Average		220
Standard		1200.0
Testing Method		IS-5183 (Part-4) 1999 RA 2019

Reviewed by
(Miss. Laxmi Sahoo)



Authorized Signatory
(Mr. Bijaya Kumar Chaharany)

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Form No. WCS/QIR/7.8/02

TEST REPORT

Issue Date : 03.11.2025

Report No. : WCS251108E

NABL ULR No. : LUT12252300000398F

Name of the Client : **Raikela Iron Ore Mines (M/S Gostarani Mohanty)**

Address : Raikela, Near Tensa, P.O.-Dengulu, Dist.-Sundargarh- 770048, Odisha

Co-Ordinate : 22°00'77.72" N 85°44'73.23" E

Sampling Location : **Ore storage & Loading**

Sample Description : Fugitive Emission

Sampling Plan & Method : WLS/QSP/SAMP (AIR)

Environmental Condition : Light Rain

Sample Collected by : Debendra Kumar Biswal

Test Performed at : WCS Laboratory

Month of Sampling : October-2025

Quantity of Sample : 4

Sample Condition : Good

Sl. No.	Date Of Sampling	SPM in (µg/m ³)
1	03.10.2025	265
2	06.10.2025	191
3	10.10.2025	288
4	14.10.2025	345
5	17.10.2025	392
6	21.10.2025	366
7	24.10.2025	344
8	27.10.2025	322
9	31.10.2025	281
Average		310
Standard		1200.0
Testing Method		IS-5182 (Part-4) 1999 RA 2019



Reviewed by
(Miss. Laxmi Sahoo)



Authorized Signature
(Mr. Bijaya Kumar Chakraborty)

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Form No: WCS/QR/7.8/02

TEST REPORT

Issue Date : 03.11.2025

Report No. : WCS251108F
 NABL U.R. No. : TC12252500003981
 Name of the Client : **Railela Iron Ore Mines (M/S Geetacadi Mahanty)**
 Address : Railela, Near Tensa, P.O.-Dangula, Dist- Sundargarh- 750048, Odisha
 Co-Ordinate : 22°10'54.59" N 85°14'75.25" E
 Sampling Location : **Waste Dump**
 Sample Description : Fugitive Emission
 Sampling Plan & Method : WCS/QSP/SAMP (A10)
 Environmental Condition : Light Rain
 Sample Collected by : Debendra Kumar Basal
 Test Performed at : WCS Laboratory
 Month of Sampling : October-2025

Quantity of Sample : 9
 Sample Condition : Good

Sl. No.	Date Of Sampling	SPM In ($\mu\text{g}/\text{m}^3$)
1	03.10.2025	227
2	06.10.2025	163
3	10.10.2025	246
4	14.10.2025	295
5	17.10.2025	335
6	21.10.2025	313
7	24.10.2025	294
8	27.10.2025	275
9	31.10.2025	240
Average		265
Standard		1280.0
Testing Method		IS-5182 (Part-4) 1999 RA 2019



Reviewed by
 (Miss. Laxmi Sahoo)




Authorized Signatory
 (Mr. Bijaya Kumar Chaharay)

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Format No: WCS/QR/2802

TEST REPORT

Report No. : WCS251234A
NABL ULR No. : FCI1225256000004431
Name of the Client : **Raikela Iron Ore Mines (M/S Geetarani Mahanty)**
Address : Raikela, Near Tansa, P.O.-Dhengula, Dist.- Sundargarh- 750048, Odisha
Co-Ordinate : 22°10'37.88" N 85°44'38.11" E
Sampling Location : **Mines Face**
Sample Description : Fugitive Emission
Sampling Plan & Method : WCS/QSP/SAMP (AIR)
Environmental Condition : Clear Weather
Sample Collected by : Laxendra Kumar Biswal
Test Performed at : WCS Laboratory
Month of Sampling : November-2025

Issue Date : 04.12.2025

Quantity of Sample : 8
Sample Condition : Good

SL No.	Date Of Sampling	SPM in ($\mu\text{g}/\text{m}^3$)
1	04.11.2025	465
2	07.11.2025	370
3	11.11.2025	365
4	14.11.2025	403
5	18.11.2025	398
6	20.11.2025	384
7	24.11.2025	368
8	28.11.2025	389
Average		392
Standard		1240.0
Testing Method		IS-5162 (Part-4) 1999 IIA 2019

Reviewed by
(Mrs. Laxmi Sahoo)



Authorized Signatory
(Mr. Bijaya Kumar Chakrabarty)

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Format No: WCS/OR/7.8/02

TEST REPORT

Report No. : WCS251234B
NABL ULN No. : TC11255250000043F
Name of the Client : Raikela Iron Ore Mines (M/S Geetarani Mohanty)
Address : Raikela, Near Tensa, P.O.-Exangula, Dist- Sundargarh- 750018, Odisha
Co-Ordinate : 22°09'62.59" N 85°44'69.34" E
Sampling Location : Haul Road
Sample Description : Fugitive Emission
Sampling Plan & Method : WCS/QSP/SAMP (AIR)
Environmental Condition : Clear Weather
Sample Collected by : Dehendra Kumar Biswal
Test Performed at : WCS Laboratory
Month of Sampling : November-2025

Issue Date : 04.12.2025

Quantity of Sample : 8
Sample Condition : Good

Sl. No.	Date of Sampling	SPM in ($\mu\text{g}/\text{m}^3$)
1	04.11.2025	441
2	07.11.2025	423
3	11.11.2025	417
4	14.11.2025	460
5	18.11.2025	455
6	20.11.2025	439
7	24.11.2025	420
8	28.11.2025	443
Average		437
Standard		1209.6
Testing Method		IS-5182 (Part-1) 1999 IZA 2019

Reviewed by
(Miss. Laxmi Sahoo)



Authorized Signatory
(Mr. Bijaya Kumar Chhannaray)

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Formal No. WCS/QR/7.8/02

TEST REPORT

Issue Date : 04.12.2025

Report No. : WCS251234C

NABL ULR No. : LC112252500000443F

Name of the Client : Raikela Iron Ore Mines (M/S Geetarani Mahanty)

Address : Raikela, Near Jansa, P.O.-Dengula, Dist- Sundargarh- 750048, Odisha

Co-Ordinate : 22°00'73.75" N 85°14'42.97" E

Sampling Location : Crushing & Screening Plant

Sample Description : Fugitive Emission

Sampling Plan & Method : WCS/QSP/SAMP (AIR)

Environmental Condition : Clear Weather

Sample Collected by : Dehendra Kumar Biswal

Test Performed at : WCS Laboratory

Month of Sampling : November-2025

Quantity of Sample : 8
Sample Condition : Good

Sl. No.	Date Of Sampling	SPM in ($\mu\text{g}/\text{m}^3$)
1	04.11.2025	331
2	07.11.2025	317
3	11.11.2025	312
4	14.11.2025	342
5	18.11.2025	311
6	20.11.2025	319
7	24.11.2025	315
8	28.11.2025	332
Average		328
Standard		1200.0
Testing Method		IS-5182 (Part-4) 1999 RA 2019

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Reviewed by
(Miss. Lexmi Sahani)



Bijaya Kumar Chhatrapati

Authorized Signatory
(Mr. Bijaya Kumar Chhatrapati)

***** END OF REPORT *****

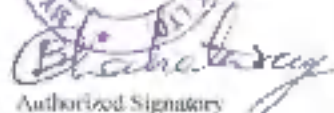
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Format No.: WCS/OR.7.8/02
 Report No.: WCS251234D
 NABL ULR No.: TC1122525000100443F
 Name of the Client: **Ralkela Iron Ore Mines (M/S Geetarani Mahanty)**
 Address: Ralkela, Near Tansa, P.O.-Dungula, Dist- Sundargarh- 750018, Odisha
 Co-Ordinate: 22°00'46.91" N 83°44'41.51" E
 Sampling Location: **Mines Gate**
 Sample Description: Fugitive Emission
 Sampling Plan & Method: WCS/QSP/SAMP (AIR)
 Environmental Condition: Clear Weather
 Sample Collected by: Debedra Kumar Hissari
 Test Performed at: WCS Laboratory
 Month of Sampling: November-2025
 Issue Date: 14.12.2025
 Quantity of Sample: 8
 Sample Condition: Good

Sl. No.	Date Of Sampling	SPM in ($\mu\text{g}/\text{m}^3$)
1	04.11.2025	307
2	07.11.2025	294
3	11.11.2025	290
4	14.11.2025	321
5	18.11.2025	317
6	20.11.2025	306
7	24.11.2025	293
8	28.11.2025	308
Average		304
Standard		120.11
Testing Method		IS-5182 (Part-4) 1999 RA 2019


 Reviewed by
 (Miss. Laxmi Sakar)



 Authorized Signatory
 (Mr. Bijaya Kumar Chhannaray)

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Form No: WCS/MR/7.8/02

TEST REPORT

Report No.

WCS251234E

Issue Date

04.12.2025

NABL ID No.

TC112252500000443F

Name of the Client

Raikela Iron Ore Mines (M/S Geetaxari Mihanji)

Address

Raikela, Near Tansa, P.O. - Dengra, Dist- Sundargarh- 750048, Odisha

Co-Ordinate

22°00'77.72" N 85°44'23.21" E

Sampling Location

Ore storage & Loading

Sample Description

Fugitive Emission

Sampling Plan & Method

WCS:QSP/SAMP (AIRC)

Environmental Condition

Clear Weather

Sample Collected by

Debdutta Kumar Biswal

Test Performed at

WCS Laboratory

Quantity of Sample

8

Month of Sampling

November-2025

Sample Condition

Good

SL No.	Date Of Sampling	SPM in ($\mu\text{g}/\text{m}^3$)
1	04.11.2025	433
2	07.11.2025	435
3	11.11.2025	409
4	14.11.2025	452
5	18.11.2025	447
6	20.11.2025	431
7	24.11.2025	413
8	28.11.2025	435
Average		429
Standard		1200.0
Testing Method		IS-5182 (Part-4) 1999 RA 2019

Reviewed by

(Miss. Tasmi Saha)

Authorized Signatory

(Mr. Bijaya Kumar Chahalany)

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Formal No: WCS/OR/7.8/02

TEST REPORT

Report No. : WL/S251234P
NABL ULR No. : LU11225250R00K0443
Name of the Client : **Raikela Iron Ore Mines (M/S Gecharani Mahanty)**
Address : Raikela, Near Tansa, P.O. Denguta, Dist- Sundargarh- 750048, Odisha
Geo-Ordinate : 22°00'64.59" N 85°44'75.25" E
Sampling Location : **Waste Dump**
Sample Description : Fugitive Emission
Sampling Plan & Method : WCS/QSP/SAMP (AIR)
Environmental Conditions : Clear Weather
Sample Collected by : Debendra Kumar Biswal
Test Performed at : WCS Laboratory
Month of Sampling : November-2025

Issue Date : 04.12.2025

Quantity of Sample : 8
Sample Condition : Good

Sl. No.	Date Of Sampling	SPM in ($\mu\text{g}/\text{m}^3$)
1	04.11.2025	370
2	07.11.2025	355
3	11.11.2025	350
4	14.11.2025	386
5	18.11.2025	382
6	20.11.2025	368
7	24.11.2025	353
8	28.11.2025	372
Average		367
Standard		1200.0
Testing Method		IS-5182 (Part-4) 1999 RA 2019

Reviewed by
(Miss. Laxmi Sahoo)



Authorized Signatory
(Mr. Bijaya Kumar Chinturay)

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Format No: WCS/QMT.8/02

Report No.

NABL ULR No.

Name of the Client

Address

Co-Ordinate

Sampling Location

Sample Description

Sampling Plan & Method

Environmental Condition

Sample Collected by

Test Performed at

Month of Sampling

WCS260136A

FC1122526000000031F

Raikala Iron Ore Mines (M/S Geetarani Mahapaty)

Raikala, Near Terna, P.O.-Dengala, Dist- Sundargarh- 770048, Odisha

22°00'77.88" N 85°44'88.11" E

Mines Face

Fugitive Emission

WCS/QSP/SAMP (AIR)

Clear Weather

Debendra Kumar Biswal

WCS Laboratory

December-2025

TEST REPORT

Issue Date : 05.01.2026

Quantity of Sample : 9
Sample Condition : Good

Sl. No.	Date Of Sampling	SPM ₁₀ ($\mu\text{g}/\text{m}^3$)
1	01.12.2025	484
2	04.12.2025	467
3	08.12.2025	445
4	11.12.2025	457
5	16.12.2025	474
6	19.12.2025	458
7	22.12.2025	403
8	25.12.2025	487
9	29.12.2025	445
Average		458
Standard		1200.8
Testing Method		IS-5182 (Part-4) 1999 RA 2019

Reviewed by
(Miss. Laxmi Sahoo)



Authorized Signatory
(Mr. Bijaya Kumar Chahatary)

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Form No: WCS/QM/7.8/02

Report No.

NABL LIR No.

Name of the Client

Address

Co-Ordinate

Sampling Location

Sample Description

Sampling Place & Method

Environmental Condition

Sample Collected by

Test Performed at

Month of Sampling

WCS3601348

TC1122526000000311

Railela Iron Ore Mines (M/S Geetarani Mahanty)

Railela, Near Tenda, P.O.-Dengala, Dist- Sundargarh- 750048, Odisha

22°00'62.59"N 85°44'69.34"E

Haul Road

Fugitive Emission

WCS/QSP/SAMP LAIRI

Clear Weather

Debendra Kumar Biswal

WCS Laboratory

December-2025

TEST REPORT

Issue Date : 05.01.2026

Quantity of Sample : 0
Sample Condition : Good

Sl. No.	Date Of Sampling	SPM is (µg/m ³)
1	01.12.2025	467
2	04.12.2025	451
3	08.12.2025	430
4	11.12.2025	441
5	16.12.2025	458
6	19.12.2025	442
7	22.12.2025	389
8	25.12.2025	471
9	29.12.2025	430
Average		442
Standard		1200.0
Testing Method		IS-5182 (Part-4) 1999 RA 2019

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Reviewed by
(Miss. Laxmi Sahoo)

Mr. Bijaya Kumar Chaharasy

Authorized Signatory
(Mr. Bijaya Kumar Chaharasy)

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WCS
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TC-11225

Format No: WCS/QR/7.8/02

Report No.

NABL ULR No.

Name of the Client

Address

Co-Ordinate

Sampling Location

Sample Description

Sampling Plan & Method

Environmental Condition

Sample Collected by

Test Performed at

Month of Sampling

WCS260136C

TC1122526000000031F

Raikela Iron Ore Mines (M/S Geetarani Mohanty)

Raikela, Near Tansa, P.O.-Dunguta, Dist- Sundargarh- 770048, Odisha

22°08'73.75" N 85°44'42.07" E

Crushing & Screening Plant

Fugitive Emission

WCS/QSP/SAMP(AIR)

Clear Weather

Debasini Kumar Biswal

WCS Laboratory

December-2025

TEST REPORT

Issue Date : 05.01.2026

Quantity of Sample : 9

Sample Condition : Good

Sl. No.	Date Of Sampling	SPM In ($\mu\text{g}/\text{m}^3$)
1	01.12.2025	353
2	04.12.2025	341
3	08.12.2025	324
4	11.12.2025	333
5	16.12.2025	345
6	19.12.2025	334
7	22.12.2025	294
8	24.12.2025	355
9	29.12.2025	324
Average		334
Standard		1200.0
Testing Method		IS-5182 (Part-4) 1999 RA 2019


Reviewed by
(Miss. Laxmi Sahoo)


Authorized Signatory
(Mr. Bijaya Kumar Chakraborty)

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WCS
MY WORLD CONSULTANCY SERVICES

Formul No: WCS/OR/1.8/02

Report No

NABL UIR No.

Name of the Client

Address

Co-Ordinate

Sampling Location

Sample Description

Sampling Place & Method

Environmental Condition

Sample Collected by

Test Performed at

Month of Sampling

WCS2601360

TC1422526000000311

Railela Iron Ore Mines (M/S Ganesan Mahanty)

Railela, Near Temra, P.O.-Dengra, Dist-Sundergarh, 750048, Odisha

22°30'46.91" N 85°44'41.51" E

Mines Gate

Fugitive Emission

WCS/QSP/SAMP (AIR)

Clear Weather

Debendra Kumar Biswal

WCS Laboratory

December-2025

TEST REPORT

Issue Date : 05.01.2026

Quantity of Sample : 9
Sample Condition : Good

Sl. No.	Date Of Sampling	SPM in ($\mu\text{g}/\text{m}^3$)
1	01.12.2025	328
2	04.12.2025	317
3	08.12.2025	302
4	11.12.2025	314
5	16.12.2025	321
6	19.12.2025	310
7	22.12.2025	273
8	25.12.2025	330
9	29.12.2025	302
Average		310
Standard		1200.0
Testing Method		IS-5182 (Part-4) 1999 RA 2019

Ms

Reviewed by
(Miss. Laxmi Sahoo)

Shahaboy

Authorized Signatory
(Mr. Bijaya Kumar Chaudhary)

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TC-11225

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MY WORLD CONSULTANCY SERVICES

Format No: WCS/QR/7.8/02

Report No.

NABL ULR No.

Name of the Client

Address

Co-Ordinate

Sampling Location

Sample Description

Sampling Plan & Method

Environmental Condition

Sample Collected by

Test Performed at

Month of Sampling

WCS260136E

TC112252600000031E

Raikela Iron Ore Mines (M/S Geelarani Mahanty)

Raikela, Near Tensa, P.O.-Dengula, Dist- Sundargarh- 770048, Odisha

22°00'77.72" N 85°44'73.23" E

Ore storage & Loading

Fugitive Emission

WCS/QSP/SAMP (AIR)

Clear Weather

Debendra Kumar Biswal

WCS Laboratory

December-2025

TEST REPORT

Issue Date : 05.01.2026

Quantity of Sample : 9
Sample Condition : Good

Sl. No.	Date Of Sampling	SPM in ($\mu\text{g}/\text{m}^3$)
1	01.12.2025	459
2	04.12.2025	444
3	08.12.2025	422
4	11.12.2025	433
5	16.12.2025	450
6	19.12.2025	415
7	22.12.2025	382
8	25.12.2025	463
9	29.12.2025	422
Average		434
Standard		1200.0
Testing Method		IS-5182 (Part-4) 1999 RA 2019

Reviewed by
(Miss, Laxmi Sahoo)Authorized Signatory
(Mr. Bijaya Kumar Chhikara)

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WCS
MY WORLD CONSULTANCY SERVICES

Format No: WCS/OR/7.8/02

Report No:

NABL ULR No,

Name of the Client

Address

Co-Ordinate

Sampling Location

Sample Description

Sampling Plan & Method

Environmental Conditions

Sample Collected by

Test Performed at

Month of Sampling

WCS260136P

TC11225260XHX0LKETJ

Raikela Iron Ore Mines (MS Geetarani Mahanty)

Raikela, Near Tanua, P.O.-Denguln, Dist.- Sundargarh- 750048, Odisha

22°00'64.59" N 85°44'75.25" E

Waste Dump

Fugitive Emission

WCS/QSP/SAMP (AIR)

Clear Weather

Dehendra Kumar Biswal

WCS Laboratory

December-2025

TEST REPORT

Issue Date : 05.01.2026

Quantity of Sample : 0
Sample Condition : Good

Sl. No.	Date Of Sampling	SPM in ($\mu\text{g}/\text{m}^3$)
1	01.12.2025	394
2	04.12.2025	380
3	08.12.2025	362
4	11.12.2025	372
5	16.12.2025	385
6	19.12.2025	372
7	22.12.2025	328
8	25.12.2025	396
9	29.12.2025	362
Average		372
Standard		1200.0
Testing Method		IS-5182 (Part-4; 1999 RA 2019)

Reviewed by

(Miss. Latmi Sahoo)

Authorized Signatory

(Mr. Bijaya Kumar Chahatany)

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MY WORLD CONSULTANCY SERVICES

Format No: WCS/QR/7.8/02

TEST REPORT

Issue Date : 03.02.2026

Report No. : WCS260211A

NABL LIR No. : TC11225260300000772

Name of the Client : **Raikela Iron Ore Mines (M/S Geetoruni Mahanty)**

Address : Raikela, Near Tansa, P.O.-Dengula, Dist- Sundargarh- 750048, Odisha

Co-Ordinate : 22°00'77.88" N 85°44'48.11" E

Sampling Location : **Mines Face**

Sample Description : Fugitive Emission

Sampling Plan & Method : WCS/QSP/SAMP (AIR)

Environmental Condition : Clear Weather

Sample Collected by : Dehendra Kumar Biswal

Test Performed at : WCS Laboratory

Month of Sampling : January-2026

Quantity of Sample : 9
Sample Condition : Good

Sl. No.	Date Of Sampling	SPM In ($\mu\text{g}/\text{m}^3$)
1	01.01.2026	497
2	06.01.2026	479
3	09.01.2026	512
4	12.01.2026	487
5	15.01.2026	469
6	19.01.2026	481
7	22.01.2026	461
8	27.01.2026	477
9	30.01.2026	455
Average		480
Standard		1240.0
Testing Method		IS-5182 (Part-4) 1900 S.A 2019


 Reviewed by
 (Miss. Laxmi Sahoo)


 Authorized Signatory
 (Mr. Bijaya Kumar Chakraborty)

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WCS
MY WORLD CONSULTANCY SERVICES

Format No: WCS/OR/7.8/02

Report No.

NABL ULR No.

Name of the Client

Address

Co-Ordinate

Sampling Location

Sample Description

Sampling Plan & Method

Environmental Condition

Sample Collected by

Test Performed at

Month of Sampling

WCS260211B

TC11225260000000771

Raikela Iron Ore Mines (M/S Geetorani Mahanty)

Raikela, Near Terna, P.O.-Dengula, Dist- Sundargarh- 750048, Odisha

22°00'62.59" N 85°44'69.34" E

Hard Road

Fugitive Emission

WCS/QSP/SAMP (AIR)

Clear Weather

Debendra Kumar Biswal

WCS Laboratory

January-2026

TEST REPORT

Issue Date

03.02.2026

Quantity of Sample

9

Sample Condition

Good

Sl. No.	Date Of Sampling	SPM In ($\mu\text{g}/\text{m}^3$)
1	01.01.2026	481
2	06.01.2026	463
3	09.01.2026	494
4	12.01.2026	470
5	15.01.2026	453
6	19.01.2026	465
7	22.01.2026	445
8	27.01.2026	461
9	30.01.2026	440
Average		464
Standard		1200.0
Testing Method		IS-5182 (Part-4) 1999 RA 2019

Reviewed by

(Mrs. Laxmi Sahoo)



Authorized Signatory

(Mr. Bijaya Kumar Chahatary)

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TC-11228

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NABL (ISO/IEC 17025:2017 ACCREDITED LABORATORY**WCS**
MY WORLD CONSULTANCY SERVICES

Form No. WCSQR/7.802

Report No.

NABL U.R. No.

Name of the Client

Address

Co-Ordinate

Sampling Location

Sample Description

Sampling Plan & Method

Environmental Condition

Sample Collected by

Test Performed at

Month of Sampling

WCS260211C

TC1122526000000077F

Ruikela Iron Ore Mines (M/S Gokulnani Mahanty)

Ruikela, Near Tansa, P.O.-Dengula, Dist- Sundargarh- 770048, Odisha

22°00'73.75" N 85°44'82.07" E

Crushing & Screening Plant

Fugitive Emission

WCS/OSP/SAMP1AIR1

Clear Weather

Dehendra Kumar Oiswal

WCS Laboratory

January-2026

TEST REPORT

Issue Date : 03.02.2026

Quantity of Sample : 9
Sample Condition : Good

Sl. No.	Date of Sampling	SPM in ($\mu\text{g}/\text{m}^3$)
1	01.01.2026	362
2	06.01.2026	349
3	09.01.2026	373
4	12.01.2026	355
5	15.01.2026	342
6	19.01.2026	351
7	22.01.2026	336
8	27.01.2026	348
9	30.01.2026	332
Average		350
Standard		12000
Testing Method		IS-3182 (Part-4) 1999 IIA 2019

Reviewed by
(Miss. Laxmi Sahoo)
Authorized Signatory
(Mr. Bijay Kumar Chakraborty)

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Format No. WCS-QR/7.8/02

Report No.

NABL U.R. No.

Name of the Client

Address

Co-Ordinate

Sampling Location

Sample Description

Sampling Plan & Method

Environmental Condition

Sample Collected by

Test Performed at

Month of Sampling

WCS260211D

TC112253MR0000077F

Raikela Iron Ore Mines (M/S Geetharani Mahanty)

Raikela, Near Tansa, P.O. -Dengula, Dist- Sundargarh- 770048, Odisha

22°00'46.91" N 85°44'61.51" E

Mines Gate

Fugitive Emission

WCS/USP/SAMP (AIR)

Clear Weather

Dehendra Kumar Biswal

WCS Laboratory

January-2026

TEST REPORT

Issue Date : 03.02.2026

Quantity of Sample : 9
Sample Condition : Good

Sl. No.	Date Of Sampling	SPM in ($\mu\text{g}/\text{m}^3$)
1	01.01.2026	337
2	06.01.2026	325
3	09.01.2026	347
4	12.01.2026	330
5	15.01.2026	318
6	19.01.2026	326
7	22.01.2026	312
8	27.01.2026	324
9	30.01.2026	309
Average		325
Standard		1200.0
Testing Method		IS-5182 (Part-4) 1999 RA 2019

Reviewed by
(Miss. Laxmi Sahoo)Authorized Signatory
(Mr. Bijaya Kumar Chaturaray)

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WCS
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Format No: WCS/OR/7.8/02

TEST REPORT

Issue Date : 03.02.2026

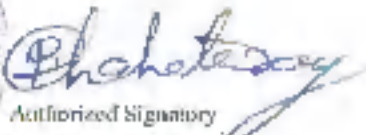
Report No. : WCS260211E
NABL ULR No. : TCT12252600000077F
Name of the Client : **Raikela Iron Ore Mines (MS Geetarani Mahanty)**
Address : Raikela, Near Tansa, P.O.-Dengala, Dist- Sundargarh- 770048, Odisha
Co-Ordinate : 22°00'77.72" N 85°44'73.23" E
Sampling Location : **Ore storage & Loading**
Sample Description : Fugitive Emission
Sampling Plan & Method : WLS/SP/SSAMP (AIR)
Environmental Condition : Clear Weather
Sample Collected by : Debendra Kumar Biswal
Test Performed at : WCS Laboratory
Month of Sampling : January-2026

Quantity of Sample : 0
Sample Condition : Good

Sl. No.	Date Of Sampling	SPM in ($\mu\text{g}/\text{m}^3$)
1	01.01.2026	472
2	06.01.2026	455
3	09.01.2026	486
4	12.01.2026	462
5	15.01.2026	445
6	19.01.2026	457
7	22.01.2026	437
8	27.01.2026	453
9	30.01.2026	432
Average		455
Standard		1200.0
Testing Method		IS-5182 (Part-4) 1999 RA 2019


Reviewed by
(Miss. Laxmi Sahoo)




Authorized Signatory
(Mr. Bijaya Kumar Chahatany)

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Format No: WCS/CIR/7.8/02

TEST REPORT

Report No :

WCS260211F

Issue Date :

03.02.2026

NABL ULR No. :

TC1123526000000077

Name of the Client :

Raikola Iron Ore Mines (NLS Geetarani Mahantya)

Address :

Raikola, Near Tansa, P.O.-Dengra, Dist- Sundargarh- 753018, Odisha

Co-Ordinate :

22°00'54.59" N 85°44'75.25" E

Sampling Location :

Waste Dump

Sample Description :

Fugitive Emission

Sampling Plan & Method :

WCS/QSP/SAMP (AIR)

Environmental Condition :

Clear Weather

Sample Collected by :

Dehendra Kumar Biswal

Test Performed at :

WCS Laboratory

Quantity of Sample :

9

Month of Sampling :

January-2026

Sample Condition :

Good

Sl. No.	Date Of Sampling	SPM in ($\mu\text{g}/\text{m}^3$)
1	01.01.2026	405
2	06.01.2026	390
3	09.01.2026	416
4	12.01.2026	396
5	15.01.2026	382
6	19.01.2026	392
7	22.01.2026	375
8	27.01.2026	388
9	30.01.2026	371
Average		390
Standard		1200.0
Testing Method		IS-5182 (Part-I) 1999 RA 2019

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Reviewed by
(Miss. Laxmi Sahoo)



Phakatesay
Authorized Signatory

Mr. Bijaya Kumar Chakraborty

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WCS
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TC-11225

Form No. WCS/QR/7.8/02

Report No.

NABL ULR No.

Name of the Client

Address

Co-Ordinate

Sampling Location

Sample Description

Sampling Plan & Method

Environmental Condition

Sample Collected by

Test Performed at

Month of Sampling

WCS260342A

TC1122526000000141F

Raikela Iron Ore Mines (M/S Geetarani Mahanty)

Raikela, Near Tansa, P.O.-Dengula, Dist- Sundargarh- 770048, Odisha

22°00'77.88" N 85°44'88.11" E

Mines Face

Fugitive Emission

WCS/QSP/SAMP (AIR)

Clear Weather

Tapas Ranjan Patel

WCS Laboratory

February-2026

TEST REPORT

Issue Date : 03.03.2026

Quantity of Sample : 8
Sample Condition : Good

Sl. No.	Date Of Sampling	SPM in ($\mu\text{g}/\text{m}^3$)
1	03.02.2026	476
2	05.02.2026	466
3	11.02.2026	438
4	13.02.2026	487
5	17.02.2026	458
6	20.02.2026	468
7	24.02.2026	450
8	27.02.2026	443
Average		460
Standard		1200.0
Testing Method		IS-5182 (Part-4) 1999 RA 2019

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Reviewed by
(Miss. Laxmi Sahoo)



Chakraborty

Authorized Signatory
(Mr. Bijaya Kumar Chakraborty)

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TC-11225

Format No: WCS/QR/7.8/Q2

Refer. No.

NABL I/LR No.

Name of the Client

Address

Co-Ordinate

Sampling Location

Sample Description

Sampling Plan & Method

Environmental Condition

Sample Collected by

Test Performed at

Month of Sampling

WCS260342B

TC 1122526000000141F

Raikela Iron Ore Mines (M/S Geetsarani Mohanty)

Raikela, Near Tensa, P.O.-Dengala, Dist- Sundargarh- 770048, Odisha

22°00'62.59" N 85°44'69.14" E

Haul Road

Fugitive Emission

WCS/QSP/SAMP (AIR)

Clear Weather

Tapas Ranjan Patel

WCS Laboratory

February-2026

TEST REPORT

Issue Date : 03.03.2026

Quantity of Sample : 8
Sample Condition : Good

Sl. No.	Date Of Sampling	SPM in (µg/m ³)
1	03.02.2026	439
2	05.02.2026	450
3	11.02.2026	423
4	13.02.2026	470
5	17.02.2026	442
6	20.02.2026	453
7	24.02.2026	434
8	27.02.2026	428
Average		445
Standard		1200.0
Testing Method		IS 5183 (Part-4) 1999 RA 2019

Signature

Reviewed by
(Miss. Laxmi Subho)



Signature

Authorized Signatory
(Mr. Bijaya Kumar Chahatary)

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NABL (ISO/IEC 17025:2017 ACCREDITED LABORATORY)



WCS
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TC/11225

Format No: WCS/QR/7.8/02

Report No.

NABL ULR No.

Name of the Client

Address

Co-Ordinate

Sampling Location

Sample Description

Sampling Plan & Method

Environmental Condition

Sample Collected by

Test Performed at

Month of Sampling

WCS260342C

TC1122526000000141F

Raikela Iron Ore Mines (M/S Geetarani Mahanty)

Raikela, Near Tensa, P.O.-Dengala, Dist- Sundargarh- 770048, Odisha

22°00'73.75" N 85°44'82.07" E

Crushing & Screening Plant

Fugitive Emission

WCS/QSP/SAMP (AIR)

Clear Weather

Tupis Ranjan Patel

WCS Laboratory

February-2025

TEST REPORT

Issue Date : 03.03.2026

Quantity of Sample : 8
Sample Condition : Good

SL No.	Date Of Sampling	SPM in ($\mu\text{g}/\text{m}^3$)
1	03.02.2026	347
2	05.02.2026	339
3	11.02.2026	319
4	13.02.2026	355
5	17.02.2026	334
6	20.02.2026	341
7	24.02.2026	328
8	27.02.2026	323
Average		336
Standard		1200.0
Testing Method		IS-5182 (Part-4) 1999 RA 2019

(Signature)

Reviewed by
(Miss. Laxmi Sahoo)



(Signature)

Authorized Signatory
(Mr. Bijaya Kumar Chahatany)

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MY WORLD CONSULTANCY SERVICES

Format No: WCS/QR/7.8/02

Report No

NABL ULR No.

Name of the Client

Address

Co-Ordinate

Sampling Location

Sample Description

Sampling Plan & Method

Environmental Condition

Sample Collected by

Test Performed at

Month of Sampling

WCS2603420

TC1122526030000141E

Raikela Iron Ore Mines (M/S Geetarani Mohanty)

Raikela, Near Tansa, P.O.-Dengula, Dist- Sundargarh- 750048, Odisha

22°00'46.91" N 85°44'61.51" E

Mines Gate

Fugitive Emission

WCS/QSP/SAMP (AIR)

Clear Weather

Tapasi Ranjan Patel

WCS Laboratory

February-2026

TEST REPORT

Issue Date : 03.03.2026

Quantity of Sample : 8
Sample Condition : Good

Sl. No.	Date Of Sampling	SPM in ($\mu\text{g}/\text{m}^3$)
1	03.02.2026	322
2	05.02.2026	316
3	11.02.2026	297
4	13.02.2026	330
5	17.02.2026	310
6	20.02.2026	318
7	24.02.2026	305
8	27.02.2026	300
Average		312
Standard		1200.0
Testing Method		IS-5182 (Part-4) 1999 RA 2019

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Reviewed by
(Miss. Laxmi Sahoo)



Bijaya Kumar Chahatray

Authorized Signatory
(Mr. Bijaya Kumar Chahatray)

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WCS
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Format No: WCS/QR/7.8/02

Report No.

NABL ULR No.

Name of the Client

Address

Co-Ordinate

Sampling Location

Sample Description

Sampling Plan & Method

Environmental Condition

Sample Collected by

Test Performed at

Month of Sampling

WCS260342E

TC1122526000K11111

Raikela Iron Ore Mines (MS Geetarani Mohanty)

Raikela, Near Tansa, P.O.-Dungula, Dist- Sundargarh- 770048, Odisha.

22°00'77.72" N 85°44'73.23" E

Ore storage & Loading

Fugitive Emission

WCS/QSI/SAMP (AIR)

Clear Weather

Tapas Ranjan Patel

WCS Laboratory

February-2026

TEST REPORT

Issue Date : 03.03.2026

Quantity of Sample : 8
Sample Condition : Good

SL No.	Date Of Sampling	SPM in ($\mu\text{g}/\text{m}^3$)
1	03.02.2026	451
2	05.02.2026	442
3	11.02.2026	416
4	13.02.2026	462
5	17.02.2026	435
6	20.02.2026	445
7	24.02.2026	427
8	27.02.2026	420
Average		437
Standard		1200.8
Testing Method		IS-5192 (Part-4) 1999 IFA 2019

Reviewed by
(Miss. Laxmi Sahoo)



Authorized Signatory
(Mr. Bijaya Kumar Chahatray)

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WCS
MY WORLD CONSULTANCY SERVICES

Form No: WCS/JR/7 8/02

TEST REPORT

Issue Date : 03.03.2026

Report No. : WCS260342F
NABL ULR No. : TC1122526000000141
Name of the Client : **Railela Iron Ore Mines (M/S Geetarani Mohanty)**
Address : Railela, Near Tensa, P.O.-Dangula, Dist- Sundargarh- 759048, Odisha
Co-Ordinate : 22°00'64.59" N 85°44'55.25" E
Sampling Location : **Waste Dump**
Sample Description : Fugitive Emission
Sampling Plan & Method : WCS/QSP/SAMP (AIR)
Environmental Condition : Clear Weather
Sample Collected by : Tapas Ranjan Patel
Test Performed at : WCS Laboratory
Month of Sampling : February-2026

Quantity of Sample : 8
Sample Condition : Good

Sl. No.	Date Of Sampling	SPM in ($\mu\text{g}/\text{m}^3$)
1	03.02.2026	387
2	05.02.2026	379
3	11.02.2026	356
4	13.02.2026	396
5	17.02.2026	372
6	20.02.2026	381
7	24.02.2026	366
8	27.02.2026	360
Average		375
Standard		1200.0
Testing Method		IS-5182 (Part-4) 1999 RA 2019

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Reviewed by
(Miss. Laxmi Sahoo)



Phahataray

Authorized Signatory
(Mr. Bijaya Kumar Chahatray)

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WCS
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Format No: WCS/OR/7.R/02

TEST REPORT

Report No. : WCS260439A
NABL ULR No. : FC1122526000000306F
Name of the Client : **Raikela Iron Ore Mines (M/S Geetarani Mohanty)**
Address : Raikela, Near Tensa, P.O.-Dengula, Dist- Sundargarh- 770048, Odisha
Co-Ordinate : 22°01'77.88" N 85°44'38.11" E
Sampling Location : **Mines Face**
Sample Description : Fugitive Emission
Sampling Plan & Method : WCS/QSP/NAAMP (AIR)
Environmental Condition : Clear Weather
Sample Collected by : Tapas Ranjan Patel
Test Performed at : WCS Laboratory
Month of Sampling : March-2026

Issue Date : 03.04.2026

Quantity of Sample : 9
Sample Condition : Good

Sl. No.	Date Of Sampling	SPM in ($\mu\text{g}/\text{m}^3$)
1	03.03.2026	491
2	05.03.2026	468
3	11.03.2026	483
4	13.03.2026	473
5	17.03.2026	331
6	20.03.2026	398
7	24.03.2026	486
8	27.03.2026	386
9	31.03.2026	484
Average		445
Standard		1200.0
Testing Method		IS-5182 (Part-4) 1999 RA 2017

Reviewed by
(Miss. Laxmi Sahoo)



Authorized Signatory
(Mr. Bijaya Kumar Chahatary)

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Plot No. 756, Telengapantha, Cuttack-754001
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WCS
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Format No: WCS/OR/7.8/02

Report No.

NABL ULR No.

Name of the Client

Address

Co-Ordinate

Sampling Location

Sample Description

Sampling Plan & Method

Environmental Condition

Sample Collected by

Test Performed at

Month of Sampling

WCS2604198

TC112252600000006F

Raikela Iron Ore Mines (M/S Geetarani Mohanty)

Raikela, Near Tensa, P.O.-Dengula, Dist- Sundargarh- 770048, Odisha

22°10'62.59" N 85°44'69.34" E

Haul Road

Fugitive Emission

WCS/QSP/SAMP (AIR)

Clear Weather

Tapas Ranjan Patel

WCS Laboratory

March-2026

TEST REPORT

Issue Date 03.04.2026

Quantity of Sample 9
Sample Condition Good

Sl. No.	Date Of Sampling	SPM in ($\mu\text{g}/\text{m}^3$)
1	03.03.2026	474
2	05.03.2026	453
3	11.03.2026	467
4	13.03.2026	457
5	17.03.2026	322
6	20.03.2026	384
7	24.03.2026	470
8	27.03.2026	373
9	31.03.2026	467
Average		430
Standard		1200.0
Testing Method		IS-5182 (Part-4) 1999 RA 2019

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Reviewed by
(Miss. Laxmi Sahoo)



Authorized Signatory
(Mr. Bijaya Kumar Chahatary)

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WCS
MY WORLD CONSULTANCY SERVICES

Format No: WCS/OR/7.8/02

Report No.

NABL ULR No.

Name of the Client

Address

Co-Ordinate

Sampling Location

Sample Description

Sampling Plan & Method

Environmental Condition

Sample Collected by

Test Performed at

Month of Sampling

WCS260439C

TC1122526009000206F

Railkela Iron Ore Mines (M/S Geetnani Mahanty)

Railkela, Near Tansa, P.O.-Dengula, Dist- Sundargarh- 770048, Odisha

22°41'73.75" N 85°44'82.07" E

Crushing & Screening Plant

Fugitive Emission

WCS/QSP/SAMP (AIR)

Clear Weather

Tapas Ranjan Patel

WCS Laboratory

March-2026

TEST REPORT

Issue Date : 03.04.2026

Quantity of Sample : 9
Sample Condition : Good

Sl. No.	Date Of Sampling	SPM in ($\mu\text{g}/\text{m}^3$)
1	03.03.2026	358
2	05.03.2026	341
3	11.03.2026	352
4	13.03.2026	345
5	17.03.2026	243
6	20.03.2026	290
7	24.03.2026	354
8	27.03.2026	281
9	31.03.2026	353
Average		324
Standard		1200.0
Testing Method		IS-5182 (Part-4) 1999 RA 2019

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Reviewed by

(Miss. Laxmi Sahoo)



Authorized Signatory

(Mr. Bijaya Kumar Chahatary)

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WCS
MY WORLD CONSULTANCY SERVICES

Format No. WCS/OR/7.8/02

TEST REPORT

Report No. : WCS260439D

Issue Date : 03.04.2026

NABL ULK No. : TC1122526000000206F

Name of the Client : **Raikela Iron Ore Mines (M/S Geclarani Mohanty)**

Address : Raikela, Near Tonsa, P.O.-Dengula, Dist- Sundargarh- 770048, (Misha)

Co-Ordinate : 22°00'46.91" N 85°44'41.51" E

Sampling Location : **Mines Gate**

Sample Description : Fugitive Emission

Sampling Plan & Method : WCS/QSP/SAMP (AIR)

Environmental Condition : Clear Weather

Sample Collected by : Tapas Ranjan Patel

Test Performed at : WCS Laboratory

Month of Sampling : March-2026

Quantity of Sample : 9

Sample Condition : Good

Sl. No.	Date Of Sampling	SPM in ($\mu\text{g}/\text{m}^3$)
1	03.03.2026	333
2	05.03.2026	318
3	11.03.2026	328
4	13.03.2026	321
5	17.03.2026	226
6	20.03.2026	270
7	24.03.2026	330
8	27.03.2026	262
9	31.03.2026	328
Average		302
Standard		1200.0
Testing Method		IS-5182 (Part-I) 1999 RA 2019

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Reviewed by
(Miss. Laxmi Sahoo)

B. Bijay Kumar Chhataraya

Authorized Signatory
(Mr. Bijay Kumar Chhataraya)

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WCS
MY WORLD CONSULTANCY SERVICES

Format No: WCS/QR/7.8/02

TEST REPORT

Report No. : WCS2604396
NABL ULR No. : TC1122526000000206F
Name of the Client : **Raikela Iron Ore Mines (MS Geetarani Mohanty)**
Address : Raikela, Near Teisa, P.O. Dengula, Dist- Sundargarh- 770048, Odisha
Co-Ordinate : 22°00'77.72" N 85°44'73.23" E
Sampling Location : **Ore storage & Loading**
Sample Description : Fugitive Emission
Sampling Plan & Method : WCS/QSP/SAMP (AIR)
Environmental Condition : Clear Weather
Sample Collected by : Tapas Ranjan Patel
Test Performed at : WCS Laboratory
Month of Sampling : March-2026

Issue Date : 03/04/2026

Quantity of Sample : 9
Sample Condition : Good

Sl. No.	Date Of Sampling	SPM in ($\mu\text{g}/\text{m}^3$)
1	03.03.2026	466
2	05.03.2026	415
3	41.03.2026	459
4	13.03.2026	449
5	17.03.2026	316
6	20.03.2026	377
7	24.03.2026	461
8	27.03.2026	366
9	31.03.2026	459
Average		422
Standard		1200.0
Testing Method		IS-5182 (Part-4) 1999 RA 2019


Reviewed by
(Mbs. Jaxmi Salino)



Authorized Signatory
(Mr. Bijaya Kumar Chahatary)

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(Testing Laboratory)

Plot No. 765, Telengapentha, Cuttack-754001
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WCS
MY WORLD CONSULTANCY SERVICES

Format No. WCSQR/78812

TEST REPORT

Issue Date : 03.04.2026

Report No. : WCS2604399

NABL ULR No. : TC1122526000000206

Name of the Client : **Raikela Iron Ore Mines (M/S Geetarani Mohanty)**

Address : Raikela, Near Tensa, P.O.-Dengula, Dist- Sundargarh- 750048, Odisha

Co-Ordinate : 22°00'41.59" N 85°44'75.25" E

Sampling Location : **Waste Dump**

Sample Description : Fugitive Emission

Sampling Plan & Method : WCS/QSP/SAMP (AIR)

Environmental Condition : Clear Weather

Sample Collected by : Tapas Ranjan Patel

Test Performed at : WCS Laboratory

Mouth of Sampling : March-2026

Quantity of Sample : 9

Sample Condition : Good

Sl. No.	Date Of Sampling	SPM in ($\mu\text{g}/\text{m}^3$)
1	03.03.2026	399
2	05.03.2026	381
3	11.03.2026	393
4	11.03.2026	385
5	17.03.2026	271
6	20.03.2026	324
7	24.03.2026	396
8	27.03.2026	314
9	31.03.2026	394
Average		362
Standard		1200.0
Testing Method		IS-5182 (Part-4) 1999 RA 2019

Reviewed by
(Miss. Laxmi Sahoo)

Authorized Signatory
(Mr. Bijaya Kumar Chahatuary)

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INDIA NON JUDICIAL

Jagynandan Mohanty
Notary, Govt. Of India
Odisha, BBSR, Dist-Khurd
Regd. No.-7791/2009
Mob: 9881006174

50AA 503244

ଓଡ଼ିଶା ଗୌରୀ ODISHA

AFFIDAVIT

I, Srinibash Sahoo, S/o Sri Duhsahsan Sahoo, aged about 60 years, presently the Managing Partner of M/s. Geetarani Mohanty, Raikela Iron Ore Mines, a partnership firm duly registered under the Indian Partnership Act, 1932 having its registered office at Station Road Barbil, do hereby solemnly affirm and state as under:

1. That M/s. Geetarani Mohanty is the Lessee of the Mining Lease bearing ML No. 666 for Iron Ore over an area of 67.586 Ha. in the Village Raikela, Taluka Koira in the district of Sundergarh, Orissa with a production capacity of Tonnes per Annum [in short MTPA] .
2. That M/s. Geetarani Mohanty has submitted a proposal before the competent authority for grant of Environment Clearance for enhancement of iron ore production capacity from MTPA to MTPA along with crushing and screening facility over the mining lease hold area [Hereinafter the Project Proponent].



20803
11.9.20

M/S Geetarmi Mahur

Station Road

Barbel

Kaunib



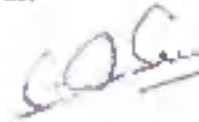
CDS

J. BARAL
STAMP VENDOR
S.R. Khandagiri, BBSR

Chaturbheja Palei

Jagyneshwar Acharya
Notary, Govt. Of India
Odisha, BBSR, Dist-Khorda
Regd No-77912409
Mob-9461006174

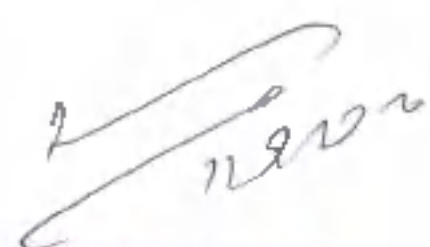
3. That as per the recommendation of the State Expert Appraisal Committee, Odisha, the Project Proponent has to submit a standard operating procedure [in short "SOP"] for de-silting at buffer zone and beyond including nearby nala/river perennially periodically and perpetually caused to wash up off mineral/OB/Dumps through an Affidavit.
4. That the SOP as drawn by the Project Proponent is Annexed herewith and the same to be read as part and parcel of this Affidavit.
5. That all the facts, figures and informations as stated in the said SOP is true to the best of my knowledge and belief and are based on records.


DEPONENT

Identified By:
IDENTIFIED BY ME

ADVOCATE, BBSR
ADVOCATE




Jagyneshwar Acharya
Notary, Govt. Of India
Odisha, BBSR, Dist-Khorda
Regd No-77912409
Mob-9461006174

STANDARD OPERATING PROCEDURE FOR DE-SILTING WORK AT BUFFER ZONE AND BEYOND INCLUDING NEARBY NALA/RIVER PERENNIALY PERIODICALLY AND PERPETUALLY CAUSED TO WASH UP OFF MINERALS/OB/DUMPS THROUGH A LEGAL AFFIDAVIT.

Introduction

In Raikela hill ranges 6nos of mines existing and out of which four mines are in operation.

The details of Leases in this region are furnished below:

1. Raikela Iron ore Mine, M/s Geetarani Mohanty
2. Raikela Iron ore Mine, M/s Penguin Trading Agency.
3. Raikela and Tantra Iron ore Mine, M/s Jindal Steel and Power Ltd.
4. Raikela Iron ore Mine, M/s National Enterprises.
5. Raikela Iron ore Mine, C.P.Sharma.
6. Raikela Iron ore Mines, S.N.Mohanty.

Out of which, 1st four mines are operating. Topographically, the mines are at higher elevation and in the North eastern part of the leases there is existence of Agricultural field of local villagers.

The location of the Agricultural field from the ML boundary is furnished below:

Most of the agricultural fields are located in the north eastern part of the lease area. These fields are located in the buffer zone at a distance of 2.5 km from the lease area.

There is no perennial nala within the core zone. In the Buffer zone Sarkunada Nala, Kuradhi Nala and Karo Nala are flowing. **The location of Nalas with respect to the ML boundary area as follows:**

Sarkunda Nala	-	4.2 km in South
Kuradhi Nadi	-	8.0 km in North West
Karo Nala	-	5.8 km in the North

Precautionary Measures

During flow of rain water, it may carry silts, clay or lateritic soil towards downhill side. Therefore, it's very much necessary to prevent these wash offs from these mines from spreading over the agricultural field. Wash off / runoff of mine workings, waste dumps, ore stock piles, during monsoon may carry the silt / ore residues and pollute the nearby nallah / streams, lands if it is let-out as such. To prevent such siltation effect, effective surfaces runoff management scheme are being devised and implemented.

Responsibility for effective run off Management

As explained above, it is the prime responsibility of the all the mine owners to make effective run off management to control the wash offs from each mines. Along with



other mine owner, M/s Geetarani Mohanty is also doing all the precautionary measures to prevent wash offs from the mines to buffer zone. Further, M/s Geetarani Mohanty, is committed to make necessary arrangement to prevent the wash offs by creating retaining wall followed by garland drain with settling ponds at strategic location. Garland drains & retaining walls have been constructed all around the dumps and plantation of native species has been carried out on the dump slopes to minimize erosion. A settling pond has been constructed to arrest silt and sediment flows from mining operations and the water so collected is being utilized for the mine area, roads, green belt development etc. The drains are regularly de-silted and maintained. M/s Geetarani Mohanty is and will be committed to do the de-silting work at regular interval.

Details of existing surface runoff management structures within core zone

Location	Retaining wall			Garland drain			Settling pond			
	L(m)	W(m)	H(m)	L(m)	W(m)	H(m)	Nos	L(m)	W(m)	H(m)
Waste dump	300	1.0	2.0	435	1.0	1.5	1	10	8	2
Existing Stack	130	1.0	2.0	362	1.0	1.5	-	-	-	-
Proposed Stack-I	485	1.0	2.0	464	1.0	1.5	1	10	8	2
Proposed Stack-II	285	1.0	2.0	284	1.0	1.5	1	10	8	2
Proposed Stack-III	-	-	-	525	1.0	1.5	1	10	8	2
Total	1180	1.0	2.0	2076	1.0	1.6	4	10	8	2

The following mitigative measures are and will be implemented to prevent run-off of water & flow of sediments directly into the nearby water bodies, land and control water environment in the area.

- Dozing and levelling of inactive waste dumps.
- Providing dump tops with inner slopes and through a system of drains and channels allowing rain water to descent into surrounding drains, so as to minimize the effects of erosion arising out of uncontrolled descent of water.
- Proper terracing of the OB dumps and covering with Geo textile mat.
- Planting native tree species on the dump tops and slopes with grasses and shrubs to arrest and prevent erosion.
- Construction of garland drains of suitable size around mine area and dump with proper gradients to prevent rain water descent into active mine area.
- Settling ponds are & will be made to prevent flow of fine particles from OB / Waste dumps, check dains, parapet/retaining walls & garlanded drains.
- The garland drains connected to settling tank to collect surface runoff, mine water and arrest siltation.
- Usage of stored water in the settling ponds for watering of haul roads, vehicle washing and green belt development etc.



- De-silting of the garland drains & settling ponds are being & will be carried out at regular intervals.
- Maintenance of all the runoff management structures

Procedure for Desilting in agricultural field and Nala

M/s Geetarani Mohanty will adopt a Standard Procedure to make de-silting work both in core zone and buffer zone (agricultural field) as well as nala within the buffer zone by using environmentally sound practices that are cost effective and safe for desilting and dredging the fields. The details of standard operating procedure for the de-silting work at buffer zone especially at Agricultural field will be as follows:

(1) Objective/purpose

The main objective of the desilting work in the agricultural field is that to remove the silts, clay other non-fertile material came from the mines, waste dump, mineral stack so that the productivity of agricultural land will be more which will help directly to the surrounding local farmers. In the similar way, de-silting of nala will be undertaken once in a year.

(2) Scope

Engagement of machine/excavator and manpower for dredging the spread silts, clay and other non-fertile material over the agricultural field. The dredged material will be transported to the Waste dump through Tractor. De-silting of nala within buffer zone will be undertaken by engaging high capacity excavator. The material from nala will be sent for making bund both side of nala. Grass patching will be done both side of nala.

(3) Responsibility

Overall responsibility lies on owner. But in the field the Mines Manager will take care the job by out sourcing the agency for dredging the wash offs.

4) Procedure to be adopted for removal of silts in the buffer zone from agricultural field and nala:

- (a) Measurement of thickness of material (silt/clay/latentitic soil) spread over the agricultural field and nala.
- (b) If the thickness is more than, small size excavator will be utilised for digging.
- (c) After digging of the deleterious material from the field and nala the said material will be transported through tractors/tippers and disposed of at a purchased valley area or can be utilised for road construction or making bund.
- (d) The project proponent will purchase compost, cow dung and farmyard manures to the cleaned up agricultural land with an aim to enhance the organic content thereby facilitating better agricultural production. The same will be provided to the farmers for spreading over the agricultural field. The project proponent will help the farmers for spreading the same.



Costing

Sl No	Particulars	Cost(In Rs) per annum
1	Deployment of Excavator	1,00,000
2	Deployment of Tractors/tippers	50,000
3	Purchase of manures	50,000
4	Engagement of Labour	30,000
5	Miscellaneous Expenditure	20,000
Total		2,50,000

Conclusion

M/s Geetarani Mohanty do the de-silting of nala and agricultural field along with other Mine owner for the benefit of surrounding villagers. Necessary arrangement for development of agriculture will be done continually within the surrounding villagers as a part of CSR activity.

M/s Geetarani Mohanty

Managing Partner.




Jagyneshwar Acharya
Notary, Govt. of India
Odisha, 751009, Dist-Khorda
Regd. No. 775912009
Mob: 9861006474



Form No: WCS/QR/7.8/12

TEST REPORT

Issue Date : 29.11.2025

Report No. : WCS231159A
NABL ULR No. : TC1122525000000435
Name of the Client : **Raikela Iron Ore Mines (M/S Geelarni Mahanty)**
Address : Raikela, Near Tansa, P.O.-Dengula, Dist-Sundargarh- 750048, Odisha
Sampling Location : **Office Bore Well (Inside Mines Office)**
Sample Description : Ground Water
Sampling Plan & Method : WCS/QSP/SAMP (WATER)
Environmental Condition : Temperature 24.3°C, Clear Weather
Sample Collected by : Debendra Kumar Biswal
Test Performed in : WCS Laboratory
Date of Testing : 28.11.2025 to 29.11.2025

Date of Sampling : 22.11.2025
Date of Receiving : 24.11.2025
Sample ID No : WCS1125W36A
Quantity of Sample : 1Ltr
Sample Condition : Good

Sl. No.	Parameter	Unit	Result	Requirement as per IS 10500:2012 Reaffirmed 2018	Test Method
1	Colour	Hazen	1	Max. 5	IS 3025 (Part4): 2021
2	Odour	—	Agreeable	Agreeable	IS 3025 (Part5): 2018
3	pH Value	—	6.625 at 24.6°C	6.5-8.5	IS 3025 (Part11): 2022
4	Turbidity	NTU	0.1	1.0	IS 3025 (Part10): 2023
5	Total Dissolved Solid as TDS	mg/l	112.0	500.0	IS 3025 (Part16): 2023
6	Ammonia as Total ammonia-N	mg/l	0.34	0.5	IS 3025 (Part14): 1988 RA 2019
7	Calcium as Ca	mg/l	12.83	75.0	IS 3025 (Part40): 2024
8	Chloride as Cl	mg/l	11.80	250.0	IS 3025 (Part12): 1988 RA 2019
9	Fluoride as F	mg/l	0.11	1.0	APHA 24th Ed. (4500-F-4): 2023
10	Iron as Fe	mg/l	0.32	1.0	IS 3025 (Part53): 2024
11	Magnesium as Mg	mg/l	3.89	30.0	APHA 24th Ed. (3500-Mg-B): 2023
12	Nitrate as NO3	mg/l	2.24	45.0	APHA 24th Ed. (NO3-B): 2023
13	Sulphate as SO4	mg/l	1.25	200.0	IS 3025 (Part24, Sec-1): 2022
14	Total Alkalinity as CaCO3	mg/l	23.0	200.0	IS 3025 (Part23): 2023
15	Total Hardness as CaCO3	mg/l	48.0	200.0	IS 3025 (Part21): 2009 RA 2019
16	Total Chromium as Cr	mg/l	<0.02	0.05	IS 3025 (Part52): 2003 RA 2019
17	Potassium as K	mg/l	20.8	—	IS 3025 (Part45): 1993 RA 2019
18	Sodium as Na	mg/l	11.7	—	IS 3025 (Part45): 1993 RA 2019
19	Total Suspended Solid as TSS	mg/l	<5.0	—	IS 3025 (Part 17): 2022
20	Boron as B	mg/l	<0.1	0.50	IS 3025 (Part 57): 2021
21	Copper as Cu	mg/l	<0.01	0.05	IS 3025 (Part 42): 2024
22	Manganese as Mn	mg/l	<0.05	0.10	Aplan 24th Edition: 2023 3141B
23	Cadmium as Cd	mg/l	<0.001	0.003	IS 3025 (Part-11): 1992 RA 2023
24	Lead as Pb	mg/l	<0.001	0.01	IS 3025 (Part-47): 2024
25	Nickel as Ni	mg/l	<0.01	0.02	IS 3025 (Part-54): 2003 RA 2019
26	Total Coliform	MPN/ 100 ml	<2.0	Shall not be detectable in any 100 ml sample	IS 1622: 1981 RA 2019

Reviewed by
(Ms. Laxmi Priya Sufi)

Authorized Signatory for Microbiological
(Miss. Laxmi Sahoo)

***** END OF REPORT *****



Authorized Signatory for Chemical
(Dr. Bijaya Kumar Choudhary)

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Form No: WCSOR/7.802

TEST REPORT

Report No.	: WCS231159A	Issue Date	: 29.11.2023
Name of the Client	: Raikela Iron Ore Mines (M/S Geetarani Mahanty)		
Address	: Raikela, Near Tansa, P.A.T.-Dengufa, Dist- Suralagarhi- 756048, Odisha		
Sampling Location	: Office Bore Well (Inside Mines Office)		
Sample Description	: Ground Water	Date of Sampling	: 22.11.2023
Sampling Plan & Method	: WCS/QSP/SAMP (WATER)	Date of Receiving	: 24.11.2023
Environmental Conditions	: Temperature 24.3°C, Clear Weather	Sample ID No	: WCS1125W36A
Sample Collected by	: Debendra Kumar Biswal	Quantity of Sample	: 1Ltr
Test Performed at	: WCS Laboratory	Sample Condition	: Good
Date of Testing	: 24.11.2023 to 29.11.2023		

Sl. No.	Parameter	Unit	Result	Requirement as per IS 10500:2012 Reaffirmed 2018	Test Method
27	Aluminium as Al	mg/l	<0.02	0.03	IS 3025 (Part 35) 2003 RA 2019
28	Anionic detergents as MBAS	mg/l	<0.02	0.2	Annex K of IS 13428
29	Barium as Ba	mg/l	<0.1	0.7	Annex F of IS 13428* or IS 15302
30	Chloramines as Cl2	mg/l	<0.02	4.0	IS 3025 (Part 26)* or APHA 4500-Cl G
31	Mineral oil	mg/l	<0.5	1.0	Clause 6 of IS 3025 (Part 39) 2021
32	Phenolic compounds as C6H5OH	mg/l	<0.001	0.001	IS 3025 (Part 43) 1992 RA 2019
33	Selenium as Se	mg/l	<0.001	0.01	IS 3025 (Part 56) 2003 RA 2019
34	Silver as Ag	mg/l	<0.02	0.10	Annex J of IS 13428
35	Sulphide as H2S	mg/l	<0.05	0.05	IS 3025 (Part 29) 1986 RA 2019
36	Zinc as Zn	mg/l	<0.05	5.0	IS 3025 (Part 49) 1994 RA 2019
37	Cyanide as CN	mg/l	<0.01	0.05	IS 3025 (Part 27) 1986 RA 2019
38	Mercury as Hg	mg/l	<0.001	0.001	IS 3025 (Part 48) 1994 RA 2009
39	Molybdenum as Mo	mg/l	<0.02	0.07	IS 3025 (Part 2)
40	Polynuclear aromatic hydrocarbons as PAH	mg/l	<0.001	0.001	APHA 6440
41	Total arsenic as As	mg/l	<0.01	0.01	IS 3025 (Part 37) 1988 RA 2019


 Reviewed by
 (Ms. Lakshmi Priya Sahoo)


 Authorized Signatory for Chemical
 (Mr. Bijaya Kumar Chahatary)

***** END OF REPORT *****

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Form No: WCSQR/7.302

TEST REPORT

Report No	: WCS2511598	Issue Date	: 29.11.2025
NABL URL No	: TCT12252500000431F		
Name of the Client	: Raikela Iron Ore Mines (M/S Geetaranj Mahanty)		
Address	: Raikela, Near Terna, P.O.-Dangula, Dist- Sundargarh- 770048, Odisha		
Sampling Location	: Terna Tube Well	Due of Sampling	: 22.11.2025
Sample Description	: Ground Water	Date of Receiving	: 24.11.2025
Sampling Plan & Method	: WCS/QSP/SAMR (WATER)	Sample ID No	: WCS25W368
Environmental Condition	: Temperature 25.0°C, Clear Weather	Quantity of Sample	: 1Ltr
Sample Collected by	: Debendra Kumar Biswal	Sample Condition	: Good
Test Performed at	: WCS Laboratory		
Date of Testing	: 24.11.2025 to 29.11.2025		

Sl. No.	Parameter	Unit	Result	Requirement as per IS 10500:2012 Reaffirmed 2018	Test Method
1	Colour	Hazen	1	Max. 5	IS 3025 (Part4): 2021
2	Odour	--	Agreeable	Agreeable	IS 3025 (Part5): 2018
3	pH Value	--	7.654 at 24.2°C	6.5-8.5	IS 3025 (Part1): 2022
4	Turbidity	NTU	0.2	1.0	IS 3025 (Part10): 2023
5	Total Dissolved Solid as TDS	mg/l	135.0	500.0	IS 3025 (Part16): 2023
6	Ammonia as Total ammonia-N	mg/l	0.18	0.5	IS 3025 (Part34): 1988 RA 2019
7	Calcium as Ca	mg/l	17.64	75.0	IS 3025 (Part40): 2024
8	Chloride as Cl	mg/l	15.50	250.0	IS 3025 (Part32): 1988 RA 2019
9	Fluoride as F	mg/l	0.20	1.0	APHA 24th Ed. (4500-F-D): 2023
10	Iron as Fe	mg/l	0.51	1.0	IS 3025 (Part53): 2024
11	Magnesium as Mg	mg/l	5.83	30.0	APHA 24th Ed. (3500-Mg-B): 2023
12	Nitrate as NO3	mg/l	1.54	45.0	APHA 24th Ed. (NO3)-(B): 2023
13	Sulphate as SO4	mg/l	2.75	200.0	IS 3025 (Part24, Sec-3): 2022
14	Total Alkalinity as CaCO3	mg/l	40.0	200.0	IS 3025 (Part23): 2023
15	Total Hardness as CaCO3	mg/l	68.0	200.0	IS 3025 (Part21): 2009 RA 2019
16	Total Chromium as Cr	mg/l	<0.02	0.05	IS 3025 (Part52): 2003 RA 2019
17	Potassium as K	mg/l	22.0	--	IS 3025 (Part45): 1993 RA 2019
18	Sodium as Na	mg/l	7.8	--	IS 3025 (Part45): 1993 RA 2019
19	Total Suspended Solid as TSS	mg/l	<5.0	--	IS 3025 (Part 17): 2022
20	Boron as B	mg/l	<0.1	0.50	IS 3025 (Part 57): 2021
21	Copper as Cu	mg/l	<0.01	0.05	IS 3025 (Part 42): 2024
22	Manganese as Mn	mg/l	<0.05	0.10	Apha 24th Edition: 2023 3111B
23	Cadmium as Cd	mg/l	<0.001	0.003	IS 3025 (Part-41) 1992 RA 2023
24	Lead as Pb	mg/l	<0.001	0.01	IS 3025 (Part-47) 2024
25	Nickel as Ni	mg/l	<0.01	0.02	IS 3025 (Part-54) 2003 RA 2019
26	Total Coliform	MPN/ 100 ml	<2.0	Shall not be detectable in any 100 ml sample	IS 1622: 1981 RA 2019

Reviewed by
 (Ms. Laxminipya Sethi)

Authorized Signatory for Microbiology
 (Miss. Laxmi Sahoo)

***** END OF REPORT *****



Authorized Signatory for Chemical
 (Mr. Bijaya Kumar Chhabatray)

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Format No: WCSQR/7.0/02

TEST REPORT

Report No. : WCS251159B Issue Date : 29.11.2025
Name of the Client : Raikela Iron Ore Mines (M/S Geelarani Mohanty)
Address : Raikela, Near Tensa, P.O.-Dengula, Dist- Sundargarh- 750048, Odisha
Sampling Location : Tensa Tube Well
Sample Description : Ground Water Date of Sampling : 22.11.2025
Sampling Plan & Method : WCSQSW/SAMP (WATER) Date of Receiving : 24.11.2025
Environmental Condition : Temperature 25.0°C, Clear Weather Sample ID No : WCS1125W364
Sample Collected by : Debendra Kumar Biswal Quantity of Sample : 1Ltr
Test Performed at : WCS Laboratory Sample Condition : Good
Date of Testing : 24.11.2025 to 29.11.2025

Sl. No.	Parameter	Unit	Result	Requirement as per IS 10500:2012 Reaffirmed 2018	Test Method
27	Aluminium as Al	mg/l	<0.02	0.03	IS 3025 (Part 55) 2003 RA 2019
28	Anionic detergents as MBAS	mg/l	<0.02	0.2	Annex K of IS 13428
29	Barium as Ba	mg/l	<0.1	0.7	Annex J of IS 13428* or IS 15302
30	Chloramines as Cl ₂	mg/l	<0.02	4.0	IS 3025 (Part 26)* or APHA 4500-Cl ₂
31	Mineral oil	mg/l	<0.5	1.0	Clause 6 of IS 3025 (Part 39) 2021
32	Phenolic compounds as C ₆ H ₅ OH	mg/l	<0.001	0.001	IS 3025 (Part 43) 1992 RA 2019
33	Selenium as Se	mg/l	<0.001	0.01	IS 3025 (Part 56) 2003 RA 2019
34	Silver as Ag	mg/l	<0.02	0.10	Annex J of IS 13428
35	Sulphide as H ₂ S	mg/l	<0.05	0.05	IS 3025 (Part 29) 1986 RA 2019
36	Zinc as Zn	mg/l	<0.05	5.0	IS 3025 (Part 49) 1994 RA 2019
37	Cyanide as CN	mg/l	<0.05	0.05	IS 3025 (Part 27) 1986 RA 2019
38	Mercury as Hg	mg/l	<0.001	0.001	IS 3025 (Part 48) 1994 RA 2009
39	Molybdenum as Mo	mg/l	<0.02	0.07	IS 3025 (Part 2)
40	Polynuclear aromatic hydrocarbons as PAH	mg/l	0.001	0.001	APHA 6440
41	Total arsenic as As	mg/l	<0.01	0.01	IS 3025 (Part 37) 1988 RA 2019

Reviewed by
Ms. Laxmi Priya Sethi



Authorized Signatory for Chemical
(Mr. Biju Kumar Chakraborty)

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Form No: WCS/QR/7.8.02

Report No.

NABL ULR No.

Name of the Client

Address

Sampling Location

Sample Description

Sampling Plan & Method

Environmental Condition

Sample Collected by

Test Performed at

Date of Testing

WCS231159C

TC1122525000004331

Raikela Iron Ore Mines (M/S Goutarani Mohanty)

Raikela, Near Tansa, P.O.-Dengula, Dist- Sundargarh- 770048, Odisha

Tentakithi Dug Well

Ground Water

WCS/SP/SAMP (WATER)

Temperature 24.8°C, Clear Weather

Debendra Kumar Biswal

WCS Laboratory

24.11.2025 to 29.11.2025

TEST REPORT

Issue Date : 29.11.2025

Date of Sampling : 22.11.2025

Date of Receiving : 24.11.2025

Sample ID No : WCS1125W36C

Quantity of Sample : 1Ltr

Sample Condition : Good

Sl. No.	Parameter	Unit	Result	Requirement as per IS 10500:2012 Reaffirmed 2018	Test Method
1	Colour	Hazen	1	Max. 5	IS 3025 (Part4): 2021
2	Odour	--	Agreeable	Agreeable	IS 3025 (Part5): 2018
3	pH Value	--	6.871 at 24.8°C	6.5-8.5	IS 3025 (Part11): 2022
4	Turbidity	NTU	0.3	1.0	IS 3025 (Part10): 2023
5	Total Dissolved Solid as TDS	mg/l	134.0	500.0	IS 3025 (Part16): 2023
6	Ammonia as Total ammonia-N	mg/l	0.21	0.5	IS 3025 (Part34): 1988 RA 2019
7	Calcium as Ca	mg/l	15.23	75.0	IS 3025 (Part40): 2024
8	Chloride as Cl	mg/l	11.0	250.0	IS 3025 (Part32): 1988 RA 2019
9	Fluoride as F	mg/l	0.24	1.0	APHA 24th Ed. (4500-F-3): 2023
10	Iron as Fe	mg/l	0.48	1.0	IS 3025 (Part53): 2024
11	Magnesium as Mg	mg/l	5.83	30.0	APHA 24th Ed. (3500-Mg-3): 2023
12	Nitrate as NO3	mg/l	2.35	45.0	APHA 24th Ed. (NO3-B): 2023
13	Sulphate as SO4	mg/l	3.45	200.0	IS 3025 (Part-24, Sec-1): 2022
14	Total Alkalinity as CaCO3	mg/l	20.0	200.0	IS 3025 (Part23): 2023
15	Total Hardness as CaCO3	mg/l	62.0	200.0	IS 3025 (Part21): 2009 RA 2019
16	Total Chromium as Cr	mg/l	<0.02	0.05	IS 3025 (Part52): 2003 RA 2019
17	Potassium as K	mg/l	12.6	--	IS 3025 (Part45): 1993 RA 2019
18	Sodium as Na	mg/l	20.1	--	IS 3025 (Part45): 1993 RA 2019
19	Total Suspended Solid as TSS	mg/l	<5.0	--	IS 3025 (Part 17): 2022
20	Boron as B	mg/l	<0.1	0.50	IS 3025 (Part 57): 2021
21	Copper as Cu	mg/l	<0.01	0.05	IS 3025 (Part 42): 2024
22	Manganese as Mn	mg/l	<0.05	0.10	Aphe 24th Edition: 2023 3111B
23	Cadmium as Cd	mg/l	<0.001	0.005	IS 3025 (Part-41): 1992 RA 2023
24	Lead as Pb	mg/l	<0.001	0.01	IS 3025 (Part-47): 2024
25	Nickel as Ni	mg/l	<0.01	0.02	IS 3025 (Part-54): 2003 RA 2019
26	Total Coliform	MPN/ 100 ml	<2.0	Shall not be detectable in any 100 ml sample.	IS 1622: 1981 RA 2019

 Reviewed by
 (Ms. Laxmipriya Sethi)

 Authorized Signatory for Microbiology
 (Miss. Laxmi Sahoo)

***** END OF REPORT *****


 Authorized Signatory for Chemical
 (Mr. Bijaya Kumar Chahatary)

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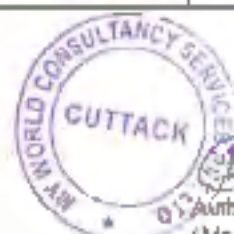
Format No. WCS/Q8/7.8/02

TEST REPORT

Report No. : WCS251159C Issue Date : 29.11.2025
Name of the Client : **Raikela Iron Ore Mines (M/S Gectranil Mohanty)**
Address : Raikela, Near Tensa, P.O.-Dengala, Dist- Sundargarh- 770048, Odisha
Sampling Location : **Tentakidih Dug Well**
Sample Description : Ground Water Date of Sampling : 22.11.2025
Sampling Plan & Method : WCSQSP/SAMP (WATER) Date of Receiving : 24.11.2025
Environmental Condition : Temperature 24.8°C, Clear Weather Sample ID No : WCS1125W36C
Sample Collected by : Debendra Kumar Biswal Quantity of Sample : 1Ltr
Test Performed at : WCS Laboratory Sample Condition : Good
Date of Testing : 24.11.2025 to 29.11.2025

SL No.	Parameter	Unit	Result	Requirement as per IS 10500:2012 Reaffirmed 2018	Test Method
27	Aluminium as Al	mg/l	<0.02	0.03	IS 3025 (Part 55) 2003 RA 2019
28	Anionic detergents as MBAS	mg/l	<0.02	0.2	Annex K of IS 13428
29	Barium as Ba	mg/l	<0.1	0.7	Annex F of IS 13428* or IS 15302
30	Chloramines as Cl ₂	mg/l	<0.02	4.0	IS 3025 (Part 26)* or APHA 4500-Cl G
31	Mineral oil	mg/l	<0.5	1.0	Clause 6 of IS 3025 (Part 39) 2021
32	Phenolic compounds as C ₆ H ₅ OH	mg/l	<0.001	0.001	IS 3025 (Part 43) 1992 RA 2019
33	Selenium as Se	mg/l	<0.001	0.01	IS 3025 (Part 56) 2003 RA 2019
34	Silver as Ag	mg/l	<0.02	0.10	Annex J of IS 13428
35	Sulphide as H ₂ S	mg/l	<0.05	0.05	IS 3025 (Part 29) 1986 RA 2019
36	Zinc as Zn	mg/l	<0.05	5.0	IS 3025 (Part 49) 1994 RA 2019
37	Cyanide as CN ⁻	mg/l	<0.01	0.05	IS 3025 (Part 27) 1986 RA 2019
38	Mercury as Hg	mg/l	<0.001	0.001	IS 3025 (Part 48) 1994 RA 2009
39	Molybdenum as Mo	mg/l	<0.02	0.07	IS 3025 (Part 2)
40	Polynuclear aromatic hydrocarbons as PAH	mg/l	0.0001	0.0001	APHA 6440
41	Total arsenic as As	mg/l	<0.01	0.01	IS 3025 (Part 37) 1988 RA 2019

Reviewed by
(Ms. Laxmipriya Sethi)



Authorized Signatory for Chemical
(Mr. Bijaya Kumar Chhabra)

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Plot No. 766, Telengapentha, Cuttack-754001
NABL (ISO/IEC 17025:2017) ACCREDITED LABORATORY



WCS
MY WORLD CONSULTANCY SERVICES

TC-11225

Format No: WCS/QR/7.8/02

Report No.

NABL ULR No.

Name of the Client

Address

Sampling Location

Sample Description

Sampling Plan & Method

Environmental Condition

Sample Collected by

Test Performed at

Date of Testing

WCS260225A

TC11225260000083

Raikela Iron Ore Mines (M/S Geetarani Mohanty)

Raikela, Near Tensa, P.O.-Dengula, Dist- Sundargarh- 750048, Odisha

Office Bore Well (Inside Mines Office)

Ground Water

WCS/QSP/SAMP (WATER)

Temperature 25.6°C, Clear Weather

Tapas Ranjan Patel

WCS Laboratory

09.02.2026 to 14.02.2026

TEST REPORT

Issue Date : 16.02.2026

Date of Sampling : 04.02.2026

Date of Receiving : 07.02.2026

Sample ID No : WCS0226W18A

Quantity of Sample : 1Ltr

Sample Condition : Good

Sl. No.	Parameter	Unit	Result	Requirement as per IS 10500:2012 Reaffirmed 2018	Test Method
1	Colour	Hazen	1	Max. 5	IS 3025 (Part4): 2021
2	Odour	--	Agreeable	Agreeable	IS 3025 (Part5): 2018
3	pH Value	--	7.016 at 25.3°C	6.5-8.5	IS 3025 (Part11): 2022
4	Turbidity	NTU	0.2	1.0	IS 3025 (Part10): 2023
5	Total Dissolved Solid as TDS	mg/l	108.0	500.0	IS 3025 (Part16): 2023
6	Ammonia as Total ammonia-N	mg/l	0.40	0.5	IS 3025 (Part34): 1988 RA 2019
7	Calcium as Ca	mg/l	8.82	75.0	IS 3025 (Part40): 2024
8	Chloride as Cl	mg/l	15.00	250.0	IS 3025 (Part52): 1988 RA 2019
9	Fluoride as F	mg/l	0.08	1.0	APHA 24th Ed. (4500-F-D): 2023
10	Iron as Fe	mg/l	0.40	1.0	IS 3025 (Part53): 2024
11	Magnesium as Mg	mg/l	5.35	30.0	APHA 24th Ed. (3500-Mg-B): 2023
12	Nitrate as NO3	mg/l	2.56	45.0	APHA 24th Ed. (NO3-B): 2023
13	Sulphate as SO4	mg/l	1.43	200.0	IS 3025 (Part24, Sec-1): 2022
14	Total Alkalinity as CaCO3	mg/l	30.0	200.0	IS 3025 (Part23): 2023
15	Total Hardness as CaCO3	mg/l	41.0	200.0	IS 3025 (Part21): 2009 RA 2019
16	Total Chromium as Cr	mg/l	<0.02	0.05	IS 3025 (Part52): 2003 RA 2019
17	Potassium as K	mg/l	23.6	--	IS 3025 (Part45): 1993 RA 2019
18	Sodium as Na	mg/l	10.1	--	IS 3025 (Part45): 1993 RA 2019
19	Total Suspended Solid as TSS	mg/l	<5.0	--	IS 3025 (Part 17): 2022
20	Boron as B	mg/l	<0.1	0.50	IS 3025 (Part 57): 2021
21	Copper as Cu	mg/l	<0.01	0.05	IS 3025 (Part 42): 2024
22	Manganese as Mn	mg/l	<0.05	0.10	APHA 24th Edition: 2023 3111B
23	Cadmium as Cd	mg/l	<0.001	0.003	IS 3025 (Part-41) 1992 RA 2023
24	Lead as Pb	mg/l	<0.001	0.01	IS 3025 (Part-47) 2024
25	Nickel as Ni	mg/l	<0.01	0.02	IS 3025 (Part-54) 2003 RA 2019
26	Total Coliform	MPN/ 100 ml	<2.0	Shall not be detectable in any 100 ml sample	IS 1622: 1981 RA 2019

Reviewed by
(Ms. Laxmi Priya Sethi)

Authorized Signatory for Microbiology
(Miss. Laxmi Sahoo)

***** END OF REPORT *****



Authorized Signatory for Chemical
(Mr. Bijaya Kumar Chakrabarty)

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Format No: WCS/QR/7.8/02

TEST REPORT

Report No.

WCS260225A

Issue Date

16.02.2026

Name of the Client

Raikela Iron Ore Mines (M/S Geetarani Mohanty)

Address

Raikela, Near Tensa, P.O.-Dangula, Dist- Sundargarh- 770048, Odisha

Sampling Location

Office Bore Well (Inside Mines Office)

Sample Description

Ground Water

Date of Sampling

04.02.2026

Sampling Plan & Method

WCS/QSP/SAMP (WATER)

Date of Receiving

07.02.2026

Environmental Condition

Temperature 25.6°C, Clear Weather

Sample ID No

WCS0226W18A

Sample Collected by

Tapas Ranjan Patel

Quantity of Sample

1Ltr

Test Performed at

WCS Laboratory

Sample Condition

Good

Date of Testing

09.02.2026 to 14.02.2026

Sl. No.	Parameter	Unit	Result	Requirement as per IS 10500:2012 Reaffirmed 2018	Test Method
27	Aluminium as Al	mg/l	<0.02	0.03	IS 3025 (Part 55) 2003 RA 2019
28	Anionic detergents as MBAS	mg/l	<0.02	0.2	Annex K of IS 13428
29	Barium as Ba	mg/l	<0.1	0.7	Annex F of IS 13428* or IS 15302
30	Chloramines as Cl ₂	mg/l	<0.02	4.0	IS 3025 (Part 26)* or APHA 4500-Cl ₂
31	Mineral oil	mg/l	<0.5	1.0	Clause 6 of IS 3025 (Part 39) 2021
32	Phenolic compounds as C ₆ H ₅ OH	mg/l	<0.001	0.001	IS 3025 (Part 43) 1992 RA 2019
33	Selenium as Se	mg/l	<0.001	0.01	IS 3025 (Part 56) 2003 RA 2019
34	Silver as Ag	mg/l	<0.02	0.10	Annex J of IS 13428
35	Sulphide as H ₂ S	mg/l	<0.05	0.05	IS 3025 (Part 29) 1986 RA 2019
36	Zinc as Zn	mg/l	<0.05	5.0	IS 3025 (Part 49) 1994 RA 2019
37	Cyanide as CN	mg/l	<0.01	0.05	IS 3025 (Part 27) 1986 RA 2019
38	Mercury as Hg	mg/l	<0.001	0.001	IS 3025 (Part 48) 1994 RA 2019
39	Molybdenum as Mo	mg/l	<0.02	0.07	IS 3025 (Part 2)
40	Polynuclear aromatic hydrocarbons as PAH	mg/l	0.0001	0.0001	APHA 6140
41	Total arsenic as As	mg/l	<0.01	0.01	IS 3025 (Part 37) 1988 RA 2019


Reviewed by
(Ms. Laxmipriya Sethi)




Authorized Signatory for Chemical
(Mr. Bijaya Kumar Chhabhanty)

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NABL (ISO/IEC 17025:2017) ACCREDITED LABORATORY



WCS
MY WORLD CONSULTANCY SERVICES

TC-11225

Format No: WCSQR/7.8/02

Report No.

NABL ULR No.

Name of the Client

Address

Sampling Location

Sample Description

Sampling Plan & Method

Environmental Condition

Sample Collected by

Test Performed at

Date of Testing

TEST REPORT

Issue Date

16.02.2026

WCS260225B

TC112252600000083F

Raikela Iron Ore Mines (M/S Geetarani Mohanty)

Raikela, Near Tensa, P.O.-Denguli, Dist- Sundargarh- 770048, Odisha

Tensa Tube Well

Ground Water

WCSQSP/SAMP (WATER)

Temperature: 24.7°C, Clear Weather

Tapas Ranjan Patel

WCS Laboratory

09.02.2026 to 14.02.2026

Date of Sampling

04.02.2026

Date of Receiving

07.02.2026

Sample ID No

WCS0226W18B

Quantity of Sample

1 Ltr

Sample Condition

Good

Sl. No.	Parameter	Unit	Result	Requirement as per IS 10500:2012 Reaffirmed 2018	Test Method
1	Colour	Hazen	1	Max. 5	IS 3025 (Part4): 2021
2	Odour	—	Agreeable	Agreeable	IS 3025 (Part5): 2018
3	pH Value	—	7.175 at 25.1°C	6.5-8.5	IS 3025 (Part11): 2022
4	Turbidity	NTU	0.2	1.0	IS 3025 (Part10): 2023
5	Total Dissolved Solid as TDS	mg/l	144.0	300.0	IS 3025 (Part16): 2023
6	Ammonia as Total ammonia-N	mg/l	0.20	0.5	IS 3025 (Part34): 1988 RA 2019
7	Calcium as Ca	mg/l	22.44	75.0	IS 3025 (Part40): 2024
8	Chloride as Cl	mg/l	12.74	250.0	IS 3025 (Part32): 1988 RA 2019
9	Fluoride as F	mg/l	0.14	1.0	APHA 24th Ed. (4500-F-D): 2023
10	Iron as Fe	mg/l	0.42	1.0	IS 3025 (Part53): 2024
11	Magnesium as Mg	mg/l	5.35	30.0	APHA 24th Ed. (3500-Mg-B): 2023
12	Nitrate as NO ₃	mg/l	1.32	45.0	APHA 24th Ed. (NO ₃ -B): 2023
13	Sulphate as SO ₄	mg/l	3.12	200.0	IS 3025 (Part-24, Sec-1): 2022
14	Total Alkalinity as CaCO ₃	mg/l	50.0	200.0	IS 3025 (Part23): 2023
15	Total Hardness as CaCO ₃	mg/l	78.0	200.0	IS 3025 (Part21): 2009 RA 2019
16	Total Chromium as Cr	mg/l	<0.02	0.05	IS 3025 (Part52): 2003RA 2019
17	Potassium as K	mg/l	18.0	—	IS 3025 (Part15): 1993RA 2019
18	Sodium as Na	mg/l	7.0	—	IS 3025 (Part15): 1993 RA 2019
19	Total Suspended Solid as TSS	mg/l	<5.0	—	IS 3025 (Part 17): 2022
20	Boron as B	mg/l	<0.1	0.50	IS 3025 (Part 57): 2021
21	Copper as Cu	mg/l	<0.01	0.05	IS 3025 (Part 42) : 2024
22	Manganese as Mn	mg/l	<0.05	0.10	Apha 24th Edition: 2023 3111B
23	Cadmium as Cd	mg/l	<0.001	0.003	IS 3025(Part-41)1992 RA 2023
24	Lead as Pb	mg/l	<0.001	0.01	IS 3025(Part-47) 2024
25	Nickel as Ni	mg/l	<0.01	0.02	IS 3025(Part-54)2003 RA 2019
26	Total Coliform	NPN/ 100 ml	<2.0	Shall not be detectable in any 100 ml sample	IS 1622: 1981 RA 2019

Reviewed by
(Ms. Laxmipriya Sethi)

Authorized Signatory for Microbiology
(Miss. Laxmi Sahoo)
***** END OF REPORT *****



Authorized Signatory for Chemical
(Mr. Bijaya Kumar Chhabra)

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Formul No: WCS/QR/7.8:12

TEST REPORT

Report No.	WCS260225B	Issue Date	16.02.2026
Name of the Client	Raikela Iron Ore Mines (M/S Geetarani Mohanty)		
Address	Raikela, Near Tansa, P.O.-Dengula, Dist- Sundargarh- 770048, Odisha		
Sampling Location	Tansa Tube Well		
Sample Description	Ground Water	Date of Sampling	04.02.2026
Sampling Plan & Method	WCS/QSP/SAMP (WATER)	Date of Receiving	07.02.2026
Environmental Condition	Temperature 24.7°C, Clear Weather	Sample ID No	WCS0226W18H
Sample Collected by	Tapas Ranjan Patel	Quantity of Sample	1Ltr
Test Performed at	WCS Laboratory	Sample Condition	Good
Date of Testing	09.02.2026 to 14.02.2026		

SL No.	Parameter	Unit	Result	Requirement as per IS 10501:2012 Reaffirmed 2018	Test Method
27	Aluminium as Al	mg/l	<0.02	0.03	IS 3025 (Part 55):2003 RA 2019
28	Anionic detergents as MBAS	mg/l	<0.02	0.2	Annex K of IS 13428
29	Barium as Ba	mg/l	<0.1	0.7	Annex F of IS 13428* or IS 15302
30	Chloramines as Cl ₂	mg/l	<0.02	4.0	IS 3025 (Part 26)* or APHA 4500-Cl G
31	Mineral oil	mg/l	<0.5	1.0	Clause 6 of IS 3025 (Part 39) 2021
32	Phenolic compounds as C ₆ H ₅ OH	mg/l	<0.001	0.001	IS 3025 (Part 43):1992 RA 2019
33	Selenium as Se	mg/l	<0.001	0.01	IS 3025 (Part 56) 2003 RA 2019
34	Silver as Ag	mg/l	<0.02	0.10	Annex I of IS 13428
35	Sulphide as H ₂ S	mg/l	<0.05	0.05	IS 3025 (Part 29):1986 RA 2019
36	Zinc as Zn	mg/l	<0.05	5.0	IS 3025 (Part 49):1991 RA 2019
37	Cyanide as CN	mg/l	<0.01	0.05	IS 3025 (Part 27):1986 RA 2019
38	Mercury as Hg	mg/l	<0.001	0.001	IS 3025 (Part 48):1994 RA 2009
39	Molybdenum as Mo	mg/l	<0.02	0.07	IS 3025 (Part 2)
40	Polynuclear aromatic hydrocarbons as PAH	mg/l	0.0001	0.0001	APHA 6140
41	Total arsenic as As	mg/l	<0.01	0.01	IS 3025 (Part 37):1988 RA 2019


Reviewed by
(Ms. Laxmi Priya Sethi)




Authorized Signatory for Chemical
Mr. Bijaya Kumar Chahatary

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TC-11225

Format No: WCSQR/7.8/02

Report No:

NABL ULR No:

Name of the Client

Address

Sampling Location

Sample Description

Sampling Plan & Method

Environmental Condition

Sample Collected by

Test Performed at

Date of Testing

TEST REPORT

Issue Date : 16.02.2026

Date of Sampling : 04.02.2026

Date of Receiving : 07.02.2026

Sample ID No : WCS0226W18C

Quantity of Sample : 1Ltr

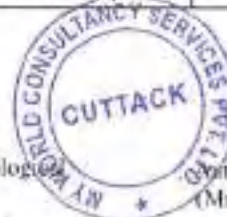
Sample Condition : Good

Sl. No.	Parameter	Unit	Result	Requirement as per IS 10500:2012 Reaffirmed 2018	Test Method
1	Colour	Hazen	1	Max. 5	IS 3025 (Part4): 2021
2	Odour	--	Agreeable	Agreeable	IS 3025 (Part5): 2018
3	pH Value	--	7.016 at 25.1°C	6.5-8.5	IS 3025 (Part11): 2022
4	Turbidity	NTU	0.2	1.0	IS 3025 (Part10): 2023
5	Total Dissolved Solid as TDS	mg/l	126.0	500.0	IS 3025 (Part16): 2023
6	Ammonia as Total ammonia-N	mg/l	0.16	0.5	IS 3025 (Part34): 1988 RA 2019
7	Calcium as Ca	mg/l	12.83	75.0	IS 3025 (Part40): 2024
8	Chloride as Cl	mg/l	14.0	250.0	IS 3025 (Part32): 1988 RA 2019
9	Fluoride as F	mg/l	0.17	1.0	APHA 24th Ed. (4500-F-D): 2023
10	Iron as Fe	mg/l	0.50	1.0	IS 3025 (Part53): 2024
11	Magnesium as Mg	mg/l	4.86	30.0	APHA 24th Ed. (3500-Mg-B): 2023
12	Nitrate as NO3	mg/l	2.56	45.0	APHA 24th Ed. (NO3-B): 2023
13	Sulphate as SO4	mg/l	3.27	200.0	IS 3025 (Part-24, Sec-1): 2022
14	Total Alkalinity as CaCO3	mg/l	35.0	200.0	IS 3025 (Part23): 2023
15	Total Hardness as CaCO3	mg/l	52.0	200.0	IS 3025 (Part21): 2009 RA 2019
16	Total Chromium as Cr	mg/l	<0.02	0.05	IS 3025 (Part52): 2003RA 2019
17	Potassium as K	mg/l	10.0	--	IS 3025 (Part45): 1993RA 2019
18	Sodium as Na	mg/l	17.6	--	IS 3025 (Part45): 1993 RA 2019
19	Total Suspended Solid as TSS	mg/l	<5.0	--	IS 3025 (Part 17): 2022
20	Boron as B	mg/l	<0.1	0.50	IS 3025 (Part 57): 2021
21	Copper as Cu	mg/l	<0.01	0.05	IS 3025 (Part 42): 2024
22	Manganese as Mn	mg/l	<0.05	0.10	APHA 24th Edition: 2023 3111B
23	Cadmium as Cd	mg/l	<0.001	0.003	IS 3025 (Part-41) 1992 RA 2023
24	Lead as Pb	mg/l	<0.001	0.01	IS 3025 (Part-47) 2024
25	Nickel as Ni	mg/l	<0.01	0.02	IS 3025 (Part-54) 2003 RA 2019
26	Total Coliform	MPN/ 100 ml	<2.0	Shall not be detectable in any 100 ml sample	IS 1622: 1981 RA 2019

Reviewed by
(Ms. Laxmi Priya Sethi)

Authorized Signatory for Microbiology
(Miss. Laxmi Sahoo)

***** END OF REPORT *****



Authorized Signatory for Chemical
(Mr. Bijaya Kumar Chahatray)

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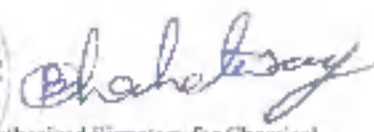
TEST REPORT

Report No.	WCS260223C	Issue Date	16.02.2026
Name of the Client	Raikela Iron Ore Mines (M/S Geetarani Mohanty)		
Address	Raikela, Near Tensa, P.O.-Dangula, Dist- Sundargarh- 770048, Odisha		
Sampling Location	Tentulidih Dug Well		
Sample Description	Ground Water	Date of Sampling	04.02.2026
Sampling Plan & Method	WCS/QSP/SAMP (WATER)	Date of Receiving	07.02.2026
Environmental Condition	Temperature 25.4°C, Clear Weather	Sample ID No	WCS0226W18C
Sample Collected by	Tapas Ranjan Patel	Quantity of Sample	1Ltr
Test Performed at	WCS Laboratory	Sample Condition	Good
Date of Testing	09.02.2026 to 14.02.2026		

SL No.	Parameter	Unit	Result	Requirement as per IS 10500:2012 Reaffirmed 2018	Test Method
27	Aluminium as Al	mg/l	<0.02	0.03	IS 3025 (Part 55)2003 RA 2019
28	Anionic detergents as MBAS	mg/l	<0.02	0.2	Annex K of IS 13428
29	Barium as Ba	mg/l	<0.1	0.7	Annex F of IS 13428* or IS 15302
30	Chloramines as Cl ₂	mg/l	<0.02	4.0	IS 3025 (Part 26)* or APHA 4500-Cl G
31	Mineral oil	mg/l	<0.5	1.0	Clause 6 of IS 3025 (Part 39) 2021
32	Phenolic compounds as C ₆ H ₅ OH	mg/l	<0.001	0.001	IS 3025 (Part 43)1992 RA 2019
33	Selenium as Se	mg/l	<0.001	0.01	IS 3025 (Part 56) 2003 RA 2019
34	Silver as Ag	mg/l	<0.02	0.10	Annex J of IS 13428
35	Sulphide as H ₂ S	mg/l	<0.05	0.05	IS 3025 (Part 29)1986 RA 2019
36	Zinc as Zn	mg/l	<0.05	5.0	IS 3025 (Part 49)1994 RA 2019
37	Cyanide as CN	mg/l	<0.01	0.05	IS 3025 (Part 27)1986 RA 2019
38	Mercury as Hg	mg/l	<0.001	0.001	IS 3025 (Part 48)1994 RA 2009
39	Molybdenum as Mo	mg/l	<0.02	0.07	IS 3025 (Part 2)
40	Polynuclear aromatic hydrocarbons as PAH	mg/l	0.0001	0.0001	APHA 6440
41	Total arsenic as As	mg/l	<0.01	0.01	IS 3025 (Part 37)1988 RA 2019


Reviewed by
(Ms. Laxmi Priya Sethi)




Authorized Signatory for Chemical
(Mr. Bijaya Kumar Chakraborty)

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Report No.

NABL ULR No.

Name of the Client

Address

Sampling Location

Sample Description

Sampling Plan & Method

Environmental Condition

Sample Collected by

Test Performed at

Date of Testing

WCS2510H1A

TC112257500X03604

Ruikela Iron Ore Mines (M/S Geetaran Mohanty)

Ruikela, Near Terisa, P.O.-Dengula, Dist- Sundargarh- 770048, Odisha

Kuru nala Down stream

Surface Water

WCS/QSP/SAMP (WATER)

Temperature 27.3°C, Clear Weather

Debendra Kumar Biswal

WCS Laboratory

23.10.2025 to 28.10.2025

TEST REPORT

Issue Date : 30.10.2025

Date of Sampling : 21.10.2025

Date of Receiving : 23.10.2025

Sample ID No : WCS1025W12A

Quantity of Sample : 1Ltr

Sample Condition : Good

Sl. No.	Parameter	Unit	Result	Test Methods
1	Odour	—	Agreeable	IS 3025 (Part 5): 2018
2	Colour	Hazen	10.0	IS 3025 (Part 4): 2021
3	pH Value	—	6.885 at 26.5°C	IS 3025 (Part 11): 2023
4	Specific Conductivity	µs/cm	162 at 27.2°C	IS 3025 (Part 14): 2013 RA 2019
5	Dissolved Oxygen as DO	mg/l	5.9	IS 3025 (Part 38): 1989 RA 2019
6	Chemical Oxygen Demand as COD	mg/l	5.0	IS 3025 (Part 58): 2023
7	Biochemical Oxygen Demand as BOD	mg/l	3.1	IS 3025 (Part 44): 2023
8	Total Suspended Solid as TSS	mg/l	13.6	IS 3025 (Part 17): 2022
9	Oil & Grease	mg/l	<4.0	APHA 24th Ed. (5520-B): 2023
10	Total Hardness as CaCO ₃	mg/l	36.0	APHA 24th Ed. (2340-C): 2023
11	Chloride as Cl ⁻	mg/l	16.69	IS 3025 (Part 32): 1988 RA 2019
12	Sulphate as SO ₄ ²⁻	mg/l	12.65	IS 3025 (Part 24, Sec-1): 2022
13	Nitrate as NO ₃ ⁻	mg/l	2.31	APHA 24th Ed. (4500-NO ₃ -H): 2023
14	Fluoride as F ⁻	mg/l	0.04	APHA 24th Ed. (4500-F ⁻ D): 2023
15	Calcium as Ca	mg/l	16.83	APHA 24th Ed. (3500-Ca-B): 2023
16	Magnesium as Mg	mg/l	1.40	APHA 24th Ed. (3500-Mg-B): 2023
17	Iron as Fe	mg/l	0.45	IS 3025 (Part 53): 2024
18	Total Dissolved Solid as TDS	mg/l	164.0	IS 3025 (Part 16): 2023
19	Total Coliform	MPN/ 100 ml	240.0	IS 1622: 1981 RA 2019

 Reviewed by
 (Ms. Laxmipriya Suthi)

 Authorized Signatory for Microbiological
 (Miss. Laxmi Sahoo)

 Authorized Signatory for Chemical
 (Mr. Bijaya Kumar Chahutaray)

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Format No: WCS-QR/7.8-02

TEST REPORT

Issue Date : 30.10.2023

Report No. : WCS251041B
NABL ULR No. : TC112252500(X0)369F
Name of the Client : **Raikela Iron Ore Mines (M/S Cesturani Mohanty)**
Address : Raikela, Near Teosa, P.O.-Dengula, Dist- Sundargarh- 770948, Odisha
Sampling Location : **Tantara Pond**
Sample Description : Surface Water
Sampling Place & Method : WCS/QSP/SAMP (WATER)
Environmental Condition : Temperature 27.2°C, Clear Weather
Sample Collected by : **Dobendra Kumar Biswal**
Test Performed at : WCS Laboratory
Date of Testing : 23.10.2023 to 28.10.2023

Date of Sampling : 21.10.2023
Date of Receiving : 23.10.2023
Sample ID No : WCS1025W12B
Quantity of Sample : 1Ltr
Sample Condition : Good

Sl. No.	Parameter	Unit	Result	Test Methods
1	Odour	--	Agreeable	IS 3025 (Part 5): 2018
2	Colour	Hazen	5.0	IS 3025 (Part 4): 2021
3	pH Value	--	7.247 at 27.2°C	IS 3025 (Part 11): 2022
4	Specific Conductivity	µs/cm	130.5 at 26.4°C	IS 3025 (Part 14): 2011 RA 2019
5	Dissolve Oxygen as DO	mg/l	5.7	IS 3025 (Part 38): 1989 RA 2019
6	Chemical Oxygen Demand as COD	mg/l	5.0	IS 3025 (Part 58): 2023
7	Biochemical Oxygen Demand as BOD	mg/l	3.1	IS 3025 (Part 44): 2023
8	Total Suspended Solid as TSS	mg/l	25.30	IS 3025 (Part 17): 2022
9	Oil & Grease	mg/l	<4.0	APHA 24th Ed. (5520-B): 2023
10	Total Hardness as CaCO ₃	mg/l	58.0	APHA 24th Ed. (2340-C): 2023
11	Chloride as Cl	mg/l	12.20	IS 3025 (Part 32): 1988 RA 2019
12	Sulphate as SO ₄	mg/l	2.32	IS 3025 (Part 24, Sec-1): 2022
13	Nitrate as NO ₃	mg/l	1.53	APHA 24th Ed. (4500-NO ₃ -B): 2023
14	Fluoride as F	mg/l	0.04	APHA 24th Ed. (4500-F- D): 2023
15	Calcium as Ca	mg/l	21.64	APHA 24th Ed. (3500-Ca-B): 2023
16	Magnesium as Mg	mg/l	0.97	APHA 24th Ed. (3500-Mg-B): 2023
17	Iron as Fe	mg/l	0.36	IS 3025 (Part 53): 2024
18	Total Dissolved Solid as TDS	mg/l	143.0	IS 3025 (Part 16): 2023
19	Total Coliform	MPN/ 100 ml	240.0	IS 1622: 1981 RA 2019

Reviewed by
(Ms. Laxmipriya Sethi)

Authorized Signatory for Microbiological
(Miss. Luvni Suboo)



Authorized Signatory for Chemical
(Mr. Bijaya Kumar Chhabra)

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Format No: WCS/QR/7.8/02

Report No.

NABL ULR No.

Name of the Client

Address

Sampling Location

Sample Description

Sampling Plan & Method

Environmental Condition

Sample Collected by

Test Performed at

Date of Testing

WCS251001C

TC/12232500000369F

Raikela Iron Ore Mines (M/S Geetarani Mohanty)

Raikela, Near Tansa, P.O.-Dengula, Dist- Sundargarh- 770048, Odisha

Kurudhimala Down-stream

Surface Water

WCS/QSP/SAMP (WATER)

Temperature 27.2°C, Clear Weather

Debendra Kumar Biswal

WCS Laboratory

23.10.2025 to 28.10.2025

Issue Date : 30.10.2025

Date of Sampling : 31.10.2025

Date of Receiving : 23.10.2025

Sample ID No : WCS1025W12C

Quantity of Sample : 1Ltr

Sample Condition : Good

Sl. No.	Parameter	Unit	Result	Test Methods
1	Odour	--	Agreeable	IS 3025 (Part 5): 2018
2	Colour	Hazen	10.0	IS 3025 (Part 4): 2021
3	pH Value	--	7.225 at 27.3°C	IS 3025 (Part 11): 2022
4	Specific Conductivity	µs/cm	152 at 26.2°C	IS 3025 (Part 14): 2013 RA 2019
5	Dissolved Oxygen as DO	mg/l	6.4	IS 3025 (Part 38): 1989 RA 2019
6	Chemical Oxygen Demand as COD	mg/l	4.0	IS 3025 (Part 58): 2023
7	Biochemical Oxygen Demand as BOD	mg/l	2.4	IS 3025 (Part 4-f): 2021
8	Total Suspended Solid as TSS	mg/l	25.0	IS 3025 (Part 17): 2022
9	Oil & Grease	mg/l	<4.0	APHA 240 Ed. (4520-B): 2023
10	Total Hardness as CaCO ₃	mg/l	34.0	APHA 240 Ed. (2340-C): 2023
11	Chloride as Cl	mg/l	15.20	IS 3025 (Part 32): 1988 RA 2019
12	Sulphate as SO ₄	mg/l	11.65	IS 3025 (Part 24, Sec-1): 2022
13	Nitrate as NO ₃	mg/l	7.52	APHA 240 Ed. (4500-NO ₃ -B): 2023
14	Fluoride as F	mg/l	0.05	APHA 240 Ed. (4300-F- B): 2023
15	Calcium as Ca	mg/l	13.63	APHA 240 Ed. (3500-Ca-B): 2023
16	Magnesium as Mg	mg/l	4.86	APHA 240 Ed. (3500-Mg-B): 2023
17	Iron as Fe	mg/l	0.34	IS 3025 (Part 53): 2024
18	Total Dissolved Solid as TDS	mg/l	142.0	IS 3025 (Part 16): 2023
19	Total Coliform	MPN/ 100 ml	300.0	IS 1622: 1981 RA 2019

 Reviewed by
 (Mr. Laxmipriya Sethi)

 Authorized Signatory for Microbiology
 (Miss. Laxmi Sahoo)

 Authorized Signatory for Chemical
 (Mr. Bijaya Kumar Chahatary)

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Format No: WCSAOR/7.002

TEST REPORT

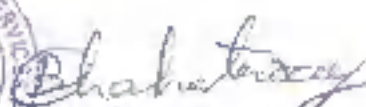
Report No.	: WCS251160A	Issue Date	: 29.11.2025
NABL ULR No.	: IL1122525060000434F		
Name of the Client	: Raikela Iron Ore Mines (M/S Ghatrani Mohanty)		
Address	: Raikela, Near Tansa, P.O.-Dengela, Dist-Sundargarh- 770048, Odisha		
Sampling Location	: Karpurita Down Stream		
Sample Description	: Surface Water	Date of Sampling	: 22.11.2025
Sampling Plan & Method	: WCS/QSP/SAMP (WATER)	Date of Receiving	: 24.11.2025
Environmental Condition	: Temperature 25.2°C, Clear Weather	Sample ID No.	: WCS2125W37A
Sample Collected by	: Debendra Kumar Biswal	Quantity of Sample	: 1Ltr
Test Performed at	: WCS Laboratory	Sample Condition	: Good
Date of Testing	: 24.11.2025 to 28.11.2025		

Sl. No.	Parameter	Unit	Result	Test Methods
1	Odour	--	Agreeable	IS 3025 (Part 5): 2018
2	Colour	Hzon	15.0	IS 3025 (Part 4): 2021
3	pH Value	--	6.646 at 24.5°C	IS 3025 (Part 1): 2022
4	Specific Conductivity	µs/cm	154 at 25.4°C	IS 3025 (Part 14): 2013 RA 2019
5	Dissolved Oxygen as DO	mg/l	6.9	IS 3025 (Part 38): 1989 RA 2019
6	Chemical Oxygen Demand as COD	mg/l	4.0	IS 3025 (Part 58): 2023
7	Biochemical Oxygen Demand as BOD	mg/l	2.4	IS 3025 (Part 44): 2021
8	Total Suspended Solid as TSS	mg/l	12.4	IS 3025 (Part 17): 2022
9	Oil & Grease	mg/l	<4.0	APHA 24th Ed. (1520-B): 2023
10	Total Hardness as CaCO ₃	mg/l	64.0	APHA 24th Ed. (2340-C): 2023
11	Chloride as Cl	mg/l	15.70	IS 3025 (Part 32): 1988 RA 2019
12	Sulphate as SO ₄	mg/l	11.85	IS 3025 (Part- 24, Sec-1): 2022
13	Nitrate as NO ₃	mg/l	2.63	APHA 24th Ed. (4500-NO ₃ -H): 2023
14	Fluoride as F	mg/l	0.06	APHA 24th Ed. (4500-F- D): 2023
15	Calcium as Ca	mg/l	16.03	APHA 24th Ed. (3500-Ca-B): 2023
16	Magnesium as Mg	mg/l	5.83	APHA 24th Ed. (3500-Mg-B): 2023
17	Iron as Fe	mg/l	0.34	IS 3025 (Part 53): 2024
18	Total Dissolved Solid as TDS	mg/l	172.0	IS 3025 (Part 16): 2023
19	Total Coliform	MPN/ 100 ml	300.0	IS 1622: 1981 RA 2019


 Reviewed by
 (M.S. Lakshmi Narayana)


 Authorized Signatory for Microbiological
 (M.S. Lakshmi Narayana)




 Authorized Signatory for Chemical
 (Mr. Bijaya Kumar Chakrabarty)

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Form No: WCS/QR/7.8/02

TEST REPORT

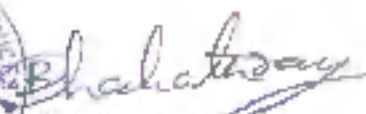
Report No.	: WCS2511603	Issue Date	: 29.11.2025
NABL ULR No.	: LC132232500000043-1F		
Name of the Client	: Rakula Iron Ore Mines (M/S Geetarani Minbarry)		
Address	: Rakula, Near Tenua, P.O.-Denguli, Dist-Sundargarh- 770048, Odisha		
Sampling Location	: Tiptara Pond		
Sample Description	: Surface Water	Date of Sampling	: 22.11.2025
Sampling Place & Method	: WCS/QSP/SAMP (WATER)	Date of Receiving	: 24.11.2025
Environmental Condition	: Temperature 27.1°C, Clear Weather	Sample ID No.	: WCS1135W17H
Sample Collected by	: Debendra Kumar Biswal	Quantity of Sample	: 1Ltr
Test Performed at	: WCS Laboratory	Sample Condition	: Good
Date of Testing	: 24.11.2025 to 28.11.2025		

Sl. No.	Parameter	Unit	Result	Test Methods
1	Colour	—	Agreeable	IS 3025 (Part 5): 2018
2	Colour	Hazen	5.0	IS 3025 (Part 4): 2021
3	pH Value	—	7.182 at 24.5°C	IS 3025 (Part 11): 2022
4	Specific Conductivity	µs/cm	138.2 at 25.1°C	IS 3025 (Part 14): 2013 RA 2019
5	Dissolve Oxygen as DO	mg/l	5.6	IS 3025 (Part 38): 1989 RA 2019
6	Chemical Oxygen Demand as COD	mg/l	6.0	IS 3025 (Part 58): 2023
7	Biochemical Oxygen Demand as BOD	mg/l	3.6	IS 3025 (Part 44): 2023
8	Total Suspended Solid as TSS	mg/l	23.50	IS 3025 (Part 17): 2022
9	Oil & Grease	mg/l	<4.0	APHA 24th Ed. (3520-B): 2023
10	Total Hardness as CaCO ₃	mg/l	52.0	APHA 24th Ed. (2340-C): 2023
11	Chloride as Cl	mg/l	13.70	IS 3025 (Part 32): 1988 RA 2019
12	Sulphate as SO ₄	mg/l	2.27	IS 3025 (Part 24, Sec-1): 2022
13	Nitrate as NO ₃	mg/l	1.12	APHA 24th Ed. (4500-NO ₃ -H): 2021
14	Fluoride as F	mg/l	0.05	APHA 24th Ed. (4500-F-1D): 2023
15	Calcium as Ca	mg/l	20.04	APHA 24th Ed. (3500-Ca-B): 2023
16	Magnesium as Mg	mg/l	0.49	APHA 24th Ed. (3510-Mg-B): 2023
17	Iron as Fe	mg/l	0.31	IS 3025 (Part 53): 2024
18	Total Dissolved Solid as TDS	mg/l	150.0	IS 3025 (Part 16): 2023
19	Total Coliform	MPN/ 100 ml	220.0	IS 1622: 1981 RA 2019


 Reviewed by
 (Ms. Laxmi Priya Sathi)


 Authorized Signatory for Microbiological
 (Miss. Laxmi Sahani)




 Authorized Signatory for Chemical
 (Mr. Bijaya Kumar Chahatray)

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Format No: WCS/OIL/7.8/02

TEST REPORT

Report No.

WCS251100C

Issue Date : 29.11.2025

NAHL, ULB No.

TC1122525000000434F

Name of the Client

Raikela Iron Ore Mines (M/S Geetaran) Mohanty

Address

Raikela, Near Tatur, P.O.-Dengula, Dist- Sundargarh- 751018, Odisha

Sampling Location

Korubhinala Down-stream

Sample Description

Surface Water

Date of Sampling : 22.11.2025

Sampling Plan & Method

WCS/QSP/SAMP (WATER)

Date of Receiving : 24.11.2025

Environmental Condition

Temperature 26.8°C, Clear Weather

Sample ID No : WCS1125W37C

Sample Collected by

Debdatta Kumar Biswal

Quantity of Sample : 1Ltr

Test Performed at

WCS Laboratory

Sample Condition : Good

Date of Testing : 24.11.2025 to 28.11.2025

Sl. No.	Parameter	Unit	Result	Test Methods
1	Odour	—	Agreeable	IS 3025 (Part5): 2018
2	Colour	Hazen	15.0	IS 3025 (Part4): 2021
3	pH Value	—	7.014 at 24.1°C	IS 3025 (Part11): 2022
4	Specific Conductivity	µs/cm	146.2 at 25.0°C	IS 3025 (Part 14): 2013 RA 2019
5	Dissolve Oxygen as DO	mg/l	6.0	IS 3025 (Part 38): 1989 RA 2019
6	Chemical Oxygen Demand as COD	mg/l	5.0	IS 3025 (Part 58): 2023
7	Biochemical Oxygen Demand as BOD	mg/l	3.2	IS 3025 (Part 44): 2023
8	Total Suspended Solid as TSS	mg/l	23.8	IS 3025 (Part 17): 2022
9	Oil & Grease	mg/l	<4.0	APHA 24th Ed. (5520-B): 2023
10	Total Hardness as CaCO ₃	mg/l	86.0	APHA 24th Ed. (2340-C): 2023
11	Chloride as Cl	mg/l	11.70	IS 3025 (Part32): 1988 RA 2019
12	Sulphate as SO ₄	mg/l	10.42	IS 3025 (Part- 24, Sec-1): 2022
13	Nitrate as NO ₃	mg/l	6.85	APHA 24th Ed. (4500-NO ₃ -B): 2023
14	Fluoride as F	mg/l	0.04	APHA 24th Ed. (4500-F- D): 2023
15	Calcium as Ca	mg/l	12.83	APHA 24th Ed. (3500-Ca-B): 2023
16	Magnesium as Mg	mg/l	6.80	APHA 24th Ed. (3500-Mg-B): 2023
17	Iron as Fe	mg/l	0.52	IS 3025 (Part53): 2021
18	Total Dissolved Solid as TDS	mg/l	151.0	IS 3025 (Part16): 2023
19	Total Coliform	MPN/ 100 ml	240.0	IS 1622: 1981 RA 2019

Reviewed by
(Mrs. Laxmipriya Sethi)

Authorized Signatory for Microbiology
(Mrs. Laxmi Saloo)



Authorized Signatory for Chemical
(Mr. Bijaya Kumar Chahatary)

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Plot No. 766, Telengapentha, Cuttack-754001
NABL (ISO/IEC 17025:2017) ACCREDITED LABORATORY



WCS
MY WORLD CONSULTANCY SERVICES

Format No: WCS/QR/7.8/02

Report No.

NABL LTR No.

Name of the Client

Address

Sampling Location

Sample Description

Sampling Plan & Method

Environmental Condition

Sample Collected by

Test Performed at

Date of Testing

WCS251267A

TC11252500000477F

Raikela Iron Ore Mines (M/S Geetarani Mohanty)

Raikela, Near Fensa, P.O.-Jengula, Dist- Sundargarh- 770048, Odisha

Karapala Down stream

Surface Water

WCS/QSP/SAMP (WATER)

Temperature 24.6°C, Clear Weather

Debendra Kumar Biswal

WCS Laboratory

22-12-2023 to 24-12-2023

TEST REPORT

Issue Date : 30.12.2023

Date of Sampling : 20.12.2023

Date of Receiving : 22.12.2023

Sample ID No : WCS1225W21A

Quantity of Sample : 1Ltr

Sample Condition : Good

Sl. No.	Parameter	Unit	Result	Test Methods
1	Odour	-	Agreeable	IS 3025 (Part 5): 2018
2	Colour	Platen	10.0	IS 3025 (Part 4): 2021
3	pH Value	-	6.754 at 24.2°C	IS 3025 (Part 11): 2022
4	Specific Conductivity	µs/cm	171 at 25.2°C	IS 3025 (Part 14): 2013 RA 2019
5	Dissolved Oxygen as DO	mg/l	6.2	IS 3025 (Part 38): 1989 RA 2019
6	Chemical Oxygen Demand as COD	mg/l	3.0	IS 3025 (Part 58): 2023
7	Biochemical Oxygen Demand as BOD	mg/l	3.3	IS 3025 (Part 44): 2023
8	Total Suspended Solid as TSS	mg/l	15.2	IS 3025 (Part 17): 2023
9	Oil & Grease	mg/l	<4.0	APHA 24th Ed. (5120-13): 2023
10	Total Hardness as CaCO ₃	mg/l	52.0	APHA 24th Ed. (2340-C): 2023
11	Chloride as Cl	mg/l	17.19	IS 3025 (Part 32): 1988 RA 2019
12	Sulphate as SO ₄	mg/l	13.62	IS 3025 (Part 24, Sec-I): 2022
13	Nitrate as NO ₃	mg/l	2.42	APHA 24th Ed. (4500-NO ₃ -B): 2023
14	Fluoride as F	mg/l	0.03	APHA 24th Ed. (4500-F- D): 2023
15	Calcium as Ca	mg/l	16.03	APHA 24th Ed. (3500-Ca-B): 2023
16	Magnesium as Mg	mg/l	3.92	APHA 24th Ed. (3500-Mg-B): 2023
17	Iron as Fe	mg/l	0.42	IS 3025 (Part 53): 2024
18	Total Dissolved Solid as TDS	mg/l	168.0	IS 3025 (Part 16): 2023
19	Total Coliform	MPN/ 100 ml	780.0	IS 1622: 1981 RA 2019

Reviewed by
(Ms. Laxmipriya Sethi)

Authorized Signatory for Microbiological
(Miss. Laxmi Sethi)

Authorized Signatory for Chemical
(Mr. Bijaya Kumar Chaharany)

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WCS
MY WORLD CONSULTANCY SERVICES

Form No. WCSQR/7.B/02

TEST REPORT

Report No. : WCS251267B
NABL ULR No. : TC1122525000004771
Name of the Client : **Raikela Iron Ore Mines (M/S Geetarani Mohanty)**
Address : Raikela, Near Tensa, P.O.-Dengula, Dist- Sundergarh- 770048, Odisha
Sampling Location : **Tantara Pond**
Sample Description : Surface Water
Sampling Plan & Method : WCS-QSP/SAMP (WATER)
Environmental Condition : Temperature 24.6°C, Clear Weather
Sample Collected by : Dehendra Kumar Biswal
Test Performed at : WCS Laboratory
Date of Testing : 22.12.2025 to 26.12.2025

Issue Date : 30.12.2025
Date of Sampling : 20.12.2025
Date of Receiving : 22.12.2025
Sample ID No : WCS1225W21B
Quantity of Sample : 1Ltr
Sample Condition : Good

Sl. No.	Parameter	Unit	Result	Test Methods
1	Odour	—	Agreeable	IS 3025 (Part 5): 2018
2	Colour	Hazen	10.0	IS 3025 (Part 4): 2021
3	pH Value	—	7.165 at 24.2°C	IS 3025 (Part 11): 2022
4	Specific Conductivity	µs/cm	127.2 at 25.2°C	IS 3025 (Part 14): 2013 RA 2019
5	Dissolve Oxygen as DO	mg/l	6.0	IS 3025 (Part 38): 1989 RA 2019
6	Chemical Oxygen Demand as COD	mg/l	5.0	IS 3025 (Part 58): 2023
7	Biochemical Oxygen Demand as BOD	mg/l	3.0	IS 3025 (Part 44): 2023
8	Total Suspended Solid as TSS	mg/l	24.30	IS 3025 (Part 17): 2022
9	Oil & Grease	mg/l	<4.0	APHA 24th Ed. (5520-B): 2023
10	Total Hardness as CaCO ₃	mg/l	60.0	APHA 24th Ed. (2340-C): 2023
11	Chloride as Cl	mg/l	12.70	IS 3025 (Part 2): 1988 RA 2019
12	Sulphate as SO ₄	mg/l	2.30	IS 3025 (Part- 24, Sec-4): 2022
13	Nitrate as NO ₃	mg/l	1.48	APHA 24th Ed. (4500-NO ₃ -B): 2023
14	Fluoride as F	mg/l	0.04	APHA 24th Ed. (4500-F- D): 2023
15	Calcium as Ca	mg/l	20.04	APHA 24th Ed. (3500-Ca-B): 2023
16	Magnesium as Mg	mg/l	2.43	APHA 24th Ed. (3500-Mg-B): 2023
17	Iron as Fe	mg/l	0.34	IS 3025 (Part 53): 2024
18	Total Dissolved Solid as TDS	mg/l	168.0	IS 3025 (Part 16): 2023
19	Total Coliform	MPN/ 100 ml	280.0	IS 1622: 1981 RA 2019

Reviewed by
(Ms. Laxmipriya Sethi)

Authorized Signatory for Microbiology
(Miss. Laxmi Sahoo)

Authorized Signatory for Chemical
(Mr. Bijaya Kumar Chahatray)

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WCS
MY WORLD CONSULTANCY SERVICES

Format No: WCS/QR/7.8/02

TEST REPORT

Report No.

Issue Date 30.12.2023

NABL ULR No.

Name of the Client

Address

Sampling Location

Sample Description

Sampling Plan & Method

Environmental Condition

Sample Collected by

Test Performed at

Date of Testing

WCS251267C

TC H122523000000477F

Railein Iron Ore Mines (M/S Cestaran Mahanty)

Railein, Near Tenua, P.O.-Dengula, Dist- Sundargarh- 770048, Odisha

Kuradhinala Down-stream

Surface Water

WCS/QSP/SAMP (WATER)

Temperature 24.8°C, Clear Weather

Debendra Kumar Biswal

WCS Laboratory

22.12.2023 to 26.12.2023

Date of Sampling 20.12.2023

Date of Receiving 22.12.2023

Sample ID No WCS1225W21C

Quantity of Sample 1Ltr

Sample Condition Good

Sl. No.	Parameter	Unit	Result	Test Methods
1	Odour	—	Agreeable	IS 3025 (Part 5): 2018
2	Colour	Hazen	15.0	IS 3025 (Part 4): 2021
3	pH Value	—	7.254 at 24.3°C	IS 3025 (Part 11): 2022
4	Specific Conductivity	µs/cm	138.2 at 25.3°C	IS 3025 (Part 14): 2013 RA 2019
5	Dissolve Oxygen as DO	mg/l	6.2	IS 3025 (Part 38): 1989 RA 2019
6	Chemical Oxygen Demand as COD	mg/l	4.0	IS 3025 (Part 58): 2023
7	Biochemical Oxygen Demand as BOD	mg/l	2.2	IS 3025 (Part 44): 2023
8	Total Suspended Solid as TSS	mg/l	23.5	IS 3025 (Part 17): 2022
9	Oil & Grease	mg/l	<4.0	APHA 24th Ed. (5520-B): 2023
10	Total Hardness as CaCO ₃	mg/l	68.0	APHA 24th Ed. (2140-C): 2023
11	Chloride as Cl	mg/l	16.69	IS 3025 (Part 32): 1988 RA 2019
12	Sulphate as SO ₄	mg/l	11.24	IS 3025 (Part 24, Sec-1): 2022
13	Nitrate as NO ₃	mg/l	7.32	APHA 24th Ed. (4500-NO ₃ -B): 2023
14	Fluoride as F	mg/l	0.05	APHA 24th Ed. (4500-F- D): 2023
15	Calcium as Ca	mg/l	15.23	APHA 24th Ed. (3500-Ca-B): 2023
16	Magnesium as Mg	mg/l	7.29	APHA 24th Ed. (3500-Mg-B): 2023
17	Iron as Fe	mg/l	0.32	IS 3025 (Part 53): 2024
18	Total Dissolved Solid as TDS	mg/l	137.0	IS 3025 (Part 16): 2023
19	Total Coliform	MPN/ 100 ml	280.0	IS 1622: 1981 RA 2019

Reviewed by
(Ms. Laxmipriya Sethi)

Authorized Signatory for Microbiology
(Miss. Laxmi Sahoo)

Authorized Signatory for Chemical
(Mr. Bijaya Kumar Chahatray)

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WCS
MY WORLD CONSULTANCY SERVICES

Format No: WCS/QR/7.8/02

Report No.

NABL ID No.

Name of the Client

Address

Sampling Location

Sample Description

Sampling Plan & Method

Environmental Condition

Sample Collected by

Test Performed at

Date of Testing

WCS260141A

TC112252600000041F

Raikela Iron Ore Mines (M/S Geelurani Mahasay)

Raikela, Near Temsa, P.O.-Denguba, Dist- Sundargarh- 770048, Odisha

Kara nala Down stream

Surface Water

WCS/QSP/SAMP (WATER)

Temperature 25.0°C, Clear Weather

Debandra Kumar Biswal

WCS Laboratory

19.01.2026 to 22.01.2026

TEST REPORT

Issue Date : 23.01.2026

Date of Sampling : 17.01.2026

Date of Receiving : 19.01.2026

Sample ID No : WCSQH26W33A

Quantity of Sample : 1Ltr

Sample Condition : Good

SL. No.	Parameter	Unit	Result	Test Methods
1	Odour	--	Agreeable	IS 3025 (Part 5): 2018
2	Colour	Hazen	10.0	IS 3025 (Part 4): 2021
3	pH Value	--	7.108 at 24.6°C	IS 3025 (Part 11): 2022
4	Specific Conductivity	µs/cm	148.2 at 24.2°C	IS 3025 (Part 14): 2013 RA 2019
5	Dissolved Oxygen as DO	mg/l	5.8	IS 3025 (Part 38): 1989 RA 2019
6	Chemical Oxygen Demand as COD	mg/l	6.0	IS 3025 (Part 58): 2023
7	Biological Oxygen Demand as BOD	mg/l	3.7	IS 3025 (Part 44): 2021
8	Total Suspended Solid as TSS	mg/l	13.30	IS 3025 (Part 17): 2022
9	Oil & Grease	mg/l	<4.0	APHA 24th Ed. (5520-G): 2023
10	Total Hardness as CaCO ₃	mg/l	70.0	APHA 24th Ed. (2340-C): 2023
11	Chloride as Cl	mg/l	13.20	IS 3025 (Part 32): 1988 RA 2019
12	Sulphate as SO ₄	mg/l	9.84	IS 3025 (Part 24, Sec-1): 2022
13	Nitrate as NO ₃	mg/l	2.50	APHA 24th Ed. (4500-NO ₃ -B): 2023
14	Fluoride as F	mg/l	0.05	APHA 24th Ed. (4500-F-D): 2023
15	Calcium as Ca	mg/l	12.83	APHA 24th Ed. (3500-Ca-B): 2023
16	Magnesium as Mg	mg/l	9.23	APHA 24th Ed. (3500-Mg-B): 2023
17	Iron as Fe	mg/l	0.36	IS 3025 (Part 53): 2024
18	Total Dissolved Solid as TDS	mg/l	185.0	IS 3025 (Part 16): 2023
19	Total Coliform	MPN/100 ml	220.0	IS (632): 1981 RA 2019

Las
Reviewed by
(Mrs. Laxmi Priya Sethi)

Las
Authorized Signatory for Microbiological
(Miss. Laxmi Sahoo)

Las
Authorized Signatory for Chemical
(Mr. Bijaya Kumar Chhabra)

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MY WORLD CONSULTANCY SERVICES

Format No: WCS/OR/7.8/12

Report No.

NABL HLR No.

Name of the Client

Address

Sampling Location

Sample Description

Sampling Plan & Method

Environmental Condition

Sample Collected by

Test Performed at

Date of Testing

TEST REPORT

WCS26014118

PCT12252600000041F

Raikula Iron Ore Mines (M/S Geetarani Mahapatra)

Raikula, Near Tansa, P.O.-Dangula, Dist- Sundargarh- 750048, Odisha

Tantara Pond

Surface Water

WCS/QSI/SAMP(WATER)

Temperature 24.0°C, Clear Weather

Debidra Kumar Biswal

WCS Laboratory

19.01.2026 to 22.01.2026

Issue Date 23.01.2026

Date of Sampling 17.01.2026

Date of Receiving 19.01.2026

Sample ID No WCS0126W33H

Quantity of Sample 1Ltr

Sample Condition Good

Sl. No.	Parameter	Unit	Result	Test Methods
1	Odour	-	Agreeable	IS 3025 (Part 5): 2018
2	Colour	Hazen	15.0	IS 3025 (Part 4): 2021
3	pH Value	-	6.972 at 24.7°C	IS 3025 (Part 1): 2022
4	Specific Conductivity	µs/cm	143.6 at 25.0°C	IS 3025 (Part 14): 2013 RA 2019
5	Dissolve Oxygen as DO	mg/l	5.8	IS 3025 (Part 38): 1989 RA 2019
6	Chemical Oxygen Demand as COD	mg/l	4.0	IS 3025 (Part 58): 2023
7	Biochemical Oxygen Demand as BOD	mg/l	2.4	IS 3025 (Part 44): 2023
8	Total Suspended Solid as TSS	mg/l	19.80	IS 3025 (Part 17): 2022
9	Oil & Grease	mg/l	<0.6	APHA 24th Ed. (5520-B): 2023
10	Total Hardness as CaCO ₃	mg/l	66.0	APHA 24th Ed. (2340-C): 2023
11	Chloride as Cl	mg/l	17.19	IS 3025 (Part 22): 1988 RA 2019
12	Sulphate as SO ₄	mg/l	2.45	IS 3025 (Part 24, Sec-1): 2022
13	Nitrate as NO ₃	mg/l	1.29	APHA 24th Ed. (4500-NO ₃ -B): 2023
14	Fluoride as F	mg/l	0.06	APHA 24th Ed. (4500-F-1): 2023
15	Calcium as Ca	mg/l	17.24	APHA 24th Ed. (3500-Ca-B): 2023
16	Magnesium as Mg	mg/l	5.35	APHA 24th Ed. (3500-Mg-B): 2023
17	Iron as Fe	mg/l	0.25	IS 3025 (Part 53): 2024
18	Total Dissolved Solid as TDS	mg/l	194.0	IS 3025 (Part 16): 2023
19	Total Coliform	MPN/100ml	240.0	IS 1622: 1981 RA 2019

Ans
Reviewed by
(Ms. Laxmipriya Sethi)

hs
Authorized Signatory for Microbiological
(Miss. Enami Sahoo)

Phalguni
Authorized Signatory for Chemical
(Mr. Bijaya Kumar Choudhary)

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WCS
MY WORLD CONSULTANCY SERVICES

Form No. WCS/QR/7.8/02

TEST REPORT

Report No. : WCS260141C
NABL ULR No. : TC FJ 2252600000004 HF
Name of the Client : **Rajkela Iron Ore Mines (MS Geetaram Mahapatra)**
Address : Itaikeha, Near Tansa, P.O.-Dengula, Dist- Sundargarh- 750048, Odisha
Sampling Location : Kuradhinahi Down-stream
Sample Description : Surface Water
Sampling Plan & Method : WCS/QSI/SAMP (WATER)
Environmental Condition : Temperature 24.7°C, Clear Weather
Sample Collected by : Debendra Kumar Biswal
Test Performed at : WCS Laboratory
Date of Testing : 19.01.2026 to 22.01.2026

Issue Date : 23.01.2026
Date of Sampling : 17.01.2026
Date of Receiving : 19.01.2026
Sample ID No : WCS0126W33C
Quantity of Sample : 1Ltr
Sample Condition : Good

SL No.	Parameter	Unit	Result	Test Methods
1	Odour	—	Agreeable	IS 3025 (Part 5): 2018
2	Colour	Hazen	10.0	IS 3025 (Part 4): 2021
3	pH Value	—	7.803 at 24.8°C	IS 3025 (Part 11): 2022
4	Specific Conductivity	us/cm	126.5 at 24.2°C	IS 3025 (Part 14): 2013 RA 2019
5	Dissolved Oxygen as DO	mg/l	5.6	IS 3025 (Part 38): 1989 RA 2019
6	Chemical Oxygen Demand as COD	mg/l	4.0	IS 3025 (Part 58): 2023
7	Biochemical Oxygen Demand as BOD	mg/l	2.3	IS 3025 (Part 44): 2023
8	Total Suspended Solid as TSS	mg/l	20.9	IS 3025 (Part 17): 2022
9	Oil & Grease	mg/l	<4.0	APHA 24th Ed. (5520-B): 2023
10	Total hardness as CaCO ₃	mg/l	58.0	APHA 24th Ed. (2340-C): 2023
11	Chloride as Cl	mg/l	13.70	IS 3025 (Part 32): 1988 RA 2019
12	Sulphate as SO ₄	mg/l	9.47	IS 3025 (Part 34, Sec-1): 2022
13	Nitrate as NO ₃	mg/l	5.94	APHA 24th Ed. (4500-NO ₃ -B): 2023
14	Fluoride as F	mg/l	0.03	APHA 24th Ed. (4500-F-19): 2023
15	Calcium as Ca	mg/l	12.02	APHA 24th Ed. (4500-Ca-3): 2023
16	Magnesium as Mg	mg/l	6.80	APHA 24th Ed. (3500-Mg-B): 2023
17	Iron as Fe	mg/l	0.44	IS 3025 (Part 53): 2021
18	Total Dissolved Solid as TDS	mg/l	133.0	IS 3025 (Part 16): 2023
19	Total Coliform	MPN/ 100 ml	220.0	IS 1622: 1981 RA 2019

Reviewed by
(Ms. Laxmipriya Sethi)

Authorized Signatory for Microbiological
(Miss. Laxmi Sahoo)

Authorized Signatory for Chemical
(Mr. Bijaya Kumar Chhabra)

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Format No: WCS/QR/7A/02

TEST REPORT

Issue Date : 16.02.2026

Report No. : WCS260222A
NABL ULR No. : TC112252600000080F
Name of the Client : **Raikela Iron Ore Mines (M/S Geetaram Mohanty)**
Address : Raikela, Near Tensa, P.O.-Dengula, Dist- Sundargarh- 750048, Odisha
Sampling Location : Karo nala Down stream
Sample Description : Surface Water
Sampling Plan & Method : WCS/QSP/SAMP (WATER)
Environmental Condition : Temperature 25.6°C, Clear Weather
Sample Collected by : Tapas Ranjan Patel
Test Performed at : WCS Laboratory
Date of Testing : 09.02.2026 to 13.02.2026

Date of Sampling : 04.02.2026
Date of Receiving : 07.02.2026
Sample ID No : WCS0226W15A
Quantity of Sample : 1Ltr
Sample Condition : Good

Sl. No.	Parameter	Unit	Result	Test Methods
1	Odour	--	Agreeable	IS 3025 (Part5): 2018
2	Colour	Hazen	15.0	IS 3025 (Part4): 2021
3	pH Value	--	6.984 at 25.3°C	IS 3025 (Part11): 2022
4	Specific Conductivity	µs/cm	142.5 at 25.0°C	IS 3025 (Part 14): 2013 RA 2019
5	Dissolve Oxygen as DO	mg/l	6.0	IS 3025 (Part 38): 1989 RA 2019
6	Chemical Oxygen Demand as COD	mg/l	5.0	IS 3025 (Part 58): 2023
7	Biochemical Oxygen Demand as BOD	mg/l	3.4	IS 3025 (Part 44): 2023
8	Total Suspended Solid as TSS	mg/l	11.91	IS 3025 (Part 17): 2022
9	Oil & Grease	mg/l	<4.0	APHA 24th Ed. (5520-B): 2023
10	Total Hardness as CaCO ₃	mg/l	62.0	APHA 24th Ed. (2340-C): 2023
11	Chloride as Cl	mg/l	18.19	IS 3025 (Part32): 1988 RA 2019
12	Sulphate as SO ₄	mg/l	12.30	IS 3025 (Part- 24, Sec-I): 2022
13	Nitrate as NO ₃	mg/l	2.43	APHA 24th Ed. (4500-NO ₃ -B): 2023
14	Fluoride as F	mg/l	0.03	APHA 24th Ed. (4500-F- D): 2023
15	Calcium as Ca	mg/l	15.23	APHA 24th Ed. (3500-Ca-B): 2023
16	Magnesium as Mg	mg/l	5.63	APHA 24th Ed. (3500-Mg-B): 2023
17	Iron as Fe	mg/l	0.40	IS 3025 (Part53): 2024
18	Total Dissolved Solid as TDS	mg/l	178.0	IS 3025 (Part16): 2023
19	Total Coliform	MPN/ 100 ml	240.0	IS 1622: 1981 RA 2019

Reviewed by
(Ms. Laxmipriya Setti)

Authorized Signatory for Microbiological
(Miss. Laxmi Sahoo)



Authorized Signatory for Chemical
(Mr. Bijaya Kumar Chabataray)

***** END OF REPORT *****

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TC-11225

Form No: WCS/QR/7.8/02

Report No.

NABL ULR No.

Name of the Client

Address

Sampling Location

Sample Description

Sampling Plan & Method

Environmental Condition

Sample Collected by

Test Performed at

Date of Testing

WCS260222B

TC112252600000080F

Raikela Iron Ore Mines (M/S Geetarani Mohanty)

Raikela, Near Temsa, P.O.-Jengula, Dist- Sundargarh- 770048, Odisha

Kuradhinola Down-stream

Surface Water

WCS/QSP/SAMP (WATER)

Temperature 24.4°C, Clear Weather

Tapes Ranjan Patel

WCS Laboratory

09.02.2026 to 13.02.2026

TEST REPORT

Issue Date : 16.02.2026

Date of Sampling : 04.02.2026

Date of Receiving : 07.02.2026

Sample ID No : WCS0226W15B

Quantity of Sample : 1Ltr

Sample Condition : Good

SL No.	Parameter	Unit	Result	Test Methods
1	Odour	--	Agreeable	IS 3025 (Part 5): 2018
2	Colour	Hazen	15.0	IS 3025 (Part 4): 2021
3	pH Value	--	7.25 at 25.2°C	IS 3025 (Part 11): 2022
4	Specific Conductivity	µs/cm	132.2 at 25.5°C	IS 3025 (Part 14): 2013 RA 2019
5	Dissolve Oxygen as DO	mg/l	5.8	IS 3025 (Part 38): 1989 RA 2019
6	Chemical Oxygen Demand as COD	mg/l	5.0	IS 3025 (Part 38): 2023
7	Biochemical Oxygen Demand as BOD	mg/l	3.0	IS 3025 (Part 44): 2023
8	Total Suspended Solid as TSS	mg/l	26.80	IS 3025 (Part 17): 2022
9	Oil & Grease	mg/l	<4.0	APHA 24th Ed. (5520-B): 2023
10	Total Hardness as CaCO ₃	mg/l	64.0	APHA 24th Ed. (2340-C): 2023
11	Chloride as Cl	mg/l	14.70	IS 3025 (Part 32): 1988 RA 2019
12	Sulphate as SO ₄	mg/l	10.65	IS 3025 (Part 24, Sec-1): 2022
13	Nitrate as NO ₃	mg/l	6.35	APHA 24th Ed. (4500-NO ₃ -B): 2023
14	Fluoride as F	mg/l	0.04	APHA 24th Ed. (4500-F- D): 2023
15	Calcium as Ca	mg/l	9.62	APHA 24th Ed. (3500-Ca-B): 2023
16	Magnesium as Mg	mg/l	9.72	APHA 24th Ed. (3500-Mg-B): 2023
17	Iron as Fe	mg/l	0.51	IS 3025 (Part 53): 2024
18	Total Dissolved Solid as TDS	mg/l	161.0	IS 3025 (Part 16): 2023
19	Total Coliform	MPN/ 100 ml	240.0	IS 1622: 1981 RA 2019

Reviewed by
(Ms. Laxmipriya Sethi)

Authorized Signatory for Microbiology
(Miss. Laxmi Sahoo)



Authorized Signatory for Chemical
(Mr. Bijaya Kumar Chaharary)

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MY WORLD CONSULTANCY SERVICES

Form No: WCS/QR/7.8/02

Report No.

NABL ULR No.

Name of the Client

Address

Sampling Location

Sample Description

Sampling Plan & Method

Environmental Condition

Sample Collected by

Test Performed at

Date of Testing

WCS260222C

TC1122526000000080F

Raikela Iron Ore Mines (M/S Geetarani Mohanty)

Raikela, Near Tenu, P.O.-Dengula, Dist- Sundargarh- 770048, Odisha

Tantara Pond

Surface Water

WCS/QSP/SAMP (WATER)

Temperature 25.2°C, Clear Weather

Tapan Ranjan Patel

WCS Laboratory

09.02.2026 to 13.02.2026

TEST REPORT

Issue Date 16.02.2026

Date of Sampling 04.02.2026

Date of Receiving 07.02.2026

Sample ID No WCS0226W13C

Quantity of Sample 1Ltr

Sample Condition Good

Sl. No.	Parameter	Unit	Result	Test Methods
1	Odour	--	Agreeable	IS 3025 (Part5): 2018
2	Colour	Hazen	10.0	IS 3025 (Part4): 2021
3	pH Value	--	6.894 at 24.4°C	IS 3025 (Part11): 2022
4	Specific Conductivity	µs/cm	132.2 at 25.4°C	IS 3025 (Part 14): 2013 RA 2019
5	Dissolve Oxygen as DO	mg/l	6.0	IS 3025 (Part 38): 1989 RA 2019
6	Chemical Oxygen Demand as COD	mg/l	5.0	IS 3025 (Part 58): 2023
7	Biochemical Oxygen Demand as BOD	mg/l	2.4	IS 3025 (Part 44): 2023
8	Total Suspended Solid as TSS	mg/l	21.3	IS 3025 (Part 17): 2022
9	Oil & Grease	mg/l	<4.0	APHA 24th Ed. (5520-B): 2023
10	Total Hardness as CaCO ₃	mg/l	60.0	APHA 24th Ed. (2340-C): 2023
11	Chloride as Cl	mg/l	14.07	IS 3025 (Part32): 1989 RA 2019
12	Sulphate as SO ₄	mg/l	2.37	IS 3025 (Part- 24, Sec-1): 2022
13	Nitrate as NO ₃	mg/l	1.34	APHA 24th Ed. (4500-NO ₃ -B): 2023
14	Fluoride as F	mg/l	0.05	APHA 24th Ed. (4500-F- D): 2023
15	Calcium as Ca	mg/l	20.84	APHA 24th Ed. (3500-Ca-B): 2023
16	Magnesium as Mg	mg/l	1.94	APHA 24th Ed. (3500-Mg-B): 2023
17	Iron as Fe	mg/l	0.32	IS 3025 (Part53): 2024
18	Total Dissolved Solid as TDS	mg/l	173.0	IS 3025 (Part16): 2023
19	Total Coliform	MPN/ 100 ml	220.0	IS 1622: 1981 RA 2019


Reviewed by
(Ms. Laxmipriya Sethi)


Authorized Signatory for Microbiology
(Miss. Laxmi Sahoo)




Authorized Signatory for Chemicals
(Mr. Bijaya Kumar Chahatany)

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Format No: WCS/OR/7.8/02

Report No.

NABL ULR No.

Name of the Client

Address

Sampling Location

Sample Description

Sampling Plan & Method

Environmental Condition

Sample Collected by

Test Performed at

Date of Testing

WCS260320A

TC112526000000027F

Raikela Iron Ore Mines (M/S Geetarani Mohanty)

Raikela, Near Tensa, P.O.-Jengula, Dist- Sundargarh- 770048, Odisha

Karunala Down stream

Surface Water

WCS/QSP/SAMP (WATER)

Temperature 25.3°C, Clear Weather

Tapas Ranjan Patel

WCS Laboratory

09.03.2026 to 14.03.2026

TEST REPORT

Issue Date : 16.03.2026

Date of Sampling : 06.03.2026

Date of Receiving : 09.03.2026

Sample ID No : WCS0326W13A

Quantity of Sample : 1Ltr

Sample Condition : Good

Sl. No.	Parameter	Unit	Result	Test Methods
1	Odour	—	Agreeable	IS 3025 (Part 5): 2018
2	Colour	Hazen	10.0	IS 3025 (Part 4): 2021
3	pH Value	—	6.865 at 26.0°C	IS 3025 (Part 11): 2022
4	Specific Conductivity	µS/cm	150.2 at 25.8°C	IS 3025 (Part 14): 2013 RA 2019
5	Dissolve Oxygen as DO	mg/l	6.1	IS 3025 (Part 38): 1989 RA 2019
6	Chemical Oxygen Demand as COD	mg/l	6.0	IS 3025 (Part 58): 2023
7	Biochemical Oxygen Demand as BOD	mg/l	3.6	IS 3025 (Part 44): 2023
8	Total Suspended Solid as TSS	mg/l	12.32	IS 3025 (Part 17): 2022
9	Oil & Grease	mg/l	<4.0	APHA 24th Ed. (5520-B): 2023
10	Total Hardness as CaCO ₃	mg/l	68.0	APHA 24th Ed. (2340-C): 2023
11	Chloride as Cl	mg/l	17.69	IS 3025 (Part 32): 1988 RA 2019
12	Sulphate as SO ₄	mg/l	10.27	IS 3025 (Part 24, Sec-I): 2022
13	Nitrate as NO ₃	mg/l	2.21	APHA 24th Ed. (4500-NO ₃ -B): 2023
14	Fluoride as F	mg/l	0.04	APHA 24th Ed. (4500-F- D): 2023
15	Calcium as Ca	mg/l	13.63	APHA 24th Ed. (3500-Ca-B): 2023
16	Magnesium as Mg	mg/l	8.26	APHA 24th Ed. (3500-Mg-P): 2023
17	Iron as Fe	mg/l	0.34	IS 3025 (Part 53): 2024
18	Total Dissolved Solid as TDS	mg/l	175.0	IS 3025 (Part 16): 2023
19	Total Coliform	MPN/ 100 ml	280.0	IS 1622: 1981 RA 2019

Reviewed by
(Ms. Laxmi Priya Sethi)

Authorized Signatory for Microbiological
(Miss. Laxmi Sahoo)



Authorized Signatory for Chemical
(Bijaya Kumar Chaharary)

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WCS
MY WORLD CONSULTANCY SERVICES

Format No. WCS/QR/7.8/62

Report No.

NABL ULR No.

Name of the Client

Address

Sampling Location

Sample Description

Sampling Plan & Method

Environmental Condition

Sample Collected by

Test Performed at

Date of Testing

TEST REPORT

Issue Date : 16.03.2026

WCS260320B

TC112252600000127F

Raikela Iron Ore Mines (M/S Geetarani Mohanty)

Raikela, Near Tensa, P.O.-Dengula, Dist.-Sundargarh- 750048, Odisha

Kuradhinala Down-stream

Surface Water

WCS/QSP/SAMP (WATER)

Temperature 25.6°C, Clear Weather

Tapas Ranjan Patel

WCS Laboratory

09.03.2026 to 14.03.2026

Date of Sampling : 06.03.2026

Date of Receiving : 09.03.2026

Sample ID No : WCS0326W13B

Quantity of Sample : 1Ltr

Sample Condition : Good

Sl. No.	Parameter	Unit	Result	Test Methods
1	Odour	--	Agreeable	IS 3025 (Part5): 2018
2	Colour	Hazen	10.0	IS 3025 (Part4): 2021
3	pH Value	--	7.365 at 25.4°C	IS 3025 (Part11): 2022
4	Specific Conductivity	µs/cm	128.1 at 25.1°C	IS 3025 (Part 14): 2013 RA 2019
5	DissolveOxygen asDO	mg/l	6.1	IS 3025 (Part 38): 1989 RA 2019
6	ChemicalOxygenDemand asCOD	mg/l	4.0	IS 3025 (Part 58): 2023
7	BiochemicalOxygenDemand asBOD	mg/l	2.5	IS 3025 (Part 44): 2023
8	TotalSuspendedSolid as TSS	mg/l	24.60	IS 3025 (Part 17): 2022
9	Oil & Grease	mg/l	<4.0	APHA 24th Ed. (15520-B): 2023
10	TotalHardness asCaCO3	mg/l	60.0	APHA 24th Ed. (2340-C): 2023
11	Chloride as Cl	mg/l	13.20	IS 3025 (Part32): 1988 RA 2019
12	Sulphate asSO4	mg/l	11.14	IS 3025 (Part- 24, Sec-1): 2022
13	Nitrate asNO3	mg/l	5.86	APHA 24th Ed. (4500-NO3-B): 2023
14	Fluoride as F	mg/l	0.03	APHA 24th Ed. (4500-F- D): 2023
15	Calcium as Ca	mg/l	10.42	APHA 24th Ed. (3500-Ca-B): 2023
16	Magnesium as Mg	mg/l	8.26	APHA 24th Ed. (3500-Mg-B): 2023
17	Iron as Fe	mg/l	0.48	IS 3025 (Part53): 2024
18	Total DissolvedSolid as TDS	mg/l	142.0	IS 3025 (Part16): 2023
19	Total Coliform	MPN/ 100 ml	220.0	IS 1622: 1981 RA 2019

Reviewed by
(Ms. Laxmipriya Sethi)

Authorized Signatory for Microbiological
(Miss. Laxmi Sahoo)



Authorized Signatory for Chemical
(Mr. Bijaya Kumar Chahatary)

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WCS
MY WORLD CONSULTANCY SERVICES

Format No: WCS/QR/7.8/02

Report No.

NABL ULR No.

Name of the Client

Address

Sampling Location

Sample Description

Sampling Plan & Method

Environmental Condition

Sample Collected by

Test Performed at

Date of Testing

TEST REPORT

Issue Date : 16.03.2026

WCS260320C

IC1122526000008127F

Raikela Iron Ore Mines (M/S Geetarani Mohanty)

Raikela, Near Tensa, P.O.-Dengula, Dist- Sundargarh- 770018, Odisha

Tantara Pond

Surface Water

WCS/QSP/SAMP1(WATER)

Temperature 25.6°C, Clear Weather

Tapas Ranjan Patel

WCS Laboratory

09.03.2026 to 14.03.2026

Date of Sampling : 06.03.2026

Date of Receiving : 09.03.2026

Sample ID No : WCS0326W13C

Quantity of Sample : 1Ltr

Sample Condition : Good

Sl. No.	Parameter	Unit	Result	Test Methods
1	Odour	—	Agreeable	IS 3025 (Part 5): 2018
2	Colour	Hazen	15.0	IS 3025 (Part 4): 2021
3	pH Value	—	7.654 at 25.5°C	IS 3025 (Part 11): 2022
4	Specific Conductivity	µs/cm	138.5 at 25.7°C	IS 3025 (Part 14): 2013 RA 2019
5	Dissolve Oxygen as DO	mg/l	6.2	IS 3025 (Part 38): 1989 RA 2019
6	Chemical Oxygen Demand as COD	mg/l	6.0	IS 3025 (Part 58): 2023
7	Biochemical Oxygen Demand as BOD	mg/l	3.4	IS 3025 (Part 44): 2023
8	Total Suspended Solid as TSS	mg/l	24.4	IS 3025 (Part 17): 2022
9	Oil & Grease	mg/l	<4.0	APHA 24th Ed. (5520-B): 2023
10	Total Hardness as CaCO ₃	mg/l	58.0	APHA 24th Ed. (2140-C): 2023
11	Chloride as Cl	mg/l	15.20	IS 3025 (Part 32): 1988 RA 2019
12	Sulphate as SO ₄	mg/l	2.12	IS 3025 (Part 24, Sec-1): 2022
13	Nitrate as NO ₃	mg/l	1.43	APHA 24th Ed. (4500-NO ₃ -B): 2023
14	Fluoride as F	mg/l	0.04	APHA 24th Ed. (4500-F-D): 2023
15	Calcium as Ca	mg/l	18.44	APHA 24th Ed. (3500-Ca-B): 2023
16	Magnesium as Mg	mg/l	2.92	APHA 24th Ed. (3500-Mg-B): 2023
17	Iron as Fe	mg/l	0.28	IS 3025 (Part 53): 2024
18	Total Dissolved Solid as TDS	mg/l	184.0	IS 3025 (Part 16): 2023
19	Total Coliform	MPN/ 100 ml	240.0	IS 1622: 1981 RA 2019

Reviewed by
(Ms. Laxmi Priya Sethi)

Authorized Signatory for Microbiological
(Miss. Laxmi Sahoo)

Authorized Signatory for Chemical
(Mr. Bijaya Kumar Chakraborty)

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Form/L No: WCS/QR/7.8/02

TEST REPORT

Issue Date : 13.10.2025

Report No. : WCS241035
NABL ULR No. : TC11225250000363F
Name of the Client : **Raikela Iron Ore Mines (M/S Geetarani Mohanty)**
Address : Raikela, Near Tansa, P.O.-Dengula, Dist- Sundargarh- 770048, Odisha
Sampling Location : **STP Out-Let**
Sample Description : Waste Water
Sampling Plan & Method : WCS/SP/SAMP (WATER)
Environmental Condition : Temperature 27.2°C, Clear Weather
Sample Collected by : Debdutta Kumar Biswal
Test Performed at : WCS Laboratory
Date of Testing : 07.10.2025 to 11.10.2025

Date of Sampling : 06.10.2025
Date of Receiving : 07.10.2025
Sample ID No : WCS1025W05
Quantity of Sample : 1Ltr
Sample Condition : Good

Sl. No.	Parameter	Unit	Result	Requirement as per MoEF & CC, Govt. of India vide G.S.R. 1265 (E), dated 13.10.2017	Test Methods
1	pH Value	—	7.625 at 26.2°C	6.5-9.0	IS 3025 (Part 11): 2022
2	Biochemical Oxygen Demand as (BOD)	mg/l	21.9	30.0	IS 3025 (Part 44): 2023
3	Chemical Oxygen Demand as (COD)	mg/l	42.0	<100	IS 3025 (Part 58): 2023
4	Total Suspended Solid as TSS	mg/l	25.3	—	IS 3025 (Part 17): 2022
5	Total Dissolved Solid as TDS	mg/l	282.0	—	IS 3025 (Part 10): 2023
6	Oil & Grease	mg/l	<4.0	—	APHA 24th Ed. (5529-03): 2023
7	Faecal Coliform	MPN/ 100 ml	500.0	<1000	IS 1622: 1981 (A) 2019

Reviewed by
(Mrs. Laxmi Priya Sethi)

Authorized Signatory for Microbiological
(Miss. Laxmi Sahoo)

Authorized Signatory for Chemical
(Mr. Bijaya Kumar Chahatary)

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Form No: WCS/OR/7,8/02

TEST REPORT

Issue Date : 30.10.2023

Report No. : WCS25E043
 NABL ULR No. : TC1122525000003711F
 Name of the Client : **Raikela Iron Ore Mines (M/S Grestarasi Mukhuty)**
 Address : Raikela, Near Tenja, P.O.-Dengula, Dist- Sundargarh- 758048, Odisha
 Sampling Location : **STP Out-Let**
 Sample Description : Waste Water
 Sampling Plan & Method : WCS/QSP/SAMP (WATER)
 Environmental Condition : Temperature 27.2°C, Clear Weather
 Sample Collected by : Debendra Kumar Biswal
 Test Performed at : WCS Laboratory
 Date of Testing : 23.10.2023 to 28.10.2023

Date of Sampling : 21.10.2023
 Date of Receiving : 23.10.2023
 Sample ID No : WCS1025W14
 Quantity of Sample : 11.0r
 Sample Condition : Good

Sl. No.	Parameter	Unit	Result	Requirement as per MoEF & CC, Govt. of India vide G.S.R. 1265 (E), dated 13.10.2017	Test Methods
1	pH Value	—	7.495 at 27.3°C	6.5-9.0	IS 3025 (Part 11): 2022
2	Biochemical Oxygen Demand as	mg/l	21.2	30.0	IS 3025 (Part 44): 2023
3	Chemical Oxygen Demand as CO	mg/l	45.0	<100	IS 3025 (Part 58): 2023
4	Total Suspended Solid as TSS	mg/l	22.5	—	IS 3025 (Part 17): 2022
5	Total Dissolved Solid as TDS	mg/l	277.0	—	IS 3025 (Part 16): 2023
6	Oil & Grease	mg/l	<4.0	—	APHA 24th Ed. (3520-OP): 2023
7	Faecal Coliform	MPN/ 100 ml	510.0	<1000	IS 1622: 1981 RA 2019


 Reviewed by
 (Ms. Laxmipriya Sethi)


 Authorized Signatory for Microbiological
 (Miss. Laxmi Sahoo)


 Authorized Signatory for Chemical
 (Mr. Bijaya Kumar Chahatary)

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Format No: WCS/QR/7.R02

TEST REPORT

Report No.	: WCS257110	Issue Date	: 15.11.2025
NABL ULR No.	: TC11225250000X381		
Name of the Client	: Raikela Iron Ore Mines (M/S Geetirani Mohanty)		
Address	: Raikela, Near Tansa, P.O.-Dengali, Dist- Sundargarh- 750048 Odisha		
Sampling Location	: STP Out-Let		
Sample Description	: Waste Water	Date of Sampling	: 08.11.2025
Sampling Plan & Method	: WCS/QSP/SAMP (WATER)	Date of Receiving	: 10.11.2025
Environmental Condition	: Temperature 24.6°C, Clear Weather	Sample ID No	: WCS1125W12
Sample Collected by	: Debendra Kumar Biswal	Quantity of Sample	: 1Ltr
Test Performed at	: WCS Laboratory	Sample Condition	: Good
Date of Testing	: 10.11.2025 to 14.11.2025		

Sl. No.	Parameter	Unit	Result	Requirement as per MoEF & CC, Govt. of India Vide G.S.R. 1265 (E), dated 13.10.2017	Test Methods
1	pH Value	--	7.674 at 24.2°C	6.5-9.0	IS 3025 (Part 11): 2022
2	Biochemical Oxygen Demand as BOD	mg/l	20.6	30.0	IS 3025 (Part 44): 2023
3	Chemical Oxygen Demand as COD	mg/l	101.1	<100	IS 3025 (Part 58): 2023
4	Total Suspended Solid as TSS	mg/l	22.6	--	IS 3025 (Part 17): 2022
5	Total Dissolved Solid as TDS	mg/l	279.0	--	IS 3025 (Part 16): 2023
6	Oil & Grease	mg/l	<4.0	--	APHA 24th Ed. (5520-B): 2023
7	Faecal Coliform	MPN/100 ml	500.0	<1000	IS 1622: 1981 HA 2019


 Reviewed by
 (Ms. Laxmi Priya Sarhi)


 Authorized Signatory for Microbiological
 (Miss. Laxmi Sahoo)


 Authorized Signatory for Chemical
 (Mr. Bijay Kumar Chhabra)

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Format No: WCSQR/7.8/02

TEST REPORT

Report No. : WCS251162

Issue Date : 29.11.2025

NABL L/R No. : FC11225250H080043n

 Name of the Client : **Railkela Iron Ore Mines (M/S Geetarani Mohanty)**

Address : Railkela, Near Tansa, P.O. Kengula, Dist- Sundargarh- 770038, Odisha

 Sampling Location : **STP Out-Let**

 Sample Description : **Waste Water**

Date of Sampling : 23.11.2025

 Sampling Plan & Method : **WCS/QSP/SAMP (WATER)**

Date of Receiving : 24.11.2025

 Environmental Condition : **Temperature 24.6°C, Clear Weather**

 Sample ID No : **WCS1135W.10**

 Sample Collected by : **Deendra Kumar Biswal**

 Quantity of Sample : **1Ltr**

 Test Performed at : **WCS Laboratory**

 Sample Condition : **Good**

 Date of Testing : **24.11.2025 to 28.11.2025**

Sl. No.	Parameter	Unit	Result	Requirement as per MEF & CC, Govt. of India vide G.S.R. 1265 (E), dated 13.10.2017	Test Methods
1	pH Value	-	7.481 at 24.3°C	6.5-9.0	IS 3025 (Part 11): 2022
2	Biochemical Oxygen Demand as	mg/l	18.0	30.0	IS 3025 (Part 44): 2021
3	Chemical Oxygen Demand as CC	mg/l	36.0	<100	IS 3025 (Part 58): 2023
4	Total Suspended Solid as TSS	mg/l	24.9	-	IS 3025 (Part 17): 2022
5	Total Dissolved Solid as TDS	mg/l	268.0	-	IS 3025 (Part 16): 2021
6	Oil & Grease	mg/l	<4.0	-	APHA 24th Ed. (5520-13): 2023
7	Faecal Coliform	MPN/ 100 ml	350.0	<1000	IS 1622: 1981 RA 2019



 Reviewed by
 (Ms. Laxmi Priya Sethi)



 Authorized Signatory for Microbiological
 (Miss. Laxmi Sahoo)



 Authorized Signatory for Chemical
 (Mr. Bijaya Kumar Chakravarty)

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Form No: WCSQR/7.8/02

TEST REPORT

Report No.	WCS251265	Issue Date	30.12.2025
NABL TLR No.	TC112252500000475		
Name of the Client	Raikela Iron Ore Mines (M/S Geetarani Mohanty)		
Address	Raikela, Near Tansa, P.O.-Dengra, Dist- Sundargarh- 770048, Odisha		
Sampling Location	STP Out-Let		
Sample Description	Waste Water	Date of Sampling	08.12.2025
Sampling Plan & Method	WCS/QSP/SAMP (WATER)	Date of Receiving	10.12.2025
Environmental Condition	Temperature 24.2°C, Clear Weather	Sample ID No	WCS1225WP7
Sample Collected by	Debenra Kumar Biswal	Quantity of Sample	1Ltr
Test Performed in	WCS Laboratory	Sample Condition	Good
Date of Testing	10.12.2025 to 15.12.2025		

Sl. No.	Parameter	Unit	Result	Requirement as per MoEF & CC, Govt. of India Vide G.S.R. 1265 (E), dated 13.10.2017	Test Methods
1	pH Value	--	7.541 at 24.2°C	6.5-9.0	IS 3025 (Part 14): 2022
2	Biochemical Oxygen Demand as BOD	mg/l	22.1	50.0	IS 3025 (Part 44): 2023
2	Chemical Oxygen Demand as COD	mg/l	44.0	<100	IS 3025 (Part 58): 2023
4	Total Suspended Solid as TSS	mg/l	24.8	--	IS 3025 (Part 17): 2022
5	Total Dissolved Solid as TDS	mg/l	274.0	--	IS 3025 (Part 16): 2023
6	Oil & Grease	mg/l	<1.0	--	API/A 24th Ed. (5520-0): 2023
7	Faecal Coliform	MPN/100 ml	300.0	<1000	IS 1622: 1981 RA.2019


Reviewed by
(Ms. Laxmi Priya Sethi)


Authorized Signatory for Microbiological
(Miss. Laxmi Sahoo)


Authorized Signatory for Chemical
(Mr. Bijaya Kumar Chaturvedi)

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Format No: WCS/OR/7.8/22

Report No. :

NABL ULR No. :

Name of the Client :

Address :

Sampling Location :

Sample Description :

Sampling Plan & Method :

Environmental Condition :

Sample Collected by :

Test Performed at :

Date of Testing :

WCS251269

TC/12252500000479

Raikela Iron Ore Mines (MS Geetarani Mohanty)

Raikela, Near Tansa, P.O.-Dengala, Dist- Sundargarh- 770048, Odisha

STP Out-Let

Waste Water

WCS/OSP/SAMP (WATER)

Temperature 24.2°C, Clear Weather

Dehendra Kumar Biswal

WCS Laboratory

22.12.2025 to 26.12.2025

TEST REPORT

Issue Date : 30.12.2025

Date of Sampling : 20.12.2025

Date of Receiving : 22.12.2025

Sample ID No : WCS/1225W21

Quantity of Sample : 11.5

Sample Condition : Good

Sl. No.	Parameter	Unit	Result	Requirement as per MoEF & CC, Govt. of India Vide G.S.R. 1265 (E), dated 13.10.2017	Test Methods
1	pH Value	--	7.598 at 24.6°C	6.5-9.0	IS 3025 (Part 11): 2023
2	Biochemical Oxygen Demand as	mg/l	19.5	30.0	IS 3025 (Part 44): 2023
3	Chemical Oxygen Demand as CO	mg/l	39.0	<100	IS 3025 (Part 58): 2023
4	Total Suspended Solid as TSS	mg/l	33.1	--	IS 3025 (Part 17): 2023
5	Total Dissolved Solid as TDS	mg/l	280.0	--	IS 3025 (Part 16): 2023
6	Oil & Grease	mg/l	<4.0	--	APHA 24th Ed. (4520-B): 2023
7	Faecal Coliform	MPN/100 ml	350.0	<1000	IS 1622: 1981 RA 2019

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Reviewed by
(Ms. Laxmipriya Sethi)

hs

Authorized Signatory for Microbiological
(Miss. Laxmi Sahoo)



Bijaya Kumar Chahatary

Authorized Signatory for Chemical
(Mr. Bijaya Kumar Chahatary)

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WCS
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Format No: WCSA/R/7.8/02

TEST REPORT

Report No. : WCS260116
NABL ID.R No. : TC112252600000016F
Name of the Client : **Raikela Iron Ore Mines (M/S Geetarani Mukanti)**
Address : Raikela, Near Tansa, P.O.-Dengula, Dist- Sundargarh- 750048, Odisha
Sampling Location : **STP Out-Let**
Sample Description : Waste Water
Sampling Plan & Method : WCS/QSP/SAMP (WATER)
Environmental Condition : Temperature 24.5°C, Clear Weather
Sample Collected by : Dehendra Kumar Biswal
Test Performed at : WCS Laboratory
Date of Testing : 07.01.2026 to 10.01.2026

Issue Date : 12.01.2026
Date of Sampling : 05.01.2026
Date of Receiving : 07.01.2026
Sample ID No : WCS0126W17
Quantity of Sample : 1Ltr
Sample Condition : Good

Sl. No.	Parameter	Unit	Result	Requirement as per bioEF & CC, Govt. of India Vide G.S.R. 1265 (E), dated 13.10.2017	Test Methods
1	pH Value	--	7.811 at 24.8°C	6.5-8.0	IS 3025 (Part 1): 2022
2	Biochemical Oxygen Demand as BOD	mg/l	16.8	30.0	IS 3025 (Part 44): 2023
3	Chemical Oxygen Demand as COD	mg/l	38.0	<100	IS 3025 (Part 58): 2023
4	Total Suspended Solid as TSS	mg/l	20.3	--	IS 3025 (Part 17): 2022
5	Total Dissolved Solid as TDS	mg/l	262.0	--	IS 3025 (Part 16): 2023
6	Oil & Grease	mg/l	<4.0	--	APHA 24th Ed. (5520-18): 2023
7	Faecal Coliform	MPN/ 100 ml	280.0	<1000	IS 1622: 1981 RA 2019

Reviewed by

(Mr. Laxmipriya Sethi)

Authorized Signatory for Microbiological
(Miss. Laxmi Soboo)

Authorized Signatory for Chemical
(Mr. Bijaya Kumar Chakrabarty)

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WCS
MY WORLD CONSULTANCY SERVICES

Format No: WCS/QR/7,8/02

TEST REPORT

Report No. : WCS260143
NABL ULR No. : TC112352600000043F
Name of the Client : **Raikela Iron Ore Mines (M/S Geetarnal Mohanty)**
Address : Raikela, Near Tensa, P.O.-Deungula, Dist- Sundargarh- 750048, Odisha
Sampling Location : **STP Out-Let**
Sample Description : **Waste Water**
Sampling Plan & Method : **WCS/QSPS/AMP (WATER)**
Environmental Condition : **Temperature 24.5°C, Clear Weather**
Sample Collected by : **Debdutta Kumar Biswal**
Test Performed at : **WCS Laboratory**
Date of Testing : **19.01.2026 to 22.01.2026**

Issue Date : 23.01.2026
Date of Sampling : 17.01.2026
Date of Receiving : 19.01.2026
Sample ID No : WCS0126W35
Quantity of Sample : 1Ltr
Sample Condition : Good

Sl. No.	Parameter	Unit	Result	Requirement as per MoEF & CC, Govt. of India Vile G.S.R. 1265 (E), dated 15.10.2017	Test Methods
1	pH Value	—	7.598 at 24.6°C	6.5-9.0	IS 3025 (Part II): 2022
2	Biochemical Oxygen Demand as	mg/l	17.5	30.0	IS 3025 (Part 44): 2023
3	Chemical Oxygen Demand as CC	mg/l	42.0	<100	IS 3025 (Part 58): 2023
4	Total Suspended Solid as TSS	mg/l	22.3	—	IS 3025 (Part 17): 2022
5	Total Dissolved Solid as TDS	mg/l	275.0	—	IS 3025 (Part 16): 2023
6	Oil & Grease	mg/l	<4.0	—	APHA 20th Ed. (5520-B): 2023
7	Fecal Coliform	MPN/100 ml	300.0	<1000	IS 1622: 1981 RA 2019

Reviewed by

(Ms. Laxmapriya Sahu)

Authorized Signatory for Microbiological

(Miss. Luani Sahoo)

Authorized Signatory for Chemical

(Mr. Bijaya Kumar Chahantany)



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WCS
MY WORLD CONSULTANCY SERVICES

Format No: WCS/OR/7.5/02

Report No.

NABL ULR No.

Name of the Client

Address

Sampling Location

Sample Description

Sampling Plan & Method

Environmental Condition

Sample Collected by

Test Performed at

Date of Testing

WCS260224

TC11215260000000821

Raikela Iron Ore Mines (M/S Geettrani Mokanti)

Raikela, Near Tenra, P.O.-Dengula, Dist- Sandargarh- 770048, Odisha

STP Out-Let

Waste Water

WCS/QSP/SAMP (WATER)

Temperature 25.0°C, Clear Weather

Tapas Ranjan Patel

WCS Laboratory

09.02.2026 to 13.02.2026

TEST REPORT

Issue Date : 16.02.2026

Date of Sampling : 04.02.2026

Date of Receiving : 07.02.2026

Sample ID No : WCS0226W17

Quantity of Sample : 1Ltr

Sample Condition : Good

Sl. No.	Parameter	Unit	Result	Requirement as per MoEF & CC, Govt. of India Vide G.S.R. 1265 (E), dated 13.10.2017	Test Methods
1	pH Value	--	7.654 at 25.3°C	6.5-9.0	IS 3025 (Part 1): 2022
2	Biochemical Oxygen Demand as BOD	mg/l	14.9	30.0	IS 3025 (Part 44): 2023
3	Chemical Oxygen Demand as COD	mg/l	36.0	<100	IS 3025 (Part 58): 2023
4	Total Suspended Solid as TSS	mg/l	18.6	--	IS 3025 (Part 17): 2022
5	Total Dissolved Solid as TDS	mg/l	272.0	--	IS 3025 (Part 16): 2023
6	Oil & Grease	mg/l	<4.0	--	APHA 24th Ed. (5520-B): 2023
7	Faecal Coliform	MPN/100 ml	300.0	<1000	IS 1622: 1981 RA 2019

Reviewed by

(Ms. Laxmi Priya Sethi)

Authorized Signatory for Microbiological

(Miss. Laxmi Sahoo)

Authorized Signatory for Chemical

(Mr. Bijaya Kumar Chaharary)

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WCS
MY WORLD CONSULTANCY SERVICES

Format No: WCS/QR/7.8/02

TEST REPORT

Report No. : WCS260344
NABL ULR No : TC1122526000000143F
Name of the Client : **Raikela Iron Ore Mines (M/S Geetarani Mohanty)**
Address : Raikela, Near Tensa, P.O.-Jengula, Dist- Sundargarh- 750048, Odisha
Sampling Location : **STP Out-Let**
Sample Description : **Waste Water**
Sampling Plan & Method : **WCS/QSP/SAMP (WATER)**
Environmental Condition : **Temperature 25.0°C, Clear Weather**
Sample Collected by : **Tapas Ranjan Patel**
Test Performed at : **WCS Laboratory**
Date of Testing : **18.02.2026 to 21.02.2026**

Issue Date : 03.03.2026
Date of Sampling : 16.02.2026
Date of Receiving : 18.02.2026
Sample ID No : WCS0226W024
Quantity of Sample : 1 Ltr
Sample Condition : Good

Sl. No.	Parameter	Unit	Result	Requirement as per MoEF & CC, Govt. of India Vide G.S.R. 1265 (E), dated 13.10.2017	Test Methods
1	pH Value	--	7.928 at 25.7°C	6.5-9.0	IS 3025 (Part 11): 2023
2	Biochemical Oxygen Demand as	mg/l	16.6	30.0	IS 3025 (Part 44): 2023
3	Chemical Oxygen Demand as CC	mg/l	40.0	<100	IS 3025 (Part 58): 2023
4	Total Suspended Solid as TSS	mg/l	30.8	—	IS 3025 (Part 17): 2022
5	Total Dissolved Solid as TDS	mg/l	269.0	—	IS 3025 (Part 16): 2023
6	Oil & Grease	mg/l	<1.0	—	APEIA 2nd Ed. (5520-B): 2023
7	Faecal Coliform	MPN/100 ml	350.0	<1000	IS 1622:1981 RA 2010

Ms.

Reviewed by
(Ms. Luxmi Priya Sethi)

Ms.

Authorized Signatory for Microbiological
(Miss. Luxmi Sahoo)



Blahctaray

Authorized Signatory for Chemical
(Mr. Bijaya Kumar Chahatray)

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WCS
MY WORLD CONSULTANCY SERVICES

Form No: WCS/QR/7.8/02

Report No.

NABL ULR No.

Name of the Client

Address

Sampling Location

Sample Description

Sampling Plan & Method

Environmental Condition

Sample Collected by

Test Performed at

Date of Testing

WCS260321

TC112252600000128F

Raikela Iron Ore mines (M/S Geetarani Mohanty)

Raikela, Near Tensa, P.O.-Dengula, Dist- Sundargarh- 770048, Odisha

STP Out-Let

Waste Water

WCS/QSP/SAMP (WATER)

Temperature 25.5°C, Clear Weather

Tapas Ranjan Patel

WCS Laboratory

09.03.2026 to 14.03.2026

Issue Date : 16.03.2026

Date of Sampling : 06.03.2026

Date of Receiving : 09.03.2026

Sample ID No : WCS0326W14

Quantity of Sample : 1Ltr

Sample Condition : Good

TEST REPORT

Sl. No.	Parameter	Unit	Result	Requirement as per MoEF & CC, Govt. of India Vide G.S.R. 1265 (E), dated 13.10.2017	Test Methods
1	pH Value	--	7.874 at 25.3°C	6.5-9.0	IS 3025 (Part 11): 2022
2	Biochemical Oxygen Demand as BOD	mg/l	17.0	30.0	IS 3025 (Part 44): 2023
3	Chemical Oxygen Demand as COD	mg/l	44.0	<100	IS 3025 (Part 58): 2023
4	Total Suspended Solid as TSS	mg/l	22.1	--	IS 3025 (Part 17): 2022
5	Total Dissolved Solid as TDS	mg/l	278.0	--	IS 3025 (Part 16): 2023
6	Oil & Grease	mg/l	<4.0	--	APHA 24th Ed. (5520-B): 2023
7	Faecal Coliform	MPN/ 100 ml	280.0	<1000	IS 1622, 1981 RA 2019

Reviewed by

(Ms. Laxmi Priya Sethi)

Authorized Signatory for Microbiological

(Miss. Laxmi Sahoo)

Authorized Signatory for Chemical

(Mr. Bijaya Kumar Chahatary)

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WCS
MY WORLD CONSULTANCY SERVICES

Format No: WCS/QR-7 R/02

TEST REPORT

Report No. : WCS260441
NABL Li.R No. : TC112252600000208F
Name of the Client : **Raikela Iron Ore Mines (M/S Geetarani Mohanty)**
Address : Raikela, Near Tensa, P.O.-Dengola, Dist- Sundargarh- 770048, Odisha
Sampling Location : **STP Out-Let**
Sample Description : Waste Water
Sampling Plan & Method : WCS/QSP/SAMP (WATER)
Environmental Condition : Temperature 25.5°C, Clear Weather
Sample Collected by : **Tapas Ranjan Patel**
Test Performed at : WCS Laboratory
Date of Testing : 23.03.2026 to 26.03.2026

Issue Date : 01.04.2026

Date of Sampling : 21.03.2026
Date of Receiving : 23.03.2026
Sample ID No : WCS0326W36
Quantity of Sample : 1Ltr
Sample Condition : Good

Sl. No.	Parameter	Unit	Result	Requirement as per MoEF & CC, Govt. of India vide G.S.R. 1265 (F), dated 13.10.2017	Test Methods
1	pH Value	—	8.062 at 26.1°C	6.5-9.0	IS 3025 (Part 1): 2022
2	Biochemical Oxygen Demand as BOD	mg/l	15.9	30.0	IS 3025 (Part 4): 2023
3	Chemical Oxygen Demand as COD	mg/l	38.0	<100	IS 3025 (Part 58): 2023
4	Total Suspended Solid as TSS	mg/l	19.3	—	IS 3025 (Part 17): 2022
5	Total Dissolved Solid as TDS	mg/l	265.0	—	IS 3025 (Part 16): 2023
6	Oil & Grease	mg/l	<4.0	—	APHA 24th Ed. (5520-B): 2023
7	Faecal Coliform	MPN/100 ml	300.0	<1000	IS 1622: 1981 RA 2019

Ms. Laxmi Sethi

Reviewed by
(Ms. Laxmi Sethi)

Miss. Laxmi Sahoo

Authorized Signatory for Microbiological
(Miss. Laxmi Sahoo)



Authorized Signatory for Chemical
(Mr. Bijaya Kumar Chahataray)

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Format No: WCS/QIR/7.8/02

TEST REPORT

Report No. : WCS251034 Issue Date : 13.10.2025
NABL LIR No. : LC112252340000362F
Name of the Client : Raikela Iron Ore Mines (M/S Geetapal Mohanty)
Address : Raikela, Near Tensa, P.O.-Dengula, Dist- Sundargarh- 770048, Odisha
Sampling Location : ETP Outlet
Sample Description : Effluent Water
Sampling Plan & Method : WCS/QSP/SAMP (WATER)
Environmental Condition : Temperature 26.2°C, Clear Weather
Sample Collected by : Debendra Kumar Biswal
Test Performed at : WCS Laboratory
Date of Testing : 07.10.2025 to 11.10.2025

Date of Sampling : 06.10.2025
Date of Receiving : 07.10.2025
Sample ID No : WCS1025W04
Quantity of Sample : 1Ltr
Sample Condition : Good

Sl. No.	Parameter	Unit	Result	Requirement as per The Environment (Protection) Amendment Rules, 2015, Into inland surface water	Test Methods
1	pH Value	—	7.752 at 27.3°C	6.0 to 9.0	IS 3025 (Part 11): 2012
2	Biochemical Oxygen Demand as BOD	mg/l	13.5	30 (Max)	IS 3025 (Part 44): 2013
3	Chemical Oxygen Demand as COD	mg/l	32.0	250 (Max)	IS 3025 (Part 58): 2013
4	Total Suspended Solid as TSS	mg/l	23.5	100 (Max)	IS 3025 (Part 17): 2012
5	Total Dissolved Solid as TDS	mg/l	287.0	2100 (Max)	IS 3025 (Part 16): 2013
6	Oil & Grease	mg/l	4.2	10 (Max)	APHA 24th Ed. (5520-16): 2013

Reviewed by
(Ms. Laxmipriya Sethi)

Authorized Signatory for Chemical
(Mr. Bijaya Kumar Chahatsray)

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TEST REPORT

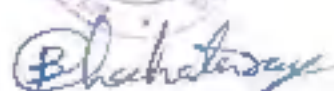
Issue Date : 30.10.2023

Report No. : WCS251042
 NABL LTR No. : TC12252500000370F
 Name of the Client : **Raikela Iron Ore Mines (M/S Goutam Mahanty)**
 Address : Raikela, Near Tensa, P.O.-Dergula, Dist- Sanchargarh- 770048, Odisha
 Sampling Location : **ETP Outlet**
 Sample Description : Effluent Water
 Sampling Plan & Method : WCS/QSP/SAMP (WATER)
 Environmental Condition : Temperature 27.5°C, Clear Weather
 Sample Collected by : Debendra Kumar Biswas
 Test Performed at : WCS Laboratory
 Date of Testing : 23.10.2023 to 28.10.2023

Date of Sampling : 21.10.2023
 Date of Receiving : 23.10.2023
 Sample ID No : WCS1025W13
 Quantity of Sample : 1Ltr
 Sample Condition : Good

Sl. No.	Parameter	Unit	Result	Requirement as per The Environment (Protection) Amendment Rules, 2015, Into Inland surface water	Test Methods
1	pH Value	—	7.783 at 27.5°C	6.0 to 9.0	IS 3025 (Part 11): 2022
2	Biochemical Oxygen Demand as BOD	mg/l	12.4	30 (Max)	IS 3025 (Part 44): 2023
3	Chemical Oxygen Demand as COD	mg/l	29.0	250 (Max)	IS 3025 (Part 58): 2023
4	Total Suspended Solid as TSS	mg/l	22.3	100 (Max)	IS 3025 (Part 17): 2022
5	Total Dissolved Solid as TDS	mg/l	277.0	1100 (Max)	IS 3025 (Part 16): 2021
6	Oil & Grease	mg/l	4.1	10 (Max)	APHA 24th Ed. (5520-13): 2023


 Reviewed by
 (Ms. Luxmipriya Sahoo)



 Authorized Signatory for Chemical
 (Mr. Bijaya Kumar Chahudary)

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Format No: WCS/QR/7.002

TEST REPORT

Report No. : WCS251109

Issue Date : 15.11.2025

NABL ULR No. : TC112252500000383F

Name of the Client : Raikela Iron Ore Mines (M/S Geetarani Mohanty)

Address : Raikela, Near Tansa, P.O.-Dengula, Dist- Sundergarh- 750048, Odisha

Sampling Location : ETP Outlet

Sample Description : Effluent Water

Date of Sampling : 08.11.2025

Sampling Plan & Method : WCS/QSP/SAMP (WATER)

Date of Receiving : 10.11.2025

Environmental Condition : Temperature 24.6°C, Clear Weather

Sample ID No : WCS123W11

Sample Collected by : Debendra Kumar Biswal

Quantity of Sample : 1Ltr

Test Performed at : WCS Laboratory

Sample Condition : Good

Date of Testing : 10.11.2025 to 14.11.2025

Sl. No.	Parameter	Unit	Result	Requirement as per The Environment (Protection) Amendment Rules, 2015, Into Inland surface water	Test Methods
1	pH Value	-	7.654 at 24.3°C	6.0 to 9.0	IS 3025 (Part 11): 2022
2	Biochemical Oxygen Demand as BOD	mg/l	10.4	30 (Max)	IS 3025 (Part 4): 2023
3	Chemical Oxygen Demand as COD	mg/l	26.0	250 (Max)	IS 3025 (Part 5B): 2023
4	Total Suspended Solid as TSS	mg/l	24.0	100 (Max)	IS 3025 (Part 17): 2022
5	Total Dissolved Solid as TDS	mg/l	275.0	2100 (Max)	IS 3025 (Part 16): 2023
6	Oil & Grease	mg/l	4.0	10 (Max)	APHA 24th Ed (5520-B): 2023



 Reviewed by
 (Ms. Laxmipriya Sethi)



 Authorized Signatory for Chemical
 (Mr. Bijaya Kumar Chakravarty)

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Formal No: WCSQR/7.3/02

TEST REPORT

Issue Date : 29.11.2023

Report No. : WCS251161
NABL ULR No. : LC1125529XKX0435F
Name of the Client : **Raikela Iron Ore Mines (M/S Geetaranal Mahanty)**
Address : Raikela, Near Tensa, P.O.-Dengula, Dist- Sonebargarh- 751008, Odisha
Sampling Location : **ETP Outlet**
Sample Description : Effluent Water
Sampling Plan & Method : WCS/QSP/8-AMP (WATER)
Environmental Condition : Temperature 27.0°C, Clear Weather
Sample Collected by : Dehendra Kumar Biswal
Test Performed at : WCS Laboratory
Date of Testing : 24.11.2023 to 28.11.2023

Date of Sampling : 22.11.2023
Date of Receiving : 24.11.2023
Sample ID No : WCS1125W/38
Quantity of Sample : 1Ltr
Sample Condition : Good

Sl. No.	Parameter	Unit	Result	Requirement as per The Environment (Protection) Amendment Rules, 2015, Into inland surface water	Test Methods
1	pH Value	—	7.708 at 24.7°C	6.0 to 9.0	IS 3025 (Part 11): 2022
2	Biochemical Oxygen Demand as BOD	mg/l	11.8	30 (Max)	IS 3025 (Part 44): 2022
3	Chemical Oxygen Demand as COD	mg/l	28.0	250 (Max)	IS 3025 (Part 58): 2023
4	Total Suspended Solid as TSS	mg/l	22.8	100 (Max)	IS 3025 (Part 17): 2022
5	Total Dissolved Solid as TDS	mg/l	282.0	2100 (Max)	IS 3025 (Part 16): 2023
6	Oil & Grease	mg/l	4.2	10 (Max)	APHA 24th Ed. (5520-B) 2023

Reviewed by
(Ms. Laxmidelya Sothi)

Authorized Signatory for Chemical
(Mr. Bijaya Kumar Chhabatany)

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WCS
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Form No: WCS-QR/7.R/02

Report No.

NABL ULR No.

Name of the Client

Address

Sampling Location

Sample Description

Sampling Plan & Method

Environmental Condition

Sample Collected by

Test Performed at

Date of Testing

WCS251264

TC112252500000474F

Raikela Iron Ore Mines (M/S Geetaram Mohanty)

Raikela, Near Tansa, P.O.-Denguli, Dist- Sundargarh- 770048, Odisha

ETP Outlet

Effluent Water

WCS/QSP/SAMP (WATER)

Temperature 24.2°C, Clear Weather

Debandra Kumar Biswal

WCS Laboratory

10.12.2025 to 15.12.2025

TEST REPORT

Issue Date : 30.12.2025

Date of Sampling : 08.12.2025

Date of Receiving : 10.12.2025

Sample ID No : WCS1225W04

Quantity of Sample : 1 Litre

Sample Condition : Good

Sl. No.	Parameter	Unit	Result	Requirement as per The Environment (Protection) Amendment Rules, 2015, into inland surface water	Test Methods
1	pH Value	-	7.614 at 24.3°C	6.0 to 9.0	IS 3025 (Part 1): 2022
2	Biochemical Oxygen Demand as BOD	mg/l	11.2	30 (Max)	IS 3025 (Part 44): 2023
3	Chemical Oxygen Demand as COD	mg/l	30.0	250 (Max)	IS 3025 (Part 58): 2023
4	Total Suspended Solid as TSS	mg/l	22.4	100 (Max)	IS 3025 (Part 17): 2022
5	Total Dissolved Solid as TDS	mg/l	284.8	2100 (Max)	IS 3025 (Part 16): 2022
6	Oil & Grease	mg/l	4.0	10 (Max)	APHA 24th Ed. (5520-B): 2023


Reviewed by
(Ms. Lakshmiya Sethi)




Authorized Signatory for Chemical
(Mr. Bijaya Kumar Chaharany)

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WCS
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Format No: WCS-OR/7.0/02

TEST REPORT

Issue Date : 30.12.2025

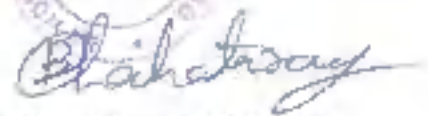
Report No : WCS251268
NABL ULR No : TC112252500000478P
Name of the Client : **Raikela Iron Ore Mines (M/S Geetarani Mohanty)**
Address : Raikela, Near Tensa, P.O.-Dengul, Dist- Sundargarh- 770048, Odisha
Sampling Location : **ETP Outlet**
Sample Description : Effluent Water
Sampling Plan & Method : WCS/QSP/SAMP (WATER)
Environmental Condition : Temperature 24.3°C, Clear Weather
Sample Collected by : Debendra Kumar Biswal
Test Performed at : WCS Laboratory
Date of Testing : 22.12.2025 to 26.12.2025

Date of Sampling : 20.12.2025
Date of Receiving : 22.12.2025
Sample ID No : WCS1225WZZ
Quantity of Sample : 1Ltr
Sample Condition : Good

Sl. No.	Parameter	Unit	Result	Requirement as per The Environment (Protection) Amendment Rules, 2015, Into inland surface water	Test Methods
1	pH Value	-	7.765 at 24.8°C	6.0 to 9.0	IS 3025 (Part 11): 2022
2	Biochemical Oxygen Demand as BOD	mg/l	12.4	30 (Max)	IS 3025 (Part 44): 2023
3	Chemical Oxygen Demand as COD	mg/l	35.0	250 (Max)	IS 3025 (Part 58): 2023
4	Total Suspended Solid as TSS	mg/l	23.9	100 (Max)	IS 3025 (Part 17): 2022
5	Total Dissolved Solid as TDS	mg/l	278.0	2100 (Max)	IS 3025 (Part 16): 2023
6	Oil & Grease	mg/l	4.1	10 (Max)	APHA 24th Ed. (5520-B): 2023


Reviewed by
(Ms. Laxmipriya Sethi)




Authorized Signatory for Chemical
(Mr. Bijaya Kumar Chahatray)

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WCS
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Form No: WCS/QR/7.8/02

Report No.

NABL ULR No.

Name of the Client

Address

Sampling Location

Sample Description

Sampling Plan & Method

Environmental Condition

Sample Collected by

Test Performed at

Date of Testing

WCS260117

TL1122526000000171

Raikela Iron Ore Mines (M/S Geetarani Mulancy)

Raikela, Near Tensa, P.O.-Dengula, Dist- Sundargarh- 751048, Odisha

ETP Outlet

Effluent Water

WCS/QSP/SAMP (WATER)

Temperature 25.0°C, Clear Weather

Debendra Kumar Biswal

WCS Laboratory

07.01.2026 to 18.01.2026

TEST REPORT

Issue Date : 12.01.2026

Date of Sampling : 05.01.2026

Date of Receiving : 07.01.2026

Sample ID No : WCS0126W18

Quantity of Sample : 1 Lit

Sample Condition : Good

Sl. No.	Parameter	Unit	Result	Requirement as per The Environment (Protection) Amendment Rules, 2015, Into Inland surface water	Test Methods
1	pH Value	-	8.046 at 24.8°C	6.0 to 9.0	IS 3025 (Part 11): 2023
2	Biochemical Oxygen Demand as BOD	mg/l	8.8	30 (Max)	IS 3025 (Part 44): 2023
3	Chemical Oxygen Demand as COD	mg/l	26.0	250 (Max)	IS 3025 (Part 58): 2023
4	Total Suspended Solid as TSS	mg/l	26.7	100 (Max)	IS 3025 (Part 17): 2023
5	Total Dissolved Solid as TDS	mg/l	291.0	2100 (Max)	IS 3025 (Part 16): 2023
6	Oil & Grease	mg/l	4.2	10 (Max)	APHA 24th Ed. (5520-05): 2023

Reviewed by

(Ms. Laxmapriya Sethi)

Authorized Signatory for Chemical
(Mr. Bijaya Kumar Choudhury)

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WCS
MY WORLD CONSULTANCY SERVICES

Format No: WCS/QR/7.8/02

TEST REPORT

Report No. : WCS260144
NABL UR No. : TC1122526000000441
Name of the Client : **Raikula Iron Ore Mines (M/S Geetarani Mohanty)**
Address : Raikula, Near Tassa, P.O.-Dengula, Dist- Sundargarh- 770048, Odisha
Sampling Location : **ETP Outlet**
Sample Description : Effluent Water
Sampling Plan & Method : WCS/QSP/SAATP (WATER)
Environmental Condition : Temperature 24.8°C, Clear Weather
Sample Collected by : **Debendra Kumar Biswal**
Test Performed at : WCS Laboratory
Date of Testing : 19.01.2026 to 22.01.2026

Issue Date : 23.01.2026
Date of Sampling : 17.01.2026
Date of Receiving : 19.01.2026
Sample ID No : WCS260126W/16
Quantity of Sample : 1Ltr
Sample Condition : Good

Sl. No.	Parameter	Unit	Result	Requirement as per The Environment (Protection) Amendment Rules, 2015, Into inland surface water	Test Methods
1	pH Value	—	7.831 at 24.3°C	6.0 to 9.0	IS 3025 (Part 11): 2022
2	Biochemical Oxygen Demand as BOD	mg/l	10.7	30 (Max)	IS 3025 (Part 41): 2022
3	Chemical Oxygen Demand as COD	mg/l	12.0	250 (Max)	IS 3025 (Part 58): 2023
4	Total Suspended Solid as TSS	mg/l	22.9	100 (Max)	IS 3025 (Part 17): 2022
5	Total Dissolved Solid as TDS	mg/l	288.0	2100 (Max)	IS 3025 (Part 14): 2023
6	Oil & Grease	mg/l	4.0	10 (Max)	APHA 24-hr Fil. (5520-B): 2023

Reviewed by

(Ms. Laxminitya Setu)

Authorized Signatory for Chemical
(Mr. Bijaya Kumar Mahapatra)

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TC-11225



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WCS
MY WORLD CONSULTANCY SERVICES

TEST REPORT

Format No: WCS/OR/7.8/02

Report No. :

WCS260226

Issue Date : 16.02.2026

NABL ULR No. :

TC1122526000000084F

Name of the Client :

Raikela Iron Ore Mines (M/S Geetarani Mohanty)

Address :

Raikela, Near Tensa, P.O.-Dengula, Dist- Sundargarh- 770048, Odisha

Sampling Location :

ETP Outlet

Sample Description :

Effluent Water

Date of Sampling : 04.02.2026

Sampling Plan & Method :

WCS/CSP/SAMP (WATER)

Date of Receiving : 07.02.2026

Environmental Condition :

Temperature 25.5°C, Clear Weather

Sample ID No : WCS0226W19

Sample Collected by :

Tapas Ranjan Patel

Quantity of Sample : 1Ltr

Test Performed at :

WCS Laboratory

Sample Condition : Good

Date of Testing :

09.02.2026 to 13.02.2026

Sl. No.	Parameter	Unit	Result	Requirement as per The Environment (Protection) Amendment Rules, 2015, Into inland surface water	Test Methods
1	pH Value	—	8.021 at 25.1°C	6.0 to 9.0	IS 3025 (Part 11): 2022
2	Biochemical Oxygen Demand as BOD	mg/l	9.7	30 (Max)	IS 3025 (Part 44): 2023
3	Chemical Oxygen Demand as COD	mg/l	28.0	250 (Max)	IS 3025 (Part 58): 2023
4	Total Suspended Solid as TSS	mg/l	24.5	100 (Max)	IS 3025 (Part 17): 2022
5	Total Dissolved Solid as TDS	mg/l	290.0	2100 (Max)	IS 3025 (Part 16): 2023
6	Oil & Grease	mg/l	4.0	10 (Max)	APHA 24th Ed. (5520-B): 2023

Reviewed by
(Ms. Lasmipriya Sethi)

Authorized Signatory for Chemical
(Mr. Bijaya Kumar Chhabaray)

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WCS
MY WORLD CONSULTANCY SERVICES

Format No: WCS/OR/7.8/02

TEST REPORT

Issue Date : 03.03.2026

Report No. : WCS260345
NABL ULR No. : TC112232600000144F
Name of the Client : Raikela Iron Ore Mines (M/S Geetarani Mohanty)
Address : Raikela, Near Tensa, P.O.-Hengula, Dist- Sundargarh- 770018, Odisha
Sampling Location : ETP Outlet
Sample Description : Effluent Water
Sampling Plan & Method : WCS/QSP/SAMP (WATER)
Environmental Condition : Temperature 25.1°C, Clear Weather
Sample Collected by : Tapas Ranjan Patel
Test Performed at : WCS Laboratory
Date of Testing : 18.02.2026 to 21.02.2026

Date of Sampling : 16.02.2026
Date of Receiving : 18.02.2026
Sample ID No : WCS0226W023
Quantity of Sample : 1Ltr
Sample Condition : Good

SL No.	Parameter	Unit	Result	Requirement as per The Environment (Protection) Amendment Rules, 2015, Into inland surface water	Test Methods
1	pH Value	—	7.954 at 24.5°C	6.0 to 9.0	IS 3025 (Part 11): 2022
2	Biochemical Oxygen Demand as BOD	mg/l	11.8	30 (Max)	IS 3025 (Part 44): 2023
3	Chemical Oxygen Demand as COD	mg/l	34.0	250 (Max)	IS 3025 (Part 58): 2023
4	Total Suspended Solid as TSS	mg/l	23.3	100 (Max)	IS 3025 (Part 17): 2022
5	Total Dissolved Solid as TDS	mg/l	284.0	2100 (Max)	IS 3025 (Part 16): 2023
6	Oil & Grease	mg/l	4.1	10 (Max)	APHA 24th Ed. (5520-B): 2023


Reviewed by
(Ms. Laxmi Priya Sethi)




Authorized Signatory for Chemical
(Mr. Bijaya Kumar Chahatany)

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WCS
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Format No: WCS/OR/7.8/02

TEST REPORT

Report No. : WCS260322
NABL ULR No. : TC11225260X000129F
Name of the Client : **Raikela Iron Ore Mines (M/S Geetarani Mohanty)**
Address : Raikela, Near Tensa, P.O.-Dunguli, Dist- Sundargarh- 750018, Odisha
Sampling Location : **ETP Outlet**
Sample Description : Effluent Water
Sampling Plan & Method : WCS/QSP/SAMP (WATER)
Environmental Condition : Temperature 26.3°C, Clear Weather
Sample Collected by : Tapas Ranjan Patel
Test Performed at : WCS Laboratory
Date of Testing : 09.03.2026 to 14.03.2026

Issue Date : 16.03.2026

Date of Sampling : 06.03.2026
Date of Receiving : 09.03.2026
Sample ID No : WCS0326WT5
Quantity of Sample : 1Ltr
Sample Condition : Good

Sl. No.	Parameter	Unit	Result	Requirement as per The Environment (Protection) Amendment Rules, 2015, Into Inland surface water	Test Methods
1	pH Value	-	7.972 at 25.7°C	6.0 to 9.0	IS 3025 (Part 11): 2022
2	Biochemical Oxygen Demand as BOD	mg/l	10.7	30 (Max)	IS 3025 (Part 44): 2023
3	Chemical Oxygen Demand as COD	mg/l	32.0	250 (Max)	IS 3025 (Part 58): 2023
4	Total Suspended Solid as TSS	mg/l	22.7	100 (Max)	IS 3025 (Part 17): 2022
5	Total Dissolved Solid as TDS	mg/l	273.0	2100 (Max)	IS 3025 (Part 16): 2023
6	Oil & Grease	mg/l	3.8	10 (Max)	APHA 24th Ed. (5520-B): 2023


Reviewed by
(Ms. Laxmi Priya Sethi)



Authorized Signatory for Chemical
(Mr. Bijaya Kumar Chaharany)

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WCS
MY WORLD CONSULTANCY SERVICES

Format No: WCS/QR/7.8/02

TEST REPORT

Report No. : WCS260442
NABL LIR No. : TC1122526000000209F
Name of the Client : **Raikela Iron Ore Mines (M/S Geetarani Mohanty)**
Address : Raikela, Near Tensa, P.O.-Dengula, Dist- Sundargarh- 770048, Odisha.
Sampling Location : **ETP Outlet**
Sample Description : Effluent Water
Sampling Plan & Method : WCS/QSP/SAMP (WATER)
Environmental Condition : Temperature 25.8°C, Clear Weather
Sample Collected by : Tapan Ranjan Patel
Test Performed at : WCS Laboratory
Date of Testing : 21.03.2026 to 26.03.2026

Issue Date : 03.04.2026

Date of Sampling : 21.03.2026
Date of Receiving : 23.03.2026
Sample ID No : WCS0326W37
Quantity of Sample : 1Ltr
Sample Condition : Good

Sl. No.	Parameter	Unit	Result	Requirement as per The Environment (Protection) Amendment Rules, 2015, Into inland surface water	Test Methods
1	pH Value	—	7.807 at 26.0°C	6.0 to 9.0	IS 3025 (Part 11): 2022
2	Biochemical Oxygen Demand as BOD	mg/l	12.0	30 (Max)	IS 3025 (Part 44): 2023
3	Chemical Oxygen Demand as COD	mg/l	35.0	250 (Max)	IS 3025 (Part 58): 2023
4	Total Suspended Solid as TSS	mg/l	25.6	100 (Max)	IS 3025 (Part 17): 2022
5	Total Dissolved Solid as TDS	mg/l	280.0	2100 (Max)	IS 3025 (Part 16): 2023
6	Oil & Grease	mg/l	4.2	10 (Max)	APHA 24th Ed. (5520-B): 2023


Reviewed by
(Ms. Laxmi Priya Sethi)


Authorized Signatory for Chemical
(Mr. Bijaya Kumar Chahatany)

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Format No: WCS/QR/7.8/02

TEST REPORT

Report No.	: WCS251273	Issue Date	: 25.12.2025
Name of the Client	: Raikela Iron Ore Mines (M/S Geetarani Mohanty)		
Address	: Raikela, Near Tensa, P.O.-Dengula, Dist- Sundargarh- 770048, Odisha		
Sample Description	: Ground Water Level		
Sampling Plan & Method	: WCS/QSP/SAMP (WATER LEVEL)		
Environmental Condition	: Clear Weather		
Sample Collected by	: Debendra Kumar Biswal		
Test Performed at	: WCS Laboratory	Quantity of Sample	: 4 Nos.
Month of Sampling	: December-2025	Date of Receiving	: 22.12.2025

Sample ID No.	Location	Date of Monitoring	Ground water Level in BGL meter
WCS1225WL03A	Geetarani Mohanty Mines	19.12.2025	8.46
WCS1225WL03B	Penguin Trading & Agencies Ltd	19.12.2025	8.35
WCS1225WL03C	Tentulidihi	19.12.2025	7.34
WCS1225WL03D	Raikela Village	19.12.2025	7.01



 Reviewed by
 (Mr Laxmi priya Sethi)



 Authorized Signatory
 (Mr. Bijaya Kumar Chahataray)

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Format No: WCS/QR/7.8/02

TEST REPORT

 Report No. : WCS251084
 NABL ULR No. : TC112252500000406F
 Name of the Client : **Raikela Iron Ore Mines (M/S Geetarani Mohanty)**
 Address : Raikela, Near Tensa, P.O.-Dengula, Dist- Sundargarh- 770048, Odisha
 Sampling Location : **Mines Surface Run Off**
 Sample Description : Surface Water
 Sampling Plan & Method : WCS/QSP/SAMP (WATER)
 Environmental Condition : Temperature 26.8°C, Cloudy
 Sample Collected by : Debendra Kumar Biswal
 Test Performed at : WCS Laboratory
 Date of Testing : 10.10.2025 to 16.10.2025

Issue Date : 18.10.2025

 Date of Sampling : 08.10.2025
 Date of Receiving : 10.10.2025
 Sample ID No : WCS1025W12
 Quantity of Sample : 1Ltr
 Sample Condition : Good

Sl. No.	Parameter	Unit	Result	Test Methods
Discipline: Chemical		Group: Water		
1	pH Value	--	6.674 at 26.3°C	IS 3025 (Part11): 2022
2	TotalSuspendedSolid as TSS	mg/l	71.0	IS 3025 (Part 17): 2022
3	Oil & Grease	mg/l	<4.0	APHA 24th Ed. (5520-B): 2023
4	TotalDissolvedSolid as TDS	mg/l	298.0	IS 3025 (Part16): 2023
5	Specific Conductivity	µs/cm	201.2 at 26.0°C	IS 3025 (Part 14): 2013 RA 2019
6	Iron as Fe	mg/l	0.068	IS 3025 (Part53): 2024
7	Manganese as Mn	mg/l	<0.01	Apha 24th Edition:2023 3111B
8	Cadmium as Cd	mg/l	<0.05	IS 3025(Part-41)1992 RA 2023
9	Lead as Pb	mg/l	<0.01	IS 3025(Part-47) 2024


 Reviewed by
 (Ms. Laxmipriya Sethi)


 Authorized Signatory for Chemical
 (Mr. Bijaya Kumar Chahataray)

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Form No: WCS/QRC/7.8012

Report No.

NABL ULR No.

Name of the Client

Address

Sample Description

Sampling Plan & Method

Environmental Condition

Sample Collected by

Test Performed at

Month of Sampling

WCS251044

TC1122525000H13721

Raikela Iron Ore Mines (M/S Geetajani Mahanty)

Raikela, Near Tansa, P.O.-Kangra, Dist- Sundargarh- 750048, Odisha

Ambient Noise

WCS/QSP/SAMP (NCHS16)

Clear Weather

Debendra Kumar Biswal

WCS Laboratory

October-2025

Issue Date: 30.10.2025

Quantity of Sample : 8

Sample Condition : Good

TEST REPORT

Sample ID No.	Location	Date of Monitoring	Day Time dB(A) Leq	Night Time dB(A) Leq
WCS1025N03A	Nuagaon	06-10-2025	53.8	36.4
WCS1025N03B	Tentulidih	07-10-2025	54.3	37.9
WCS1025N03C	Daugun	08-10-2025	53.6	35.2
WCS1025N03D	Office	09-10-2025	63.2	37.8
WCS1025N03E	North Boundary	10-10-2025	64.7	38.1
WCS1025N03F	South Boundary	11-10-2025	64.0	38.9
WCS1025N03G	East Boundary	13-10-2025	59.6	39.2
WCS1025N03H	West Boundary	14-10-2025	61.3	41.1
Test Method	IS 989 : 1981			

Noise Standard in dB(A) Leq as per CPCB		
Category of Area	Day Time dB(A) Leq (6.00 Am to 10.00 Pm)	Night Time dB(A) Leq (10.00 Pm to 6.00 Am)
Industrial Area	75	70
Commercial Area	65	55
Residential Area	55	45
Sensitive Area	50	40


 Reviewed by
 (Miss. Laxmi Sahoo)


 Authorized Signatory
 (Mr. Bijay Kumar Chahotaray)

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Format No: WCS/QR/7.0/02

TEST REPORT

Report No:

WCS251235

Issue Date:

04.12.2025

NABL QLR No:

TC122525000004401

Name of the Client:

Raikela Iron Ore Mines (M/S Gostaram Mahanty)

Address:

Raikela, Near Tensa, P.O.-Dengala, Dist- Sundargarh- 750048, Odisha

Sample Description:

Ambient Noise

Sampling Plan & Method:

WCS/QSP/SAMP (NOISE)

Environmental Condition:

Clear Weather

Sample Collected by:

Dehendra Kumar Biswal

Test Performed at:

WCS Laboratory

Quantity of Sample:

8

Month of Sampling:

November-2025

Sample Condition:

Good

Sample ID No.	Location	Date of Monitoring	Day Time dB(A) Leq	Night Time dB(A) Leq
WCS1125N05A	Nuagnon	08-11-2025	53.1	37.9
WCS1125N05B	Tentulidih	09-11-2025	54.7	36.4
WCS1125N05C	Dengala	10-11-2025	52.5	36.5
WCS1125N05D	Office	11-11-2025	61.4	39.4
WCS1125N05E	North Boundary	12-11-2025	64.8	36.1
WCS1125N05F	South Boundary	13-11-2025	64.2	37.4
WCS1125N05G	East Boundary	15-11-2025	56.8	40.1
WCS1125N05H	West Boundary	16-11-2025	60.2	41.2
Test Method	IS 989 : 1981			

Noise Standard in dB(A) Leq as per CPCB		
Category of Area	Day Time dB(A) Leq (6.00 Am to 10.00 Pm)	Night Time dB(A) Leq (10.00 Pm to 6.00 Am)
Industrial Area	75	70
Commercial Area	65	55
Residential Area	55	45
Sensitive Area	50	40



Reviewed by

(Miss. Laxmi Sahas)




Authorized Signatory

(Mr. Bijaya Kumar Chaharary)

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WCS
MY WORLD CONSULTANCY SERVICES

Format No.: WCS/QR/7,8/02

Report No.

NABL I/LR No.

Name of the Client

Address

Sample Description

Sampling Plan & Method

Environmental Condition

Sample Collected by

Test Performed at

Month of Sampling

WCS260137

FC12252600000032F

Ralkela Iron Ore Mines (M/S Geetarani Mohanty)

Ralkela, Near Tansa, P.O.-Deapula, Dist.- Sundargarh- 770048, Odisha

Ambient Noise

WCS/QSP/SAMP (NOISE)

Clear Weather

Debendra Kumar Biswal

WCS Laboratory

December-2023

TEST REPORT

Issue Date : 05.01.2024

Quantity of Sample : 8
Sample Condition : Good

Sample ID No.	Location	Date of Monitoring	Day Time dB(A) Leq	Night Time dB(A) Leq
WCS1225N09A	Nungoon	04.12.2023	52.8	36.2
WCS1225N09B	Tatuldihhi	05.12.2023	53.7	37.0
WCS1225N09C	Dengula	06.12.2023	53.1	37.5
WCS1225N09D	Office	08.12.2023	62.6	38.8
WCS1225N09E	North Boundary	09.12.2023	63.7	39.0
WCS1225N09F	South Boundary	10.12.2023	64.0	38.3
WCS1225N09G	East Boundary	11.12.2023	59.6	39.6
WCS1225N09H	West Boundary	12.12.2023	61.8	40.5
Test Method	IS 9889 : 1981			

Noise Standard in dB(A) Leq as per CPCB		
Category of Area	Day Time dB(A) Leq (6.00 Am to 10.00 Pm)	Night Time dB(A) Leq (10.00 Pm to 6.00 Am)
Industrial Area	75	70
Commercial Area	65	55
Residential Area	55	45
Sensitive Area	50	40


Reviewed by
(Miss. Laxmi Sahoo)


Authorized Signatory
(Mr. Bijaya Kumar Chakraborty)

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TC-1729



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NABL (ISO/IEC 17025:2017 ACCREDITED LABORATORY)



WCS
MY WORLD CONSULTANCY SERVICES

Format No: WCS/QR/7.8/02

TEST REPORT

Issue Date : 20.01.2026

Report No. :

WCS260140

NABL ULR No. :

TC112252600000040F

Name of the Client :

Raikela Iron Ore Mines (M/S Geetaran Mohanty)

Address :

Raikela, Near Tensa, P.O.-Dengula, Dist- Sundargarh- 770048, Odisha

Sample Description :

Ambient Noise

Sampling Plan & Method :

WCS/QSP/SAMP (NOISE)

Environmental Condition :

Clear Weather

Sample Collected by :

Debendra Kumar Biswal

Test Performed at :

WCS Laboratory

Quantity of Sample : 8

Month of Sampling :

January-2026

Sample Condition : Good

Sample ID No.	Location	Date of Monitoring	Day Time dB(A) Leq	Night Time dB(A) Leq
WCS0126N04A	Nuaggon	05.01.2026	53.6	38.0
WCS0126N04B	Tentulidih	06.01.2026	52.9	37.6
WCS0126N04C	Dengula	07.01.2026	52.6	36.7
WCS0126N04D	Office	08.01.2026	63.5	38.1
WCS0126N04E	North Boundary	09.01.2026	62.8	38.8
WCS0126N04F	South Boundary	10.01.2026	63.9	39.0
WCS0126N04G	East Boundary	12.01.2026	60.4	39.5
WCS0126N04H	West Boundary	13.01.2026	62.6	38.9
Test Method	IS 9989 : 1981			

Noise Standard in dB(A) Leq as per CPCB		
Category of Area	Day Time dB(A) Leq (6.00 Am to 10.00 Pm)	Night Time dB(A) Leq (10.00 Pm to 6.00 Am)
Industrial Area	75	70
Commercial Area	65	55
Residential Area	55	45
Sensitive Area	50	40


Reviewed by
(Miss. Laxmi Sahoo)


Authorized Signatory
(Mr. Bijaya Kumar Chahatray)

***** END OF REPORT *****

N.B.:

- Liability for return of sample ceases after 7 days from the date of test certificate.
- The report cannot be reproduced either in full or in part, without prior written consent of QM.
- In case of any complaint, please mail us bijaya@theworld.co.in or contact us at +91-91245 84650
- Above Results related only to the item tested.



MY WORLD CONSULTANCY SERVICES PRIVATE LIMITED
(Testing Laboratory)

Plot No. 766, Telengapentha, Cuttack-754001
NABL (ISO/IEC 17025:2017) ACCREDITED LABORATORY



WCS
MY WORLD CONSULTANCY SERVICES

Format No: WCS/OR/7.802

Report No

NABL ULR No.

Name of the Client

Address

Sample Description

Sampling Plan & Method

Environmental Condition

Sample Collected by

Test Performed at

Month of Sampling

WCS260343

TC1122526000000142F

Raikela Iron Ore Mines (M/S Geetarani Mohanty)

Raikela, Near Tensa, P.O.-Dengula, Dist- Sundargarh- 770048, Odisha

Ambient Noise

WCS/QSP/SAMP (NOISE)

Clear Weather

Tapas Ranjan Patel

WCS Laboratory

February-2026

TEST REPORT

Issue Date : 03.03.2026

Quantity of Sample : 8

Sample Condition : Good

Sample ID No.	Location	Date of Monitoring	Day Time dB(A) Leq	Night Time dB(A) Leq
WCS0226N03A	Nungao	05.02.2026	54.2	37.5
WCS0226N03B	Tambalidih	06.02.2026	50.6	36.1
WCS0226N03C	Dengula	07.02.2026	51.8	36.4
WCS0226N03D	Office	09.02.2026	63.6	37.9
WCS0226N03E	North Boundary	10.02.2026	63.1	38.4
WCS0226N03F	South Boundary	11.02.2026	62.8	39.6
WCS0226N03G	East Boundary	12.02.2026	60.7	37.7
WCS0226N03H	West Boundary	13.02.2026	63.6	38.2
Test Method	IS 9890 : 1981			

Noise Standard in dB(A) Leq as per CPCB

Category of Area	Day Time dB(A) Leq (6.00 Am to 10.00 Pm)	Night Time dB(A) Leq (10.00 Pm to 6.00 Am)
Industrial Area	75	70
Commercial Area	65	55
Residential Area	55	45
Sensitive Area	50	40

Reviewed by
(Miss. Laxmi Sahoo)



Authorized Signatory
(Mr. Bijaya Kumar Chahatray)

***** END OF REPORT *****

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- Above Results related only to the Item Tested.



TD-11225



MY WORLD CONSULTANCY SERVICES PRIVATE LIMITED
(Testing Laboratory)

Plot No. 766, Telengapentha, Cuttack-754001
NABL (ISO/IEC 17025:2017 ACCREDITED LABORATORY)



WCS
MY WORLD CONSULTANCY SERVICES

Format No: WCS/QR/7.8/02

TEST REPORT

Issue Date : 03.04.2026

Report No. : WCS260440

NABL ULR No. : FC112252600000207F

Name of the Client : Raikela Iron Ore Mines (M/S Geetarani Mohanty)

Address : Raikela, Near Tensa, P.O.-Dengula, Dist- Sundargarh- 770048, Odisha

Sample Description : Ambient Noise

Sampling Plan & Method : WCS/QSP/SAMP (NOISE)

Environmental Condition : Clear Weather

Sample Collected by : Tapas Ranjan Patel

Test Performed at : WCS Laboratory

Month of Sampling : March-2026

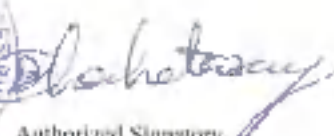
Quantity of Sample : 8
Sample Condition : Good

Sample ID No.	Location	Date of Monitoring	Day Time dB(A) Leq	Night Time dB(A) Leq
WCS0326N02A	Nugaon	06.03.2026	53.9	37.9
WCS0326N02B	Tentalihili	07.03.2026	53.2	37.4
WCS0326N02C	Dengula	09.03.2026	54.1	38.0
WCS0326N02D	Office	10.03.2026	63.8	39.4
WCS0326N02E	North Boundary	11.03.2026	64.0	40.7
WCS0326N02F	South Boundary	12.03.2026	63.2	38.5
WCS0326N02G	East Boundary	13.03.2026	61.1	36.8
WCS0326N02H	West Boundary	14.03.2026	62.8	37.6
Test Method	IS 9989 : 1981			

Noise Standard in dB(A) Leq as per CPCB		
Category of Area	Day Time dB(A) Leq (6.00 Am to 10.00 Pm)	Night Time dB(A) Leq (10.00 Pm to 6.00 Am)
Industrial Area	75	70
Commercial Area	65	55
Residential Area	55	45
Sensitive Area	50	40


Reviewed by
(Miss. Laxmi Sahoo)




Authorized Signatory
(Mr. Bijaya Kumar Chahatray)

***** END OF REPORT *****

N.B.:

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- In case of any complaint, please mail us bijaya@theworld.co.in or contact us at +91-91245 84650
- Above Results related only to the item tested.

CALIBRATION REPORT

Date: 21/05/2025

Customer Name	M/s GEETARANI MOHANTY RAIKELA IRON ORE MINES
Instrument	Continuous Ambient Gas Monitoring Analyzer
Principle	Differential Optical Absorption Spectroscopy
Instrument S/No:	AR500 S E-2703
Path Length	110 Meter
Date of Calibration	21/05/2025
Next Calibration Date	20/05/2026

CALIBRATION DATA

PARAMETERS	ZERO CALIBRATION $\mu\text{g}/\text{m}^3$		SPAN CALIBRATION $\mu\text{g}/\text{m}^3$		SPAN	
	ACUTUAL	MEASURED	ACTUAL	MEASURED	OLD	NEW
SULFUR DIOXIDE (SO ₂)	0.0	0.0	743.6	741.1	1.00	1.00
NITROGEN DIOXIDE (NO ₂)	0.0	0.0	381.0	382.00	1.00	1.00

Method: Calibration method: DOAS K203

Calibration of above Analyzers is performed with accredited reference materials and valid for one year.

Calibration Gas Cylinder Details:-

Supplier :- M/s. SIGMA GASES AND SERVICES

GAS NAME	CYLINDER S/N	GAS CONCENTARTION	GAS VALIDITY
Sulfur Dioxide (SO ₂)	31486	718 PPM	01/10/2025
Nitrogen Dioxide (NO ₂)	31606	513 PPM	01/10/2025



Authorized Signatory

NEVCO Engineers Pvt. Ltd.

CIN No.: 55-57-103 OF 1993-94 Dt. 27.01.94

CALIBRATION REPORT

Date: 21/05/2025

Customer Name	M/s GEETARANI MOHANTY RAIKELA IRON ORE MINES
Instrument	Continuous Ambient Gas Monitoring Analyzer
Principle	Differential Optical Absorption Spectroscopy
Instrument S/No:	AR500 S E-2702
Path Length	110 Meter
Date of Calibration	21/05/2025
Next Calibration Date	20/05/2026

CALIBRATION DATA

PARAMETERS	ZERO CALIBRATION $\mu\text{g}/\text{m}^3$		SPAN CALIBRATION $\mu\text{g}/\text{m}^3$		SPAN	
	ACUTUAL	MEASURED	ACTUAL	MEASURED	OLD	NEW
SULFUR DIOXIDE (SO ₂)	0.0	0.1	743.6	742.5	1.00	1.00
NITROGEN DIOXIDE (NO ₂)	0.0	0.1	381.00	380.5	1.00	1.00

Method: Calibration method: DOAS K203

Calibration of above Analyzers is performed with accredited reference materials and valid for one year.

Calibration Gas Cylinder Details:-

Supplier :- M/s. SIGMA GASES AND SERVICES

GAS NAME	CYLINDER S/N	GAS CONCENTARTION	GAS VALIDITY
Sulfur Dioxide (SO ₂)	31486	718 PPM	01/10/2025
Nitrogen Dioxide (NO ₂)	31606	513PPM	01/10/2025



Authorized Signatory

NEVCO Engineers Pvt. Ltd.

CIN No.: 55-57-103 OF 1993-94 Dt. 27.01.94

CALIBRATION REPORT

Date: 21/05/2025

Customer Name	M/s GEETARANI MOHANTY RAIKELA IRON ORE MINES
Instrument	Continuous Ambient Gas Monitoring Analyzer
Principle	Differential Optical Absorption Spectroscopy
Instrument S/No:	AR500 S E-2704
Path Length	110 Meter
Date of Calibration	21/05/2025
Next Calibration Date	20/05/2026

CALIBRATION DATA

PARAMETERS	ZERO CALIBRATION $\mu\text{g}/\text{m}^3$		SPAN CALIBRATION $\mu\text{g}/\text{m}^3$		SPAN	
	ACUTUAL	MEASURED	ACTUAL	MEASURED	OLD	NEW
SULFUR DIOXIDE (SO ₂)	0.0	0.0	743.6	746.5	1.00	1.00
NITROGEN DIOXIDE (NO ₂)	0.0	0.0	381.0	380.5	1.00	1.00

Method: Calibration method: DOAS K203

Calibration of above Analyzers is performed with accredited reference materials and valid for one year.

Calibration Gas Cylinder Details:-

Supplier :- M/s. SIGMA GASES AND SERVICES

GAS NAME	CYLINDER S/N	GAS CONCENTARTION	GAS VALIDITY
Sulfur Dioxide (SO ₂)	31486	718 PPM	01/10/2025
Nitrogen Dioxide (NO ₂)	31606	513 PPM	01/10/2025



Authorized Signatory

NEVCO Engineers Pvt. Ltd.

CIN No.: 55-57-103 OF 1993-94 Dt. 27.01.94

CALIBRATION REPORT

Date:17/03/2025

Customer Name	M/s GEETARANI MOHANTY RAIKELA IRON ORE MINES
Instrument	Continuous Ambient Gas Monitoring Analyzer
Principle	NDIR
Instrument S/No:	CO-SERINUS30-00001C17031A
Date of Calibration	17/03/2025
Next Calibration Date	16/03/2026

CALIBRATION DATA

PARAMETERS	ZERO CALIBRATION ppm		SPAN CALIBRATION ppm		SPAN	
	ACUTUAL	MEASURED	ACTUAL	MEASURED	OLD	NEW
CARBON MONOXIDE	0.0	0.0	40	39.97	1.00	1.00

Method: Calibration of the above Analyzers is performed with accredited Ecotech reference material.

Calibration of above Analyzers is performed with accredited reference materials and valid for one year.

Calibration Gas Cylinder Details:-

Supplier :- M/s. SIGMA GASES AND SERVICES

GAS NAME	CYLINDER S/N	GAS CONCENTARTION	GAS VALIDITY
Carbon Monoxide (CO)	44865	40PPM	19/03/2025



Authorized Signatory

NEVCO Engineers Pvt. Ltd.

CIN No.: 55-57-103 OF 1993-94 Dt. 27.01.94

CALIBRATION REPORT

Date:17/03/2025

Customer Name	M/s GEETARANI MOHANTY RAIKELA IRON ORE MINES
Instrument	Continuous Ambient Gas Monitoring Analyzer
Principle	NDIR
Instrument S/No:	CO-SERINUS30-00001C16FBDC
Date of Calibration	17/03/2025
Next Calibration Date	16/03/2026

CALIBRATION DATA

PARAMETERS	ZERO CALIBRATION ppm		SPAN CALIBRATION ppm		SPAN	
	ACUTUAL	MEASURED	ACTUAL	MEASURED	OLD	NEW
CARBON MONOXIDE	0.0	0.0	40	40.95	1.00	1.00

Method: Calibration of the above Analyzers is performed with accredited Ecotech reference material.

Calibration of above Analyzers is performed with accredited reference materials and valid for one year.

Calibration Gas Cylinder Details:-

Supplier :- M/s.SIGMA GASES AND SERVICES

GAS NAME	CYLINDER S/N	GAS CONCENTARTION	GAS VALIDITY
Carbon Monoxide (CO)	44865	40PPM	19/03/2025



Authorized Signatory

NEVCO Engineers Pvt. Ltd.

CIN No.: 55-57-103 OF 1993-94 Dt. 27.01.94

 Tel.: +91-11-41717112/3/4/5, Fax: +91-11-26285202; Mobile: 09871833900
 a.ray@nevcoengineers.com / nevcohyd@nevcoengineers.com  www.nevcoengineers.com
 90A-2nd Floor, Opposite Iskon Temple, Amrit Puri B, Main Road, East of Kailash, Delhi - 110065

CALIBRATION REPORT

Date: 17/03/2025

Customer Name	M/s GEETARANI MOHANTY RAIKELA IRON ORE MINES
Instrument	Continuous Ambient Gas Monitoring Analyzer
Principle	NDIR
Instrument S/No:	CO-SERINUS30-00001C1709BB
Date of Calibration	17/03/2025
Next Calibration Date	16/03/2026

CALIBRATION DATA

PARAMETERS	ZERO CALIBRATION ppm		SPAN CALIBRATION ppm		SPAN	
	ACUTUAL	MEASURED	ACTUAL	MEASURED	OLD	NEW
CARBON MONOXIDE	0.0	0.0	40	41.45	1.00	1.00

Method: Calibration of the above Analyzers is performed with accredited Ecotech reference material.

Calibration of above Analyzers is performed with accredited reference materials and valid for one year.

Calibration Gas Cylinder Details:-

Supplier :- M/s. SIGMA GASES AND SERVICES

GAS NAME	CYLINDER S/N	GAS CONCENTARTION	GAS VALIDITY
Carbon Monoxide (CO)	44865	40PPM	19/03/2025



Authorized Signatory

NEVCO Engineers Pvt. Ltd.

CIN No.: 55-57-103 OF 1993-94 Dt. 27.01.94

 Tel.: +91-11-41717112/3/4/5, Fax: +91-11-26285202; Mobile: 09871833900
 a.ray@nevcoengineers.com / nevcohyd@nevcoengineers.com  www.nevcoengineers.com
 90A-2nd Floor, Opposite Iskon Temple, Amrit Puri B, Main Road, East of Kailash, Delhi - 110065

CALIBRATION REPORT

Date: 20/05/2025

Customer Name	M/s GEETARANI MOHANTY RAIKELA IRON ORE MINES
Instrument	Ambient Dust Monitoring Analyzer (PM 2.5 um)
Principle	Beta Attenuation
Instrument S/No:	SM 200 -1555
Flow Rate	2.3 m3/hr
Sampling Time	1 Hours
Date of Calibration	20/05/2025
Next Calibration Date	19/05/2026

CALIBRATION DATA

Flow (Liter/Minute)		
Before	After	Difference
14.57	14.57	0.00

Span Factor		
Before	After	Difference
1.0	1.0	0

Flow Factor		
Before	After	Difference
2.324	2.321	0.003

Span & Leak Calibration:

S: 2.046 0.23 0.2%

L: 4.85 Kpa 0 Pa

Beta Calibration:

DK: 22 CE: -3.6%

A: 2867121 B: 2115063

Method: Calibration of the above Analyzer is performed with reference to OPSIS instrument and valid for one year.
Reference: OPSIS Flow Meter FM200 kit. S/no:FM-L-020



Signature:

NEVCO Engineers Pvt. Ltd.

CIN No.: 55-57-103 OF 1993-94 Dt. 27.01.94

CALIBRATION REPORT

Date: 20/05/2025

Customer Name	M/s GEETARANI MOHANTY RAIKELA IRON ORE MINES
Instrument	Ambient Dust Monitoring Analyzer (PM 2.5 um)
Principle	Beta Attenuation
Instrument S/No:	SM 200 -1551
Flow Rate	2.3 m ³ /hr
Sampling Time	1 Hours
Date of Calibration	20/05/2025
Next Calibration Date	19/05/2026

CALIBRATION DATA

Flow (Liter/Minute)		
Before	After	Difference
14.52	14.51	0.01

Span Factor		
Before	After	Difference
1.0	1.0	0

Flow Factor		
Before	After	Difference
2.320	2.320	0.000

Span & Leak Calibration:

S: 2.047 0.23 0.2%

L: 4.92 Kpa 0 Pa

Beta Calibration:

DK: 22 CE: -3.7%

A: 2867121 B: 2115060

Method: Calibration of the above Analyzer is performed with reference to OPSIS instrument and valid for one year.
Reference: OPSIS Flow Meter FM200 kit. S/no: FM-L-020



Signature:

NEVCO Engineers Pvt. Ltd.

CIN No.: 55-57-103 OF 1993-94 Dt. 27.01.94

CALIBRATION REPORT

Date: 20/05/2025

Customer Name	M/s GEETARANI MOHANTY RAIKELA IRON ORE MINES
Instrument	Ambient Dust Monitoring Analyzer (PM 2.5 um)
Principle	Beta Attenuation
Instrument S/No:	SM 200 -1558
Flow Rate	2.3 m3/hr
Sampling Time	1 Hours
Date of Calibration	20/05/2025
Next Calibration Date	19/05/2026

CALIBRATION DATA

Flow (Liter/Minute)		
Before	After	Difference
14.55	14.53	0.02

Span Factor		
Before	After	Difference
1.0	1.0	0

Flow Factor		
Before	After	Difference
2.327	2.327	0.00

Span & Leak Calibration:

S: 2.046 0.23 0.1%

L: 4.8 Kpa 0 Pa

Beta Calibration:

DK: 22 CE: -3.7%

A: 2867121 B: 2115063

Method: Calibration of the above Analyzer is performed with reference to OPSIS instrument and valid for one year.
Reference: OPSIS Flow Meter FM200 kit. S/no:FM-L-020



Signature:

NEVCO Engineers Pvt. Ltd.

CIN No.: 55-57-103 OF 1993-94 Dt. 27.01.94

CALIBRATION REPORT

Date: 19/05/2025

Customer Name	M/s GEETARANI MOHANTY RAIKELA IRON ORE MINES
Instrument	Ambient Dust Monitoring Analyzer (PM 10 um)
Principle	Beta Attenuation
Instrument S/No:	SM 200 -1550
Flow Rate	2.3 m3/hr
Sampling Time	1 Hours
Date of Calibration	19/05/2025
Next Calibration Date	18/05/2026

CALIBRATION DATA

Flow (Liter/Minute)		
Before	After	Difference
13.01	13.00	0.1

Span Factor		
Before	After	Difference
1.0	1.0	0

Flow Factor		
Before	After	Difference
1.226	1.226	0.0

Span & Leak Calibration:

S: 2.135 0.24 0.2%

L: 5.3 Kpa 0 Pa

Beta Calibration:

DK: 29 CE: 0.0%

A: 1291826 B: 11005171

Method: Calibration of the above Analyzer is performed with reference to OPSIS instrument and valid for one year.
Reference: OPSIS Flow Meter FM200 kit. S/no:FM-L-020



Signature:

NEVCO Engineers Pvt. Ltd.

CIN No.: 55-57-103 OF 1993-94 Dt. 27.01.94

CALIBRATION REPORT

Date: 19/05/2025

Customer Name	M/s GEETARANI MOHANTY RAIKELA IRON ORE MINES
Instrument	Ambient Dust Monitoring Analyzer (PM 10 um)
Principle	Beta Attenuation
Instrument S/No:	SM 200 -1783
Flow Rate	2.3 m3/hr
Sampling Time	1 Hours
Date of Calibration	19/05/2025
Next Calibration Date	18/05/2026

CALIBRATION DATA

Flow (Liter/Minute)		
Before	After	Difference
13.05	13.02	0.3

Span Factor		
Before	After	Difference
1.0	1.0	0

Flow Factor		
Before	After	Difference
1.220	1.220	0.0

Span & Leak Calibration:

S: 2.135 0.23 0.1%

L: 5.4 Kpa 0 Pa

Beta Calibration:

DK: 29 CE: 0.0%

A: 1291826 B: 11005171

Method: Calibration of the above Analyzer is performed with reference to OPSIS instrument and valid for one year.
Reference: OPSIS Flow Meter FM200 kit. S/no:FM-L-020



Signature:

NEVCO Engineers Pvt. Ltd.

CIN No.: 55-57-103 OF 1993-94 Dt. 27.01.94

CALIBRATION REPORT

Date: 19/05/2025

Customer Name	M/s GEETARANI MOHANTY RAIKELA IRON ORE MINES
Instrument	Ambient Dust Monitoring Analyzer (PM 10 um)
Principle	Beta Attenuation
Instrument S/No:	SM 200 -1411
Flow Rate	2.3 m ³ /hr
Sampling Time	1 Hours
Date of Calibration	19/05/2025
Next Calibration Date	18/05/2026

CALIBRATION DATA

Flow (Liter/Minute)		
Before	After	Difference
13.01	13.01	0.0

Span Factor		
Before	After	Difference
1.0	1.0	0

Flow Factor		
Before	After	Difference
1.222	1.220	02

Span & Leak Calibration:

S: 2.136 0.24 0.1%

L: 5.5 Kpa 0 Pa

Beta Calibration:

DK: 29 CE: 0.0%

A: 1291826 B: 11005172

Method: Calibration of the above Analyzer is performed with reference to OPSIS instrument and valid for one year.
Reference: OPSIS Flow Meter FM200 kit. S/no: FM-L-020



Signature:

NEVCO Engineers Pvt. Ltd.

CIN No.: 55-57-103 OF 1993-94 Dt. 27.01.94

FORM - O

(See Rule 29 F (2) and 29 L)

REPORT OF MEDICAL EXAMINATION UNDER RULE 29BCertificate No.: **VC-0440**

Certified that, **SHRI TAPAN KUMAR MAHANTA** employed
as **JR. ENGINEER(MECH.)** in **RAIKELA IRON ORE MINES**
of M/s. **GEETARANI MOHANTY** Form 'A' No. **-**

has been examined for an periodical medical examination. He/She appears to be **42** years of age.

The findings of examining authority are given in the attached sheet.

It is considered that, **SHRI TAPAN KUMAR MAHANTA**

a) is medically fit for any employment in mines

b) is suffering from _____ and is medically unfit for

- i) any employment in mine, or
- ii) any employment below ground or
- iii) any employment or work

c) is suffering from _____ and should get this disability
cured / controlled* and should be again examined within a period of _____ months. He/She will
appear for re-examination with the result of tests of _____

and the opinion of _____ specialist from _____

He/She may be permitted / not permitted to carry on his/her duty during this period.



AADHAAR NO. : 205367238267

Signature of the Examining Authority
Name and Designation in Block Letters

DR. B. N. MOHAPATRA, MBBS, AFM (Mumbai)
Occupational Health Consultant,
Trained in ILO Classification of Pneumoconiosis
Trained in Cardiology
Regd. No. 7338 (Orissa), 219 (DGFASLI)

Date : 12-04-2026

Place : EZMA, BARBIL

* Delete whatever not applicable.

** One copy of the certificate shall be handed over to the person concerned and
other copy shall be sent to Manager of the Mine concerned by registered
post and the third copy shall be retained by the examining authority.

FORM - O (Contd...)

(See Rule 29F(2) and 29L)

REPORT OF MEDICAL EXAMINING AUTHORITY

(To be filled in for every medical examination whether initial or periodical
or re-examination or after cure/control of disability)

Annexure to Certificate No.: **VC-0440** as a result of Medical Examination on **12-04-2026**

Identification of mark : **BLACK MOLE ON LT. SIDE NECK**

1. General Development: **GOOD**

2. Height: **165** cms.

3. Weight: **70** Kgs.

4. Eyes : (i) Visual acuity-Distant vision (with or without glasses)

Right eye: **6/6 Without Glass**

Left eye: **6/6 Without Glass**

ii) Any Organic Disease of Eye: **NO**

iii) Night Blindness **NO**

iv) Colour Blindness **NO**

v) Squint **NO**

(* to be tested in special cases)

5. Ears : i) Hearing : Right Ear : **NORMAL**

Left Ear : **NORMAL**

ii) any organic disease : **NO**

6. Respiratory System : Chest Measurement : (i) after full inspiration : **95** cms.

(ii) after full expiration : **90** cms.

7. Circulatory System : Blood Pressure : **112/70** mm of Hg.

Pulse **64** Per Minute

8. Abdomen : Tenderness **NO**

Liver **NOT PALPABLE**

Spleen **NOT PALPABLE**

Turnour **NO**

9. Nervous System : History of fits or epilepsy: **NO**

Paralysis : **NO**

Mental Health : **GOOD**

10. Locomotor system : **NAD**

11. Skin : **NAD**

12. Hernia : **NO**

13. Hydrocele : **NO**

14. Any other abnormality : **NAD**

15. Urine : Reaction **ACIDIC**

Albumin : **NIL**

Sugar : **NIL**

Audiometry :

Left : NORMAL

Right: NORMAL

P. F. T. :

MILD RESTRICTION

16. Skigram of Chest : **NORMAL**

17. Any other 'C' test considered necessary by examining authority **NO**

18. Any opinion of specialist considered necessary **NO**

Date : 12-04-2026

Place : EZMA, BARBIL

DR. B. N. MOHAPATRA, MBBS, AFM (Mumbai)
Occupational Health Consultant,
Trained in ILO Classification of Pneumoconiosis
Trained in Cardiology
Regd. No. 7338 (Orissa), 219 (DGFASLI)

Gende	Name	Year	Spleen	Tum	Gener	Epile	para	Mental	Right Eye	Left Eye	Locom	Hydro	Night	Other	Colour	Urine R	Squir	Albur	Sugar	Skiagram	RightEar	LeftEar	PFT	PF	Orgar	Inspir	Expir	Anyo	Abnor	Abnormal	Abnorm	Abnor	Abnorm	Suggestio	Suggestio	Suggestio	Suggestio	Suggestio	BloodPri	Pulse1	Pulse2	Liver
Male	Shri. JATINDRA PRADHAN	42	Not Pal	NO	Good	No	NO	GOOD	6/6 Witho	6/6 Witho	NAD	NO	NO	NO	NO	ACIDIC	NO	NII	NII	NORMAL	NORMAL	NORMAL	MILD RESTRIC	NO	94	87	NO												114/70	100	Per Minut	Not Palpable
Male	Shri. BRUNDA MUNDA	41	Not Pal	NO	Good	No	NO	GOOD	6/6 Witho	6/6 Witho	NAD	NO	NO	NO	NO	ACIDIC	NO	NII	NII	NORMAL	NORMAL	NORMAL	MILD RESTRIC	NO	92	88	NO											120/80	72	Per Minut	Not Palpable	
Male	Shri. PRAMOD MAHANTA	40	Not Pal	NO	Good	No	NO	GOOD	6/6 Witho	6/6 Witho	NAD	NO	NO	NO	NO	ACIDIC	NO	NII	NII	NORMAL	NORMAL	NORMAL	MILD RESTRIC	NO	104	98	NO											138/86	93	Per Minut	Not Palpable	
Male	Shri. HARI NAIK	46	Not Pal	NO	Good	No	NO	GOOD	6/6 Witho	6/6 Witho	NAD	NO	NO	NO	NO	ACIDIC	NO	NII	NII	NORMAL	NORMAL	NORMAL	NORMAL	NO	90	83	NO										106/70	89	Per Minut	Not Palpable		
Male	Shri. UGRASEN MAHANTA	50	Not Pal	NO	Good	No	NO	GOOD	6/6 With	6/6 With	NAD	NO	NO	NO	NO	ACIDIC	NO	NII	NII	NORMAL	NORMAL	NORMAL	NORMAL	NO	94	90	YES	REFRA	DIABETES MELLITUS ON MEDICAT	CONSTAN	FAT FREE	REGULAR	& PHYSICIAN CHECK	124/80	74	Per Minut	Not Palpable					
Male	Shri. PAULUSH LAKRA	40	Not Pal	NO	Good	No	NO	GOOD	6/6 Witho	6/6 Witho	NAD	NO	NO	NO	NO	ACIDIC	NO	NII	NII	NORMAL	NORMAL	NORMAL	MILD RESTRIC	NO	97	93	NO										110/70	104	Per Minut	Not Palpable		
Male	Shri. NATABARA MAHARANA	50	Not Pal	NO	Good	No	NO	GOOD	6/6 Witho	6/6 Witho	NAD	NO	NO	NO	NO	ACIDIC	NO	NII	NII	NORMAL	NORMAL	NORMAL	NORMAL	NO	93	87	NO									124/80	87	Per Minut	Not Palpable			
Male	Shri. SANTOSH KUMAR BARIK	41	Not Pal	NO	Good	No	NO	GOOD	6/6 Witho	6/6 Witho	NAD	NO	NO	NO	NO	ACIDIC	NO	NII	+	NORMAL	NORMAL	NORMAL	NORMAL	NO	104	97	YES	DIABETES MELLITUS				REGULAR	FAT FREE	REGULAR PHYSICAL EXERCISE	110/70	83	Per Minut	Not Palpable				
Male	Shri. ANUP SINKU	35	Not Pal	NO	Good	No	NO	GOOD	6/6 Witho	6/6 Witho	NAD	NO	NO	NO	NO	ACIDIC	NO	NII	NII	NORMAL	NORMAL	NORMAL	NORMAL	NO	105	100	NO										114/70	59	Per Minut	Not Palpable		
Male	Shri. LACHHAMAN NAIK	42	Not Pal	NO	Good	No	NO	GOOD	6/6 Witho	6/6 Witho	NAD	NO	NO	NO	NO	ACIDIC	NO	NII	NII	NORMAL	NORMAL	NORMAL	NORMAL	NO	86	81	NO										110/70	101	Per Minut	Not Palpable		
Female	Shrimati. SUKUMANI NAIK	43	Not Pal	NO	Good	No	NO	GOOD	6/6 Witho	6/6 Witho	NAD	Not A	NO	NO	NO	ACIDIC	NO	+	NII	NORMAL	NORMAL	NORMAL	NORMAL	OB	NO	82	78	YES	PFT:OBST. WITH POSSIBLE RESTRICTION	REGULAR BREATHING EXERCISE & USE OF PPE					110/70	79	Per Minut	Not Palpable				
Female	Shrimati. DRUPATI NAIK	37	Not Pal	NO	Good	No	NO	GOOD	6/6 Witho	6/6 Witho	NAD	Not A	NO	NO	NO	ACIDIC	NO	NII	NII	NORMAL	NORMAL	NORMAL	MILD RESTRIC	NO	90	86	NO										110/70	88	Per Minut	Not Palpable		
Female	Shrimati. LACHHMA NAIK	42	Not Pal	NO	Good	No	NO	GOOD	6/6 Witho	6/6 Witho	NAD	Not A	NO	NO	NO	ACIDIC	NO	NII	NII	NORMAL	NORMAL	NORMAL	NORMAL	NO	83	79	NO										110/70	87	Per Minut	Not Palpable		
Female	Shrimati. JADINI NAIK	37	Not Pal	NO	Good	No	NO	GOOD	6/6 Witho	6/6 Witho	NAD	Not A	NO	NO	NO	ACIDIC	NO	NII	NII	NORMAL	NORMAL	NORMAL	NORMAL	NO	73	69	NO										106/70	88	Per Minut	Not Palpable		
Male	Shri. SATYANANDA JHAMPULA	40	Not Pal	NO	Good	No	NO	GOOD	6/6 Witho	6/6 Witho	NAD	NO	NO	NO	NO	ACIDIC	NO	NII	NII	NORMAL	NORMAL	NORMAL	MODERATE RE	NO	98	94	YES	PFT:MOD.FRESTRICITION				REGULAR BREATHING EXERCISE & USE OF PPE				134/80	91	Per Minut	Not Palpable			
Male	Shri. SANTOSH OJHA	22	Not Pal	NO	Good	No	NO	GOOD	6/6 With	6/6 With	NAD	NO	NO	NO	NO	ACIDIC	NO	NII	NII	NORMAL	NORMAL	NORMAL	NORMAL	NO	95	89	YES	REFRACTIVE ERROR CORRECTED BY GLAS	CONSTANT USE OF GLASSES							120/80	83	Per Minut	Not Palpable			
Male	Shri. TANAMI NAIK	45	Not Pal	NO	Good	No	NO	GOOD	6/6 Witho	6/6 Witho	NAD	NO	NO	NO	NO	ACIDIC	NO	NII	NII	NORMAL	NORMAL	NORMAL	NORMAL	NO	80	76	NO									110/70	84	Per Minut	Not Palpable			
Male	Shri. TOPI MUNDA	43	Not Pal	NO	Good	No	NO	GOOD	6/6 Witho	6/6 Witho	NAD	NO	NO	NO	NO	ACIDIC	NO	NII	++	NORMAL	NORMAL	NORMAL	NORMAL	NO	92	88	YES	DIABETES MELLITUS				REGULAR	FAT FREE	REGULAR PHYSICAL EXERCISE	130/80	89	Per Minut	Not Palpable				
Male	Shri. JAGADISH PATRA	46	Not Pal	NO	Good	No	NO	GOOD	6/6 Witho	6/6 Witho	NAD	NO	NO	NO	NO	ACIDIC	NO	NII	NII	NORMAL	NORMAL	NORMAL	NORMAL	NO	96	90	NO									114/70	60	Per Minut	Not Palpable			
Male	Shri. BASANTA KUMAR PRADHAN	49	Not Pal	NO	Good	No	NO	GOOD	6/6 Witho	6/6 Witho	NAD	NO	NO	NO	NO	ACIDIC	NO	NII	NII	NORMAL	NORMAL	NORMAL	NORMAL	NO	92	86	NO									110/70	84	Per Minut	Not Palpable			
Female	Shrimati. PRATIMA NAIK	31	Not Pal	NO	Good	No	NO	GOOD	6/6 Witho	6/6 Witho	NAD	Not A	NO	NO	NO	ACIDIC	NO	NII	NII	NORMAL	NORMAL	NORMAL	MILD RESTRIC	NO	84	80	NO										114/70	97	Per Minut	Not Palpable		
Female	Shrimati. NIRASA NAIK	44	Not Pal	NO	Good	No	NO	GOOD	6/6 Witho	6/6 Witho	NAD	Not A	NO	NO	NO	ACIDIC	NO	NII	NII	NORMAL	NORMAL	NORMAL	NORMAL	NO	80	76	NO									106/70	72	Per Minut	Not Palpable			
Male	Shri. MILU CHARAN MAHAKUD	33	Not Pal	NO	Good	No	NO	GOOD	6/6 Witho	6/6 Witho	NAD	NO	NO	NO	NO	ACIDIC	NO	NII	NII	NORMAL	NORMAL	NORMAL	MODERATE RE	NO	92	87	YES	PFT:MOD. RESTRICTION				REGULAR BREATHING EXERCISE & USE OF PPE				110/70	61	Per Minut	Not Palpable			
Male	Shri. YUDHISTIRA PATRA	40	Not Pal	NO	Good	No	NO	GOOD	6/6 Witho	6/6 Witho	NAD	NO	NO	NO	NO	ACIDIC	NO	NII	NII	NORMAL	NORMAL	NORMAL	MILD RESTRIC	NO	89	84	NO									130/80	73	Per Minut	Not Palpable			
Male	Shri. NIRANJAN NAIK	44	Not Pal	NO	Good	No	NO	GOOD	6/6 Witho	6/6 Witho	NAD	NO	NO	NO	NO	ACIDIC	NO	NII	NII	NORMAL	NORMAL	NORMAL	NORMAL	NO	86	80	NO									120/84	85	Per Minut	Not Palpable			
Male	Shri. KABITRA DEHURY	42	Not Pal	NO	Good	No	NO	GOOD	6/6 Witho	6/6 Witho	NAD	NO	NO	NO	NO	ACIDIC	NO	NII	NII	NORMAL	NORMAL	NORMAL	NORMAL	NO	95	88	NO									110/70	93	Per Minut	Not Palpable			
Male	Shri. SURENDRA PALEI	42	Not Pal	NO	Good	No	NO	GOOD	6/6 Witho	6/6 Witho	NAD	NO	NO	NO	NO	ACIDIC	NO	NII	NII	NORMAL	NORMAL	NORMAL	NORMAL	NO	97	93	NO									136/84	92	Per Minut	Not Palpable			
Male	Shri. SHARATA NAIK	43	Not Pal	NO	Good	No	NO	GOOD	6/6 Witho	6/6 Witho	NAD	NO	NO	NO	NO	ACIDIC	NO	NII	NII	NORMAL	NORMAL	NORMAL	MILD RESTRIC	NO	86	80	NO									110/70	84	Per Minut	Not Palpable			
Male	Shri. HEMAKANT KHORA	30	Not Pal	NO	Good	No	NO	GOOD	6/6 Witho	6/6 Witho	NAD	NO	NO	NO	NO	ACIDIC	NO	NII	NII	NORMAL	NORMAL	NORMAL	NORMAL	NO	91	87	NO									110/70	92	Per Minut	Not Palpable			
Male	Shri. BIDYADHAR NAIK	50	Not Pal	NO	Good	No	NO	GOOD	6/6 Witho	6/6 Witho	NAD	NO	NO	NO	NO	ACIDIC	NO	NII	NII	NORMAL	NORMAL	NORMAL	NORMAL	NO	86	81	NO									124/80	80	Per Minut	Not Palpable			
Male	Shri. PRAMOD KUMAR SAHOO	53	Not Pal	NO	Good	No	NO	GOOD	6/6 With	6/6 With	NAD	NO	NO	NO	NO	ACIDIC	NO	NII	NII	NORMAL	NORMAL	NORMAL	NORMAL	NO	108	101	YES	HYPERTON MEDICATION				FAT FREE	REGULAR	PHYSICIAN CHECKUP	140/90	94	Per Minut	Not Palpable				
Male	Shri. MANAS KUMAR DAS	40	Not Pal	NO	Good	No	NO	GOOD	6/6 Witho	6/6 Witho	NAD	NO	NO	NO	NO	ACIDIC	NO	NII	NII	NORMAL	NORMAL	NORMAL	NORMAL	NO	102	98	YES	HYPERTENSION ON MEDICATION				FAT FREE	REGULAR	& PHYSICIAN CHECKUP	134/84	78	Per Minut	Not Palpable				
Male	Shri. PRAFULLA MAHAKUD	39	Not Pal	NO	Good	No	NO	GOOD	6/6 Witho	6/6 Witho	NAD	NO	NO	NO	NO	ACIDIC	NO	NII	NII	NORMAL	NORMAL	NORMAL	NORMAL	NO	86	81	NO									130/74	68	Per Minut	Not Palpable			
Male	Shri. SHIVA CHARAN MAHANTA	52	Not Pal	NO	Good	No	NO	GOOD	6/6 With	6/6 With	NAD	NO	NO	NO	NO	ACIDIC	NO	NII	NII	NORMAL	NORMAL	NORMAL	NORMAL	NO	94	90	NO									116/70	70	Per Minut	Not Palpable			
Male	Shri. DAMDEV DEHURY	45	Not Pal	NO	Good	No	NO	GOOD	6/6 With	6/6 With	NAD	NO	NO	NO	NO	ACIDIC	NO	NII	NII	NORMAL	NORMAL	NORMAL	NORMAL	NO	91	86	YES	REFRACTIVE ERROR CORRECTED BY GLAS	CONSTANT USE OF GLASSES							130/80	68	Per Minut	Not Palpable			
Male	Shri. SINGA MUNDA	42	Not Pal	NO	Good	No	NO	GOOD	6/6 Witho	6/6 Witho	NAD	NO	NO	NO	NO	ACIDIC	NO	NII	NII	NORMAL	NORMAL	NORMAL	MILD RESTRIC	NO	93	87	NO									130/86	75	Per Minut	Not Palpable			
Male	Shri. BASUDEV DEHURY	51	Not Pal	NO	Good	No	NO	GOOD	6/6 Witho	6/6 Witho	NAD	NO	NO	NO	NO	ACIDIC	NO	NII	NII	NORMAL	NORMAL	NORMAL	NORMAL	NO	84	80	NO									110/70	71	Per Minut	Not Palpable			
Male	Shri. RAMAKANTA DAS ADHIKARI	57	Not Pal	NO	Good	No	NO	GOOD	6/6 With	6/6 With	NAD	NO	NO	NO	NO	ACIDIC	NO	NII	NII	NORMAL	NORMAL	NORMAL	NORMAL	NO	91	87	YES	REFRACTIVE ERROR CORRECTED BY GLAS	CONSTANT USE OF GLASSES							110/70	82	Per Minut	Not Palpable			
Male	Shri. ASHOK KUMAR MOHAPATRA	45	Not Pal	NO	Good	No	NO	GOOD	6/6 Witho	6/6 Witho	NAD	NO	NO	NO	NO	ACIDIC	NO	NII	NII	NORMAL	NORMAL	NORMAL	NORMAL	NO	91	87	NO									110/70	67	Per Minut	Not Palpable			
Male	Shri. PRATAP NAIK	44	Not Pal	NO	Good	No	NO	GOOD	6/6 Witho	6/6 Witho	NAD	NO	NO	NO	NO	ACIDIC	NO	NII	NII	NORMAL	NORMAL	NORMAL	NORMAL	NO	90	85	NO									110/70	57	Per Minut	Not Palpable			
Male	Shri. NARAHARI NAIK	44	Not Pal	NO	Good	No	NO	GOOD	6/6 Witho	6/6 Witho	NAD	NO	NO	NO	NO	ACIDIC	NO	++	NII	NORMAL	NORMAL	NORMAL	NORMAL	NO	91	87	NO									120/80	83	Per Minut	Not Palpable			
Male	Shri. PURNA CHANDRA SAHOO	48	Not Pal	NO	Good	No	NO	GOOD	6/6 Witho	6/6 Witho	NAD	NO	NO	NO	NO	ACIDIC	NO	NII	NII	NORMAL	NORMAL	NORMAL	MILD RESTRIC	NO	93	87	NO									124/80	59	Per Minut	Not Palpable			
Male	Shri. GOURANGA CHARAN PARIDA	39	Not Pal	NO	Good	No	NO	GOOD	6/6 Witho	6/6 Witho	NAD	NO	NO	NO	NO	ACIDIC	NO	NII	++++	NORMAL	NORMAL	NORMAL	NORMAL	NO	99	94	YES	DIABETES MELLITUS UNDER MEDICATION	REGULAR	FAT FREE	REGULAR PHYSICAL EXERCISE	130/80	98	Per Minut	Not Palpable							
Male	Shri. SANJAYA PRADHAN	49	Not Pal	NO	Good	No	NO	GOOD	6/6 Witho	6/6 Witho	NAD	NO	NO	NO	NO	ACIDIC	NO	NII	NII	NORMAL	NORMAL	NORMAL	NORMAL	NO	95	90	YES	DIABETES MELLITUS UNDER MEDICATION	REGULAR	FAT FREE	REGULAR PHYSICAL EXERCISE	110/70	83	Per Minut	Not Palpable							
Male	Shri. SHYAMAPADA KUNDU	57	Not Pal	NO	Good	No	NO	GOOD	6/6 Witho	6/6 Witho	NAD	NO	NO	NO	NO	ACIDIC	NO	NII	NII	NORMAL																						

Initial Medical Examination (2023-24)

Sl. No.	SAP ID	EmployeeName	Designation	DOB	AGE	IME/ PME	Certificate No.	Issue Date
3	100055	GORA SINGH	ASST. SUPERVISOR	06/04/1977	47	IME	VC-072	16/Mar/2024
4	100106	TIKESWAR DAS	ASST. SUPERVISOR	15/07/1974	49	IME	VC-0186	26/Nov/2023
7	100053	JAYANTA DEO	CRUSHER OPERATOR	30/06/1969	54	IME	VC-069	16/Mar/2024
8	100017	LACHHMAN SAHU	FITTER	18/04/1973	51	IME	VC-095	16/Mar/2024
10	100034	BIJU BARAIK	EXCAVATOR OPRT.	01/01/1974	50	IME	VC-080	15/Mar/2024
14	100005	GOBINDA BAIDYA	DRIVER	04/04/1971	53	IME	VC-068	16/Mar/2024
23	100110	HRUSHIKESH MAHANTA	HMV DRIVER	20/05/1977	47	IME	VC-0193	26/Nov/2023
24	100107	RAMESH NAIK	HMV DRIVER	07/01/1983	41	IME	VC-0189	26/Nov/2023
27	100032	SRIKANTA MAHANTA	MECHANIC	14/04/1977	47	IME	VC-084	15/Mar/2024
35	100050	UMAKANTA MAHARANA	HELPER	14/06/1975	48	IME	VC-083	16/Mar/2024
43	100049	HALADHAR NAIK	W/B CLERK	25/06/1972	51	IME	VC-071	15/Mar/2024
48	100143	DAYANIDHI MOHANTA	Electrician	06/06/1976	47	IME	VC-0174	25/Nov/2023
49	100153	MANAS RANJAN SAHOO	Sr. Supervisor (Mechanical)	04/06/1979	44	IME	VC-0198	13/Mar/2024
50	100182	PRAFULLA KUMAR RANA	PLUMBER	01/01/1984	40	IME	VC-0191	26/Nov/2023
52	100100	PRASANTA KUMAR DAS	MANAGER (SURVEY)	02/07/1977	46	IME	VC-0171	25/Nov/2023
53	100103	SUSILA KUMAR PRADHAN	MANAGER MINES	25/05/1976	48	IME	VC-0172	25/Nov/2023
57	100120	RANJAN KUMAR BHOI	JR. OFFICE EXECUTIVE	02/04/1972	52	IME	VC-110	16/Mar/2024
58	100129	BAPI MALLICK	FOREMAN MINES	20/05/1991	33	IME	VC-0137	24/Nov/2023
59	100139	JAGA JYOTI LENKA	ASST. OFFICER STORE	20/06/1980	43	IME	VC-0138	24/Nov/2023
60	100142	PRAKASH KUMAR SAHOO	WELFARE OFFICER	20/06/1992	31	IME	VC-0140	24/Nov/2023
61	100138	SOUMYA RANJAN BEHERA	JR. OFFICER ENVT.	08/10/1996	27	IME	VC-0173	25/Nov/2023
62	100141	AMULYA KUMAR DASH	ASST. MANAGER (IT)	04/05/1989	35	IME	VC-0139	24/Nov/2023
63	100147	PRABINA TARAI	DY. OFFICER GEOLOGY	18/04/1993	31	IME	VC-0175	25/Nov/2023
64	100148	TRIBIKRAM RATH	ASST. GEOLOGIEST	06/09/1996	27	IME	VC-0141	24/Nov/2023
65	100149	TANMAY TARUN	ASST. OFFICER SURVEY	16/07/1997	26	IME	VC-0196	13/Apr/2024
66	100151	NARENDRA PALEI	FOREMAN MINES	13/06/1999	24	IME	VC-0176	25/Nov/2023
67	100152	ABHI NAIK	FOREMAN MINES	10/07/1985	38	IME	VC-0177	25/Nov/2023
68	100156	RAJIB KUMAR MOHAPATRA	MANAGER (C & S)	12/05/1973	51	IME	VC-0247	13/Apr/2024
69	100159	JAJATI KESHARI DALAI	ACCOUNTS EXECUTIVE	13/08/1993	30	IME	VC-0178	25/Nov/2023
70	100160	BISWAJIT MISHRA	ASST. ENGINEER (CIVIL)	19/07/1994	29	IME	VC-0142	24/Nov/2023
71	100163	AKSHAYA KUMAR SAHOO	FOREMAN TRAINEE	06/03/2001	23	IME	VC-0192	26/Nov/2023
72	100164	MANOJ KUMAR MAHANTA	JR. CHEMIST	28/02/1997	27	IME	VC-0143	24/Nov/2023
73	100165	SUBHRANSHU SEKHAR JENA	SUPERVISOR	20/06/1997	26	IME	VC-0144	24/Nov/2023
74	100166	ANSHUMAN ROUT	ASST. GEOLOGIEST	06/04/1993	31	IME	VC-0179	25/Nov/2023
75	100167	SASANKA SEKHAR SWAIN	MINING ENGINEER	23/11/1998	25	IME	VC-0180	25/Nov/2023
76	100168	PRASANA KUMAR JENA	MINING ENGINEER	10/05/1996	28	IME	VC-0181	25/Nov/2023
77	100169	RAKHEE MISHRA	ASST. GEOLOGIEST	08/04/1998	26	IME	VC-0145	24/Nov/2023
78	100170	LITUN SAMAL	ASST. GEOLOGIEST	02/03/1999	25	IME	VC-0146	24/Nov/2023
79	100173	BIKASH RANJAN BEHERA	MINING ENGINEER	27/06/1989	34	IME	VC-0147	24/Nov/2023
80	100183	ABHISEK BISWAL	JR. OFFICER (IT)	12/03/2000	24	IME	VC-0149	24/Nov/2023

83	150009	BIPIN BIHARI MOHANTA	OFFICER SECURITY & SAFETY	04/01/1976	48	IME	VC-0190	26/Nov/2023
84	100185	KHIROD CHANDRA BEHERA	SECURITY SUPERVISOR	28/06/1977	46	IME	VC-0204	13/Mar/2024
85	100186	CHITTA RANJAN PRADHAN	SECURITY SUPERVISOR	05/03/1982	42	IME	VC-0213	13/Mar/2024

 भारत सरकार Govt. of India धन एवं रोजगार मंत्रालय Ministry of Labour & Employment खान सुरक्षा महानिदेशालय Directorate-General of Mines Safety 	
NO: 330270 SEZ Bhubaneswar Region 2 Perm 2025 280177	Bhubaneswar, Date: 10/02/2026

प्रेषक:

**खान सुरक्षा निदेशक,
भुवनेश्वर क्षेत्र 2, भुवनेश्वर ।**

सेवा में:

**श्री सुनील पटेल, अभिकर्ता,
रायकेला लौह खदान,
मेसर्स गीतारानी मोहंती,
गांव: बारबिल, तहसील: बारबिल,
जिला: कोंडार (ओडिशा राज्य)-758035।**

विषय: Renewal of the Permission under Regulation 106(2)(b) of the Metalliferous Mines Regulations, 1961 for deployment of Heavy Earth Moving Machinery in conjunction with deep hole drilling & blasting for digging, excavation and removal of ore and overburden at Raikela Iron Ore Mine of M/s Geetarani Mohanty.

महोदय,

Please refer to your online application No. 280177, dated 16.12.2025 and your letter No. 499/GRM/RIOM/2025-26 dated 16.12.2025, enclosing therewith surface plan No. GRM/SUR/2025/07 dated 30.11.2025 on the above mentioned subject.

The matter has since been examined on the basis of the information furnished in your application under reference and shown on the enclosed plans and sections submitted by you.

In exercise of the powers conferred on the Chief Inspector Cum Facilitator (also designated as Director-General of Mines Safety) under the provisions of Regulations 106(2)(b) of the Metalliferous Mines Regulations, 1961 and by virtue of authorization granted to me by the Chief Inspector Cum Facilitator (also designated as Director-General of Mines Safety) under Section 34(10) of the Occupational Safety, Health and Working Conditions Code, 2020 (*previously Section 6(1) of the Mines Act, 1952*), I, hereby grant renewal of permission for the deployment of Heavy Earth Moving machinery in the area bounded by change points "1,2,3,4,5,.....25,26,27,28 and 1" as shown in blue colour bold lines and to conduct deep hole blasting in the area bounded by change points "26,27,28,29,30, ,.....,41,42,43 and 26" as shown in cyan colour bold lines on the Surface Plan No. GRM/SUR/2025/07 dated 30.11.2025, at Raikela Iron Ore Mine of M/s Geetarani Mohanty situated in Village- Raikela, Tehsil- Koida, District-Sundargarh(Odisha State), subject to the following conditions being strictly complied with:

I. GENERAL:

1.1 Except where otherwise provided for in this permission, all provisions of the Metalliferous Mines Regulations, 1961 shall be strictly complied with.

1.2 No blasting shall be conducted in the mine using Ammonium Nitrate Fuel Oil (ANFO), Site Mixed Slurry (SMS) or Site Mixed Emulsion (SME) explosives without obtaining a separate permission under Regulation 155(1) and 162(5) of Metalliferous Mines Regulations, 1961.

1.3 No blasting shall be conducted in the mine within the danger zone of 300m from any permanent building or other surface structure not belonging to the owner except with the strict compliance of provisions under Regulations 164(1A)(c)&(1B)(a) of the Metalliferous Mines Regulations, 1961, which includes obtaining of prior permission in certain circumstances as required thereunder.

1.4 Owner and Agent of the mine shall ensure that the mine, including its method of working, ultimate pit slope, dump slope and monitoring of slope stability, is planned, designed and worked as determined by a scientific study and a copy of the scientific study report shall be submitted to this Directorate within six months from the date of issue of this letter.

1.5 Safety Management Plan shall be prepared and implemented as per DGMS Tech (S&T) Circular No.5/2016 and DGMS Technical Circular No. 3/2019.

1.6 Owner, Agent and Manager of the mine shall ensure adequate lightning protection system to safeguard the persons and machinery deployed in the mines from hazards associated with lightning strike as per DGMS Circular No. 10/2020.

II. OPENCAST WORKINGS:

2.0 HEIGHT AND WIDTH OF BENCHES:

2.1 The height of the benches in overburden consisting of alluvial soil, morrum, gravel, clay, debris or other similar ground shall not be more than 3 m meters and width thereof shall not be less than three times the height of the bench.

2.2 The height of the benches in ore body or overburden of rock formation other than that mentioned in para 2.1 above shall not be more than the digging height or reach of the excavation machine in use thereat for digging, excavation or removal, or in any case not more than 10 m, and the width thereof shall not be less than –

- (i) the width of the widest machine plying on the bench plus two metres, or
 - (ii) if dumpers/tippers/trucks ply on the bench, three times the width of the largest dumper/tipper/truck; or
 - (iii) the height of the bench,
- whichever is more.

2.3 Special care shall be taken to prevent danger to the work-persons in zones where any slip or other planes of weakness or other geological disturbances are encountered or exist. In such zones, the bench height shall be suitably reduced and width suitably increased to improve stability.

2.4 Where the excavation is proposed in an area having surface topography in the form of hillock(s), the mining shall be commenced with laying of haul roads right upto the top(peak) of the hillock(s) and the workings shall proceed by forming benches from top downwards.

2.5 No manual workers shall be employed on any bench where HEMM is deployed or on the next lower bench. Manual workers may be employed only after withdrawal of HEMM and only at the places where benches conform to the requirements of Regulation 106(1), & (2)(a) of the Metalliferous Mines Regulations, 1961 and sides are free from any undercut, overhang and loose.

3.0 ROADS FOR TRUCKS AND DUMPERS ETC:

3.1 All haul roads for dumpers/trucks/tippers or other mobile machinery shall be constructed to suit its load capacity and shall be maintained in good condition. No vehicle other than the HEMMs shall be used on the haul roads, except between designated points and when permitted in writing by the manager.

3.2 Where practicable, all haul roads leading from the surface to opencast workings shall be arranged to provide one-way traffic. Where it is not practicable to provide for one way traffic, width of haul road shall not be less than three times the width of the largest vehicle plying on that road plus 5 m or definite turn-outs, crossing points, and waiting points shall be designated and demarcated by proper sign boards for the guidance of operators/drivers of such vehicles.

3.3 All corners and bends on haul roads shall be so designed, made and kept maintained that the operators and drivers of vehicles plying on the haul road have clear view for a distance not less than 3 times the braking distance of the largest HEMM working at 40 kms/hour.

3.4 Where it is not possible to ensure the visibility as mentioned in clause 3.3 above, the road shall be provided with two separate lanes for up and down traffic, each of width not less than 2 times the width of the largest vehicles plying thereon plus 3 m, with a strong divider at centre with adequate lighting and reflector along the divider.

3.5 No road shall have gradient steeper than 1 in 16. However, gradient of the ramps shall not be steeper than 1 in 10 and its length shall not be more than 50m at one stretch. The ramps shall be used for crawler mounted machines only not for tyre mounted machines.

3.6 (i) If large capacity dumpers and smaller capacity tipper/trucks are deployed in the mine, separate roads for dumpers and tippers/trucks shall be provided.

(ii) Separate road shall be provided for Light Motor Vehicles plying in the mine premises. Where it is not practicable, definite turnouts, crossing points and waiting points shall be designated for use of vehicles.

(iii) Pedestrians shall not be allowed to travel on the haul road made for tippers, dumpers or other mobile machinery.

(iv) Two wheelers shall not be allowed into the mine.

3.7 Where any part of the road exists above the level of the surrounding area, a strong parapet wall or berm or embankment of the following dimensions:

- i. width at top not less than 1 m,
- ii. width at bottom not less than 2.5 m,
- iii. the height not less than the diameter of the tyre of largest vehicle plying on the road.

It may be noted that mere dumping of mud or overburden shall not be treated as strong parapet wall.

3.8 Warning notices and road signs with fluorescent paint shall be provided along the haul roads at appropriate places like crossings, curves etc. for guidance of drivers, especially at night times.

3.9 At every curve, a parapet wall or vertical posts with 'Zebra lines' shall be provided to help the drivers to keep the transport vehicles on the track, especially at night times.

3.10 Suitable drainage system shall be provided and maintained on one side of the haul road.

4.0 FENCING AROUND OPENCAST WORKINGS:

4.1 The top edges of the opencast workings shall be kept fenced with wire rope strands or barbed wire, supported on movable posts (wooden, iron or concrete). The gap between the adjacent rope strands or wires shall not be more than 0.30 m, the bottom-most rope strand/wire shall not be more than 0.25 m above the ground level and the top most rope strand or wire shall not be less than 1.00m from ground level.

4.2 The periphery around the limits of opencast workings shall be kept fenced with a masonry wall not less than 0.40m thick and not less than 1.2 m in height, with a parapet top.

5.0 SPOIL BANKS AND DUMPS:

5.1 While removing overburden, the top soil shall be stacked at a separate place, so that the same is used to cover the reclaimed area.

5.2 Spoil, overburden or debris shall be deposited at places belonging to the mine and duly approved by the manager in writing.

- 5.3 Spoils, overburden or debris shall not be deposited, beneath transmission, telephone or power lines or near any other public structure.
- 5.4 The slope of a spoil bank face shall be determined by natural angle of repose of the material being deposited but, in any case, shall not exceed 37.5° from the horizontal. The spoil bank face shall not be retained by artificial means at an angle in excess of its natural angle of repose.
- 5.5 Loose overburden and other such material from opencast workings or other rejects from plants, mills or from other source shall be dumped in such a manner that there is no possibility of dumped material sliding.
- 5.6 Any spoil bank exceeding 30 m in height shall be kept benched so that no such bench exceeds 30 m in height and the general slope does not exceed 1 vertical to 1.5 horizontal. However, the overall height of any spoil bank shall not be allowed to exceed 60 m unless a greater height has been recommended as a result of a scientific study made on stability of the dump and subject to such conditions as recommended in the study report.
- 5.7 Garland drains shall be provided around the periphery of the dumps, both at top and bottom, to collect run-off water. A clay capping shall be made over the exposed dump surface to prevent water entry.
- 5.8 The toe of a spoil-bank shall not be permitted to approach a railway or other public works, public road or building or other permanent structure not belonging to the owner of the mine closer than distance equal to the vertical height of its face.
- 5.9 The backfilled area shall be kept benched and the distance of any active mine workings (faces) from the toe of bottom-most backfilled face (bench) shall not be less than 100m.
- 5.10 A suitable fence shall be erected between any railway line, other public works or road, or building or structures of permanent nature not belonging to the management, and the toe of every active spoil bank so as to prevent any unauthorised persons from approaching the spoil bank.
- 5.11 No person shall, or shall be permitted to approach the toe of an active spoil bank where he may be endangered from material rolling down the face. Suitable warning signs at conspicuous places shall also be displayed.

6.0 SUPERVISION OF OPENCAST WORKINGS:

- 6.1 A person possessing First class manager's competency certificate holder under the Metalliferous Mines Regulations, 1961 shall be appointed as the manager of the mine. This permission shall stand revoked as soon as the qualified manager ceases to work at the mine. Use of HEMM shall be suspended in the absence of manager with aforesaid qualification.
- 6.2 During every shift, the opencast workings shall be placed under the charge of such number of Assistant Managers, assisted by adequate numbers of mine foremen and mining mates, as to have overall control and guidance of operations connected with the mine and who shall be responsible to see that all the regulations and orders made thereunder are strictly complied with.
- 6.3 Each and every operation, including operations carried out through contractors' workers or by outside agency, shall be placed under the charge of a competent supervisor, duly appointed and authorised by the manager, with his jurisdiction clearly demarcated.
- 6.4 A code specifying duties and responsibilities of all mine-officials, i.e., Assistant Managers, Under Managers, Engineer(s), Supervisors, Technicians, Mechanics, Fitters, Machine Operators, helpers, loading supervisors etc. shall be drawn up and distributed to all concerned.
- 6.5 The Manager shall issue to every Driver/Operator, Supervisor and Mine Official connected with the use of Heavy Earth Moving Machinery, a copy of rules/regulations, orders made thereunder and guidelines listed in this permission governing his duties, in a language understood by the person concerned. The Manager and the Engineer shall be responsible to ensure that all the precautions and guidelines listed in this permission are strictly followed by all concerned.
- 6.6 It shall be the responsibility of the Manager, Engineer and other supervisors to ensure that all persons working in the mine, and those working on machines/equipment etc. work as per the code and all machines and equipment etc. are installed, operated and maintained in safe working conditions.

III. DESIGN, OPERATION AND MAINTENANCE OF HEMM

7.0 DESIGN AND SAFETY FEATURES OF HEMM:

7.1 General Requirements:

The following Safety features and devices shall be provided in all Heavy Earth Moving Machinery (HEMM) including dumpers and tippers.

7.1.1 Access:

- (i) Safe access to the Operator Station and to routine maintenance points of HEMM shall be provided. Proper placement of components of the access system shall permit and encourage a person to use three-point support while ascending, descending or moving about the access system, when more than 1m above the ground. Two-point support is acceptable for stairs, stairways, ramps, walkways and platforms. Three-point support should be used for all ladder systems. Track shoe and track pad surfaces are accepted as access steps if three-point support is provided when the HEMM is in 'OFF' condition.
- (ii) On machines with articulated frames and in the fully articulated steering position, a minimum clearance of 150mm shall be provided between firm structure and components with relative movement in the path of the access systems to the operator's station.
- (iii) An alternative exit path shall be provided on a different location of the machine than the primary access path from the operator platform. If the alternative exit path is Not Obvious, it shall be identified. The alternative exit path is intended for emergency situations (e.g. machine tip-over) and therefore does not need to meet the primary access requirements.

7.1.2 Operator's Station (Cabin):

- (i) The cabin shall protect the operator against foreseeable adverse climatic conditions, heat, dust, noise etc. Air-conditioning system shall be provided in the Operator's Station. A ventilation system, an adjustable heating system and a system for defrosting windows shall be provided wherever required.

- (ii) Alternative opening (Emergency Exit): An alternative opening shall be provided on a side other than that of the primary opening. A window panel or another door is acceptable if they are easy to open or remove without the use of keys or tools. Latches may be used if they can be opened from the inside without the use of keys or tools. The breaking of a suitable size of glass pane is considered to represent a suitable alternative opening, provided that the necessary pane hammer, immediately accessible to the operator, is provided and stored in the cab. When the window panel is used as an emergency exit, it shall bear an appropriate marking.
- (iii) Doors and Windows: Doors, Windows and flaps shall be securely held in their intended operating positions. Doors shall be retained at their intended operating positions by a positive engagement device. The front window shall be fitted with motorized windscreen wipers and washers. The tank of the window washers shall be easily accessible.
- (iv) Pipes and hoses that contain fluids at pressures exceeding 5 MPa or temperatures above 60 °C located inside the cab shall be suitably guarded.

7.1.3 Operator's Protective Structures:

All HEMM with a seated operator shall be equipped with a roll-over protective structure (ROPS). The ROPS shall comply with ISO 3471. Further, it shall also be fitted with FOPS, when they are intended for applications where there is a risk of falling objects. The fitted FOPS shall be in accordance with ISO3449.

7.1.4 Seats:

- (i) The Operator's Station shall be fitted with an ergonomically designed adjustable seat that supports the operator in a position that allows the operator to control the machine under the intended operating conditions. The seat and its suspension shall be so designed to reduce vibration transmitted to the operator to the lowest level that can be reasonably achieved.
- (ii) If an additional seat for a trainer is installed in the Operator's Station, it shall be padded and shall provide adequate space for the trainer. The trainer shall also have available a conveniently placed handhold.
- (iii) Seat belt for Operator with reminder shall be provided.

7.1.5 Operator's Controls and Indicators:

- (i) The controls shall be of suitable design and construction and arranged so that they are able to be operated with ease from the operator's seat and within the operator's force limits. Controls shall be laid out and designed to allow easy and safe operation based on the principle that give direction of movement of any control produces a consistent and expected effect. The surfaces of frequently used pedals shall be fitted with skid resistant type materials.
- (ii) Controls that can cause a hazard due to inadvertent activation shall be so arranged, deactivated or guarded as to minimize the risk, particularly while the operator is getting into or out of the operator's station. The deactivation device shall either be self-acting or shall act by compulsory actuation of the relevant device.
- (iii) A device/system shall be provided to release the residual pressure in each hydraulic and pneumatic circuits which can cause a risk.

7.1.6 Starting and Stopping System:

- (i) All HEMM shall be equipped with starting and stopping device (e.g., key). The starting system shall have a provision for protection against unauthorized use.
- (ii) The starting and Stopping system shall be designed such that movement of the machine, working equipment and attachment, shall not be possible, while starting or stopping the engine, without activating the controls (e.g. Transmission Neutral-Engine Start safety arrangement).
- (iii) In case of remote control operated equipment, the Starting and Stopping system shall conform to National/Internationally accepted standard.

7.1.7 Steering System:

- (i) The steering system shall be such that the movement of the steering control corresponds to the intended direction of steering.
- (ii) Hydraulic Steering circuits shall, if used, incorporate the following features:
 - (a) pressure control devices as required to avoid excessive pressure in hydraulic circuit;
 - (b) hydraulic hoses, fittings and tubing with test burst pressures at least four times the working circuit pressure control device(s) for normal and emergency steering systems;
 - (c) plumbing arrangements which avoid excessively tight hose bends, torsion in the installed hoses, or scrubbing and chafing of hoses.
- (iii) An emergency steering system shall be provided which also function with reverse machine movement if the maximum rated speed in reverse exceeds 20 km/h.
- (iv) A warning device indicating a normal steering power source shall be provided. This warning device shall be audible or visual, and shall be activated by failure of the normal steering power source.
- (v) Articulation safety locks shall be provided in articulated steering equipment. All articulated equipment shall be equipped with a safety bar or a device, which can readily be fitted without special tools, to prevent movement of the articulation joint during maintenance work in the vicinity of this joint

7.1.8 Brake System:

All HEMM shall be equipped with the following brake systems and all these systems shall be effective under all conditions of service, load, speed, terrain and slope, according to the intended use of the machine:

- (i) Service Brake: to be used as the primary braking system during normal operation of the equipment.
- (ii) Emergency brake-to be applied by the operator in the event of a failure of the service brake.
- (iii) Parking brake-used to prevent movement of stationary equipment.

Provided that at least one of the brakes shall be "fail safe", i.e. the spring applied-hydraulically released (SAHR) or any other means.

All HEMM shall have a brake system in accordance with ISO3450 except for crawler machines with a travel speed less than 20 km/h, which shall have a brake system in accordance with ISO10265.

7.1.9 Visibility:

- (i) All HEMM shall be designed so that the operator has sufficient visibility from the operator's station in relation to the travel and work areas of the machine necessary for its intended use. The performance criteria shall be in accordance with ISO5006.
- (ii) Rear Vision Camera shall be provided in all HEMM.
- (iii) Blind Spot Mirrors / Camera apart from rear side view mirror to enable operator to have clear visibility of blind spot shall be provided in all HEMM.

7.1.10 Stability:

- (i) All HEMM with attachments, including optional equipment, shall be designed and constructed so that stability is provided under all intended operating conditions including maintenance, assembling, dismantling, and transportation, as specified by the manufacturer in the operation manual.
- (ii) Devices (e.g. outriggers, oscillating axle locking) intended to increase the stability of HEMM in working mode shall be fitted with interlocking devices or check valves which keep them in position in case of hose failure or in case of oil leakage.

7.1.11 Noise:

The operator and persons near to the HEMM shall not be exposed to noise level that exceeds an eighth ours' equivalent continuous sound pressure level of 85 dB(A) and wherever it exceeds 85 dB(A), Personnel Protection Equipment (PPE) of adequate strength shall be used by the operators and the persons.

7.1.12 Warning devices and safety signs:

- (i) All the HEMM shall be equipped with an audible warning device (horn) controlled from the operator's station.
- (ii) Warning system for Operator's fatigue shall be provided in all HEMM.
- (iii) Audio Visual Alarm (AVA) system for reversing shall be provided in all HEMM.
- (iv) Safety signs and hazard pictorials shall be displayed at conspicuous places.
- (v) Retro-Reflective Reflectors shall be provided on all sides of the HEMM at suitable positions.

7.1.13 Protective measures and devices:

- (i) All dangerously exposed moving parts of the equipment shall be provided with suitable guards of substantial construction to prevent injury to person(s).
- (ii) Guards or shields shall be provided in the vicinity of exhaust and turbocharger to prevent fuel or oil spraying on hot surfaces.

7.1.14 Electrical and Electronic Systems:

- (i) Electrical components and conductors shall be installed in such a way as to avoid damage from exposure to environmental conditions (corresponding to the intended use of the machine) that can cause deterioration. Electrical component insulation shall have flame-retardant properties.
- (ii) Degree of protection:
Depending on the location/installation of electrical and electronic components, the following degrees of protection are required:
 - (a) All components installed exterior to the machine or directly exposed to the environment shall have a minimum degree of protection corresponding to according IEC60529,IP55;
 - (b) All components installed in the operator's cab or protected against the environment, the protection shall be designed and executed to safeguard a correct function under expected and intended conditions.
 - (iii) Electronic controls, connectors in control circuits, multi-pin connectors and control switches external to the cab, shall have a minimum protection of IP55.
 - (iv) All HEMM powered by electrical power source shall be provided with tripping device in Operator's Cabin to cut off Electric supply at Principal Switch Gear (PSG) end.

7.1.15 Fire Protection

- (i) All HEMM shall be equipped with suitable portable Fire Extinguisher(s) in addition to Automatically operated Fire Detection and Suppression device or System.
- (ii) Hydraulic hoses, Electric Wires, sleeves and conduits (where cable/wire is passed) of fire-resistant quality shall be provided in all HEMM.

7.2 In addition to General requirement mentioned above, the following safety devices/features specific to machines shall be provided:

7.2.1 Dumpers:

- (a) Mechanical steering locking to prevent untoward movement of steering wheel and tyre during work persons working below the cabin while engine is running.
- (b) Mechanical type device to protect the operator in case of head to tail collision of dumpers.
- (c) Limiting speed device to limit the speed as per working conditions.
- (d) Propeller shaft guard.
- (e) Proximity warning device.
- (f) Dump body raised position indicator with Warning.
- (g) Retarder System in addition to Service, Parking and Dump Brakes.
- (h) Rock ejectors for tandem tyres.
- (i) Body raised position mechanical locking arrangement
- (j) Engine cut off arrangement/ Battery Cut-off switch on front lower portion of the dumper.
- (k) Cabin Guard Extension/Canopy fully covering operator's cabin.
- (l) Load Indicator.
- (m) Auto dipping System.

7.2.2 Tippers /Trucks:

- (a) Cabin Guard Extension/ Canopy fully covering the operator's cabin.
- (b) Exhaust/Retard Brake.
- (c) Propeller shaft guard
- (d) Tailgate protection
- (e) Limiting speed device
- (f) Dump Body lift position locking arrangement.
- (g) Dump Body raised position indicator with Warning.
- (h) Dum body stabilizers.
- (i) Proximity warning device
- (j) Auto dipping System
- (k) Load Indicator.

7.2.3 Excavators:

7.2.3.1 Hydraulic Excavators:

- (a) All functions cut off switch
- (b) Swing Motor Brake and Swing lock
- (c) Parking Brake.
- (d) Vent valve on top of hydraulic tank (should be able to be removed without any tool).
- (e) Provision for Limiting of hydraulic cylinders-Stopppers.
- (f) Battery cut off switch out side cabin
- (g) Two-way communication system other than mobile phone in Operator's Cabin.

7.2.3.2 Rope Shovels:

- (a) All functions, such as Crowd, Hoist, Swing, Propel and Drag shall be provided with 'ON' type brake so as to automatically apply the brake in case of Electrical power failure.
- (b) Travel limit switches for crowd, hoist and Drag functions as applicable.
- (c) Limit switch for boom movement.
- (d) Two-way communication system other than mobile phone in Operator's Cabin
- (e) Boom crack monitoring system in Draglines.

7.2.4 Drills:

- (a) Dust prevention or suppression system provided in the Drills shall confirm to DGMS circular no. DGMS (S&T)/circular (Approval) No.1, dated 10.03.2017.
- (b) Emergency 'Stop' push button in
 - (i) Operator's cabin
 - (ii) Mainframe.
 - (iii) Propeller pendent
 - (iv) Rear end
- (c) Over Temperature protection devices, in motor winding and other related parts.
- (d) Explosive vent in transformer.
- (e) Interlock between propel and drilling operations.
- (f) High air discharge temperature trip switch
- (g) Low lube oil pressure cut off switch (engine and compressor)
- (h) Oil stop valve (electric solenoid valve in compressor lubrication line)
- (i) No bump circuit
- (j) Tower lock.
- (k) Propel joystick-spring loaded type to return to neutral (dead man safety)
- (l) Lock check valves for preventing creeping in drill
- (m) Unloader valve
- (n) Stabilizers
- (o) Break out wrench.

7.3 All Heavy Earth Moving Machinery including dumpers and tippers shall be provided with Safety features and devices mentioned above before putting them into operation in a Mine.

7.4 The various safety features fitted or to be fitted with Heavy Earth Moving Machinery (HEMM) and Heavy/Light vehicles used in the mine shall conform to the standards as stipulated in DGMS (Tech) circular No. 06 of 2020, dated 27.02.2020.

8.0 OPERATION OF HEMM OTHER THAN DUMPERS/TIPPERS:**8.1 Operation:**

- (a) Every shovel, excavator and other machine shall be under the charge of a competent person, authorised in writing by the manager, herein called as the 'Operator'.
- (b) All persons employed or to be employed to operate shovel, excavator and other machine shall be trained and their competency shall be evaluated by a Board constituted by the management. The members of such board shall be persons who are not connected with imparting of training. However, the training officer(s) may be co-opted in the Board as observer. The Board may require operators to possess certain minimum educational qualifications in case of higher technology/automation-based equipment.
- (c) Only such fitters/mechanics possessing driver's/operator's license, shall be allowed to carry out test-run of shovel, excavator and other machine.
- (d) No person other than the operator or any person so authorised in writing by the manager shall ride on a shovel, excavator or other machine.
- (e) No person shall be permitted to ride in the bucket of a shovel, excavator or other machine.
- (f) Shovel/excavator bucket shall be lowered to the ground during greasing operations.
- (g) No shovel/excavator shall be operated in a position, where any part of the machine or suspended loads therefrom are brought closer than 3m to exposed high voltage transmission lines, unless the current has been cut off from such exposed transmission lines, and positive means have been taken to prevent the lines from being energised. A notice of this requirement shall be posted at the operator's position.
- (h) Electrical cables, if any, shall be laid in such a manner that they are not damaged either by falling rocks or by any mobile equipment.
- (i) The shovel/excavator bucket shall be pulled out of the bank as soon as it is full.
- (j) When being operated in soft or unstable ground, every shovel and excavator shall be supported on mats, heavy planks or poles so as to distribute the load of the machinery over larger area and prevent its toppling.
- (k) When not in use, shovel/excavator shall be moved to and stood on stable ground.

(l) If more than one stripping machine is in use in any area, either on the same bench or on different benches, the machines shall be so spaced that there is adequate space for safe operation of each equipment, and there is no danger from flying or falling pieces of stones etc. from one machine to the other.

8.2 Duties of Shovel Operators:

Every person authorised to operate heavy earth moving machineries such as shovel or excavator shall-

- a. inspect the machine assigned to him in the beginning of his shift and test the various systems, sub-systems and protective devices, as stipulated in this respect by the engineer in consultation with the manufacturer or supplier;
- b. not take out the machine for work nor shall he operate the machine unless he is satisfied that it is mechanically sound and in efficient working order;
- c. maintain a record of every inspection made under clause (a) in a bound paged book kept for the purpose and shall sign every entry made therein;
- d. keep the cabin or engine room and all window glasses clean;
- e. keep the walk-ways, hand-rails, ladder-ways free of loose tools, lubricants or other material that might fall or cause a tripping hazard;
- f. not allow any unauthorised person to ride on the machine;
- g. not move or operate the machine when persons are in such proximity as to be endangered;
- h. check that the visual aids like blind spot mirrors, rear vision cameras, etc. are in place and working in order to have proper visibility around the equipment, or else immediately report any defect noticed to the engineer;
- i. not swing the bucket over the passing haulage units or over the cabin of the units being loaded;
- j. lower the bucket to ground, switch-off the power supply to the machine or stop the prime mover, lock the cabin door and switch-off the battery cut-off switch before leaving the machine;
- k. strictly adhere to the code of practices prepared by the manager of the mine while operating the machinery;
- l. enter the condition of the machine at the end of his shift in the register or book maintained under clause (c) for necessary information for his successor.

9.0 OPERATION OF DUMPER/TIPPER/TRUCK:

9.1 Operation:

- (a) Every tipper/truck or dumper shall be under the charge of a competent person authorised in writing by the manager herein called the 'driver'.
- (b) All persons employed or to be employed to drive/operate trucks/dumpers/tippers shall be trained and their competency shall be evaluated by a Board constituted by the management. The members of such board shall be persons who are not connected with imparting of training. However, the training officer(s) may be co-opted in the Board as observer. The Board may require operators to possess certain minimum educational qualifications in case of higher technology/automation-based equipment.
- (c) Only such fitters/mechanics possessing driver's/operator's license, shall be allowed to carry out test-run of trucks/dumpers/tippers.
- (d) No person other than the driver or the manager or any person authorised in writing by the manager shall ride on a truck or dumper.
- (e) No person shall, or shall be permitted to, ride on the board of a running truck or dumper.
- (f) No vehicle shall be loaded/unloaded on gradient.
- (g) As far as possible, loaded trucks or dumpers shall not be reversed on gradients.
- (h) Sufficient stop blocks shall be provided at every tipping point and these shall be used on every occasion, material is dumped.
- (i) Code of Traffic Rules framed by the Manager shall be adopted and followed during movement of all trucks and dumpers. They shall be prominently displayed at relevant places in the opencast workings and on truck/dumpers roads.
- (j) When not in use, every truck or dumper or other wheeled trackless machinery shall be moved to and parked at proper parking place(s) which shall be on level ground and away from working area of other mobile equipment. The truck or dumper or other wheeled trackless machinery shall not be parked at a place where it cannot be observed.
- (k) No person shall, or shall be permitted to, work on the chassis of a truck or dumper, with the body in a raised position unless the truck or dumper body has been securely blocked in position. The hoist mechanism shall not be depended upon to hold the body of the truck or dumper in a raised position.
- (l) Suitable points shall be designated for parking utility vans and other light vehicles in the opencast workings, which in no case shall be less than 30m away from the area where mobile HEMM operates. The light vehicles shall in no case be taken beyond the designated point unless operation of HEMM in the vicinity has been stopped.
- (m) No person other than those authorised shall be permitted to enter or remain in any dumping yard, loading and unloading points and turning points.
- (n) In respect of every truck/dumper or class of truck/dumper, the maximum load to be hauled shall be determined and notified to operators/drivers by the Manager. Speed limits at which such loads can be hauled shall also be determined and fixed by the Manager, depending on the road gradient, direction of movement, road surface etc., and notices/sign boards specifying the same shall be posted along the haul road at appropriate places/sections.

9.2 Duties of Tipper / Dumper Operators:

9.2.1 Every person authorised to operate tippers and dumpers in a mine shall-

- a. inspect the machine assigned to him in the beginning of his shift and test the various systems, sub-systems and protective devices;

- b. not take out the machine for work nor shall he operate the machine unless he is satisfied that it is mechanically sound and in efficient working order;
- c. maintain a record of every inspection made under clause (a) in a bound paged book kept for the purpose and shall sign every entry made therein;
- d. not drive the machine under his charge too fast, shall avoid distractions, and drive defensively, not attempt to overtake another vehicle unless he can see clearly far enough ahead to be sure that he can pass it safely and sound the audible warning signal before overtaking;
- e. when approaching a stripping or loading equipment, sound the audible warning signal and not attempt to pass the stripping equipment until he has received proper audible signal in reply;
- f. before crossing a road or railway line, reduce his speed, look in both directions along the road or railway line and proceed across the road or railway line only if it is safe to do so;
- g. sound the audible warning signal while approaching a blind corner or any other points from where persons may walk in front unexpectedly;
- h. before starting or turning the vehicle, ensure that no person or light motor vehicle is present in front or near its vicinity;
- i. check that the visual aids like blind spot mirrors, rear vision cameras, etc. are in place and working in order to have proper visibility around the equipment, or else immediately report any defect noticed to the engineer;
- j. not operate the tipper or dumper in reverse unless he has a clear view of the area behind and give audible warning signal before reversing a tipper or dumper;
- k. be sure of clearance before driving through areas such as tunnel, archway and plant structures;
- l. strictly adhere to the transport rules made by the manager of the mine while operating the tipper or dumper;
- m. apply parking brake and turn-off battery cut-off switch before leaving the equipment;
- n. enter the condition of the machine at the end of his shift in the register or book maintained under clause (c) for necessary information for his successor.

9.2.2 The driver shall ensure that the vehicle is not overloaded and that the material is not loaded in tipper or dumper so as to project horizontally beyond the sides of its body and that any material projecting beyond the front carrier is indicated by a red flag during day and red light after day light hours.

9.2.3 The driver shall not allow any unauthorised person to ride on the vehicle. He shall also not allow more than the authorized number of persons to ride on the vehicle.

9.2.4 As far as possible loaded tipper or dumper shall not be reversed on gradient

9.2.5 "The Code of Traffic Rules" framed by the Mines Manager for movement of all tippers and dumpers prominently displayed at the relevant places in the opencast workings of the mine shall be complied with.

10.0 TESTING OF BRAKES AND STEERING:

A. Brakes of every dumper/truck, tipper and any other wheeled trackless machine shall be tested atleast once in two weeks, in a manner as indicated below:

(a) **SERVICE BRAKE TEST:** The brake shall be tested as specified by the manufacturer of the vehicle or on a specified gradient and speed when the vehicle is fully loaded. The vehicle should stop within a distance as specified by the OEM when the brake is applied, which shall be obtained from the manufacturer of the vehicle.

(b) **PARKING BRAKE TEST:** The parking brake shall be capable to hold the vehicle for a period of at least ten minutes when it is fully loaded and placed at the maximum gradient of roadway on which it is permitted to ply.

B. Unless otherwise recommended by the OEM, the brakes and steering of the dumper, tipper or any such other vehicles shall be tested at the commencement of every shift by the operator or competent person appointed in writing by the manager before operating the vehicle, as per the procedures indicated below:

1.0 Test Procedure- Service Brake:

- i. Fasten the seat belt.
- ii. Move the machine to dry level surface.
- iii. Check area around the machine.
- iv. Make sure that machine is clear from obstacles.
- v. Start the engine and build air pressure up to cut off point.
- vi. Apply the service brake while keeping all other brakes off and move the transmission selector lever to first range forward.
- vii. Accelerate the engine RPM to 1400 and maintain it for a few seconds.

Desired result: Machine should not move.

2.0 Test Procedure- Retard Brake:

- i. Fasten the seat belt.
- ii. Move the machine to dry level surface.
- iii. Check area around the machine.
- iv. Make sure that machine is clear from obstacles.
- v. Start the engine and build air pressure up to cut off point.
- vi. Apply the retard brake while keeping all other brakes off and move the transmission selector lever to first range forward.
- vii. Accelerate the engine RPM to 1300 and maintain it for a few seconds.

Desired result: Machine should not move.

3.0 Test Procedure- Dump and Parking Brake:

- i. Fasten the seat belt.
- ii. Move the machine to dry level surface.
- iii. Check area around the machine.
- iv. Make sure that machine is clear from obstacles.
- v. Start the engine and build air pressure up to cut off point.
- vi. Apply the service brake while keeping all other brakes off and move the transmission selector lever to first range forward.
- vii. Accelerate the engine RPM to 1200 and maintain it for a few seconds.

Desired result: Machine should not move. Parking brake is considered to be in good working condition and can be expected to hold a loaded dumper on gradient of 15%.

4.0 Test Procedure- Steering:

- i. Fasten the seat belt.
- ii. Move the machine to dry level surface.
- iii. Check area around the machine and ensure that machine is clear from obstacles.
- iv. Start the engine and build air pressure up to cut off point.
- v. Remove all the brakes and keep gear in neutral.
- vi. Rotate the steering wheel and bring the tyres to an extreme end position.
- vii. Remove the hands from steering wheel.
- viii. Accelerate the engine RPM to 1000.
- ix. Rotate the steering wheel and bring the tyres to other extreme end position. Repeat (vii) & (viii).

Desired result: When the hand is removed from the steering wheel, either the steering or the tyres shall not move on its own. If any movement is observed, it shall be concluded that the steering system needs checking and necessary repairs shall be carried out before putting in the dumper into service.

C. A record of every such test carried on every dumper/truck/tipper/other mobile HEMM shall be kept maintained in a bound paged book which shall be signed by the person carrying out the tests and shall be countersigned by the engineer and the manager. In case any defect in braking system is observed in any equipment/HEMM, such equipment/HEMM shall be taken off from operation and record thereof shall be kept maintained.

11.0 EXAMINATION, REPAIR AND MAINTENANCE OF HEMM AND OTHER MACHINES:

11.1 A scheme for proper maintenance, repair, overhaul and erection in respect of heavy earth moving machinery (commensurate with the capacity/size type of machines used in the mine), covering places such as repair sheds and workshops, shall be drawn and implemented. This shall also include framing and implementation of Code of Practice for erection, inspection, examination, repair, maintenance, etc. of such equipment before putting the same into use in the mine.

11.2 Every drilling and earth moving machinery or equipment or accessory (herein after called machine) shall be thoroughly examined at least once in every shift and maintained in good and safe working condition. In case of wheeled trackless HEMM like dumpers, trucks, tippers and other such machinery, special attention shall be paid to safe working order of brakes, steering system, horn, audio-visual reversing alarm, side indicator lamps, rear view mirrors and head lights & tail lights.

11.3 If the engineer, mechanical foreman or other competent person making an inspection notices any defect in any machinery, the said machinery shall not be used until the defect has been remedied.

11.4 Any defect in any machinery, reported by its operator, shall be promptly attended to.

11.5 Any machinery found to be in an unsafe operating condition shall be tagged at the operator's position; "*Out of Service, Do Not Use*" and its use shall be prohibited until the unsafe condition has been corrected.

11.6 All repairs shall be done at a location (Workshop) which provides a safe place for the persons engaged on repairs. Adequate attention shall be paid towards proper layout of workshops and repair sheds so as to ensure due protection from the movement of HEMM therein to work persons deployed at these places.

11.7 Except for testing, trial or adjustment, which must necessarily be done while the machine is in motion, every machine shall be shut down, and positive means taken to prevent its operation, before any repair, maintenance or lubrication is undertaken on it.

11.8 Power shall be disconnected when repairs are to be carried on any electrically powered machine/apparatus.

11.9 Any machinery, equipment or part thereof which is suspended or held apart by use of slings, hoists, or jacks shall be substantially blocked or cribbed, before men are permitted to work underneath or between the same.

11.10 While inflating tyres, suitable protective cages shall be used. Tyres shall in no case be inflated by sitting either in the front of it or on top of the same.

11.11 Operation and maintenance of heavy machineries such as shovels, excavators, pay-loaders, dumpers, tippers, trucks etc. shall be done strictly in accordance with the OEM's operation and maintenance instructions which shall be obtained from the manufacturers.

11.12 The stability of HEMM shall be carried out at least once in every year and after every major overhaul by an independent agency.

11.13 The crane and overhead crane shall be subjected to proof load test and NDT test once in a year from a competent authority.

11.14 The pressure vessel receiver shall be subjected to hydraulic and NDT test and shall be carried by a competent authority.

11.15 In case of any defect in equipment such as brake, steering and safety device, the equipment shall immediately be taken out from use keeping a record thereof.

11.16 The Operator or Driver shall not leave the machine while it is running state unless it is placed under the charge of a competent person.

11.17 Additional Duties of Engineer In-Charge of Machines and Vehicles in Opencast Workings:

11.17.1 During each shift, the machines and equipment deployed in the mine shall be placed under the charge of such number of qualified and experienced engineers, assisted by adequate numbers of mechanical foremen and mechanics, as is adequate to effect adequate inspection, examination, safe operation and maintenance of the machines, equipment and accessories.

11.17.2 During his shift the engineer(s) shall -

- (i) inspect, test & examine every machines, equipment and accessories, and satisfy himself that they are in sound and safe working order.
- (ii) if the vehicle or machine is required to work after day-light hours, ensure that the lights in working order.
- (iii) not allow any machine, equipment to be used, if it is found defective.
- (iv) ensure that every machine, equipment, accessory is used in a safe and efficient manner.
- (v) ensure that each operation/activity concerning repair, maintenance and operation of machinery/equipment is carried on in a safe and efficient manner.

11.18 A record of every examination, repair and maintenance carried out in accordance with the above shall be maintained in a bound-paged book for the purpose. Every entry made in the book shall be signed and dated by person making the inspection and countersigned by the Engineer-in-charge.

IV. DEEP HOLE DRILLING AND BLASTING:

12.0 DRILL MACHINES:

12.1 Truck mounted drill machines designed for tube-well drilling for sources of water shall not be used and only proper type of (crawler mounted) blast hole drill machines, designed for mining purposes, shall be used in the mine.

12.2 All control switches for all drilling operations including tramming and set up shall be centralized in a properly designed operator's cabin located at the drilling end. Drill shall be provided with hydraulically operated carousel/ rod changer. Suitable hydraulic jacks with controls from operator's cabin shall be provided for levelling of the machine.

12.3 The drill shall have an inbuilt system of directing a jet of water on the cutting edge to wet the cuttings or other equally efficient device kept in operation to prevent the atmosphere being charged with dust.

13.0 DUTIES OF DRILL OPERATORS:

13.1 At the beginning of his shift, the drill operator shall examine the drilling equipment and satisfy himself that-

- (i) crown blocks are mounted securely;
- (ii) where compressed air drills are used, all hose connections are in order;
- (iii) the drilling equipment is in safe working condition, and,
- (iv) wet drilling system is in order.

13.2 The drill operator shall ensure that -

- (i) work persons keep clear of auger and drill stem while the drill is in motion;
- (ii) work persons do not work under suspended tools, when tools are removed from the holes,
- (iii) all finished drill holes are properly plugged so as avoid possible injury to any one accidentally stepping onto the hole.

14.0 DRILLING AND BLASTING OF DEEP HOLES:

14.1 General:

14.1.1 The owner and agent of the opencast mine shall ensure that deep hole drilling and blasting pattern for the mine is scientifically designed taking into consideration all mining parameters which could have adverse impact on ground vibration in and around the mine and long-term stability of slope of opencast workings and dump yards.

14.1.2 The Owner, Agent and Manager of the mine where deep hole blasting is proposed shall indemnify the occupants/owners of houses / dwellings / buildings or other structures and the public authority concerned, if any, against danger to their property or injury to them or other persons, arising out of the operations conducted in respect of deep hole blasting.

14.1.3 The Owner, Agent and Manager of the mine where deep hole blasting is proposed shall ensure that:-

- a. Only properly trained persons who are authorized in writing by the manager for the purpose are deployed.
- b. Adequate personal protective equipment that are required to be used by persons deployed in this connection are provided and also used.
- c. Adequate scientific equipment for measurement of various blasting parameters like ground vibrations, air-overpressure, etc., are provided.

14.1.4 The entire operations of conduct of deep-hole drilling and blasting operations in the mine including transport of the explosive to the site of its use, shall be placed under the overall charge of a competent person holding First or Second class manager's certificate, hereinafter referred to as "Blasting Officer", duly appointed in writing by the manager for the purpose. He shall be assisted in operations connected therewith by adequate number of persons holding at least an Foreman certificate of competency, who are duly authorized in writing by the Manager and are fully trained in deep hole drilling and blasting techniques.

14.1.5 No deep hole blasting shall be conducted in the mine using Ammonium Nitrate Fuel Oil (ANFO), Site Mixed Slurry (SMS) or Site Mixed Emulsion (SME) explosives without obtaining a separate permission as required under Regulation 155(1) and 162(5) of Metalliferous Mines Regulations, 1961.

14.1.6 No deep hole blasting shall be conducted in the mine within the danger zone of 300m from any permanent building or structure not belonging to the owner without obtaining a separate permission under Regulations 164(1A)(c)&(1B)(a) of the Metalliferous Mines Regulations, 1961.

14.2 Drilling of Deep Holes:

14.2.1 Before commencement of drilling, the area where drilling is proposed shall be thoroughly cleaned of loose rocks and debris and position of every deep hole to be drilled shall be distinctly marked by the blasting office or blasting foreman, so as to be readily seen by the drillers.

14.2.2 No drilling shall be commenced in an area where shots have been fired, until the blaster/ blasting foreman has made a thorough examination of all places, including remaining butts of old deep holes, for unexploded charges that the drill rod may strike.

14.2.3 No drill or bore rod or pick shall be inserted in butts of old deep holes even if an examination under clause 14.2.2 has failed to reveal presence of explosives.

14.2.4 Drilling operations shall not be carried on simultaneously on two benches, at places directly one above the other.

14.2.5 Drilling and charging of deep holes shall not be carried out in the same area at the same time.

14.3 Charging and Stemming of Deep Holes:

14.3.1 No deep hole shall be charged in crushed, broken or fractured ground strata.

14.3.2 All detonators and primed cartridges shall be kept in secure receptacles at a safe distance from the detonating fuse and the explosive, until actually required for use.

14.3.3 Charging of explosives shall be such as to ensure continuity of the explosive column. Where deck charging is done, continuity shall be ensured for each deck of explosive charge.

14.3.4 Primer explosive cartridge shall not be slit or deformed.

14.3.5 Adequate amount of cap sensitive explosive shall be used with non-cap sensitive explosive charge to ensure complete detonation of the explosive charge.

14.3.6 In case, water is encountered in any shot-hole, either the shot hole shall be dewatered by blowing compressed air into the hole or the explosive column shall be gently pushed down by wooden rod and sufficient time given for the explosive column to sink to the desired depth before the round is fired. Decking in watery holes shall be avoided.

14.3.7 The charging of holes shall be carried out in day light hours only.

14.3.8 During the approach and progress of an electric storm, no charging and blasting shall be done and precaution laid down in DG Technical Circular 1/1995 shall be followed.

14.3.9 Only such minimum number of persons shall be allowed to remain at the charging site as are required during charging operations and firing of deep holes.

14.3.10 The entire area where charging of explosives is to be done shall be demarcated by suitable flags and effectively guarded to prevent unauthorised entry of persons or plying of other vehicles, and shall be kept free from dry vegetation and other combustible material.

14.3.11 Smoking, naked light, open flames or mobile phone shall not be allowed within 300m of the area where charging of explosives is being carried on.

14.3.12 The holes shall be charged (and fired) as soon as possible after the explosive is transported to the site of blasting.

14.3.13 Explosives shall be delivered/charged first into the hole farthest from the 'Priming Station'.

14.3.14 Not more than one hole shall be in process of being charged on any face at any point of time.

14.3.15 All operations connected with charging, stemming and making connections shall be done while standing on the solid ground.

14.3.16 The cartridges of explosives shall be lowered carefully into the shot holes, so as to avoid sticking of cartridges in the shot holes, thereby causing air space(s) in the explosive column. After charging such hole with explosives, the length of the uncharged/remaining portion of the hole shall be measured to confirm that the cartridges are in close contact with each other and there is no air gap between the explosive column. In case, the length of uncharged portion of the hole is not as per calculation, thereby indicating the presence of air space, attempt may be made to push down the charge in case of slurry explosives only. The remaining hole shall then be stemmed with moist sand before blasting the shot holes.

14.4 Precautions during Blasting/Firing:

14.4.1 Shots shall not be fired except during the hours of day light.

14.4.2 Shots shall not be fired in crushed, broken or fractured ground.

14.4.3 The manager shall fix the blasting time and shall circulate it to all concerned and display it prominently on the notice Board and at conspicuous places in and around the mine. As far as practicable, such blasting time shall be fixed either between the shifts, or during the rest interval, or at the end of work for the day.

14.4.4 The danger zone shall be distinctly demarcated (by means of red flags or other suitable means) at least 30 minutes before firing of holes.

14.4.5 During approach of an electric storm, following precautions shall be taken –

- (i) No explosives, particularly detonators shall be handled.
- (ii) If charging operations have begun, work shall be discontinued till the storm has passed.
- (iii) If shots are being fired electrically, all exposed wires shall be coiled up and kept covered by something other than a metal plate.
- (iv) All wires shall be removed from contact with metallic plates/steel rails so as to prevent the charge from exploding prematurely by a local strike of the lightning.
- (v) If the firing circuit has been set up before the thunderstorm came on, the persons at the site should withdraw at the earliest and the blast should be fired off immediately;

14.4.6 All holes charged on any one day shall be fired on the same day so that the charged holes are not allowed to sleep over night.

14.4.7 The area of explosives charged shot holes shall be conspicuously marked by visible bright red flags.

14.4.8 Blasting shall be done preferably against a free face. Blasted material shall be cleared off before commencement of drilling operations for succeeding round.

14.4.9 All normal precautions for charging and firing, as laid down under Regulation 162 of Metalliferous Mines Regulations, 1961, shall be strictly observed.

14.4.10 Guards shall be posted to ensure that no person inadvertently enters the danger zone and to ensure that all persons within the danger zone, have taken proper shelter.

14.4.11 Before shots are charged, stemmed and fired, sufficient warning by siren or other suitable means shall be given to warn persons in the danger zone, including to the habitants of structures and dwellings, not belonging to Owner.

14.4.12 In case of misfires, precautions as laid down in Regulation 167 of Metalliferous Mines Regulations, 1961, shall be taken.

14.5 Miscellaneous:

14.5.1 Mobile phones shall not be used by any person connected with deep hole blasting operations or handling of explosives. Only a two-way communication by wireless devices other than mobile phones shall be provided to the blasting officer, all sentries and the assistant of the blaster. The sets, including any other radio frequency devices in possession of blasting personnel, if any, shall remain switched off during handling and charging of explosives within 50 m radius from blast site.

14.5.2 A proper record of blast parameters like spacing & burden of holes, hole depth, number of holes fired in the round, charge/hole, charge/delay, charge/round, length of explosive column(s) & stemming column length(s), initiation pattern (with proper sketches wherever called for), results of ground vibration observed (ppv, frequency & air over pressure) and distance upto which flying fragments resulting out of blasting projected, shall also be kept maintained in a bound paged book for each round of deep-hole shots fired. The records shall be duly signed by the Blasting Officer and countersigned by the Manager of the mine.

14.5.3 The Manager of the mine, after thorough consultations with the OEM and explosives manufacturers, shall formulate suitable Codes of Practice in respect of drilling, charging, stemming, warning of persons, taking shelter, and firing of shots.

V. MISCELLANEOUS

15.0 GENERAL ILLUMINATION:

15.1 Adequate general lighting arrangements conforming to stipulations not less than as specified in Govt. Notification No.GSR-618(E) dated 28th April 2017, published in the Gazette of India Part II, section 3(i) on 21st June 2017, (reproduced in DGMS (Legis.) Circular No.3 of 2017 dated 06.11.2017), issued under Regulation 148(2) of the Metalliferous Mines Regulations, 1961, shall be provided at all opencast workings, haul roads, dump yards, sumps and other working places for working the mine beyond day-light hours.

15.2 Illumination surveys at an interval not exceeding 30 days shall be conducted at all work-places to ascertain that stipulations of Govt. Notification No. GSR-618(E) dated 28th April 2017 are being met with.

15.3 Suitable search lights shall be provided to the concerned mine officials for better supervision at night.

16.0 PRECAUTIONS AGAINST FIRE:

16.1 A code of practice shall be drawn up for dealing with fires at different locations in the opencast mine, and for dealing of fires in heavy earth moving machinery.

16.2 Every heavy earth moving machinery used in opencast workings shall be provided with automatically operated fire detection and suppression device or system. However, in case of trucks and dumpers of less than 35 tonne capacity used in opencast mines, it may be sufficient if semi-automatic type fire suppression system is provided.

16.3 Every fire protection system mentioned at clause 16.2 shall be tested at such interval and as per such procedure as recommended or prescribed by the manufacturer.

16.4 Daily inspection/maintenance and periodical washing of the HEMM and other equipment shall be carried out to avoid leakages or accumulation of hydraulic oils/fuels and, thereby to control the accidents due to fire.

16.5 A competent person shall, once at least in every month, examine all the equipment, material and arrangements provided for fire-fighting and shall discharge and re-fill the fire-extinguishers as often as may be necessary to ensure that these are in proper working order and any deficiency found during any such examination or otherwise shall be immediately remedied.

17.0 PROTECTION OF WORKERS AGAINST NOISE & VIBRATION:

17.1 Suitable steps shall be taken by all appropriate means to reduce the exposure of workers to any excessive noise and vibration. Guidelines given in DGMS (Tech.) Circular No.18 of 1975 may be followed.

18.0 SAFE USE OF MOBILE CRANES: CODE OF PRACTICE

18.1 All machinery used to lift or transport equipment and materials, shall be designed, constructed and erected, inspected, maintained and operated as specified by the manufacturer.

18.2 The rated capacity or legible load chart, where appropriate, of a crane shall be permanently marked on the structure at a clearly visible place and, in any case, such machinery shall not be operated at a capacity in excess of the rated limit.

18.3 No persons shall load any crane in excess of the safe working load except for the purpose of test, which shall be carried out by an authorized person and only in a manner specified by manufacturer.

18.4 The rated capacity of a hoist shall not exceed the capacity of the structure supporting the hoist.

18.5 The engineer or other component persons shall regularly inspect and maintain all cranes to ensure that every component thereof is capable of carrying out its original designated function, who shall also maintain a record thereof, duly signed and dated by him.

18.6 A crane shall not be used until any condition that may endanger safety of any person is remedied.

18.7 All installations, modifications and repairs to load-bearing equipment shall be certified by a competent person or authorised organisation in accordance with the original design and safety standard.

18.8 All cranes with a boom that is movable in vertical plan shall-

(a) have a device that can be clearly read by the operator, to indicate the boom angle if the rated capacity is affected; and

(b) be fitted with an automatic load indicator showing the safe working load.

18.9 All modifications that effect the rated capacity of a crane or hoist shall be assessed, and the rated capacity shall be adjusted by the original equipment manufacturer or a competent person or authorised organisation.

18.10 There shall be a safe means of access and egress to the operator's position and to maintenance locations for all cranes and hoists.

18.11 If normal means of egress is not always available to the operator, then an alternative safe means shall be provided to get from the operating position to a safe area in the event of a power failure or other emergency.

18.12 Effective audible and visible communications devices shall be installed on crane or hoist.

18.13 The crane or hoist operator shall sound a warning signal when it is necessary to alert workers.

18.14 All controls on a crane or hoist shall be clearly identified and shall return to neutral when release, and an automatic braking system shall be activated.

18.15 The operator of crane or hoist shall be protected against hazardous conditions such as airborne contaminants, falling or flying objects and excessive heat or cold.

18.16 The operator's seat on a crane or hoist shall be of an ergonomic design that allows operator to operate the equipment safely.

18.17 All the hooks, hook guards or latches, wire ropes, chains and other attachments and fittings shall be maintained and inspected on a regular basis.

18.18 The operator of a crane or hoist shall perform a check at the start of each shift and test the limit switch and a report thereof shall be maintained.

18.19 Transport routes for cranes shall be clear of obstructions and transport routes for wheeled or tracked cranes shall, as far as practicable be level.

18.20 Stability of the crane shall be ensured by avoiding any addition of extra load when the crane at the point of tipping.

18.21 To avoid toppling of crane, the operator shall be select correct configuration prior to the operation of the crane like telescoping of boom, slewing of super structures, derricking of boom, lifting of load etc.

18.22 Training shall be given to crane operators to ensure proper and safe operation of the crane.1

8.23 All Cranes shall be provided with Fail-Safe braking and emergency steering.

19.0 CONTRACTOR WORK VIS-À-VIS SAFETY:

19.1 In mines where any work is carried out through contractors, the owner, agent and manager of the mine shall ensure that the guidelines on 'employer's responsibilities', 'contractor's responsibilities' and contract employee's responsibilities' as recommended by the 10th National Conference on Safety in Mines (and reproduced by DGMS Tech. (SOMA) Circular No. 1, dated 04.01.2008) are strictly complied with.

19.2 Additional Precautions While Deploying Contractual Workers and Machineries Not Belonging to the Owner:

19.2.1 Buyers' trucks shall not be allowed to enter into the mine workings, be parked away from the mine premises and only such number of trucks shall be allowed to enter the dispatch yard which can be accommodated thereat and are due for loading during the shift, with due consideration of safety of persons engaged in loading operations.

19.2.2 Trucks, tippers and other heavy vehicles, not belonging to management (including trucks/ tippers engaged for transport of mineral from opencast workings to Crusher/Siding, and for transport of mineral from Crusher to Siding), shall not be allowed in the mine premises without a valid pass issued by the manager or other competent person. Before the pass is issued, the engineer shall ensure the road-worthiness of such vehicles.

19.2.3 In order to check entry of unauthorised trucks, tippers and other vehicles in mine premises, properly manned check gate(s) at the mine entrance(s) shall be set up, where record of entry and exit of each vehicle shall be maintained.

19.2.4 At the check gate(s), driving license of the drivers shall also be checked for eliminating the possibility of unlicensed persons driving the vehicles. Entry of unauthorised persons shall also be checked & controlled at such check gate(s) which shall be manned suitably for the purpose.

19.2.5 Persons engaged through contractors in any work within the mine premises shall be imparted relevant training and other job-related briefings, and the drivers/operators of HEMM/trucks/tippers/vehicles belonging to contractors shall additionally be explained the salient provisions of "traffic rules".

19.3 The explosive vehicles and fuel bowsers deployed in the mines shall have valid PESO license.

19.4 A surveyed-off or old equipment which has crossed its rated life shall not be used in the mine unless its fitness has been certified by a Committee consisting of senior technical officers of the company, OEM and an independent agency after making a thorough check and inspection of the condition of equipment and, if necessary, after such maintenance/repairs of the equipment as advised by the Committee.

20.0 CODE OF SAFE WORK PRACTICES:

20.1 A suitable 'Code of Traffic Rules & Safe Work Procedures' for regulating the movement of Heavy Earth Moving Machinery, trucks, tippers and other wheeled trackless machinery (commensurate with the capacity/size type of machines used in the mine) shall be framed by the manager and enforced in the mine. Such Code of Traffic Rules should be deliberated in the Safety Committee. A copy of traffic rules, in a language understood by them, shall be made over to all concerned, i.e., to drivers and operators of HEMM/trucks/tippers (including those belonging to contractors), supervisors and mine officials, and to such other persons who monitor/control movement of HEMM.

20.2 A suitable 'Code of Practice' for prevention of injuries to persons engaged in tipping on stock piles, tipping at crusher, dumping of overburden at dump yards, at loading and unloading points etc. (commensurate with the capacity/size type of machines used in the mine) shall be framed by the manager and enforced in the mine. Such Code of Practice should be deliberated in the Safety Committee. A copy of the code of practice, in a language understood by them, shall be made over to all concerned, i.e., to dump-men, drivers and operators of HEMM/trucks/tippers (including those belonging to contractors), supervisors and mine officials, and to such other persons who monitor/control dumping/tipping operations.

21.0 Additional Conditions:

This permission is also subject to the following additional conditions:

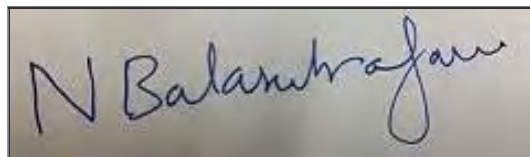
21.1 In the event of any change in the circumstances connected with this permission which is likely to endanger the life of persons employed in the mine, the mining operations for which this permission has been granted shall be stopped forthwith and intimation thereof shall be sent to this Directorate. The said mining operation shall not be resumed without express and fresh permission in writing from this Directorate.

21.2 This permission may be amended or withdrawn at any time if considered necessary in the interest of safety.

21.3 If at any time any of the conditions, subject to which this permission has been granted, is violated or not complied with, this permission shall be deemed to have been revoked with immediate effect.

21.4 This permission is being issued specifically under the regulations mentioned above and without prejudice to any other provisions of law, which may be or may become applicable at any time.

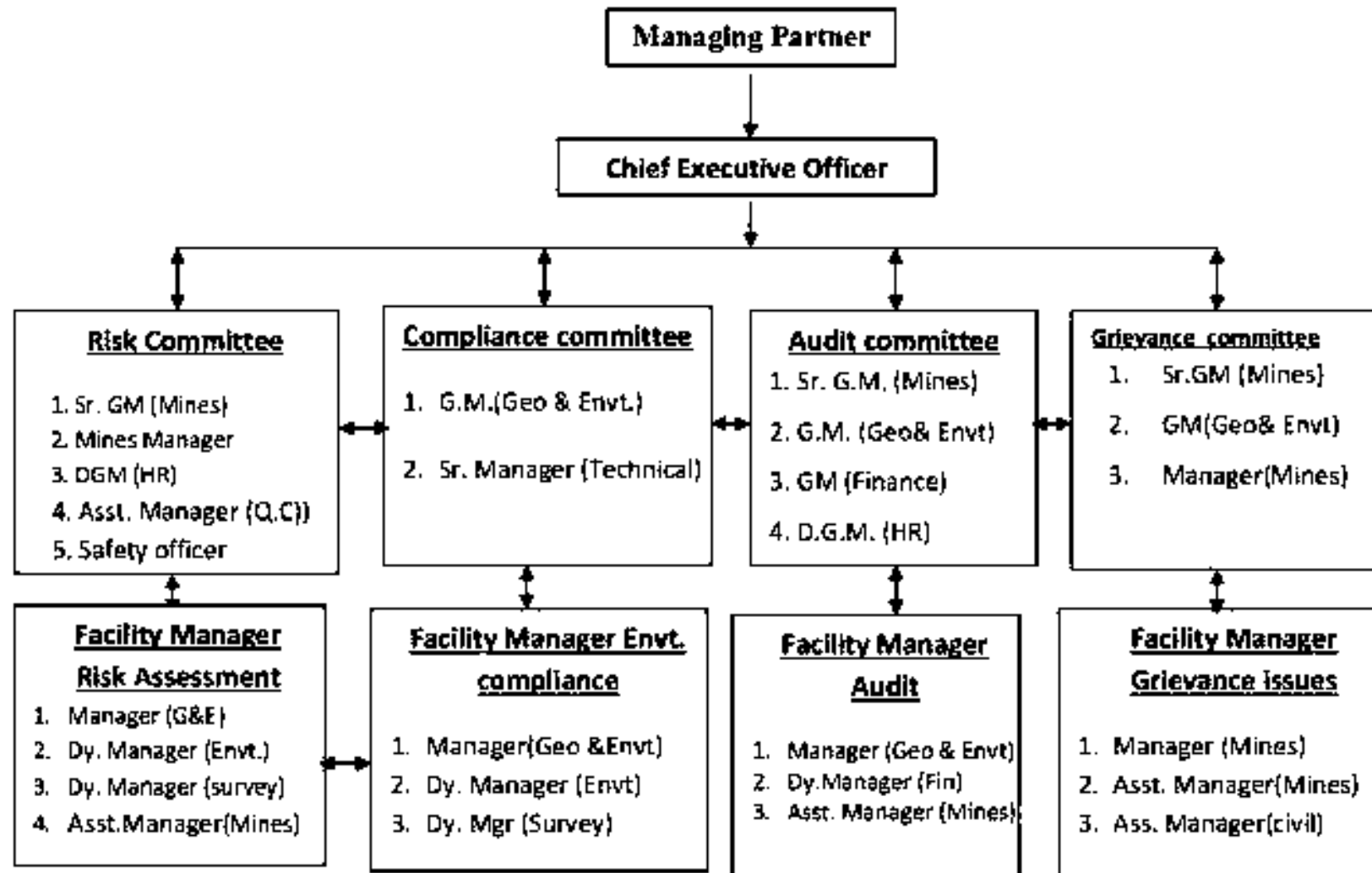
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ORGANISATIONAL STRUCTURE



Report on
Scientific Study for Controlled Blasting at Raikela Iron Ore Mines, Raikela

Submitted to
M/s Geetarani Mohanty



APRIL, 2026

Project Code: C3/25/MN/039

**Department of Mining Engineering
National Institute of Technology
Rourkela-769008**



राष्ट्रीय प्रौद्योगिकी संस्थान

NATIONAL INSTITUTE OF TECHNOLOGY

राउरकेला ROURKELA – 769008, ओडिशा ODISHA



RIGHT TO
INFORMATION

INVESTIGATION STATEMENT

The scientific work documented in this report titled “**Scientific Study for Controlled Blasting at Raikela iron Ore Mines, Raikela**” was carried out by the National Institute of Technology- Rourkela at the request of **M/s Geetarani Mohanty**. This report is classified as confidential and is meant for the internal use of the organization to which it is submitted. This report, in full or part thereof, can neither be quoted nor published anywhere by anybody other than the investigator and M/s Geetarani Mohanty. It should not be communicated/circulated to other agencies other than the concerned government departments. NIT-Rourkela reserves the right to publish the results of the present study.


07.04.2026

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Executive Summary

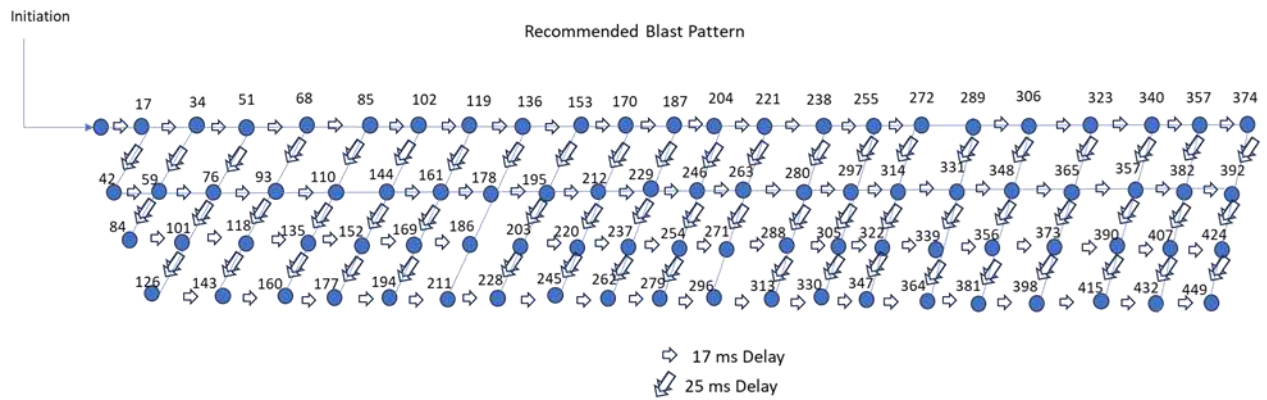
This scientific study was carried out by National Institute of Technology Rourkela for determining design parameters for controlled blast induced ground vibration, air over pressure, and fly rocks for Raikela Iron Ore Mines owned by M/s Geetarani Mohanty. The objectives of this study are to recommend the Maximum Charge Per Delay (MCPD) for limiting the Peak Particle Velocity (PPV) of the blast induced vibration as per DGMS Circulars considering the protection of structures lying beyond 100 and within 500m of the mine. In this context, 24 trial blasts were conducted with the monitoring of the blast induced vibration and air over pressure using Seismographs for 37 sets of monitored data. The distance between blast site and seismograph was measured using GPS. The scaled distances were calculated using distance and Maximum Charge Per Delay. The regression analysis of peak particle velocity and scaled distance was performed for establishing a prediction equation for the proposed design blast parameters. The depth of hole ranged from 5-10 m, spacing 2-2.5m, burden 1.5-2.0m. The Maximum Charge per delay was varied 15-35 kg. The delay detonators 17 & 25 milliseconds were used. The over pressure monitored during trial blast was observed below the permissible limit. The maximum distance of fly rock recorded was within 10 meters. This report incorporated the suggested design parameters for the controlled blast induced ground vibrations, air overpressure and fly rock with the implementation of established controlled blasting techniques for protection of structures. The site-specific prediction empirical equation is established as follows:

$$V = 299.13 \times \left(\frac{D}{\sqrt{Q}} \right)^{-1.416} \text{-----Eq. (1)}$$

The maximum charge per delay for protecting structures was estimated using the above equation in terms of vibration, distance and based on considering depth of hole, length of stemming, burden and spacing. The recommended blast design parameters are compiled in following Table.

Blast Parameters/Distance, m	100-200	200-300	300-500
Hole Diameter, mm	115	115	115
Hole Depth, m	5/10	5/10	5/10
No. of Holes	100	130	150
Drilling Patterns	Staggered	Staggered	Staggered
Burden, m	2.0-2.5	2.0-2.5	2.0-2.5
Spacing, m	2.0-2.5	2.0-2.5	2.0-2.5
Top Stemming, m	2-3	2-3	2-3
Maximum Charge Per Hole, kg	15/20	20/25	30/35
Maximum Charge Per Delay (MCPD), kg	15/20	20/25	30/35
Maximum Charge Per Round, kg	1500/2000	2600/3250	4500/5250
Initiation system	Nonel with Electronic Detonator	Nonel with Electronic Detonator	Nonel with Electronic Detonator
Explosives Types	Cartridge explosives.	Cartridge explosives.	Cartridge explosives.
Rows per blast	2	3	4

The followings are recommended blast patterns to protect the structures through controlled blasting to keep the vibration within acceptable limit of 5mm/s as hutments are close to mine boundary/controlled blasting zone.



No. of Holes: 86
 Average depth: 5/10m
 Average burden: 2.0m
 Average spacing: 5.0m

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1.0 INTRODUCTION

This report is an integral part of a Scientific Study for Controlled Blasting at Raikela Iron Ore Mines, Raikela operated and assigned by M/S Geetarani Mohanty with reference to Work Order No. -GRM/2024-25/607 Dated 05.02.2026 to National Institute of Rourkela for determining design parameters for controlled blast induced ground vibration, air over pressure, and fly rocks to protect the nearby structures.

1.1 Objectives: The core objective of this study is to estimate a safe maximum explosive charge per delay that ensures ground vibrations remain within acceptable limits of peak particle velocity (PPV) and frequency as per DGMS circular no. 7 of 1997.

1.2 Methodology: The blast design aspect of this study was carried out by NIT Rourkela. This report comprehensively presents the details of the blasts, their results, and the recommendations. To achieve the objective, 24 trial blasts were executed. The report's content is based on the findings and data analysis derived from 24 trial blasts. Throughout the study duration, the blasts were actively monitored to examine various blast parameters associated with bench blasting in the mining pit, with a specific focus on understanding the impact of these blasts on surrounding structures. Measurements of peak particle velocity and frequency of ground vibrations resulting from blasts at varying distances from the blast site were measured in the field using suitable instrumentation, including a Seismograph. It is essential to recognize that the utilization of explosive energy for rock fragmentation is accompanied by adverse effects, such as the formation of boulders, back breaks, ground vibrations, air blasts, and the potential for fly rock. Ground vibrations, if exceeding threshold values, can result in damage to structures and disturbance to nearby residents. These threshold values may vary depending on the type of structures. Additionally, air overpressure generated by blasting operations can cause disturbances, including rattling and breaking of window panes if it surpasses threshold levels. Fly rock poses another significant challenge associated with blasting operations, potentially causing harm to machinery in mines and structures in close proximity, and may lead to accidents if not handled with due care. Mining engineers must exercise caution and precision when designing and executing blasting operations to mitigate the fly rock problem.

2.0 PROJECT DESCRIPTION

2.1 General: Raikela iron ore mine of M/s Geetarani Mohanty over an area of 67.586 hectares is located in village Raikela, PO-Tensa in the district of Sundergarh of Odisha state. The area contains both forest and non-forest land. Out of total lease area, 66.671 ha comes under forest land which falls under “DLC Forest” and rest 0.915 ha area is under non-forest area. The mining lease area is approachable from Koira town covering a distance of 8 km by Bhadrasahi – Rourkela NH – 520. The area can also be approachable from Tensa town ship which is at a distance of 2 km. Nearest Railway Station is at Barsuan (Both Passenger and goods train). The leasehold area falls under Survey of India Toposheet No. 73 G/1 and is delineated between latitude $21^{\circ}52'35.45''$ N to $21^{\circ}52'3.18''$ N and longitude $85^{\circ}11'4.11''$ E to $85^{\circ}10'32.80''$ E. The lease area presents an undulating topography. The highest and lowest elevation is 835m and 635m above M.S.L. respectively.

2.2 Geology: The geological formations of this region represent a part of eastern limb of famous horse-shoe shaped, Synclinorium of Pre-Cambrian age. The general strike of the formation is NNE-SSW and dip towards NW. The various litho-units occurring in this region include Granite, Dolerites, Gabbro Anorthosites, Ultramafic intrusions, Quartzite, Conglomerates, BHJ, BHQ and Iron ore formations.

The available field studies conducted indicates that the local structural elements are compatible with the general regional trend of the western limb of the synclinorium. The main rock types found in this mine are BHQ, Hematite (Massive, Laminated and as float ores), Conga and ferruginous laterite. In the ML area, iron ore found as mainly hard massive and laminated variety. The strike varies from N300E – S300W to N550E – S550W. The dip is generally westerly but varying from 400 to 550 and in few isolated locations the dip amount is 700. These normally conform to the regional trend of the rock i.e. BHQ/BHJ.

Lithological successions

The lithological succession established as observed within the leasehold area are compatible with other locations on the western limb of the synclinorium. The general lithological succession is as follows –

- Alluvium
- Ferruginous Lateritic float ore
- Massive / Laminated in-situ ore
- BHQ / BHJ / Shale

Control of mineralization

The possible parameters of control of mineralization may be attributed to

- a) Regional and local tectonics
- b) Leaching and metasomatic replacement of BHQ and there by leading to iron ore formations, as evidenced by the presence of un-leached portion of the ore and BHQ in the ore body.

Effects of Weathering

The weathering has led to the formation of Laterite, which is highly erratic in nature, hence irregular/discontinuous pockets of Laterite is a common feature in the iron ore deposits.

Description of rock types

The main rock types such as Laterite, BHQ & Hematite found in Raikela Iron Ore Mines of M/s Geetarani Mohanty are of iron ore series of Singhbhum.

- (i) Laterite - The Laterite is reddish, brown, porous, concretionary material. It is exposed in the eastern section of the Raikela Iron Ore Mines whereas Brecciated Laterite (conga) is found in the north eastern part.
- (ii) Banded Hematite Quartzite (BHQ) - BHQ is found in the east covers a small area. Banded hematite quartzite is found as big boulders. Alternate band of hematite and quartzite is the main characteristic of BHQ. The BHQ is very hard to disintegrate the hematite portion.
- (iii) Hematite (Iron Ore) - Hematite is a massive and steel gray color ore ranging from 55% to 65% Fe. Porous laminated variety is also available ranging from low to medium grade

of iron content. Iron ore found within the M.L. area is of massive, hard and soft laminated variety.

2.3 Method of Mining

Presently the production of ROM of the mine is 5.988 million tonnes per annum. Mining is carried out with the help of deployment of HEMM in conjunction with deep hole drilling blasting and processing of ROM to suitable sizes. The average height and width of benches are maintained at 10 meters. Drilling is carried out with 115mm diameter drill bits with average depth of 11 meters. Blasting is done with 83mm diameter cartridge and delay is being used. The haul roads are maintained properly as per the DGMS guidelines. The Crushing and screening of ROM is carried out with the help of fixed crusher and mobile crushing and screen plants deployed within lease area.

It has been planned to enhancement of production from 5.988 MTPA to 6.89 MTPA of iron ore per annum. During ensuing plan period, the existing quarries i.e. Top pit and south pit have been selected for development. The lessee will obtain Environment Clearance for the production of 6.89 million ton of ROM per annum. During the plan period it has been planned to develop the Top quarry from one end i.e. from the safety zone boundary to RL 635 and south pit to be developed up to ultimate pit limit. The existing benches of the top pit and south pit will be developed both laterally and depth ward. The lateral bench movement will be done due west and south -west direction.

The benches will be developed in a systematic manner with 10m height and 10m width. The layout of roads for haulage of ore/ waste and access to different locations in the mine will be developed complying with the statutory regulations stipulated in the Metalliferous Mines Regulations, 1961.

2.4 Structures beyond 100 m and within 500 m

There are structures lying beyond 100 m and within 500 m as shown in Table 1 which needs to be protected using controlled blasting within permissible limit as per DGMS circular Tech 7 of 1997:

Table 1. Structures beyond 100 m and within 500 m

Type of structures	Name of village	Distance from mines boundary/Controlled blasting zone to villages	Vibration limit corresponding with established natural frequency
HOUSE WITH CEMENT AND BRICK	TENSA	110M	Considered as per DGMS norm
	TENSA	240M	Considered as per DGMS norm

Elements of building construction acts as mass-spring systems, each with its own natural frequencies of about 4-24 Hz (low frequency). When the low frequency ground vibration

coincides with the natural frequency of the structure, resonance is originated. The resonance is a state in which the structure absorbs most energy progressively becoming deformed with the time, until plastic deformation occurs. Therefore, even the low peak particle velocity of ground vibration at natural frequency of structure is more harmful to the structure. Natural frequencies of kuchaa mud house, brick and concrete structure generally vary from 8-16 Hz. The vibration limit was considered with established natural frequency of structures as per DGMS Circular no. Tech 7 of 1997.

3.0 GROUND VIBRATIONS AND AIR OVERPRESSURE

3.1 Generation of Ground Vibrations

When an explosive charge detonates, intense dynamic waves are set around the blast hole, due to the sudden acceleration of the rock mass. The energy liberated by the explosive is transmitted to the rock mass as strain energy. The transmission of energy takes place in the form of waves. The energy carried by these waves crushes the rock, which is in the immediate vicinity of the hole, to a fine powder. The region in which this takes place is called the shock zone. The radius of this zone is nearly two times the radius of the hole. Beyond the shock zone, the energy of the waves gets attenuated to some degree which causes the radial cracking of the rock mass. The gas generated as a result of detonation enters into these cracks and displaces the rock further apart causing its fragmentation. The region in which this phenomenon takes place is called the transition zone. The radius of this zone is twenty to fifty times the radius of the hole. As a result of further attenuation taking place in the transition zone, the waves although cause the generation of the cracks to a lesser extent but they are not in a position to cause permanent deformation in the rock mass located outside the transition zone. If these attenuated waves are not reflected from a free face, then they may cause vibrations in the rock. However, if a free face is available, the waves reflected from a free face cause further breakage in the rock mass under the influence of the dynamic tensile stress.

3.2 Ground Vibration Waves

Blast-induced ground vibrations, which are propagated in rock, can be divided into three categories:

- i. Compression waves
- ii. Shear waves
- iii. Rayleigh waves.

The motion of the ground particle takes place in three perpendicular directions viz. vertical, longitudinal, and transverse directions. For the compression wave, the particle moves along the direction of propagation (longitudinal), while the shear wave moves across this direction (transverse). The Rayleigh waves have elliptical particle movements in the vertical plane (vertical). The particles rotate backward in this plane.

The propagation velocity for the different wave types is dependent on the elasticity and density of the medium. Typical velocities for shear waves in rock vary from 2000-4000 m/s correspondingly for compression waves 3000-6000 m/s. For inhomogeneous and stratified rocks, the propagation of wave energy is complicated. During unfavorable conditions

resonance and focusing, effects may be created by the interference of incoming and reflecting waves. Under such conditions, the vibrations may increase and not decrease when the distance from the blast source gets larger.

The three important wave characteristics, which are significant for blast damage are amplitude, frequency, and duration. The amplitude, acceleration, peak particle velocity or displacement, depend on detonating charge, length of the charge, confinement, damping conditions in the ground, the building response, and the distance between the object and the blasting site. Concerning ground conditions and building response, nothing can be done. Earlier peak particle velocity was the sole criterion for the ground vibration standards. However, after the role of frequency in the damage to the structures became known, it is now common to prescribe maximum permissible peak particle velocity along with a corresponding frequency. Fig 1 shows a pictorial representation of the various zones and the phenomenon of reflection of waves.

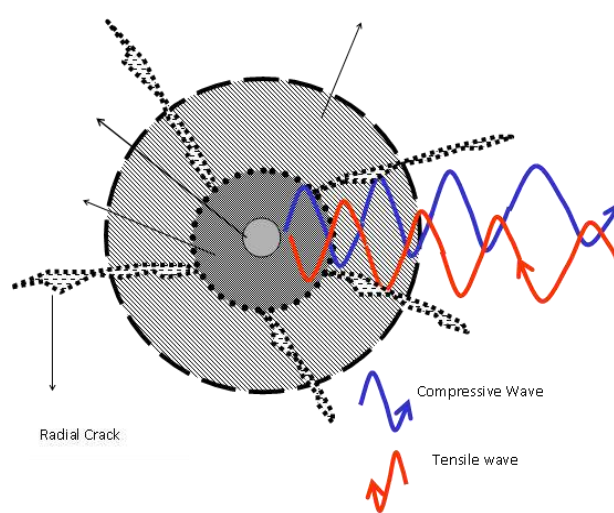


Figure 1. Pictorial representation of the various zones and the phenomenon of reflection of waves

Prediction of Ground Vibrations

A number of investigators have studied ground vibrations from blasting and have developed theoretical analysis to explain the experimental data. The energy released is considered to be proportional to the square root of charge. Earlier studies on wave propagation showed that the amplitude of particle displacement can be given by:

$$A = K \frac{Q^{0.5}}{D}$$

Where K is site constant; D is the distance from blasting site to vibration monitoring station and Q is the charge per delay.

Assuming the cylindrical explosive geometry for long cylindrical charges, researchers

working on blast-induced ground vibrations concluded that any linear dimension should be scaled with the square root of the charge weight. Blasts should be scaled to the equivalent distance, which is the actual distance divided by the square root of the charge per delay as follows:

$$(SD = \frac{D}{\sqrt{Q}}).$$

Where D is various distances (m) from blasting site and Q is charge per delay (kg) used. SD is the scaled distance.

The corresponding relation known as USBM predicting equation takes up following form:

$$(A = K \frac{D}{Q^{0.5}})$$

Where, K and β are site-specific constants, which depend on local geology and ground characteristics and other terms have their usual meanings. The USBM predicting equation is used in India for calculating maximum safe charge per delay for different distances according to the standards fixed by DGMS. The value of K and β are determined by regression analysis of the data generated by trial blasts in terms of A, D and Q.

3.4 Damage Criteria

The damage criteria were proposed by many organizations including USBM and DGMS. Based on the permissible PPV in mm/s and frequency of the ground vibrations in Hz for various types of structures as per DGMS Circular no. Tech. 7 of 1997 as presented below in Table 2 is followed to estimate safe charge per delay and safe charge per round to keep the ground vibrations within the safe limits in Indian geo-mining conditions.

Table 2. Permissible Peak Particle Velocity (PPV) at the foundation level of structures in Mining Areas in mm/s as per DGMS Circular no. Tech 7 of 1997

Type of structure	Dominant excitation Frequency, Hz		
	<8 Hz	8-25 Hz	>25 Hz
(A) Buildings/structures not belong to the owner			
(i) Domestic houses/structures (kuchha brick & cement)	5	10	15
(ii) Industrial Buildings (RCC & Framed structures)	10	20	25
(iii) Objects of historical importance & sensitive structures	2	5	10
(B) Buildings belonging to owner with limited span of life			
(i) Domestic houses/structures (kuchha, brick & cement)	10	15	25
(ii) Industrial buildings (RCC & framed structures)	15	25	50

3.5 Parameters Influencing Propagation and Intensity of Ground Vibrations

The parameters, which exhibit control on the amplitude, frequency, and duration of the ground vibration, are divided into two groups as follows:

- i. Non-controllable Parameters

ii. Controllable Parameters

The non-controllable parameters are those, over which the Blasting Engineer does not have any control. The local geology, rock characteristics, and distances of the structures from the blast site are non-controllable parameters. The controllable parameters are those over which the Blasting Engineer has control. The amount of explosive per delay, stemming height, spacing, burden, and depth of the hole, are controllable parameters.

3.6 Air-Overpressure

Pressure waves emanated in the atmosphere by the detonating charge are called air-overpressure/noise. The air overpressure is calculated in dB (L) or Pa. The frequency of the pressure waves in the range of 20 Hz to 20 kHz is in the audible range. The intensity of noise depends upon the quantity of the charge and its confinement.

The principal sources of air-over pressure are:

- i. Detonation of unconfined charges.
- ii. Too short stemming or improper stemming material
- iii. Venting of high-velocity gases through poorly designed blasts.

The dB (L) is calculated by the following formula:

$$dB = 20 \log(P/P_0)$$

Where P is the measured pressure and P_0 is the reference pressure of 0.00002 Pa.

At present, we don't have any standards regarding levels of air-over pressure. However, types of the damage that occurs by air overpressure (as established by different researchers) is reproduced in Table 3.

Table 3. Types of Damage Due to Air Overpressure

Structural Damage	Value in dB-L
Plaster Cracks	180
Loose window sash rattles	176
Failure of Badly Installed Window Panes	140-145
Failure of Correctly Installed Window Panes	Over 168
All Window Panes Fail	176

Based on the USBM Standard for surface mining (RI 8485) as given in Table 4&5, the air overpressure level of 134 dB(L) has been considered a safe limit for large-scale surface mine blasting. Table 6 shows the Central Pollution Control Board (CPCB) permissible levels for noise exposure in work zone areas, India's permissible levels for noise exposure in work zone areas as prescribed under the Model Rules of Factories Act, 1948.

Table 4: Air Overpressure limits by USBM for surface mining (RI 8485)

134 dB	0.1 Hz high pass measuring system
133 dB	2.0 Hz high pass measuring system

129 dB	6.0 Hz high pass measuring system
105 dB	C-slow weighing scale on a sound level meter
(Events less than or equal to 2-sec duration)	

Table 5: Typical air overpressure criteria (Oriard, 2002)

171 dB	General window breakage
151 dB	Occasional window breakage
140 dB	Long-term history of application as a safe project specification
134 dB	Bureau of Mines recommendations following a study of large-scale surface mine blasting

Table 6: Central Pollution Control Board permissible levels for noise exposure for work zone area

Peak sound pressure in dB(L)	Permitted number of impulse or impact/day
140	100
135	315
130	1000
125	3160
120	10000

4.0 DRILLING & BLASTING

Drilling and blasting are important aspects of open pit mining which needs to be optimized. The mine is being worked by mechanized drilling and blasting method. The details of the drilling and blasting operation are explained as follows:

4.1 Drilling:

The average height and width of benches are maintained at 10 meters. Drilling is carried out with 115mm diameter drill bits with average depth of 11 meters as per drilling pattern in attached Annexure-I

4.2 Blasting:

The trial blasting was accomplished with the use of cartridge explosives of 83mm diameter and proper delay interval. The blasting pattern adopted for each trial blast is shown in Annexure –I. The blast induced vibration monitoring event report is shown in Annexure-II.

5.0 TRIAL BLASTS DESIGN AND MONITORING

The primary objective is to optimize the blasting pattern, ultimately leading to the design of controlled blasting techniques aimed at safeguarding structures. In Raikela ore Mine, a series of 24 trial blasts were conducted at the mine site, adhering to the guidelines set forth by the Directorate General of Mines Safety (DGMS). The trial blast location in mine is shown in Figure 2. The staggered trial blast design pattern practiced in mine is shown in Figure 3. The blast vibration was monitored with a Seismograph Minimate instrument at the mine. The distance between blast site and monitoring station was calculated using GPS co-ordinates and blast induced vibration (Peak Particle Velocity) was measured using Seismograph.

The details of 24 trial blasts with 37 vibration monitoring data were compiled in Table 7.

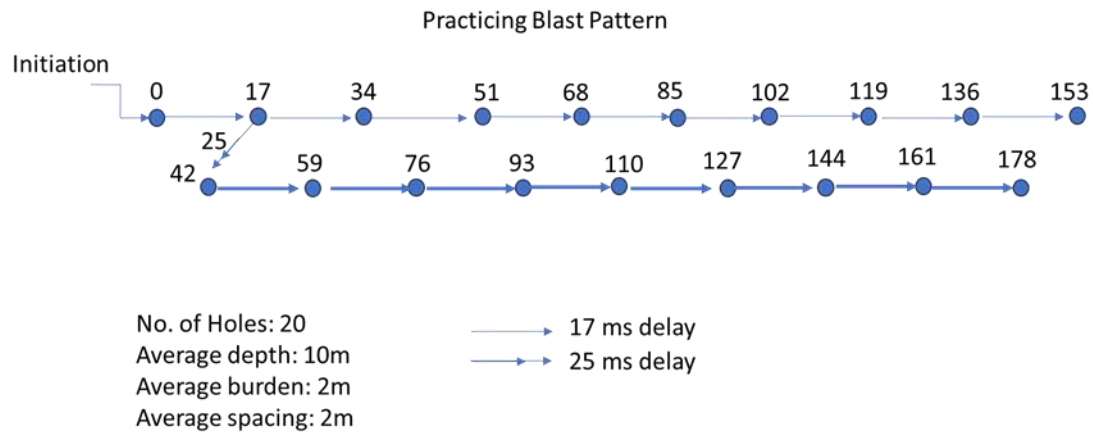


Figure 3. Blasting Practices in Raikela Iron Ore Mines

Table 7: Trial blasts data used for regression analysis

Sl. No.	Date	Name of Area	No. of Rows	No. of Holes	Avg. Depth (m)	Burden (m)	Spacing (m)	Total Charge (kg)	Average Charge Per Hole (kg)	Max. Charge Per Delay (kg)	Distance From Blasting Point (m)	PPV (mm/s)			AOP (dB)	Scaled Distance	Dominant PPV (mm/s)	Dominant Frequency (Hz)	Fly Rock Distance (m)
												Tran	Vert	Long					
1	07.02.2026	750RL&760RL	5	200	10.0	2	2	5925	29.6	29.6	103	1.214	1.860	1.639	79	18.9	1.86	6.9	≤10
2	13.02.2026	660&670RL	5	106	10.0	2	2	3075	29.0	29	155	5.620	4.225	4.177	88	28.8	5.620	22	≤10
3	13.02.2026	760RL	2	35	8.0	1.5	1.5	1000	28.6	28.6	114	2.908	2.104	2.845	85	21.3	2.908	9.9	≤10
4	16.02.2026	670RL	3	66	8.0	2	2	2100	31.8	31.8	290	1.222	1.663	1.111	81	51.4	1.663	12.2	≤10
5	16.02.2026	740RL	2	73	10.0	2	2	1900	26.0	26	215	3.011	3.720	3.468	79	42.1	3.720	4	≤10
6	18.02.2026	Old Office Area	3	80	5.0	2	1.5	950	11.9	11.9	196	0.843	0.670	1.230	103.8	56.9	1.23	47	≤10
7	18.02.2026	Old Office Area	3	80	5.0	2	1.5	950	11.9	11.9	165	0.039	0.047	0.039	111	47.9	0.047	100	≤10
8	18.02.2026	750RL	2	105	9.0	2	2	2925	27.9	27.9	200	5.029	3.279	6.897	96	37.9	6.897	14.4	≤10
9	20.02.2026	660RL	3	81	10.0	2	1.5	2250	27.8	27.8	168	4.138	2.499	4.138	99	31.9	4.138	41	≤10

10	20.02.2026	660RL	3	81	10.0	2	1.5	2250	27.8	27.8	139	3.783	3.082	0.047	103	26.4	3.783	32	≤10
11	20.02.2026	760RL	2	96	9.0	2	2	2325	24.2	24.2	135	7.196	2.270	7.464	104	27.4	7.464	16	≤10
12	23.02.2026	730RL	4	81	8.0	2	2	2475	30.6	30.6	360	1.419	1.876	0.78	97	65.1	1.876	3.5	≤10
13	23.02.2026	730RL	4	81	6.0	2	2	2475	30.6	30.6	328	0.835	1.356	4.839	135	59.3	4.839	5.2	≤10
14	23.02.2026	730RL	3	39	10.0	2	2	1250	32.1	32.1	237	0.678	1.103	0.670	93	41.9	1.103	5.8	≤10
15	23.02.2026	730RL	3	39	10.0	2	2	1250	32.1	32.1	265	1.033	0.749	4.430	130	46.8	4.430	6.6	≤10
16	23.02.2026	750RL	2	37	8.0	2	2	825	22.3	22.3	190	0.071	0.071	4.422	131	40.2	4.422	1	≤10
17	25.02.2026	760RL	2	66	10.0	2	2	2175	33.0	33	246	0.938	1.647	0.946	90	42.9	1.647	7.9	≤10
18	25.02.2026	760RL	2	66	10.0	2	2	2175	33.0	33	177	0.110	0.142	0.118	135	30.8	0.142	8	≤10
19	25.02.2026	750RL	3	52	7.0	2	2	1175	22.6	22.6	229	1.608	2.987	2.010	95	48.2	2.987	4.9	≤10
20	25.02.2026	750RL	3	52	7.0	2	2	1175	22.6	22.6	181	0.055	0.071	0.063	134	38.1	0.071	9	≤10
21	27.02.2026	700RL (office area)	2	38	10.0	2	2	1050	27.6	27.6	178	2.152	2.428	1.687	100	33.9	2.428	11.1	≤10
22	27.02.2026	700RL (office area)	2	38	10.0	2	2	1050	27.6	27.6	118	2.743	3.397	1.183	107	22.4	3.397	6.9	≤10
23	27.02.2026	740RL	2	90	10.0	2	2	2775	30.8	30.8	169	3.058	3.302	4.745	100	30.4	4.745	8.5	≤10

24	28.02.2026	750RL	2	122	7.0	2	2	2075	17.0	17	66	2.948	3.736	4.311	103	16.0	4.311	10.7	≤10
25	28.02.2026	750RL	2	122	7.0	2	2	2075	17.0	17	197	0.055	0.055	0.047	110	47.8	0.055	51	≤10
26	28.02.2026	710RL (office area)	2	37	10.0	2	2	1050	28.4	28.4	218	0.520	0.749	0.701	101	40.9	0.749	21	≤10
27	28.02.2026	710RL (office area)	2	37	10.0	2	2	1050	28.4	28.4	229	4.863	0.039	0.039	105	43.0	4.863	16	≤10
28	03.03.2026	720RL	2	84	10.0	2	2	2825	33.6	33.6	211	1.096	1.009	0.985	97	36.4	1.096	24	≤10
29	03.03.2026	760RL	6	50	3.0	2	2	250	5.0	5	85	2.097	1.671	1.892	92	38.0	2.097	1.6	≤10
30	06.03.2026	660RL (office area)	2	50	10.0	2	2	1400	28.0	28	169	1.616	3.239	1.387	113	31.9	3.239	13	≤10
31	06.03.2026	660RL (office area)	2	50	10.0	2	2	1400	28.0	28	182	1.884	0.047	0.047	108	34.4	1.884	34	≤10
32	06.03.2026	670RL (office area)	2	35	10.0	2	2	1000	28.6	28.6	291	0.370	0.386	0.575	91	54.4	0.575	114	≤10
33	06.03.2026	740RL	3	71	10.0	2	2	2225	31.3	31.3	202	4.122	2.861	3.168	111	36.1	4.122	10	≤10
34	10.03.2026	760RL	6	101	7.0	2	2	2175	21.5	21.5	86	10.01	7.37	7.756	111	18.5	10.01	8.4	≤10
35	10.03.2026	760RL	6	101	7.0	2	2	2175	21.5	21.5	65	3.066	5.58	7.086	114	14.0	7.086	7	≤10
36	10.03.2026	700RL	4	63	4.0	2	2	1150	18.3	18.3	79	3.752	3.042	5.084	109	18.5	5.084	17	≤10
37	10.03.2026	700RL	4	63	4.0	2	2	1150	18.3	18.3	72	10.66	0.055	0.055	108	16.9	10.66	10	≤10

6.0 OBSERVATIONS AND ANALYSIS

6.1 Observations

Details of monitoring distance, PPV, Air Over Pressure, etc. during experimental trial blasts are shown in Table 7. The blast vibration was monitored with Seismographs at the mine. The blast result was also assessed in terms of ground vibrations, its frequency; air overpressures produced, and fly rock. The seismograph was installed at a predetermined distance in the range of 65 to 360 m from the blast site to the monitoring station to monitor the ground vibrations generated from the blast. The fly rock, fragmentation, and muck pile tightness were assessed qualitatively using visual inspection. The peak particle velocity (PPV) was measured for experimental blasts with respect to the distance from the blast site to the monitoring station with varying charges per delay. Air overpressures measured in the above trial blasts were in the range of 79 to 135 dB(L), which is within the damage limits (as per standards) of any structure. The observed data as shown in Table 7 are analysed in terms of statistical parameters as shown in Table 8.

Table 8. Analysis of blast monitoring Data

Parameters	Class Interval	No. of Event	Remarks
Maximum Charge Per Delay, Q, kg	11.9-20	07	Majority of event utilized more than 20 kg of MCPD
	20-33.6	30	
PPV, mm/s	≤ 5	30	Most of events represented vibration less than 5 mm/sec
	>5-10	07	
Distance, m	<100	06	Most of the events represented monitoring data in range of 100- 200m
	100-200	18	
	200-400	13	
Dominant Frequency, Hz	<8	12	Most of events was measured with the range of 8-25 Hz of frequency
	8-25	18	
	>25	05	
AOP (Air Over Pressure), dB (L)	79-120	33	Most of events belongs in the range of 85-120 dB(L).

The findings revealed an intriguing trend: when maintaining a consistent charge per delay, ground vibration exhibited a decreasing pattern with increasing distance. highlighting the intricacies of the charge/delay relationship and its impact on ground vibration.

The number of trial blast conducted within 100m of monitoring station is limited, but it is sufficient for developing prediction equation. Rigorous monitoring of the blasting operations ensured, and a comprehensive statistical analysis of Peak Particle Velocity (PPV) was undertaken. This data is compiled based on both frequency and the charge/delay relationship.

6.2 Analysis

In the comprehensive study of ground vibrations resulting from experimental blasts conducted at the above mine site, a network of ground vibration monitoring stations was strategically placed at distances ranging from 65 to 360 meters from the blast site. The experimental blasts were systematically carried out. To enhance safety measures and mitigate potential damage at different distances from the blast site, a regression analysis was employed. The blast hole diameter used in each trial blast is 115mm and the fly rocks distance was observed for each blast within 10m.

The results of the regression analysis, depicted in Fig 4, aimed to predict a safe maximum charge per delay that would confine ground vibrations within acceptable limits. This analysis was based on 20 monitored vibration data, each monitored data as shown in Table 7. The suggested charge per delay is documented in Table 9 and serves as a predictive tool for determining the charge per delay needed to maintain a Peak Particle Velocity (PPV) value of $\leq 5\text{mm/sec}$ for frequency range of $\leq 8\text{Hz}$. This predictive model is crucial for safeguarding structures in the vicinity of the mine, ensuring that ground vibrations remain within safe thresholds.

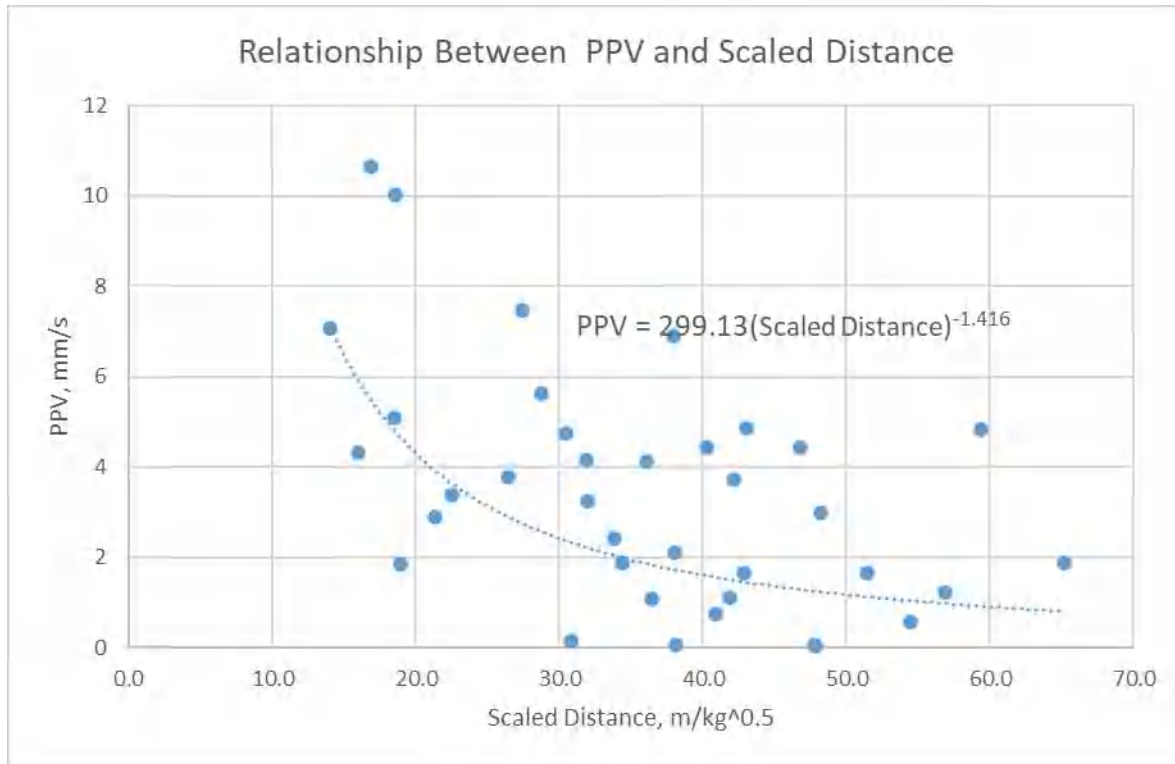


Figure 4. Regression analysis for estimation of safe charge per delay

In the observations, the maximum air overpressure recorded was less than the acceptable limit, which is within the safe limits as per standards. A regressions equation in terms of the scaled distance (D) and PPV (Peak particle velocity) was generated to represent the data for the

estimation of safe explosive charge per delay to keep the vibration level within the safe limits for Raikela Iron Ore Mines.

$$V = 299.13 \times \left(\frac{D}{\sqrt{Q}} \right)^{-1.416} \text{-----Eq. (1)}$$

Damage criteria vis-à-vis Buildings / Structures not belonging to the owner were considered for the design of a safe blast in the above geo-mining condition to contain the vibration levels less than or equal to PPV of 5 mm/sec (Frequency $\leq 8\text{Hz}$). The explosive charge per delay is estimated and is shown in Table 9 for containing the PPV of 5mm/s for ground vibration within the damage limit for various distances from the blast site. As the hutments are close to mine boundary, therefore, the estimation of the charges for restricting induced vibration in terms of PPV of 5mm/s is determined from Equation 1 derived from regression analysis which is for the reference.

Table 9. Estimated value of Maximum Charge Per Delay (kg) for containing PPV ≤ 5 mm/s for protection of structures nearby mine

Distance(m)	Maximum Charge per delay (kg) for containing PPV ≤ 5 mm/sec for frequency of $\leq 8\text{Hz}$
100	54
200	219
300	494
400	879
500	1373

As the estimated charge for distances from 100-500m is on higher side which is taken for the reference only. The diameter and depth of the hole and consequently, volume of hole were not taken into consideration in Equation 1. Therefore, the estimated charge cannot be accommodated in volume of the hole for the 115 mm diameter and 5-10 m depth.

The recommended Maximum Charge Per delay (MCPD) for distances (100-200m, 200-300m and 300-400m, 400-500m) considering diameter (115mm) and depth of the hole (5-10m), suitable stemming depth, and restricting the vibration limit to 5mm/sec is provided in Table 10 for implementing in controlled blasting.

Table 10: Recommended value of Maximum Charge Per Delay (Kg) for containing PPV ≤ 5 mm/s for protection of structures nearby mine

Distance (m)	Maximum Charge per delay (kg) for containing PPV ≤ 5 mm/sec for frequency of $\leq 8\text{Hz}$
100-200	15
200-300	20
300-400	25
400-500	35

6.3 Comparison of General Practice of Regular Deep Hole Blasting and Controlled Deep-Hole Blasting based on our Scientific Study:

The general practice of regular deep hole blasting and controlled deep-hole blasting based on our scientific study are compared and compiled in Table 11.

Table 11. Comparison of General Practice of Regular Deep Hole Blasting and Trial Blast Conducted for Deep-Hole Controlled Blasting

Parameter	Regular Deep-Hole Blasting (General Practice)	Controlled Deep-Hole Blasting (Raikela Iron Ore Mine Scientific Study)
Hole Depth	3-10m	3-10m
Burden	2.0m	2.0-2.5m
Spacing	2.0 to 2.5 m	2.0-2.5
Hole Diameter	115mm (DTH)	115 mm (DTH drill used)
Stemming Length	Around 70% of hole depth	Around 70% of hole depth
Charge per Hole	11.9-33.6 kg (depending on depth and geology)	20 kg for 100-200m 25 kg for 200-300m 30 kg for 300-400m 35 kg for 400-500m
Charge per Delay (MCPD)	11.9-33.6 kg	20 kg for 100-200m 25 kg for 200-300m 30 kg for 300-400m 35 kg for 400-500m
Explosive Type	Cartridge explosives	Cartridge explosives
Initiation System	NONEL with Electronic detonators for initiation	NONEL with Electronic detonators for initiation
Blasting Pattern	Regular staggered patterns with larger number of rows	Staggered patterns with limited rows (max up to 4) and tailored burden/spacing
No. of Holes per Blast	Often number of holes per blast is up to 200	Up to 150 holes per blast
No. of Rows	Up to 6	Up to 4

7.0 CONCLUSION AND RECOMMENDATIONS

The Conclusions and recommendations based on data gathered between February-March, 2026 in Raikela Iron Ore Mines for our scientific study are as follows:

7.1 Conclusions

Total 24 trial blasts with 37 monitored data were analysed and blasting parameters and vibrations were recorded. Based on the scientific study of data recorded and analysis performed, conclusions are as follows.

1. Ground vibration measured in terms of PPV are 0.047 mm/sec to 10.66 mm/sec.
2. While conducting trial blasts, suggested blasting pattern helped to keep the ground vibration under a safe limit as prescribed under DGMS Circular no. Tech 7 of 1997.
3. Air overpressures (79-135 dB(L)) are within damage limits for the controlled blasting pattern.
4. All trial blasts conducted during the experimental studies are safe concerning ground vibration, air overpressure, and fly rock.
5. The most dominant frequency for the trial blasts monitored are 8-25 Hz
6. The fly rock distances observed for each blast are within 10 m.
7. The recommended Maximum Charge Per Delay is provided for limiting the PPV $\leq$ 5mm as per DGMS norms.

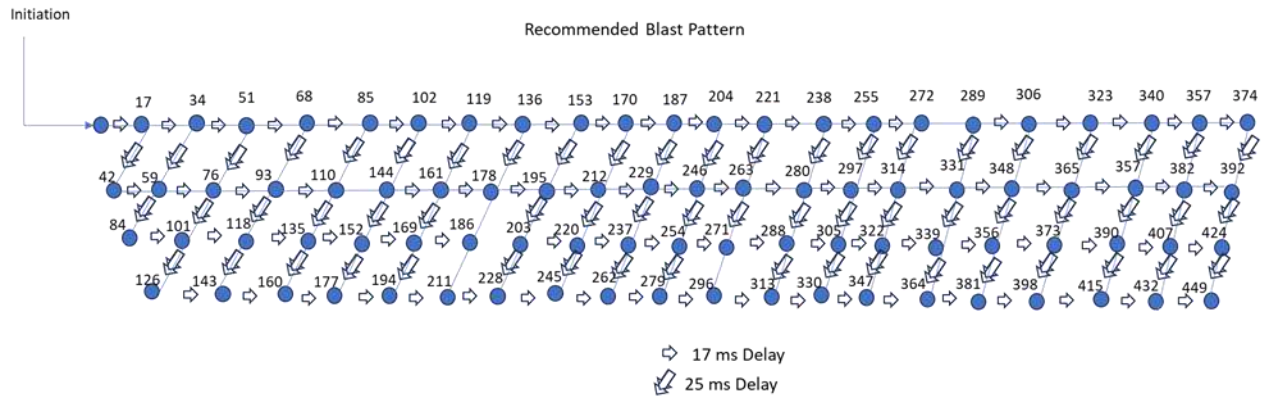
7.2 Recommendations

Recommended Drilling and Blasting Parameters: The recommended drilling and blasting parameters for deep hole blasting are shown in Table 12 to keep ground vibration within acceptable limit of 5mm/s as hutments are close to mine boundary/controlled blasting zone.

Table 12: Drilling and Blasting Parameters recommended for Raikela Iron Ore Mines

Blast Parameters/Distance, m	100-200	200-300	300-500
Hole Diameter, mm	115	115	115
Hole Depth, m	5/10	5/10	5/10
No. of Holes	100	130	150
Drilling Patterns	Staggered	Staggered	Staggered
Burden, m	2.0-2.5	2.0-2.5	2.0-2.5
Spacing, m	2.0-2.5	2.0-2.5	2.0-2.5
Top Stemming, m	2-3	2-3	2-3
Maximum Charge Per Hole, kg	15/20	20/25	30/35
Maximum Charge Per Delay (MCPD), kg	15/20	20/25	30/35
Maximum Charge Per Round, kg	1500/2000	2600/3250	4500/5250
Initiation system	Nonel with Electronic Detonator	Nonel with Electronic Detonator	Nonel with Electronic Detonator
Explosives Types	Cartridge explosives.	Cartridge explosives.	Cartridge explosives.
Rows per blast	2	3	4

Recommended Blast Patterns: The followings are the recommended blast patterns to protect the structures through controlled blasting to keep the vibration within acceptable limit of 5mm/s as hutments are close to mine boundary/controlled blasting zone.



No. of Holes: 86
Average depth: 5/10m
Average burden: 2.0m
Average spacing: 5.0m

ACKNOWLEDGMENTS

We would like to express our gratitude for the invaluable support received from dedicated officers of Raikela iron Ore Mines Raikela M/s Geetarani Mohanty, whose keen interest and insightful discussions greatly contributed to this study.

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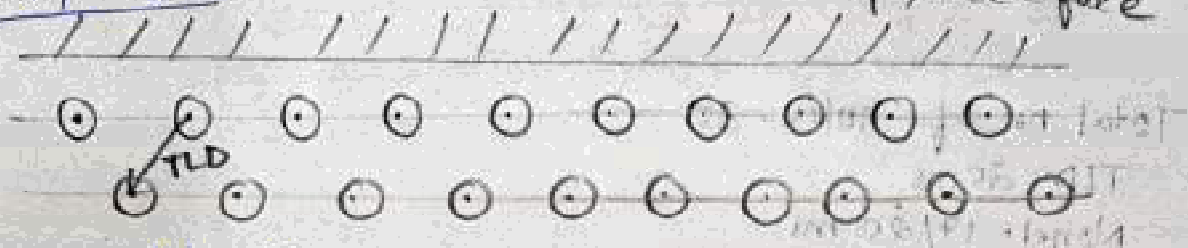
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Annexure-I

Date = 07/02/2026

Location - 760 RL

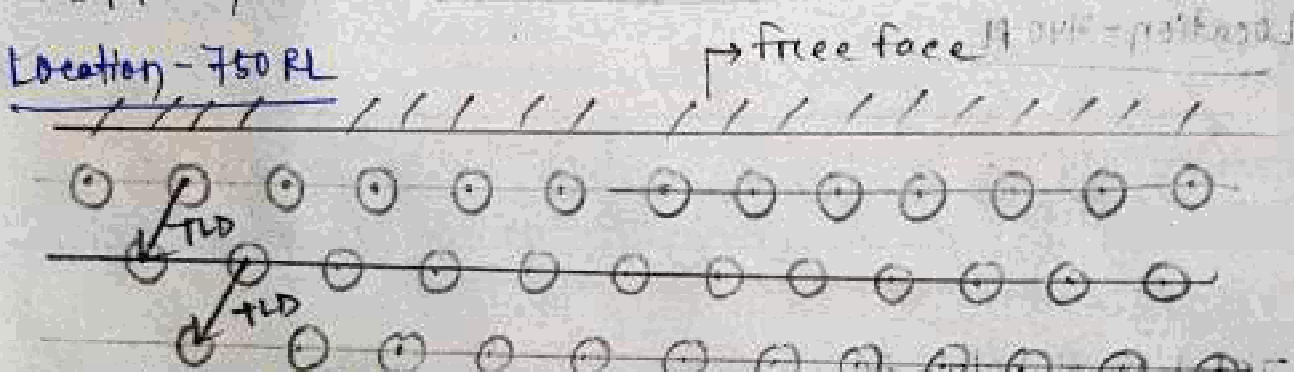


Total no. of holes = 20

TLD = 25 ms

None! = 17/250 ms

Location - 750 RL



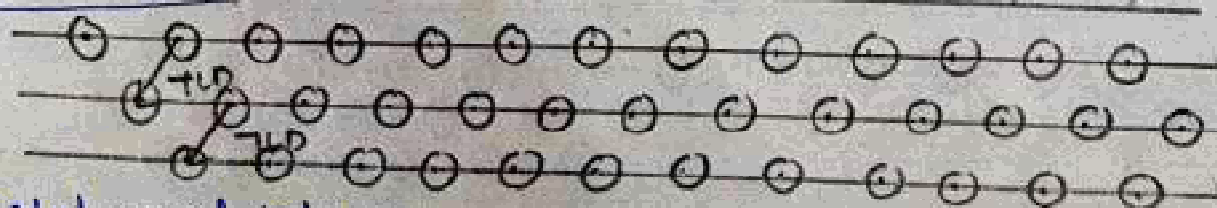
Total no. of holes = 180

TLD = 25 ms

None! = 17/250 ms

Date = 13/02/2026

Location - 660 RL

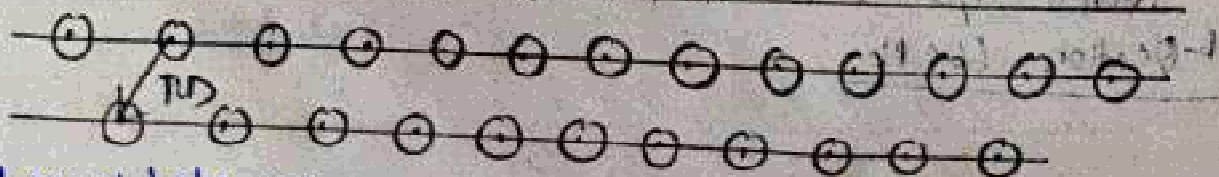


Total no. of holes = 61

TLD = 25 ms

None! = 17/250 ms

Location - 670 RL

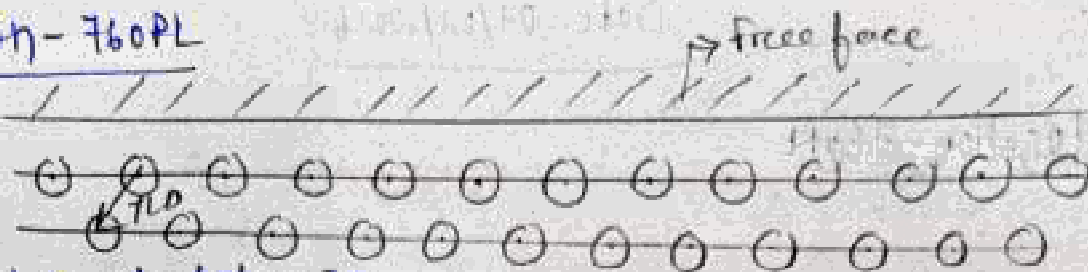


Total no. of holes = 56

TLD = 25 ms

None! = 17/250 ms

Location - 760 PL



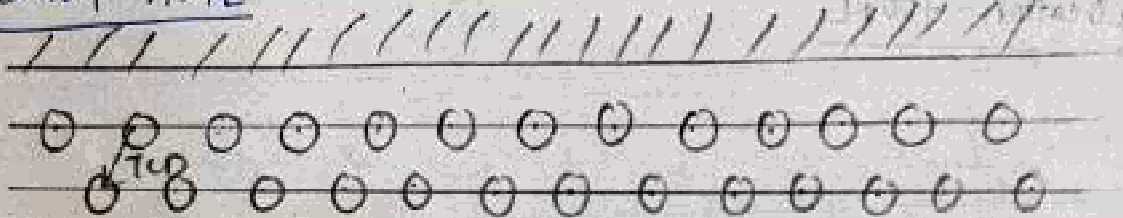
Total no. of holes - 35

TLD = 25 ms

None! = 17/250 ms

Date = 14/02/2026

Location - 740 PL



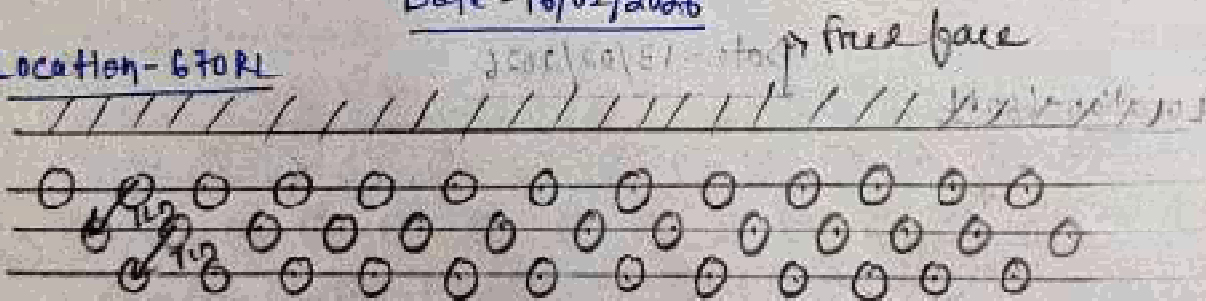
Total no. of holes - 70

TLD = 25 ms

None! = 17/250 ms

Date = 16/02/2026

Location - 670 PL

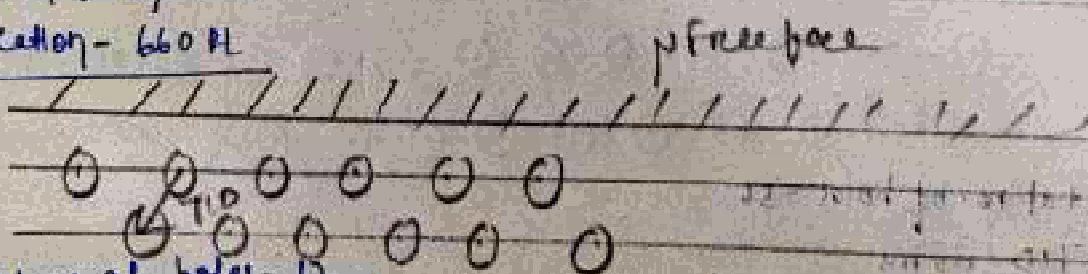


Total no. of holes - 66

TLD = 25 ms

None! = 17/250 ms

Location - 660 PL

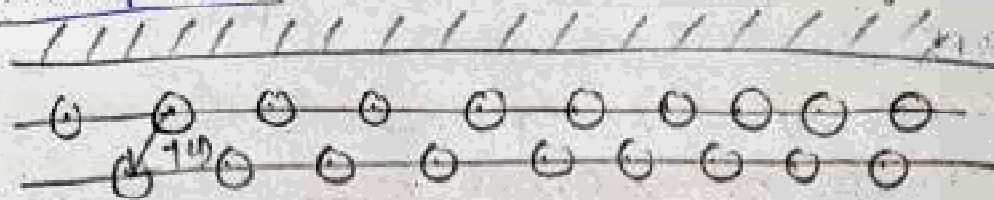


Total no. of holes - 12

TLD = 25 ms

None! = 17/250 ms

Location - 740 PL



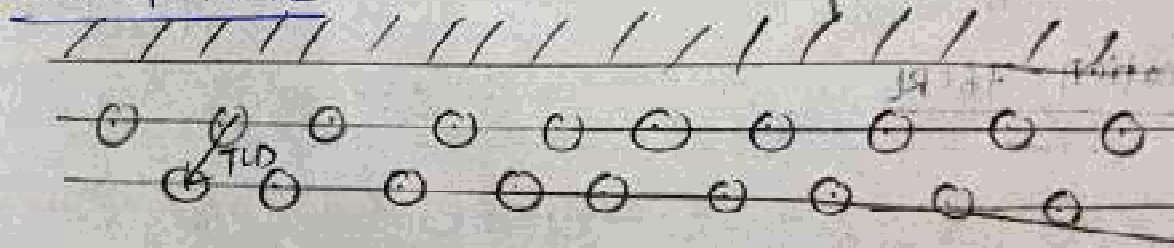
Total no of holes - 73

TLD = 25 ms

None! = 17 / 250 ms

Date - 18/02/2026

Location - 750 PL

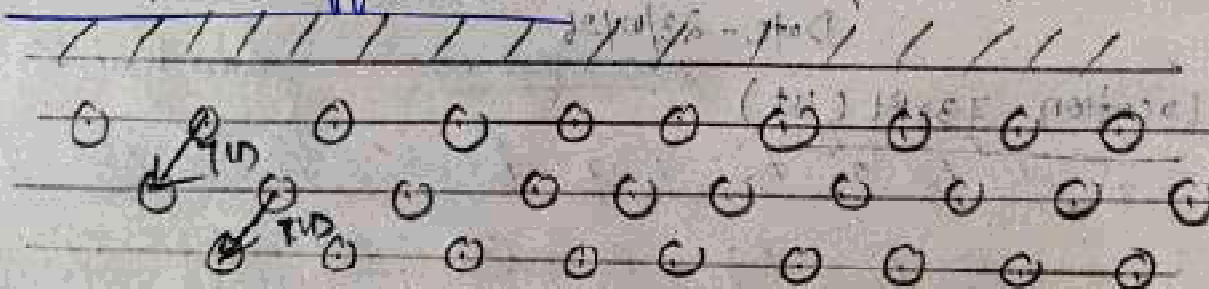


Total no of holes - 105

TLD = 25 ms

None! = 17 / 250 ms

Location - OLD office area



Total no of holes - 50

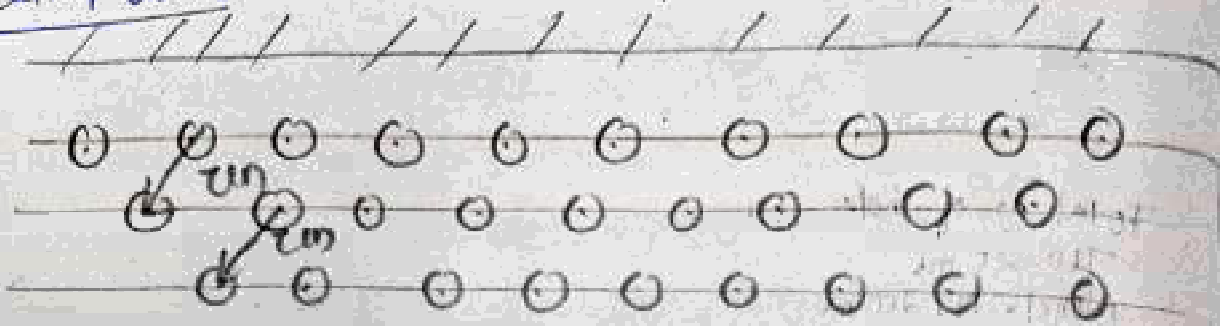
TLD = 25 ms

None! = 17 / 250 ms

Date - 20/2/26

Location - 660 RL

Free face



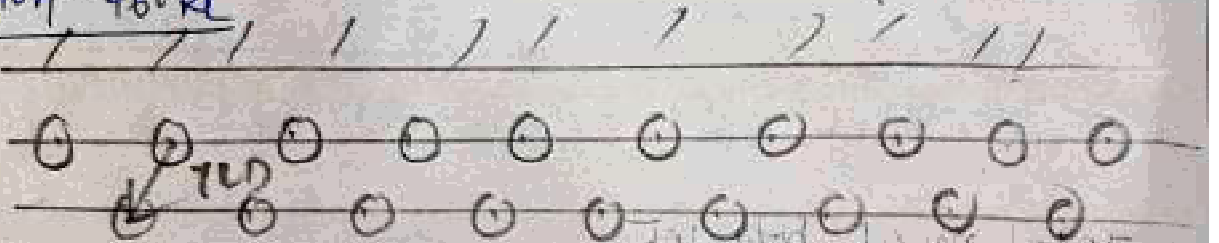
Total no. of holes - 81

TUN = 25 ms

Nomel = 17/20 ms

Location - 760 RL

Free face



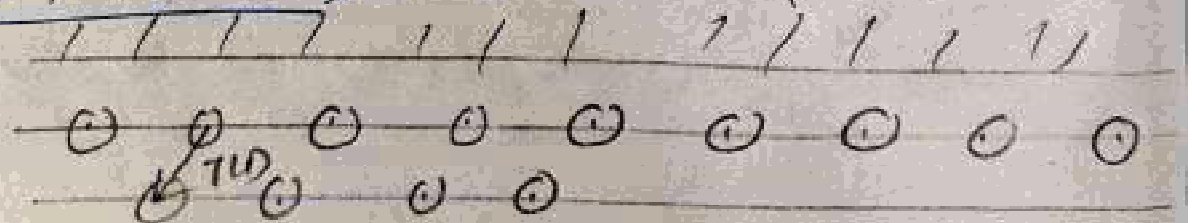
Total no. of holes - 96

TUN = 25 ms

Nomel = 17/20 ms

Location = 730 RL (1st)

Free face



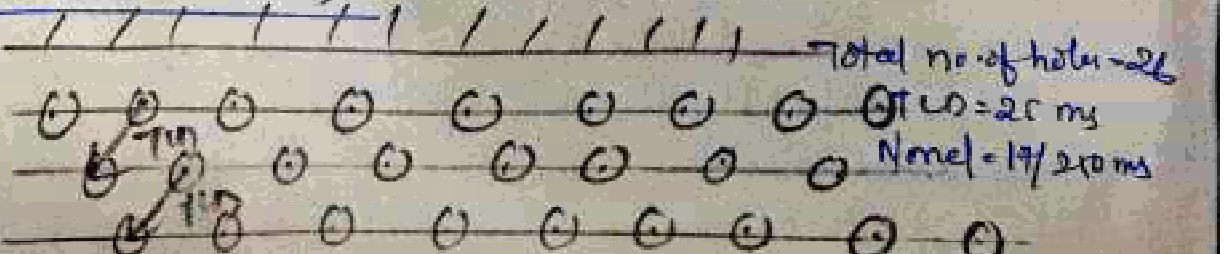
Total no. of holes = 13

TUN = 25 ms

Nomel = 17/20 ms

Location - 730 RL (2nd)

Free face

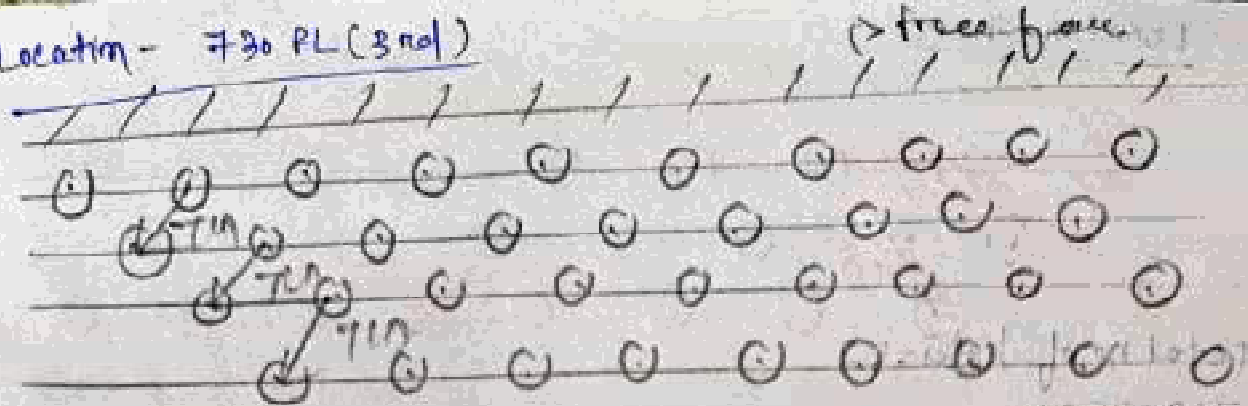


Total no. of holes = 26

TUN = 25 ms

Nomel = 17/20 ms

Location - 730 PL (3 no.)



no. 18 = 0.17

no. 05 / FI = 1.00/1.0

Total no. of holes = 81

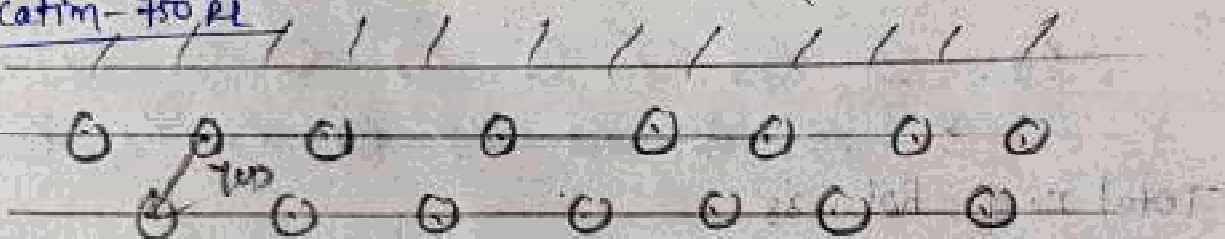
TLD = 25 ms

Nump = 17/200 ms

Date = 25/02/2023

free face

Location - 750 PL



no. 25 = 0.17

no. 05 / FI = 1.00/1.0

Total no. of holes = 37

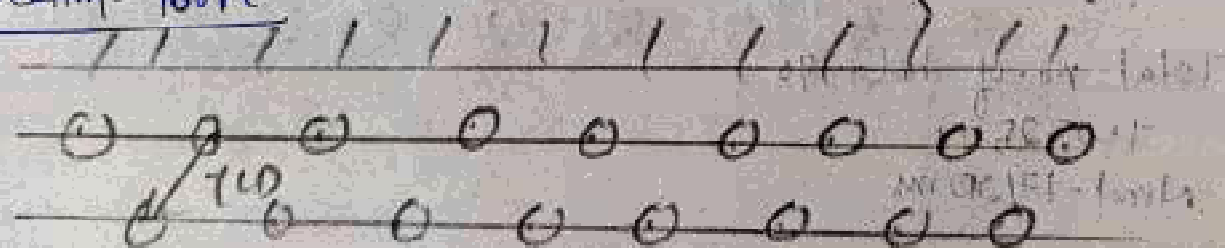
TLD = 25 ms

Nump = 17/200 ms

It is not a part of

Date = 25/02/2023

Location - 760 PL



no. 05 / FI = 1.00/1.0

Total no. of holes = 66

TLD = 25 ms

Nump = 17/200 ms

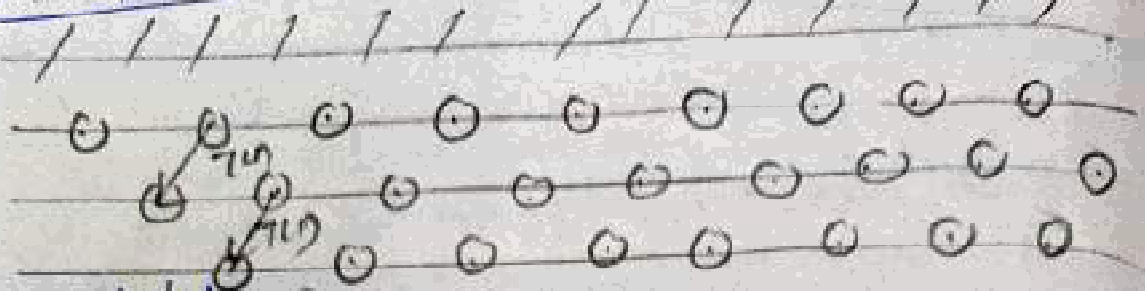
It is not a part of

for what to be taken

no. 25 = 0.17

no. 05 / FI = 1.00/1.0

Location = 750 PL



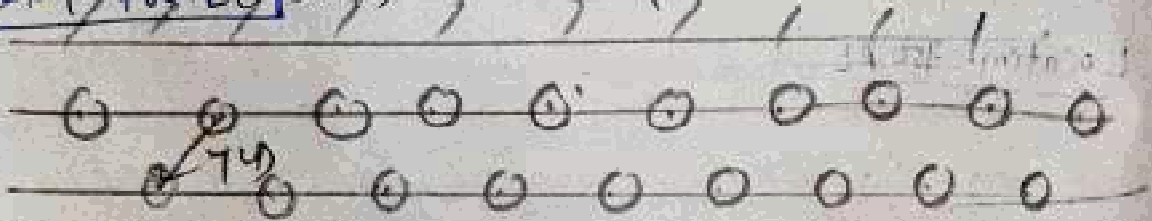
Total no. of holes = 52

TUD = 25 ms

Nomul = 17/200 ms

Date = 29/02/2021

Location = 700 PL (of carcer)

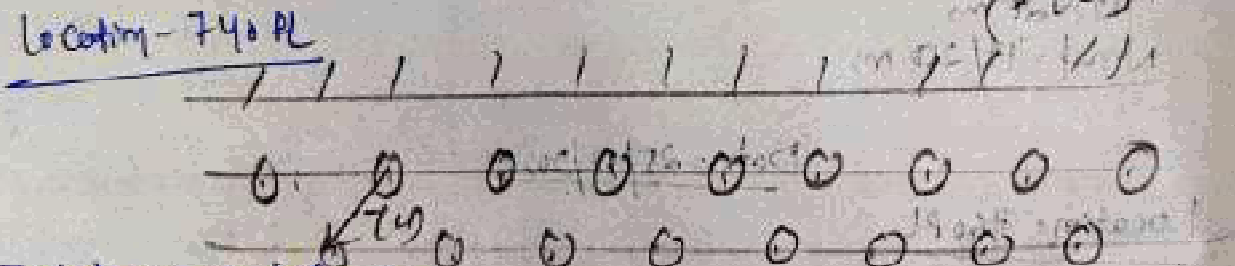


Total no. of holes = 38

TUD = 25 ms

Nomul = 17/200 ms

Location = 740 PL



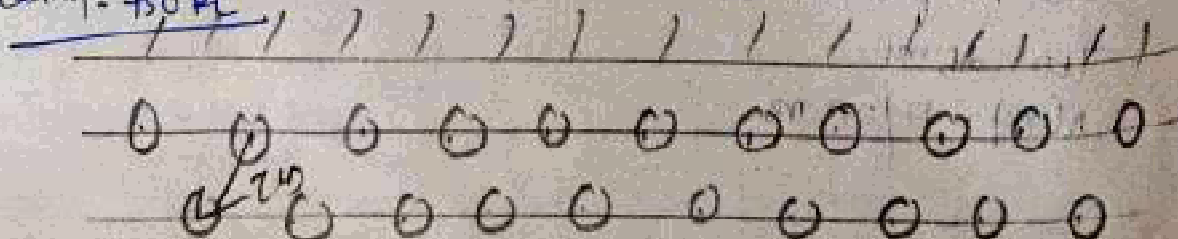
Total no. of holes = 90

TUD = 25 ms

Nomul = 17/200 ms

Date = 28/02/21

Location = 750 PL

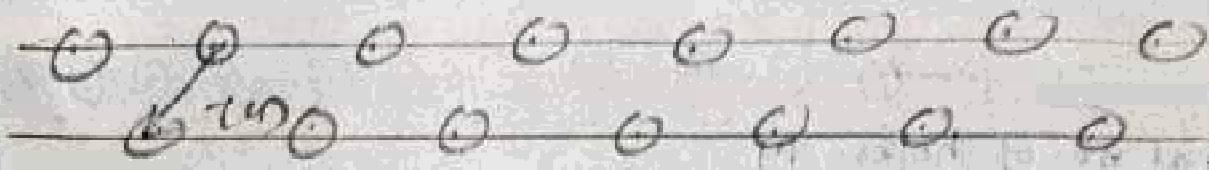


Total no. of holes = 122

TUD = 25 ms

Nomul = 17/200 ms

Location - 710 PL (safe area)



Total no of holes = 37

$T_{un} = 25 \text{ ms}$

$n_{hole} = 17/200 \text{ ms}$

Date = 03/03/2026

Location - 730 PL

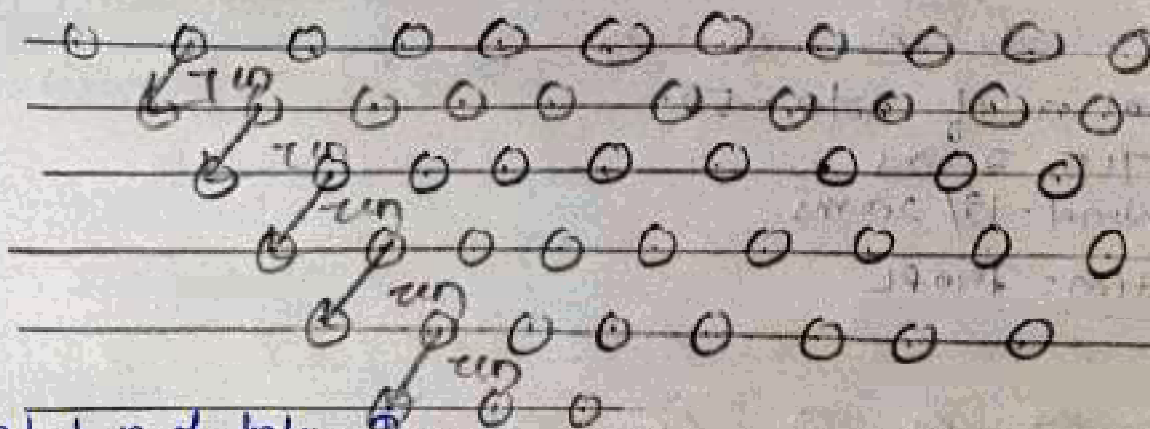


Total no. of holes = 84

$T_{un} = 25 \text{ ms}$

$n_{hole} = 17/200 \text{ ms}$

Location = 760 PL



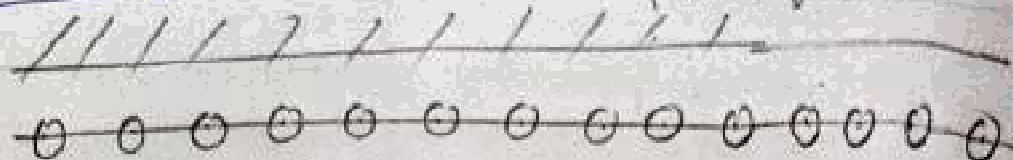
Total no of holes = 10

$T_{un} = 25 \text{ ms}$

$n_{hole} = 17/200 \text{ ms}$

Location - 670 PL

free face



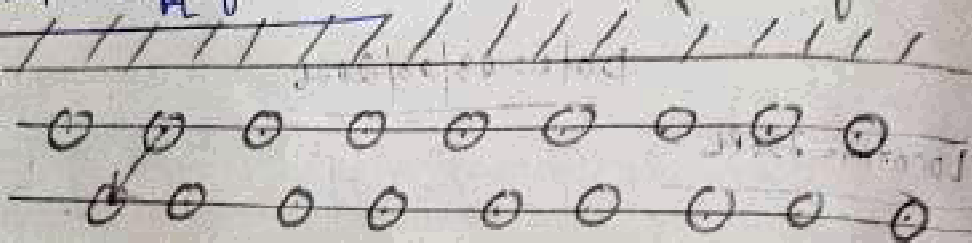
Total no. of holes = 14

Monel = 17/20 ms

Date = 06/03/2026

Location - 670 PL (of area)

free face



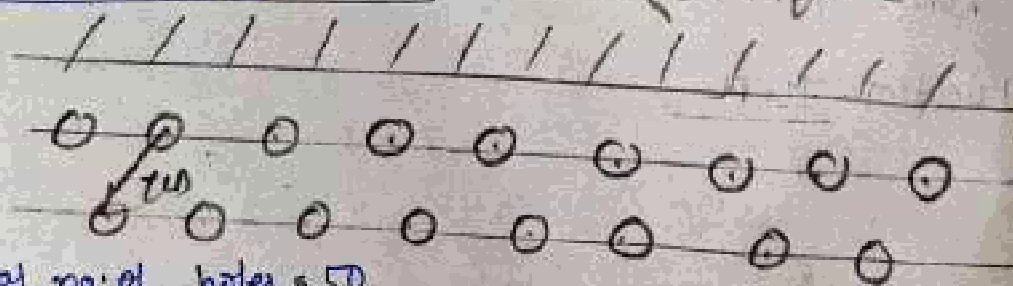
Total no. of holes = 35

$T_{UD} = 25$ ms

Monel = 17/20 ms

Location - 660 PL (of area)

free face



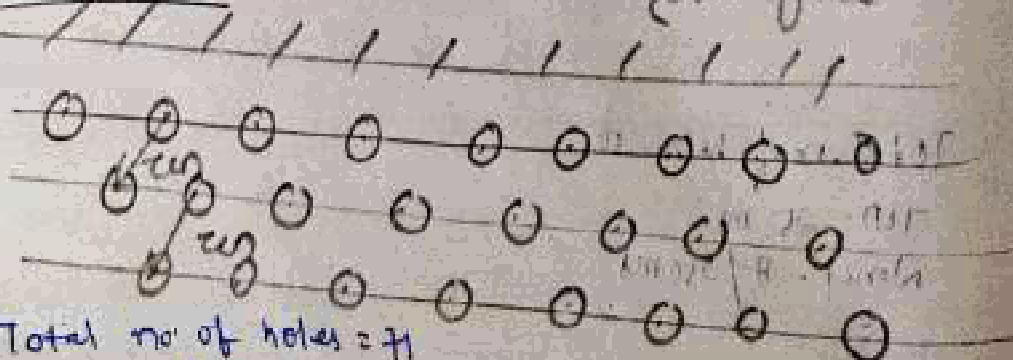
Total no. of holes = 50

$T_{UD} = 25$ ms

Monel = 17/20 ms

Location - 740 PL

free face



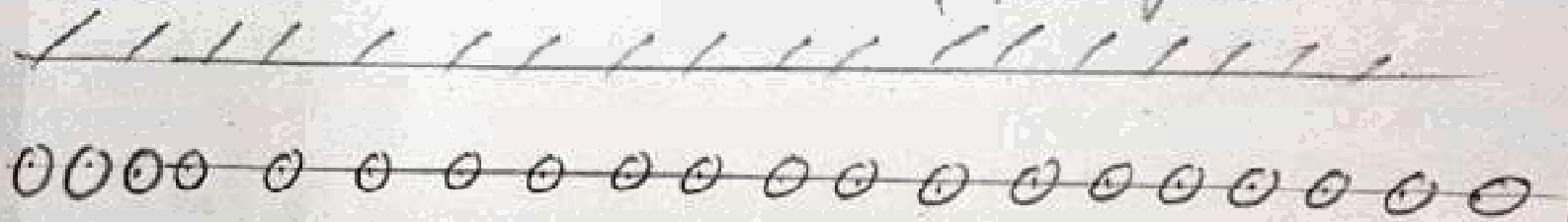
Total no. of holes = 71

$T_{UD} = 25$ ms

Monel = 17/20 ms

Location - 640 PL

Free face



Total no. of holes = 20

$TLD = 27 \text{ ms}$

$N_{me1} = 17 / 270 \text{ ms}$

Annexure-II



Event Report

Date/Time: Wed at 13:35:45 February 7, 2025
Trigger Source: Geo: 0.300 mm/s, Mic: 70.00 ps.(L)
Range: Geo: 254.0 mm/s
Record Time: 3.0 sec at 2048 sps
Operator/Setup: Operator/Extended notes :MMB

Serial Number: UM30000 V 10-80GC Micromate ISBE
Battery Level: 3.7 Volts
Unit Calibration: February 20, 2025 by UES New Delhi
File Name: _T1EMP (V)T

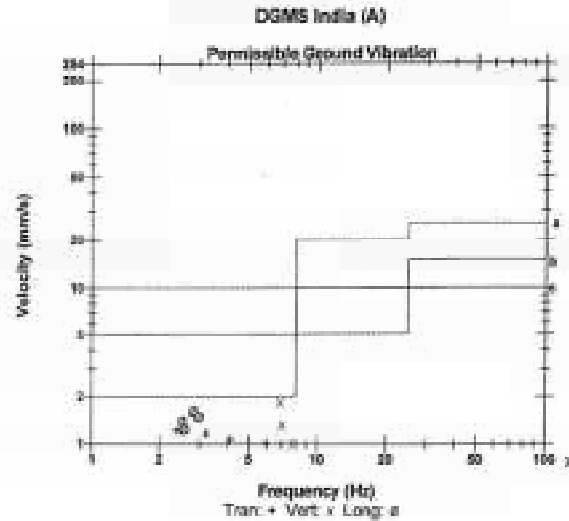
Notes

Location: RL = 750 & 760, RAIKELA IRON MINES.
Client: M/S GITARAN MOHANTY
User Name: IDL EXPLOSIVE LTD
General: 300 m Distance from the blasting face.

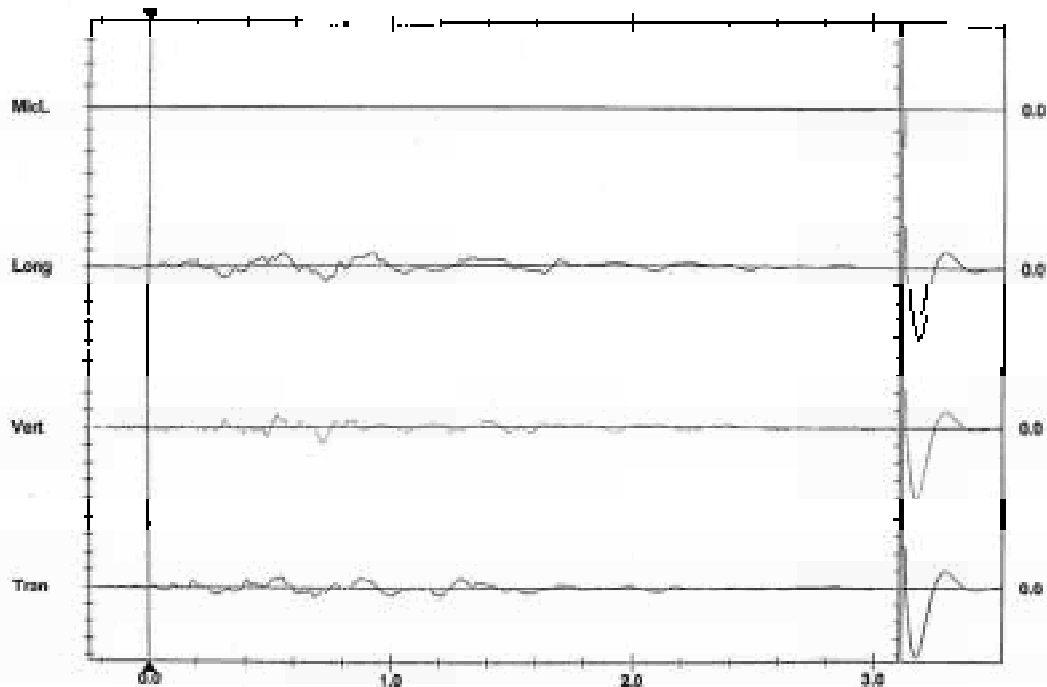
Microphone: Linear Weighting
PSPL: -0.500 ps.(L)
2G Freq: 102 Hz
Channel Test: Check (Freq = 0.0 Hz Amp = 0 mv)

	Trans	Vert	Long	
PPV	1.214	1.000	1.630	mm/s
2G Freq	2.4	6.9	2.8	Hz
Time (Ref. to Trig)	0.550	0.722	0.730	sec
Peak Acceleration	0.013	0.015	0.013	g
Peak Displacement	0.056	0.038	0.071	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.3	7.3	7.3	Hz
Overswing Ratio	4.2	4.5	4.5	

Peak Vector Sum: 2.422 mm/s at 0.734 sec
N/A: Not Applicable



a) Industrial Buildings
b) Domestic houses/structures
c) Historic objects, sensitive structures



Time Scale: 0.20 sec/div Amplitude Scale: Geo: 2.000 mm/s/div Mic: 1.000 ps.(L)/div
Trigger: →

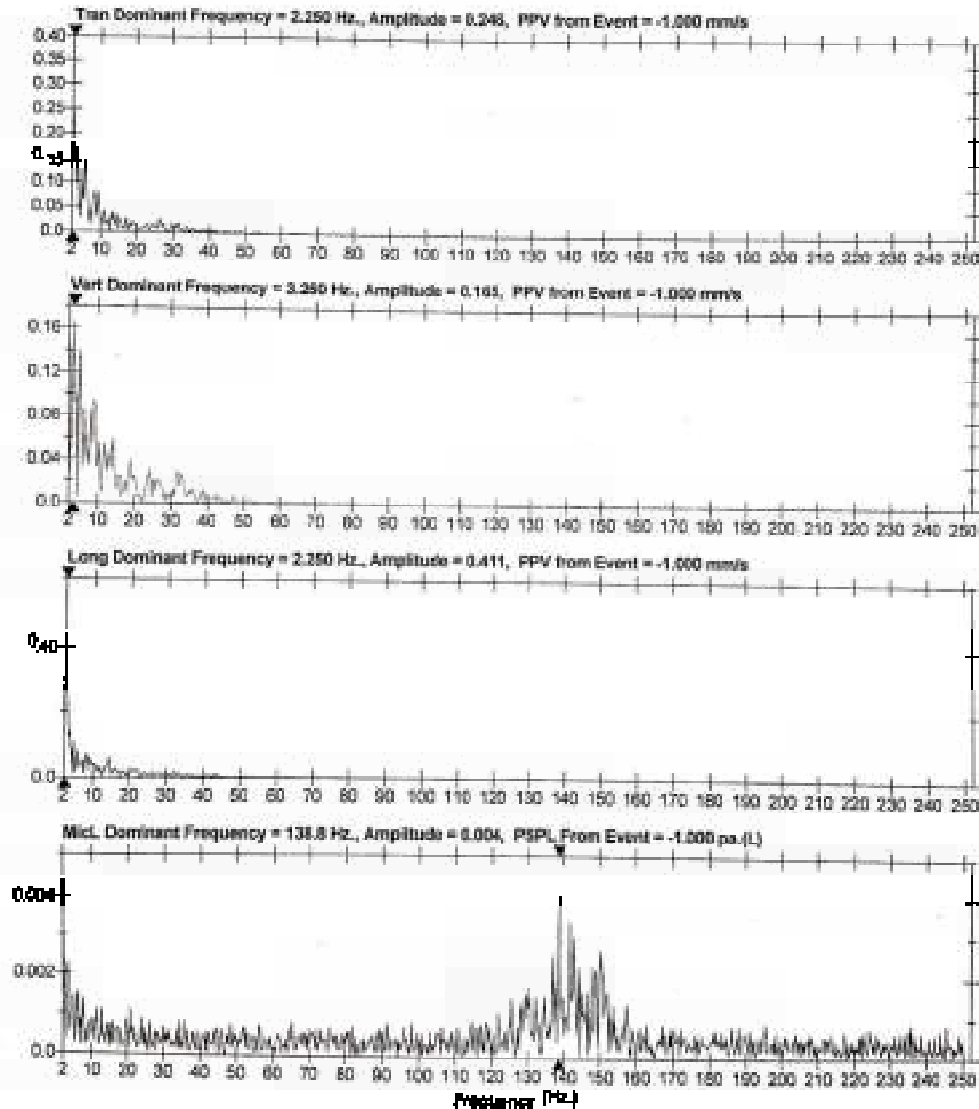
Sensor Check

Date/Time: Vent at 13:35:45 February 7, 2025
 Trigger Source: Geo: 0.300 mm/s, Mic: 70.95 pa (L)
 Range: Geo: 254.8 mm/s
 Record Time: 3.0 sec at 2048 sps.
 Operator/Setup: Operator/Extended notes: JMMH

Serial Number: UM20055 V 10-60GC Micromate ISEE
 Battery Level: 3.7 Volts
 Unit Calibration: February 20, 2025 by UES New Delhi
 File Name: __TEMP.EVT

Notes

Location: JIL - 750 & 750, RAJELA IRON MINES
 Client: M/S GITARANI MOHANTY
 User Name: IDL EXPLOSIVE LTD
 General: 300 m Distance from the blasting face.



Date/Time Long at 15:02:41 February 13, 2025
 Trigger Source Geo: 0.300 mm/s, Mic: 70.86 ps (L)
 Range Geo: 254.0 mm/s
 Record Time 3.0 sec at 2048 sps
 Operator/Setup: Operator/Extended Note:MMIS

Serial Number LM15575 V 10-00FD Micronate ISEE
 Battery Level 3.7 Volts
 Unit Calibration June 17, 2025 by UES New Delhi
 File Name LM15575_20250213130241.3DPW

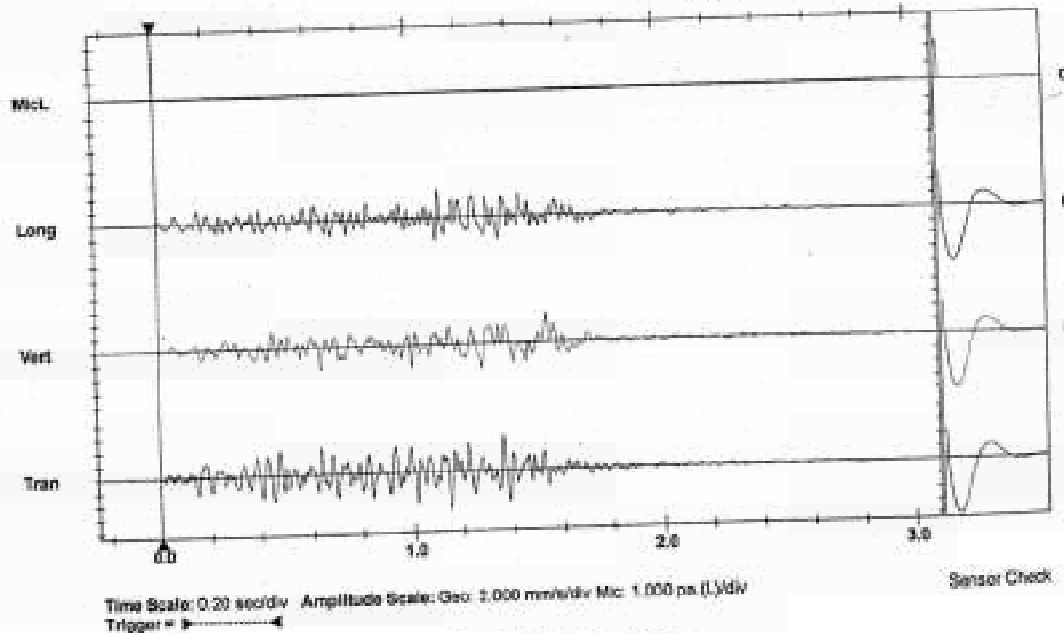
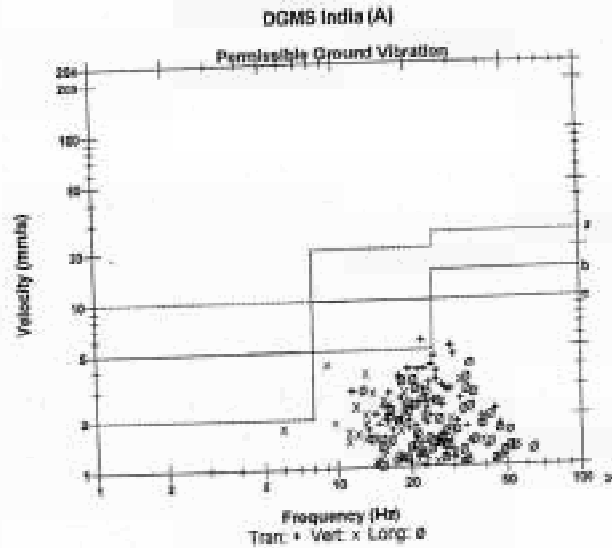
Notes
 Location: RL - 660 & 675, RAKELA IRON MINES
 Client: M/S GITARANI MOHANTY
 User Name: IDL EXPLOSIVE LTD.
 General: 150 m distance from the blasting face.

Extended Notes

Microphone Linear Weighting
 PSPL <0.000 ps (L)
 ZC Freq 2.5 Hz
 Channel Test Check (Freq = 0.0 Hz Amp = 0 mv)

	Tran	Vert	Long	
PPV	5.620	4.225	4.177	mm/s
ZC Freq	22	8.1	35	Hz
Time (Rel. to Trig)	1.147	1.539	1.117	sec
Peak Acceleration	0.120	0.100	0.145	g
Peak Displacement	0.039	0.041	0.032	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.1	7.3	7.1	Hz
Overswing Ratio	4.0	4.2	4.1	

Peak Vector Sum: 6.164 mm/s at 1.147 sec
 N/A: Not Applicable

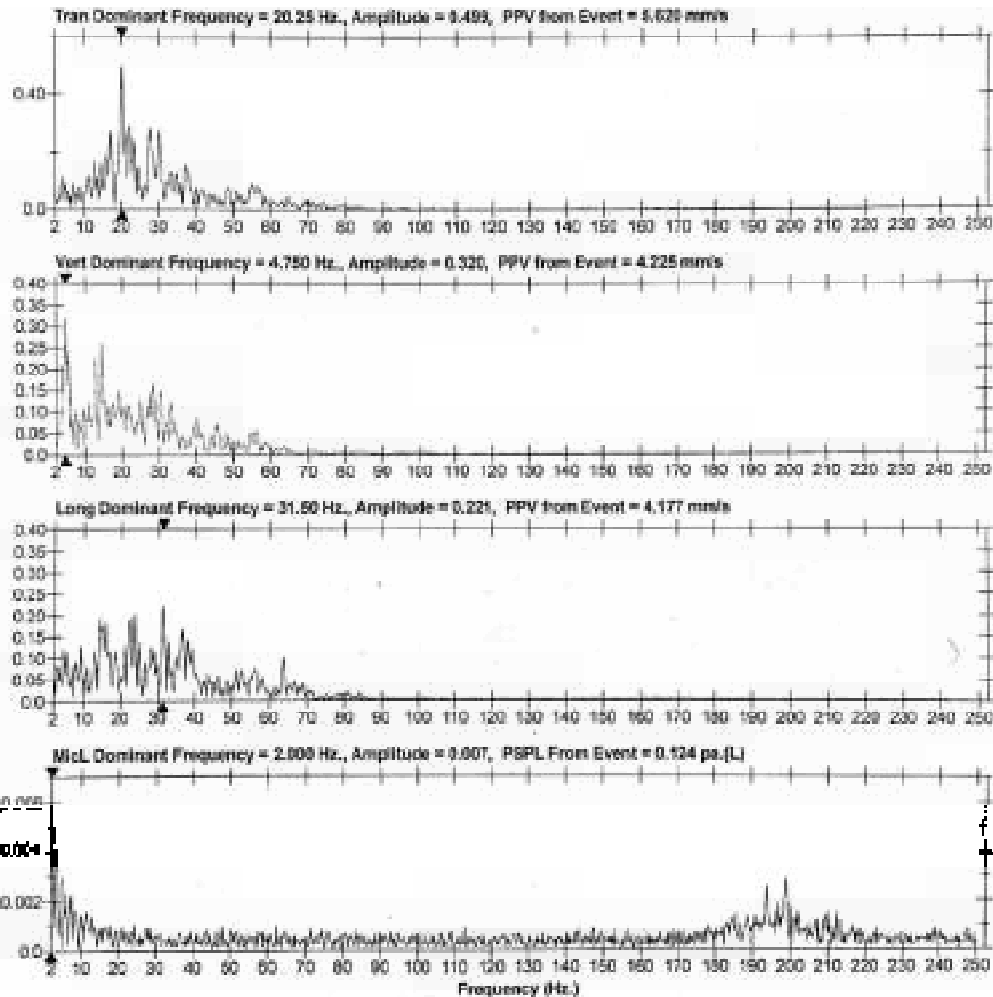


Date/Time Long at 13:02:41 February 13, 2026
Trigger Source Geo: 0.300 mm/s, Mic: 70.95 ps.(L)
Range Geo: 254.0 mm/s
Record Time 3.0 sec at 2048 s/s
Operator/Setup: Operator/Extended: Note:MMB

Serial Number UM15578 V 10-90FB Micromate ISEE
Battery Level 3.7 Volts
Unit Calibration June 17, 2025 by UES New Delhi
File Name UM15578_20260213130241.D\FW

Notes
Location: RL - 660 & 670, RAIKELA IRON MINES
Client: M/S GITARANIMOHANTY
User Name: ISL EXPLOSIVE LTD.
General: 158 m distance from the blasting face.

Extended Notes



Date/Time: Tran at 12:31:00 February 13, 2020
 Trigger Source: Geo: 0.300 mm/s, Mic: 70.95 ps(L)
 Range: Geo: 254.0 mm/s
 Record Time: 3.0 sec at 2048-sps
 Operator/Setup: Operator/Extended Note/MMB

Serial Number: UM15576 V 10-00FB Micromate ISEE
 Battery Level: 3.7 Volts
 Unit Calibration: June 17, 2020 by UES New Delhi
 File Name: UM15576_20200213133100 IDPW

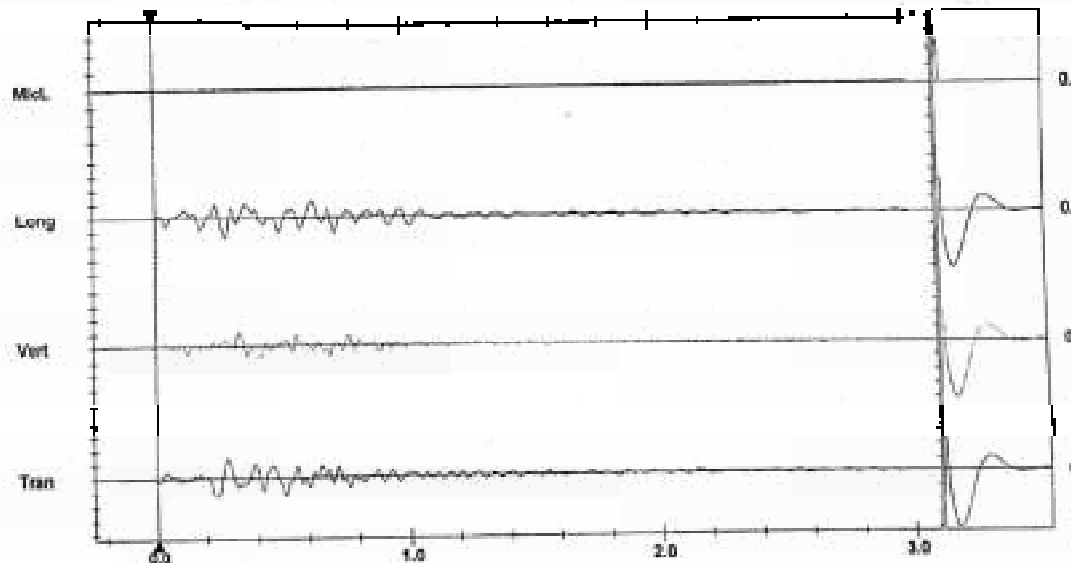
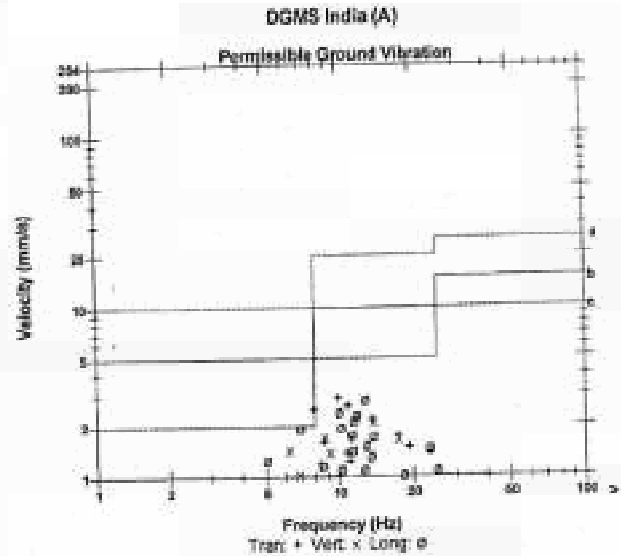
Notes:
 Location: RL - 760, RAIKELA IRON MINES
 Client: M/S GITARAMI MOHANTY
 User Name: IDL EXPLOSIVE LTD.
 General: 114 is distance from the blasting face.

Extended Notes

Microphone: Linear Weighting
 PSPL: <0.000 ps(L)
 ZC Freq: N/A
 Channel Test: Check (Freq = 0.0 Hz Amp = 0 mv)

	Tran	Vert	Long	
PPV	2.008	2.104	2.645	mm/s
ZC Freq	9.9	13.6	12.8	Hz
Time (Rel. to Trigi)	0.260	0.331	0.279	sec
Peak Acceleration	0.030	0.033	0.033	g
Peak Displacement	0.042	0.039	0.041	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.3	7.3	7.1	Hz
Overswing Ratio	4.0	4.1	4.0	

Peak Vector Sum: 4.130 mm/s at 0.279 sec
 N/A: Not Applicable



Time Scale: 0.20 sec/div Amplitude Scale: Geo: 2.000 mm/s/div Mic: 1.000 ps (L)/div

Trigger

Sensor Check



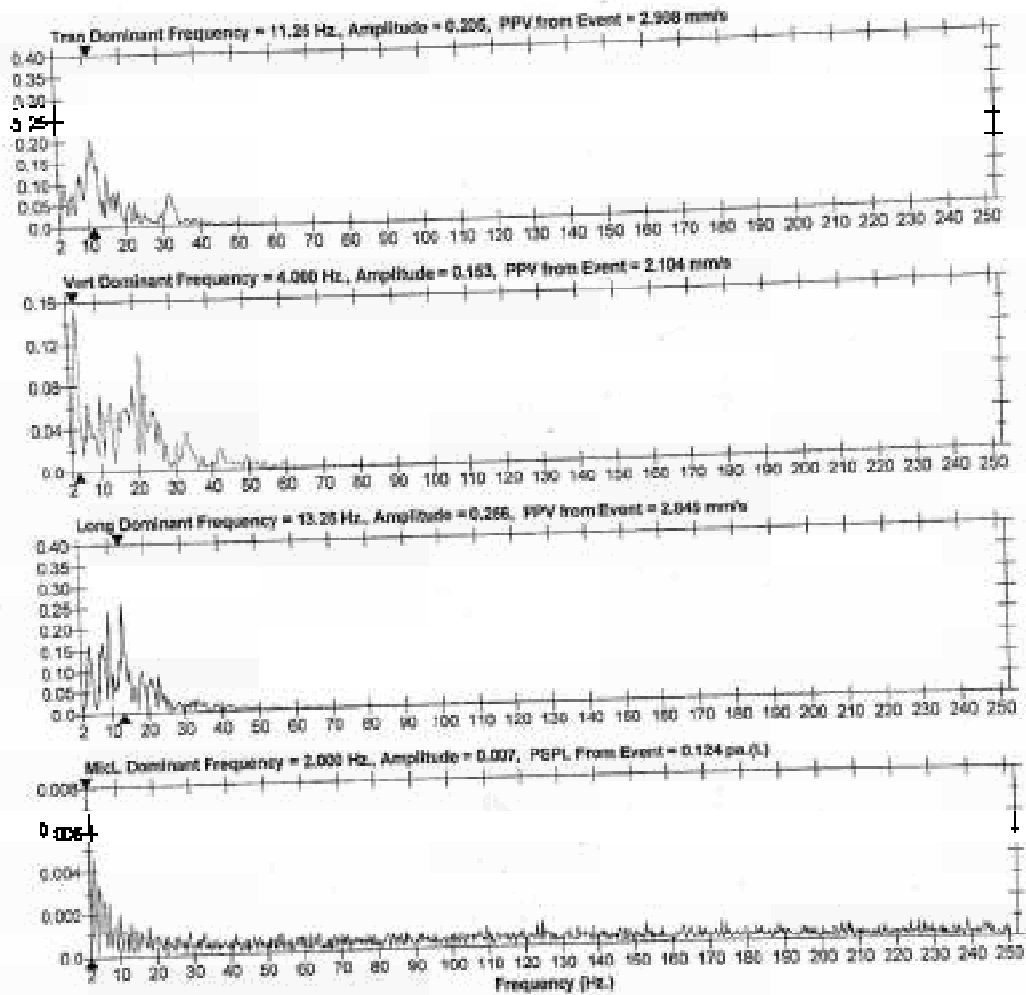
FFT Report

Date/Time: Train at 11:31:08 February 13, 2025
Trigger Source: Geo: 0.300 mm/s, Mic: 70.86 pa(L)
Range: Geo: 254.0 mm/s
Record Time: 3.0 sec at 2048 sps
Operator/Setup: Operator/Extended Note MMR

Serial Number: UM15576 V 10-80FB Microstate BEE
Battery Level: 3.7 Volts
Unit Calibration: June 17, 2025 by UES New Delhi
File Name: UM15576_2025021311310810PW

Extended Notes

Notes:
Location: RL - 750, RAUKELA IRON MINES
Client: M/S GITARAM MOHANTY
User Name: IDL EXPLOSIVE LTD.
General: 114 m distance from the blasting face.





Event Report

Date/Time: Veri at 10:01:03 February 16, 2026
Trigger Source: Geo: 0.300 mm/s, Mic: 70.99 pa (L)
Range: Geo: 254.0 mm/s
Record Time: 3.0 sec at 2048 sps
Operator/Setup: Operator/Extended Note: MMB

Notes

Location: RL - 570, RAKELA IRON MINES
Client: M/S GITARAMI MOHANTY
User Name: IDL EXPLOSIVE LTD.
General: 200 m distance from the blasting face.

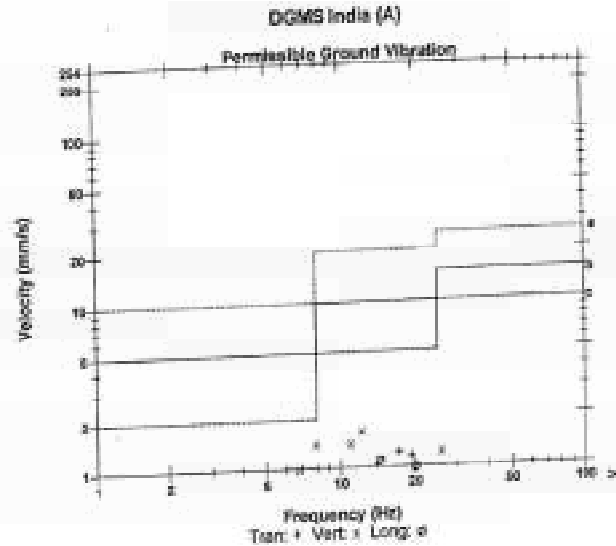
Extended Notes

Microphone: Linear Weighting
PSPL: <0.500 pa (L)
ZC Freq: N/A
Channel Test: Check (Freq = 0.0 Hz Amp = 0 mV)

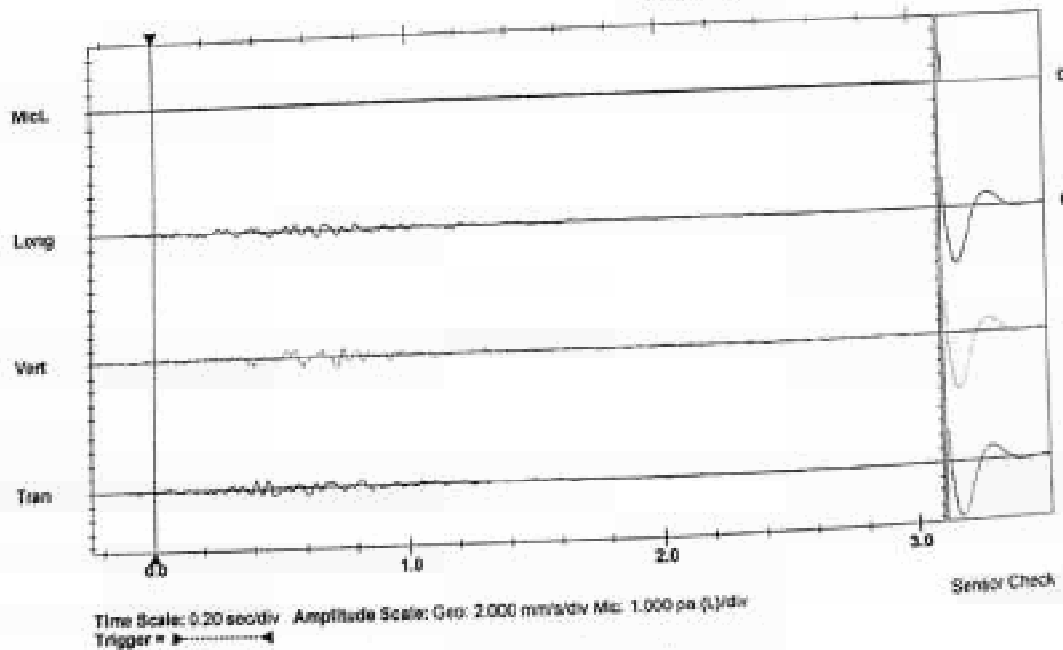
	Trans	Vert	Long	
PPV	1.222	1.063	1.117	mm/s
ZC Freq	17.4	12.2	14.4	Hz
Time (Ref. to Trig)	0.401	0.718	0.843	sec
Peak Acceleration	0.023	0.028	0.018	g
Peak Displacement	0.011	0.025	0.034	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.1	7.3	7.1	Hz
Overswing Ratio	4.0	4.1	4.1	

Peak Vector Sum: 1.851 mm/s at 0.720 sec
N/A: Not Applicable

Serial Number: UM15575 V 10-00FB MicroMics IEEE
Battery Level: 3.7 Volts
Unit Calibration: June 17, 2025 by UES New Delhi
File Name: UM15575_20260216130103.IDPW



a) Industrial Buildings
b) Domestic houses/structures
c) Historic objects, sensitive structures

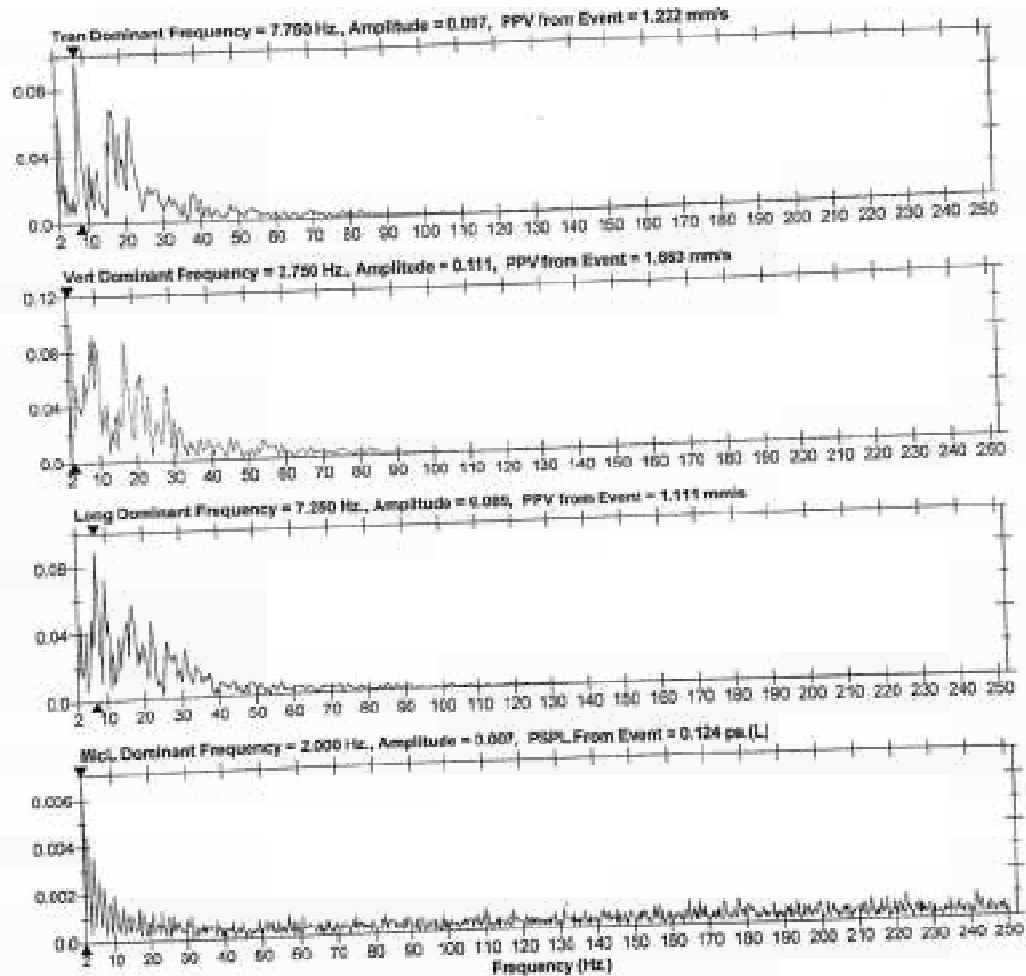


Date/Time: Wed at 13:01:03 February 16, 2026
 Trigger Source: Geo: 0.306 mm/s, Mic: 70.98 ps(L)
 Range: Geo: 254.0 mm/s
 Record Time: 3.0 sec. at 2048 sps
 Operation/Setup: Operator/Extended Note.MMS

Serial Number: UM15576 V 10-80FS Micromate ISEE
 Battery Level: 3.7 Volts
 Unit Calibration: June 17, 2025 by UES New Delhi
 File Name: UM15576_20260216130103.IDFW

Extended Notes

Notes:
 Location: RL - 070, RAUKELA IRON MINES
 Client: M/S GITAKANI MOHANTY
 User Name: IDL EXPLOSIVE LTD.
 General: 200 m distance from the blasting face.





Event Report

Date/Time: Sat at 13:33:22 February 16, 2026
Trigger Source: Geo: 0.500 mm/s, Mic: 75.98 pa.(L)
Range: Geo: 254.0 mm/s
Record Time: 3.0 sec at 2048 sps
Operator/Setup: Operator/Extended Note.MVB

Serial Number: UM15578 V 10-90FB Micromate (SES)
Battery Level: 3.7 Volts
Unit Calibration: June 17, 2025 by UES New Delhi
File Name: UM15578_20260216133322.30FW

Notes

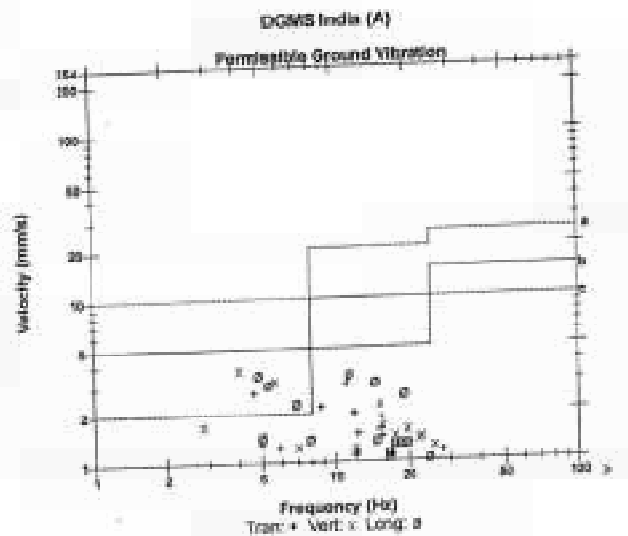
Location: RL - 342, RAUKELA IRON MINES
Client: M/S GITARAN MOHANTY
User Name: IDL EXPLOSIVE LTD.
General: 170 m distance from the blasting face.

Extended Notes

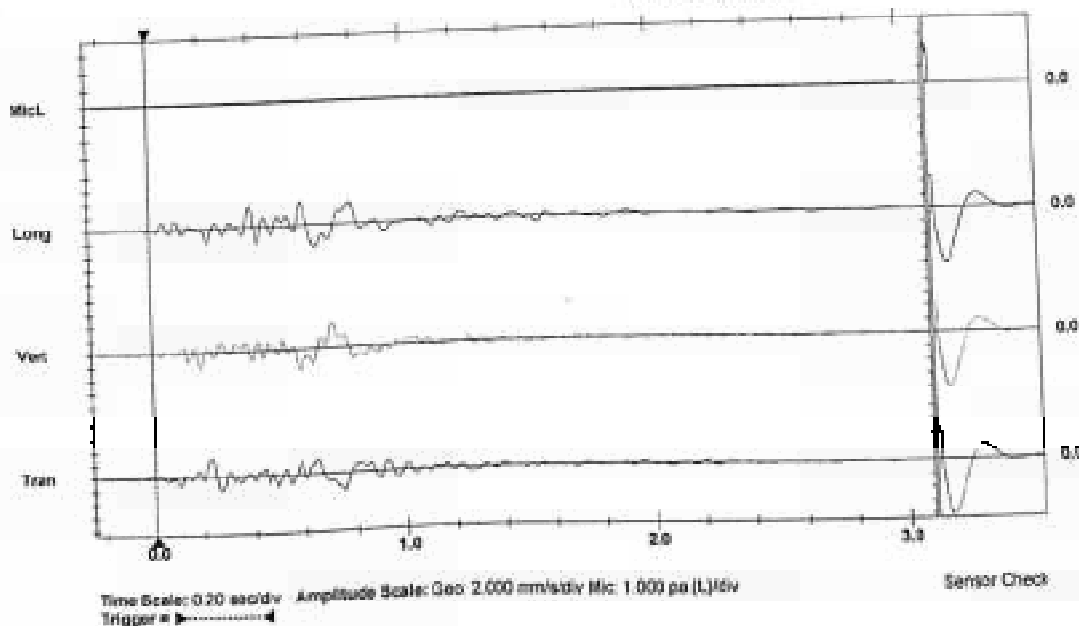
Microphone: Linear Weighting
PSPL: <0.500 pa.(L)
20 Freq: N/A
Channel Test: Check (Freq = 0.0 Hz Amp = 0 mv)

	Tran	Vert	Long	
RPV	3.011	3.720	3.468	mm/s
ZC Freq	11.1	4.0	4.9	Hz
Time (Rel. to Trig)	0.231	0.710	0.690	sec
Peak Acceleration	0.031	0.030	0.033	g
Peak Displacement	0.077	0.104	0.108	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.3	7.3	7.1	Hz
Overswing Ratio	3.9	4.1	4.0	

Peak Vector Sum: 4.263 mm/s at 0.708 sec
NA: Not Applicable



a) Industrial Buildings
b) Domestic houses/structures
c) Historic objects, sensitive structures





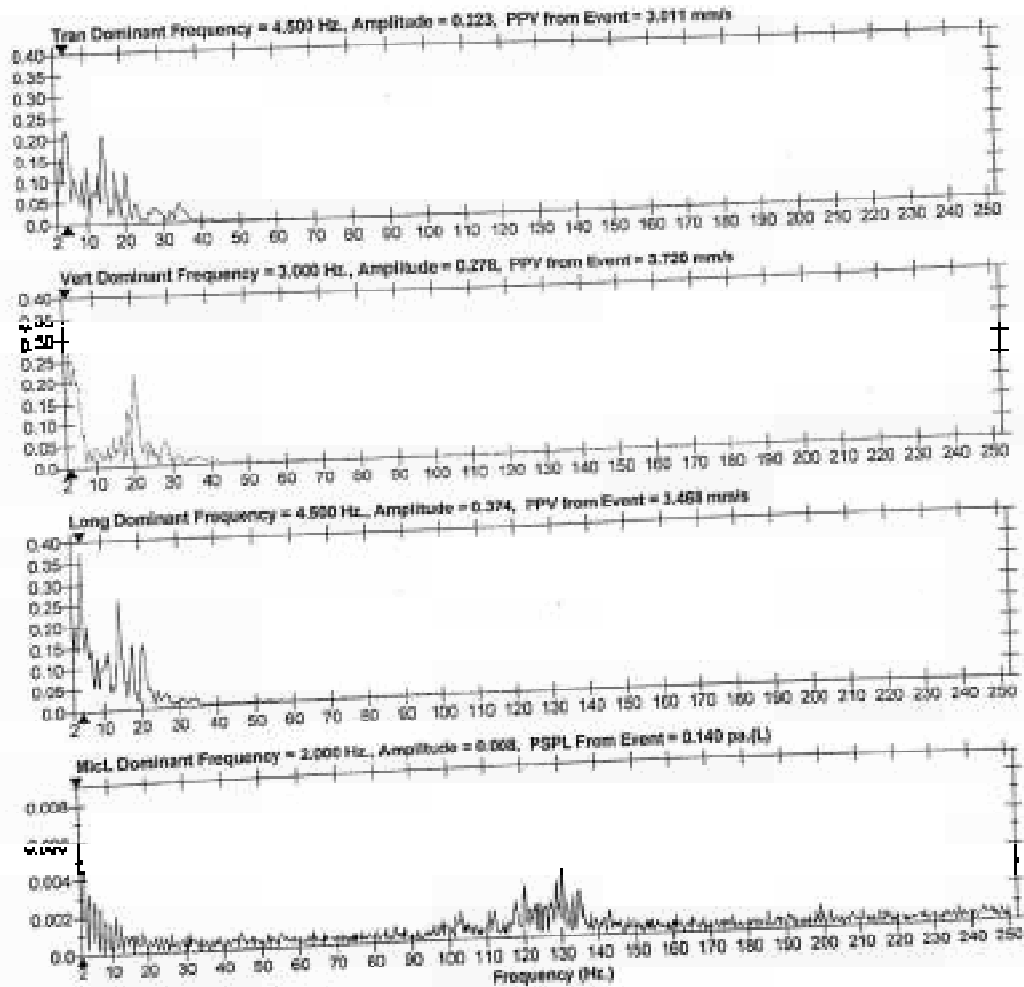
FFT Report

Date/Time: Vert at 13:33:22 February 18, 2026
Trigger Source: Geo: 0.300 mm/s, Mic: 70.86 ps.(L)
Range: Geo: 254.0 mm/s
Record Time: 3.0 sec @ 2048 sps
Operator/Setup: Operator/Extended Note: NMB

Serial Number: UM15578 V 10-90FB Micromate ISEE
Battery Level: 3.7 Volts
Unit Calibration: June 17, 2025 by UES New Delhi
File Name: UM15578_20260218-133322.IDPW

Extended Notes

Notes:
Location: RL - 740, RAJKELA IRON MINES
Client: M/S GITARAM MOHANTY
User Name: IDL EXPLOSIVE LTD.
General: 170 m distance from the blasting face.





Event Report

Date/Time: Fri at 15:22:02 February 16, 2025
Trigger Source: Geo: 3.500 mm/s, Ntc: 20.00 ps(L)
Range: Geo: 254.0 mm/s
Record Time: 3.0 sec at 2048 kps
Operator/Setup: Operator/MT ROURKELA/MSVS

Serial Number: UM19104 V 16-5075 Micro male (SE)
Battery Level: 3.8 Vdc
Unit Calibration: August 27, 2020 by USS New Delhi
File Name: UM19104_20200218 132202 JOPNY

Motion

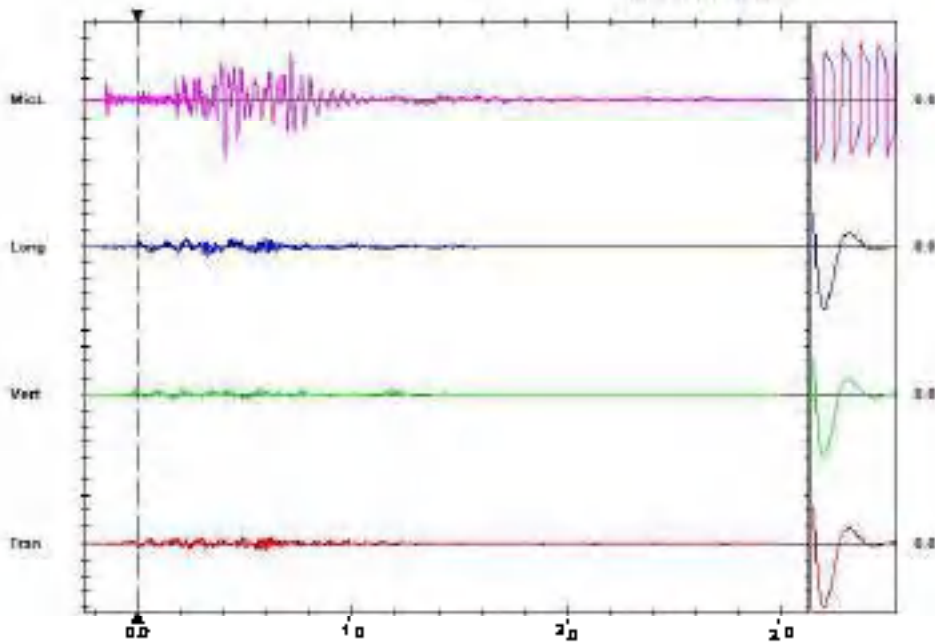
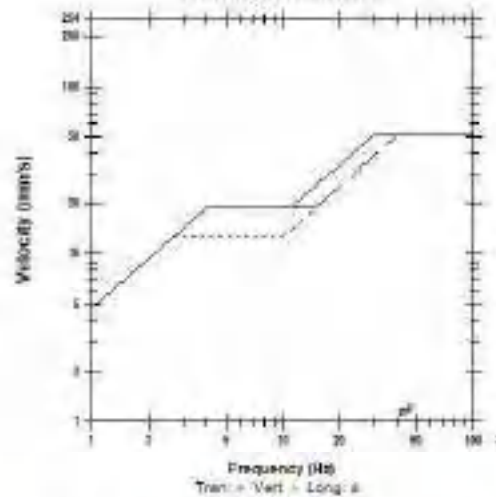
Location:
Site: BANGLA MINES, NIT ROURKELA
User Name: SU GEOTECH ENGG. PVT. LTD.
General:

Microphone: Linear Weighting
PSPL: 3.000 ps(L) at 0.000 sec
ZC Freq: 20 Hz
Channel Test: Passed (Freq = 15.7 Hz Amp = 1127 mV)

	Trans	Vert	Long	
PPV	0.843	0.070	1.238	mm/s
ZC Freq	57	9.8	47	Hz
Time (Ref. to Trig)	-0.001	-0.106	0.318	sec
Peak Acceleration	0.930	0.923	0.008	g
Peak Displacement	0.005	0.011	0.008	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.3	7.3	7.1	Hz
Overwing Ratio	4.0	4.7	5.0	

Peak Vector Sum: 1.308 mm/s at 0.317 sec

USBM R0507 And OSNRE



Time Scale: 0.20 sec/div Amplitude Scale: Geo: 2.000 mm/s/div Ntc: 1.000 ps(L) Ntc

Sensor Check

NAME: PRADEEP K. SINGH

NAME: SU GEOTECH ENGG. PVT. LTD.



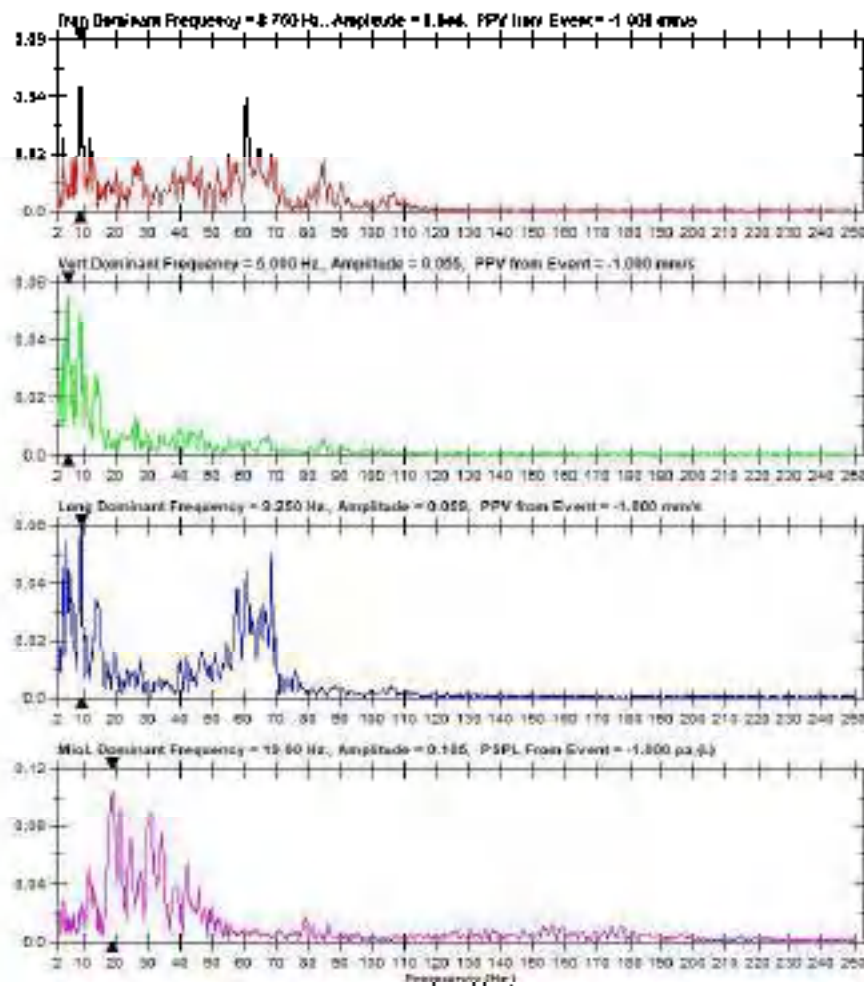
FFT Report

Date/Time: Tran at 13:22:02 February 16, 2020
Trigger Source: Geo: 3.500 mm/s, Mko: 20.00 g(1L)
Range: Geo: 254.0 mm/s
Record Time: 3.0 sec at 2048 kps
Operator/Setup: Operator: MT ROURKELA.RSING

Serial Number: UM19104 V 10-5075 Micromate ISEE
Battery Level: 3.8 VDC
Unit Calibration: August 27, 2020 by USS New Delhi
File Name: UM19104_2020021613220210PM.V

Motion

Location:
Desc: BANGLA MINES, MT ROURKELA
User Name: SRI GEOTECH ENGINE, PVT. LTD.
General





Event Report

Date/Time: 1/10/2025 15:00:00
Trigger Source: Geo: 5.000 mm/s, Hic: 0.525 ps(L)
Range: Geo: 254.0 mm/s
Record Time: 3.0 sec at 1024 kps
Operator/Setup: Operator/IT ROURKELA, INDIA

Serial Number: UM15187 V 10-5075 MicroMale (SEE)
Battery Level: 3.8 Volts
Unit Calibration: February 27, 2025 by UDS New Delhi
File Name: UM15187_20250218 132515 (CPV)

Notes

Location: RANGLA MINES HIT ROURKELA
User Name: IT, ENTERPRISES
Serial:

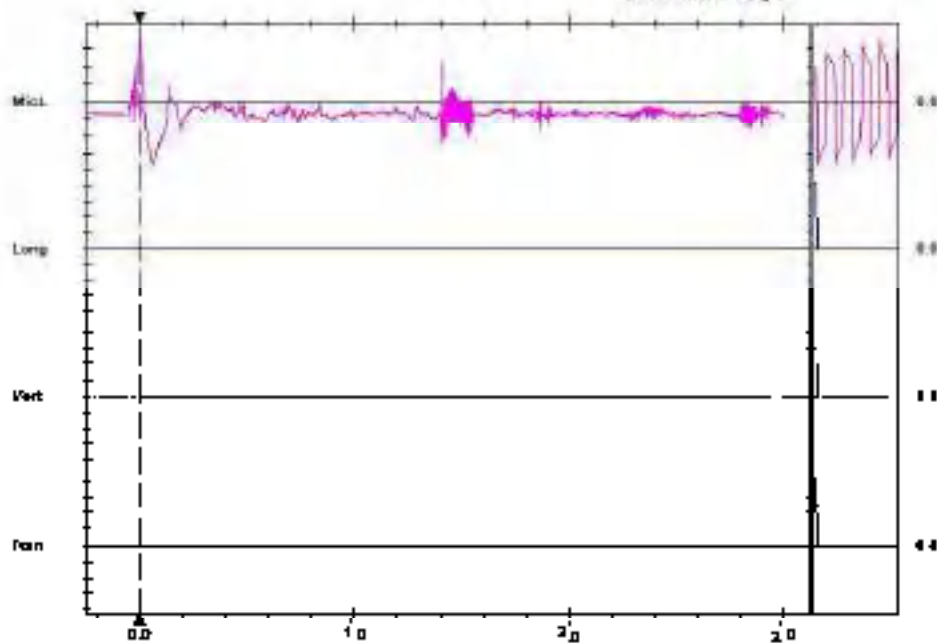
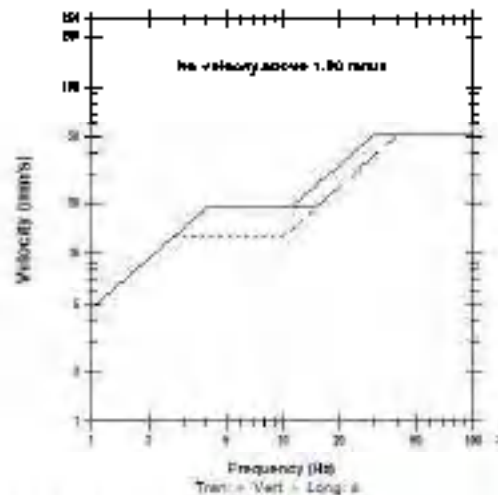
Microphone: Linear Weighting

PSPL: 7.075 ps(L) at 0.055 sec
ZC Freq: 4.4 Hz
Channel Test: Passed (Freq = 15.7 Hz Amp = 119.5 mV)

	Trans	Vert	Long	
PPV	0.038	0.047	0.038	mm/s
ZC Freq	>100	>100	>100	Hz
Time (Ref. to Trig)	1.404	0.977	0.102	sec
Peak Acceleration	0.905	0.905	0.005	g
Peak Displacement	0.000	0.000	0.000	mm
Sensor Check	Check	Check	Check	
Frequency	1024.0	1024.0	1024.0	Hz
Overwriting Ratio	0.0	0.0	0.0	

Peak Vector Sum: 0.000 mm/s at 2.310 sec

USBd R8507 And OSMRE



Time Scale: 0.20 sec/div Amplitude Scale: Geo: 0.050 mm/s/div Hic: 0.020 ps(L)/div

Sensor Check

PSPL: 7.075 ps(L) at 0.055 sec

Peak Vector Sum: 0.000 mm/s at 2.310 sec



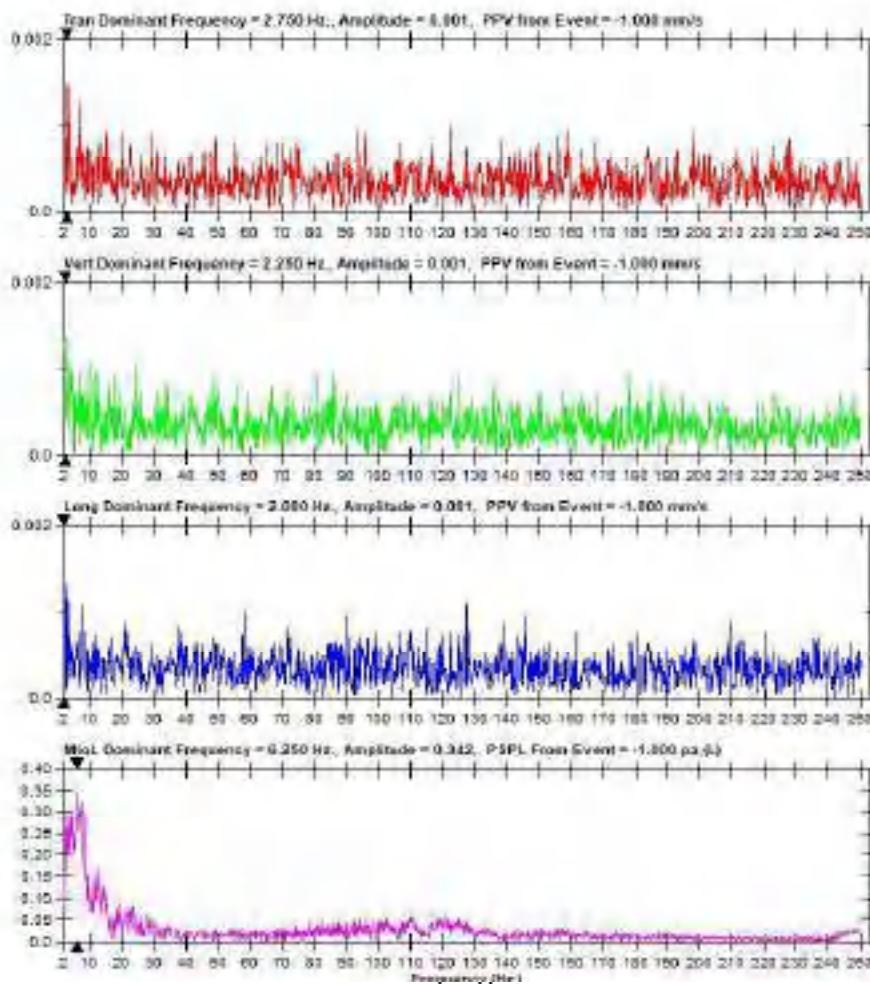
FFT Report

Date/Time: KSL at 11:25:15 February 18, 2025
Trigger Source: Geo: 5.800 mm/s, Mag: 6.325 ps(L)
Range: Geo: 264.0 mm/s
Record Time: 3.0 sec at 1024 kps
Operator/Setup: Operator/NT ROURELA.XBVS

Serial Number: UM19187 V 16-60FS Microscale (SEE)
Battery Level: 3.8 Volts
Unit Calibration: February 21, 2025 by UES New Delhi
File Name: UM19187_2025021813251510P1V

Motion

Location:
Desc: RAJGELA MINES-NT ROURELA
User Name: I.I. ENTERPRISES
General





Event Report

Date/Time: Wed at 12:44:14 February 13, 2020
Trigger Source: Geo: 3.500 mm/s, file: 20.00 sec (L)
Range: Geo: 254.0 mm/s
Record Time: 3.0 sec at 2048 kps
Operator/Setup: Operator/MT ROURKELA/KRVS

Serial Number: UM19104 V 10-5075 Microphone (SEE)
Battery Level: 3.8 VDC
Unit Calibration: August 27, 2020 by USGS New Delhi
File Name: UM19104_20200213 134404 (OPN)

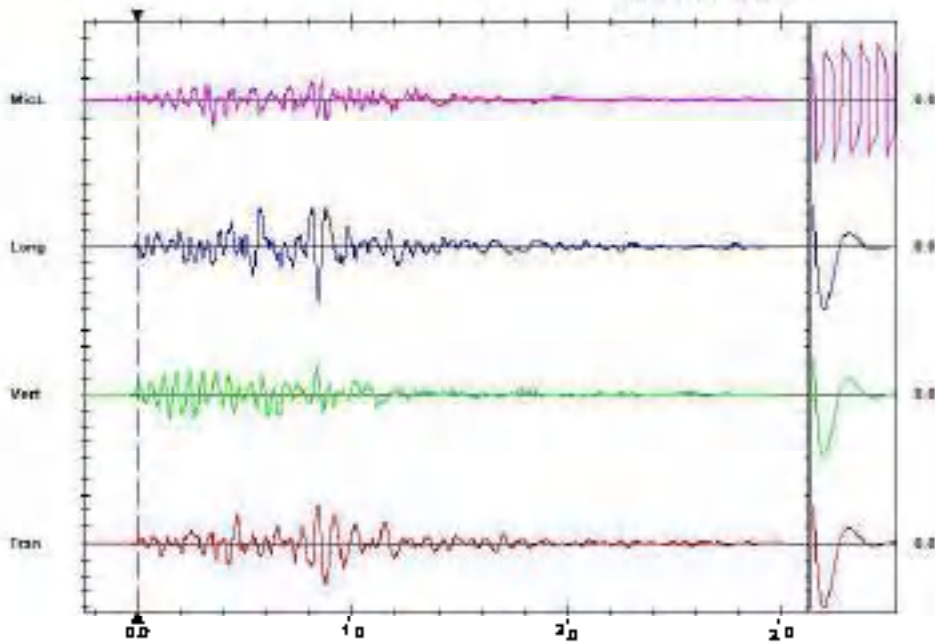
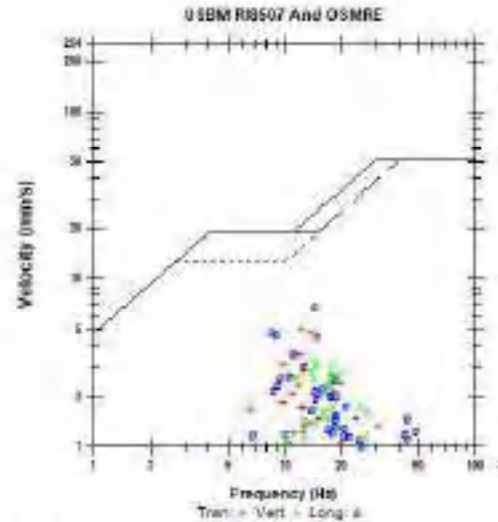
Motion

Location:
Site: BANGLA MINES, MT ROURKELA
User Name: SU GEOTECH ENGG. PVT. LTD.
General:

Microphone: Linear Weighing
PSPL: 1.200 psu(L) at 0.350 sec
ZC Freq: 34 Hz
Channel Test: Passed (Freq = 15.7 Hz Amp = 1195 mv)

	Trans	Vert	Long	
PPV	6.629	3.279	0.887	mm/s
ZC Freq	12.9	14.9	14.4	Hz
Time (Ref. to Trig)	0.979	0.931	0.842	sec
Peak Acceleration	0.971	0.911	0.977	g
Peak Displacement	0.683	0.330	0.077	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.3	7.3	7.1	Hz
Overwriting Ratio	4.5	4.7	5.3	

Peak Vector Sum: 8.418 mm/s at 0.840 sec



Time Scale: 0.20 sec/div Amplitude Scale: Geo: 2.000 mm/s/div Mic: 1.000 psu(L)/div

Sensor Check

RECORDING IN PROGRESS

RECORDING IN PROGRESS



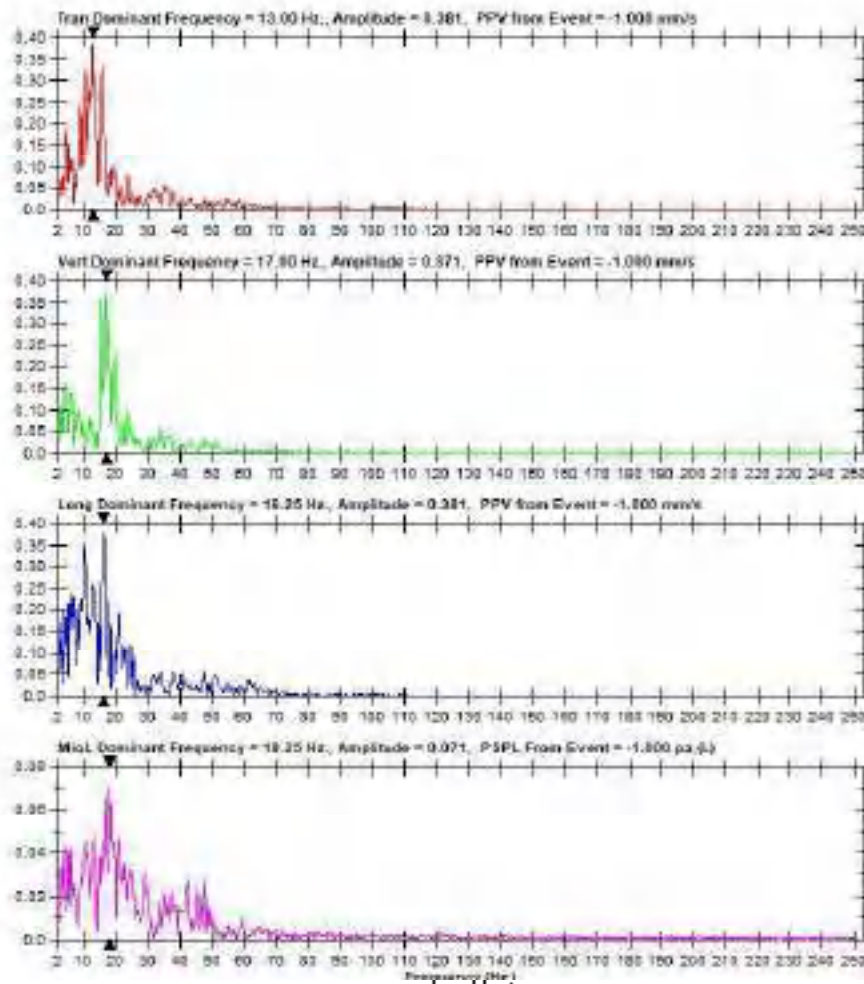
FFT Report

Date/Time: Wed at 12:44:14 February 13, 2020
Trigger Source: Geo. 3,500 mm/s, Mic. 20.03 ps (L)
Range: Geo. 254.0 mm/s
Record Time: 3.0 sec at 2048 kps
Operator/Setup: Operator/MT ROURKELA.XIVIS

Serial Number: UM19104 V 16-5075 Microphone (SEE)
Battery Level: 3.8 VDC
Unit Calibration: August 27, 2020 by USGS New Delhi
File Name: UM19104_20200213134434 (OPV)

Motion

Location:
Desc: BANGLA MINES-WT ROURKELA
User Name: SU GEOTECH EGGG, PVT. LTD.
General





Event Report

Date/Time: Long at 15:17:28 February 20, 2020
Trigger Source: Geo: 5,500 mm/s, file: 20_03_00.L
Range: Geo: 254.0 mm/s
Record Time: 3.0 sec at 2048 kps
Operator/Setup: Operator/MT ROURKELA/RBVS

Serial Number: UM19104 V 10-5075 Micromate (SE)
Battery Level: 3.8 VDC
Unit Calibration: August 27, 2020 by USGS New Delhi
File Name: UM19104_20200220151728 (DPN)

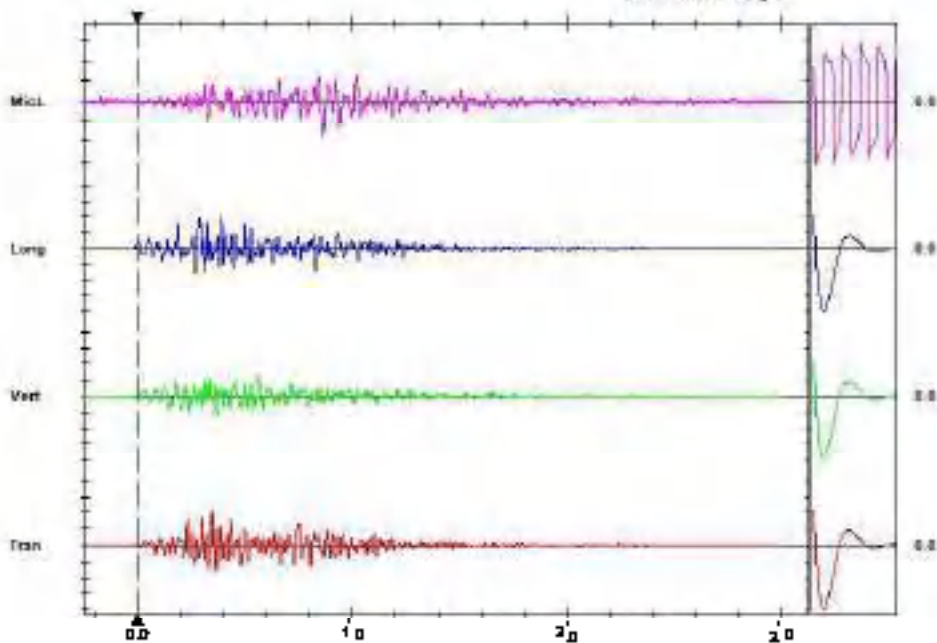
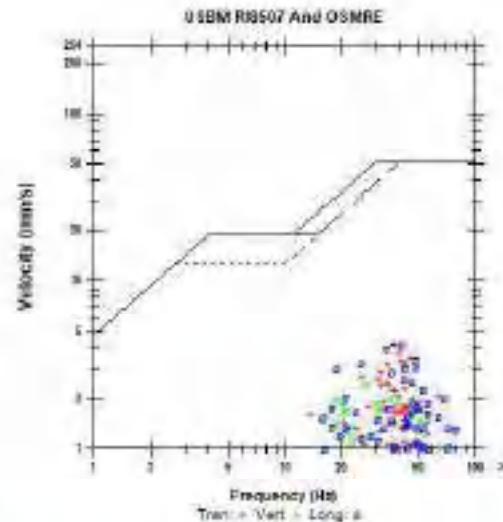
Motion

Location:
Client: BANGLA MINES, IIT ROURKELA
User Name: SU GEOTECH ENGG. PVT. LTD.
General:

Microphone: Linear Weighting
PSPL: 1.730 ps(L) at 0.002 sec
ZC Freq: 13.7 Hz
Channel Test: Passed (Freq = 13.7 Hz Amp = 1117 mv)

	Tran	Vert	Long	
PPV	4.138	2.499	4.138	mm/s
ZC Freq	56	47	41	Hz
Time (Ref. to Trig)	-0.346	-0.308	0.399	sec
Peak Acceleration	9.122	9.122	0.149	g
Peak Displacement	9.617	9.815	0.021	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.3	7.3	7.1	Hz
Overwing Ratio	4.8	4.7	5.2	

Peak Vector Sum: 4.439 mm/s at 0.390 sec



Time Scale: 0.20 sec/div Amplitude Scale: Geo: 5,500 mm/s/div Nuc: 1,000 ps(L)/div

Sensor Check

RECORDING IN PROGRESS

RECORDING IN PROGRESS

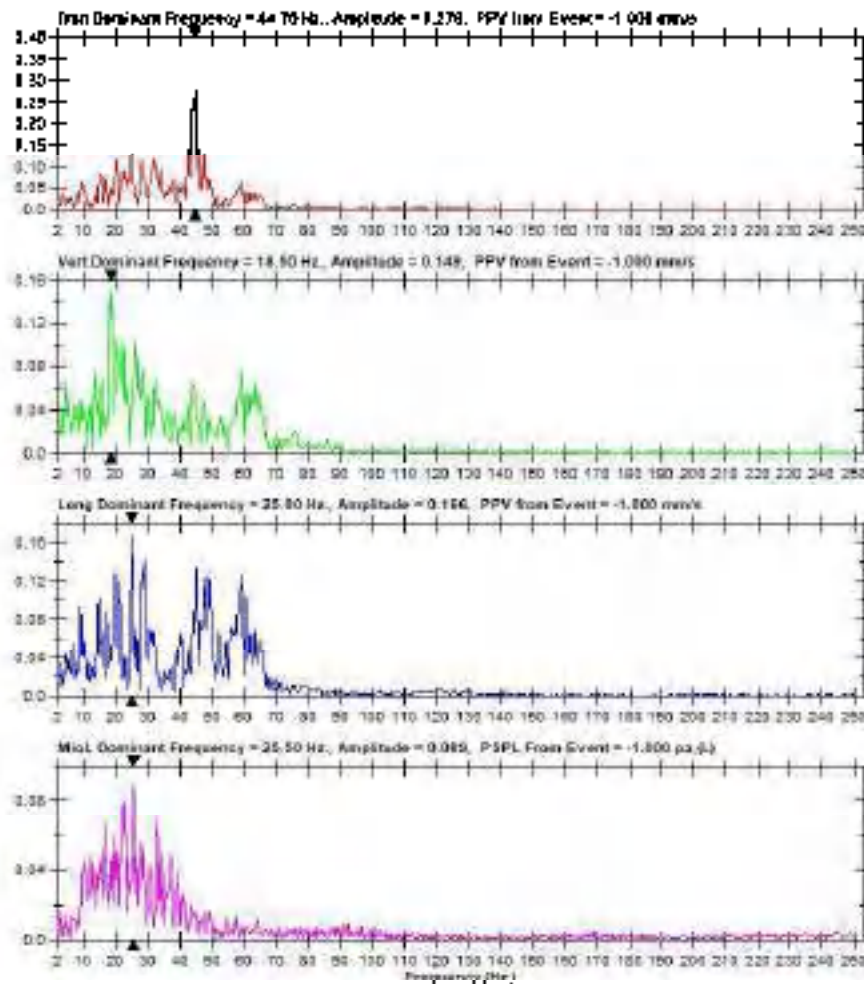


FFT Report

Date/Time: Long at 15:17:28 February 20, 2020
Trigger Source: Geo: 5,500 mm/s, file: 20_03_00.L1
Range: Geo: 254.0 mm/s
Record Time: 3.0 sec at 2048 kps
Operator/Setup: Operator/MT ROURKELA.XIVS

Serial Number: UM19194 V 16-5075 Micromate (SEE)
Battery Level: 3.8 VDC
Unit Calibration: August 27, 2020 by USS New Delhi
File Name: UM19194_20200220151728 (DPV)

Notes:
Location:
Client: BANGLA MINES, MT ROURKELA
User Name: BM GEOTECH E&S, PVT. LTD.
General:





Event Report

Date/Time: Fri at 15:17:35 February 20, 2025
Trigger Source: Geo: 5,800 mm/s, Nix: 0.325 ps (L)
Range: Geo: 264.0 mm/s
Record Time: 3.0 sec at 1024 kps
Operator/Setup: Operator/NT ROUKELA, NIX/MS

Serial Number: UM15187 V 18-5075 Microphone (SEE)
Battery Level: 3.8 Volts
Unit Calibration: February 27, 2025 by USG New Delhi
File Name: UM15187_20250220151735 (CPV)

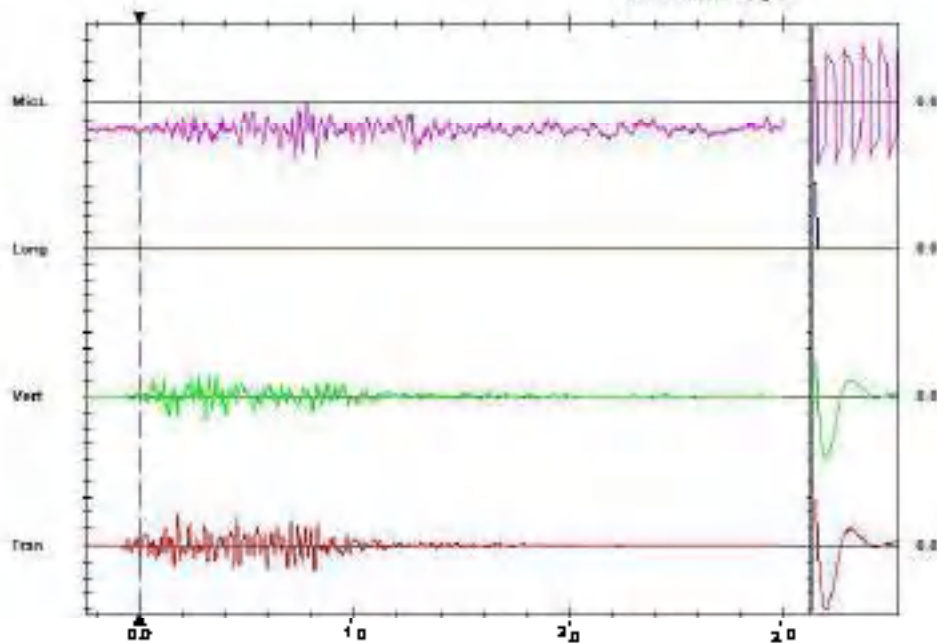
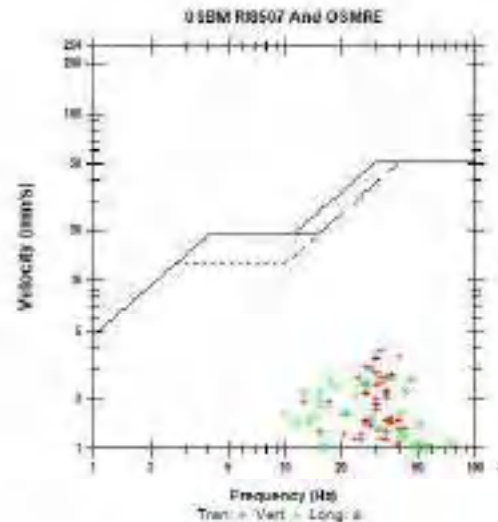
Motion

Location:
Site: RAUKELA MINES-NT ROUKELA
User Name: I.I. ENTERPRISES
General

Microphone: Linear Weighting
PSPL: 2.870 ps (L) at 0.727 sec
ZC Freq: NA
Channel Test: Passed (Freq = 15.7 Hz Amp = 121.4 mV)

	Tran	Vert	Long	
PPV	5.788	5.882	0.047	mm/s
ZC Freq	50	38	>100	Hz
Time (Ref. to Trig)	-0.174	-0.302	-0.313	sec
Peak Acceleration	-0.150	0.130	0.005	g
Peak Displacement	0.020	0.024	0.001	mm
Sensor Check	Passed	Passed	Check	
Frequency	7.3	7.3	1024.0	Hz
Overwing Ratio	4.1	4.1	0.0	

Peak Vector Sum: 4.503 mm/s at 0.173 sec
Nix: Not Applicable



Time Scale: 0.20 sec/div Amplitude Scale: Geo: 2.000 mm/s/div Nix: 1.000 ps (L)/div

Sensor Check

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NT/MS/MS/NT/MS/NT/MS/NT/MS



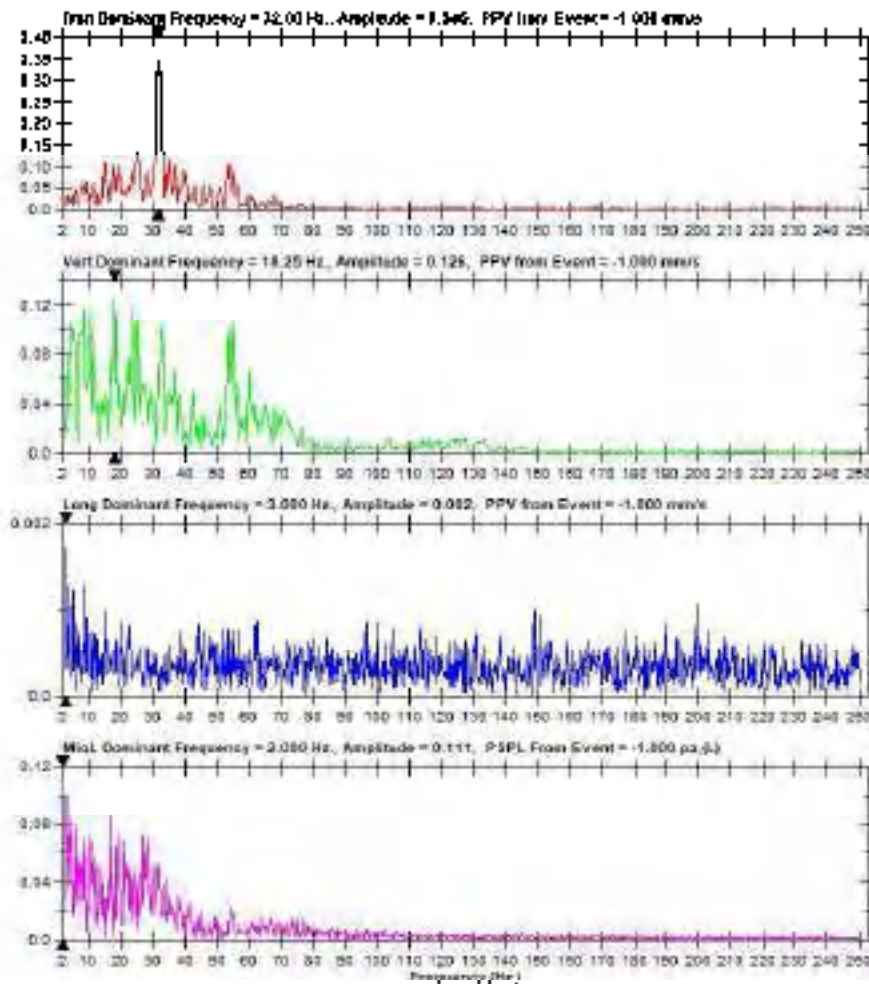
FFT Report

Date/Time: Train At 12:17:35 February 20, 2025
Trigger Source: Geo: 5,800 mm/s, Mko: 0.325 ps (L)
Range: Geo: 254.0 mm/s
Record Time: 3.0 sec at 1024 kps
Operator/Setup: Operator/NT ROUKELA.XIVIS

Serial Number: UM15187 V 16-5075 MicroMale (SEE)
Battery Level: 3.8 Volts
Unit Calibration: February 21, 2025 by UES New Delhi
File Name: UM15187_20250220121735 (CPV)

Notes:

Location:
Dist: RAUKELA MINES-NT ROUKELA
User Name: I.I. ENTERPRISES
General





Event Report

Date/Time: Long at 19:30:25 February 20, 2020
Trigger Source: Geo: 3,500 mm/s, hls: 20.00 g(L)
Range: Geo: 254.0 mm/s
Record Time: 3.0 sec at 2048 kps
Operator/Setup: Operator/MT ROURKELA/KRVS

Serial Number: UM19104 V 10-5075 Microphone (SE)
Battery Level: 3.8 VDC
Unit Calibration: August 27, 2020 by USGS New Delhi
File Name: UM19104_2020022010302510PMV

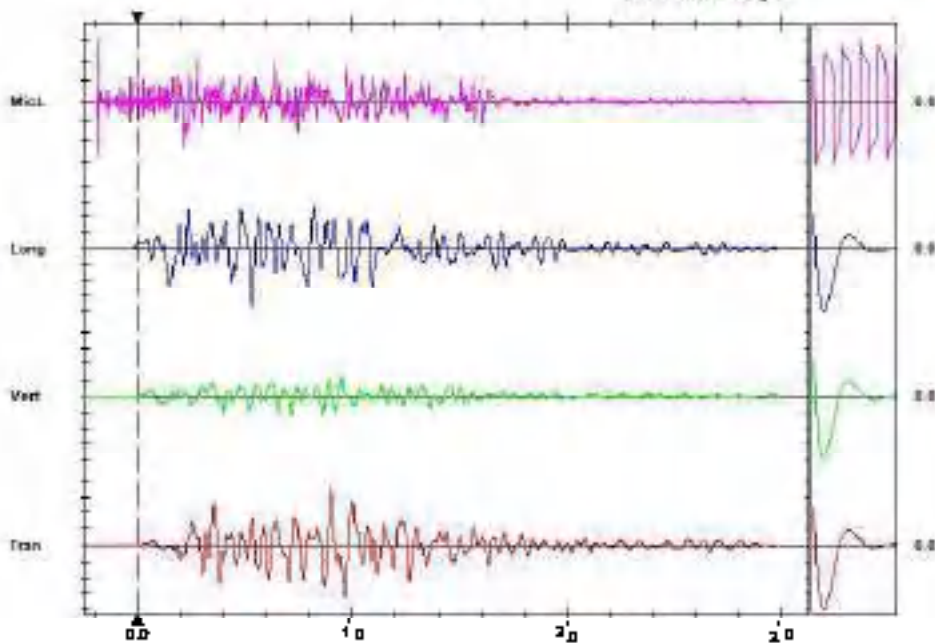
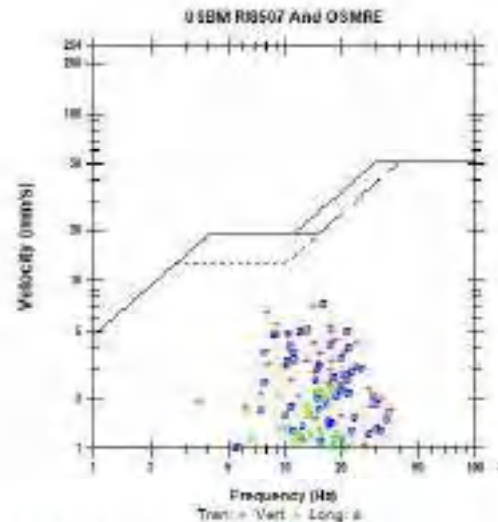
Motion

Location:
Site: BANGLA MINES, MT ROURKELA
User Name: SU GEOTECH ENGG. PVT. LTD.
General:

Microphone: Linear Weighing
PSPL: 3.05T pa(L) at 0.100 sec
ZC Freq: 171 Hz
Channel Test: Passed (Freq = 15.7 Hz Amp = 1145 mv)

	Tran	Vert	Long	
PPV	7.180	3.270	7.404	mm/s
ZC Freq	14.2	17.4	16.8	Hz
Time (Ref. to Trig)	0.001	0.000	0.032	sec
Peak Acceleration	0.110	0.041	0.115	g
Peak Displacement	0.052	0.038	0.079	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.3	7.3	7.1	Hz
Overwing Ratio	4.3	4.7	5.1	

Peak Vector Sum: 8.121 mm/s at 0.032 sec



Time Scale: 0.20 sec/div Amplitude Scale: Geo: 2.000 mm/s/div Nuc: 1.000 g(L)/div

Sensor Check

Serial Number: UM19104 V 10-5075

Unit Calibration: August 27, 2020 by USGS New Delhi

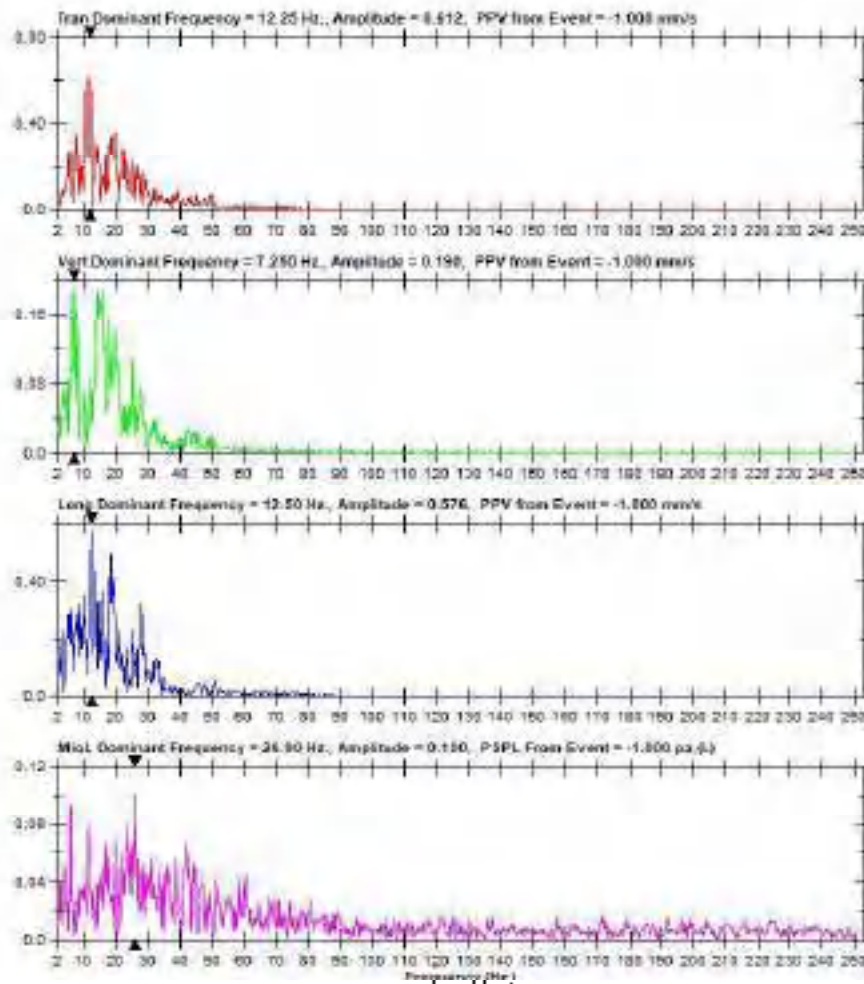


FFT Report

Date/Time	Long at 19:30:25 February 20, 2020	Serial Number	UM19194 V 10-5075 Micromate (SEE
Trigger Source	Geo: 0.500 mm/s, hhd: 20.00 ps(L)	Battery Level	3.8 VDC
Range	Geo: 254.0 mm/s	Unit Calibration	August 27, 2020 by UES New Delhi
Record Time	3.0 sec at 2048 kps	File Name	UM19194_20200220103025 (OPN)
Operator/Setup	Operator: MIT ROURKELA, INDIA		

Motion

Location:
Desc: BANGLA MINES, MT ROURKELA
User Name: SU GEOTECH EGGG, PVT. LTD.
General





Event Report

Date/Time: Wed at 14:13:37 February 23, 2023
Trigger Source: Geo: 3.500 mm/s, Ndc: 20.03 sec (L)
Range: Geo: 254.0 mm/s
Record Time: 3.0 sec at 2048 kps
Operator/Setup: Operator/MT ROURKELA/KSVG

Serial Number: UM19104 V 16-5075 Microphone (SE)
Battery Level: 3.8 Vdc
Unit Calibration: August 27, 2020 by UES New Delhi
File Name: UM19104_20200223141037 (OPN)

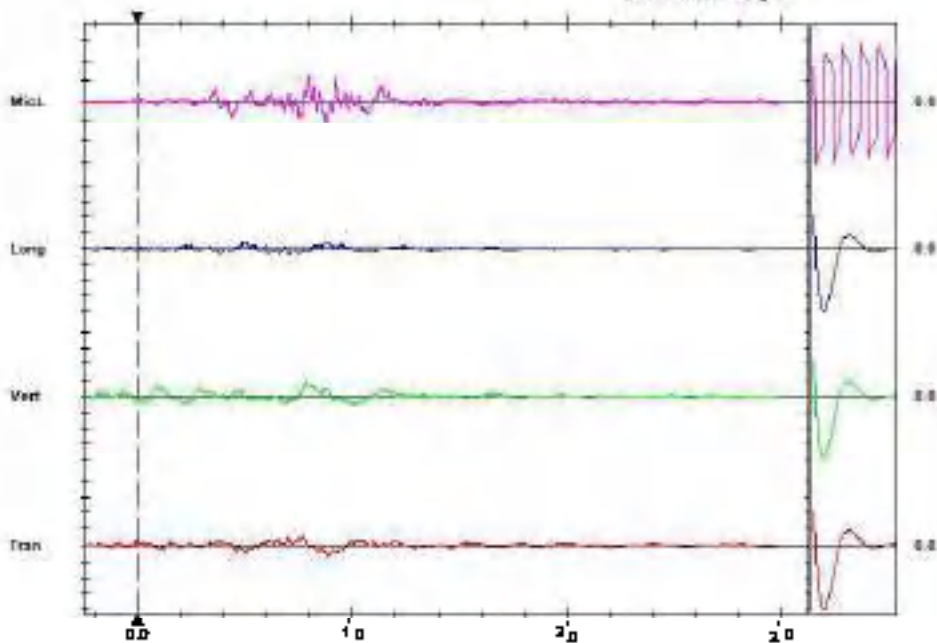
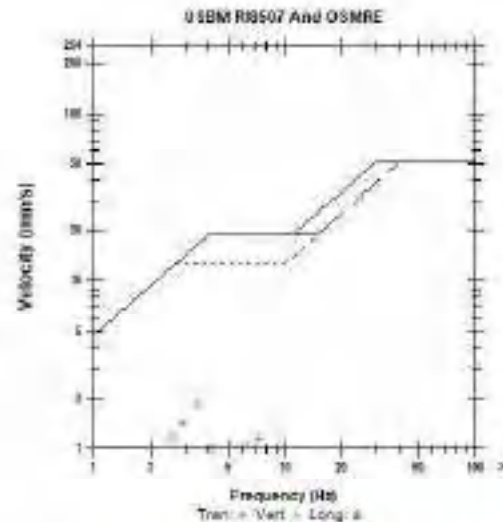
Motion

Location:
Client: BANGLA MINES, IIT ROURKELA
User Name: SU GEOTECH ENGG. PVT. LTD.
General:

Microphone: Linear Weighting
PSPL: 1.25T ps(L) at 0.780 sec
ZC Freq: 12.5 Hz
Channel Test: Passed (Freq = 15.7 Hz Amp = 1120 mV)

	East	Vert	Long	
PPV	1.418	1.570	0.783	mm/s
ZC Freq	9.0	9.5	4.8	Hz
Time (Ref. to Trig)	0.880	0.760	0.489	sec
Peak Acceleration	0.010	0.010	0.010	g
Peak Displacement	0.054	0.059	0.028	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.3	7.3	7.1	Hz
Overwing Ratio	4.8	4.7	5.1	

Peak Vector Sum: 1.948 mm/s at 0.780 sec



Time Scale: 0.20 sec/div Amplitude Scale: Geo: 2.050 mm/s/div Ndc: 1.050 sec (L) at

Sensor Check

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RECORDING OF SEISMICITY



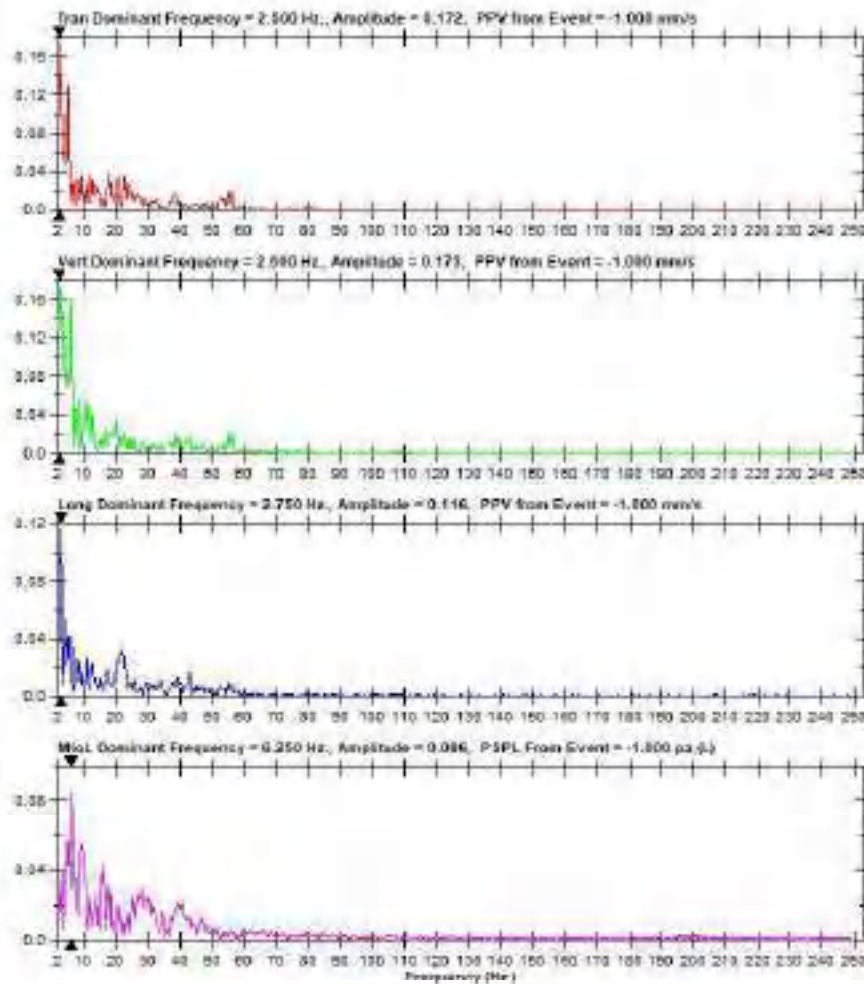
FFT Report

Date/Time: Wed: 14-13:37 February 23, 2023
Trigger Source: Geo: 3.500 mm/s, Mch: 20.03 ps (L)
Range: Geo: 254.0 mm/s
Record Time: 3.0 sec at 2048 kps
Operator/Setup: Operator: MIT ROURKELA.XBVS

Serial Number: UM19134 V 16-5075 Micromate ISEE
Battery Level: 3.8 VDC
Unit Calibration: August 27, 2020 by UES New Delhi
File Name: UM19134_20200223141037 (OPV)

Motion

Location:
Desc: BANGLA MINES, MT ROURKELA
User Name: SM GEOTECH ENGINE, PVT. LTD.
General





Event Report

Date/Time: Long at 14:10:45 February 23, 2025
Trigger Source: Geo: 5.800 mm/s, filer: 0.825 ps(L)
Range: Geo: 254.0 mm/s
Record Time: 3.0 sec at 1024 kps
Operator/Setup: Operator/MT ROURKELA,NBVG

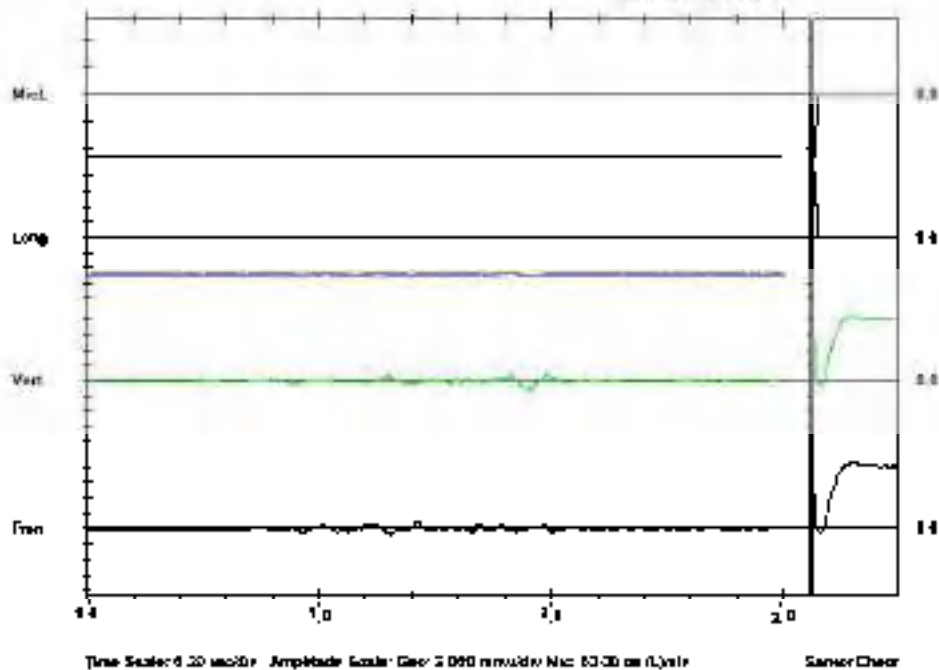
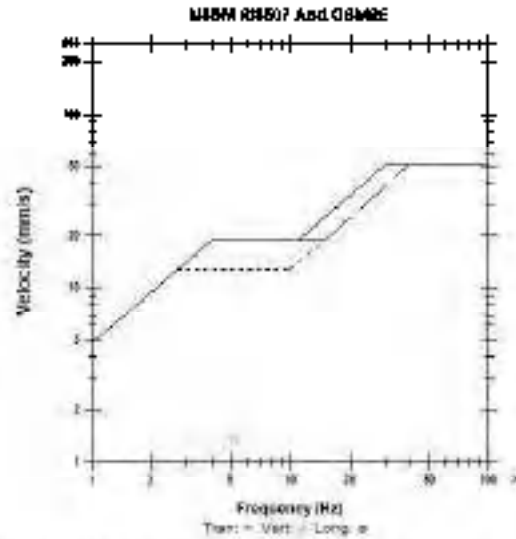
Serial Number: UM15187 V 10-5075 Microphone (SEE)
Battery Level: 3.8 Volts
Unit Calibration: February 21, 2025 by USG New Delhi
File Name: UM15187_20250223141045/CPV

Notes
Location
Case: RANGLA MINES MT ROURKELA
User Name: H. ENTERPRISES
Sensor

Microphone: Linear Weighing
PSPL: 112.1 ps(L) at 0.455 sec
ZC Freq: N/A
Channel Test: Check (Filt = 0.0 Hz Amp = 5 mv)

	Trans	Vert	Long	
PPV	0.835	1.350	4.839	mm/s
ZC Freq	9.8	5.2	N/A	Hz
Time (Ref. to Trig)	1.303	1.902	1.828	sec
Peak Acceleration	0.811	0.007	0.001	g
Peak Displacement	0.819	0.037	0.000	mm
Sensor Check	Check	Check	Check	
Frequency	27.7	28.0	1024.0	Hz
Overwing Ratio	347.0	448.0	0.0	

Peak Vector Sum: 5.810 mm/s at 1.890 sec
N/A: Not Applicable





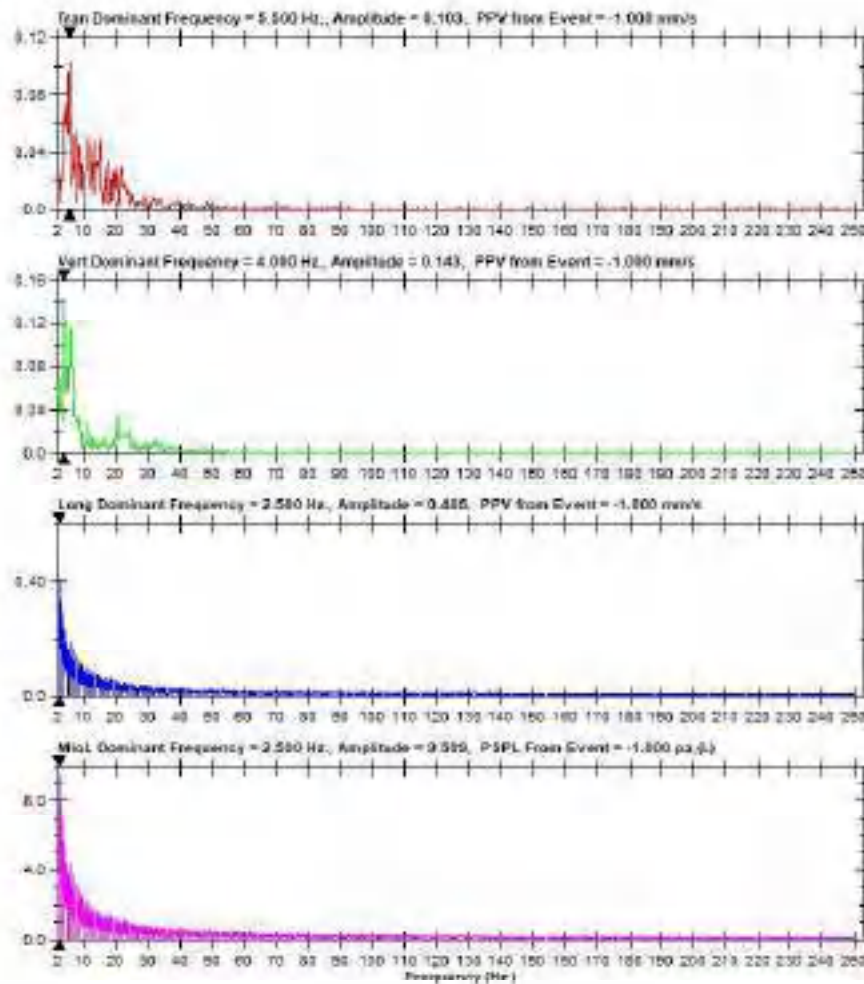
FFT Report

Date/Time: Long at 14:10:45 February 23, 2025
Trigger Source: Geo: 5,800 mm/s, filter: 0.825 ps (L)
Range: Geo: 264.0 mm/s
Record Time: 3.0 sec at 1024 kps
Operator/Setup: Operator/NT ROUKELA.XIVS

Serial Number: UM15187 V 10-5075 Microscale (SEE)
Battery Level: 3.8 Volts
Unit Calibration: February 21, 2025 by USG New Delhi
File Name: UM15187_20250223141045/CPV

Motion

Location:
Desc: RAUKELA MINES-NT ROUKELA
User Name: I.I. ENTERPRISES
General





Event Report

Date/Time: Wed at 14:11:13 February 25, 2025
Trigger Source: Geo: 3.500 mm/s, Mtd: 20.03 sec (L)
Range: Geo: 254.0 mm/s
Record Time: 3.0 sec at 2048 kps
Operator/Setup: Operator/MT ROURKELA.RBVS

Serial Number: UM19104 V 10-5075 Microphone (SE)
Battery Level: 3.8 Vdc
Unit Calibration: August 27, 2020 by: USGS New Delhi
File Name: UM19104_20200223141113.10P.V

Motion

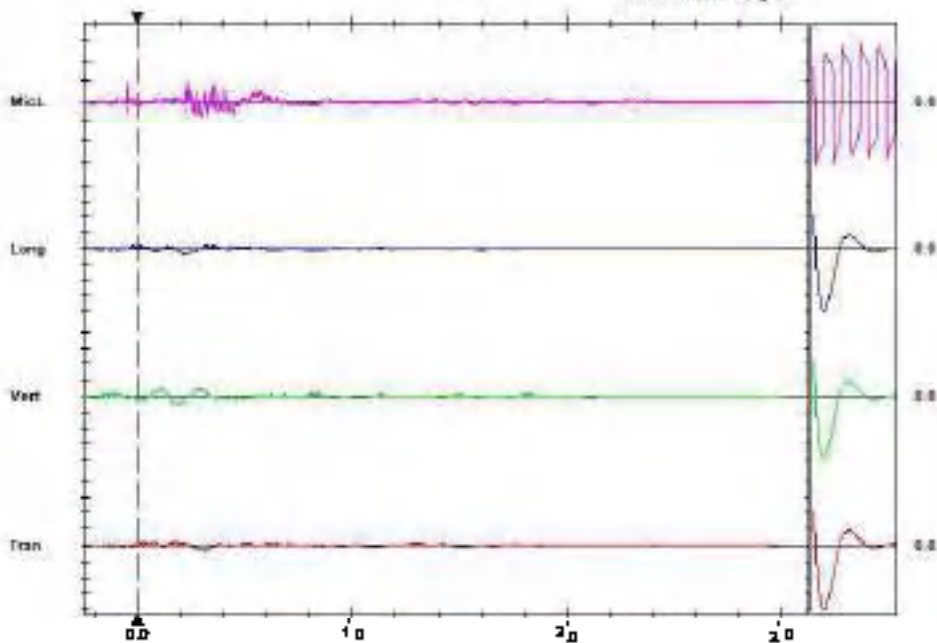
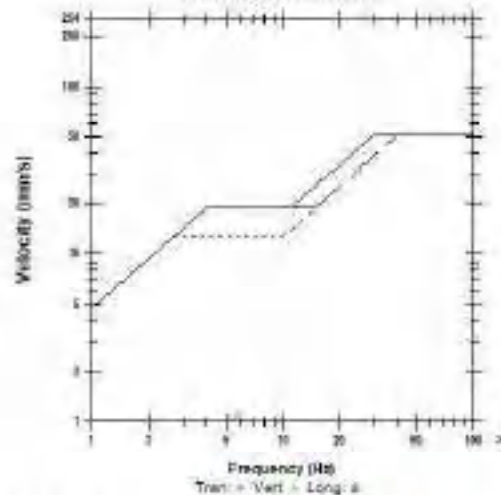
Location:
Site: BANGLA MINES, IIT ROURKELA
User Name: SU GEOTECH ENGG. PVT. LTD.
General

Microphone: Linear Weighting
PSPL: 0.010 ps/L at 0.220 sec
ZC Freq: 47 Hz
Channel Test: Passed (Freq = 15.7 Hz Amp = 1120 mm/s)

	Trans	Vert	Long	
PPV	0.078	1.103	0.073	mm/s
ZC Freq	4.0	5.8	4.7	Hz
Time (Ref. to Trig)	-0.016	-0.191	0.012	sec
Peak Acceleration	-0.010	0.010	0.010	g
Peak Displacement	0.021	0.030	0.020	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.3	7.3	7.1	Hz
Overwriting Ratio	4.8	4.7	5.1	

Peak Vector Sum: 1.183 mm/s at 0.288 sec

USBM R8507 And OSNRE



Time Scale: 0.20 sec/div Amplitude Scale: Geo: 2.000 mm/s/div Mtd: 1.000 ps/L (L)

Sensor Check

RECORDING AL. 000.00 0.00

RECORDING AL. 000.00 0.00



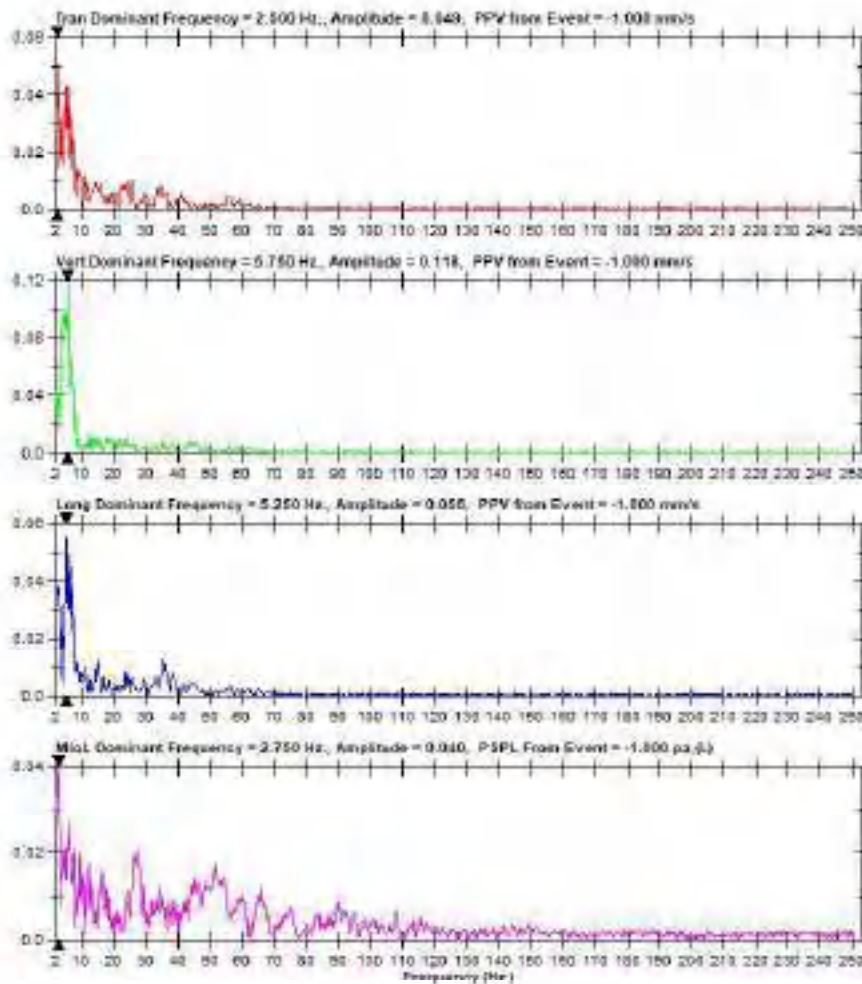
FFT Report

Date/Time: Wed: 14:11:15 February 25, 2020
Trigger Source: Geo. 3.500 mm/s, Mtd: 20.03 ps (L)
Range: Geo: 254.0 mm/s
Record Time: 3.0 sec @ 2048 kps
Operator/Setup: Operator: MT ROURKELA.XBVS

Serial Number: UM19134 V 10-5075 Micromate (SEE)
Battery Level: 3.8 VDC
Unit Calibration: August 27, 2020 by: USS New Delhi
File Name: UM19134_20200223141115.10P.V

Motion

Location:
Desc: BANGLA MINES-WT ROURKELA
User Name: SMI GEOTECH E&S, PVT. LTD.
General





Event Report

Date/Time: Long at 14:11:22 February 23, 2025
Trigger Source: Geo: 5.800 mm/s, filr: 0.825 ps (L)
Range: Geo: 254.0 mm/s
Record Time: 3.0 sec at 1024 kps
Operator/Setup: Operator/NT ROURKELA.XIVIS

Serial Number: UM15187 V 10-5075 Microphone (SEE)
Battery Level: 3.8 Volts
Unit Calibration: February 21, 2025 by UES New Delhi
File Name: UM15187_20250223141122.10P.V

Notes

Location:
Case: RANGLA MINES HT ROURKELA
User Name: H. ENTERPRISES
Serial:

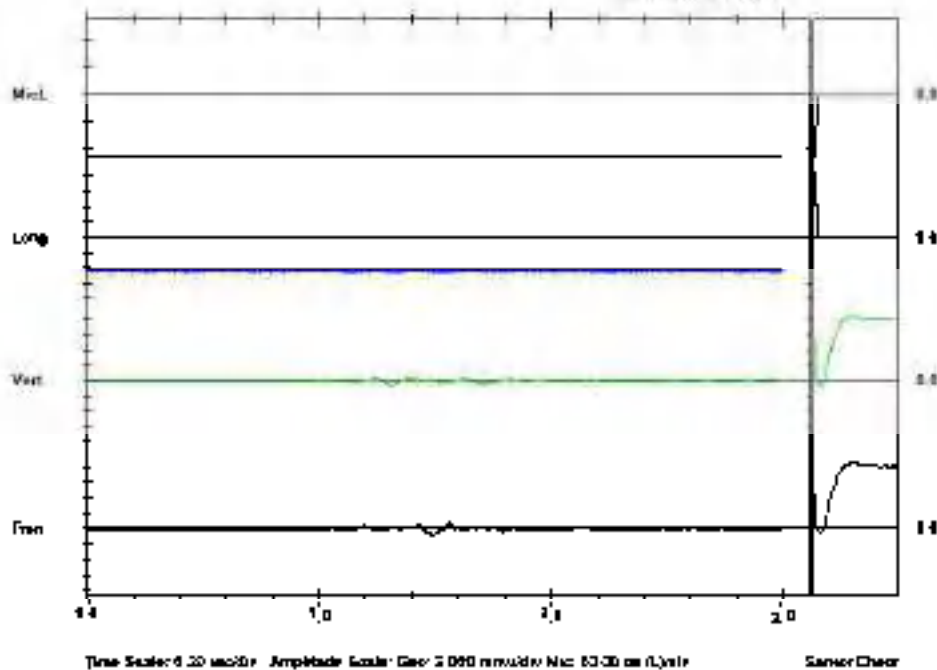
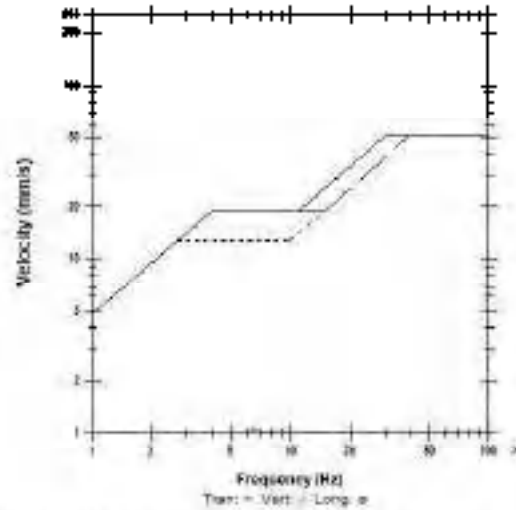
Microphone: Linear Weighting

PSPL: 112.1 ps(L) at 1.732 sec
ZC Freq: N/A
Channel Test: Check (Freq = 1.0 Hz Amp = 5 mv)

	Trans	Vert	Long	
PPV	1.833	0.748	4.430	mm/s
ZC Freq	0.8	5.7	N/A	Hz
Time (Ref. to Trig)	1.492	1.389	0.721	sec
Peak Acceleration	3.912	0.045	0.031	g
Peak Displacement	3.821	0.015	0.030	mm
Sensor Check	Check	Check	Check	
Frequency	27.7	28.0	1024.0	Hz
Overwing Ratio	347.0	446.0	0.0	

Peak Vector Sum: +533 mm/s at 1.492 sec
NB: Not Applicable

UM15187 And 08442





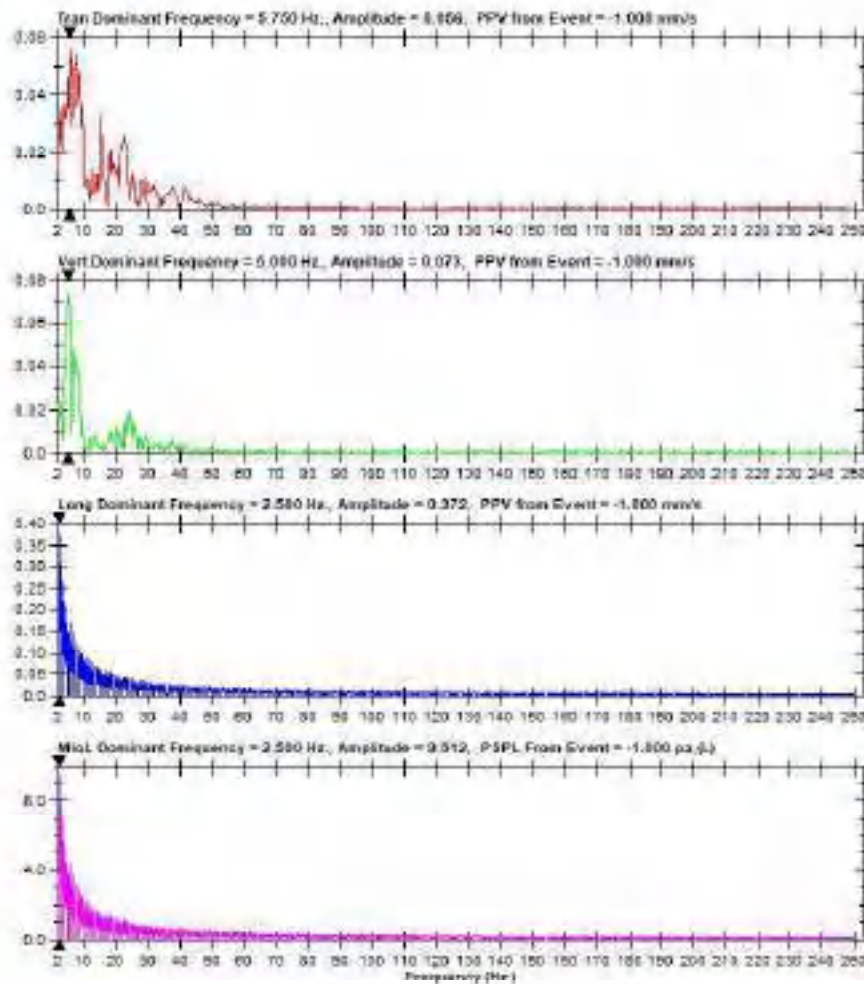
FFT Report

Date/Time: Long at 14:11:22 February 23, 2025
Trigger Source: Geo: 5.800 mm/s, filter: 0.825 ps (L)
Range: Geo: 254.0 mm/s
Record Time: 3.0 sec at 1024 kps
Operator/Setup: Operator/NT ROURELA.XIVIS

Serial Number: UM15187 V 10-5075 Microphone (SEE)
Battery Level: 3.8 Volts
Unit Calibration: February 21, 2025 by UES New Delhi
File Name: UM15187_20250223141122 (OPV)

Notes:

Location:
Dist: RAJELA MINES-NT ROURELA
User Name: I.I. ENTERPRISES
General





Event Report

Date/Time: Long at 14:11:31 February 23, 2025
Trigger Source: Geo: 5.800 mm/s, filr: 0.825 ps(L)
Range: Geo: 254.0 mm/s
Record Time: 3.0 sec at 1024 kps
Operator/Setup: Operator/NT ROURKELA.XBVS

Serial Number: UM15187 V 10-5075 Microphone (SEE)
Battery Level: 3.8 Volts
Unit Calibration: February 21, 2025 by USG New Delhi
File Name: UM15187_20250223141131.00PV

Notes

Location:
Case: RANGLA MINES HT ROURKELA
User Name: H. ENTERPRISES
Serial:

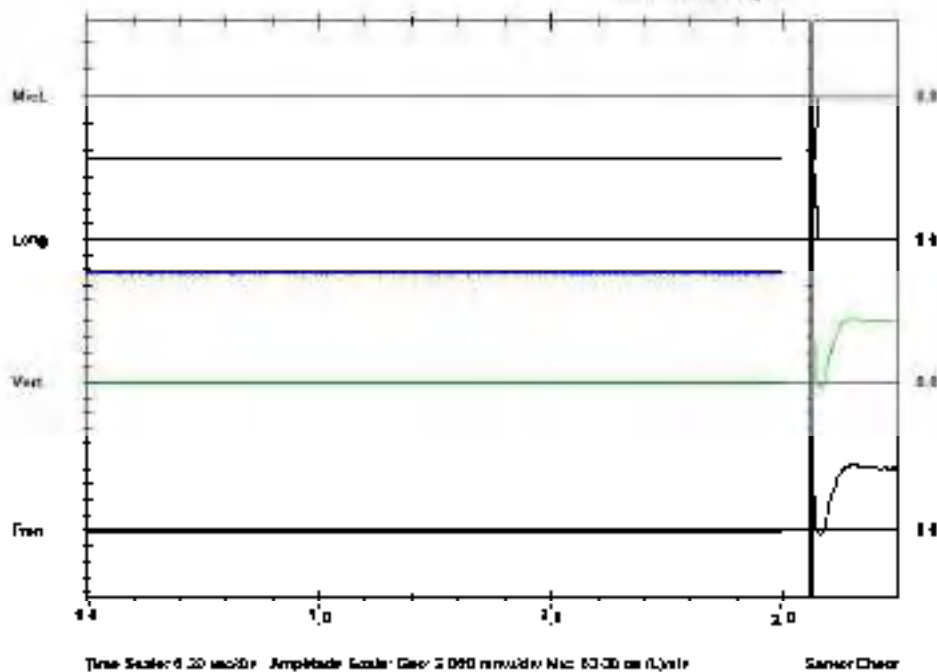
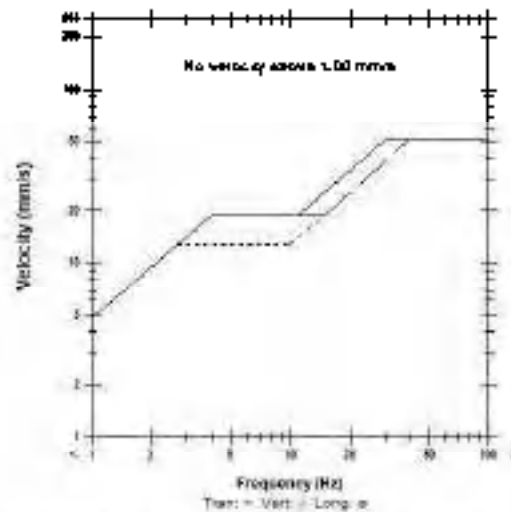
Microphone: Linear Weighting

PSPL: 112.1 ps(L) at 1.028 sec
ZC Freq: N/A
Channel Test: Check (Freq = 3.0 Hz Amp = 5 mv)

	Trans	Vert	Long	
PPV	3.871	0.071	4.422	mm/s
ZC Freq	<1.0	N/A	N/A	Hz
Time (Ref. to Trig)	0.538	2.278	0.049	sec
Peak Acceleration	3.404	0.005	0.034	g
Peak Displacement	0.830	0.000	0.030	mm
Sensor Check	Check	Check	Check	
Frequency	27.7	28.0	1024.0	Hz
Overwing Ratio	347.0	448.0	0.0	

Peak Vector Sum: 4.422 mm/s at 2.108 sec
N/A: Not Applicable

UM15187 And 08402





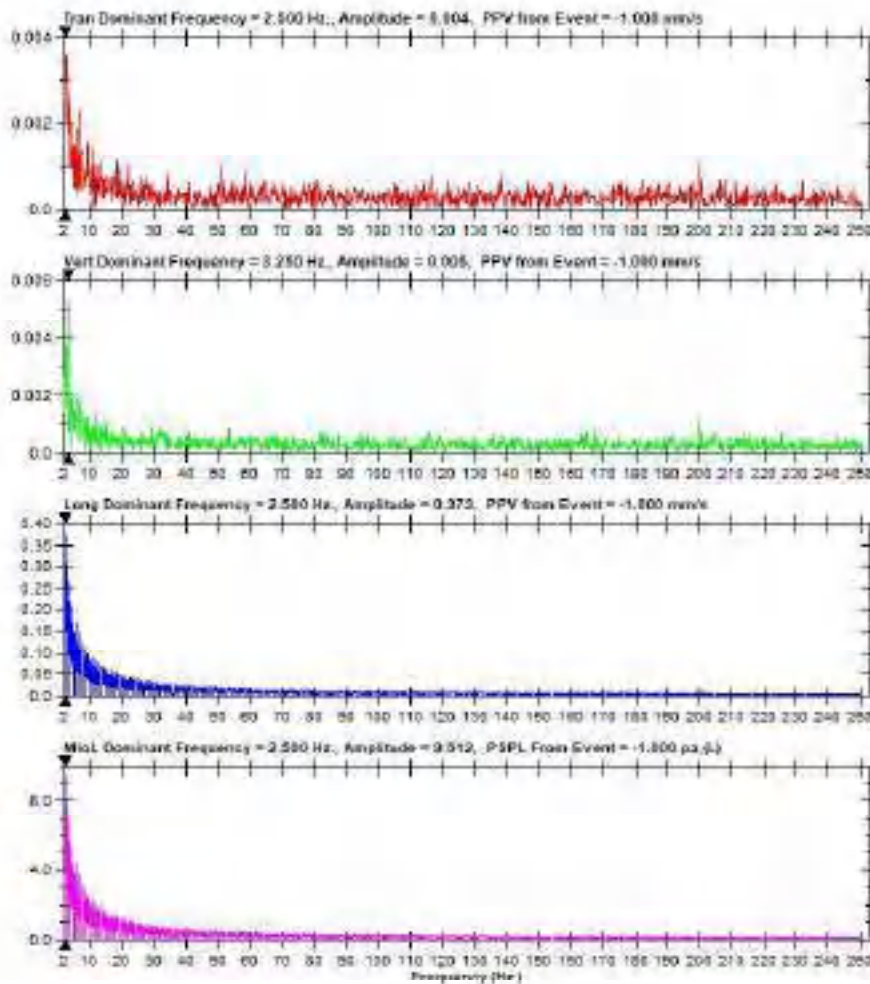
FFT Report

Date/Time: Long at 14:11:21 February 23, 2025
Trigger Source: Geo: 5,800 mm/s, filter: 0.825 ps(L)
Range: Geo: 254.0 mm/s
Record Time: 3.0 sec at 1024 kps
Operator/Setup: Operator/NT ROUKELA, NING

Serial Number: UM15187 V 10-5075 Micro male (SEE)
Battery Level: 3.8 Volts
Unit Calibration: February 21, 2025 by UES New Delhi
File Name: UM15187_20250223141131.DPV

Motion

Location:
Desc: RAUKELA MINES-NT ROUKELA
User Name: I.I. ENTERPRISES
General





Event Report

Date/Time: Wed at 12:38:16 February 25, 2020
 Trigger Source: Geo: 3.500 mm/s, Mic: 20.03 ps (L)
 Range: Geo: 254.0 mm/s
 Record Time: 3.0 sec at 2048 kps
 Operator/Setup: Operator/MT ROURKELA.XBVS

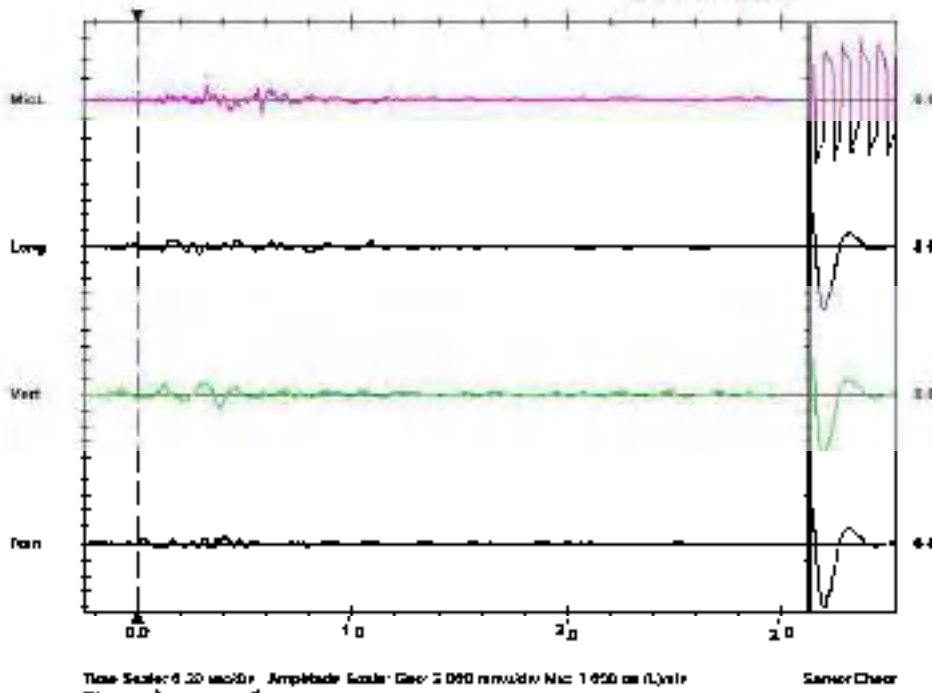
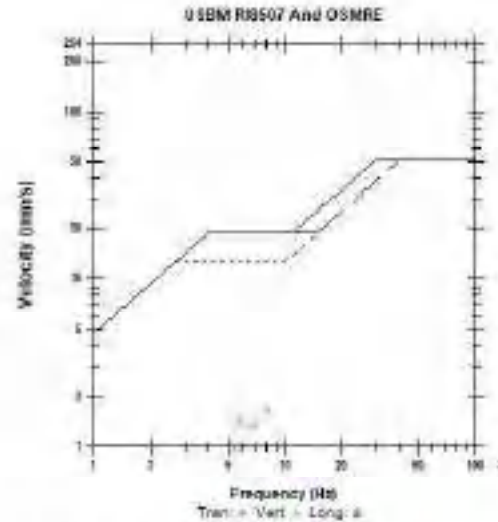
Serial Number: UM19104 V 10-5075 Microphone (SE)
 Battery Level: 3.8 Volts
 Unit Calibration: August 27, 2020 by USB New Delhi
 File Name: UM19104_20200225153816 (OPN)

Motion:
 Location:
 Client: BANGLA MINES, IIT ROURKELA
 User Name: SU GEOTECH ENGG. PVT. LTD.
 General:

Microphone: Linear Weighing
 PSPL: 0.002 ps (L) at 0.075 sec
 ZC Freq: 15.7 Hz
 Channel Test: Passed (Freq = 15.7 Hz Amp = 1125 mV)

	Trans	Vert	Long	
PPV	0.988	1.047	0.840	mm/s
ZC Freq	9.1	7.6	13.3	Hz
Time (Ref. to Trig)	-0.401	-0.376	0.394	sec
Peak Acceleration	-0.013	0.010	0.018	g
Peak Displacement	0.019	0.038	0.029	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.1	7.3	7.1	Hz
Overwriting Ratio	4.8	4.7	5.2	

Peak Vector Sum: 1.082 mm/s at 0.273 sec



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UM19104 V 10-5075 Microphone (SE)

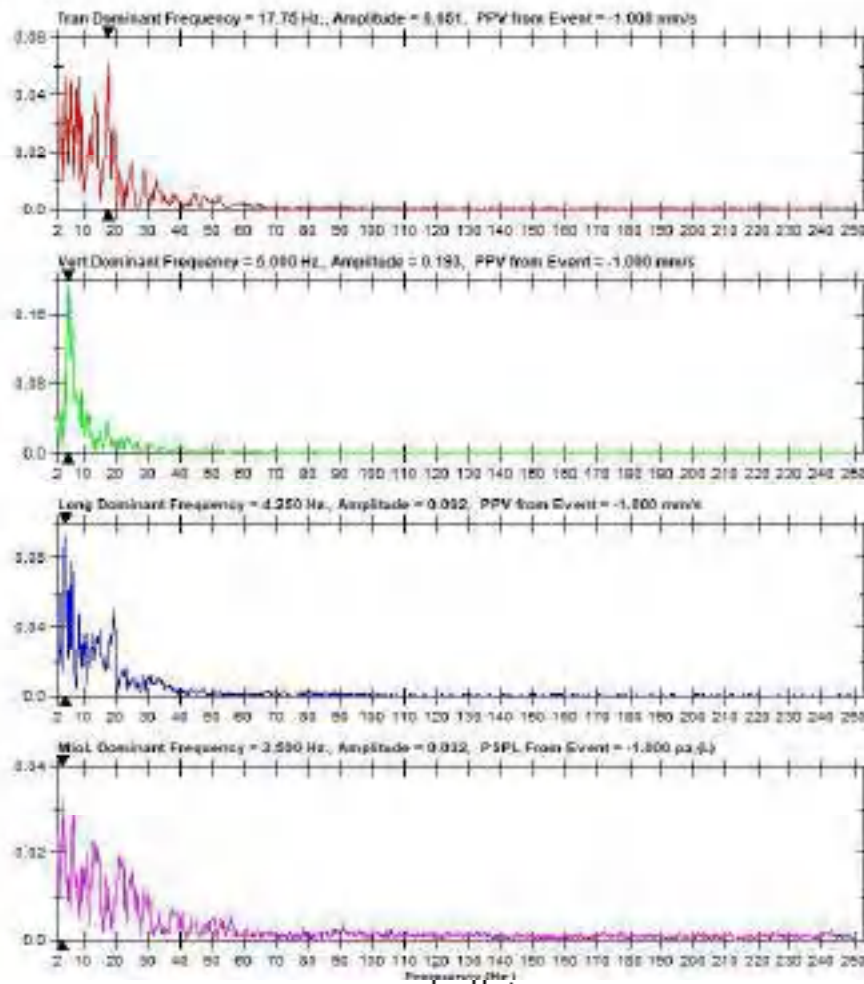


FFT Report

Date/Time: Wed at 12:38:16 February 25, 2020
Trigger Source: Geo. 3.500 mm/s, Mch 20.03 ps (L)
Range: 0 to 254.0 mm/s
Record Time: 3.0 sec at 2048 kps
Operator/Setup: Operator/MT ROURKELA.XBVG

Serial Number: UM19104 V 10-5075 Micromate (SEE)
Battery Level: 3.8 VDC
Unit Calibration: August 27, 2020 by USG New Delhi
File Name: UM19104_20200225153816 (DPV)

Motion:
Location:
Desc: BANGLA MINES, MT ROURKELA
User Name: SU GEOTECH E339, PVT. LTD.
General





Event Report

Date/Time: MSL at 13:18:04 February 26, 2025
Trigger Source: Geo: 5,800 mm/s, Msc: 6.325 ps(L)
Range: Geo: 264.0 mm/s
Record Time: 3.0 sec at 1024 kps
Operator/Setup: Operator/MT ROUKELA/KING

Serial Number: UM15187 V 16-5075 MicroMale ISEE
Battery Level: 3.8 Volts
Unit Calibration: February 27, 2025 by USG New Delhi
File Name: UM15187_20250226133604.10FIV

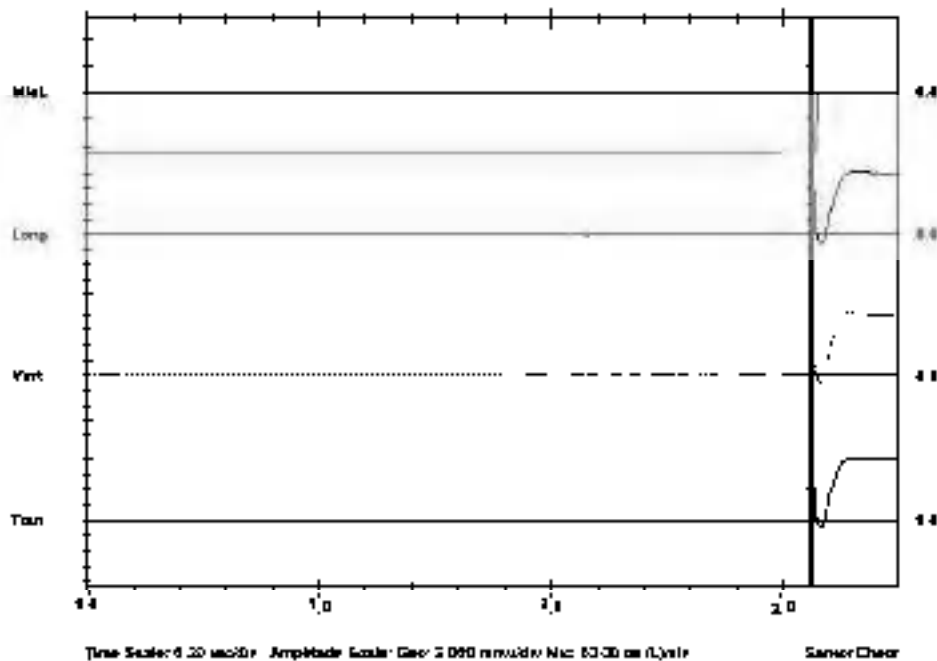
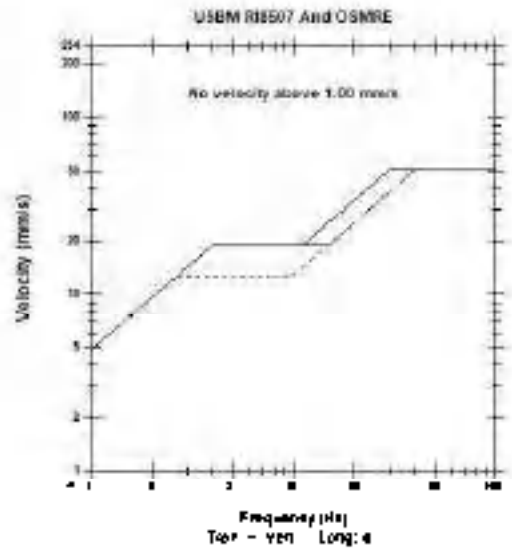
Notes:

Location:
Client: RAUKELA MINES-MT ROUKELA
User Name: I.I. ENTERPRISES
General:

Microphone: Linear Weighing
PSPL: 111.0 ps(L) at 0.255 sec
ZC Freq: NA
Channel Test: Check (Freq = 3.0 Hz Amp = 5 mv)

	Tran	Vert	Long	
PPV	8.110	6.142	8.118	mm/s
ZC Freq	10	8.0	7.1	Hz
Time (Ref. to Trig)	1.908	2.121	2.151	sec
Peak Acceleration	3.904	0.009	3.909	g
Peak Displacement	0.917	0.048	0.938	mm
Sensor Check	Check	Check	Check	
Frequency	25.0	22.8	20.8	Hz
Overwing Ratio	445.0	485.0	559.0	

Peak Vector Sum: 8.107 mm/s at 2.276 sec
Msc: Not Applicable



RAUKELA MINES-MT ROUKELA

RAUKELA MINES-MT ROUKELA

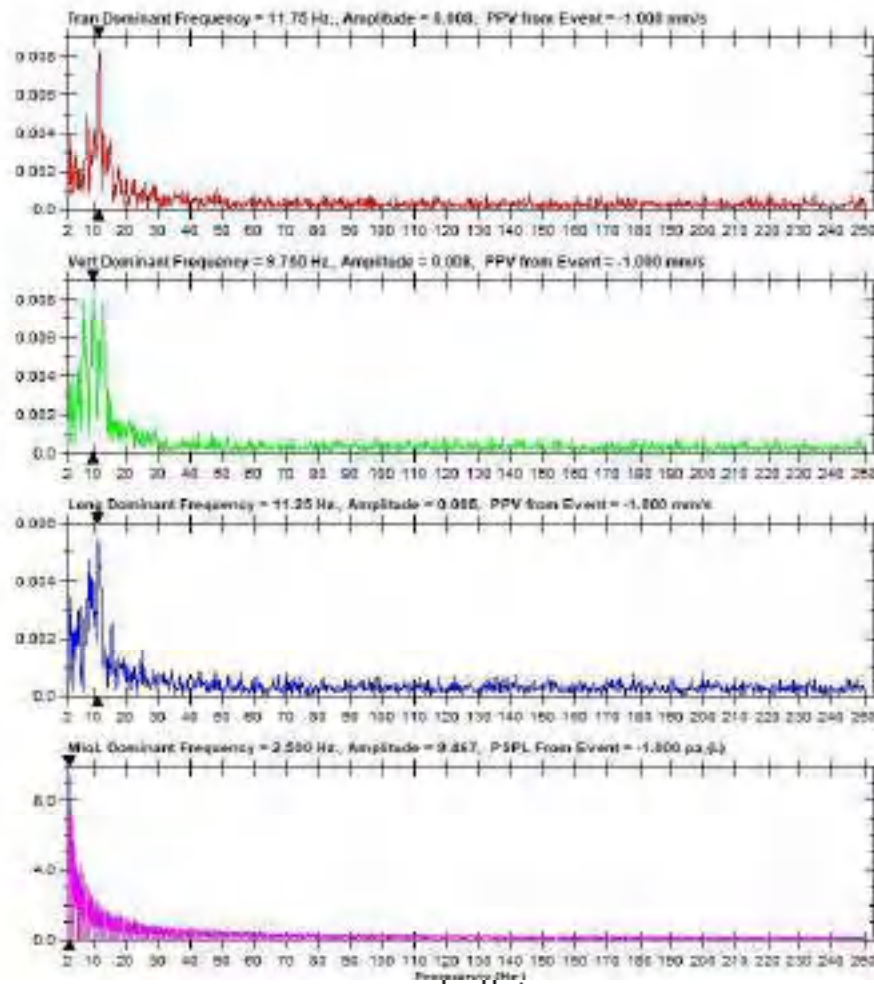


FFT Report

Date/Time	USOL at 13:18:04 February 25, 2025	Serial Number	UM19187 V 10-6075 Micromale (SEE)
Trigger Source	Geo: 5,800 mm/s, Mko: 6.525 ps(L)	Battery Level	3.8 Volts
Range	Geo: 264.0 mm/s	Unit Calibration	February 21, 2025 by USG New Delhi
Record Time	3.0 sec at 1024 kps	File Name	UM19187_2025022513360410FIV
Operator/Setup	Operator/NT ROURELA.XBVG		

Motion

Location:
Dist: RAJOLA MINES-NT ROURELA
User Name: I.I. ENTERPRISES
General





Event Report

Date/Time: Fri at 12:40:22 February 26, 2020
Trigger Source: Geo: 3,500 mm/s, tMo: 20.00 s(1L)
Range: Geo: 254.0 mm/s
Record Time: 3.0 sec at 2048 kps
Operator/Setup: Operator/MT ROURKELA/RSVS

Serial Number: UM19104 V 10-5075 Micromale (SE)
Battery Level: 3.8 VDC
Unit Calibration: August 27, 2020 by USGS New Delhi
File Name: UM19104_20200225154022.10P19

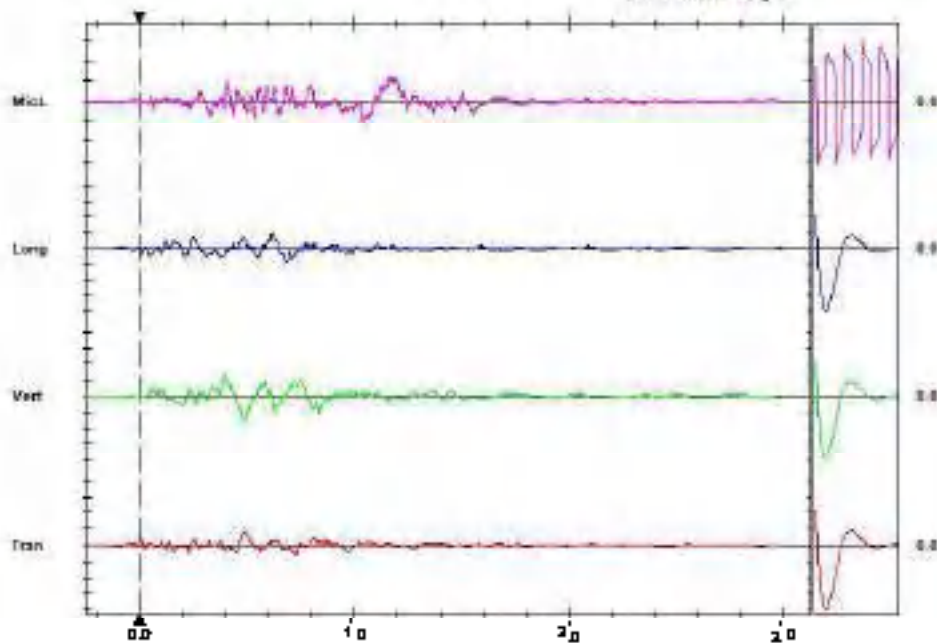
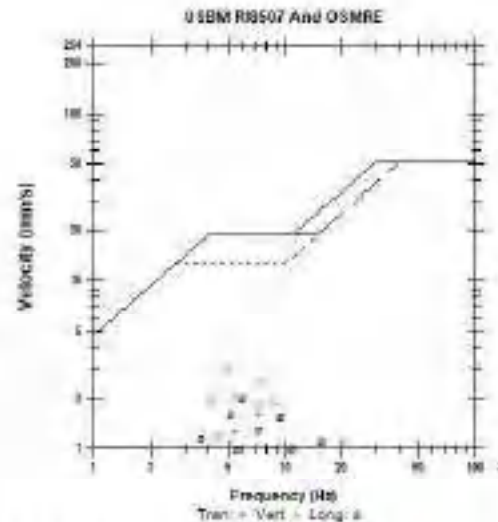
Motion

Location:
Site: BANGLA MINES, NIT ROURKELA
User Name: SU GEOTECH ENGG. PVT. LTD.
General:

Microphone: Linear Weighing
PSPL: 1.170 ps(L) at 1.320 sec
ZC Freq: 3.3 Hz
Channel Test: Passed (Freq = 15.7 Hz Amp = 1125 mV)

	Trans	Vert	Long	
PPV	1.608	2.987	2.012	mm/s
ZC Freq	7.9	4.9	6.8	Hz
Time (Ref. to Trig)	-0.459	-0.454	-0.618	sec
Peak Acceleration	-0.916	-0.916	-0.031	g
Peak Displacement	0.029	0.070	-0.041	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.1	7.2	7.1	Hz
Overwing Ratio	4.8	4.7	5.2	

Peak Vector Sum: 3.520 mm/s at 0.480 sec



Time Scale: 0.20 sec/div Amplitude Scale: Geo: 2,000 mm/s/div Nuc: 1,000 ps(L)/div

Sensor Check

REMARK: NIT, 2020 FEB 26

REMARK: NIT, 2020 FEB 26



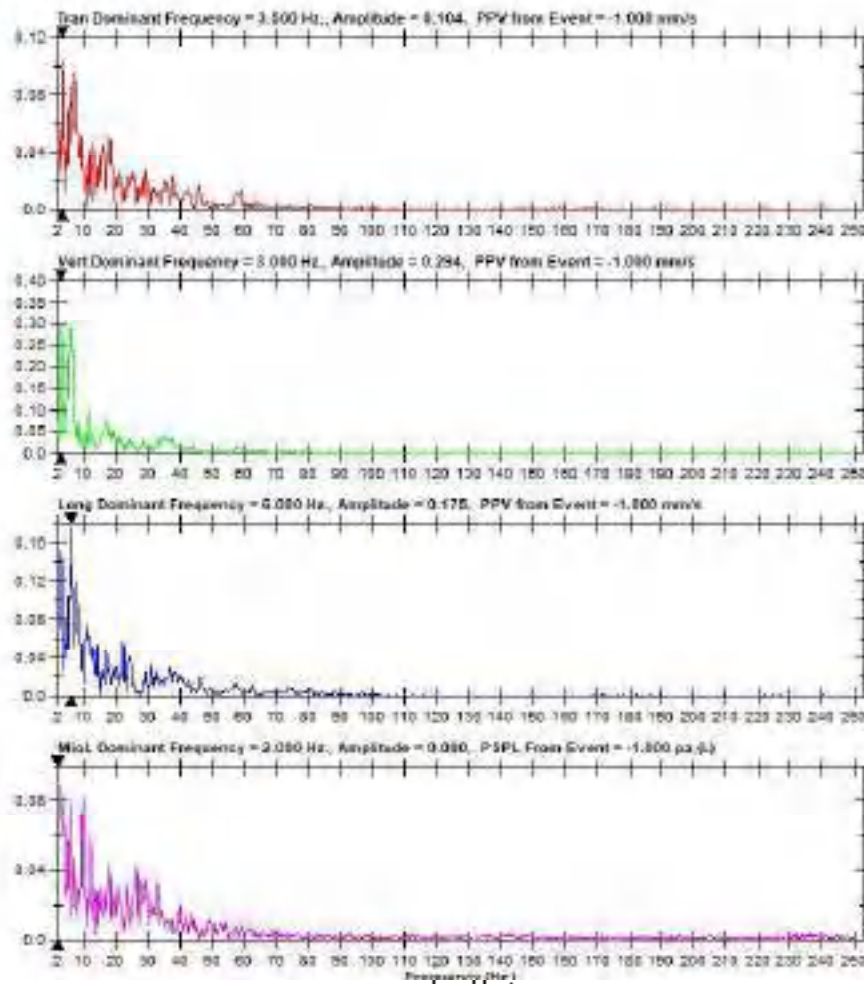
FFT Report

Date/Time: Fri Jan 12 12:40:22 February 26, 2025
Trigger Source: Geo: 3.500 mm/s, tMo: 20.00 s(1L)
Range: Geo: 254.0 mm/s
Record Time: 3.0 sec at 2048 kps
Operator/Setup: Operator: MT ROURKELA.XBVS

Serial Number: UM19134 V 16-5075 Micromate (SEE)
Battery Level: 3.8 VDC
Unit Calibration: August 27, 2020 by URS New Delhi
File Name: UM19134_20200225134022.10P.V

Motion

Location:
Desc: BANGLA MINES, MT ROURKELA
User Name: SRI GEOTECH E&S, PVT. LTD.
General





Event Report

Date/Time: 1/10/2025 February 25, 2025
Trigger Source: Geo: 5,000 mm/s, N/A: 0.525 ps(L)
Range: Geo: 254.0 mm/s
Record Time: 3.0 sec at 1024 kps
Operator/Setup: Operator/NT ROURELA.NBVS

Serial Number: UM15187 V 10-5075 Microphone ISEE
Battery Level: 3.8 Volts
Unit Calibration: February 21, 2025 by USGS New Delhi
File Name: UM15187_20250225133558 IOPV

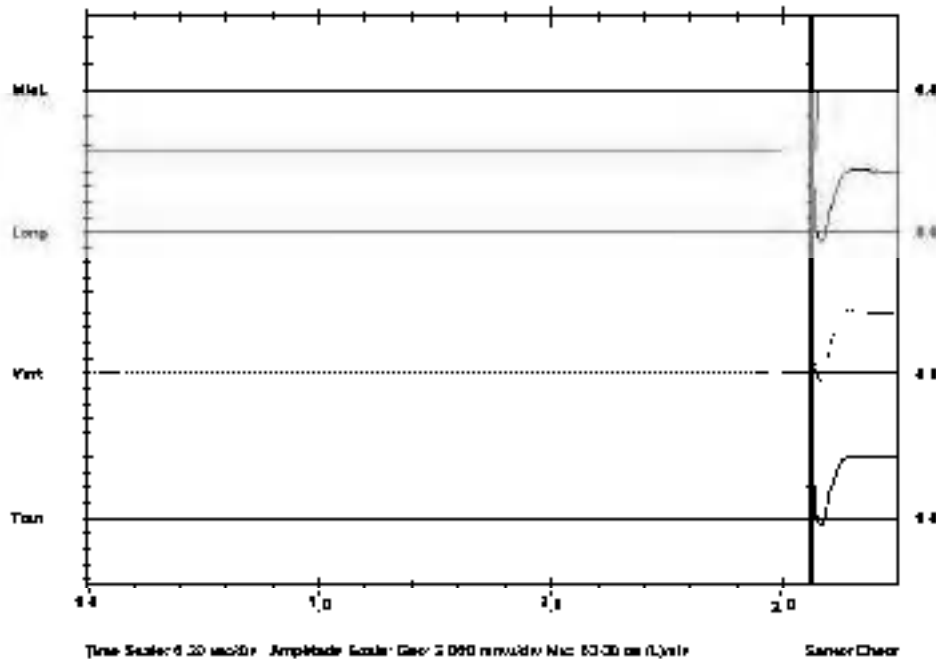
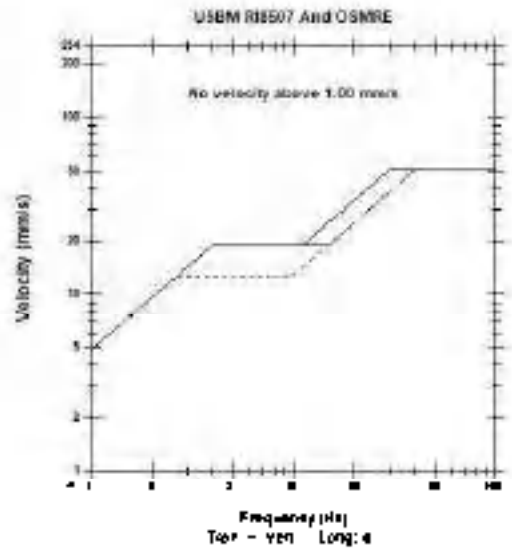
Motion

Location:
Client: RAJELA MINES-NT ROURELA
User Name: I.I. ENTERPRISES
General

Microphone: Linear Weighting
PSPL: 111.0 ps(L) at 0.952 sec
ZC Freq: N/A
Channel Test: Check (Freq = 1.0 Hz Amp = 5 mv)

	Tran	Vert	Long	
PPV	0.005	0.071	0.003	mm/s
ZC Freq	9.0	<1.0	1.2	Hz
Time (Ref. to Trig)	1.148	1.649	1.355	sec
Peak Acceleration	1.001	0.005	1.001	g
Peak Displacement	0.007	0.028	0.020	mm
Sensor Check	Check	Check	Check	
Frequency	25.0	22.5	20.0	Hz
Overwing Ratio	445.0	455.0	555.0	

Peak Vector Sum: 0.082 mm/s at 1.021 sec
N/A: Not Applicable



RAJELA MINES-NT ROURELA

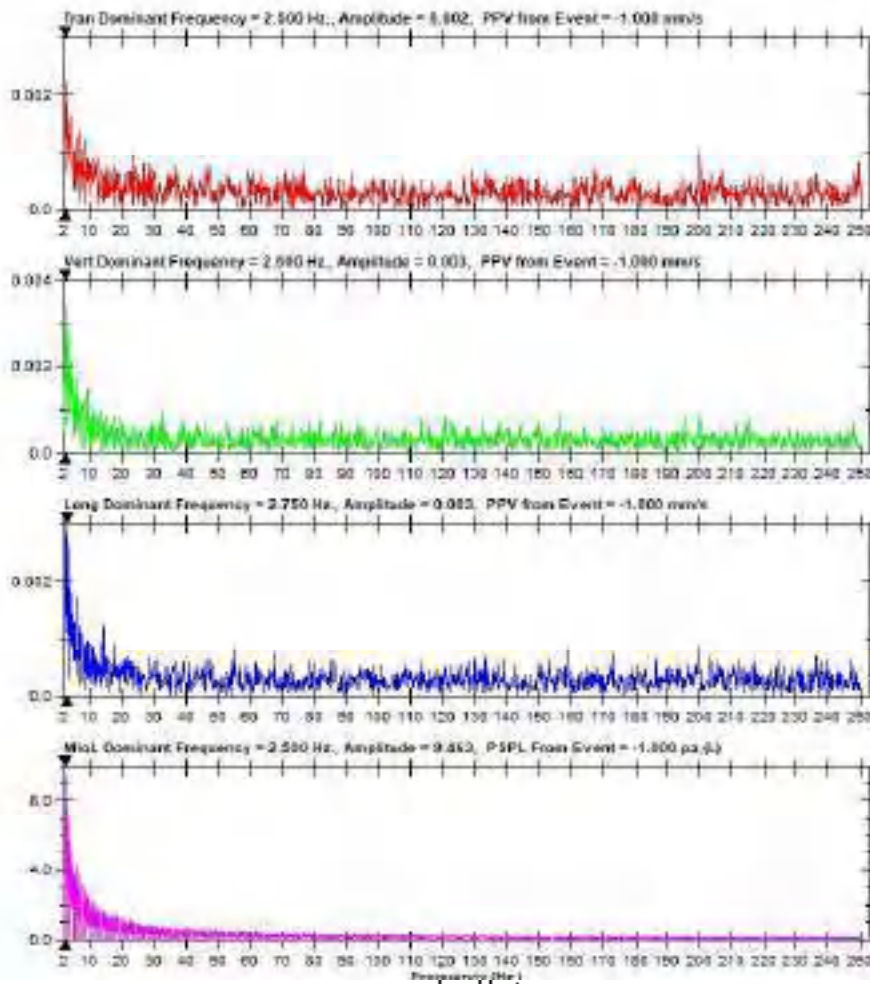
RAJELA MINES-NT ROURELA



FFT Report

Date/Time	USOL at 13:39:59 February 26, 2026	Serial Number	UM19187 V 16-60FS Microscale ISEE
Trigger Source	Geo: 5,800 mm/s, Max: 6.525 ps(L)	Battery Level	3.8 Volts
Range	Geo: 264.0 mm/s	Unit Calibration	February 27, 2025 by USGS New Delhi
Record Time	3.0 sec at 1024 kps	File Name	UM19187_20260226133959.10PVV
Operator/Setup	Operator/NT ROUKELA.XBVS		

Notes:
Location:
Dist: RAJOLA MINES-NT ROUKELA
User Name: I.I. ENTERPRISES
General





Event Report

Date/Time: Long at 19:08:44 February 27, 2020
Trigger Source: Geo: 5,500 mm/s, file: 20.00 (s.s.L.)
Range: Geo: 254.0 mm/s
Record Time: 3.0 sec at 2048 kps
Operator/Setup: Operator/MT ROURKELA.RBVS

Serial Number: UM19104 V 10-5075 Microphone (SE)
Battery Level: 3.8 Vdc
Unit Calibration: August 27, 2020 by UES New Delhi
File Name: UM19104_20200227190844 (OPN)

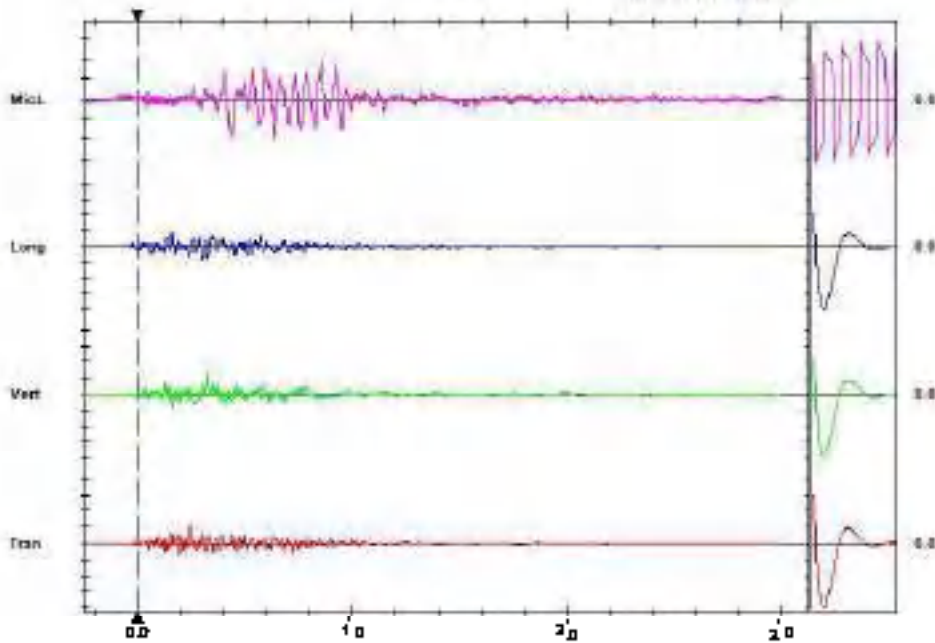
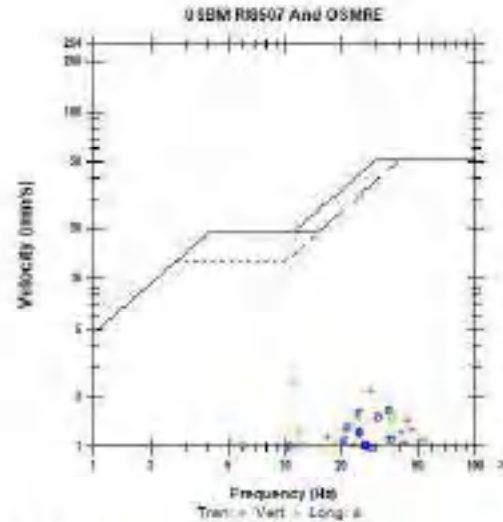
Motion

Location:
Client: BANGLA MINES, IIT ROURKELA
User Name: SU GEOTECH ENGG. PVT. LTD.
General

Microphone: Linear Weighing
PSPL: 1.071 ps/Ly at 0.034 sec
ZC Freq: 17.1 Hz
Channel Test: Passed (Freq = 15.7 Hz Amp = 1200 mv)

	Tran	Vert	Long	
PPV	2.152	2.428	1.687	mm/s
ZC Freq	.28	11.1	.35	Hz
Time (Ref. to Trig)	-0.242	-0.325	-0.159	sec
Peak Acceleration	0.001	0.001	0.000	g
Peak Displacement	0.011	0.022	0.013	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.0	7.2	7.1	Hz
Overwing Ratio	4.0	4.0	5.2	

Peak Vector Sum: 2.900 mm/s at 0.320 sec



REMARK: NOISE 1.000 (V) 0.010

REMARK: NOISE 1.000 (V) 0.010



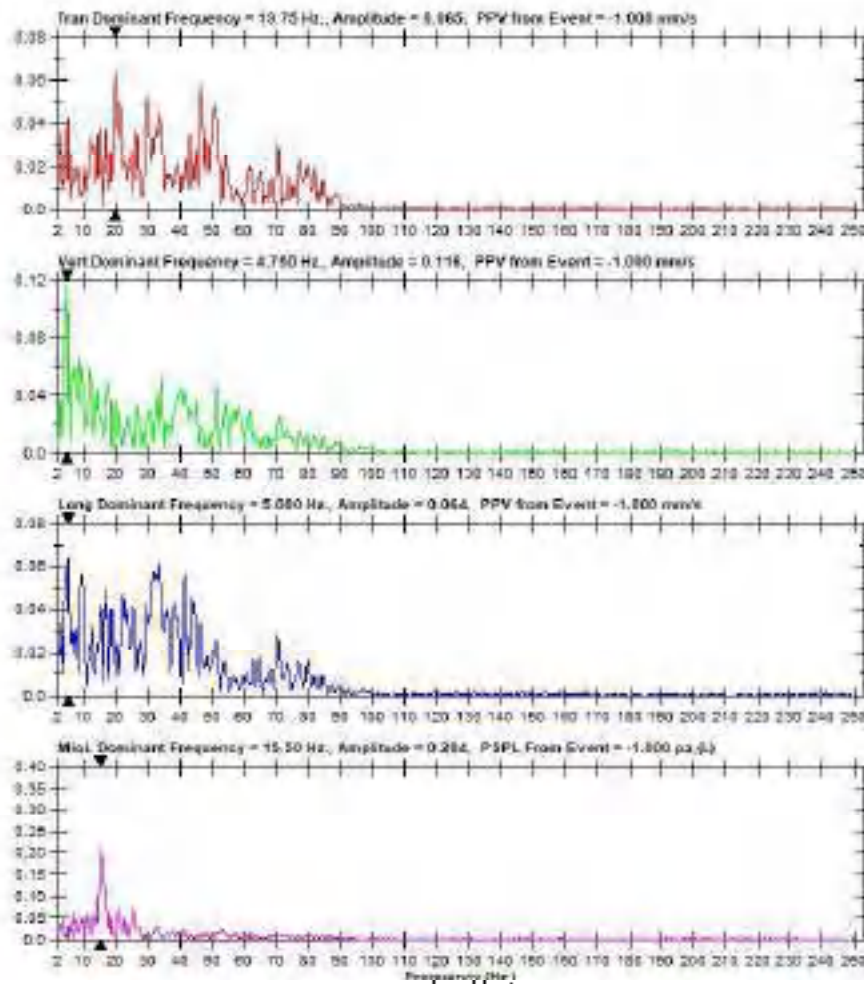
FFT Report

Date/Time: Long at 13:00:44 February 27, 2020
Trigger Source: Geo: 0.500 mm/s, hhd: 20.00 ps(L)
Range: Geo: 254.0 mm/s
Record Time: 3.0 sec at 2048 kps
Operator/Setup: Operator/MT ROURKELA.RBVG

Serial Number: UM19134 V 16-5075 Micromate (SEE)
Battery Level: 3.8 VDC
Unit Calibration: August 27, 2020 by UES New Delhi
File Name: UM19134_20200227130044 (DPN)

Motion

Location:
Desc: BANGLA MINES-WT ROURKELA
User Name: SU GEOTECH E&S, PVT. LTD.
General





Event Report

Date/Time: Long at 13:05:54 February 27, 2025
Trigger Source: Geo: 5.800 mm/s, Nix: 0.525 ps(L)
Range: Geo: 254.0 mm/s
Record Time: 3.0 sec at 1024 kps
Operator/Setup: Operator/NT ROUKELA/KRVS

Serial Number: UM15187 V 16-5075 Micromale (SE)
Battery Level: 3.8 Volts
Unit Calibration: February 27, 2025 by UDS New Delhi
File Name: UM15187_2325022713055410FV

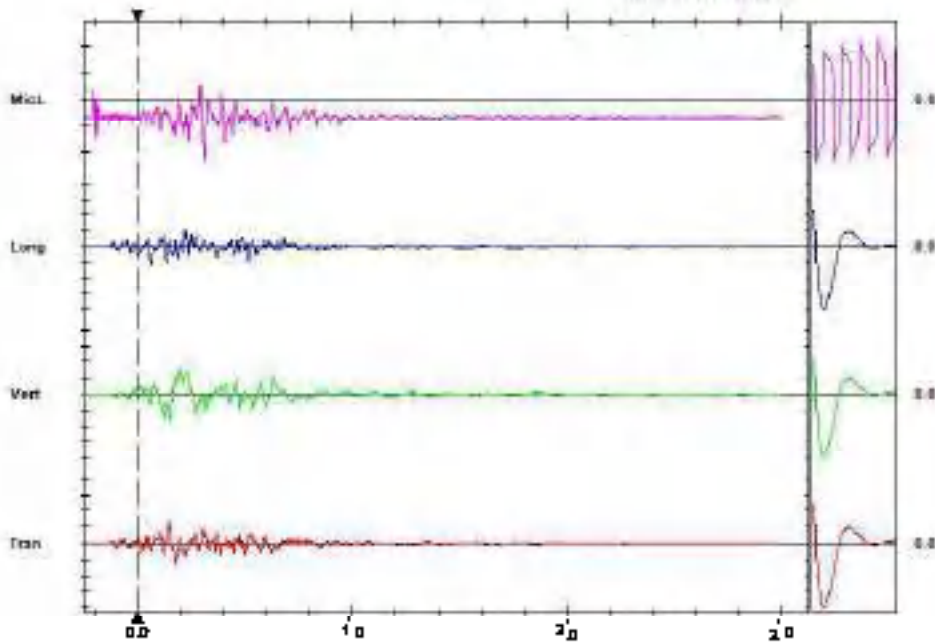
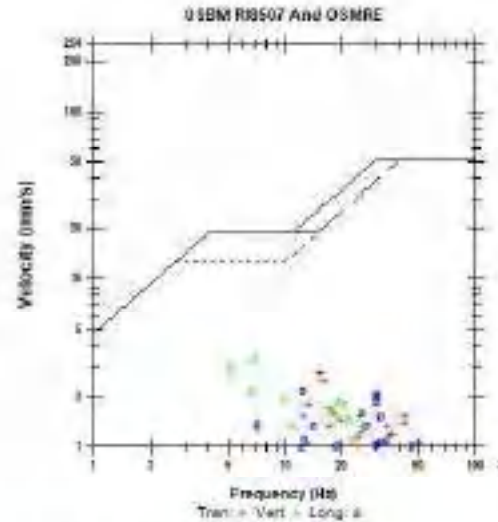
Motion

Location:
Site: RAUKELA MINES-NT ROUKELA
User Name: I.I. ENTERPRISES
General

Microphone: Linear Weighting
PSPL: 4.717 ps(L) at 0.300 sec
ZC Freq: 17 Hz
Channel Test: Passed (Freq = 15.7 Hz Amp = 1244 mv)

	Tran	Vert	Long	
PPV	2.748	3.397	2.181	mm/s
ZC Freq	16	8.6	12	Hz
Time (Ref. to Trig)	0.146	0.151	0.002	sec
Peak Acceleration	0.351	0.301	0.018	g
Peak Displacement	0.022	0.002	0.018	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.3	7.3	7.3	Hz
Overwing Ratio	4.2	4.2	4.3	

Peak Vector Sum: +127 mm/s at 0.146 sec



Time Scale: 0.20 sec/div Amplitude Scale: Geo: 5.000 mm/s/div Nix: 0.525 ps(L)/div

Sensor Check

RAUKELA MINES-NT ROUKELA

RAUKELA MINES-NT ROUKELA

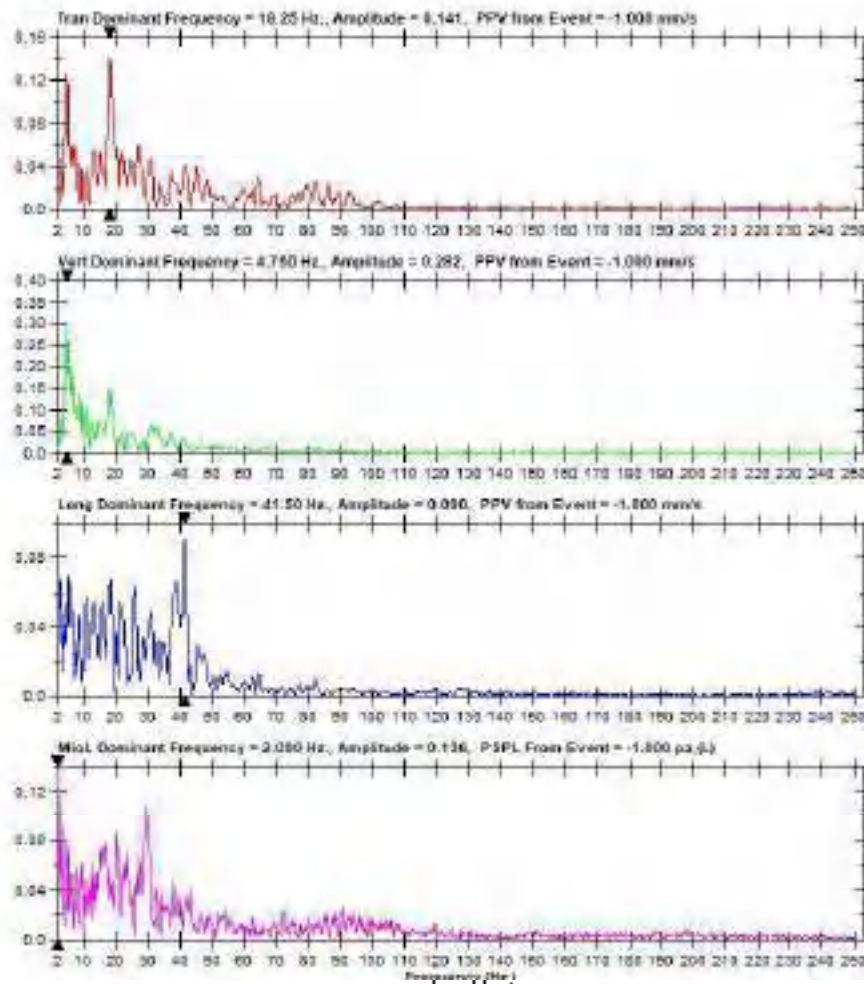


FFT Report

Date/Time	Long at 13:05:54 February 27, 2025	Serial Number	UM15187 V 16-5075 Micro male (SEE
Trigger Source	Geo: 5.800 mm/s, Hilo: 0.825 g _o (L)	Battery Level	3.8 Volts
Range	Geo: 254.0 mm/s	Unit Calibration	February 27, 2025 by UCS New Delhi
Record Time	3.0 sec at 1024 kps	File Name	UM15187_2325022713055410FIV
Operator/Setup	Operator/NT ROUKELA.NBVS		

Motion

Location:
Desc: RAJGELA MINES-NT ROUKELA
User Name: I.I. ENTERPRISES
General





Event Report

Date/Time: Long at 19:27:45 February 27, 2020
Trigger Source: Geo: 3,500 mm/s, file: 20.00 (s.s.L.)
Range: Geo: 254.0 mm/s
Record Time: 3.0 sec at 2048 kps
Operator/Setup: Operator/MT ROURKELA/KSVG

Serial Number: UM19104 V 10-5075 Microphone (SE)
Battery Level: 3.8 VDC
Unit Calibration: August 27, 2020 by: UES New Delhi
File Name: UM19104_20200227133745 (OPN)

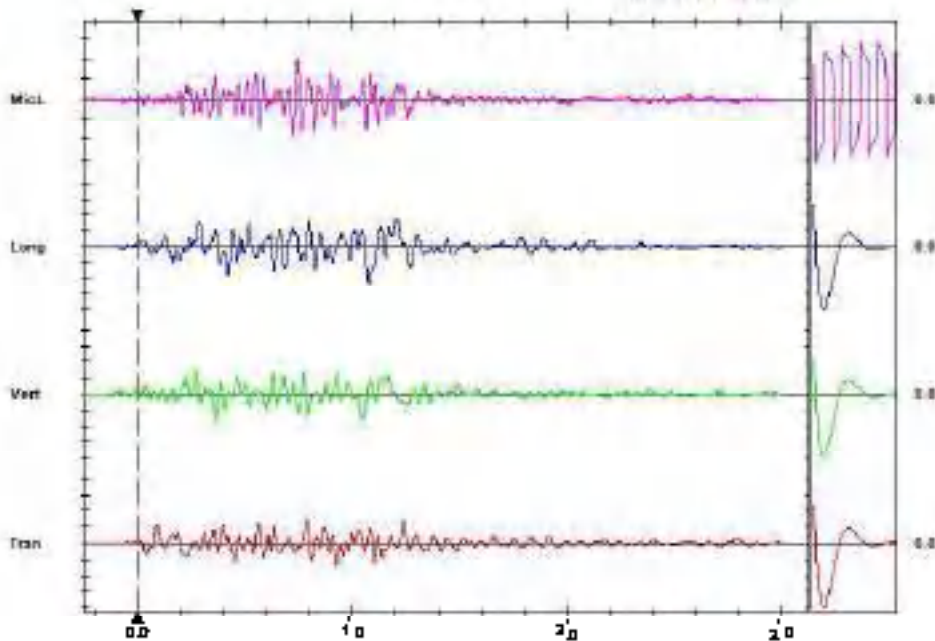
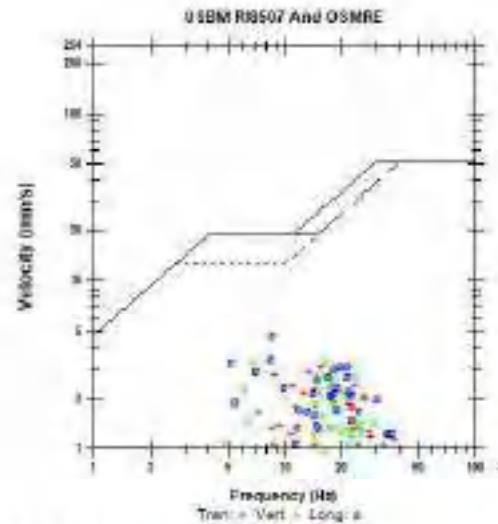
Motion

Location:
Site: BANGLA MINES, MT ROURKELA
User Name: SU GEOTECH ENGG. PVT. LTD.
General

Microphone: Linear Weighting
PSPL: 1.524 ps (L) at 0.743 sec
ZC Freq: 23 Hz
Channel Test: Passed (Freq = 15.7 Hz Amp = 121.1 mV)

	Tran	Vert	Long	
PPV	3.058	3.302	4.745	mm/s
ZC Freq	15.5	18.9	3.5	Hz
Time (Ref. to Trig)	-5.787	-5.364	1.078	sec
Peak Acceleration	0.355	0.304	0.064	g
Peak Displacement	0.058	0.058	0.077	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.3	7.3	7.3	Hz
Overwing Ratio	4.3	4.3	5.1	

Peak Vector Sum: 5.281 mm/s at 1.078 sec



Time Scale: 0.20 sec/div Amplitude Scale: Geo: 2,000 mm/s/div Nuc: 1,000 ps (L)/div

Sensor Check

REMARK: NOISE 1.000 (V) 0.074

REMARK: NOISE 2.000 (V) 0.074



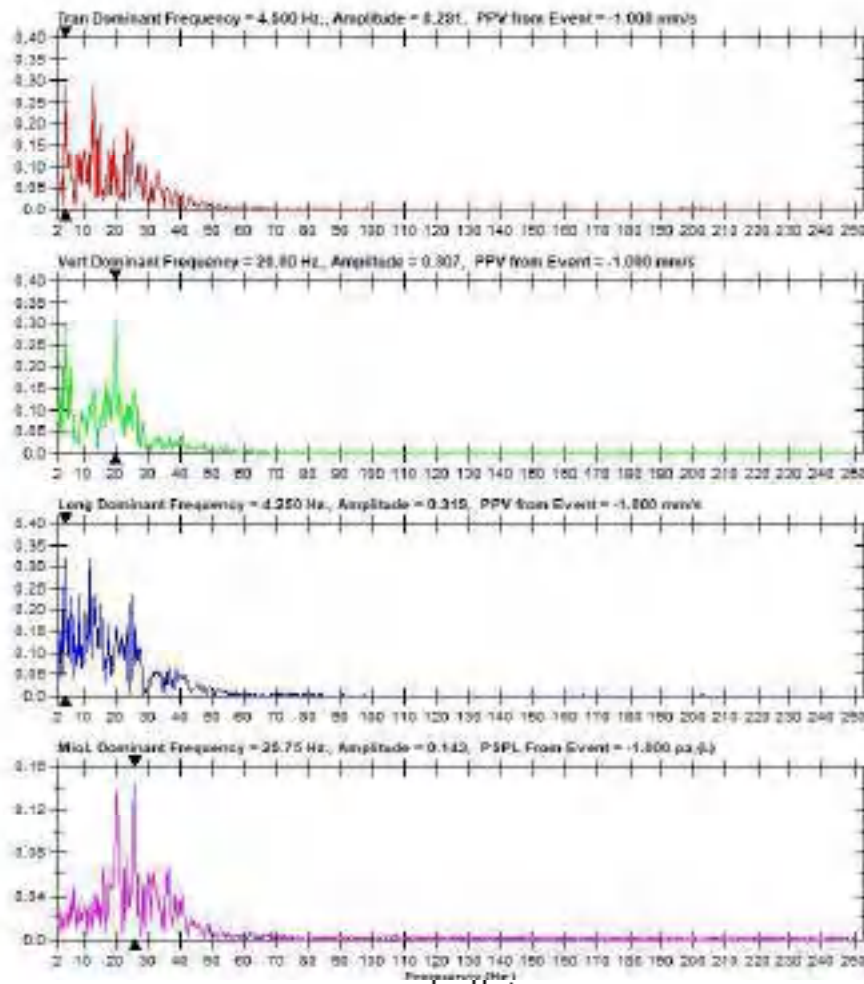
FFT Report

Date/Time: Long at 19:07:45 February 27, 2020
Trigger Source: Geo: 0.500 mm/s, file: 20.00 pa(L)
Range: Geo: 254.0 mm/s
Record Time: 3.0 sec at 2048 kps
Operator/Setup: Operator/MT ROURKELA.XIVIS

Serial Number: UM19104 V 10-5075 Micromate (SEE)
Battery Level: 3.8 VDC
Unit Calibration: August 27, 2020 by: URS New Delhi
File Name: UM19104_20200227193745 (OPN)

Motion

Location:
Desc: BANGLA MINES, MT ROURKELA
User Name: SU GEOTECH EGGG, PVT. LTD.
General





Event Report

Date/Time: Tran At 12:12:55 February 26, 2020
Trigger Source: Geo: 3,500 mm/s, Mtd: 20.00 ps(L)
Range: Geo: 254.0 mm/s
Record Time: 3.0 sec at 2048 kps
Operator/Setup: Operator/MT ROURKELA/KSVG

Serial Number: UM19104 V 16-5075 Microphone (SE)
Battery Level: 3.8 Vdc
Unit Calibration: August 27, 2020 by USGS New Delhi
File Name: UM19104_2020022613125510P.V

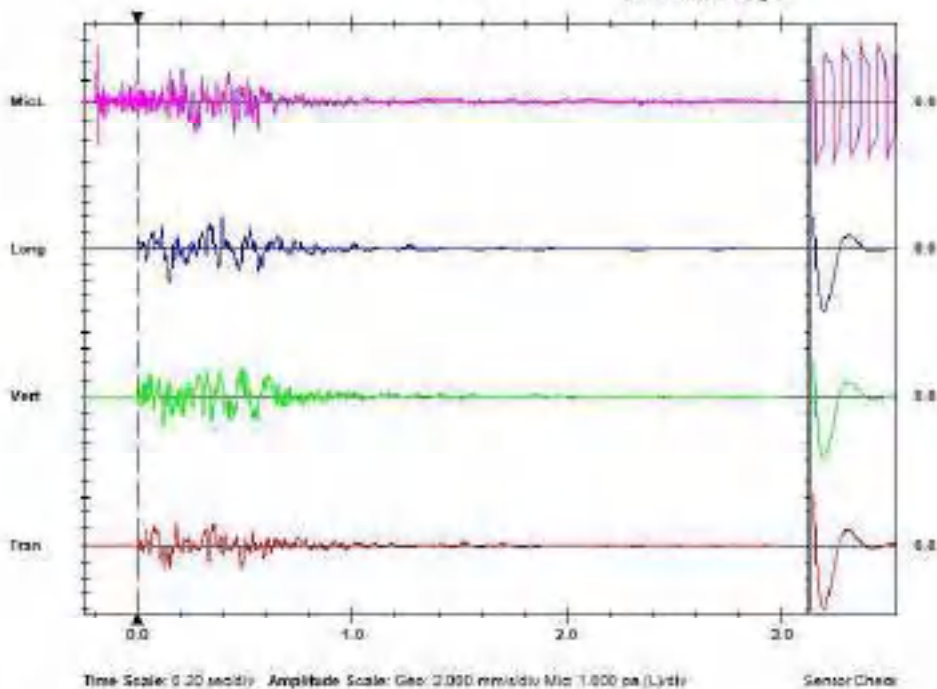
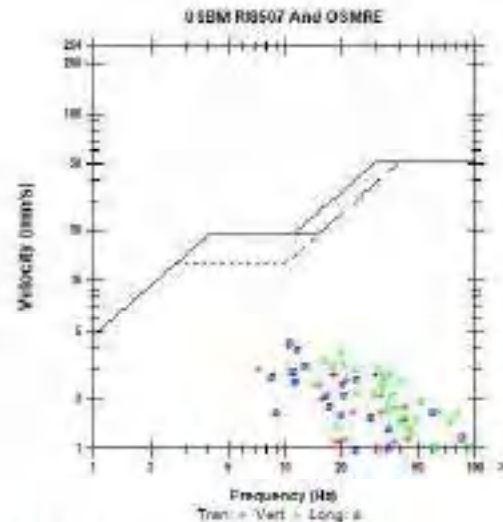
Motion

Location:
Site: BANGLA MINES, NIT ROURKELA
User Name: SU GEOTECH ENGG. PVT. LTD.
General

Microphone: Linear Weighting
PSPL: 2,715 ps(L) at 0.101 sec
ZC Freq: >200 Hz
Channel Test: Passed (Freq = 15.7 Hz Amp = 1245 mv)

	Tran	Vert	Long	
PPV	2.948	3.780	4.311	mm/s
ZC Freq	7.3	10.3	19.7	Hz
Time (Ref. to Trig)	-0.125	-0.110	0.100	sec
Peak Acceleration	-0.950	0.130	0.103	g
Peak Displacement	0.045	0.041	0.057	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.0	7.2	7.1	Hz
Overwing Ratio	4.5	4.6	5.2	

Peak Vector Sum: 5.427 mm/s at 0.150 sec





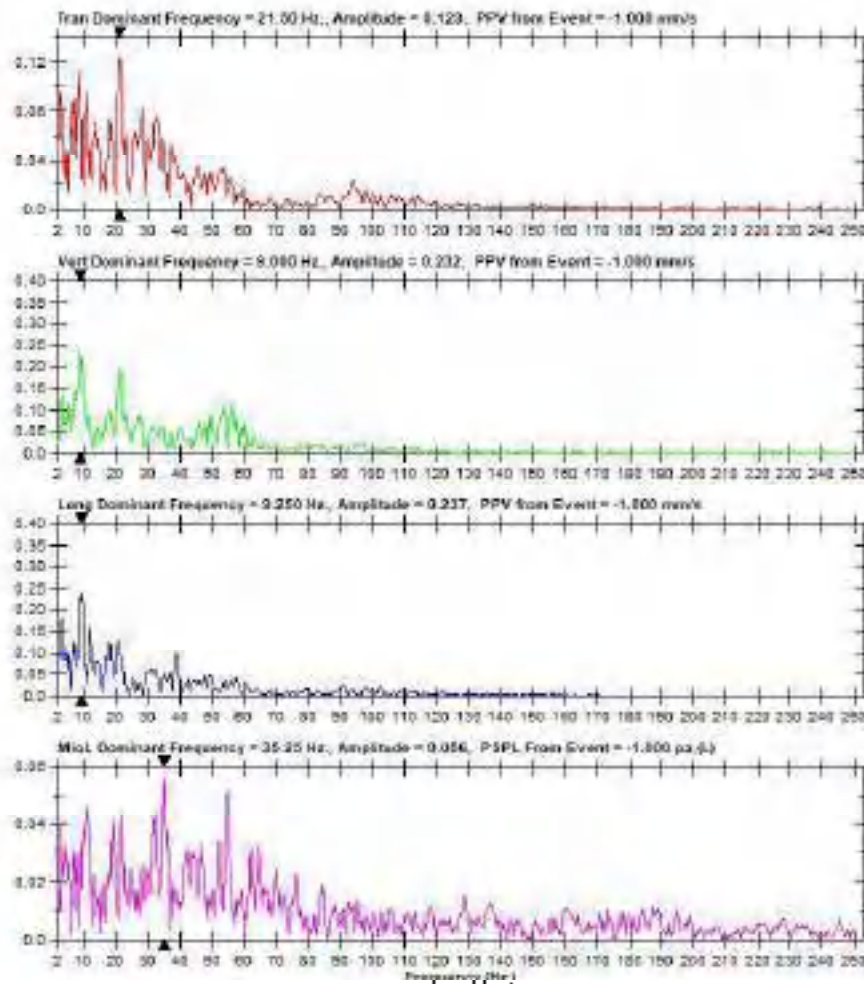
FFT Report

Date/Time: Tran at 12:12:55 February 26, 2020
Trigger Source: Geo: 3.500 mm/s, tko: 20.00 s(1L)
Range: Geo: 254.0 mm/s
Record Time: 3.0 sec at 2048 kps
Operator/Setup: Operator/MT ROURKELA.RBVG

Serial Number: UM19194 V 10-5075 Micromate ISEE
Battery Level: 3.8 VDC
Unit Calibration: August 27, 2020 by USS New Delhi
File Name: UM19194_2020022613125510P.V

Motion

Location:
Desc: BANGLA MINES, MT ROURKELA
User Name: SA GEOTECH EGGG, PVT. LTD.
General





Event Report

Date/Time: 15:01 at 13:15:27 February 28, 2025
Trigger Source: Geo: 3,500 mm/s, N/A: 0.525 ps(L)
Range: Geo: 254.0 mm/s
Record Time: 3.0 sec at 1024 kps
Operator/Setup: Operator/IT: ROURKELA, RUVIS

Serial Number: UM15187 V 10-5075 Microphone (SEE)
Battery Level: 3.8 Volts
Unit Calibration: February 27, 2025 by UES New Delhi
File Name: UM15187_20250228 131527 10PMV

Notes

Location:
Case: RANGLA MINES HIT ROURKELA
User Name: H. ENTERPRISES
Serial:

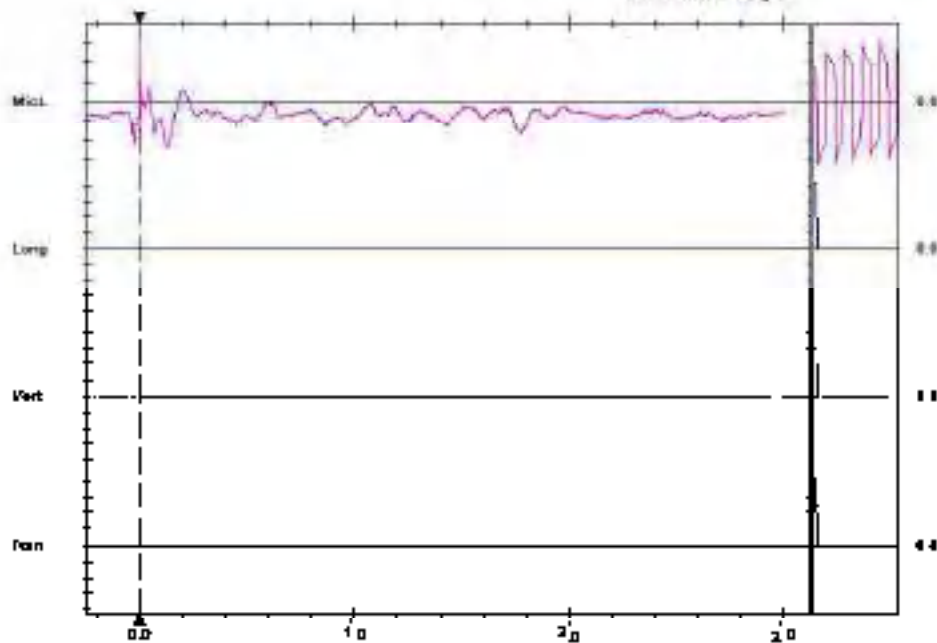
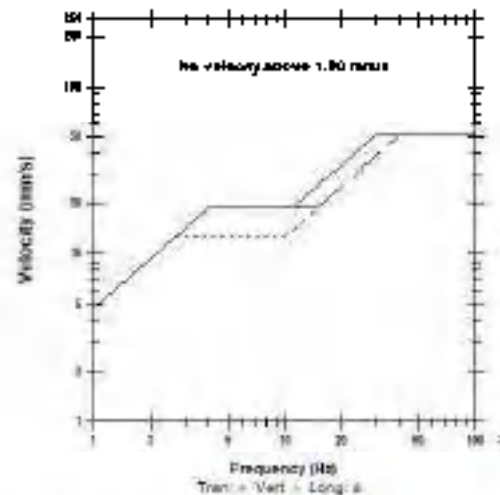
Microphone: Linear Weighting

PSPL: 5.345 ps(L) at 0.000 sec
ZC Freq: 3.0 Hz
Channel Test: Passed (Freq = 15.7 Hz Amp = 1237 mV)

	Trans	Vert	Long	
PPV	0.055	0.055	0.047	mm/s
ZC Freq	51	99	84	Hz
Time (Ref. to Trig)	-0.732	-1.583	-0.129	sec
Peak Acceleration	0.905	3.105	0.005	g
Peak Displacement	0.000	0.001	0.001	mm
Sensor Check	Check	Check	Check	
Frequency	1024.0	1024.0	1024.0	Hz
Overwing Ratio	0.0	0.0	0.0	

Peak Vector Sum: 0.071 mm/s at 2.220 sec

USBd R8507 And OSMRE



Time Scale: 0.20 sec/div Amplitude Scale: Geo: 2.050 mm/s/div N/A: 0.020 ps(L)/div

Sensor Check

REMARK: MICROPHONE IS NOT IN USE

REMARK: MICROPHONE IS NOT IN USE



Event Report

Date/Time: Wed at 12:38:37 February 28, 2020
Trigger Source: Geo: 3,500 mm/s; Mic: 20.00 ps (L)
Range: Geo: 254.0 mm/s
Record Time: 3.0 sec at 2048 kps
Operator/Setup: Geosensor/MT ROURKELA/KING

Serial Number: UM19104 V 16-5075 Microphone (SEE)
Battery Level: 3.8 VDC
Unit Calibration: August 27, 2020 by UCS New Delhi
File Name: UM19104_20200228133837 (OPN)

Notes

Location

C/Site: RAKOLA MINES MT ROURKELA
User Name: SU/GEOTECH/ENR/PAT LTD
Serial:

Microphone: Linear Weighting

PSPL: 2,224 ps (L) at 0.000 sec

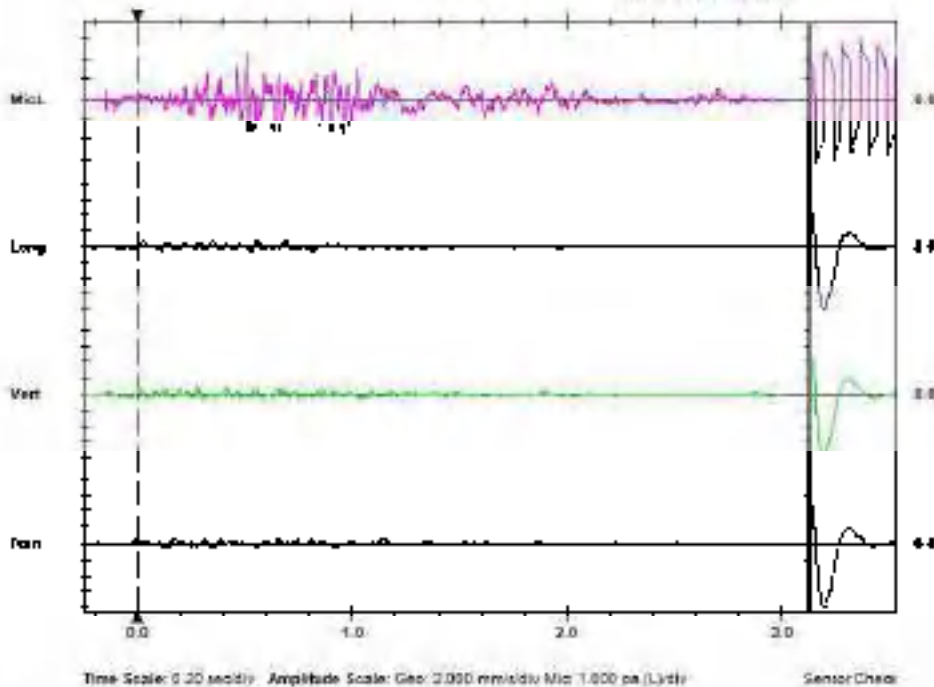
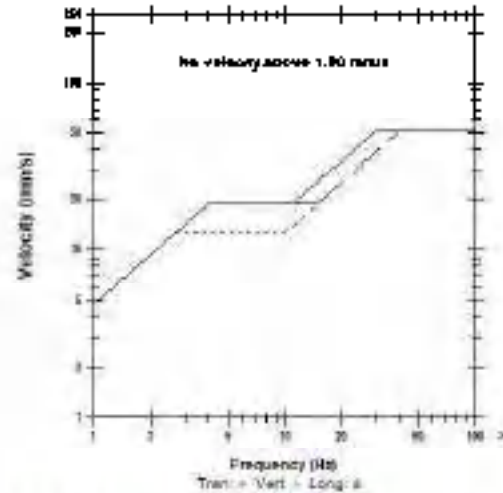
20 Hz

Channel Test: Passed (Freq = 15.7 Hz Amp = 1104 mv)

	Trans	Vert	Long	
PPV	0.620	0.748	0.701	mm/s
20 Hz	9.1	21	8.2	Hz
Time (Ref. to Trig)	-0.100	-0.272	-0.018	sec
Peak Acceleration	0.010	0.010	0.021	g
Peak Displacement	0.012	0.010	0.008	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.3	7.3	7.1	Hz
Overwriting Ratio	4.5	4.7	5.0	

Peak Vector Sum: 0.811 mm/s at 0.000 sec

USBd R8507 And OSMRE





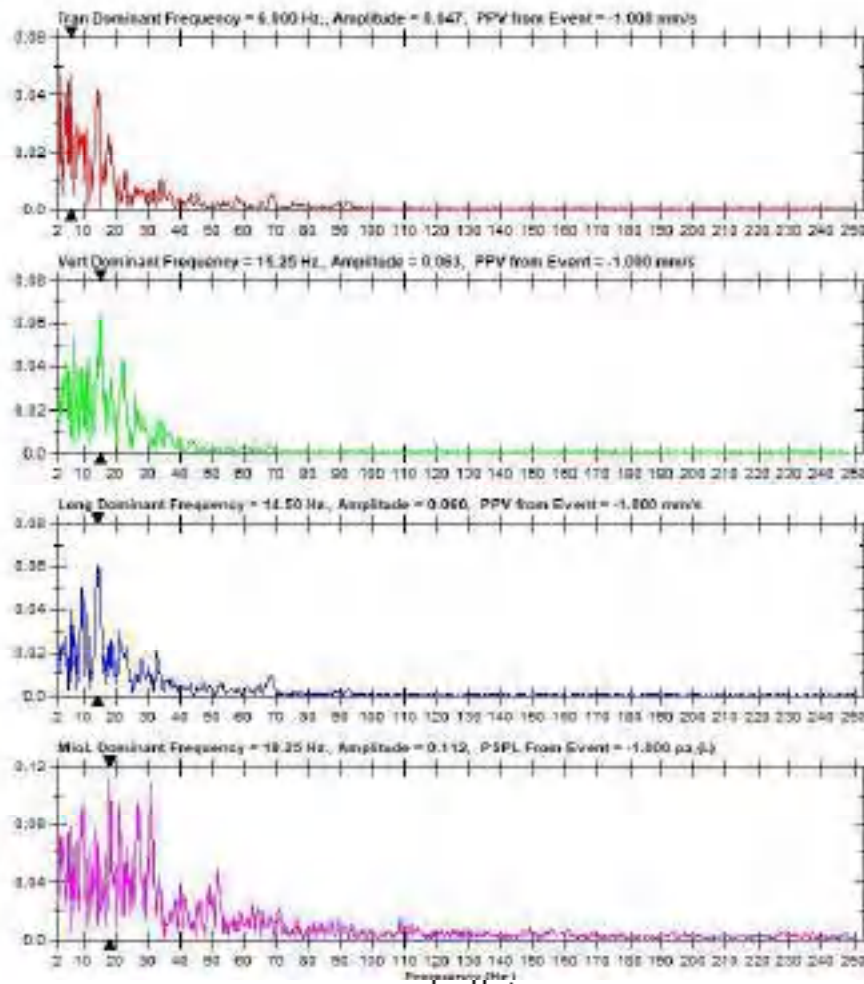
FFT Report

Date/Time: Wed at 12:39:37 February 28, 2020
Trigger Source: Geo. 3,500 mm/s, Mdo. 20.03 ps (L)
Range: Geo. 264.0 mm/s
Record Time: 3.0 sec at 2048 kps
Operator/Setup: Operator/MT ROURKELA.XBVS

Serial Number: UM19194 V 16-6075 Micromate (SEE)
Battery Level: 3.8 VDC
Unit Calibration: August 27, 2020 by UES New Delhi
File Name: UM19194_20200228133937 (DPV)

Motion

Location:
Desc: BANGLA MINES-WT ROURKELA
User Name: SRI GEOTECH E&S, PVT. LTD.
General





Event Report

Date/Time: Trial at 12:28:45 February 26, 2025
Trigger Source: Geo: 3,800 mm/s; Mic: 0.325 ps(L)
Range: Geo: 254.0 mm/s
Record Time: 3.0 sec at 1024 sps
Operator/Setup: Operator/MT: ROUKELA JUNG

Serial Number: UM15167 V 15-50PS Micromale (SEE)
Battery Level: 3.8 Vdc
Unit Calibration: February 21, 2025 by USGS New Delhi
File Name: UM15167_20250228133545/CPV

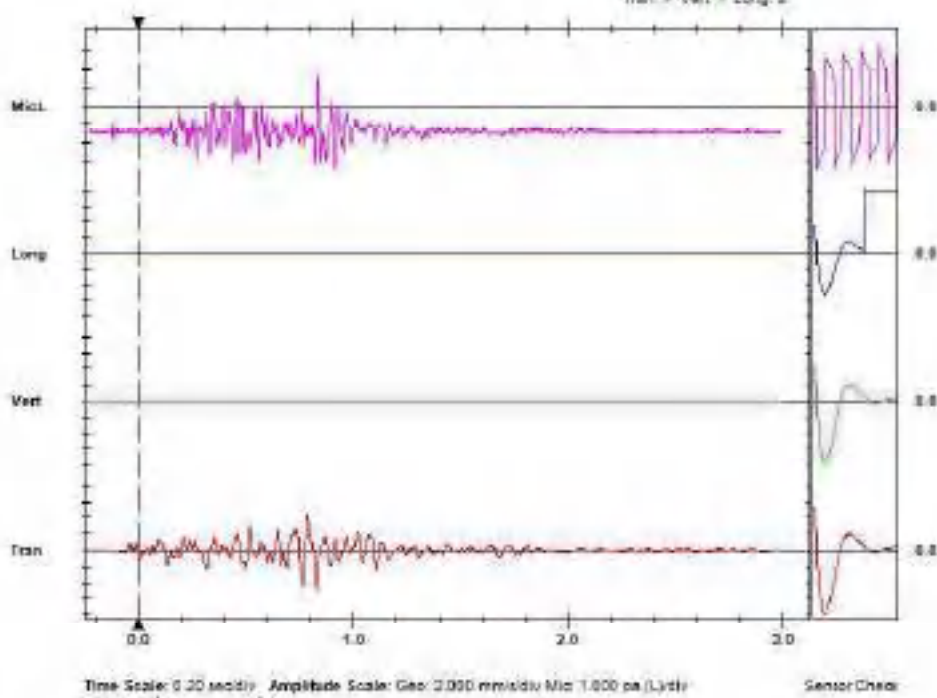
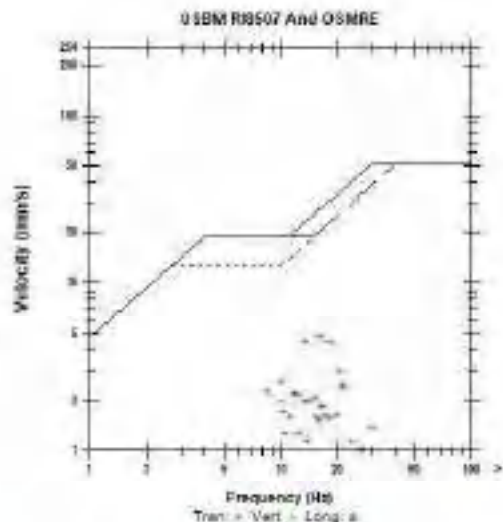
Notes:

Location:
Dist: RAKELA MINDS-NT ROUKELA
User Name: I. ENTERPRISES
General:

Microphone: Linear Weighting
PSPL: 3.451 ps(L) at 0.912 sec
ZC Freq: N/A
Channel Test: Passed (Freq = 15.7 Hz Amp = 1000 mv)

	Tran	Vert	Long	
PPV	4.803	3.338	0.038	mm/s
ZC Freq	16	>100	>100	Hz
Time (Ref. to Trig)	0.820	-2.147	2.715	sec
Peak Acceleration	6.115	3.305	0.005	g
Peak Displacement	0.843	0.300	0.003	mm
Sensor Check	Passed	Passed	Check	
Frequency	7.3	7.3	7.3	Hz
Overwriting Ratio	4.1	4.1	5233.4	

Peak Vector Sum: +3803 mm/s at 0.820 sec
N/A: Not Applicable





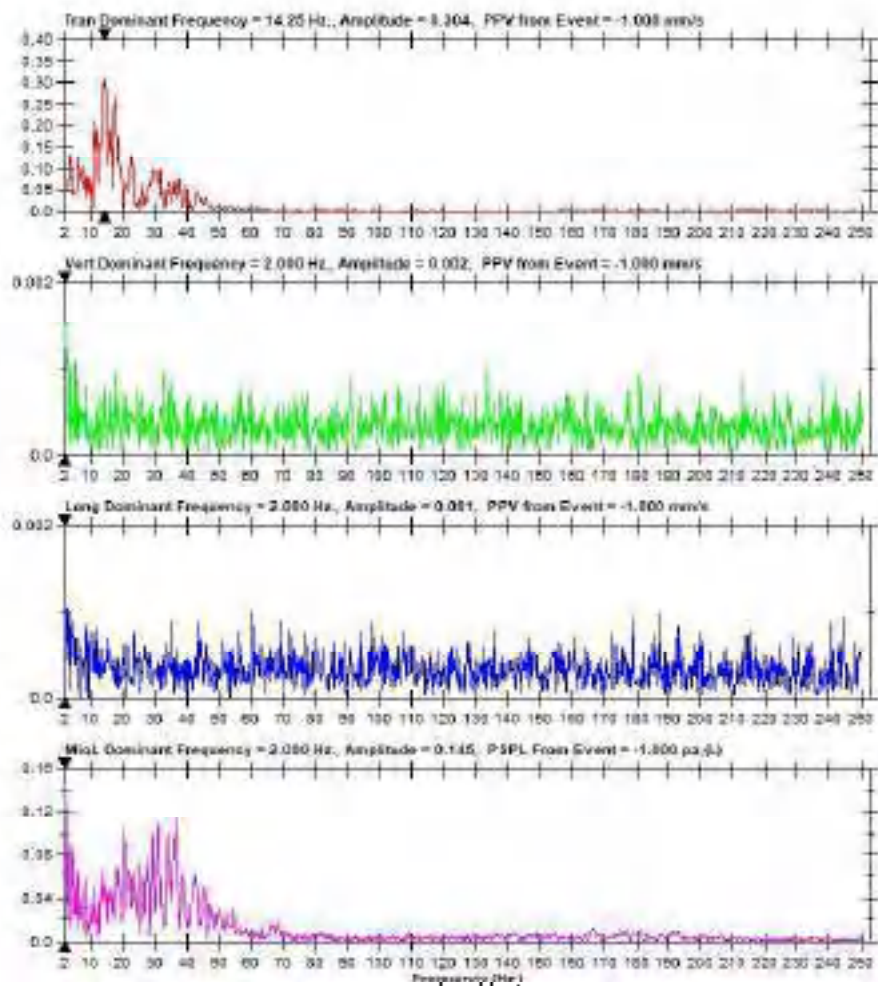
FFT Report

Date/Time: Trial at 12:22:45 February 26, 2025
Trigger Source: Geo: 5,800 mm/s, Nbr: 0.325 (9.1L)
Range: Geo: 254.0 mm/s
Record Time: 3.0 sec at 1024 sps
Operator/Setup: Operator/NT: ROURKELA JUVG

Serial Number: UM15167 V 15-50FS Micromale (SEE)
Battery Level: 3.8 Vdc
Unit Calibration: February 21, 2025 by USGS New Delhi
File Name: UM15167_20250226133545/CPW

Notes:

Location:
Dist: RAKELA MISS-NIT ROURKELA
User Name: J. ENTERPRISES
General:



INSTANTEL 15-50FS V 15-50FS

INSTANTEL 15-50FS V 15-50FS



Event Report

Date/Time: Wed at 12:26:52 March 1, 2020
Trigger Source: Geo: 3.500 mm/s, Mic: 20.00 g (L)
Range: Geo: 254.0 mm/s
Record Time: 3.0 sec @ 2048 kps
Operator/Setup: Operator/MT ROURKELA/KRVS

Serial Number: UM19104 V 10-5075 Micromale (SDE)
Battery Level: 3.8 Vdc
Unit Calibration: August 27, 2020 by UES New Delhi
File Name: UM19104_20200301132653 (OPV)

Makes

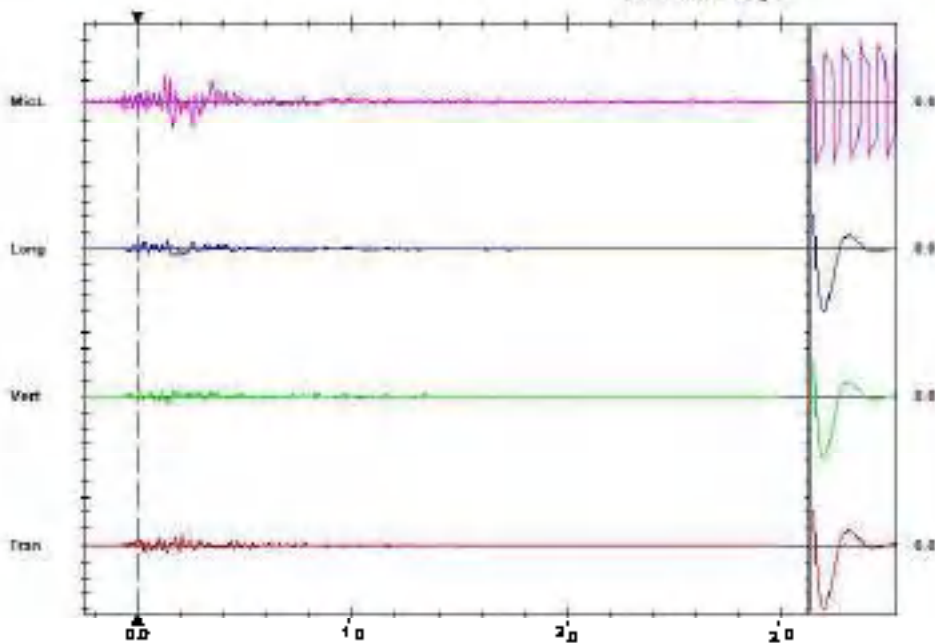
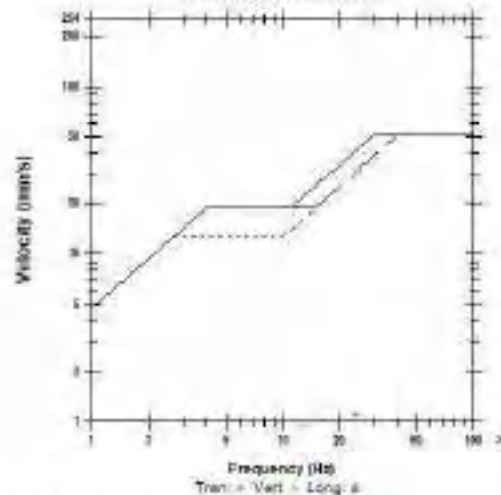
Location:
Client: BANGLA MINES, IIT ROURKELA
User Name: SU GEOTECH ENGG. PVT. LTD.
General:

Microphone: Linear Weighting
PSPL: 1.334 pa (L) at 0.150 sec
ZC Freq: 35 Hz
Channel Test: Passed (Freq = 15.7 Hz Amp = 1200 mV)

	Tran	Vert	Long	
PPV	1.090	1.009	0.885	mm/s
ZC Freq	24	13.1	18.8	Hz
Time (Ref. to Trig)	-0.208	-0.150	0.140	sec
Peak Acceleration	0.920	0.930	0.029	g
Peak Displacement	0.008	0.010	0.011	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.3	7.3	7.1	Hz
Overwing Ratio	4.7	4.6	5.1	

Peak Vector Sum: 1.385 mm/s at 0.287 sec

USBM R8507 And OSNRE



Time Scale: 0.20 sec/div Amplitude Scale: Geo: 2.000 mm/s/div, Mic: 1.000 g (L)

Sensor Check

REMARK: NOISE IS NOT IN THE

REMARK: NOISE IS NOT IN THE



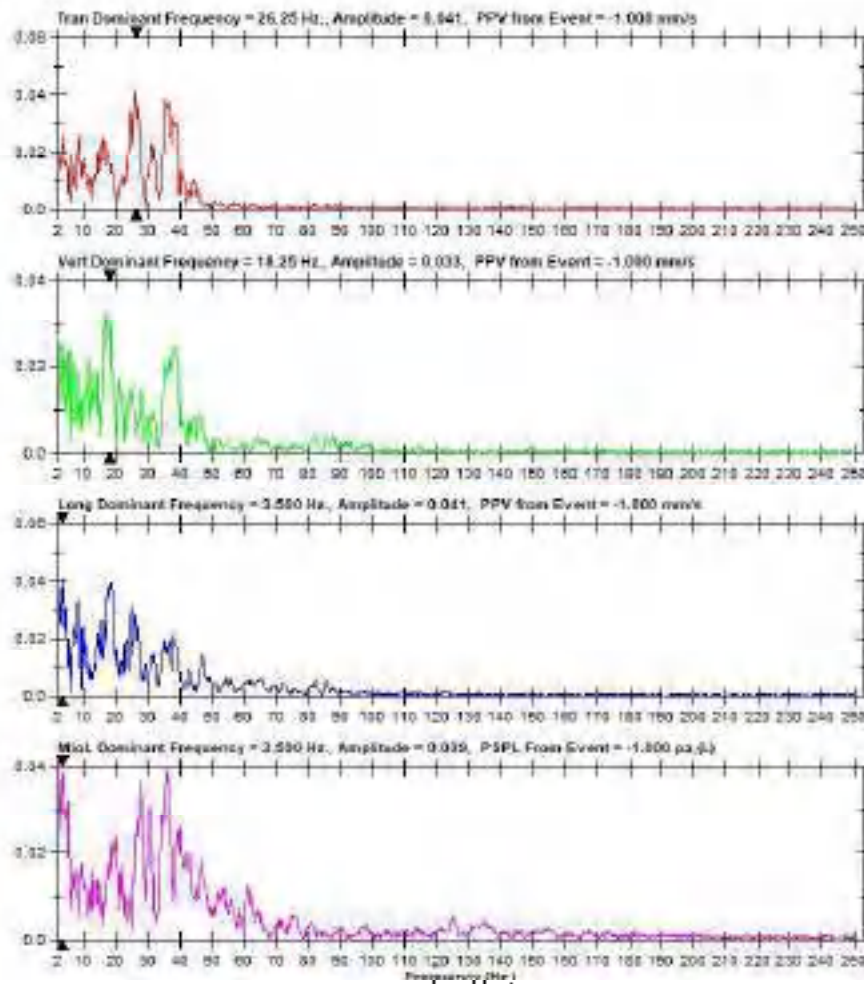
FFT Report

Date/Time: Wed: 12:26:52 March 1, 2020
Trigger Source: Geo: 3.500 mm/s, file: 20.00 ps(L)
Range: Geo: 254.0 mm/s
Record Time: 3.0 sec at 2048 kps
Operator/Setup: Operator: MIT ROURKELA, RUVIS

Serial Number: UM19104 V 10-5075 Micromate (SEE)
Battery Level: 3.8 VDC
Unit Calibration: August 27, 2020 by: URS New Delhi
File Name: UM19104_20200301132653 (OPV)

Motion

Location:
Desc: BANGLA MINES, MT ROURKELA
User Name: SU GEOTECH E&S, PVT. LTD.
General





Event Report

Date/Time: Long at 15:42:35 March 3, 2020
Trigger Source: Geo: 3,500 mm/s, file: 20.03 sq (L)
Range: Geo: 254.0 mm/s
Record Time: 3.0 sec at 2048 kps
Operator/Setup: Operator/MT ROURKELA/KRVS

Serial Number: UM19104 V 10-5075 Micromale (SE)
Battery Level: 3.8 VDC
Unit Calibration: August 27, 2020 by UCS New Delhi
File Name: UM19104_20200303154235 (DPV)

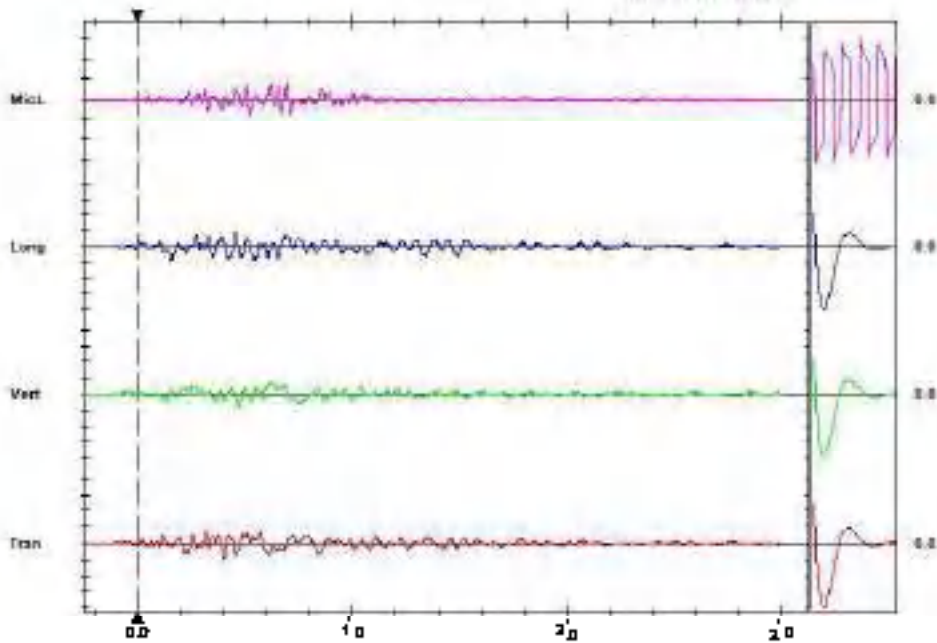
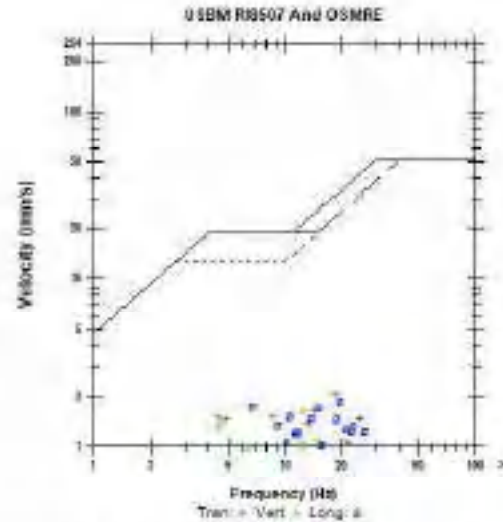
Motion

Location:
Client: BANGLA MINES, IIT ROURKELA
User Name: SU GEOTECH ENGG. PVT. LTD.
General:

Microphone: Linear Weighing
PSPL: 0.007 ps(L) at 0.021 sec
ZC Freq: 13.0 Hz
Channel Test: Passed (Freq = 13.7 Hz Amp = 1121 sec)

	Tran	Vert	Long	
PPV	2.087	1.671	1.892	mm/s
ZC Freq	18.8	12.5	19.3	Hz
Time (Ref. to Trig)	-0.402	-0.473	-0.408	sec
Peak Acceleration	0.030	0.030	0.048	g
Peak Displacement	0.045	0.047	0.025	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.3	7.3	7.1	Hz
Overwing Ratio	4.5	4.5	5.1	

Peak Vector Sum: 2.582 mm/s at 0.450 sec



Time Scale: 0.20 sec/div Amplitude Scale: Geo: 2,000 mm/s/div Mic: 1,000 ps(L)/div

Sensor Check

REMARK: NOISE IS NOT AFFECTING

REMARK: NOISE IS NOT AFFECTING



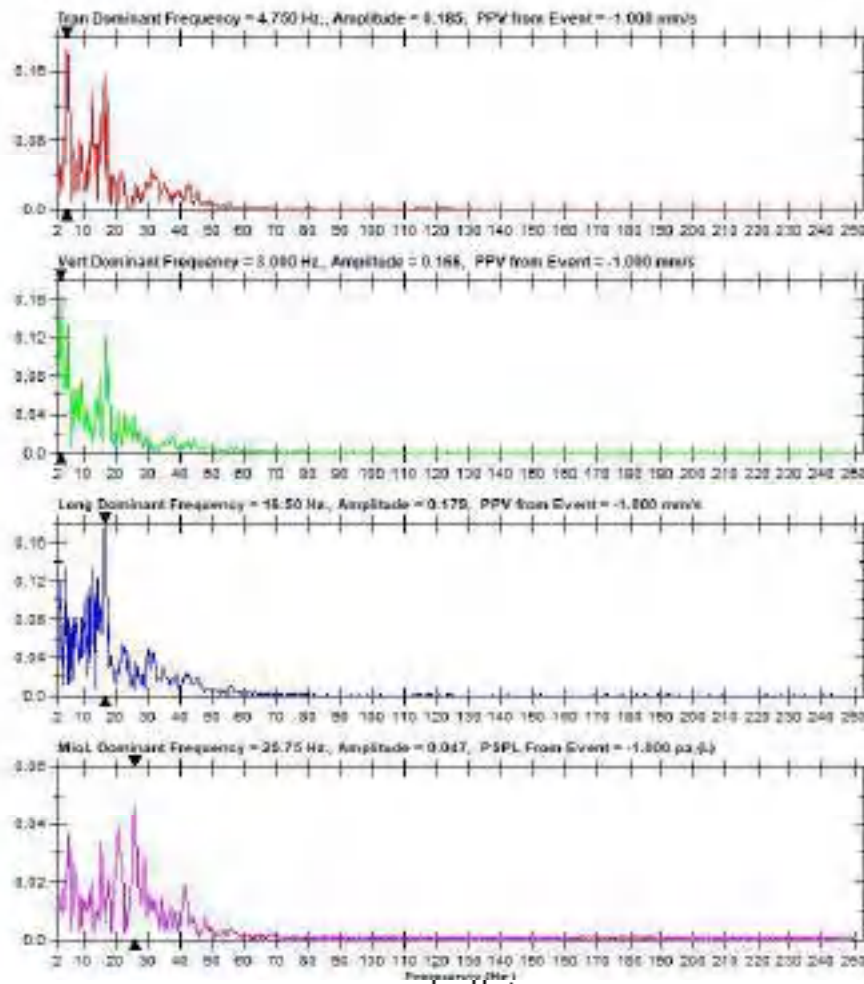
FFT Report

Date/Time Long at 15:42:39 March 3, 2020
Trigger Source Geo: 5.500 mm/s, file: 20.03 pp (L)
Range Geo: 254.0 mm/s
Record Time 3.0 sec at 2048 kps
Operator/Setup Operator: MIT ROURKELA, RUVIS

Serial Number UM19124 V 16-5075 Micromate (SEE)
Battery Level 3.8 VDC
Unit Calibration August 27, 2020 by UCS New Delhi
File Name UM19124_20200303154239 (DPV)

Motion

Location
Desc RANGELA MINES, WT ROURKELA
User Name SM GEOTECH E&S, PVT. LTD.
General





Event Report

Date/Time: Long at 13:22:58 March 5, 2020
Trigger Source: Geo: 3,500 mm/s, file: 20.00 sq (L)
Range: Geo: 254.0 mm/s
Record Time: 3.0 sec at 2048 kps
Operator/Setup: Operator: MIT ROURKELA, RING

Serial Number: UM19104 V 10-5075 Micromale (SE)
Battery Level: 3.8 VDC
Unit Calibration: August 27, 2020 by USGS New Delhi
File Name: UM19104_20200305132258 (OPV)

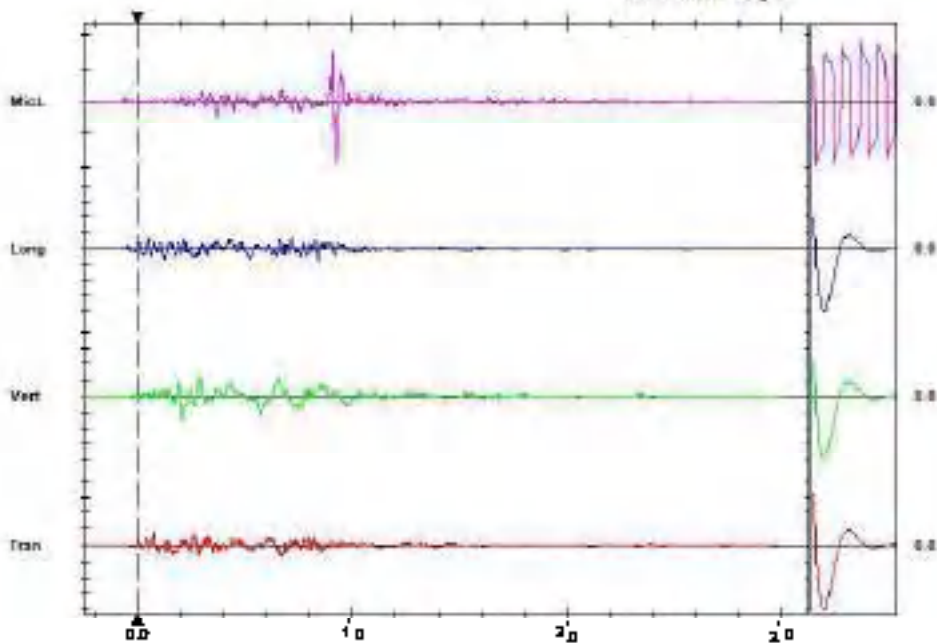
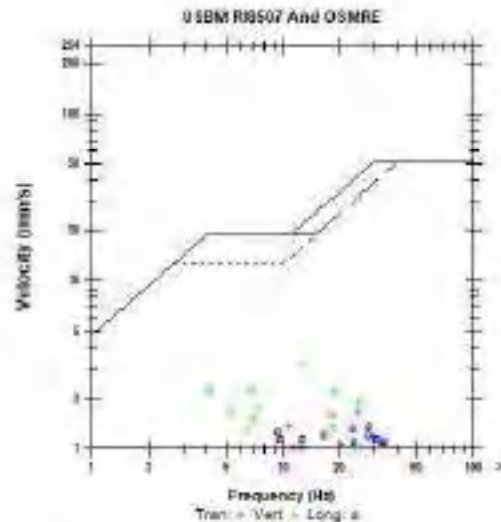
Motion

Location:
Client: BANGLA MINES, IIT ROURKELA
User Name: SU GEOTECH ENGG. PVT. LTD.
General:

Microphone: Linear Weighting
PSPL: 3.542 ps (L) at 0.020 sec
ZC Freq: 20 Hz
Channel Test: Passed (Freq = 15.7 Hz Amp = 1221 mV)

	Trans	Vert	Long	
PPV	1.616	3.238	1.387	mm/s
ZC Freq	26	13.0	28	Hz
Time (Ref. to Trig)	-0.070	0.208	0.639	sec
Peak Acceleration	0.951	0.777	0.558	g
Peak Displacement	0.017	0.050	0.018	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.3	7.3	7.1	Hz
Overwing Ratio	4.0	4.0	5.2	

Peak Vector Sum: 3.328 mm/s at 0.296 sec



Time Scale: 0.20 sec/div Amplitude Scale: Geo: 2,000 mm/s/div Nuc: 1,000 ps (L)/div

Sensor Check

REMARK: NOISE IS NOT A PROBLEM

REMARK: NOISE IS NOT A PROBLEM



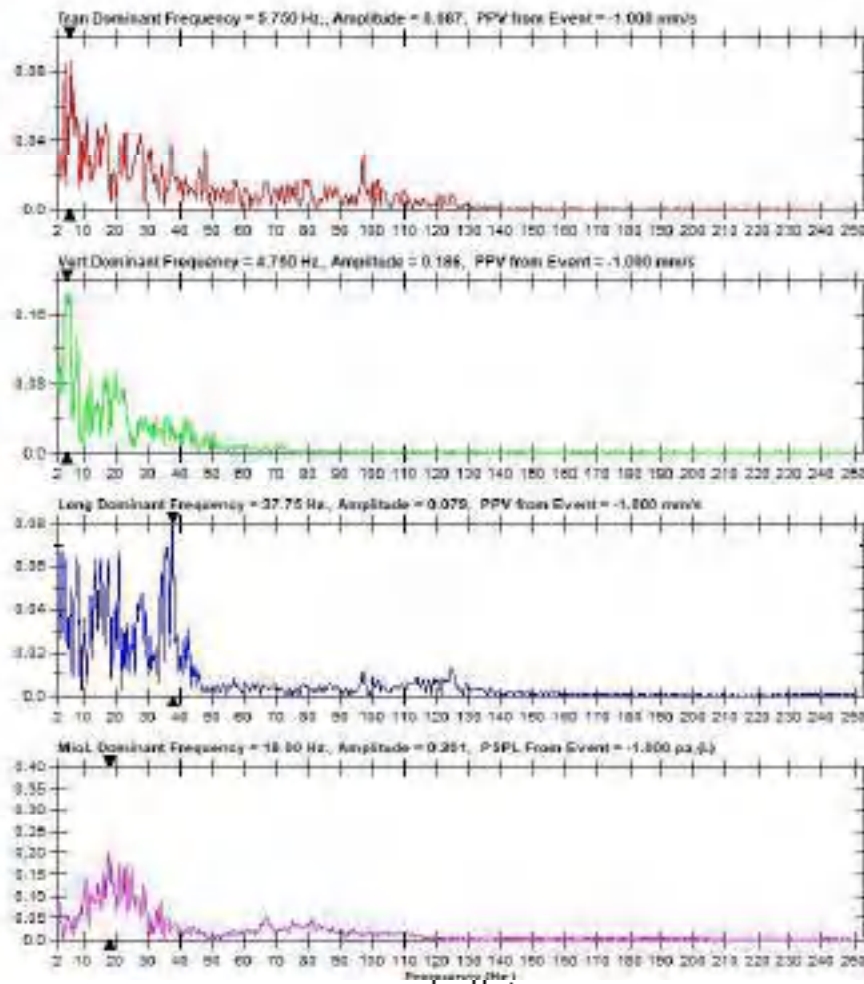
FFT Report

Date/Time Long at 13:22:58 March 6, 2026
Trigger Source Geo: 5.500 mm/s, file: 20.03 pg (L)
Range Geo: 254.0 mm/s
Record Time 3.0 sec at 2048 kps
Operator/Setup Operator/MT ROURKELA.RVING

Serial Number UM19134 V 16-5075 Micromate (SEE)
Battery Level 3.8 VDC
Unit Calibration August 27, 2020 by UES New Delhi
File Name UM19134_20200306132258 (OPV)

Motion

Location
Desc RANGELA MINES- MT ROURKELA
User Name SU GEOTECH E&S, PVT. LTD.
General





Event Report

Date/Time: Fri at 12:23:54 March 6, 2025
Trigger Source: Geo: 5.800 mm/s, hko: 0.525 sec (L)
Range: Geo: 254.0 mm/s
Record Time: 3.0 sec at 1024 kps
Operator/Setup: Operator/NT ROUKELA.XMVS

Serial Number: UM15187 V 10-5075 Micromale (SEE)
Battery Level: 3.8 Volts
Unit Calibration: February 27, 2025 by UDS New Delhi
File Name: UM15187_2025030613230410FV

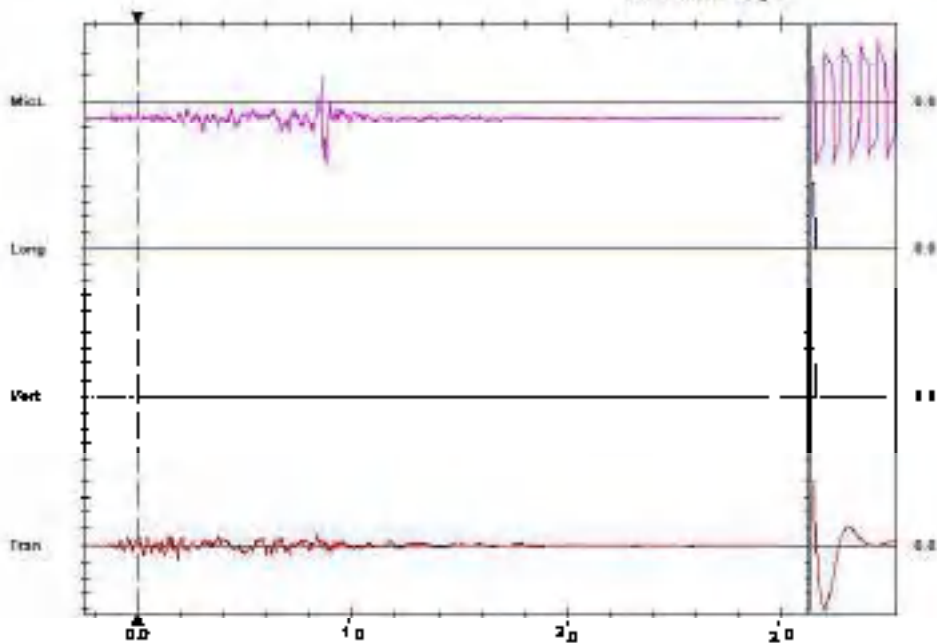
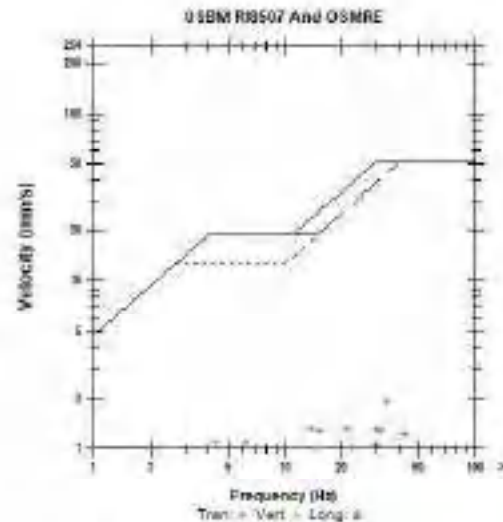
Motion

Location:
Site: RAUKELA MINES-NT ROUKELA
User Name: I.I. ENTERPRISES
General

Microphone: Linear Weighting
PSPL: 5.102 ps(L) at 0.576 sec
ZC Freq: 10 Hz
Channel Test: Passed (Freq = 15.7 Hz Amp = 1192 mv)

	Tran	Vert	Long	
PPV	1.884	0.047	0.047	mm/s
ZC Freq	94	>100	>100	Hz
Time (Ref. to Trig)	0.151	1.892	0.444	sec
Peak Acceleration	0.355	0.005	0.005	g
Peak Displacement	0.325	0.000	0.000	mm
Sensor Check	Passed	Check	Check	
Frequency	7.3	1024.0	1024.0	Hz
Overwing Ratio	3.0	0.0	0.0	

Peak Vector Sum: 1.894 mm/s at 0.157 sec



Time Scale: 0.20 sec/div Amplitude Scale: Geo: 2.050 mm/s² Div: 2.050 ps (L) at 0.576 sec

Sensor Check

RAUKELA MINES-NT ROUKELA

RAUKELA MINES-NT ROUKELA



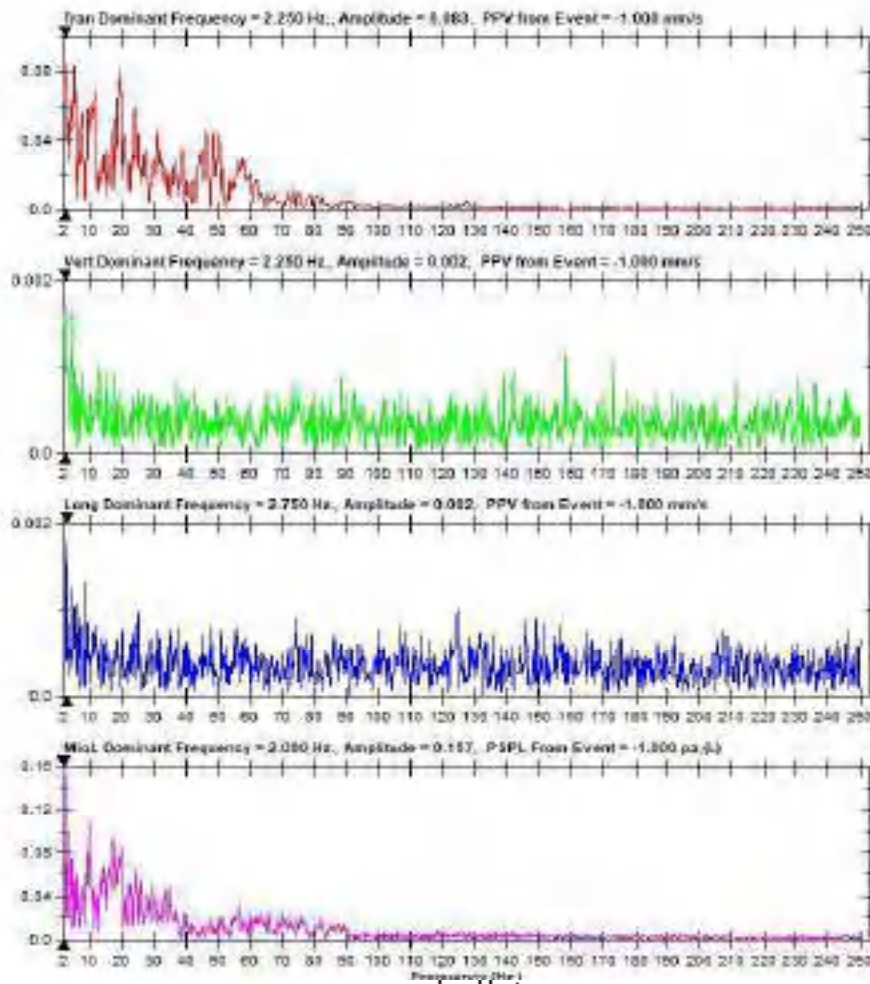
FFT Report

Date/Time: Tran at 12:23:54 March 6, 2025
Trigger Source: Geo: 5,800 mm/s, hko: 0.525 g_o (L)
Range: Geo: 264.0 mm/s
Record Time: 3.0 sec at 1024 kps
Operator/Setup: Operator/NT ROURELA.XBVS

Serial Number: UM15187 V 16-5075 Micromale (SEE)
Battery Level: 3.8 Volts
Unit Calibration: February 21, 2025 by UDS New Delhi
File Name: UM15187_2325030613230410FIV

Notes:

Location:
Dist: RAJOLA MINES-NT ROURELA
User Name: I.I. ENTERPRISES
General:





Event Report

Date/Time: Long at 19:27:22 March 5, 2020
Trigger Source: Geo: 0.500 mm/s, file: 20.00 ps (L)
Range: Geo: 254.0 mm/s
Record Time: 2.75 sec at 2048 sp/s
Operator/Setup: Geosensor/NT ROURKELA/KRVS

Serial Number: UM19104 V 10-5075 Microphone (SEE)
Battery Level: 3.8 Volts
Unit Calibration: August 27, 2020 by UCS New Delhi
File Name: UM19104_20200305192722.10PMV

Notes

Location:
Site: RAJOLA MINES, NT ROURKELA
User Name: SU GEOTECH ENGR. PVT. LTD
Sensor:

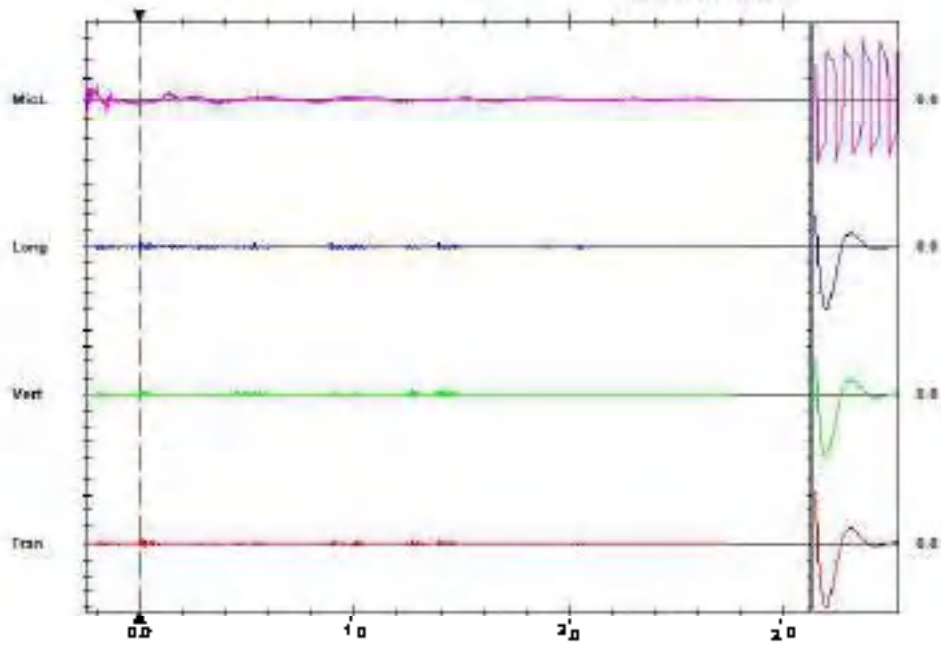
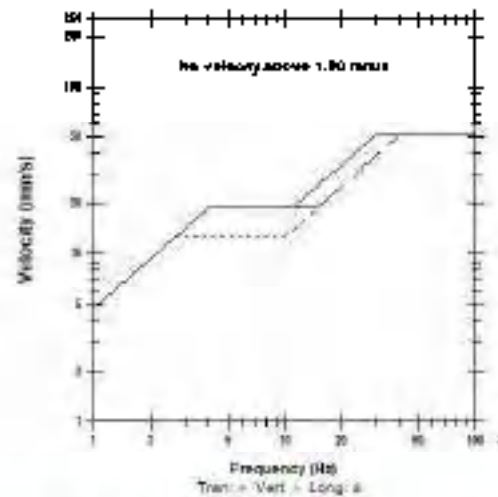
Microphone: Linear Weighting

PSPL: 0.720 ps (L) at 0.204 sec
ZC Freq: 10.4 Hz
Channel Test: Passed (Freq = 15.7 Hz Amp = 1221 mV)

	East	Vert	Long	
PPV	0.370	0.380	0.675	mm/s
ZC Freq	114	146	114	Hz
Time (Ref. to Trig)	-0.013	-1.336	0.003	sec
Peak Acceleration	-0.020	-0.030	0.019	g
Peak Displacement	0.001	0.001	0.001	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.3	7.3	7.1	Hz
Overwing Ratio	4.0	4.0	5.2	

Peak Vector Sum: 0.823 mm/s at 0.010 sec

USBd R8507 And OSMRE



Time Scale: 0.20 sec/div Amplitude Scale: Geo: 0.050 mm/s^2 Div: 1.000 ps (L) (s)

Sensor Check

RAJOLA MINES, NT ROURKELA

RAJOLA MINES, NT ROURKELA



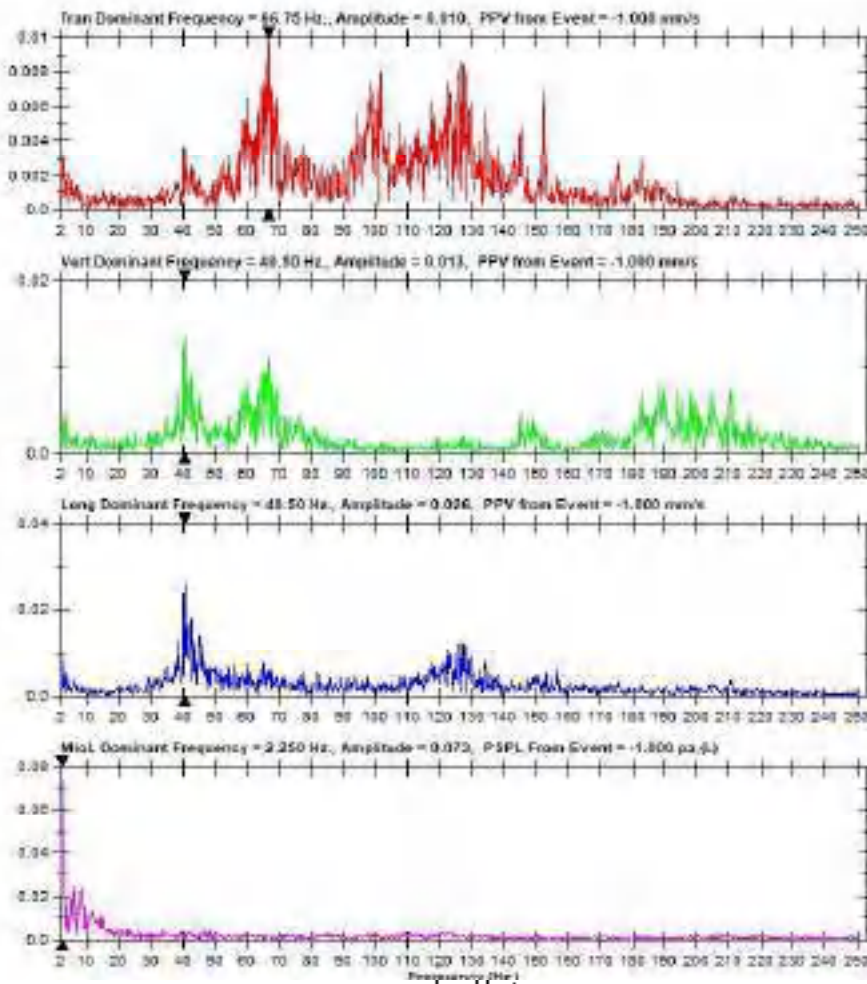
FFT Report

Date/Time: Long at 19:27:22 March 6, 2026
Trigger Source: Geo: 0.500 mm/s, hko: 20.00 ps (L)
Range: Geo: 254.0 mm/s
Record Time: 2.75 sec at 2048 sps
Operator/Setup: Operator/MT ROURKELA.XIVIS

Serial Number: UM19134 V 10-5075 Microscale ISEE
Battery Level: 3.8 VDC
Unit Calibration: August 27, 2020 by USGS New Delhi
File Name: UM19134_20260306152722.10P1V

Motion

Location:
Client: BANGLA MINES, MT ROURKELA
User Name: SRI GEOTECH EARTH, PVT. LTD.
General





Event Report

Date/Time: Long at 15:44:54 March 5, 2025
Trigger Source: Geo: 3,500 mm/s, file: 20.00 sq (L)
Range: Geo: 254.0 mm/s
Record Time: 3.0 sec at 2048 kps
Operator/Setup: Operator/MT ROURKELA, RING

Serial Number: UM19104 V 10-5075 Microphone (SEE)
Battery Level: 3.8 VDC
Unit Calibration: August 27, 2020 by UCS New Delhi
File Name: UM19104_20200305154454.10P1V

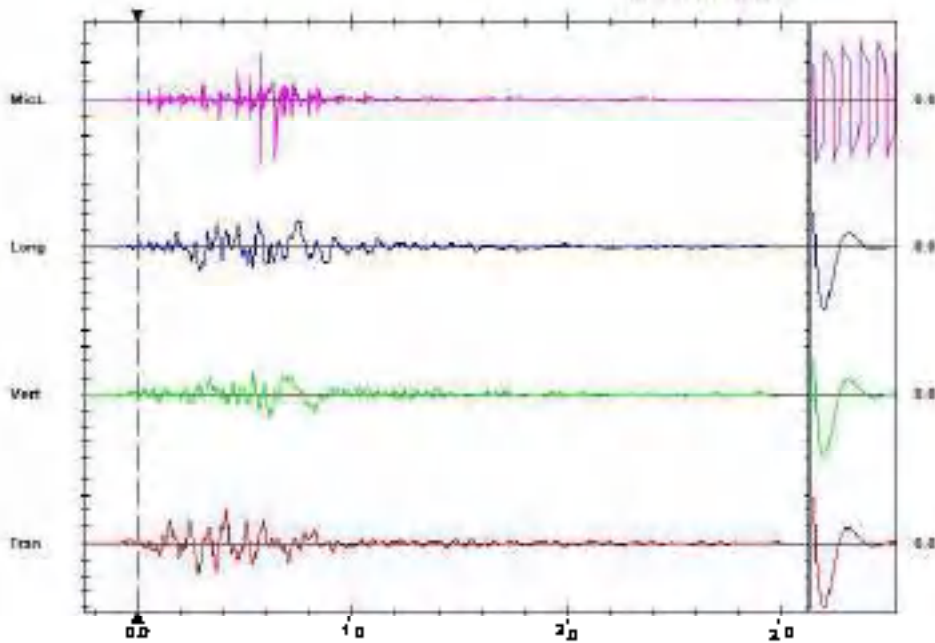
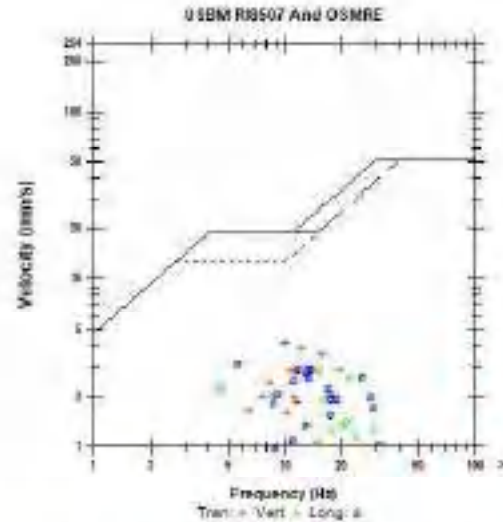
Motion

Location:
Client: BANGLA MINES, IIT ROURKELA
User Name: SU GEOTECH ENGG. PVT. LTD.
General:

Microphone: Linear Weighing
PSPL: 6.873 ps (L) at 0.955 sec
ZC Freq: 145 Hz
Channel Test: Passed (Freq = 15.7 Hz Amp = 1145 mv)

	Trans	Vert	Long	
PPV	8.122	2.801	3.108	mm/s
ZC Freq	10.0	15.1	5.7	Hz
Time (Ref. to Trig)	-0.410	0.010	0.745	sec
Peak Acceleration	0.951	0.300	0.008	g
Peak Displacement	0.055	0.005	0.008	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.3	7.3	7.1	Hz
Overwing Ratio	4.4	4.7	5.3	

Peak Vector Sum: + 720 mm/s at 0.410 sec



Time Scale: 0.20 sec/div Amplitude Scale: Geo: 2,000 mm/s²; Nuc: 2,000 ps (L) at 0.955 sec

Sensor Check

REMARK: NOISE IS NOT IN THE

REMARK: NOISE IS NOT IN THE



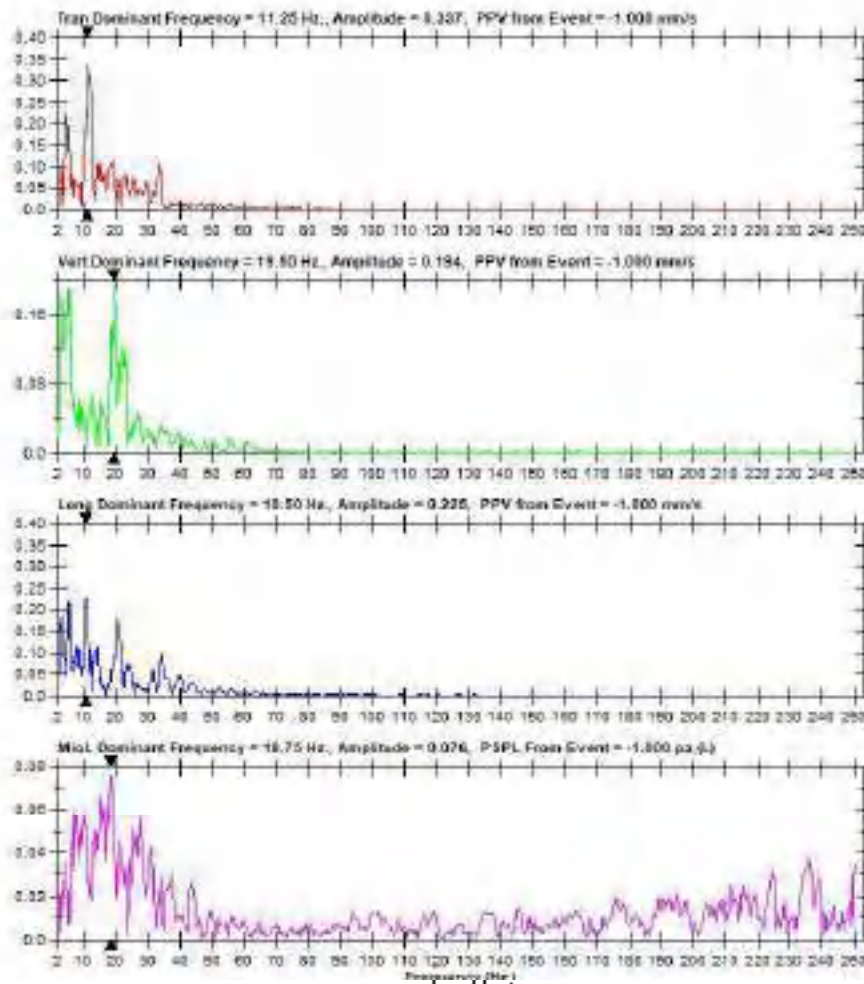
FFT Report

Date/Time Long at 15:44:54 March 8, 2020
Trigger Source Geo: 5.500 mm/s, file: 20.00 ps (L)
Range Geo: 254.0 mm/s
Record Time 3.0 sec at 2048 kps
Operator/Setup Operator: MIT ROURKELA, RING

Serial Number UM19134 V 10-5075 Micromate ISEE
Battery Level 3.8 VDC
Unit Calibration August 27, 2020 by UES New Delhi
File Name UM19134_202003081544541.DAT

Motion

Location
Desc RANGELA MINES, MT ROURKELA
User Name SU GEOTECH E&S, PVT. LTD.
General





Event Report

Date/Time: Tran at 12:08:08 March 18, 2020
Trigger Source: Geo: 3.500 mm/s, N/A 20.00 sec(L)
Range: Geo: 254.0 mm/s
Record Time: 3.0 sec at 2048 kps
Operator/Setup: Operator/MT ROURKELA/KING

Serial Number: UM19104 V 10-5075 Micromale (SE)
Battery Level: 3.8 VDC
Unit Calibration: August 27, 2020 by USGS New Delhi
File Name: UM19104_2020031813580510P.V

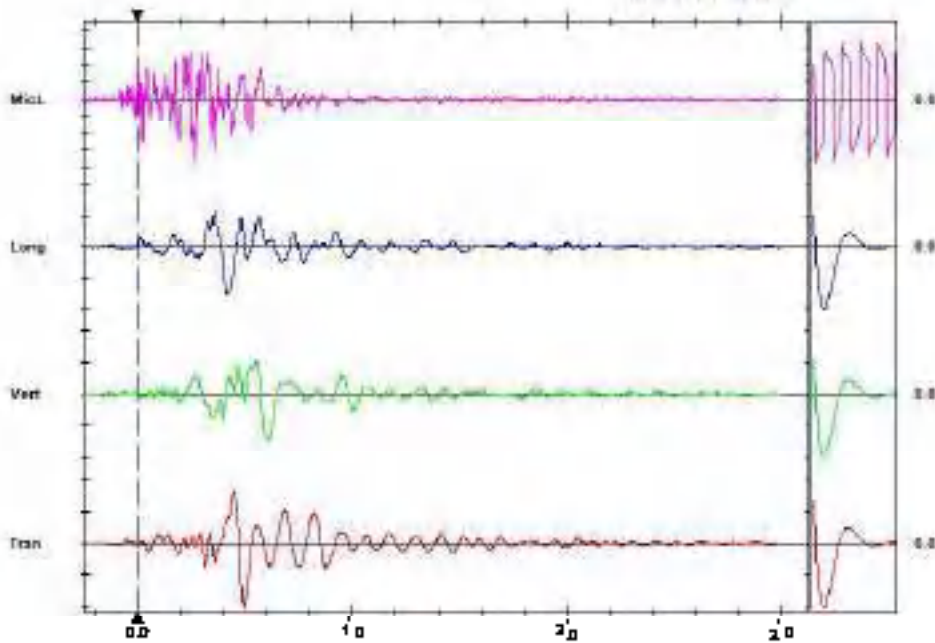
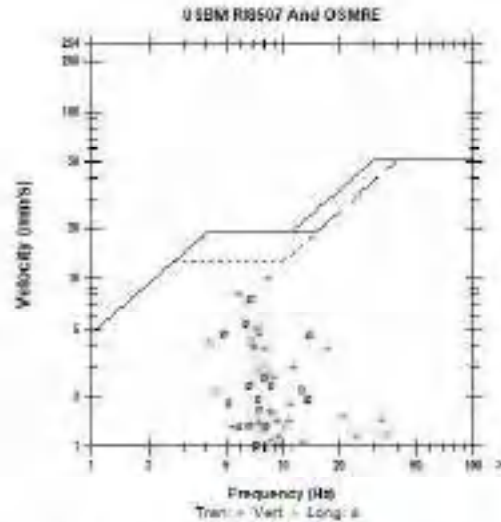
Motion

Location:
Client: BANGLA MINES, IIT ROURKELA
User Name: SU-GEOTECH ENGG. PVT. LTD.
General:

Microphone: Linear Weighting
PSPL: 7.432 ps(L) at 0.250 sec
ZC Freq: 17.1 Hz
Channel Test: Passed (Freq = 15.7 Hz Amp = 1000 mv)

	Tran	Vert	Long	
PPV	10.01	7.570	7.756	mm/s
ZC Freq	8.4	6.5	6.5	Hz
Time (Ref. to Trig)	-0.483	0.608	0.418	sec
Peak Acceleration	9.104	9.302	0.061	g
Peak Displacement	0.181	0.175	0.181	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.3	7.3	7.1	Hz
Overwing Ratio	4.3	4.8	5.2	

Peak Vector Sum: 10.07 mm/s at 0.499 sec



Time Scale: 0.20 sec/div Amplitude Scale: Geo: 0.010 mm/s/div N/A: 0.020 ps(L)/div

Sensor Check

REMARK: N/A

REMARK: N/A



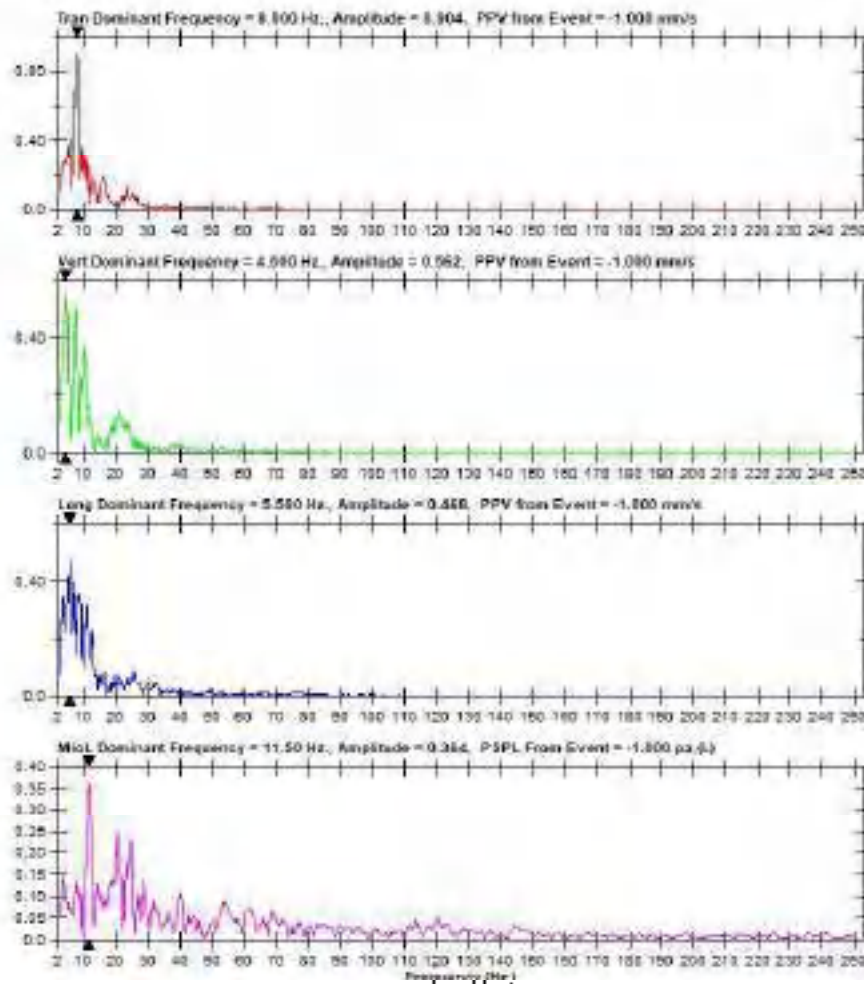
FFT Report

Date/Time: Tran at 12:09:58 March 19, 2020
Trigger Source: Geo: 3.500 mm/s, tko 20.00 ps(L)
Range: Geo: 254.0 mm/s
Record Time: 3.0 sec at 2048 kps
Operator/Setup: Operator/MT ROURKELA.RBVG

Serial Number: UM19124 V 10-5075 Micromate ISEE
Battery Level: 3.8 VDC
Unit Calibration: August 27, 2020 by USG New Delhi
File Name: UM19124_2020031913580510P.V

Motion

Location:
Desc: BANGLA MINES-WT ROURKELA
User Name: SU GEOTECH EGGG, PVT. LTD.
General





Event Report

Date/Time: 15:01:13:15:14 March 10, 2025
Trigger Source: Geo: 5,800 mm/s, hfo: 0.525 ps (L)
Range: Geo: 264.0 mm/s
Record Time: 3.0 sec at 1024 kps
Operator/Setup: Operator/NT ROURELA.XBVS

Serial Number: UM15187 V 10-5075 Microphone (SEE)
Battery Level: 3.8 Volts
Unit Calibration: February 21, 2025 by UES New Delhi
File Name: UM15187_2025031013561410FV

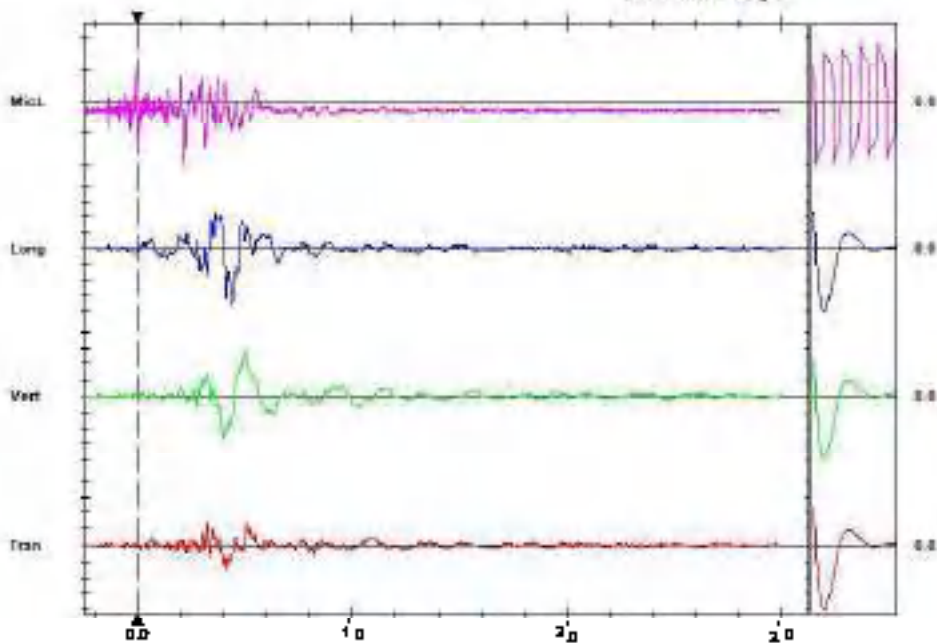
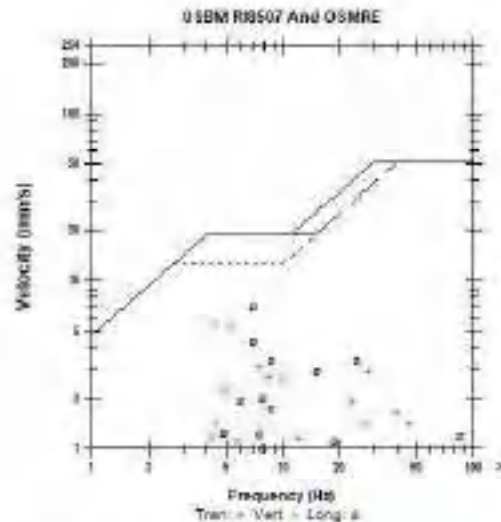
Motion

Location:
Site: RAJELA MINES-NT ROURELA
User Name: I.I. ENTERPRISES
General

Microphone: Linear Weighting
PSPL: 5.700 ps(L) at 0.216 sec
ZC Freq: 14 Hz
Channel Test: Passed (Freq = 15.7 Hz Amp = 1172 mV)

	Trans	Vert	Long	
PPV	3.906	5.580	7.086	mm/s
ZC Freq	7.8	4.4	7.1	Hz
Time (Ref. to Trig)	-0.415	0.501	0.408	sec
Peak Acceleration	6.110	9.310	0.108	g
Peak Displacement	0.951	0.162	0.143	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.1	7.2	7.2	Hz
Overwing Ratio	4.3	4.1	4.2	

Peak Vector Sum: 8.354 mm/s at 0.412 sec



Time Scale: 0.20 sec/div Amplitude Scale: Geo: 2.000 mm/s/div Nuc: 0.020 ps (L) x 10

Sensor Check

REMARK: N/A

REMARK: N/A



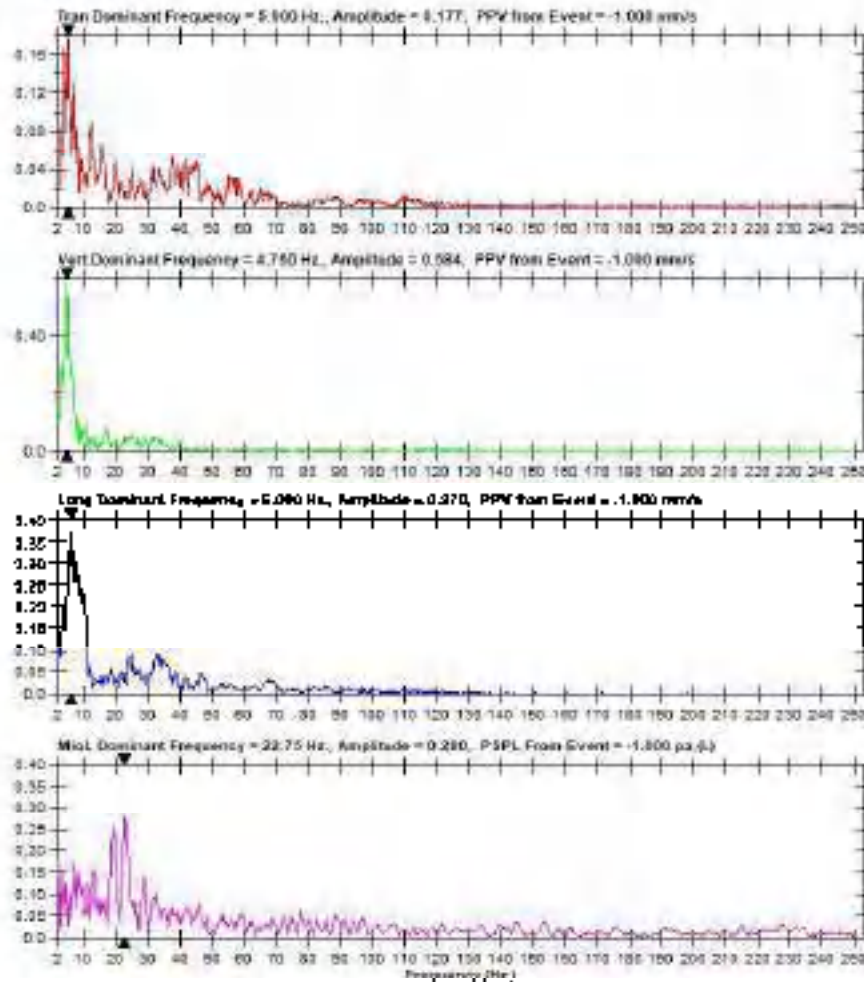
FFT Report

Date/Time: 15:01 at 13:55:14 March 10, 2025
Trigger Source: Geo: 5.800 mm/s, hfo: 0.325 ps (L)
Range: Geo: 264.0 mm/s
Record Time: 3.0 sec at 1024 kps
Operator/Setup: Operator/NT ROURKELA.XBVS

Serial Number: UM19107 V 10-5075 Micromate (SEE)
Battery Level: 3.8 Volts
Unit Calibration: February 21, 2025 by UES New Delhi
File Name: UM19107_2025031013551410FV

Motion

Location:
Desc: RAJKELA MINES-NT ROURKELA
User Name: J.J. ENTERPRISES
General





Event Report

Date/Time: Long at 14:14:15 March 15, 2020
Trigger Source: Geo: 5,500 mm/s, hko: 20.00 ps(L)
Range: Geo: 254.0 mm/s
Record Time: 3.0 sec at 2048 kps
Operator/Setup: Operator/MT ROURKELA.XIVIS

Serial Number: UM19104 V 10-5075 Microphone (SE)
Battery Level: 3.8 VDC
Unit Calibration: August 27, 2020 by USGS New Delhi
File Name: UM19104_20200310141410.10P.V

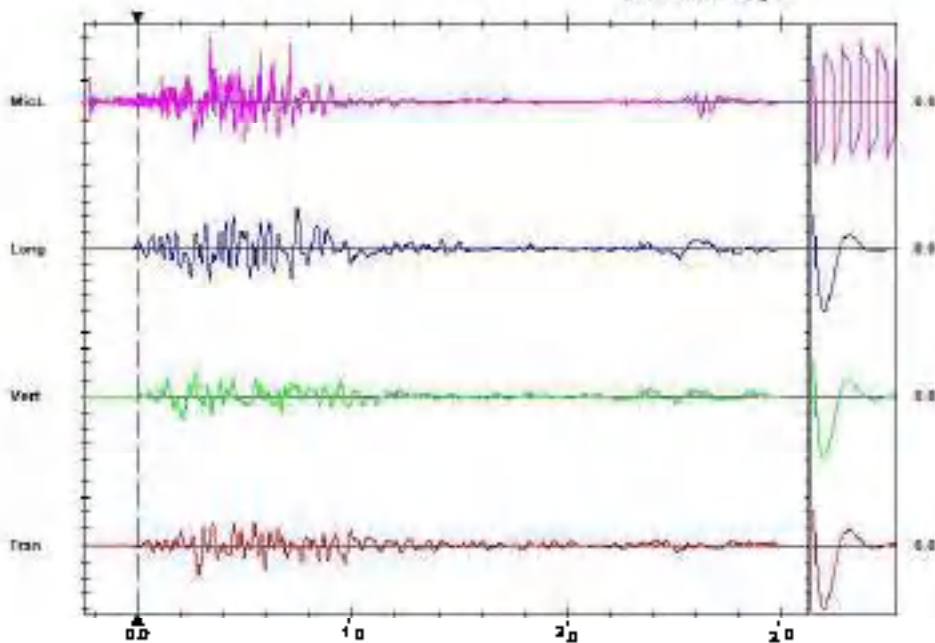
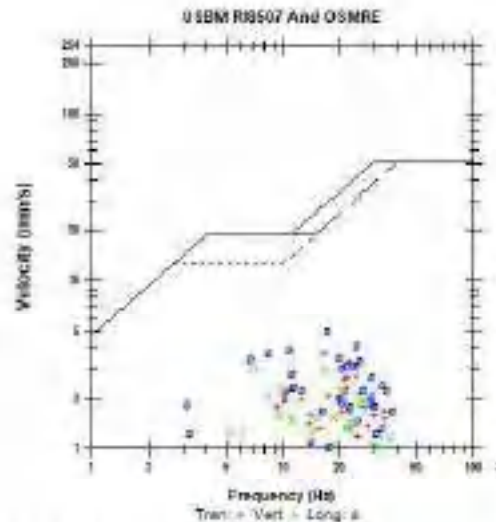
Motion

Location:
Client: BANGLA MINES, IIT ROURKELA
User Name: SU GEOTECH ENGG. PVT. LTD.
General:

Microphone: Linear Weighing
PSPL: 5.012 ps(L) at 0.340 sec
ZC Freq: 41 Hz
Channel Test: Passed (Freq = 15.7 Hz Amp = 1120 mV)

	Tran	Vert	Long	
PPV	3.702	3.942	5.084	mm/s
ZC Freq	10.5	7.0	17.1	Hz
Time (Ref. to Trig)	-0.252	0.210	0.743	sec
Peak Acceleration	-0.910	0.930	0.005	g
Peak Displacement	0.034	0.059	0.085	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.3	7.3	7.1	Hz
Overwing Ratio	4.0	4.0	5.0	

Peak Vector Sum: 5.279 mm/s at 0.743 sec



Time Scale: 0.20 sec/div Amplitude Scale: Geo: 5,000 mm/s/div Nuc: 5,000 ps(L)/div

Sensor Check

REMARK: N/A

REMARK: N/A



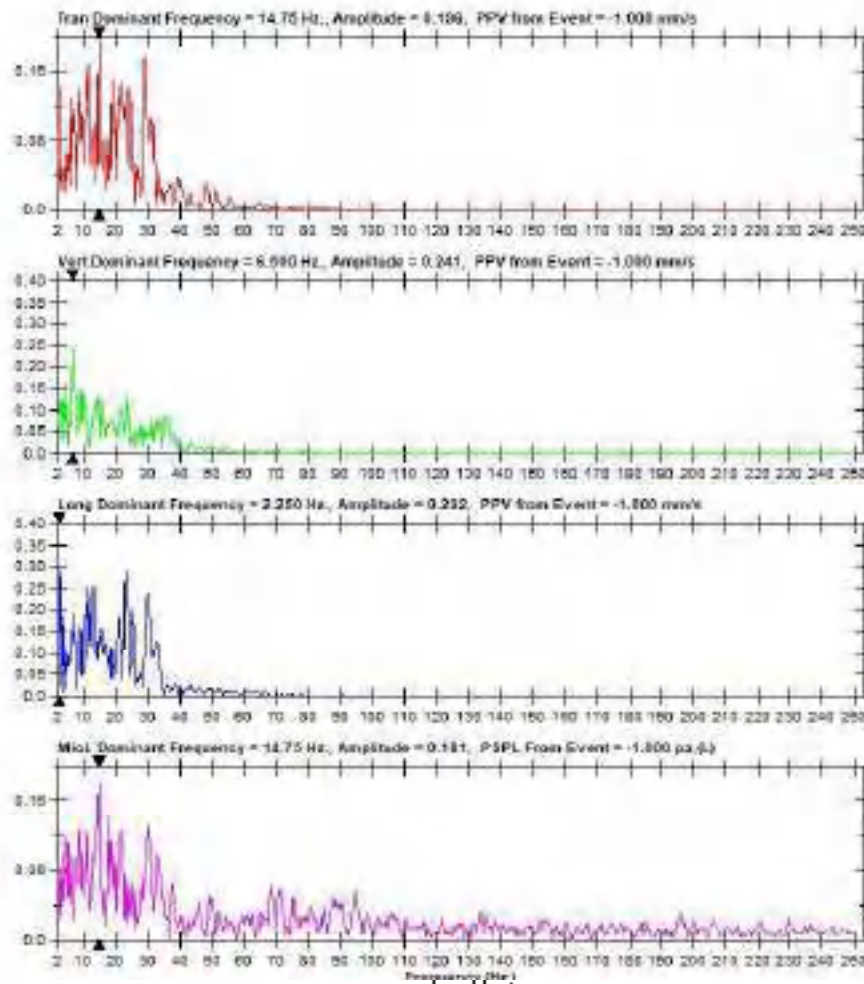
FFT Report

Date/Time: Long at 14:14:15 March 15, 2025
Trigger Source: Geo: 0.500 mm/s, hko: 20.08 ps(L)
Range: Geo: 254.0 mm/s
Record Time: 3.0 sec at 2048 kps
Operator/Setup: Operator: MT ROURKELA, KVVG

Serial Number: UM19124 V 10-5075 Microscale ISEE
Battery Level: 3.8 VDC
Unit Calibration: August 27, 2020 by USGS New Delhi
File Name: UM19124_20200314141510.DMP

Motion

Location:
Desc: BANGLA MINES, MT ROURKELA
User Name: SRI GEOTECH EGGG, PVT. LTD.
General





Event Report

Date/Time: Tran at 14:14:18 March 15, 2025
Trigger Source: Geo: 5.800 mm/s, Mic: 0.825 ps(L)
Range: Geo: 254.0 mm/s
Record Time: 3.0 sec at 1024 kps
Operator/Setup: Operator/MT ROUKELA/KMVS

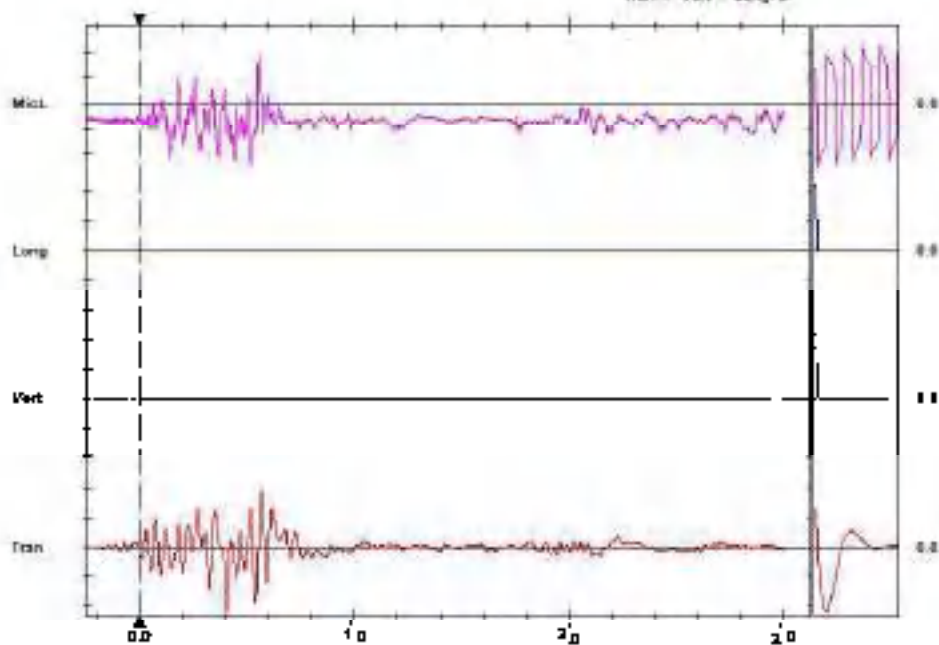
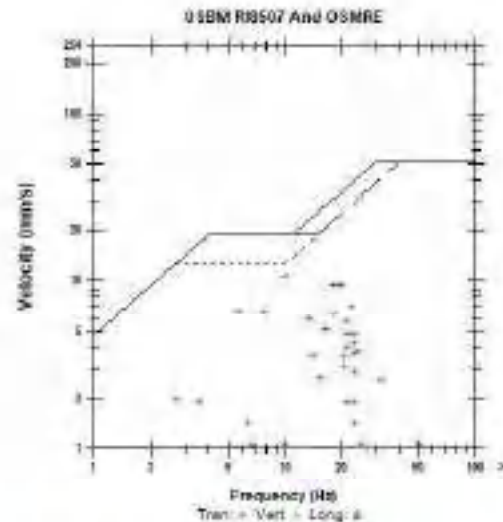
Serial Number: UM15187 V 10-5075 Micromale (SEE)
Battery Level: 3.8 Volts
Unit Calibration: February 27, 2025 by USGS New Delhi
File Name: UM15187_20250315141418 (OPV)

Motion

Location:
Site: RAUKELA MINES-MT ROUKELA
User Name: I.I. ENTERPRISES
General

Microphone: Linear Weighting
PSPL: 4.801 ps(L) at 0.520 sec
ZC Freq: 12 Hz
Channel Test: Passed (Freq = 15.7 Hz Amp = 1105 mV)

	Tran	Vert	Long	
PPV	10.00	3.005	0.005	mm/s
ZC Freq	10	>100	43	Hz
Time (Ref. to Trig)	0.407	1.954	0.349	sec
Peak Acceleration	0.215	0.305	0.005	g
Peak Displacement	0.125	0.800	0.003	mm
Sensor Check	Passed	Check	Check	
Frequency	7.3	1024.0	1024.0	Hz
Overwing Ratio	4.2	0.0	0.0	
Peak Vector Sum	10.00 mm/s at 0.487 sec			



Time Scale: 0.20 sec/div Amplitude Scale: Geo: 0.010 mm/s² Mic: 0.020 ps(L) x 10

Sensor Check

RAUKELA MINES-MT ROUKELA

RAUKELA MINES-MT ROUKELA



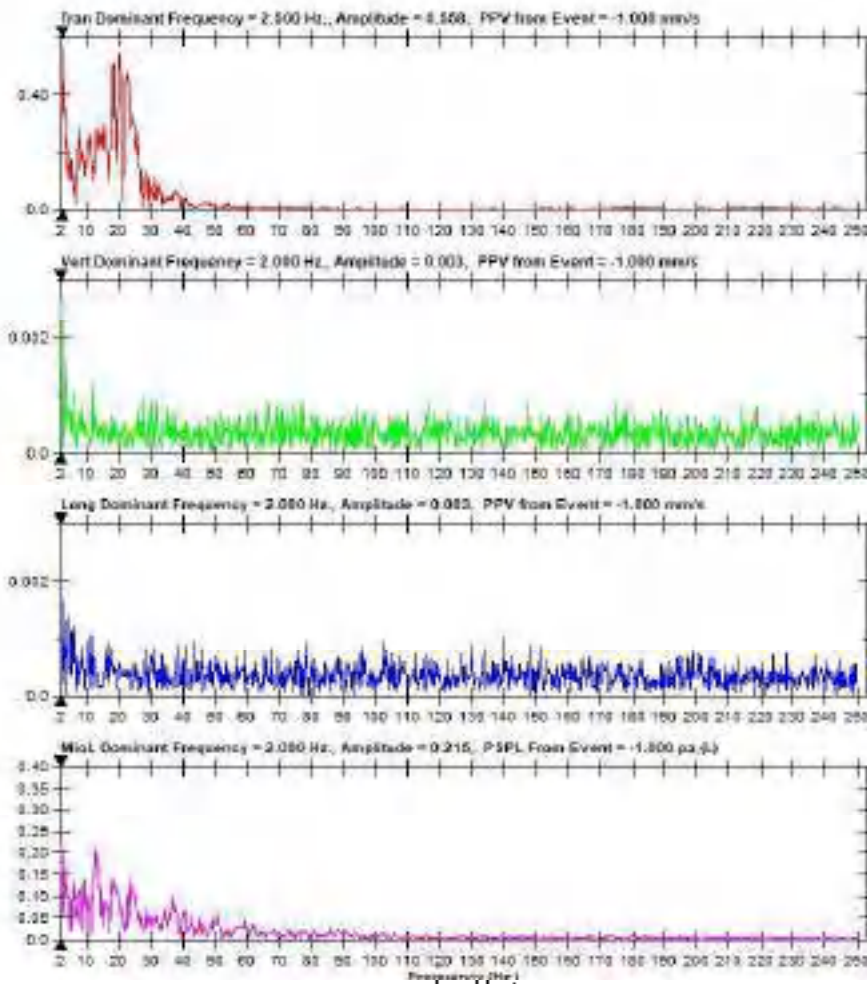
FFT Report

Date/Time: Tran at 14:14:18 March 15, 2025
Trigger Source: Geo: 5.900 mm/s, Mic: 0.825 ps(L)
Range: Geo: 254.0 mm/s
Record Time: 3.0 sec at 1024 kps
Operator/Setup: Operator/NT ROURELA.XBVS

Serial Number: UM15187 V 10-5075 Micromale (SEE)
Battery Level: 3.8 Volts
Unit Calibration: February 27, 2025 by USGS New Delhi
File Name: UM15187_20250315141418.10FV

Notes:

Location:
Dist: RAJOLA MINES-NT ROURELA
User Name: I.I. ENTERPRISES
General:





सत्यमेव जयते

INDIA NON JUDICIAL Government of Odisha

e-Stamp

Certificate No. : IN-OD00525930203675R
 Certificate Issued Date : 10-May-2019 12:46 PM
 Account Reference : SHCIL (FI)/ odshcil01/ SUNDARGARH/ OD-SDG
 Unique Doc. Reference : SUBIN-ODODSHCIL0100636034453578R
 Purchased by : MS GEETARANI MOHANTY REP BY SRINIBASH SAHOO
 Description of Document : Article IA-35 Lease Deed
 Property Description : MZ-RAIKELA, KHT-66.64, PLT-610 AND 10 OTHERS, AR-67.586 HECTS, PS/TAH-KOIRA, DIST-SUNDARGARH
 Consideration Price (Rs.) : 498,20,67,907
 (Four Hundred Ninety Eight Crore Twenty Lakh Sixty Seven Thousand Nine Hundred And Seven only)
 First Party : GOVERNOR OF ODISHA
 Second Party : MS GEETARANI MOHANTY REP BY SRINIBASH SAHOO
 Stamp Duty Paid By : MS GEETARANI MOHANTY REP BY SRINIBASH SAHOO
 Stamp Duty Amount(Rs.) : 24,91,03,395
 (Twenty Four Crore Ninety One Lakh Three Thousand Three Hundred And Ninety Five only)



Please write or type below this line.....

Registration 1781900863
 I.D. No. 11781900861
 Document No. 11781900861
 Book No. 11781900861
 Dated 10/05/2019 day of May 2019
 Registering Office
 900

11781900861
 4500 99641359 = 10
 11781900861
 280 = 10
 015, 99641639 = 10

TQ 0007069751

Statutory Alert:

Statutory Alert:
 This Certificate should be verified at www.shcilodisha.com. Any discrepancy in the details of this Certificate and its registration is on the responsibility of the purchaser. In case of any discrepancy, please inform the Competent Authority.

Statutory Alert:
 This Certificate should be verified at www.shcilodisha.com. Any discrepancy in the details of this Certificate and its registration is on the responsibility of the purchaser. In case of any discrepancy, please inform the Competent Authority.

Signature



Kundan Patel *Handwritten signature*
 Stock Holding Corporation of India Ltd.
 E-Stamping Sundargarh
Name:- M/s. Geetarani Mohanty Represented By
Srinibash Sahoo

DATE:-10/05/2019

S/o :- Duhshasan Sahoo
At :- Station Road
P.O :- Barbil
P.S :- Barbil
Dist :- Keonjhar
Pin :- 758035
Mob No :- 7381038404
Addhar No :- 5205-1215-0418

Handwritten signature
Signature of the e-Stamp Purchaser

**Endorsement of the certificate of admissibility**

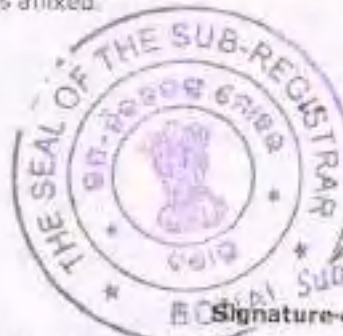
Admissible under rule 25: duly stamped under the Indian stamp (Orissa Amendment act 1 of 2008) Act 1899
 Schedule 1-A No. 35(b) Fees Paid : A5(c)-99641359 , User Charges-280 ,Total 99641639

Date: 30/05/2019

Signature of Registering officer

Endorsement under section 52

Presented for registration in the office of the Sub-Registrar **Sub-Registrar BANER** between the hours of 7:30 AM and 10:30 AM on the **30/05/2019** by **COLLECTOR SUNDARGARH (GOVT)**, son/daughter/wife of , of **SUNDARGARH**, by caste , profession and finger prints affixed.



Signature of Presenter / Date: 30/05/2019

Signature of Registering officer.

Endorsement under section 58

Execution is admitted by :

Name	Photo	Thumb Impression	Signature	Date of Admission of Execution
COLLECTOR SUNDARGARH (GOVT)	Execution By COLLECTOR SUNDARGARH (GOVT) Who is Exempt from personal Appearance in this office U/S 88 Act XVI of 1908 approved by	Execution By COLLECTOR SUNDARGARH (GOVT) Who is Exempt from personal Appearance in this office U/S 88 Act XVI of 1908 approved by	Execution By COLLECTOR SUNDARGARH (GOVT) Who is Exempt from personal Appearance in this office U/S 88 Act XVI of 1908 approved by Signature of the Registering officer	

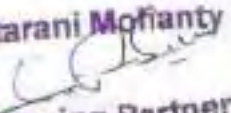
SUPPLEMENTARY LEASE DEED

This indenture made this 27th day of **May, 2019** between the Governor of Odisha (hereinafter referred to as the "State Government" which expression shall where the context so admits, be deemed to include the successors and assigns) of the one part.

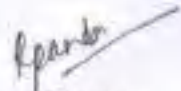
AND

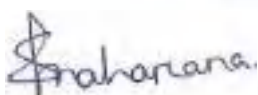
M/s. Geetarani Mohanty a partnership firm bearing Regn. No.5/92 (Cuttack) reconstituted on 01.04.1993 having its registered office at Station Road P.O/P.S.- Barbil, Dist.- Keonjhar represented through its Managing Partner, **Sri Srinibash Sahoo, S/o. Duhshasan Sahoo** aged about 56 years, Station Road, P.O./P.S.- Barbil, Dist.-Keonjhar (hereinafter referred to as "the lessee" which expression shall where context so admits be deemed to include his/its/their successors and permitted assigns) of the Other Part.

WHEREAS the lessee has executed a mining lease deed on date **02/07/1991** in accordance with the Mineral Concession Rules, 1960 (hereinafter referred to as the said Rules), in respect of the land and described in Part 1 of the schedule of the said lease of **Iron Ore over an area of 67.586 Hects. in village Raikela** under Bonai Sub-Division of Sundargarh District, which has been registered vide Book (I), Vol.-6 in the office of DSR, Sundargarh on date **10.10.1991**, deed No.344 (O) and 345 (D), dt.10.10.1991. (hereinafter referred to as the said lease);

M/s Geetarani Mohanty

Managing Partner




**COLLECTOR
SUNDARGARH**


Anaharana



AND, WHEREAS the period of the said lease deed was valid from **02.07.1991** to **01.07.2011**.

AND WHEREAS after expiry of the validity period of the said lease deed, the lessee had continued to conduct mining operations in the said lease under the deemed extension provisions of section 8 of the Mines and Minerals (Development and Regulations) Act, 1957 (hereinafter referred as the MMDR Act) read with Rule, 24 A(6) of Mineral Concession Rule, 1960 with the permission of the party of the First Part till the date **16/12/2012**,

AND, WHEREAS the MMDR Act has been amended with effect from 12.01.2015 and section 8A has been inserted in the said Act, providing for extension of validity period of lease granted in the past under the provisions of the said Act, subject to fulfillment of conditions provided therein;

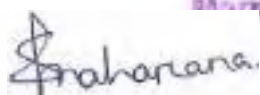
AND, WHEREAS the Government of Odisha has decided to extend the validity period of the lease upto **1st July, 2041**, subject to all the conditions in the said lease deed and subject to the following additional conditions, as described herein below at paragraphs 1 to 8 AND, it is hereby mutually agreed between the parties that :

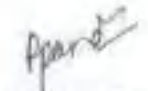
AND, WHEREAS this supplementary lease deed is a part and parcel of the said deed and the terms and conditions are in furtherance to the terms and conditions in addition to the terms and conditions agreed to in the said lease deed.

The lessee has deposited Rs.185,94,55,010/- (Rupees One hundred eighty five crore ninety four lakhs fifty five thousand ten) only alongwith the interest amount of Rs.21,99,86,990/- (Rupees Twenty one crore ninety nine lakhs eighty six thousand nine hundred ninety) only towards compensation under section 21(5) of MMDR Act, 1957 for production of Iron Ore without/ in excess of the environmental clearance under EP Act, 1986 during 2000-01 to 2010-11.

M/s Geetarani Mohanty

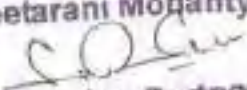

Managing Partner


Managing Partner


**COLLECTOR
SUNDARGARH**



1. The extension of validity is without prejudice to ongoing proceedings, if any, for lapsing or determination of lease which have been initiated or may be initiated in accordance to the provisions of MMDR Act, 1957 or rules framed there under.
2. The extension of validity is without prejudice to any action to be initiated/already initiated under the provisions of the Environment (Protection) Act, Odisha Forest Act or any other law for the time being in force in the relevant time in respect of any violations committed by the lessee during the original period of lease or during the period of deemed extension.
3. The extension of validity period of lease is subject to the result/ outcome of the case Writ Petition (Civil) 114/2014 (Common Cause-Vrs.-Union of India and Others) pending in Hon'ble Supreme Court of India, where the Shah Commission Report and CEC Report are under active consideration.
4. The extension is subject to condition that any terms and conditions of the original lease, if not complied so far, shall be complied by the lessee within such period as may be specified by the competent authority and the lessee shall furnish an undertaking to such effect.
5. The lease is subject to condition that the lessee shall not enter upon any Forest of any category to which the provisions of the Forest (Conservation) Act, 1980 are applicable without previous sanction of the Competent Authority nor fell, cut and use any timber or trees without obtaining the sanction of that authority nor otherwise than in accordance with such conditions as the State Government may prescribe.
6. The lessee shall not undertake mining operation except under and in accordance to the approvals under the Forest (Conservation) Act, 1980 and the Environment (Protection) Act, 1986 and rules framed thereunder.
7. Additional condition as per Letter No: 9179/DM Dt.21.10.2014 of Director of Mines, Bhubaneswar.

M/s Geetarani Mohanty

Managing Partner


**COLLECTOR
SUNDARGARH**

 **Anaharana.**



The Lessee shall abide by the outcome of final orders of Hon'ble High Court of Odisha in the writ petitions relating to Indian Stamp (Odisha) Amendment Act, 2013 and Indian Stamp (Odisha) Amendment Rules, 2013 pending before Hon'ble High Court of Odisha and accordingly shall pay the differential stamp duty, if any.

In case of production level is enhanced through the modification of mining plan in future, the stamp duty may be re-assessed on the differential production level and the lessee shall deposit the differential stamp duty before such enhancement is actually carried out by him.

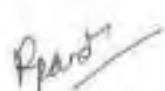
8. Special Condition as per Notification F. NO.10/75/2008-MV, New Delhi, dt. 23.12.2010 of Ministry of Mines, Govt. of India.

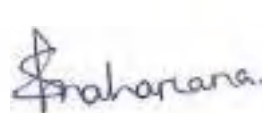
The lessee shall

- (a) Ensure that prospecting work is carried out in his lease area at his own cost in such mining lease where:
- i) Prospecting has not been done and a Prospecting Report has not been filed with the Indian Bureau of Mines.
 - ii) The Prospecting Report for the mining lease has been prepared in terms of standards that are materially different or incompatible with UNFC standards.
 - iii) Fresh prospecting work has become necessary for such minerals for which the threshold values have been revised by the Indian Bureau of Mines and
 - iv) Fresh prospecting is required to prove the depth persistency of the ore or mineral deposit.
- (b) Ensure that prospecting work, if required under clause (a) above, shall be completed as per the time-schedule given below

Ms Geetarani Mohanty

Managing Partner


COLLECTOR
SUNDARGARH


Anaharana.



Sl. No.	Item	Time Limit
1.	All mining lease with an area of less than 10 hectares.	Within one year of the imposition of the condition in the mining lease.
2.	All mining leases with an area more than 10 hect. and less than 50 hectares.	One half of the area within one year of the imposition of the condition in the mining lease and remaining half of the mining lease area within three years of imposition of condition in the mining lease.
3.	All mining leases with an area of more than 50 hectares.	The mining lease area to be equally demarcated for prospecting work such that all the prospecting work is completed in a period of five years from the date of imposition of the condition in the mining lease

(c) Submit:

(i) Yearly report on the progress in the prospecting work along with the expenditure details and a copy of the Interim Prospecting Report, where the prospecting report is for a part area as at serial number (2) and (3) of the sub-clause (b) above; and

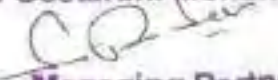
(ii) Complete Prospecting Report with a feasibility report at end of the Prospecting Report.

to the Chief Controller of Mines, Indian Bureau of Mines, and concerned State Government.

AND WHEREAS, the party of the Second Part has agreed to all these terms and conditions and has agreed to execute a supplementary lease deed accepting the extension of the validity period of lease.

NOW, THEREFORE the period of validity of the said lease deed is hereby extended and deemed to have been extended upto **1st July, 2041** subject to all terms and conditions of the said lease and the further terms and conditions described in this supplementary lease deed.

M/s Geetarani Mohanty


Managing Partner
Anaharana.


COLLECTOR
SUNDARGARH

For the purpose of stamp duty the anticipated royalty from the demised land is **Rs.166,04,82,878/- (Rupees One Hundred Sixty Six Crores Four Lakhs Eighty Two Thousands Eight Hundred Seventy Eight) Only per year for Iron Ore. {Security deposit Rs.10,000/-, Preliminary expenses Rs. 1000/-, Surface Rent -Rs.3,000/- per Hect. Per year}.**

IN WITNESS

WHEREOF these presents have been executed in the manner hereunder appearing the day and year first above written.

Signed by

[Signature]
COLLECTOR
SUNDARGARH
COLLECTOR, SUNDARGARH

For and on behalf of the Governor of Odisha

In the presence of witnesses

1. *Pratima Das*
Deputy Collector
Mining, Collectorate
Sundargarh.
2. *Subodh Chandra*
Sec. Chk
Mining Section
Collectorate, Sng

M/s Geetarani Mohanty

[Signature]
Managing Partner
Srinibasi Sahoo (Lessee)

Managing Partner,

M/s. Geetarani Mohanty

In the presence of witnesses

1. *Bidhu Bhushan Sahoo*
General Manager
Raikela Iron Ore Mines
M/s. Geetarani Mohanty
2. *Debasish Rout*

[Signature]
Pratima Das

[Signature]

IMPOUND CASE NO- 19/2019

Certified that the delict Stamp duty of Rs. 01 and Penalty Rs.5/- Total Rs. 06 only has been realized from Proprietor only misc Receipt No. 128190261, 21-05-19 is adjudicated with proper stamp.

AN 30/5/19
Sub-Registrar
Cum Stamp Collector U/S 38 (2)
of the Indian Stamp Act

SRI BHAS SAHOO



241507539

30-May-2019

Identified by **BIDU BHUSAN SAHOO** Son/Wife of **BALKAL BHUSAN SAHOO** of **GENERAL MANAGER**
RAIKELA IRON ORE MINES SUNDARGARH by profession **Cultivation**

Name	Photo	Thumb Impression	Signature	Date of Admission of Execution
BIDU BHUSAN SAHOO				30-May-2019

41126994

Date: 30/05/2019

Signature of Registering officer

Endorsement of certificate of registration under section 60

Registered and true copy filed in : Office of the Sub-Registrar, BANEI

Book Number : 1 || Volume Number : 6

Document Number : 11721900261

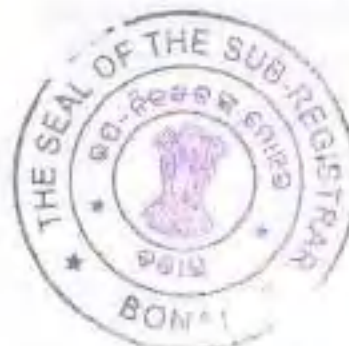
For the year : 2019

Seal :

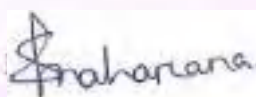
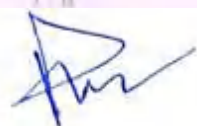
Date: 31/05/2019

Print

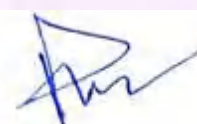
Signature of Registering officer



Registered Lease Advance with Rent Immovable Deed									
Nature of the Document		LEASE ADVANCE WITH RENT IMMOVABLE				Volume Number : 6			
Date of Execution		30/05/2019				Place of Execution		BANEI	
Document Number		11721900261				Registration Date		31/05/2019	
FIRST PARTY DETAILS									
Name		Photo		Thumb Impression		Signature			
COLLECTOR SUNDARGARH (GOVT)									
SECOND PARTY DETAILS									
Name		Photo		Thumb Impression		Signature			
SRINIBAS SAHOO									
PROPERTY DETAILS									
Sl.No.	District	Village/Thana	Khata	Plot	Property Area	Kisam	Market Value	Sabak Khata No.	Sabak Plot No.
9	SUNDARGARH	RAIKELA (S) -14	64	607	2Decimal	ALL OTHER LAND	0	Not Available	Not Available
East	West	North	South	Property Transaction Details					
N/A	N/A	N/A	N/A						
3	SUNDARGARH	RAIKELA (S) -14	64	594	224Decimal	VILLAGE ROAD SITE	0	Not Available	Not Available
East	West	North	South	Property Transaction Details					
N/A	N/A	N/A	N/A						
1	SUNDARGARH	RAIKELA (S) -14	66	593/793	209Decimal	PAHADA	0	Not Available	Not Available
East	West	North	South	Property Transaction Details					
N/A	N/A	N/A	N/A						
5	SUNDARGARH	RAIKELA (S) -14	66	611	1088Decimal	PAHADA	0	Not Available	Not Available
East	West	North	South	Property Transaction Details					
N/A	N/A	N/A	N/A						
2	SUNDARGARH	RAIKELA (S) -14	66	610	40Acre	PAHADA	0	Not Available	Not Available
East	West	North	South	Property Transaction Details					
N/A	N/A	N/A	N/A						
4	SUNDARGARH	RAIKELA (S) -14	66	609	1611Decimal	PAHADA	0	Not Available	Not Available
East	West	North	South	Property Transaction Details					
N/A	N/A	N/A	N/A						
8	SUNDARGARH	RAIKELA (S) -14	66	608	2367Decimal	PAHADA	0	Not Available	Not Available
East	West	North	South	Property Transaction Details					
N/A	N/A	N/A	N/A						
11	SUNDARGARH	RAIKELA (S) -14	66	596	23.9Acre	PAHADA	0	Not Available	Not Available

East	West	North	South	Property Transaction Details					
N/A	N/A	N/A	N/A						
10	SUNDARGARH	RAIKELA (S) -14	66	595	3354Decimal	PAHADA	0	Not Available	Not Available
East	West	North	South	Property Transaction Details					
N/A	N/A	N/A	N/A						
6	SUNDARGARH	RAIKELA (S) -14	66	593	1428Decimal	PAHADA	0	Not Available	Not Available
East	West	North	South	Property Transaction Details					
N/A	N/A	N/A	N/A						
7	SUNDARGARH	RAIKELA (S) -14	66	592	27Decimal	PAHAD	0	Not Available	Not Available
East	West	North	South	Property Transaction Details					
N/A	N/A	N/A	N/A						
IDENTIFIER DETAILS									
Name		Father's / Husband's Name			Identifier Address			Profession	
BIDU BHUSAN SAHOO		BALKAL BHUSAN SAHOO			GENERAL MANAGER RAIKELA IRON ORE MINES			Cultivation	
Name		Photo		Thumb Impression		Signature			
BIDU BHUSAN SAHOO									
REMARK DETAILS									
Remark									
OK									





RAIKELA IRON ORE MINES

M/S. GEETARANI MOHANTY

06767 275896

geetarani.mines@gmail.com | gnm@theworld.co.in

Station Road, Barbil, Keonjhar, Odisha, Pin-758035



Raikela Iron Ore Mines

EC SI	Proposal No	EC ID	Date	EC Capacity in MTPA
1	IA/OR/MIN/11458/2006	No. J-11015/380/2006-IA. II(M)	02-Jul-08	0.864
2	SIA/OR/MIN/41890/2019	41890/08-MINB1/09-2019	23.11.2020	2.99
3	SIA/OR/MIN/64563/2001	EC22B001OR152352	27.12.2022	4.99
4	SIA/OR/MIN/523021/2025	523021/28-MINB1/02-2025	16.06.2025	5.988

Sl. No	Financial Year	Capital Cost in Lakhs	Recurring Cost lakhs	Remarks
1	July 2008-March 2009	85	35	500 Lakhs as per EC Condition
2	April 2009-March 2010	58	26	
3	April 2010-March 2011	61	38	
4	April 2011-March 2012	25	35	
5	April 2012-March 2013	10	25	
6	April 2013-March 2014			Non-Working Mines
7	April 2014-March 2015			Non-Working Mines
8	April 2015-March 2016			Non-Working Mines
9	April 2016-March 2017			Non-Working Mines
10	April 2017-March 2018			Non-Working Mines
11	April 2018-March 2019			Non-Working Mines
12	April 2019-March 2020	108	45	Capital Cost Rs.213 lakhs & Rec. Cost Rs 74.8 Lakhs as per EC Condition
13	April 2020-March 2021	113	58	
14	April 2021-March 2022	78	75	
15	April 2022-March 2023	124	82	Capital Cost Rs.816 lakhs & Rec. Cost Rs 145.98 Lakhs as per EC Condition
16	April 2023-March 2024	188	108	
17	April 2024-March 2025	45	113	
18	April 2025-March 2026	15	18	Capital Cost Rs.420 lakhs & Rec. Cost Rs 234.3 Lakhs as per EC Condition
		910	658	

M/S GEETARANI MOHANTY

Yours Faithfully

MANAGING PARTNER

Managing Partner M/s Geetarani Mohanty



सत्यमेव जयते



भूजल निकासी हेतु अनापत्ति प्रमाण पत्र
NO OBJECTION CERTIFICATE (NOC) FOR GROUND WATER ABSTRACTION

PROJECT NAME RAIKELA IRON ORE MINE		
PROJECT ADDRESS VILLAGE-RAIKELA		PIN CODE 770048
STATE ODISHA	DISTRICT SUNDARGARH	TOWN/BLOCK KOIDA
COMMUNICATION ADDRESS Station Road, Barbil		
ADDRESS OF CGWB REGIONAL OFFICE Bhujal Bhawan, Khandagiri Square, NH-5,Bhubaneshwar 751001, Odisha		
1. NOC NO. NOC/MIN/OD/2024/932/R-2/2		2. DATE OF ISSUANCE 25/02/2025
3. APPLICATION NO. MIN/OD/2024/932/R-2		4. APPLICATION TYPE Mining
5. PROJECT STATUS Existing Project		6. NOC TYPE Renew
7. VALID FROM 31/01/2025		8. VALID UP TO 30/01/2027
9. WATER QUALITY TYPE Fresh Water		10. AREA TYPE CATEGORY Safe (GWRE-2024)

11. Ground Water Abstraction Permitted

GW Abstraction		Dewatering		Total	
m ³ /day	m ³ /year	m ³ /day	m ³ /year	m ³ /day	m ³ /year
170.00	56100.00	0.00	0.00	170.00	56100.00

12. Details of Ground Water Abstraction /Dewatering Structures

EXISTING 2					PROPOSED 2					TOTAL 4				
DW	DCB	BW	TW	Pu	DW	DCB	BW	TW	Pu	DW	DCB	BW	TW	Pu
0	0	2	0	0	0	0	2	0	0	0	0	4	0	0

*DW-Dug Well; DCB-Dug-cum-Bore Well; BW-Bore Well; TW-Tube Well; Pu Pumps;

13. No. Of Mine Pits

EXISTING	PROPOSED	TOTAL
0	0	0

Validity of this NOC shall be subject to mandatory compliance of the following conditions:

Phase I (within 30 days)

1. Installation of tamper proof digital water flow meter with telemetry on all the abstraction structure(s) is mandatory for all users seeking No Objection Certificate. Intimation regarding their installation shall be updated in Self-Compliance Module (Phase-I) of BhuNeer APP portal within 30 days of grant of No Objection Certificate.

Phase II (after 11 months)

1. Proponents shall mandatorily get water flow meter calibrated from an authorized agency once in a year.
 2. Construction of purpose-built observation wells (piezometers) for ground water level monitoring is mandatory as per Section 14 of Guidelines. Water level data shall be made available to CGWA through web portal. Detailed guidelines for construction of piezometers are given in Annexure-II of the notified guidelines.
 3. Proponents shall monitor quality of ground water from all the abstraction structure(s) once in a year. Water samples from bore wells/ tube wells / dug wells shall be collected during April/May every year and analyzed in NABL accredited or Govt. approved laboratories for basic parameters (cations and anions), heavy metals, pesticides/ organic compounds etc. Water quality data shall be made available to CGWA through the web portal.
 4. In case of mining projects, additional key wells in core as well as buffer zones of the mine shall be established in consultation with the Regional Director, CGWB for ground water level monitoring four (4) times a year (January, May, August and November).
 5. In case of mining project, the firm shall submit water quality report of mine discharge/ seepage from Govt. approved/ NABL accredited lab.
- # All the above-mentioned mandatory compliance conditions are to be filed online in BHUNEER APP (<https://cgwa-bhuneer.mowr.gov.in>) timely.

General Conditions:

1. Application for renewal can be submitted online from 90 days before the expiry of NOC. Ground water withdrawal, if any, after expiry of NOC shall be illegal & liable for legal action as per provisions of Environment (Protection) Act, 1986 and amendment thereto, if any.
2. This NOC is subject to prevailing Central/State Government rules/laws/norms or Court orders related to construction of tube well/ground water abstraction structure / recharge or conservation structure/discharge of effluents or any such matter as applicable.
3. This NOC is being issued without any prejudice to the directions of the Hon'ble NGT/court orders in cases related to ground water or any other related matters.
4. No additional ground water abstraction and/or de-watering structures shall be constructed for this purpose without prior approval of the Central Ground Water Authority (CGWA).
5. The proponent shall seek prior permission from CGWA for any increase in quantum of groundwater abstraction as permitted in NOC.
6. Proponents shall install roof top rain water harvesting in the premise as per the existing building bye laws.
7. Proponents, who have installed/constructed rain water harvesting and artificial recharge structures shall continue to regularly maintain the water conservation structures.
8. The project proponent shall take all necessary measures to prevent contamination of ground water in the premises failing which the firm shall be responsible for any consequences arising thereupon.
9. Industries which are likely to cause ground water pollution, e.g. Tanning, Slaughter Houses, Dye, Chemical/ Petrochemical, Coal washeries, pharmaceutical, other hazardous units etc. (as per CPCB list), no recharge measures shall be taken up by such firms inside the plant premises. The runoff generated from the rooftop shall be stored and put to beneficial use by the firm. The firm need to undertake necessary well head protection measures to ensure prevention of ground water pollution as per Annexure III of the notified guidelines
10. Wherever feasible, requirement of water for greenbelt (horticulture) shall be met from recycled / treated waste water.
11. Wherever the NOC is for abstraction of saline water and the existing wells (s) is /are yielding fresh water, the same shall be sealed and new tubewell(s) tapping saline water zone shall be constructed within 3 months of the issuance of NOC. The firm shall also ensure safe disposal of saline residue, if any.
12. Unexpected variations in inflow of ground water into the mine pit, if any, shall be reported to the concerned Regional Director, Central Ground Water Board.
13. This NOC does not absolve the proponents of their obligation / requirement to obtain other statutory and administrative clearances from appropriate authorities.
14. This NOC does not imply that other statutory / administrative clearances shall be granted to the project by the concerned authorities. Such authorities would consider the project on merits and take decisions independently of the NOC.
15. In case of change of ownership, new owner of the industry will have to apply for incorporation of necessary changes in the No Objection Certificate with documentary proof within 6 months of taking over possession of the premises.
16. In case of new infrastructure projects having ground water abstraction of more than 20 m³/day, the firm/entity shall ensure implementation of dual water supply system in the projects.
17. In case of infrastructure projects, paved/parking area must be covered with interlocking/perforate tiles or other suitable measures to ensure groundwater infiltration/harvesting.

18. In case of coal and other base metal mining projects, the project proponent shall use the advance dewatering technology (by construction of series of dewatering abstraction structures) to avoid contamination of surface water.

19. In the self-compliance report, the PP shall submit details of Drilling Agency/ Agencies, which has/ have constructed BW(s)/ TW(s) along with undertaking to the effect that all necessary measures have been taken as per directions of Hon'ble Supreme Court provided in Annexure-VII of guidelines dated 24.09.2020 in respect of abandoned/ failed BW(s)/ TW(s)/ Piezometer(s), if any. The PP is advised to engage registered drilling agency/agencies. In the event of any mishap/ unfortunate incident due to negligence in taking measures for prevention of accident due to falling in Bore Well, both PP and concerned drilling agency shall jointly be hold responsible and penal action as per extant Government rules shall be taken.

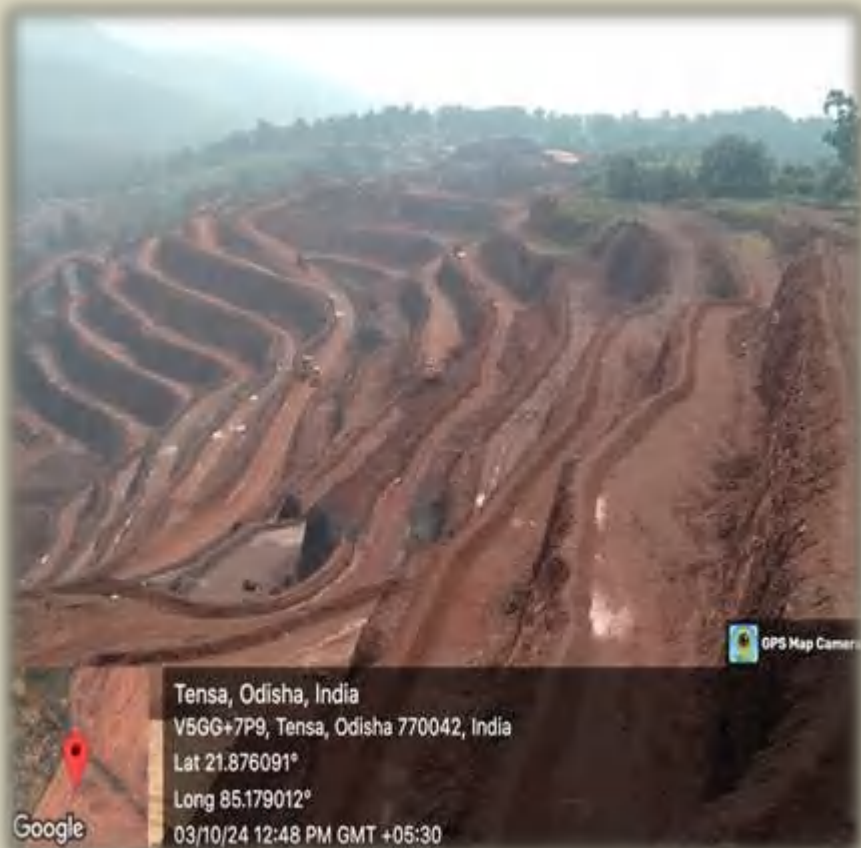
20. Non-compliance of the conditions mentioned above is likely to result in the cancellation of NOC and legal action against the proponent. In case of violation of any NOC conditions, the applicant shall be liable to pay the penalties as per Section 16 of Guidelines



Comprehensive Report on:

Groundwater Condition in both core and buffer zone of Raikela Iron ore Mining Project of M/s. Geetarani Mohanty, Koira Tehsil, Sundargarh District, Odisha.

[Report submitted for Renewal of Groundwater NOC form CGWA under Section 5 of the Environment (Protection) act, 1986 (29 of 1986) as per the new notification no 2941 of 24th Sept 2020]



M/s Geetarani Mohanty, House No – 96, Station Road, Keonjhar, Odisha, Pin-758035
E-MAIL ID: geetarani.mines@gmail.com

Comprehensive Report on:
Groundwater Condition in both core and buffer zone
of Raikela Iron ore Mining Project of M/s. Geetarani
Mohanty, Koira Tehsil, Sundargarh District, Odisha.

*[Report submitted for Renewal of Groundwater NOC form CGWA under Section 5 of the Environment
(Protection) act, 1986 (29 of 1986) as per the new notification no 2941 of 24th Sept 2020]*



M/s Geetarani Mohanty, House No – 96, Station Road, Keonjhar, Odisha, Pin-758035
E-MAIL ID: geetarani.mines@gmail.com
By MRCAWTM – November, 2024

Executive summary

Raikela Iron ore Mining Project of M/s. Geetarani Mohanty spread over an area of 67.586 Ha is under operation with the production capacity of Iron Ore @ 4.99 MTPA in village Raikela under Bonai Sub-Division of Sundargarh district was initially executed for a period of 20 years w.e.f. 02.07.1991 in favour of Smt. Geetarani Mohanty. As per the Supplementary lease deed, the validity of the lease period is now extended up to 01.07.2041. The study area falls under survey of India toposheet no F45N1 (73G/1). The existing iron Ore Mining project is in running condition and consent to operate has been obtained from State Pollution Control Board (SPCB) Govt. of Odisha. The Ministry of Environment and Forest has granted the Environmental Clearance for the production capacity of 0.864MTPA capacity vide the letter No-J- 11015/380/2006-IA.II dated 02.07.2008.

The lessee has obtained all the statutory clearances like Mining Plan approval from IBM, Forest and Environment Clearance from MoEF, Consent to Operate from SPCB.

The mine has been developed by opencast mining method with mechanized means deploying machinery like wagon drill machine, rock breaker, hydraulic / diesel operated shovel, dumper/tipper etc.

The present production capacity of the Iron Ore Mine is @ 4.99 MTPA. The present study is made for renewal of NOC from CGWA for extraction of maximum 170KLD of groundwater during mining operation as per the approved mine plan and previous NOC. The present report is based on the Hydrogeological investigation made within core zone and its 10km radius i.e buffer zone for assessment of impact of dewatering of groundwater by the mine and will be submitted to CGWA for obtaining NOC.

The area is drained by IB and Brahmani River and its tributaries. The easterly flowing Sankh and westerly flowing Koel River join at Vedavyas near Rourkela to form the Brahmani River. The river, IB a tributary of Mahanadi controls the drainage of the western parts of the district. The drainage pattern of the area is dendritic. The study area is located in Koira Tehsil of Sundargarh District, Odisha, which falls under **safe blocks** as per the report on Dynamic Groundwater Resource of India, published by CGWB in 2019-20. The study area is having largely one geological formation name Singbhum-Keonjhar-Bonai group of iron ore of Precambrian age. These constitute hard rock's includes schist, tuffs, phyllite, basic rock, BHQ/BHJ have been classified as Iron Ore Series (IOS). Aquifers are developed only in the low lying area and valley parts of the study area. Groundwater quality is fresh and potable in both core and buffer zone area and EC remains below 1900 ppm and TDS varies from 50 to 500 ppm in the core & buffer zone both. As per the approved mine plan the dewatering of groundwater is maximum 170KLD is required for mining operations. Rainwater is harvested within the ML area through construction of water conservation pond, and earth bunds to meet the complete requirement. The annual conservation through RWH is about 26825m³/y. There is no long term impact on groundwater has reported because of mining.



Acknowledgments and Certificate

Impact assessment and report preparation work as per the CGWA guideline was entrusted to MRCAWTM, Manav Rachna as accredited Groundwater Institution of CGWA by **My world consultancy services (WCS), Bhubaneswar.**

Discussions with Mr. Mr. Bidhu Bhusan Sahoo, AVP, Operation & Development (Mines), GRM and Mr. Prabina Tarai, DY. Geologist, GRM regarding the geology of lease area and plan our investigations according to scope of work are gratefully acknowledged. Help rendered by Mr. Pramod Kumar Sahoo, Sachidananda Giri and Rakhee, GRM in every stage of planning and Field verification, investigations in and around lease area and report preparation is thankfully acknowledged. They also provided all the available relevant data and records many of them are reproduced in this report and forms part of annexure section. Mr. Pradeept Mohapatra, Director, WCS is also involved in every stage of report preparation work.

The report has been prepared by Ms Sheha Rai, Dy. Director, MRCAWTM under the supervision of Prof (Dr) Arunangshu Mukherjee, Director MRCAWTM. Mr. Sandeep Kumar, Scientist, is assist her in field data collection and Map preparation.

It is to certify that MRCAWTM have investigated the area of Raikela Iron ore Mining Project of M/s. Geetarani Mohanty, village Raikela of Koira Tehsil of Sundargarh District, Odisha. Based on actual data collected from field, available documents and literature survey done, has prepared the report as per the format of CGWA.

(Dr Arunangshu Mukherjee)

Director, MRCAWTM

MR Centre for Advance Water Technology & Management
Manav Rachna International Institute of Research & Studies

(Deemed to be University under section 3 of the UGC Act, 1956)

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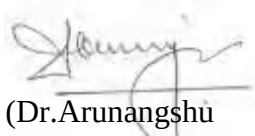
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Report on Hydrogeological Investigation and Impact Assessment for Raikela Iron ore Mining, village Raikela, Koira Tahasil of Sundergarh District, Odisha.

1. SALIENT FEATURES OF THE PROPOSAL

1.1	Application No	
1.2	Accredited by	CGWA
1.3	Date of Accreditation	01/10/2021
1.4	Validity upto	30/09/26
1.5	Work Order Date (Attach copy of the Work Order with masking details of charges)	17/09/2024, Attached as annexure 3.
1.6	New/ Existing Project	Existing Project
1.7	CTE issued date	19-08-2022
1.8	Alluvium/ Non-alluvium	Non-Alluvium
1.9	Block Name & Category (GWRA, 2020)	Koira block , Safe category
1.10	Ground water requirement	170KLD
1.11	Date of NOC issued & Authority	31/01/2023, CGWA
1.12	Date of NOC validity	30/01/2025, Annexure 1
1.13	Ground water Modelling Required (Yes/No)	NO
1.14	In case the report is prepared jointly by accredited Institute and Individual consultant, name/details of chapters prepared by the Individual consultant	NO
1.15	Signature of the Consultant(s)	 (Dr. Arunangshu Mukherjee), Director, MRCAWTM

2.0 ABOUT THE PROJECT

Raikela Iron ore Mining Project of M/s. Geetarani Mohanty spread over an area of 67.586 Ha is under operation with the production capacity of Iron Ore @ 4.99 MTPA located in Raikela village in Koira Tahasil of Bonai sub-division in Sundergarh district of Odisha. The lessee is a partnership firm. The latest lists of partners are as 1.Sri Srinibash Sahoo, 2.Duhshasan Sahoo, and 3.Smt Suprassana Sahoo. The existing iron Ore Mining projects was executed for a period of 20 years w.e.f. 02.07.1991 in favour of Smt. Geetarani Mohanty and as per the Supplementary lease deed, the validity of the lease period is now extended up to 01.07.2041. The Mine is in running condition and consent to operate has been obtained from State Pollution Control Board (SPCB) Govt. of Odisha. The lessee has applied for enhancing production capacity EC for a capacity of 7.0 MTPA, which is in due process. The Review of Mining Plan under Rule 17(2) of MCR 2016 was approved vide letter no MRMP/A/05-ORI/BHU/2021-22 dated.01.07.2021 for the production capacity of 4.99 MTPA. The validity of the Review of the Mining plan is up to dt.31.03.2026.

Out of the 67.586Ha of Mining Lease area, forest land under DLC category is 66.671Ha and 0.915Ha is non-forest land. Out of the 66.671Ha, DLC Forest land, 43.033Ha had been broken prior to 12.12.1996 and mining operation in this area was being continued. Ministry of Environment and Forest, Govt of India has accorded the Stage-II Forest Clearance over an area of 66.671Ha vide letter No. F No.8-37/2007-FC dated 22.10.2014.

There is no environmental sensitive zone in core and buffer zone. However, the reserve forest found in the buffer zone is as follows: Sarkunda R.F - 2.5 Km (South), Tohra R.F - 3.3km (South),Tohra R.F - 5.9km (North), Karo R.F - 9.5km (North-east) Kathmal R.F - 8.2km(East)

As per the approved mining plan, the mineral processing like screening and crushing will be suggested by deploying mobile screening and crushing plant for future. Now the lessee proposed a fixed 1000TPH Central processing unit (CPU) for screening and crushing of iron ore of required sizes. As a result of installation of CPU the mining operation will be in a systematic and scientific manner.

In present there is no beneficiation proposal.. The lessees will directly sale the product in open market. Total mineral reserve is 74455138 T, mineral resource is 13980220 T and total reserve resource is 88435358 T.

NOC for withdrawal of 180 m³/day of Ground water has been obtained from CGWA vide ltr no CGWA/NOC/MIN/ORIG/2021/10588 dt 31.01.2021 and the NOC obtained for 170 KLD withdrawal from CGWA vide CGWA/NOC/MIN/REN/1/2023/8368 dated 11/10/2023 valid from 31/01/2023 to 30/01/2025. **(Annexure 1)**. The water requirement will be met from own bore wells situated in the lease area. The area falls under safe category as far as stage of development is concerned.

Location:

Raikela Iron ore Mining Project of M/s. GeetaraniMohanty spread over an area of 67.586 Ha is under operation, located in Raikela village in Koira Tahasil of Bonai sub-division in Sundergarh district of Odisha. Location Map and Satellite Image of the Project area is shown in Figure no.2.1 & 2.2. The coordinates of lease pillars is given below.

DGPS SURVEYED CO-ORDINATES OF ML PILLARS					
SL.NO.	PILLAR NO.	LONGITUDE	LATITUDE	UTM COORDINATE	
		DD-MM-SS	DD-MM-SS	EASTING	NORTHING
1	1	85°10'43.50432"	21°52'35.39676"	311823.778	2420271.88
2	2	85°10'39.17784"	21°52'29.73648"	311697.506	2420099.257
3	3	85°10'37.58988"	21°52'26.27508"	311650.661	2419993.342
4	4	85°10'38.32032"	21°52'23.63160"	311670.664	241991.785
5	5	85°10'34.63140"	21°52'19.69536"	311563.326	2419791.972
6	6	85°10'32.83140"	21°52'14.74932"	311509.848	2419640.454
7	7	85°10'32.27952"	21°52'10.05348"	311492.283	2419496.223
8	8	85°10'33.52152"	21°52'06.88260"	311526.783	2419398.267
9	9	85°10'34.38336"	21°52'04.17540"	311550.546	2419314.709
10	10	85°10'36.46488"	21°52'02.64468"	311609.746	2419266.922
11	11	85°10'39.38772"	21°51'58.90212"	311692.296	2419150.811
12	12	85°10'41.23128"	21°51'57.16728"	311744.587	2419096.834
13	13	85°10'44.15304"	21°51'54.47556"	311827.492	2419013.045
14	14/1	85°10'45.80220"	21°51'56.04840"	311875.406	2419060.887
15	14/2	85°10'53.13144"	21°52'02.65296"	312088.239	2419261.509
16	14/3	85°10'54.26796"	21°52'03.72828"	312121.256	2419294.194
17	14/4	85°10'57.69120"	21°52'07.64724"	312220.964	2419413.570
18	14/5	85°10'58.70136"	21°52'08.72364"	312250.350	2419446.339
19	14/6	85°11'01.76964"	21°52'11.13960"	321339.315	2419519.603
20	14/7	85°11'05.16660"	21°52'14.84508"	312438.184	2419632.414

Table-2.1: Pillar coordinates of the lease boundary

The mining lease area is approachable from Koira town covering a distance of 8 km by Bhadrasahi – Rourkela NH–215. The area can also be approachable from Tensa town ship which is on NH – 215 at a distance of 2 km. Nearest Rail Head is at Barsuan (both Passenger and goods train) located adjacent to several working mines connected by road from

Bhadrasahi-Koira-Rajamunda NH-215. District headquarter is at Sundergarh – 110 km from lease area. The lease area comes under the toposheet no F45N1 (73 G/1) is delineated between latitude $21^{\circ} 51' 54.47556''$ to $21^{\circ} 52' 35.39676''$ N and longitude $85^{\circ} 10' 32.27952''$ to $85^{\circ} 11' 05.16660''$ E. List of the co-ordinates of the pillars are shown in table no 2.1.

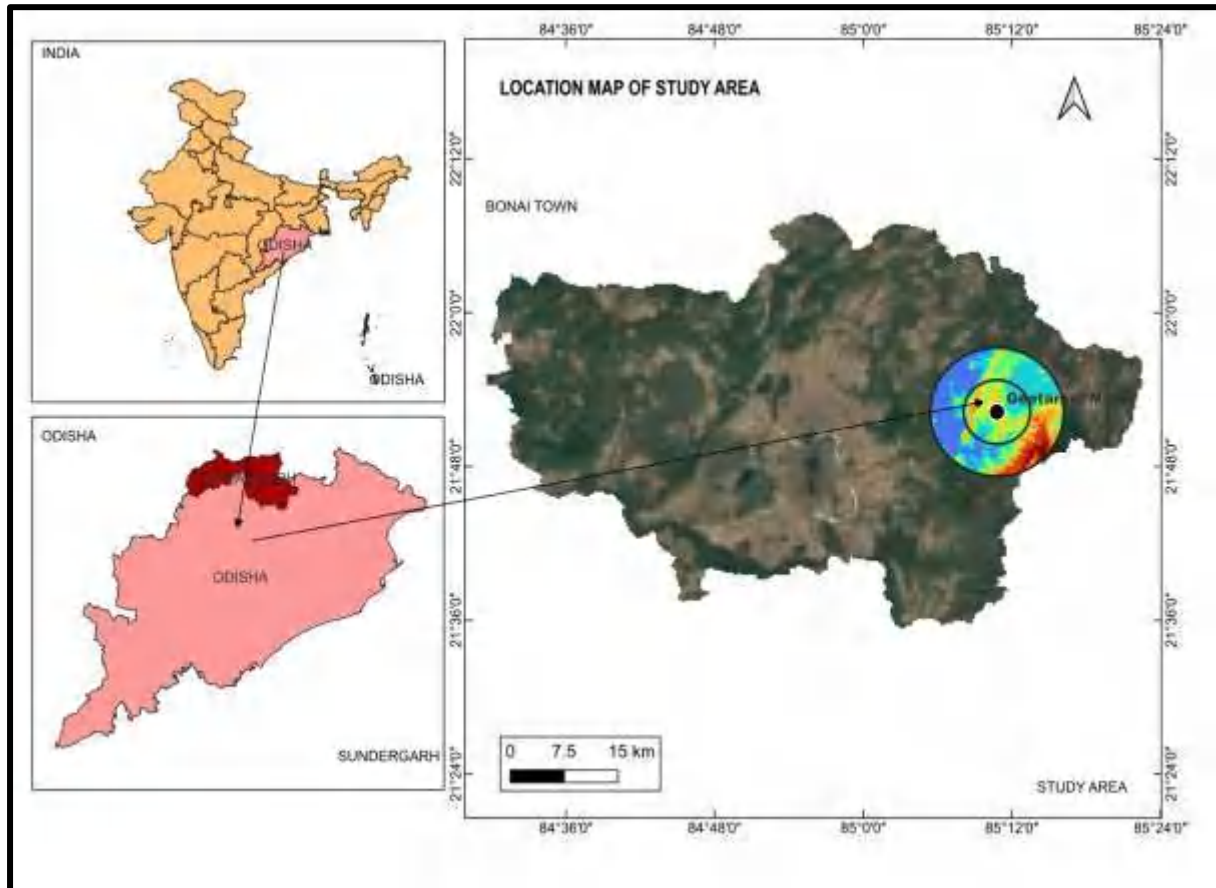


Fig-2.1. Location Map of Raikela Iron ore mine, Sundergarh district, Odisha



Fig-2.2. Satellite Image of the Project area

2.1 Land Use Land Cover of surrounding area

“Land use” is the term used to describe the human use of land. It represents the economic and cultural activities (e.g., agricultural, residential, industrial, mining, and recreational uses) that are practiced at a given place. Land use and land management practices have a major impact on natural resources including water, soil, nutrients, plants and animals. Land use information can be used to develop solutions for natural resource management issues. The major effect of land use on land cover is deforestation more recent significant effects of land use include urban sprawl, soil erosion, soil degradation, salinization, and desertification. In the present study, land use and land cover within 10Km buffer area covering 347.16 sq.km using historical remote sensing satellite data and LULC within the Core Zone (CZ) has been carried out. The study area is mostly an undulating rugged mountain terrain except a relatively flat and gently undulating terrain in the northwestern part. The hills trending from northeast to southwest. Most of the terrain is covered with forest ranging from dense through open and degraded forest cover. The rugged terrain has the highest elevation range of approximately 1000m above MSL and 400m above MSL as the lowest elevation. Plains are also seen, which are narrow and very small in spatial extent. Such places are inhabited with settlements that are scattered in nature and seasonal agricultural activities are seen. There are many first order nallas are seen in the hilly area which act as overland flow of precipitation. These seasonal nallas join to form minor

streams and later confluence with major rivers. There are two major nallas flowing in the study area are Kuradhi Nadi, Karo river and Sarkanda nalla with former flowing in the northeast and latter in southwest direction. Villages are scattered and seen along the foothills and along the narrow valleys between the hills. Because of the natural constraints on land availability and lack of proper storage mechanism for water, only seasonal agriculture cropping is practiced in this area.

2.1.1 LULC Pattern within 10 Km Radial Buffer around the ML

Map showing various LULC categories is prepared using visual interpretation technique based on image elements such as spectral band width colour, tone, texture, size, shape and association of elements. Categorization of LULC and their nomenclature is based on the national level land use classification system, which is adopted for the entire country as recommended by National Remote Sensing Centre (NRSC), Department of Space, and Government of India.

Sr. No	Major LULC Category	Land use unit
1.	Built-up Land Settlement	Industries / Mining, Infrastructures
2.	Agricultural Land Crop land	Plantation
3.	Forest Dense Forest	Open Forest, Scrub Forest
4.	Waste Land with Scrub	Land without scrub
5.	Water bodies Tanks / Ponds	Rivers / Streams

LULC map showing 10 Km radial buffer around the mining lease (ML) area and major LULC categories such as built-up, agriculture, forest, and wasteland and water bodies along with their spatial estimation are discussed below. Settlements: About 18.06 km² is under habitation comprising villages, settlements. Since, the buffer area is mostly a rugged mountainous terrain, habitation settlements – villages - are numerous, small in size and scattered in nature. From the satellite image, built-up / settlements are identified by their typical image elements such as light grayish green color, medium to coarse tone, medium to coarse texture and close association with vegetative cover (red color). They are small and scattered in nature and there is one larger settlement Koida town in the study area. There are some mining related industrial activities in the buffer area apart from some infrastructure buildings such as temporary shelters - camps and schools). Agricultural Land Agricultural land covers of 55.65 Sq.km. Cultivation is seasonal, Kharif crops, are grown along with

maize, pulses like Ragi, Mango, Biri are grown to substantiate the household requirements and provide some form of earning to the local people. Owing to mountainous terrain, cultivation practice is limited and restricted to a few pockets in the study area. Plantation Area is very meagre with presence of teak, mango, neem trees occupying an area of 0.24 Sq.km of the buffer area. Forest is the major land cover in the study area and most of the area is covered with forest of varying density covered with deciduous trees, shrubs and scrubs with trees such as Sal, Sidha, Mahula, kendu Champa. Based on the image elements such as color, tone and textural variations, forest is delineated qualitatively as “dense forest”, “open forest” and “scrub forest” cover. Cumulatively, LULC of forest category covers an area of 203.92 Sq.km of the study are. Detail of LULC is mention in Table 2.2

Wasteland is another important LULC where land lie unproductive in terms of agricultural activity, land use such industrial activities and mining activities. The total wasteland is 43.42sq km. Waterbodies Water bodies include features such as tanks, ponds, streams and rivers. This is an important LULC that indicates the terrain condition and agricultural resource of an area. There are many ponds and tanks existing near settlements. They are identified by their typical blue colour. The water bodies cover 1.59sq km.

Sr. No.	Land use Category	Area In Sq. Km
1	Settlement	4.66
2	Road	0.19
3	Railway	0.33
4	Mining / Industries	12.88
5	Agricultural land	55.43
6	Land with Scrub	24.49
7	Land without Scrub	43.42
8	Dense Forest	116.31
9	Open Forest	73.63
10	Scrub Forest	13.99
11	Plantation	0.24
12	River / Stream	1.44
13	Reservoir / Tank / Pond	0.15
Total Area		347.16

Table-2.2: LULC units within 10 Km Buffer zone and their Spatial Extent

2.1.2 LULC Pattern within core zone

Total ML area covers 67.586Ha. Out of the 67.586vHa of Mining Lease area, forest land under DLC category is 66.671Ha and 0.915Ha is non-forest land. Out of the 66.671Ha, DLC Forest land, 43.033 Ha had been broken prior to 12.12.1996 and mining operation in this area was being continued. In present, during mining land use pattern is given in table 2.3.

Table-2.3: A Present Land use of the ML area

SI No	Pattern of utilization	Area put on use at start of Plan period (Ha)
1	Mining	33.593
2	Overburden dump	2.000
3	Mineral storage	3.799
4	Infrastructure	0.200
5	Road	1.900
6	Mineral separation plant	0
7	Greenbelt	2.477
Subtotal		43.054
8	Safety zone	2.523
9	Area undisturbed	21.094
Total		67.586

2.2 DEM / TOPOGRAPHY

M/s Geetarani Mohanty Raikela iron ore mine of over an area of 67.586 hectares is located in village Raikela, PO-Tensa in the district of Sundergarh of Odisha state. The area contains both forest and non-forest land. Out of total lease area, 66.671 ha come in forest land which falls under in “DLC Forest” and rest 0.915 ha area is under non-forest area. The mining lease area is approachable from Koira town covering a distance of 8 km by Bhadrasahi – Rourkela NH – 215. The leasehold area falls under Survey of India Toposheet No. 73 G/1 and is delineated between latitude 21° 51’ 54.47556’’ to 21° 52’ 35.39676’’N and longitude 85° 10’ 32.27952’’ to 85° 11’ 05.16660’’E. Topography map including core zone and Buffer Zone is shown in Fig-3.4.

The lease area presents an undulating topography. The highest and lowest elevation is 845m and 625m above M.S.L. respectively. Digital elevation map of the area is showing in Fig-2.3 and topographic map in 2.4 Respectively.

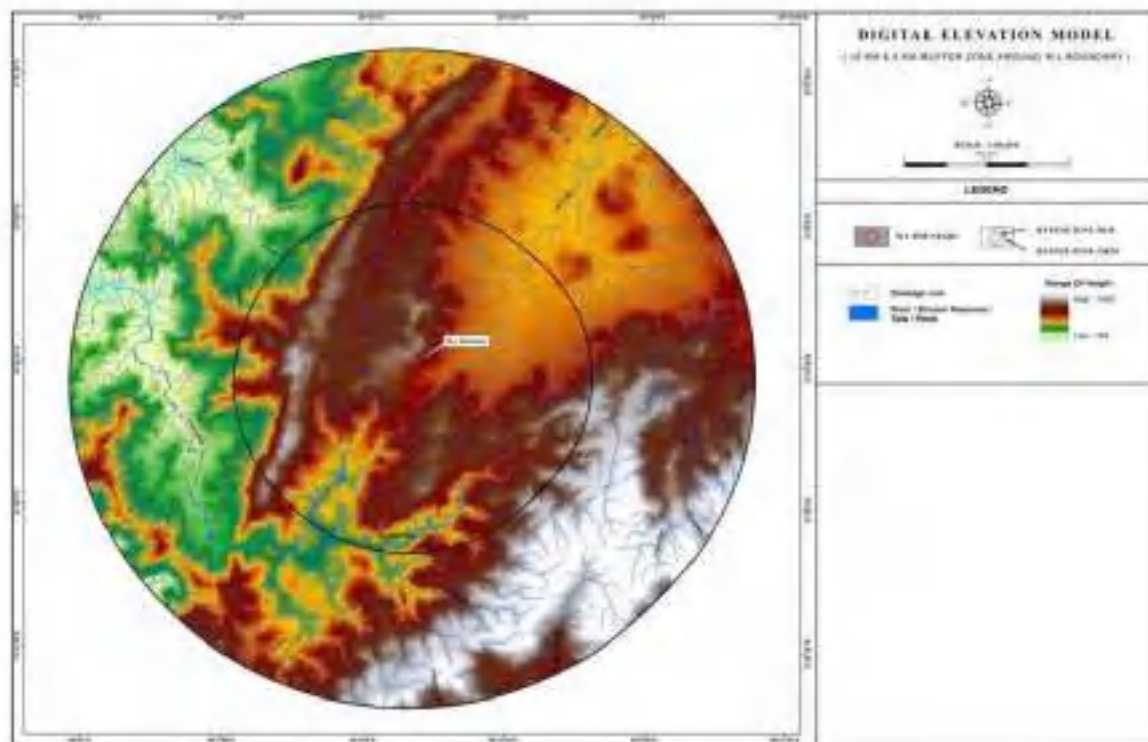


Fig-2.3: Digital Elevation Model of the Study area showing highest and lowest altitudes



Fig-2.4: Topography map including core zone and Buffer Zone

2.3 GEOMORPHOLOGY AND DRAINAGE

As far as drainage pattern is concerned, dendritic pattern can be observed regionally in the lease area and its surrounding area. There is no perennial nala flowing within the lease area. Only some seasonal nala flowing due east along the valley. The Kurahi Nadi is flowing due North West in the western part of the lease area at a distance of 8km. Geomorphological map of the buffer zone is shown in fig-2.5, Drainage in 2.6 and watershed area is 2.7 respectively.

Drainage system of the area is dendritic type, controlled by river Baitarani (outside the buffer zone) and its tributaries like Kuarhi Nadi, Marda Nadi, Burghar Nadi, Kiri Nadi etc. Kuarhi Nala a perennial source, starting near village Basada, drains the north-western part of the buffer zone similarly, southeastern and southwestern part of the buffer zone is drained by Marda Nadi and Burghar nadi respectively. Drainage density is very high indicating the hilly nature of the land-form.

The rainfall runoff is generated through drainage of different orders, which flows in general from north-west towards south-east. Besides there are other prominent seasonal nallas, the whole area dendritic drainage pattern can be observed that generally follows physiography as shown in Drainage map (Fig. 2.6). Vegetation is sparse with deep-rooted trees at number of places especially along the nallas. The area has deciduous forest which spread over hills. The area comes within Micro-watershed of sub basin is given in fig 2.7.

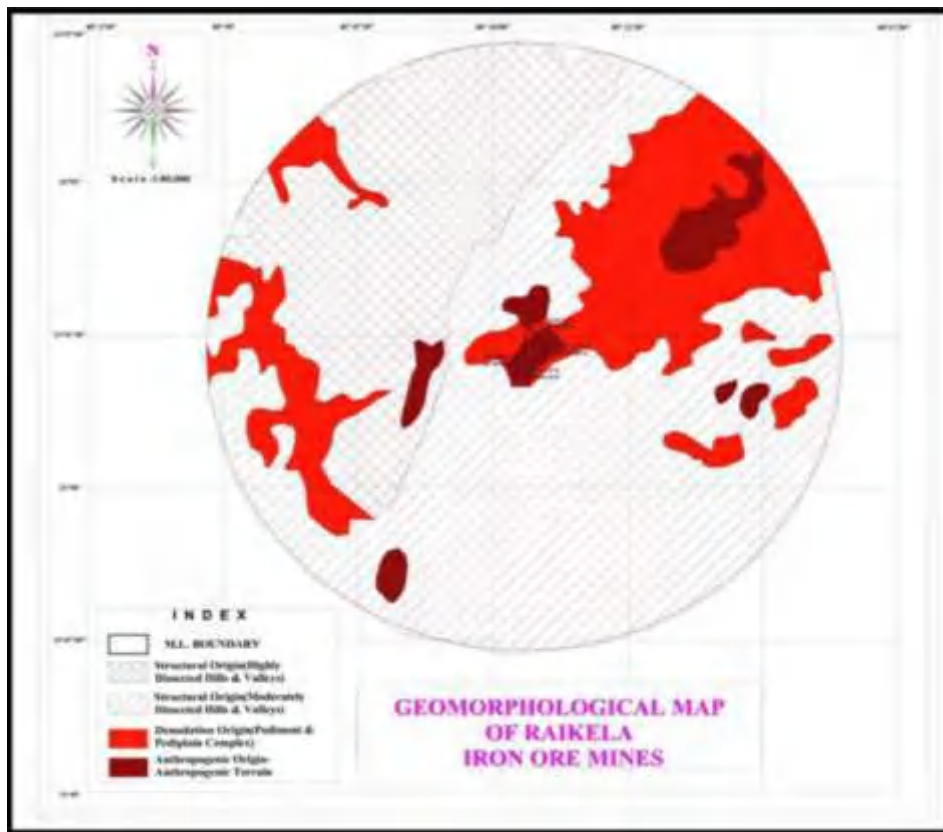


Fig-2.5: Geomorphological Map of the study area

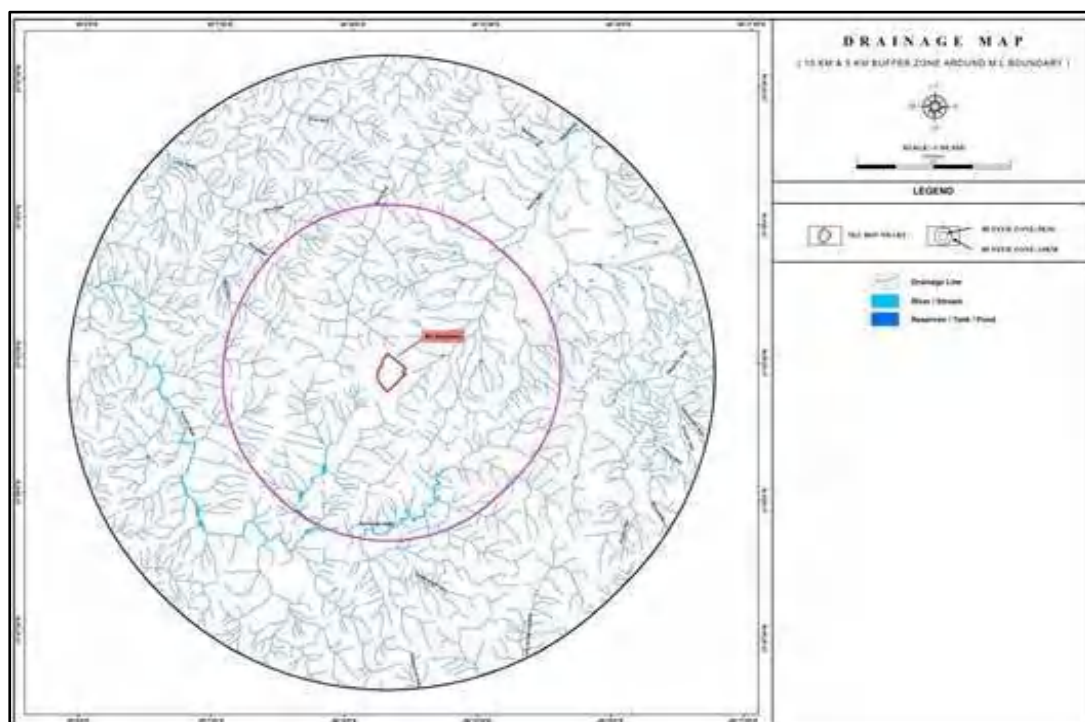


Fig-2.6: Drainage map of core Zone and buffer Zone



Fig-2.7: Drainage Map showing drainage basin area

2.4 DETAILS OF WETLANDS/ MAJOR WATER BODIES

No wetland has reported in the core and buffer zone of the lease area, nor any major water bodies. Mostly the 1st and second order streams were reported in surrounding. The drainage pattern is dendritic generally but since the region is fracture controlled, trellis pattern is also observed. The drainage density is moderately high indicating more run-off than infiltration. The drainage system is predominately controlled by Karo river flowing at a distance of 7km in North eastern side and Kurahi Nadi, flowing due North West in the western part of the lease area at a distance of 8km. Similarly, Sarkunda Nala flowing at a distance of 4.20 km in the southern side joins Kuradi Nadi at a distance of 5.0 km in the southwestern direction. Drainage density is moderate indicating the hilly nature of the land-form. The slope is generally towards west and southwest. The drainage map of the study area is shown in Fig-2.6.

3. HYDROGEOLOGY

Sundergarh district is North Western part of Odisha state. Sundargarh is recognized as an industrial district in the map of Odisha. Steel Plant, Fertilizer Plant, Cement factory, Ferro Vanadium Plant, are some of the major industries of this District. Large part of the study area belongs to Raikela Village, Koira Tehsil of Sundargarh District, Odisha. Ground water is the main source of drinking as well as industrial and domestic purpose. However, the requirement of water in irrigation and agriculture is fulfilled mainly by river, canals as well as by rainwater. The rainwater also is the main source for recharge of groundwater of the area. The following major subtopics that are covered in this particular chapter are:

3.1 GEOLOGICAL SETUP

3.1.1. Regional Geology

Sundergarh district is rich in Iron ore, limestone, manganese, dolomite, and fire clay. Banded Iron Formation (BIF) and Iron ore deposit occupy three distinct provinces surrounding the North Odisha Iron Ore Craton (NOIOC). They are Bonai-Keonjhar belt in the western side of the Craton, Badampahar Gorumahisani- Suleipat belt in the eastern flank and Daitari-Tomka belt in the southern side of the Craton. All of these three belts having best preserved basin of Precambrian age that form Iron Ore Super Group (IOSG) of Odisha. Sundergarh district lies under Western flank by the Bonai –Keonjhar (BK) belt forming U shaped synclinorium which is known as the Horseshoe belt. Iron Ore Super Group (IOSG) Odisha, rock assemblages is belonging to Singhbhum – North Odisha Iron Ore Craton. There are three or more Iron Ore Group existing in the IOSG such as Badampahar Group, Noamundi Group and Koira Group. These groups are separated by unconformity, different metamorphic grade, distinct sedimentary and igneous assemblages and ore types (Fig: 2.1).

The Mayurbhanj granite occurring along the eastern fringe of the Singhbhum granite was dated to be 3100Ma. The A type Mayurbhanj Granite Pluton (3.09Ga) occurring along the eastern margin of the Singhbhum – Odisha Craton, eastern India, represent the final phase of acid plutonism in this crustal block of Archaean age.

I. BIF-1: Badampahar – Gorumahisani – Sulpet Belt

The BIF-1 comprising of iron formation of Badampahar- Gorumahisani – Sulpet (BGS) Belt. The litho assemblage of this oldest Iron Ore Group consists of banded cherty quartzite, tremolite-

actinolite schist and fuchsite quartzite. The Badam Quartzite is well exposed in the western side of BGS. Banded magnetite quartzite is the dominant litho unit in the BIF-1. The major mineral constituents are Magnetite, martite, hematite, specularite, goethite, grunerite, and quartz. The BIF-1 has suffered amphibolites facies of metamorphism.

II. BIF – II: Daitari- Tomka Belt

The BIF-II lying in the southern portion of the North Odisha Iron Ore Craton is confirmed to Daitari – Tomka belt. It is underlain and overlain by Badampahar quartzite and Dhanjori quartzite. The litho assemblage of this belt consists of banded magnetite/hematite quartzite, banded magnetite/hematite jasper, quartz sericite schist, phyllite, slate and banded chert. The rocks of BIF –II attain green schist facies of metamorphism.

III. BIF – III: Bonai- Keonjhar Belt:

BIF-III is a U- shaped pattern in the western flank of the NOIOC that rests over the Dhanjori Quartzite. The litho association of this area forms the youngest Iron Ore Group comprising of banded hematite jasper, banded hematite quartz/cherty, banded shale, banded manganese formation and ferruginous shale. The banded iron formation consists of predominantly iron oxide mineral such as hematite, martite, specularite, and magnetite. The litho assemblage of this youngest iron ore belt is un-metamorphosed and lack of intrusive Fig (3.1).

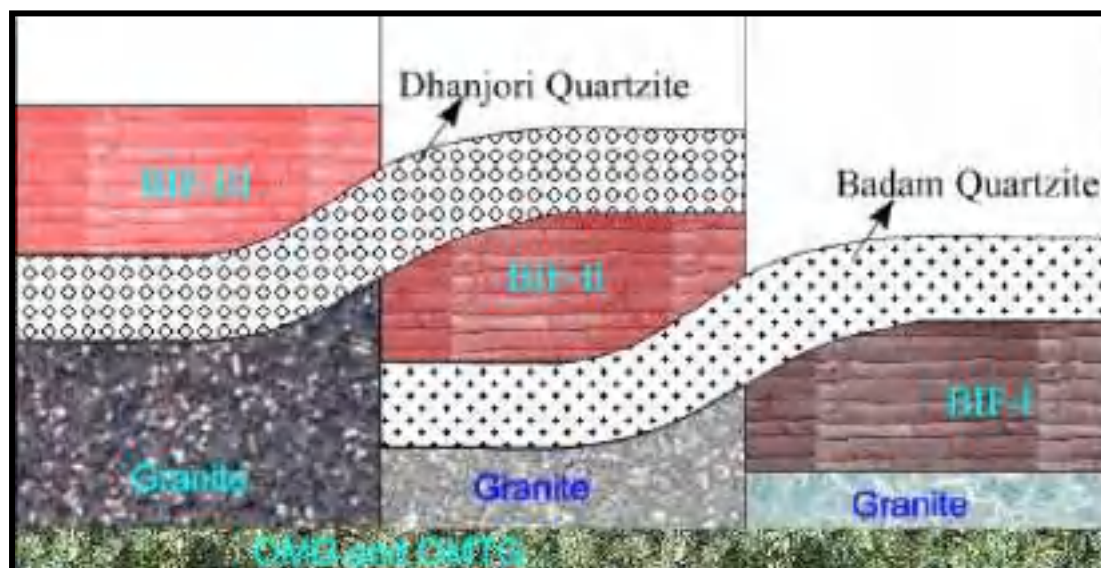


Fig -3.1: Schematic diagram of stratigraphic setting of three BIF of IOSG (Beura et al.2016)

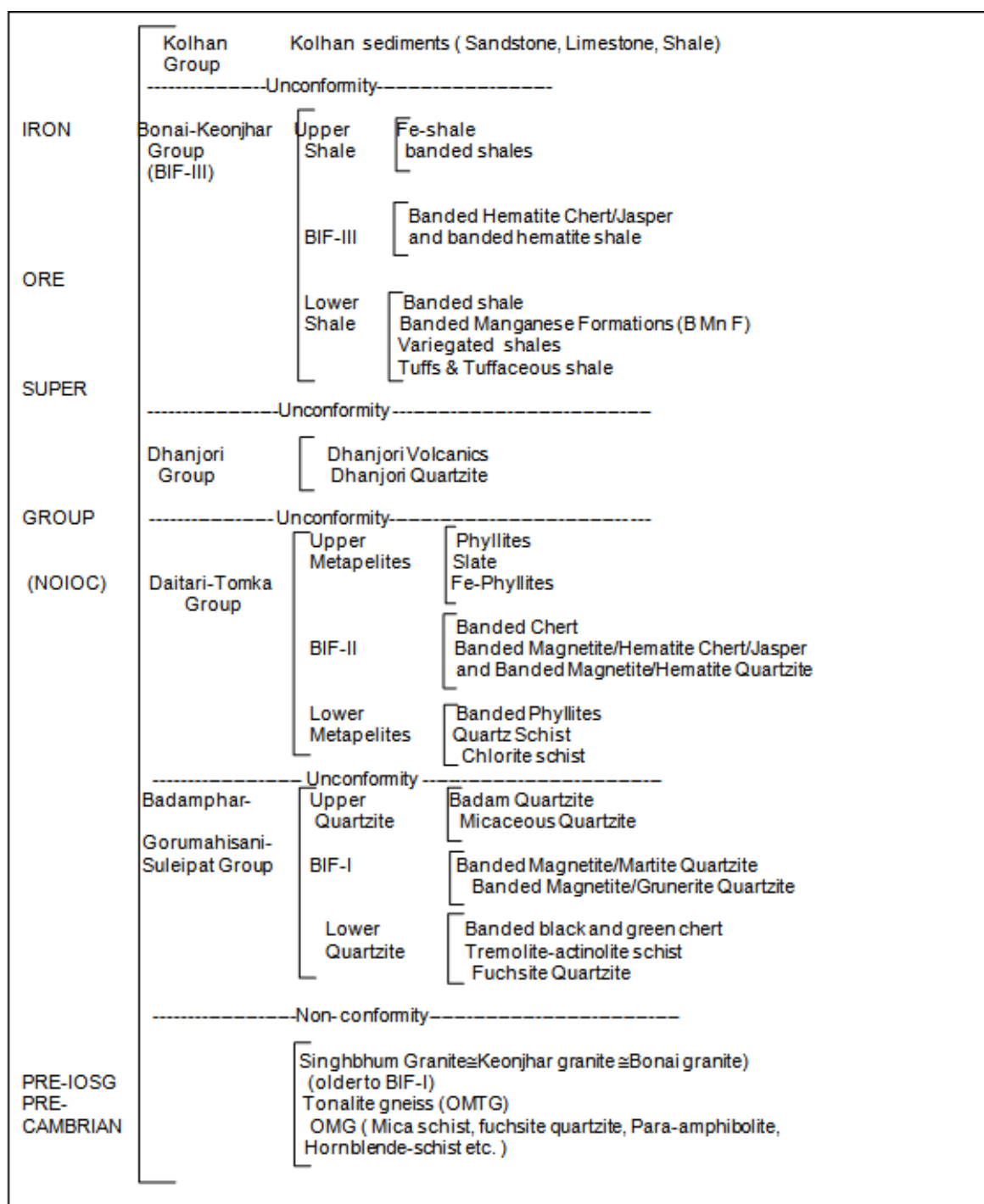


Fig 3.2: Stratigraphic Succession of Iron Ore Super Group of Odisha (Beura et al.2016).

3.1.2. Local Geology

The study area is occupied by the rock of Koira group Table (2.1). This belt is 60km long and 25 km wide extending from south of Malangtoli in Keonjhar district up to Chakra Dhampur in West Singhbhum district (Jharkhand). The western syncline known as Koira syncline, due to steep dip and overturned nature of its limb form a deeper basin with thick sequence of younger shales in the core region. On the other hand, the eastern syncline known as Bamberi syncline is a shallower basin and exposes younger litho members within the core region as outliers. The Upper shale unit within the Koira syncline is more or less continuous. The general strike of the beddings in N100W- S100E direction with occasional swings to N300E-S300W and having 20° - 40° dip towards west in the area. The area under investigation lies within the Upper Shale Formation of the Koira group described by Murthy & Acharya (19975)

Table 3.1: Stratigraphy of Koira Group in Sundergarh district, Odisha			
Soil Laterite			
Koira Group	Upper Formation	Shale	Shale's of different color like purple, yellow with inter beds of Iron ore
	Banded Formation	Iron	Coarsely banded BHJ followed up by finely banded BHJ and iron ore in the eastern block.

M/s Geetarani-Mohanty-Raikela iron ore mine is belonging to Singhbhum iron ore series and main rock type in the study area are Laterite, Hematite, and Shale. Geologically, the area is underlain by Pre – Cambrian crystalline rocks like Granite, Granitic Gneiss, Banded Hematite Jasper, Quartzite, Slate, Phyllite, and Mica Schist.

Laterite

Laterites are observed in the study area including ML area that has been the resulted from a process of residual weathering. Laterite has been developed mostly over the shale unit or low grade iron ores of the area. The shale rich in alumina has given rise to aluminous laterite and those rich in iron have developed ferruginous laterites. Ferruginous laterite occupies most of the high lands in the vicinity of iron ore of central ridge while aluminous laterite occurs in the extreme east of the area.

Shale

Western side study area has occupied with fine laminated rock having different shades of colors ranging from brownish to purple grey. Different colors of the Shale are largely dependent of minerals compositions. It is mostly composed of clayey micaceous minerals, with lenses of chert.

Iron Ore

Iron ore formation are economically important meta sedimentary rocks that occur most commonly in Precambrian sedimentary succession Based on surface exposures and sub-surface geology 4 (four) types of iron ore are recorded in the explored block.(Fig 2.1).These are Hard Laminated Ore (HLO), Soft Laminated Ore (SLO), blue dust (powdery ore), lateritic ore and float ores. . The general strike of the beddings in N100W- S100E direction with occasional swing to N300E-S300W, having 20° - 40° dip towards west in the study area

3.1.3 Geomorphology & Soil Type

Geomorphology: The district has varied geomorphological features. The geomorphic units are (I) Plain (ii) Deep Buried Pediment (iii) Shallow buried pediment (iv) Intermontane valley (v) Inselberg, (vi) Mesa & Butte, (vii) Residual Hills, (viii) Intermontane Valleys, (ix) Structural hills. The soil characteristics of the district show wide variation depending upon their occurrence, physical and chemical properties. The soil of the district is broadly grouped into (I) Alfisols (II) Ultisols (CGWB Report).

I. Alfisol and Red Soil

The study area is covered with red sandy soils and red loamy soils. These soils predominantly occupy high and medium land throughout the Sundergarh district. The characteristics feature of Red soil is porous and fragile in structure. These are usually deficient in nitrogen, phosphate, organic matter and lime. These soils are suitable for cultivation of paddy and other crops.

II. Ultisols

The ultisols comprises mainly of lateritic soils and red and yellow soils. These soils are mildly acidic in nature and deficient in nitrogen, phosphorous and potassium and organic matters. Soils of the district are generally having average to good fertility status. All common types of crops can be grown in the district.

3.2 HYDROGEOLOGICAL SETUP

The climate of the district is sub-tropical climate characterized with hot and dry summer, cold winter and erratic in rainfall. The winter season extends from November to end of February, which is followed by summer season from March to the middle of June, and rainy season from middle of June to middle of October. During summer months the maximum temperature rises up to 43° C and May is the hottest month. December is the coldest month of the year when the average daily temperature drops down to 8° C. Relative humidity is around 60-70% throughout the year. The highest and lowest monthly mean relative humidity so far recorded is 97% (Dec) and 26% (April). The annual rainfall of last decade is given in Table 2.2.

Table 3.2 Decadal Rainfall in Sundergarh District (Source: WRIS online portal) 2011-2020						
Year	Actual Rainfall (mm)	Deviation (%)	Year	Actual Rainfall (mm)	Deviation (%)	Average Rainfall (mm)
2011	1788.35	20.87	2016	1098.51	-28.82	1415.126
2012	1435.18	1.39	2017	1323.91	-6.8	
2013	1537.77	7.97	2018	1396.59	-1.32	
2014	1335.09	-5.99	2019	1387.02	-2.02	
2015	1286.6	-9.9	2020	1562.24	9.4	

3.2.1 Aquifer Characteristics

The study area comprises 10km radius zone in Raikela iron ore Mines, located in Koira Tehsil of Sundargarh district of Odisha. Detailed hydrogeological study of both core and buffer zone of mine area is carried out. The hydrogeological condition varied from place to place due to different litho unit of aquifer. The hydrogeological units of the study area are broadly categorized into two groups namely.

1. Consolidated formations.
2. Unconsolidated formations
3. Semi-consolidated

1. Consolidated formations

The study area is occupied by the consolidated formations comprising of Precambrian metasediments of Gangpur series and Iron ore series and also granite gneiss,

A Google Earth map titled "Google Earth Map of Study Area". The map shows a satellite view of a region with a grid overlay indicating coordinates from 85°4'48" E to 85°21'36" E and 21°46'48" N to 21°57'36" N. A central point is labeled "Geetarani Mine". Two concentric circles are drawn around this point: an inner circle representing a "5km Core Zone" and an outer circle representing a "10km Buffer Zone". Various locations are marked with dots and labels, including Dagaon, Karamiya, Karamiyana, Harshchandra, Nuagan, Gopurashi, Gopurashahi, Saraga, Sarusah, Zero Point, Devapur, Chingasa School Hostel, Segun, Rakesh, Kadohla, Tinduli, Tanera School, Bhima, Beglali, Kula Gov Primary, and Rengda. A scale bar at the top right indicates distances of 0, 2.5, and 5 km. Below the scale bar is a logo featuring a gear with "GIS" inside it. To the left of the legend is a box containing the text "By: MRCAWTM, MRIBS Farkibad, Haryana". The legend itself lists the symbols used: a black dot for "Geetarani Mine", a white square with a black border for "5km Core Zone", a white square with a black border for "10km Buffer Zone", and a small blue dot for "Wells Location".

Unconsolidated formations- Unconsolidated sand and gravel aquifers are characterized by intergranular porosity and all contain water primarily under unconfined, or water-table, conditions. They are grouped into four categories: basin-fill, blanket sand and gravel, glacial-deposit, and stream-valley aquifers. All four types have intergranular porosity, and all contain water primarily under unconfined or water-table conditions. The hydraulic conductivity of the aquifers is variable, depending on the sorting of aquifer materials and the amount of silt and clay present, but generally it is high. Aquifer thickness ranges from a few meters or tens of meters. Groundwater in these aquifers flows along relatively short flow paths typical of local flow systems.

Hydrogeological Investigation and Impact Assessment Report for Raikela Iron Ore Mines, Sundergarh District, Odisha

3.2.2 Ground water flow and aquifer interaction with surface water bodies

As per the field investigation it has been observed that the main source of water is from River and groundwater. Groundwater is withdrawal from bore well as well as from hand pump. Most of dug well having water level from 2 to 10m in pre monsoon period. Total depth of dug well is from 9 to 12m. It has been observed that the bore wells are often from 16 to 30m in depth. Ground water is lying in weathered part of hard rock aquifer. Hard rock comprises Precambrian met sediments like Mica schist, quartzite, phyllite, conglomerate along with granite. The movement of the ground water in deeper rocks is controlled by the nature, size opening and continuity of joints & fracture present in them. Wells in hard rock generally yield 50 to 70 m³ /day of all the rock types. Schist, phyllite and their variants form very poor aquifers yielding 10 to 30 m³ /day for heavy drawdown. Well inventory of study area in Post Monsoon (Oct, 2024) period showing ground water level varies within the range from 1.5 m to 10m bgl (Table 2.3). The groundwater flow is towards east side of the lease area. Showing in figure below.

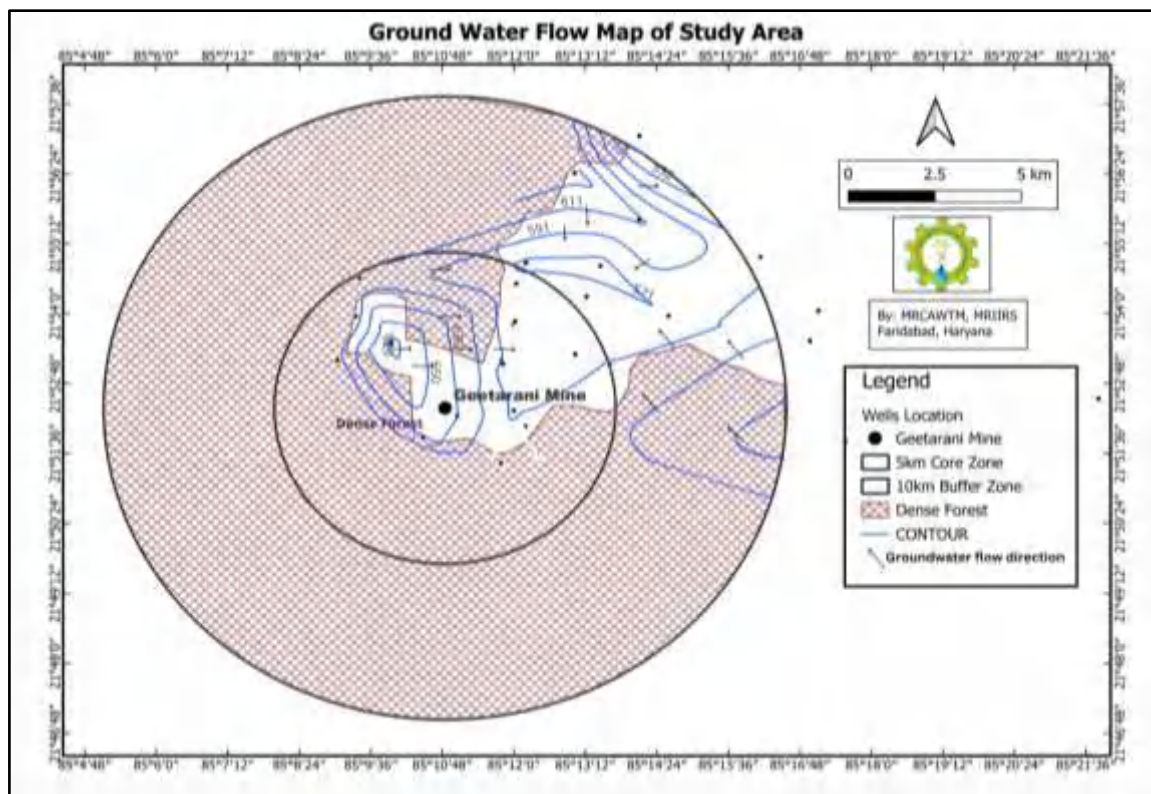


Fig3.4: Natural groundwater flow Direction's in Buffer Zone



Figure 3.5: Field Data collection

3.2.3 Depth of water Level

Various location points has been selected for groundwater data collection in Buffer zone and core zone, some points from outside of the boundary were also taken for clear picture and modelling purpose. The details of quality and water level are given below.

Table 3.3: well inventory in core and Buffer Zone of Raikela Mines

<u>S. No</u>	<u>Location</u>	<u>Latitude</u>	<u>Longitude</u>	<u>R.L.</u>	<u>EC</u>	<u>PH</u>	<u>TDS</u>	<u>WL</u> <u>(m)</u>	<u>Type</u>
1	Goppursahi	21.899344	85.243196	575	480	6.7	240	2.5	D.W.
2	Goppursahi	21.899378	85.243237	579	490	7	245	2	D.W.
3	Denguda School Hostel	21.867709	85.203258	596	240	6.5	110	2.5	H.P.
4	Geetarani Mines Location	21.870696	85.184213	631					
5	Gov Primary School Raikela	21.886675	85.196546	596	404	6.5	209		H.P.
6		21.872219	85.200037	594	480	6.7	240	3.1	H.P.
7	Raikela	21.885631	85.19695	588	120	6.4	160	6.3	D.W.
8	Nuagaon	21.897018	85.199784	584	264	6.3	132	6.2	H.P.
9	Bandal	21.897794	85.20033	592	192	6.3		4.1	D.W.
10	Rengma	21.908591	85.200662	577	303	6.1	150	2.1	D.W.
11	Kula Gov Primary	21.914481	85.203388	573	160	6.4	80	5	H.P.
12	Harishchandra	21.913603	85.224212	570	330	6.3	150	6.3	H.P.
13	Nuagaon	21.904835	85.220333	587	153	6.1	90		
14	Kadohila	21.888358	85.217158	589	100	6.1	50	5.8	
15	Tentulli	21.885336	85.226819	600	110	6.1	55	8	H.P.
16	Tantra School	21.891516	85.165848	684	381	6.3	191	8.4	H.P.
17	Zero Point	21.875654	85.363546	719	240	6.7	140	10	H.P.
18	Sarusarh	21.892185	85.282821	629	221	6.2	111	9.4	H.P.
19	Sargigarh	21.90079	85.285204	621	90		45	7.6	H.P.
20	Khyurdi	21.863617	85.294464	662	560	6.2	250	10	H.P.
21	Baldhi	21.872028	85.299814	639	152		75		H.P.

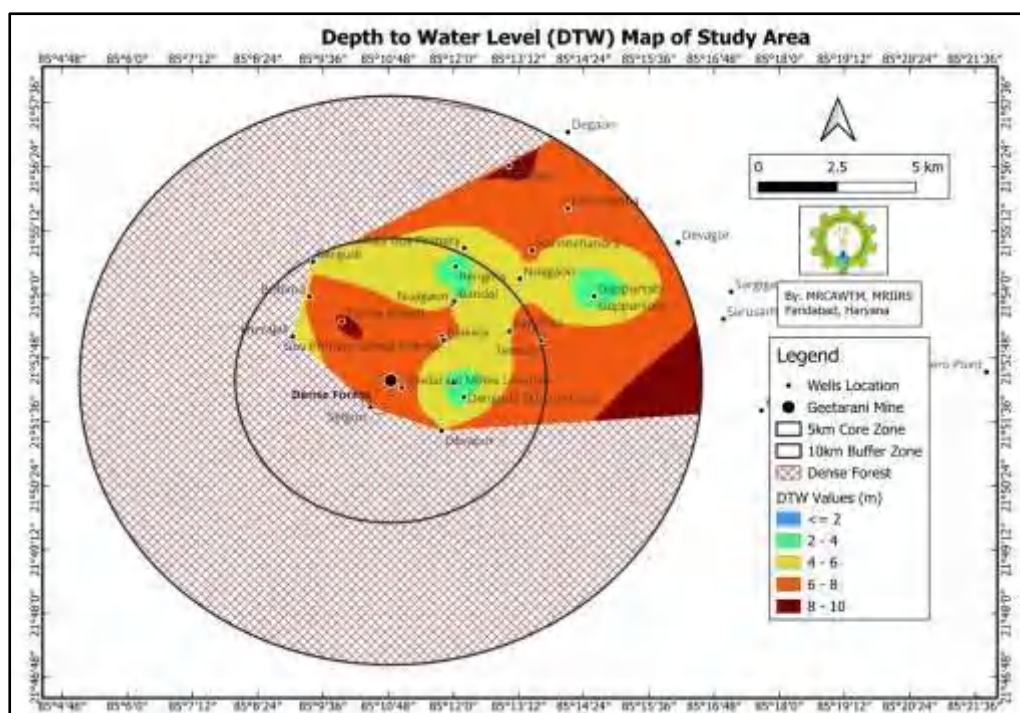


Fig3.6: DTW map of buffer zone of Raikela Iron ore Mines (Post Monsoon)

3.2.4 Long term water level data analysis

The study area comprises 10km radius zone in Raikela Iron Ore Mines that largely fall under Koirā tehsil, Sundergarh district, Odisha. In the core zone village the source of ground water such as bore well; hand pump and pond are used for domestic, irrigation and drinking whereout of 3 observation location of dug well, it has been observed that the water level (Pre monsoon 2022) varying from 3 to 7.5m bgl. Long term trend analysis of data obtained from WRIS shows no significant change-rise or fall as depicted in **Fig: 3.7**.

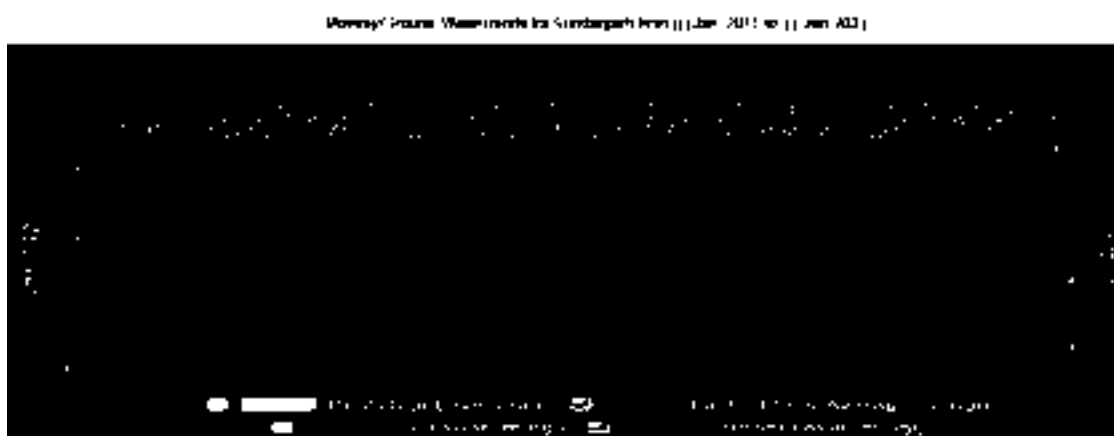


Fig 3.7: Long term well hydrograph of wells of Sundergarh district, Odisha (source: WRIS portal)

Dynamic Groundwater Resource of study area

The groundwater resource as estimated by CGWB (2020) is presented in the table 3.3 for Koira block of Sundergarh district Odisha and is in safe category.

Table: 3.4 Block wise Dynamic Groundwater Resources of Koira block, Sundergarh district

District	Block	Ground water Recharge (Ham)				Total Ground water Recharge (Ham)	Total Natural Discharge (Ham)	Annual Extractable ground water resources (Ham)
		Monsoon Season		Non Monsoon Season				
		Recharge from Rainfall	Recharge from other sources	Recharge from Rainfall	Recharge from other sources			
Sundergarh	Koira	4777.33	139.58	572.73	172.14	5661.78	283.09	5378.69
Annual Extractable Ground water Resources (Ham)	Annual Groundwater Draft (Ham)				Annual GW allocation for Domestic use as on 2025 (Ham)	Net Groundwater availability for future use (Ham)	Stage of Ground water Extraction (%)	Categorization (over exploited/ Critical/ semi critical/ safe/ saline)
	Irrigation	Industrial	Domestic	Total Extraction				
5378.63	873.45	290.16	265.25	1428.8	304.71	3910.38	26.57	Safe

3.2.5 Groundwater Quality

Based on the above study, different ground water parameters were computed, which include pH, TDS, EC, and Temperature. Ground water in study area is potable with pH ranging 5.9 to 7.6 and total dissolved solid (TDS) ranging from 50 to 300ppt and EC ranging from 20 to 600 μ S. Groundwater quality in the study area is fresh and all major and trace elements are found within the BIS 10500 permissible limit. Thus is suitable for all domestic, industrial and irrigational use. The general parameters of groundwater in study area as analyses are given in Table 3.2. The comparison of data reveals that the area mining (Project Area) is having less TDS. TDS and EC map of the Buffer zone is shown in Figure--3.8 & Figure 3.9.

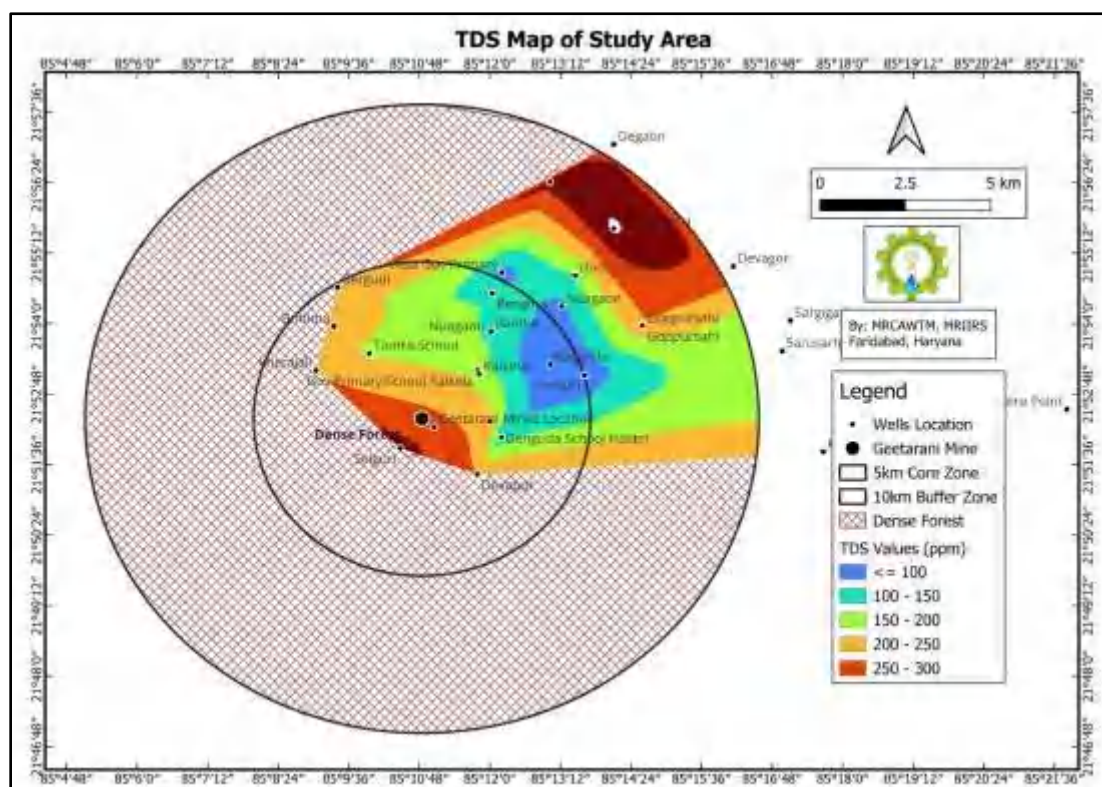


Fig 3.8: TDS map of Raikela Iron Ore mine

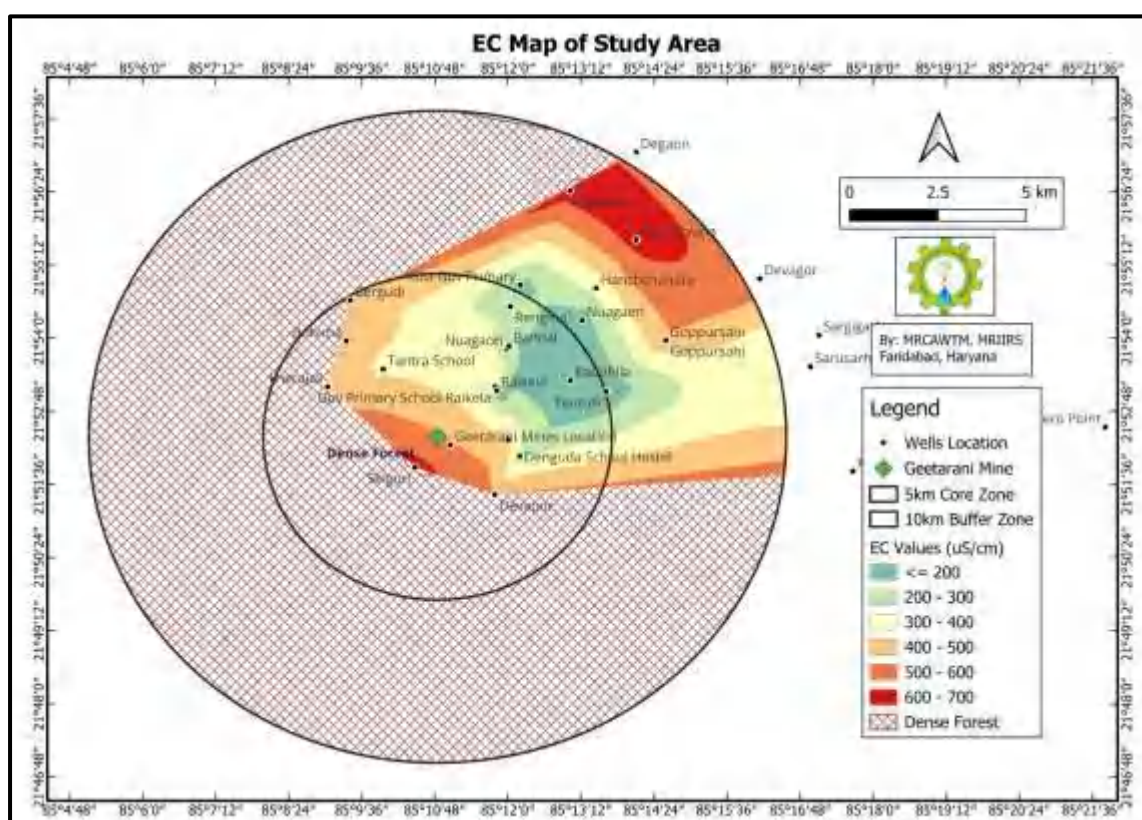


Fig-3.9: EC map of 10km of Buffer Zone of Raikela Iron ore Mines

3.2.6 Water Quality of nearby water bodies

Data in Piper Trilinear Diagram: Different graphical methods can be adopted for representing geochemical variation which gives a better insight into the groundwater quality monitoring. One such efficient method of representation is plotting of Hill Piper Trilinear diagram in which data are plotted in two triangle fields and one diamond field. The diamond is then classified under various categories emphasizing their characteristics.

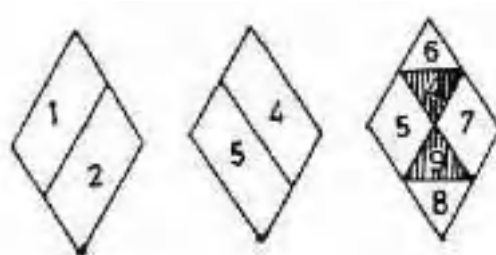


Fig 3.10: Sub-divisions of the diamond field

On the basis of data collection from CGWB report (2020-2021). It has been observed that out of 63 samples are concentrated in Area 6 indicating that: Non-carbonate hardness exceeds 50% i.e., $\text{Ca} + \text{Mg} - (\text{SO}_4 + \text{Cl} + \text{NO}_3)$. 50% samples are lies under area 4 representing strong acids $(\text{SO}_4 + \text{Cl} + \text{NO}_3)$ exceed weak acids $(\text{CO}_3 + \text{HCO}_3)$. Few samples can be noticed under Area 7: Non-carbonate alkali exceeds 50% i.e., $\text{Na} + \text{K} - (\text{SO}_4 + \text{Cl} + \text{NO}_3)$. The Piper Trilinear diagram shown in figure 3.11 below.

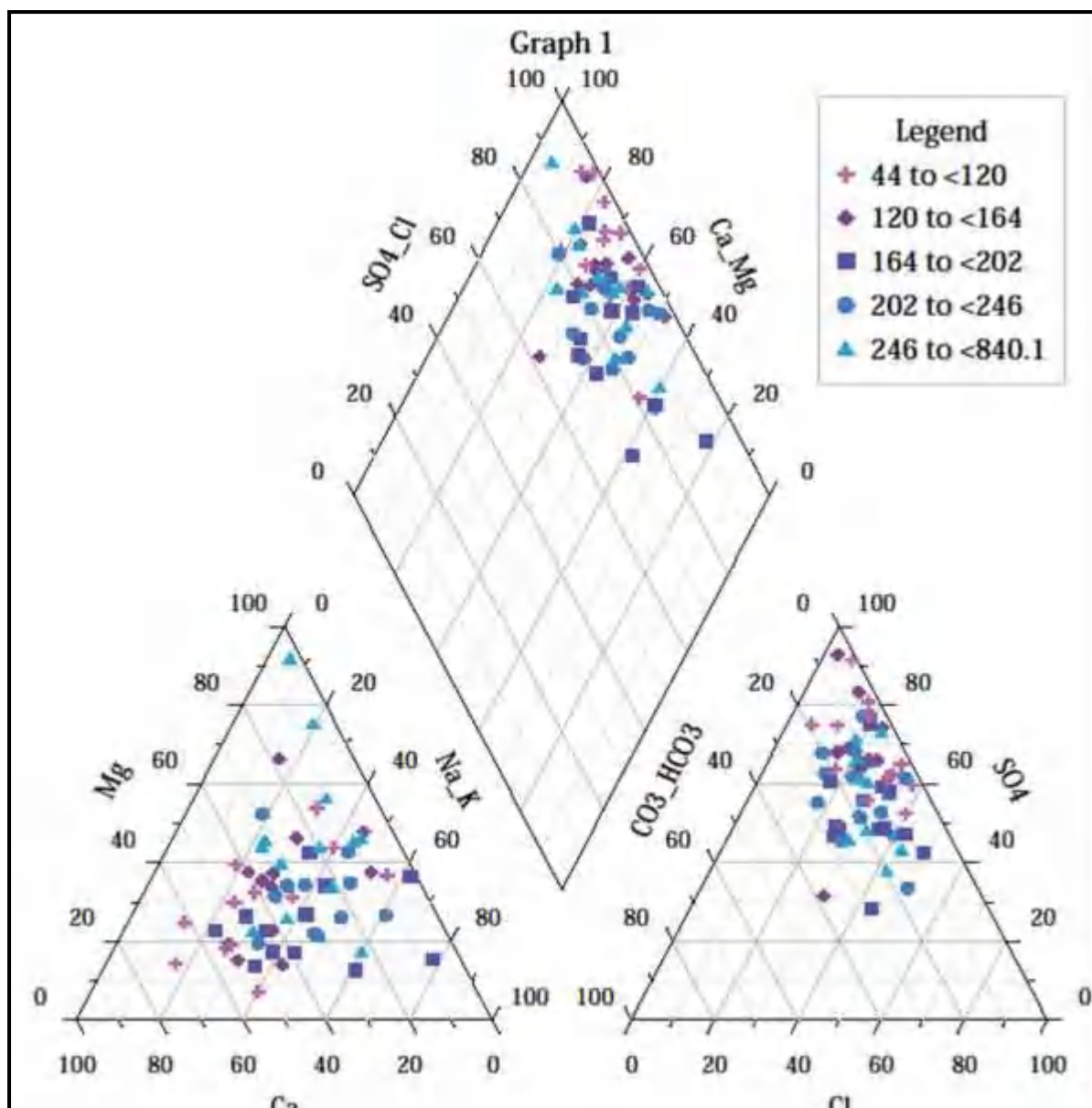


Fig 3.11 Piper Trilinear diagram

USSL Diagram: The United States Salinity Laboratory (USSL) (1954) and Wilcox (1955) established standards for irrigation water quality classification. The Fig.3.13 is a simple scatter chart of sodium hazard (SAR) on the Y-axis versus salinity hazard (EC) on the X-axis. Using the SAR and the EC value of 41 water samples of Balaghat area determines the quality classification of the water.

Based on the EC, irrigation water can be classified into four categories; include:

- I. Low-salinity water (C_1) can be used for irrigation with most crops on most soils with little likelihood that **soil salinity** will develop.
- II. Medium-salinity water (C_2) can be used if a moderate amount of leaching occurs. Plants with moderate salt- tolerance can be grown in most cases without special practices for salinity control.
- III. High-salinity water (C_3) cannot be used on soils, special management for salinity control may be required and plants with good salt tolerance should be selected.
- IV. Very high salinity water (C_4) is not suitable for irrigation under ordinary conditions.

Sodium Adsorption Ratio: High sodium in irrigation water reduces the permeability of soil. The USSL diagram based on SAR divided to four categories included:

$$SAR = \frac{Na}{\sqrt{\frac{Ca + Mg}{2}}}$$

- I. Low-sodium water (S_1) can be used for irrigation on almost all soils.
- II. Medium-sodium water (S_2) will present an appreciable sodium hazard in certain fine-textured soils. This water may be used on coarse-textured or organic soils with good permeability.
- III. High-sodium water (S_3) may produce harmful levels of exchangeable sodium in most soils and will require special soil management.
- IV. Very high sodium water (S_4) is generally unsatisfactory for irrigation unless special action is taken, such as addition of gypsum to soil (Lyerly and Longenecker, 1957).

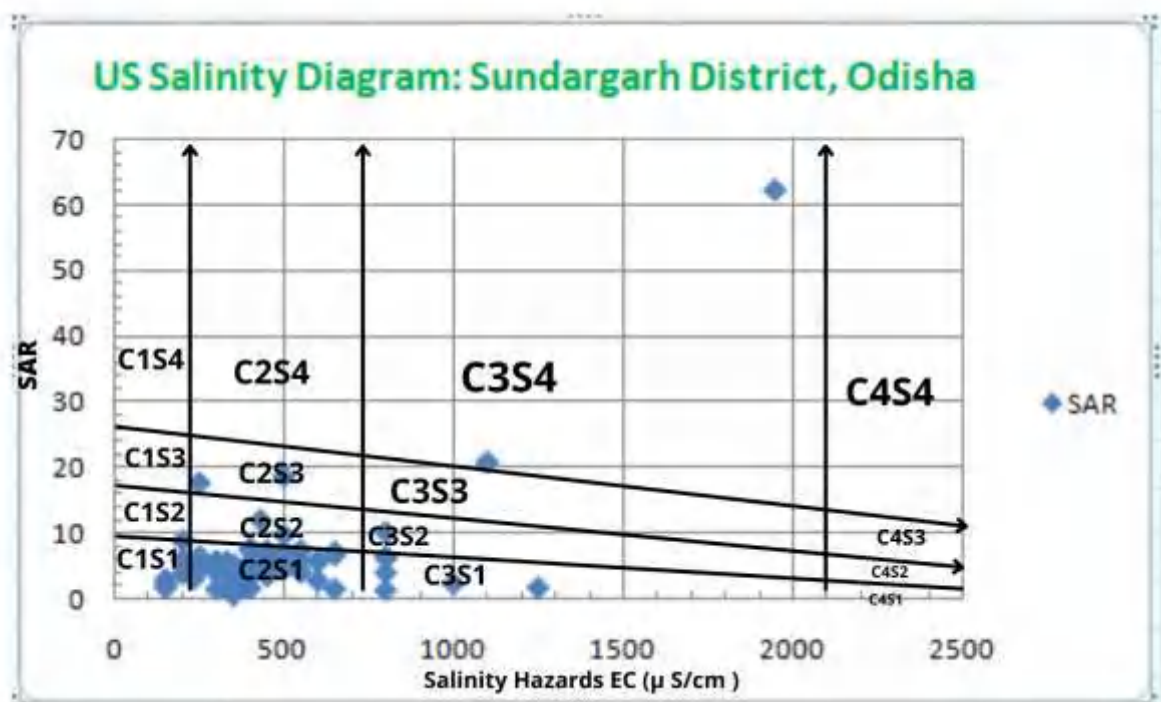


Fig 3.12: US Salinity diagram , Sundergarh district , Odisha

Data Analysis

On the basis of data collection from CGWB report (2020-2021). It has been observed that out of 63 sample, most of the samples are concentrated under C2S1, C2S2 and C3S2 categories indicating low to medium sodium hazards with medium salinity. Out of these, few samples are scattered under C3S1 and C3S2 categories representing high salinity with low to medium sodium hazard. Few samples are scattered in C1S1 indicating low sodium hazards with low salinity.

4. APPROVED MINE PLAN

4.1 DETAILS OF APPROVED MINING PLAN/SCHEME OF MINING.

Date and reference of earlier approved Mining Plan/Scheme of mining

The details of approved Mining Plan/Scheme of Mining in chronological order are as summarized in **Table 4.1**.

Documents approved	Under Rule	Period	Approval
Mining Plan	22 of MCR 1960	1993-94 to 1998-1999	Approved vide letter No RQP/ CAL/ 006/ 87/A/MO-94 dated 27.06.1990
1 st Mining Scheme	12 of MCDR' 1988	1999-2000 to 2003-04	Approved vide their letter No BBS/SNG/Fe/MS-7 dated 11.10.1999.
Modification in the Approved Scheme of Mining	10 of MCDR' 1988	2002-2003 to 2003-04	Approved vide their letter No BBS/ SNG/Fe/MS-7 dated 08.05.2003.
2 nd Mining Scheme	12 of MCDR' 1988	2004-05 to 2008-09	Approved vide letter No 314(3)/2004/MCCM(C)/MS-14 dated 17.02 .2005.
3 rd Scheme of Mining	12 of MCDR' 1988	2009-10 to 2011 - 12 (up to 01.07.11)	Approved vide letter No 314(3)/2009 /MCCM/ (CZ)/ MS / 36 dated 22.03.2010.
Mining Plan	24A of MCR 1960	01.07.2011- 2012 to 2015-16	Approved vide letter No 314(3)/ 2011/MCCM/(CZ)/MP/10 dated 03.08.2011.
1 st Scheme of Mining	12 of MCDR' 1988	2016-17 to 2020-21	Approved vide letter No MPM / FM/07-ORI/BHU/2015-16 dated 15.06.2016.
Modification of Review of the Mining Plan	17(3) of MCR,M2016	2019-20 to 2020-21	Approved vide letter No. MSM/FM/10-ORI/BHU/2019-20/1087 dated 20.09.2019
Review of Mining Plan	17(2) of MCR,M2016	2021-22 to 2025-26	Approved vide letter No. RMP/A/30-ORI/ BHU/2020-21 dated 18.11.2020

Table 4.1: List of Approved Mine plans

4.2 Mining Method

Opencast fully mechanized method will be adopted to achieve the targeted production. The existing quarries namely Top quarry, Middle quarry and South Pit shall be developed by deploying shovel and dumper combination during the mining operation. Mining operation will be done on the Top quarry on the northern side, bottom quarry on the south eastern side and South pit on the South eastern side with lateral and depth ward extensions with top slicing method. The details of salient description of present mining method in table no 4.2.

Method of Mining	Opencast mechanized method (A-FM).
Type of ore	Laminated hard and soft ore, massive boulder type
Laminated hard and soft ore , massive boulder type	With the help of excavator and Dumper combination.
Bench height and width	10m height with 15m width.
Overall slope angle	28 ⁰
Transportation of Ore	By dumper through haulage road to the Crusher at 1:16 gradient.
g	Drilling of 11.0m drill holes with Crawler mounted DTH drill and blasting by using Class 3 explosives. Since the formations are mostly soft, drilling & blasting is done only for 75% of the volume. One hydraulic rock breaker is used for reducing the size of the large boulders instead of secondary blasting.

Table 4.2: Jest of Mining Method

The ROM produced is fed to the Screening unit for the production of 0-10mm, 10-30mm, and +30mm sized ore. The +30 mm ore sent to the crushing unit for production of 5-18mm, 0-5mm. So, the various finished products are 0-5mm, 0-10mm, 5-18mm and 10-30mm.

(i) Recovery factor:

Considering the available borehole data, different litho unit has been demarcated on the Geological section. Based on this updated geological sections different grade wise resource calculation i.e 45 to 55% Fe and +55% Fe has been made. Further waste as BHJ, Shale and Laterite has been demarcated in each geological section, which has been calculated separately. As the grade wise resource and waste calculation carried out separately for each

section, 100% recovery factor has been considered for the estimation of resource.

(ii) Cutoff grade

The threshold value is considered at 45%Fe and calculation of reserves is done under different range of Fe% i.e. 45 to 55% Fe and +55% Fe. While above 55% Fe ore is termed as saleable iron ore, below that up to 45% Fe is termed as Mineral Reject. Ore containing less than 45% Fe is considered as mineral waste.

(iii) Ultimate pit depth

The maximum depth up to which the quarry can be developed economically is considered as the ultimate or conceptual extent of the quarry. Based on the present geological information and mine ability of ore the ultimate pit limit has been marked. The depth of ultimate pit limit has been shown up to the probable limit in the iron ore zone.

(iv) Mineral/ ore blocked dues to benches, safety zone:

During mining operation certain resources have been blocked under UPL, lease boundary safety zone and blocked area within bench slope. The ore in these blocked areas are non-mineable. Although feasibility study has been carried out and the quantity is established, because of the above mentioned blockages the quantity falls under F-2 category. By considering these blockages, due to above mention various factors, the mineable resource has been estimated.

(v) Tonnage Factor

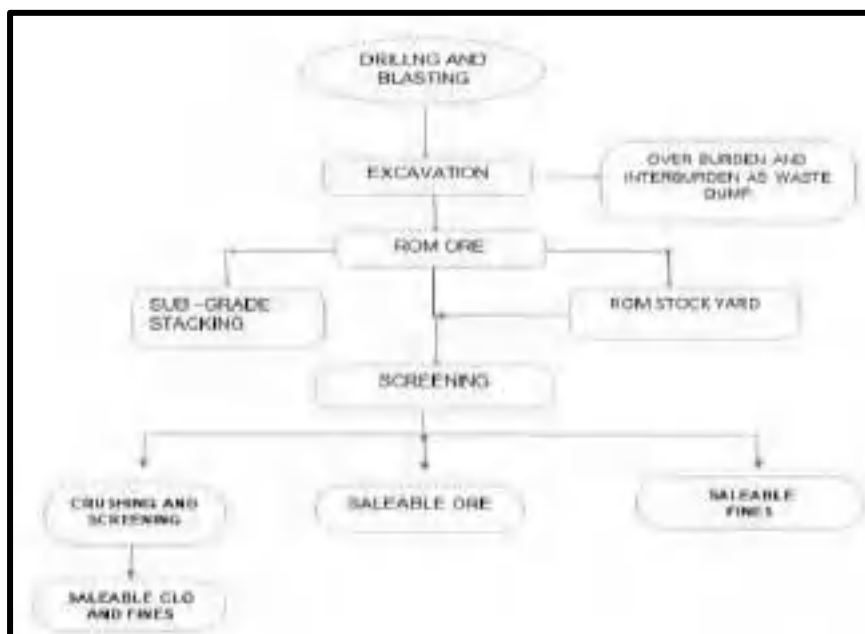
As per the approved Scheme of Mining, the tonnage factor of saleable ore has been considered as 3.0MT/m³ and for sub-grade ore as 2.5MT/m³. The tonnage factor of waste has been considered as 2.0MT/m³. For tonnage factor the lessee has undertaken a bulk density study through a NABL Accredited Laboratory. The copy of the report is enclosed as **Annexure- XXV**.

Sequence of mining operation

Based on earlier mining operation can be observed that three pits have been formed within the lease area. The dimension of the quarries has been mentioned in the table below in the next

page. The following flow chart depicts the entire process of mining which is in-vogue at present in Raikela Iron ore Mine.

Fig 4.1: Flow chart of mining operation



As per guidelines of IBM threshold value of iron ore is considered as 45% Fe. While above 55 % Fe ore is termed as saleable iron ore(cutoff grade), and 45-55% Fe is termed as Mineral Reject iron ore. Ore containing less than 45% Fe is considered as waste.

4.3 PRODUCTION DETAILS.

As per guidelines of IBM threshold value of iron ore is considered as 45% Fe. While above 55 % Fe ore is termed as saleable iron ore(cutoff grade), and 45-55% Fe is termed as Mineral Reject iron ore. Ore containing less than 45% Fe is considered as waste.

Table 4.3: Details of production Plan of iron ore (+55%Fe and 45-55%Fe)

YEAR	IRON ORE(MT) (+55%Fe)	MINERAL REJECT (MT) (45-55%Fe)	ROM(MT) (+45%Fe)
2021-22	2023052	966948	2990000
2022-23	4411541	578459	4990000
2023-24	4598847	391153	4990000
2024-25	4680387	309613	4990000

2025-26	4990000	NIL	4990000
TOTAL	20703827	2246173	22950000

As per the approved mining plan total production of +55%Fe will be 20703827 T. Before dispatch to the consumers, grade wise stacking will be undertaken at specified location proposed in the mining plan. This product will be dispatched as per the requirement of consumers.

Beyond plan period about 5730731cum of Mineral Reject i.e. 45-55%Fe will be generated. The mineral reject generated will be stored for a short period as per requirement. Further, it is also planned to evacuate the mineral reject by blending with the high grade ore so that stacking of mineral reject during conceptual period will not arise.

5. ESTIMATION OF MINE SEEPAGE AND ADVANCED DEWATERING PLAN

The nearest habitations from the mine are Raikela, Dengula, Tantra, Tensa town etc. The wells at village Raikela, and Dengula is indicating that the water level is encountering at 610MRL.

Indicate Maximum and Minimum depth of working

Mining operation in this lease area is going on after the lease was executed. Continuation of mining operation in the area has opened up three quarries i.e. Top Quarry, Middle Quarry and South Pit. The detail of the quarry is as follows in Table no 5.1 and Table 5.2 below.

Name of the pit	Location	Length (m.)	Breadth (m.)	Depth(m)	Top RL(m.)	BottomRL (m.)
TopQuarry	N2419636to 2420236 & E 311610to 312070	553.2701	376.502	115.778	843.944	728.166
MiddleQuarry	N2419500to 2420017 & E 311900to 312252	676.611	267.964	90.197	728.685	638.488
SouthPit	N2419237to 2419310 & E 311795to 311925	75.957	59.443	23.551	688.551	665.000

Table 5.1: Mining operation in this lease area has opened up three quarries

It has been proposed to develop the existing pits i.e. Top Quarry and Middle Quarry. At present the existing bottom RL of Top quarry is 730.497m and Middle quarry is 638.488m. During ensuing plan period the working will be done up to 690m.RL in Top quarry, 620m.RL in Middle quarry.

Table 5.2: Ultimate Pit limit within Plan Period

Name of the Quarry	At the end of plan period (m.RL)	
	Top	Bottom
Top Quarry	843.944	690
Middle Quarry	730.497	620

5.1 Estimation of Mine seepage – Mining operation has been carried out in above of water Table; hence no seepage is reported in the benches of the mine Pit.

5.2 Advance Dewatering Plan in case of Coal/Lignite mines – NA

5.3 GW modeling- NA

6.0 Mine water Management

6.1 WATER REQUIREMENT:

The project proponent should submit the quantity of surface water or ground water to be used in this project. The water requirement for the Project, its availability and source should be furnished. A detailed water balance has been provided in Table no. 6.1. Fresh water requirement for the project is also mention.

Total water management including domestic use wrt sourcing from bore well, rain water harvesting and recycling of waste water from ETP/STP has been calculated for the existing mines and propose expansion. Total makeup water requirement for production of 4.99 MTPA Iron Ore is 281.3 KLD, out of this fresh water requirement is 170KLD is sourced from bore well existed in the lease area. The contribution of rainwater harvested water is about 98 KLD and 13.3 KLD recycling water from STP & ETP.

The water requirement for the Project, its availability and source should be furnished. A detailed water balance has been al provided in Table no 6.1 and location of bore wells in Table 6.2. The proponent has proposed to draw the required quantity from bore well for 8 months excluding Rainey season. During Rain the required quantity will be met from rain

water harvesting pond. There is two borewells were located in the lease area to meet the freshwater requirements in the lease area. The requirement of water for domestic use is about 14KLD only but the requirement of water in Dust suppression is huge. The total requirement is about 222.5KLD out of this 127.4KLD comes from groundwater, 90KLD from Rainwater harvesting and 5.1 KLD from recycle water of STP and ETP. The details of breakup of 281.3 m³ /day is as follows:

Sl. No	Purpose	Ground Water (KLD)	RWH (KLD)	Recycled STP &ETP (KLD)	Total from all source (KLD)
1	Dust Suppression	127.4	90	5.1	222.5
2	Domestic Use	14.0			14.0
3	Plantation	16.3	8.0	8.2	32.5
4	ETP & Workshop, Wheel Washing System	12.3	-	-	12.3
Total		170	98	13.3	281.3

Table 6.1: Details of water requirement in mining operation

Sl No.	Longitude	Latitude	Structure	Total Depth (m)
1	85.181044°	21.8647304°	Bore well	91
2	85.184118°	21.870599°	Bore well	95

Table 6.2: Groundwater withdrawal structure within the Lease area.

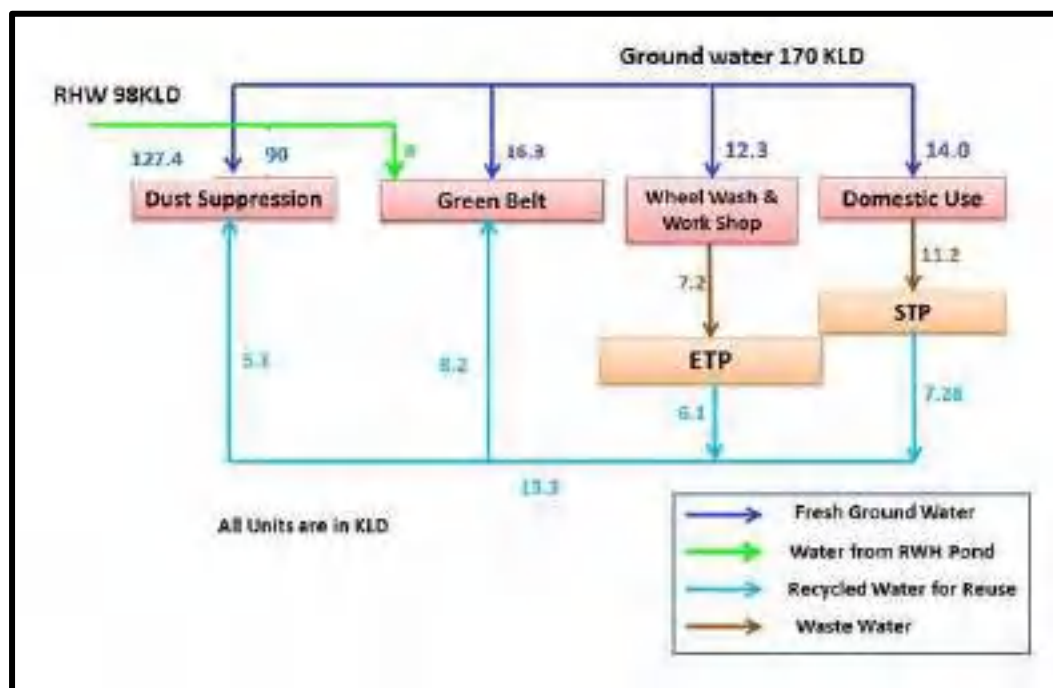


Fig- 6.1 Flowchart for Mine water utilization

There will be reduction of 10 KLD of groundwater in total consumption of water in the mining activities in previous period but now the mining is going for expansion for increasing the production upto 7 MTPA. Hence there is no scope of reducing the water requirement. The mine will require more water for mining operation but the necessary requirement has been fulfilled through the rain water harvesting and recycled water. The flowchart of water utilization is shown in Fig 6.1.

1st NOC for drawl of 64.5 m³/day of Ground water has been obtained from CGWA vide ltr no 21-4(83/3ER/CGWA/2008-1723 dt 18.12.2008. After that, NOC for drawl of 180 m³/day of Ground water has been obtained from CGWA vide ltr no CGWA/NOC/MIN/ORIG/2021/10588 dt 31.01.2021. The present NOC of groundwater withdrawal obtaining from CGWA vide CGWA/NOC/MIN/REN/1/2023/8368 dated 11/10/2023 valid upto 30/01/2025. The letter of NOC is attached in **Annexure 1**. The water requirement will be met from two bore wells situated in the lease area. The details of borewells were given in table No. 6.2 above and Geotag photographs of the groundwater withdrawal structure are given in figure no 6.2 below. The area falls under safe category as far as stage of development is concerned.



Figure 6.2: Groundwater withdrawal wells within lease area.

6.2 Rain water accumulation within Open Mine Pit Area

The open pit area in Railkela Mines is 33.593ha. The average rainfall receive in the area as per record is 1415mm, i.e. 1.415m, that occurs in about 75days. It is also considered as the maximum rainfall per day is 100mm. The Iron ore Mines is located on the hill slop and garland drains were constructed along the boundary of the Mine pit, hence no runoff water enters within the open pit area.

Considering above facts of rainfall, the total volume of water can be generated within the mine area has been calculated and present below.

Duration	Open Mine area in Ha	Rainfall in m	Volume in ham	Volume in m3	Considering Rainy days	Total volume in m3
Annual	33.593	1.415	47.5341	475341	75	6338
Max/day(100mm)	33.593	0.1	3.3593	33593	1	33593

As per the above table of calculation the maximum volume of water that can be generated within the open mine pit annually is about 47.53ham. However, the per day rain fall is 6338m3/d only and in extreme case it will 33593m3.

Considering evaporation and percolation losses per day, it will insignificant quantity of water left for discharge by pumping.

It is therefore concluded that there is no adequate rain water accumulation in pit bottom nor it cut the groundwater table. Hence no mine water discharge generated from Railkera Iron ore Mines.

7. Impact of mine Dewatering/ Abstraction and Mitigation Measures

Piezometric well has been established to monitor the ground water Table/water depilation in the lease area due to withdrawal of groundwater. After observing the detail Piezometric reading from June to August 2024 (Pre-monsoon) no Impact has been seen in water level in the area because of Abstraction of the ground water for the smooth running of the Mines (Shown in Table 7.1).Detail of the readings has attached in Annexure5. Rain water harvesting and recharge structures were established for minimise the ground water extraction and recharge the area. Piezometer well with DWLR is showing in Figure 7.1 below.

Sl. No	Date	Time	Water Level
1	1 st July, 2024	06:00 AM	11.21
2	28 th July, 2024	06:00 AM	11.63
3	1 st August, 2024	06:00 AM	11.79
4	28 th August, 2024	06:00 AM	11.38
5	1 st September, 2024	06:00AM	11.28
6	28 th September, 2024	06:00 AM	11.82

Table 7.1: Pre-monsoon and Post-monsoon water level within the lease area



Figure 7.1: Piezometer well with DWLR within the lease area.

7.1 Impact on ground water regime

As discuss above no major/Serious Impact has been reported in the area because of groundwater withdrawal. The lease area is lies within the Safe zone for groundwater. Groundwater flow is in the outside direction from the lease area hence no or very less effect of groundwater regime will be reported because of the mining activities.

7.2 Impact on Surface water sources

Retaining wall is already made around the existing waste dump. Further the retaining wall is also constructed at the bottom periphery of the waste dump mineral reject stack followed by a garland drain during the plan period, showing in Fig 7.1.

Water during rainy season that percolates through the wastes in the waste/overburden dump shall be drained to the garland drain and the retaining wall has been arrested and breaks the movement of waste materials. Garland drain shall be channelized in such a way that the water flows to an area has been captured continuously and channelized whole water to Desiltation Pond constructed in the bottom of the hill. Regular cleaning of the drain has been planned for easy flow of water. Besides the garland drain and the retaining wall, and six (6) settling pond of 10 m x 8 m x 2 m size will be constructed at the end of garland drain, which will accumulate water. Alum shall be added here for settlement of suspended solids. After suspended solids are settled, the water shall be discharged in the check dam, the only excess water of check dam is allowed to drain outside of the lease area. A rain water harvesting pond/Check Dam had constructed and this pond water has been used for different purposes within the lease area. The proposed year wise protective measures are in table no 7.2 & 7.3.

Location	Retaining wall			Garland drain			Settling pond			
	L(m)	W(m)	H(m)	L(m)	W(m)	D(m)	Nos	L(m)	W(m)	D(m)
Proposed Mineral reject stack -1	620	1.0	2.0	620	1.0	1.5	3	10	8	2
Proposed Mineral reject stack -2	188	1.0	2.0	468	1.0	1.5	1	10	8	2
Proposed Mineral reject stack -3	230	--	--	230	1.0	1.5	1	10	8	2
Total	1038	1.0	2.0	1318	1.0	1.5	5	10	8	2

Table 7.2: Protective Measures around the Mineral reject stack

Coir matting over proposed dump: It has been proposed to prevent waste dump from water cutting in rainy season. Detail year wise construction shown in Table 7.4.

Period	Area of coir matting	No of sapling
2021-22	4000 sq.m	grass seedlings
2022-23	2500 sq.m	grass seedlings
2023-24	4100 sq.m	grass seedlings
2024-25	3700 sq.m	grass seedlings

2025-26	2900 sq.m	grass seedlings
Total	17200 sq.m	

Table 7.3: Year wise proposal of coir matting

Fig 7.2: Retaining Walls and Garland Drain in Mining area



7.3 Impact on water quality

Continuous monitoring has been taken care by the mines authority. Quarterly ground water sample of the lease area and nearby places has been collected and send for testing at NABL aggregated Laboratory at Bhubaneswar. In Laboratory 38 parameters have tested for drinking and domestic water. The regular test of ETP and STP water is also scheduled. For ETP and STP outlet water, selected eight parameters were tested in NABL Lab including EC, PH, Biochemical Oxygen Demand as BOD at 27(°C), Chentical Oxygen Demand as COD, Total Suspended Solid, Total Dissolved Solid TDS, Oil and Grease, Faecal Coliform etc. to ensure the quality of outlet water. The detail test report is enclosed in Annexure.

Regular testing of surface water is also in practice, the test report of Kuradhi Nala and Karo nala in Down-Stream site is enclosed in Annexure. In series of surface water, the water sample of nearby Tantara Pond is also tested monthly in NABL Lab to ensure the safety of water body and human health.

The groundwater sample of nearby village Tentulidihi (Dug Well) and Tensa (Tube Well) is also scheduled monthly. The total 41 parameters were tested here, and all are reported in permissible level, the report of the Dug well is enclosed in Annexure.

The Bore wells located in the lease area is also tested regularly to ensure the health safety. The test report with tested 41 parameters is enclosed in Annexure.

For the better safety of surface water, runoff water during monsoon season is also tested regularly. The report is also enclosed in Annexure.

All Till now no serious Impact/issues has been reported in the groundwater quality.

According to the Report Groundwater is safe for drinking and other activates. The test report of Tap water by NABL accredited Laboratory, conducted in moth of June, July and August, 2024 is shown in Fig 7.3, 7.4 and 7.5 below. Also the analysis report of abstraction wells, surface flow, Ponds and adjoining groundwater wells are attached as Annexure 4.

WCS/LQR/60

TEST REPORT

Report No. : WCS240701 Issue Date : 02.07.2024
NABL ULR No. : TC1122524000000092F
Name of the Client : **Raikela Iron Ore Mines (M/S Geetarani Mohanty)**
Address : Raikela, Near Tensa, P.O.-Dengula, Dist- Sundargarh- 770048, Odisha
Sampling Location : **Canteen Tap Water**
Sample Description : Drinking Water Date of Sampling : 22.06.2024
Sampling Plan & Method : WCS/QSP/SAMP (WATER) Date of Receiving : 24.06.2024
Environmental Condition : Temperature 29°C, Clear Weather Sample ID No : WCS0624W06
Sample Collected by : WCS Laboratory Quantity of Sample : 1 Ltr
Date of Testing : 24.06.2024 to 29.06.2024 Sample Condition : Good

Sl. No.	Parameter	Unit	Result	Requirement as per IS 10500:2012 Reaffirmed 2018	Test Methods
1	Colour	Hazen	1	Max, 5	IS 3025 (Part-4): 2021
2	Odour	--	Result	Agreeable	IS 3025 (Part-5): 2018
3	pH Value	--	6.76	6.5-8.5	IS 3025 (Part-11): 2022
4	Taste Threshold	--	Agreeable	Agreeable	IS 3025 (Part-7): 2017
5	Turbidity	NTU	0.3	1	IS 3025 (Part-10): 1984 RA 2017
6	Total Dissolved Solid as TDS	mg/l	179	500	IS 3025 (Part-16): 1984 RA 2017
7	Ammonia as Total ammonia-N	mg/l	0.03	0.5	IS 3025 (Part-34): 1988 RA 2019
8	Chloride as Cl	mg/l	18.0	250	IS 3025 (Part-32): 1988 RA 2019
9	Fluoride as F	mg/l	0.02	1.0	APHA 24 th Ed. (4500-F-D): 2023
10	Free Residual Chlorine	mg/l	<0.04	0.2	IS 3025 (Part-26): 2021
11	Iron as Fe	mg/l	0.29	1.0	IS 3025 (Part-53): 2003 RA 2019
12	Total Hardness as CaCO ₃	mg/l	24.0	200	IS 3025 (Part-21): 2009 RA 2019
13	Calcium as Ca	mg/l	6.41	75	IS 3025 (Part-40): 1991 RA 2019
14	Magnesium as Mg	mg/l	1.94	30	APHA 24 th Ed. (3500-Mg-B): 2023
15	Nitrate as NO ₃	mg/l	3.77	45	APHA 24 th Ed. (4500-NO ₃ -B): 2023
16	Sulphate as SO ₄	mg/l	0.76	200	IS 3025 (Part-24 Sec 1):2022
17	Total Alkalinity as CaCO ₃	mg/l	25.0	200	IS 3025 (Part-23): 1986 RA 2019
18	Total Chromium as Cr	mg/l	<0.02	0.05	IS 3025 (Part-52) : 2003 RA 2019
19	Potassium as K	mg/l	24.3	--	IS 3025 (Part-45): 1993 RA 2019
20	Sodium as Na	mg/l	26.3	--	IS 3025 (Part-45) : 1993 RA 2019
21	Total Suspended Solid as TSS	mg/l	<0.02	--	IS 3025 (Part-17): 2022

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Reviewed by

(Mr. Bijaya Kumar Chahataray)

Pradeep Mohanty
Authorized Signatory
(Mr. Pradeep Mohanty)

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TEST REPORT

Report No. : WCS240701 Issue Date : 02.07.2024
Name of the Client : Raikela Iron Ore Mines (M/S Geetarani Mohanty)
Address : Raikela, Near Tensa, P.O.-Dengula, Dist- Sundargarh- 770048, Odisha
Sampling Location : Canteen Tap Water
Sample Description : Drinking Water Date of Sampling : 22.06.2024
Sampling Plan & Method : WCS/QSP/SAMP (WATER) Date of Receiving : 24.06.2024
Environmental Condition : Temperature 29°C, Clear Weather Sample ID No : WCS0624W06
Sample Collected by : WCS Laboratory Quantity of Sample : 1 Ltr
Date of Testing : 24.06.2024 to 29.06.2024 Sample Condition : Good

Sl. No.	Parameter	Unit	Result	Requirement as per IS 10500:2012 Reaffirmed 2018	Test Methods
22	Aluminium as Al	mg/l	<0.02	0.03	IS 3025 (Part 55)
23	Boron as B	mg/l	<0.1	0.5	IS 3025 (Part 57)
24	Chloramines as Cl ₂	mg/l	<0.02	4.0	IS 3025 (Part 26)* or APHA 4500-Cl G
25	Copper as Cu	mg/l	<0.01	0.05	IS 3025 (Part 42)
26	Manganese as Mn	mg/l	<0.05	0.1	IS 3025 (Part 59)
27	Mineral oil	mg/l	<0.5	1.0	Clause 6 of IS 3025 (Part 39)
28	Phenolic compounds as C ₆ H ₅ OH	mg/l	<0.001	0.001	IS 3025 (Part 43)
29	Sulphide as H ₂ S	mg/l	<0.05	0.05	IS 3025 (Part 29)
30	Zinc as Zn	mg/l	<0.05	5	IS 3025 (Part 49)
31	Cadmium as Cd	mg/l	<0.001	0.003	IS 3025 (Part 41)
32	Cyanide as CN	mg/l	<0.01	0.05	IS 3025 (Part 27)
33	Lead as Pb	mg/l	<0.01	0.01	IS 3025 (Part 47)
34	Mercury as Hg	mg/l	<0.001	0.001	IS 3025 (Part 48)
35	Nickel as Ni	mg/l	<0.01	0.02	IS 3025 (Part 54)
36	Total arsenic as As	mg/l	<0.01	0.01	IS 3025 (Part 37)
37	E.Coli	CFU/100 ml	<2	Shall not be detectable in any 100 ml sample	IS 15185: 2016
38	Total Coliform	CFU/100 ml	<2	Shall not be detectable in any 100 ml sample	IS 15185: 2016

Reviewed by
(Mr. Bijaya Kumar Chahataray)

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(Miss. Laxmi Sahoo)

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(Mr. Pradeep Mohapatra)

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Fig7.3: Quality Report from NABL accredited Lab for Office Bore-well in June, 2024

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TEST REPORT

Report No. : WCS240708 Issue Date : 26.07.2024
NABL ULR No. : TC11225240000000110F
Name of the Client : **Raikela Iron Ore Mines (M/S Geetarani Mohanty)**
Address : Raikela, Near Tensa, P.O.-Dengula, Dist- Sundargarh- 770048, Odisha
Sampling Location : **Canteen Tap Water**
Sample Description : Drinking Water Date of Sampling : 18.07.2024
Sampling Plan & Method : WCS/QSP/SAMP (WATER) Date of Receiving : 20.07.2024
Environmental Condition : Temperature 29°C, Clear Weather Sample ID No : WCS2407W07
Sample Collected by : WCS Laboratory Quantity of Sample : 1 Ltr
Date of Testing : 20.07.2024 to 25.07.2024 Sample Condition : Good

Sl. No.	Parameter	Unit	Result	Requirement as per IS 10500:2012 Reaffirmed 2018	Test Methods
1	Colour	Hazen	1	Max, 5	IS 3025 (Part-4): 2021
2	Odour	--	Agreeable	Agreeable	IS 3025 (Part-5): 2018
3	pH Value	--	6.85	6.5-8.5	IS 3025 (Part-11): 2022
4	Taste Threshold	--	Agreeable	Agreeable	IS 3025 (Part-7): 2017
5	Turbidity	NTU	0.2	1	IS 3025 (Part-10): 1984 RA 2017
6	Total Dissolved Solid as TDS	mg/l	168	500	IS 3025 (Part-16): 1984 RA 2017
7	Ammonia as Total ammonia-N	mg/l	0.02	0.5	IS 3025 (Part-34): 1988 RA 2019
8	Chloride as Cl	mg/l	17.99	250	IS 3025(Part-32): 1988 RA 2019
9	Fluoride as F	mg/l	0.02	1.0	APIHA 24 th Ed. (4500-F-D): 2023
10	Free Residual Chlorine	mg/l	<0.04	0.2	IS 3025 (Part-26): 2021
11	Iron as Fe	mg/l	0.26	1.0	IS 3025 (Part -53): 2003 RA 2019
12	Total Hardness as CaCO ₃	mg/l	26	200	IS 3025 (Part-21): 2009 RA 2019
13	Calcium as Ca	mg/l	7.21	75	IS 3025 (Part-40): 1991 RA 2019
14	Magnesium as Mg	mg/l	1.94	30	APIHA 24 th Ed. (3500-Mg-B): 2023
15	Nitrate as NO ₃	mg/l	3.84	45	APIHA 24 th Ed. (4500-NO ₃ -B): 2023
16	Sulphate as SO ₄	mg/l	0.86	200	IS 3025 (Part-24 Sec 1):2022
17	Total Alkalinity as CaCO ₃	mg/l	25	200	IS 3025 (Part-23): 1986 RA 2019
18	Total Chromium as Cr	mg/l	<0.02	0.05	IS 3025 (Part-52): 2003 RA 2019
19	Potassium as K	mg/l	25.6	--	IS 3025 (Part-45): 1993 RA 2019
20	Sodium as Na	mg/l	23.5	--	IS 3025 (Part-45): 1993 RA 2019
21	Total Suspended Solid as TSS	mg/l	<5.0	--	IS 3025 (Part-17): 2022

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(Mr. Bijaya Kumar Chahataray)

Pradeept Mohapatra
Authorized Signatory
(Mr. Pradeept Mohapatra)

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TEST REPORT

Report No. : WCS240708 Issue Date : 26.07.2024
Name of the Client : Raikela Iron Ore Mines (M/S Geetarani Mohanty)
Address : Raikela, Near Tensa, P.O.-Dengula, Dist- Sundargarh- 770048, Odisha
Sampling Location : Canteen Tap Water
Sample Description : Drinking Water Date of Sampling : 18.07.2024
Sampling Plan & Method : WCS/QSP/SAMP (WATER) Date of Receiving : 20.07.2024
Environmental Condition : Temperature 29°C, Clear Weather Sample ID No : WCS2407W07
Sample Collected by : WCS Laboratory Quantity of Sample : 1 Ltr
Date of Testing : 20.07.2024 to 25.07.2024 Sample Condition : Good

Sl. No.	Parameter	Unit	Result	Requirement as per IS 10500:2012 Reaffirmed 2018	Test Methods
22	Aluminium as Al	mg/l	<0.02	0.03	IS 3025 (Part 55)
23	Boron as B	mg/l	<0.1	0.5	IS 3025 (Part 57)
24	Chloramines as Cl ₂	mg/l	<0.02	4.0	IS 3025 (Part 26)* or APHA 4500-Cl G
25	Copper as Cu	mg/l	<0.01	0.05	IS 3025 (Part 42)
26	Manganese as Mn	mg/l	<0.05	0.1	IS 3025 (Part 59)
27	Mineral oil	mg/l	<0.5	1.0	Clause 6 of IS 3025 (Part 39)
28	Phenolic compounds as C ₆ H ₅ OH	mg/l	<0.001	0.001	IS 3025 (Part 43)
29	Sulphide as H ₂ S	mg/l	<0.05	0.05	IS 3025 (Part 29)
30	Zinc as Zn	mg/l	<0.05	5	IS 3025 (Part 49)
31	Cadmium as Cd	mg/l	<0.001	0.003	IS 3025 (Part 41)
32	Cyanide as CN	mg/l	<0.01	0.05	IS 3025 (Part 27)
33	Lead as Pb	mg/l	<0.01	0.01	IS 3025 (Part 47)
34	Mercury as Hg	mg/l	<0.001	0.001	IS 3025 (Part 48)
35	Nickel as Ni	mg/l	<0.01	0.02	IS 3025 (Part 54)
36	Total arsenic as As	mg/l	<0.01	0.01	IS 3025 (Part 37)
37	E.Coli	CFU/100 ml	<2	Shall not be detectable in any 100 ml sample	IS 15185: 2016
38	Total Coliform	CFU/100 ml	<2	Shall not be detectable in any 100 ml sample	IS 15185: 2016

Reviewed by
(Mr. Bijaya Kumar Chahataray)

Authorized Signatory for Microbiology
(Miss. Laxmi Sahoo)

Authorized Signatory for Chemical
(Mr. Pradeep Mohapatra)

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Fig7.4: Quality Report from NABL accredited Lab for Office Bore-well in July, 2024

WCS/LQR/60

TEST REPORT

Report No. : WCS240819 Issue Date : 27.08.2024
NABL ULR No. : TC11225240000000142F
Name of the Client : **Raikela Iron Ore Mines (M/S Geetarani Mohanty)**
Address : Raikela, Near Tensa, P.O.-Dengula, Dist- Sundergarh- 770048, Odisha
Sampling Location : **Canteen Tap Water**
Sample Description : Drinking Water Date of Sampling : 17.08.2024
Sampling Plan & Method : WCS/QSP/SAMP (WATER) Date of Receiving : 19.08.2024
Environmental Condition : Temperature 29°C, Clear Weather Sample ID No : WCS2408W12
Sample Collected by : WCS Laboratory Quantity of Sample : 1 Ltr
Date of Testing : 20.08.2024 to 26.08.2024 Sample Condition : Good

Sl. No.	Parameter	Unit	Result	Requirement as per IS 10500:2012 Reaffirmed 2018	Test Methods
1	Colour	Hazen	1	Max, 5	IS 3025 (Part-4): 2021
2	Odour	--	Agreeable	Agreeable	IS 3025 (Part-5): 2018
3	pH Value	--	6.52	6.5-8.5	IS 3025 (Part-11): 2022
4	Taste Threshold	--	Agreeable	Agreeable	IS 3025 (Part-7): 2017
5	Turbidity	NTU	0.3	1	IS 3025 (Part-10): 1984 RA 2017
6	Total Dissolved Solid as TDS	mg/l	165.0	500	IS 3025 (Part-16): 1984 RA 2017
7	Ammonia as Total ammonia-N	mg/l	0.03	0.5	IS 3025 (Part-34): 1988 RA 2019
8	Chloride as Cl	mg/l	17.49	250	IS 3025 (Part-32): 1988 RA 2019
9	Fluoride as F	mg/l	0.03	1.0	APHA 24 th Ed. (4500-F-D): 2023
10	Free Residual Chlorine	mg/l	<0.04	0.2	IS 3025 (Part-26): 2021
11	Iron as Fe	mg/l	0.28	1.0	IS 3025 (Part -53): 2003 RA 2019
12	Total Hardness as CaCO ₃	mg/l	24.0	200	IS 3025 (Part-21): 2009 RA 2019
13	Calcium as Ca	mg/l	6.41	75	IS 3025 (Part-40): 1991 RA 2019
14	Magnesium as Mg	mg/l	1.94	30	APHA 24 th Ed. (3500-Mg-B): 2023
15	Nitrate as NO ₃	mg/l	3.72	45	APHA 24 th Ed. (4500-NO ₃ -B): 2023
16	Sulphate as SO ₄	mg/l	0.73	200	IS 3025 (Part-24 Sec 1): 2022
17	Total Alkalinity as CaCO ₃	mg/l	25	200	IS 3025 (Part-23): 1986 RA 2019
18	Total Chromium as Cr	mg/l	<0.02	0.05	IS 3025 (Part-52): 2003 RA 2019
19	Potassium as K	mg/l	25.2	--	IS 3025 (Part-45): 1993 RA 2019
20	Sodium as Na	mg/l	23.8	--	IS 3025 (Part-45): 1993 RA 2019
21	Total Suspended Solid as TSS	mg/l	<5	--	IS 3025 (Part-17): 2022

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(Mr. Pradeep Mohanty)



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TEST REPORT

Report No. : WCS240819 Issue Date : 27.08.2024
Name of the Client : Raikela Iron Ore Mines (M/S Geetarani Mohanty)
Address : Raikela, Near Tensa, P.O.-Dengula, Dist- Sundergarh- 770048, Odisha
Sampling Location : Canteen Tap Water
Sample Description : Drinking Water Date of Sampling : 17.08.2024
Sampling Plan & Method : WCS/QSP/SAMP (WATER) Date of Receiving : 19.08.2024
Environmental Condition : Temperature 29°C, Clear Weather Sample ID No : WCS2408W12
Sample Collected by : WCS Laboratory Quantity of Sample : 1 Ltr
Date of Testing : 20.08.2024 to 26.08.2024 Sample Condition : Good

Sl. No.	Parameter	Unit	Result	Requirement as per IS 10500:2012 Reaffirmed 2018	Test Methods
22	Aluminium as Al	mg/l	<0.02	0.03	IS 3025 (Part 55)
23	Boron as B	mg/l	<0.1	0.5	IS 3025 (Part 57)
24	Chloramines as Cl ₂	mg/l	<0.02	4.0	IS 3025 (Part 26)* or APHA 4500-Cl G
25	Copper as Cu	mg/l	<0.01	0.05	IS 3025 (Part 42)
26	Manganese as Mn	mg/l	<0.05	0.1	IS 3025 (Part 59)
27	Mineral oil	mg/l	≤0.5	1.0	Clause 6 of IS 3025 (Part 39)
28	Phenolic compounds as C ₆ H ₅ OH	mg/l	<0.001	0.001	IS 3025 (Part 43)
29	Sulphide as H ₂ S	mg/l	<0.05	0.05	IS 3025 (Part 29)
30	Zinc as Zn	mg/l	<0.05	5	IS 3025 (Part 49)
31	Cadmium as Cd	mg/l	<0.001	0.003	IS 3025 (Part 41)
32	Cyanide as CN	mg/l	<0.01	0.05	IS 3025 (Part 27)
33	Lead as Pb	mg/l	<0.01	0.01	IS 3025 (Part 47)
34	Mercury as Hg	mg/l	<0.001	0.001	IS 3025 (Part 48)
35	Nickel as Ni	mg/l	<0.01	0.02	IS 3025 (Part 54)
36	Total arsenic as As	mg/l	<0.01	0.01	IS 3025 (Part 37)
37	E. Coli	CFU/100 ml	<2	Shall not be detectable in any 100 ml sample	IS 15185: 2016
38	Total Coliform	CFU/100 ml	<2	Shall not be detectable in any 100 ml sample	IS 15185: 2016

Chahataray

Reviewed by
(Mr. Bijaya Kumar Chahataray)

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Authorized Signatory for Microbiology
(Miss. Laxmi Sahoo)

Pradeep

Authorized Signatory for Chemical
(Mr. Pradeep Mohapatra)

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Fig7.5: Quality Report from NABL accredited Lab for Office Bore-well in August, 2024

7.4 Mitigation Measures

The rain fall data has been obtained from IMD for the financial year 2009-2013. Based on the data the rain minimum Annual rainfall is 971mm during 2010 and the maximum rain fall is 1820mm during 2013. However, the average rain fall data is calculated to be 1503.3 mm. Since the proposed waste dumps are located in areas which is a steep slope, maximum flow of water in rainy season will endanger the retaining walls. Therefore, wall had constructed along the toe of the proposed dump. However, the following precautionary measures have taken for the best available water and its management.

Retaining Walls

Retaining boulder wall (2.0m high and 1.0m width) of substantial strength shall be constructed all around the bottom periphery of waste dumps with locally available boulders mixed with sand and cement, to arrest any rolling down of the dump materials. Perforation shall be left at around 10 m intervals to allow for passage of water.



Figure 7.6: Concrete Retaining walls



Figure 7.7: Retaining Walls along the Dump

Garland drains

Garland drains of 1.5 m deep and 1.0 m wide shall be constructed all along the bottom periphery of waste dumps followed by the retaining wall to prevent any wash off or leaching of dump materials during heavy rains. Side walls and the base shall be pitched with locally available boulders. Joints shall be filled up with cement and sand mixture so that water cannot percolate.



Figure 7.8: Garland drain from storm water in mining area.

Settling Tank

The garland drain shall be channelized to settling tank of 10m long, 8m width and 2.0m deep. Side walls and base shall be packed with locally available boulders mixed with cement and sand.

RWH Ponds



Fig-7.9: Rainwater Harvesting Pond

Piezometric Well

Piezometric wells were established for continuous monitoring of groundwater level. It is helpful for keep an eye on ground water fluctuation due to extraction for various mining activities. Day wise three readings has been collected i.e, at 00.00hrs, 06.00hrs, 12.00hrs and 18.00hrs Post Monsoon and Pre-monsoon is attached in Annexure 5. (Figure 7.1)

Rainwater Harvesting and Check Dam

The average annual rainfall is around 1278 mm per annum. The maximum daily rainfall ever recorded at Koida was 110 mm on 12.08.2022. out of which 36% is lost as the surface runoff, 44% is lost through evapotranspiration and only 20% is enter into the subsoil and recharge the aquifer. To harvest the rain water in the lease area one Pond is constricted and one is proposed for future. Two nala bunds are also constricted for catch the flood and recharge the groundwater. Figure 7.10 is showing the check dam and Fig 7.9 is Pond in the Lease area.



Figure 7.10: Check dam in foot hills of the existing Mine.

Roof Top Rainwater Harvesting in Lease area

To catch the roof top water during rainy days and roof top rain water harvesting structures has been established in the lease area to direct recharge the groundwater. The established structure is shown in Figure 7.11.



Fig-7.11: Roof Top Rainwater Harvesting in Lease area.

Installation of Flowmeter in abstraction structure: for continuous monitoring of the groundwater flow, flow meter is installed in both the bore wells. Figure shown below.



Figure 7.12 : Flow meter installed in groundwater withdrawal wells

Protection of sessional nalla/natural stream Path-The natural seasonal stream flowing in the lease area is also protected by the mining authority to maintain the natural path. Figure no 7.13 show the structure below.



Figure 7.13: Protection of existing seasonal stream

Regularly Plantation:

Regular plantation has been planned in lease area to protect forest, environment and soil cutting. After closer of the mines the complete leasehold will be afforested. As shown in figure 7.14, 7.15 and 7.16 respectively.



Figure. 7.14: Regular Plantation in periphery of Lease area



Figure 7.15: Post mining land use plan with reclamation and restoration of mined out areas

ETP and STP:

ETP is constricted within the lease hold to recycle the wastage water and again make it usable. The regular quality check of product water has been scheduled by the mining authority in NABL lab to maintain the contamination level. Shown in Fig7.17. the detail chart of ETP and STP working procedure is shown in figure no 7.18 and 7.19 below.



Fig 7.17: ETP for recycling water is established in Lease area.

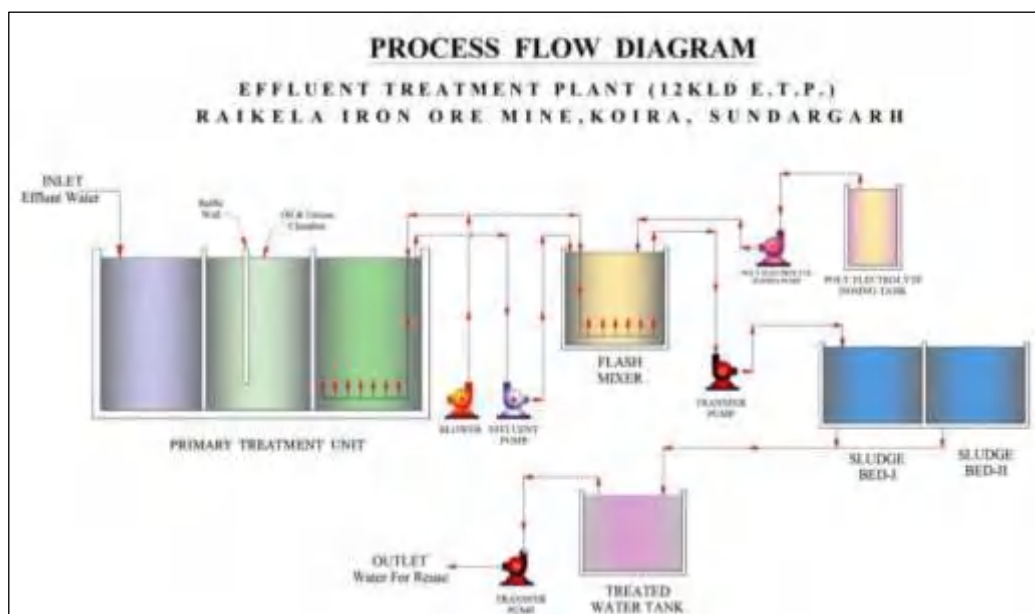


Figure 7.18: Showing ETP flow Chart

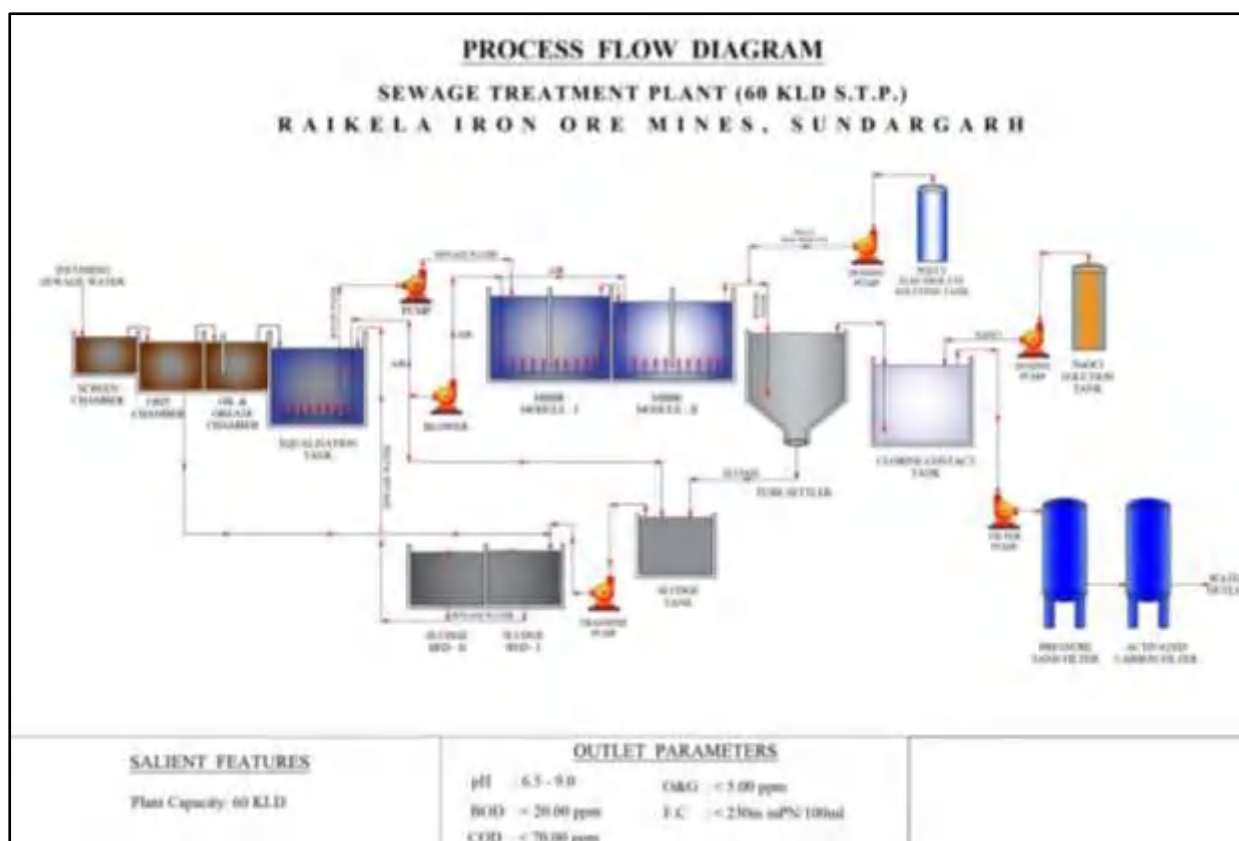


Figure 7.19: STP flow chart

7.5 Saline water Disposal- NA

8. Summery and conclusion

Raikela Iron ore Mining Project of M/s. Geetarani Mohanty spread over an area of 67.586 Ha is under operation with the production capacity of Iron Ore @ 4.99 MTPA located in Raikela village in Koira Tahasil of Bonai sub-division in Sundergarh district of Odisha. The Raikela Iron ore Mining Project is planning for enhance the production of Iron ore upto 7 MTPA. To meet this production target, water requirement of the mine will also upsurge but management is decided to meet this extra demand with rainwater harvested during rainy season.

The groundwater resource as estimated by CGWB (2020) is presented in the table 3.4 for Koira block of Sundargarh district Odisha, is comes under the safe category. The total estimated recharge in this block is 5661.78(Ham) and the Discharge is 283.09Ham. The total available extractable water is 5378.69 Ham. At present, area is having huge surplus reserves. Hence, no adverse impact on ground water regime of the area is envisaged.

However the RWH structure has been constructed properly to catch the every drop of rain falls in the lease area. The Ponds and check dam provide the good source of water, available for mining use and also a very good source of groundwater recharge. It also reduces the cost for pumping of ground water, Reduces soil erosion in urban areas, and Provides self-sufficiency to the water supply.

The slope of groundwater flow is apart from the mine. Hence, with reference to our field study, earlier NOC and GCWB report, it has been safely concluded that the area is under safe zone and the extraction of water for the mining activates will not affect groundwater in adverse. The available and proposed measure of RWH and groundwater recharging also play the key role in fulfilling the requirement and sustain the groundwater.

Annexure 1: Copy of present NOC for groundwater Abstraction by CGWA



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जल शक्ति मंत्रालय
जल संसाधन, नदी विकास
और गंगा संरक्षण विभाग
केन्द्रीय भूमि जल प्राधिकरण
Government of India
Ministry of Jal Shakti
Department of Water Resources,
River Development & Ganga Rejuvenation
Central Ground Water Authority

(भूजल निकासी हेतु अनापत्ति प्रमाण पत्र)

NO OBJECTION CERTIFICATE (NOC) FOR GROUND WATER ABSTRACTION

Project Name:	Raikela Iron Ore Mine		
Project Address:	Village-raikela		
Village:	Raikela	Block:	Koida
District:	Sundargarh	State:	Odisha
Pin Code:			
Communication Address:	Bomikhal, Plot No 380, Rasulgarh, Bhubaneswar, Bhubaneswar, Khordha, Odisha - 751010		
Address of CGWB Regional Office :	Central Ground Water Board South Eastern Region, Bhujal Bhawan, Khandagiri Square, Nh-5, Bhubaneshwar, Khordha, Odisha - 750001		

1.	NOC No.:	CGWA/NOC/MIN/REN/1/2023/8368					2.	Date of Issuance	11/10/2023						
3.	Application No.:	21-4/2466/OR/MIN/2020					4.	Category: (GWRE 2022)	Safe						
5.	Project Status:	Existing Ground Water					6.	NOC Type:	Renewal						
7.	Valid from:	31/01/2023					8.	Valid up to:	30/01/2025						
9.	Ground Water Abstraction Permitted:														
Fresh Water		Saline Water				Dewatering				Total					
m ³ /day		m ³ /year		m ³ /day		m ³ /year		m ³ /day		m ³ /year		m ³ /day		m ³ /year	
170.00		56100.00													
10.	Details of ground water abstraction /Dewatering structures														
Total Existing No.:2							Total Proposed No.:0								
		DW	DCB	BW	TW	MP	MPu	DW	DCB	BW	TW	MP	MPu		
Abstraction Structure*		0	0	2	0	0	0	0	0	0	0	0	0		
*DW- Dug Well; DCB-Dug-cum-Bore Well; BW-Bore Well; TW-Tube Well; MP-Mine Pit;MPu-Mine Pumps															
11.	Ground Water Abstraction/Restoration Charges paid (Rs.):							131846.00							
12.	Environment Compensation (if applicable) paid (Rs.):							0.00							
13.	Number of Piezometers(Observation wells) to be constructed/ monitored & Monitoring mechanism.					No. of Piezometers		Monitoring Mechanism							
							Manual	DWLR**	DWLR With Telemetry						
**DWLR - Digital Water Level Recorder					1		0	1	0						

(Compliance Conditions given overleaf)

This is an auto generated document & need not to be signed.

18/11, जामनगर हाउस, मानसिंह रोड, नई दिल्ली - 110011 / 18/11, Jamnagar House, Mansingh Road, New Delhi-110011
Phone: (011) 23383561 Fax: 23382051, 23386743
Website: cgwa-noc.gov.in

पानी बचाये - जीवन बचाये

Validity of this NOC shall be subject to compliance of the following conditions:

Mandatory conditions:

- 1) Installation of tamper proof digital water flow meter with telemetry on all the abstraction structure(s) shall be mandatory for all users seeking No Objection Certificate and intimation regarding their installation shall be communicated to the CGWA within 30 days of grant of No Objection Certificate.
- 2) Proponents shall mandatorily get water flow meter calibrated from an authorized agency once in a year.
- 3) Construction of purpose-built observation wells (piezometers) for ground water level monitoring shall be mandatory as per Section 14 of Guidelines. Water level data shall be made available to CGWA through web portal. Detailed guidelines for construction of piezometers are given in Annexure-II of the guidelines.
- 4) Proponents shall monitor quality of ground water from the abstraction structure(s) once in a year. Water samples from bore wells/tube wells / dug wells shall be collected during April/May every year and analysed in NABL accredited laboratories for basic parameters (cations and anions), heavy metals, pesticides/ organic compounds etc. Water quality data shall be made available to CGWA through the web portal.
- 5) In case of mining projects, additional key wells shall be established in consultation with the Regional Director, CGWB for ground water level monitoring four (4) times a year (January, May, August and November) in core as well as buffer zones of the mine.
- 6) In case of mining project the firm shall submit water quality report of mine discharge/ seepage from Govt. approved/ NABL accredited lab.
- 7) The firm shall report compliance of the NOC conditions online in the website (www.cgwa-noc.gov.in) within one year from the date of issue of this NOC.
- 8) Industries abstracting ground water in excess of 100 m³/d shall undertake annual water audit through certified auditors and submit audit reports within three months of completion of the same to CGWA. All such industries shall be required to reduce their ground water use by at least 20% over the next three years through appropriate means.
- 9) Application for renewal can be submitted online from 90 days before the expiry of NOC. Ground water withdrawal, if any, after expiry of NOC shall be illegal & liable for legal action as per provisions of Environment (Protection) Act, 1986.
- 10) This NOC is subject to prevailing Central/State Government rules/laws/norms or Court orders related to construction of tube well/ground water abstraction structure / recharge or conservation structure/discharge of effluents or any such matter as applicable.

General conditions:

- 11) No additional ground water abstraction and/or de-watering structures shall be constructed for this purpose without prior approval of the Central Ground Water Authority (CGWA).
- 12) The proponent shall seek prior permission from CGWA for any increase in quantum of groundwater abstraction (more than that permitted in NOC for specific period).
- 13) Proponents shall install roof top rain water harvesting in the premise as per the existing building bye laws in the premise.
- 14) The project proponent shall take all necessary measures to prevent contamination of ground water in the premises falling which the firm shall be responsible for any consequences arising thereupon.
- 15) In case of industries that are likely to contaminate the ground water, no recharge measures shall be taken up by the firm inside the plant premises. The runoff generated from the rooftop shall be stored and put to beneficial use by the firm.
- 16) Whenever feasible, requirement of water for greenbelt (horticulture) shall be met from recycled / treated waste water.
- 17) Whenever the NOC is for abstraction of saline water and the existing wells (s) is/are yielding fresh water, the same shall be sealed and new tubewell(s) tapping saline water zone shall be constructed within 3 months of the issuance of NOC. The firm shall also ensure safe disposal of saline residue, if any.
- 18) Unexpected variations in inflow of ground water into the mine pit, if any, shall be reported to the concerned Regional Director, Central Ground Water Board.
- 19) In case of violation of any NOC conditions, the applicant shall be liable to pay the penalties as per Section 15 of Guidelines.
- 20) This NOC does not absolve the proponents of their obligation / requirement to obtain other statutory and administrative clearances from appropriate authorities.
- 21) The issue of this NOC does not imply that other statutory / administrative clearances shall be granted to the project by the concerned authorities. Such authorities would consider the project on merits and take decisions independently of the NOC.
- 22) In case of change of ownership, new owner of the industry will have to apply for incorporation of necessary changes in the No Objection Certificate with documentary proof within 60 days of taking over possession of the premises.
- 23) This NOC is being issued without any prejudice to the directions of the Hon'ble NGT/Court orders in cases related to ground water or any other related matters.
- 24) Proponents, who have installed/constructed artificial recharge structures in compliance of the NOC granted to them previously and have availed rebate of upto 50% (fifty percent) in the ground water abstraction charges/ground water restoration charges, shall continue to regularly maintain artificial recharge structures.
- 25) Industries which are likely to cause ground water pollution e.g. Tanning, Slaughter Houses, Dye, Chemical, Petrochemical, Coal washeries, pharmaceutical, other hazardous units etc. (as per CPCB list) need to undertake necessary well head protection measures to ensure prevention of ground water pollution as per Annexure-III of the guidelines.
- 26) In case of new infrastructure projects having ground water abstraction of more than 20 m³/day, the firm/entity shall ensure implementation of dual water supply system in the projects.
- 27) In case of infrastructure projects, paved/parking area must be covered with interlocking/perforated tiles or other suitable measures to ensure groundwater infiltration/harvesting.
- 28) In case of coal and other base metal mining projects, the project proponent shall use the advance dewatering technology (by construction of series of dewatering abstraction structures) to avoid contamination of surface water.
- 29) The NOC issued is conditional subject to the conditions mentioned in the Public notice dated 27.01.2021 failing which penalty/EC/cancellation of NOC shall be imposed as the case may be.
- 30) This NOC is issued subject to the clearance of Expert Appraisal Committee (EAC) (if applicable).
- 31) In the self-compliance report, the PP shall submit details of Drilling Agency/ Agencies, which has/ have constructed BW(s)/ TW(s) along with undertaking to the effect that all necessary measures have been taken as per directions of Hon'ble Supreme Court provided in Annexure-VII of guidelines dated 24.09.2020 in respect of abandoned/ failed BW(s)/ TW(s)/ Piezometer(s), if any. The PP is advised to engage registered drilling agency/ agencies. In the event of any mishap/ unfortunate incident due to negligence in taking measures for prevention of accident due to falling in Bore Well, both PP and concerned drilling agency shall jointly be held responsible and penal action as per extant Government rules shall be taken.

(Non-compliance of the conditions mentioned above is likely to result in the cancellation of NOC and legal action against the proponent.)

CENTRAL GROUND WATER AUTHORITY
Department of Water Resources, River Development and Ganga Rejuvenation
Ministry of Jal Shakti, Govt. of India

18/11, जामनगर हाउस, मानसिंह रोड, नई दिल्ली - 110011 / 18/11, Jamnagar House, Mansingh Road, New Delhi-110011
Phone: (011) 23383561 Fax: 23382051, 23386743
Website: cgwa-noc.gov.in

Annexure 2: Copy of Accreditation of MRCAWTM, Faridabad



Annexure 3: Work Order copy to MRCAWTM from Raikela Iron Ore Mines

 WCS World Consultancy Services	MY WORLD CONSULTANCY SERVICES PRIVATE LIMITED GST NO: 21AADCT4043NIZE
Ref. No. WCS/2024-25/WO/53	Date.17.09.2024
To Dr A Mukherjee Director, CAWTM, MRIIRS, Faridabad, Haryana	
Sub: Work order for carrying obtaining renewal of NOC, (170 m³/day) from CGWA, GOI for Extraction/ use of ground water for drinking and domestic purpose in respect of M/s Geetarani Mohanty Raikela Iron Ore Mines (67.586 Ha) of as per Guidelines to regulate and control Ground Water Extraction in India.	
Dear Sir, We are pleased to entrust the work for carrying out the ground water study for obtaining NOC from CGWA for Raikela Iron Ore Mines (67.586 Ha) of M/s. Geetarani Mohanty as per Guidelines to regulate and control Ground Water Extraction in India.	
A. Scope of work for CAWTM, MRIIRS • Site visit • Site investigation • Collection of data • Surface runoff threshold • Rainwater harvesting potential & conservation technology. • Water of GW regime pre & post monsoon with categorization for safe, semi critical, critical, over exploited • Draft report preparation • Final report submission • Included- Providing guidance to the customer on techno-legal aspects and compliance strategies. (was not included in scope)	
Reach us at Telengapetha, Cuttack, Odisha - 754001+91 79787 24154wcs@theworld.co.in www.worldconsultancy.com 	





World Consultancy Services

MY WORLD CONSULTANCY SERVICES PRIVATE LIMITED
GST NO: 21AADCT4043NIZE

B. My WCS Scope

- Providing convenience (logistics & accommodation) for the expert team.
- Reimbursement of travel fare.
- Providing basic data on location & study area.

C. Timeline:

- 10 days from the date of receiving this work order.
- Survey & investigation, 1st week of October 2024.
- Submission of report 20th October 2024

D. Financial Terms

25% Mobilization advance

25% Draft Report submission

50% Final Report submission



Please revert us a signed copy of this work order as a token of acceptance.

Thanking you,

Yours faithfully

Pradeept Mohapatra

Authorized Signatory

Reach us at Telengapetha,
Cuttack, Odisha - 754001

+91 79787 24154

wcs@theworld.co.in
www.worldconsultancy.com



Annexure 4: Quality Analysis by NABL accredited Laboratory of June, 2024



WCS
World Consultancy Services

MY WORLD CONSULTANCY SERVICES PRIVATE LIMITED
(TESTING LABORATORY)
GST NO: 21AADCT4043NIZE
CIN: U72501OR2010PTC011651



TC-11225

WCS/LQR/60
Report No. : WCS240702A
NABL ULR No. : TC112252400000093F
Name of the Client : **Raikela Iron Ore Mines (M/S Geetarani Mohanty)**
Address : Raikela, Near Tensa, P.O.-Dengula, Dist- Sundargarh- 770048, Odisha
Sampling Location : **Karo nala Down stream**
Sample Description : Surface Water
Sampling Plan & Method : WCS/QSP/SAMP (WATER)
Environmental Condition : Temperature 29°C, Clear Weather
Sample Collected by : WCS Laboratory
Date of Testing : 24.06.2024 to 29.06.2024

TEST REPORT

Issue Date : 02.07.2024
Date of Sampling : 22.06.2024
Date of Receiving : 24.06.2024
Sample ID No : WCS0624W07A
Quantity of Sample : 1 Ltr
Sample Condition : Good

Sl. No.	Parameter	Unit	Result	Test Methods
1	Odour	--	Agreeable	IS 3025 (Part-5): 2018
2	Colour	Hazen	4.0	IS 3025 (Part-4): 2021
3	pH Value	--	6.89 at 27.6	IS 3025 (Part-11): 2022
4	Specific Conductivity	µs/cm	169 at 26.8	IS 3025 (Part-14): 2013
5	Dissolve Oxygen as DO	mg/l	6.8	IS 3025 (Part-38): 1989
6	Chemical Oxygen Demand as COD	mg/l	4.0	IS 3025 (Part-58): 2006
7	Biochemical Oxygen Demand as BOD	mg/l	2.1	IS 3025 (Part-44): 1993
8	Total Suspended Solid as TSS	mg/l	18.0	IS 3025 (Part-17): 2022
9	Oil & Grease	mg/l	<1	APHA 24 th Ed. (5520-B): 2023
10	Total Hardness as CaCO ₃	mg/l	36.0	APHA 24 th Ed. (2340-C): 2023
11	Chloride as Cl	mg/l	16.99	IS 3025 (Part-32): 1988
12	Sulphate as SO ₄	mg/l	17.6	IS 3025 (Part-24, Sec-1): 2022
13	Nitrate as NO ₃	mg/l	2.8	APHA 24 th Ed. (4500-NO ₃ -B): 2023
14	Fluoride as F	mg/l	0.03	APHA 24 th Ed. (4500-F-D): 2023
15	Calcium as Ca	mg/l	12.83	APHA 24 th Ed. (3500-Ca-B): 2023
16	Magnesium as Mg	mg/l	0.97	APHA 24 th Ed. (3500-Mg-B): 2023
17	Iron as Fe	mg/l	0.56	IS 3025 (Part-53): 2003
18	Total Dissolved Solid as TDS	mg/l	136.0	IS 3025 (Part-16): 1984
19	Total Coliform	MPN/100 ml	>161	IS 1622 : 1981



Reviewed by
(Mr. Bijaya Kumar Chahataray)



Authorized Signatory for Microbiological
(Miss. Laxmi Sahoo)



Authorized Signatory for Chemical
(Mr. Pradeep Mohapatra)

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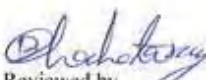
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WCS/LQR/60
Report No. : WCS240702B Issue Date : 02.07.2024
NABL ULR No. : TC1122524000000093F
Name of the Client : **Raikela Iron Ore Mines (M/S Geetarani Mohanty)**
Address : Raikela, Near Tensa, P.O.-Dengula, Dist- Sundargarh- 770048, Odisha
Sampling Location : **Tantara Pond**
Sample Description : Surface Water Date of Sampling : 22.06.2024
Sampling Plan & Method : WCS/QSP/SAMP (WATER) Date of Receiving : 24.06.2024
Environmental Condition : Temperature 29°C, Clear Weather Sample ID No : WCS0624W07B
Sample Collected by : WCS Laboratory Quantity of Sample : 1 Ltr
Date of Testing : 24.06.2024 to 29.06.2024 Sample Condition : Good

Sl. No.	Parameter	Unit	Result	Test Methods
1	Odour	--	Agreeable	IS 3025 (Part-5): 2018
2	Colour	Hazen	4.0	IS 3025 (Part-4): 2021
3	pH Value	--	7.65 at 27.3	IS 3025 (Part-11): 2022
4	Specific Conductivity	µs/cm	126 at 26.3	IS 3025 (Part-14): 2013
5	Dissolve Oxygen as DO	mg/l	5.9	IS 3025 (Part-38): 1989
6	Chemical Oxygen Demand as COD	mg/l	2.4	IS 3025 (Part-58): 2006
7	Biochemical Oxygen Demand as BOD	mg/l	2.0	IS 3025 (Part-44): 1993
8	Total Suspended Solid as TSS	mg/l	26.0	IS 3025 (Part-17): 2022
9	Oil & Grease	mg/l	<4	APHA 24 th Ed. (5520-B): 2023
10	Total Hardness as CaCO ₃	mg/l	66.0	APHA 24 th Ed. (2340-C): 2023
11	Chloride as Cl	mg/l	15.0	IS 3025 (Part-32): 1988
12	Sulphate as SO ₄	mg/l	2.6	IS 3025 (Part-24, Sec-1): 2022
13	Nitrate as NO ₃	mg/l	1.73	APHA 24 th Ed. (4500-NO ₃ -B): 2023
14	Fluoride as F	mg/l	0.05	APHA 24 th Ed. (4500-F-D): 2023
15	Calcium as Ca	mg/l	24.85	APHA 24 th Ed. (3500-Ca-B): 2023
16	Magnesium as Mg	mg/l	0.97	APHA 24 th Ed. (3500-Mg-B): 2023
17	Iron as Fe	mg/l	0.263	IS 3025 (Part-53): 2003
18	Total Dissolved Solid as TDS	mg/l	76.0	IS 3025 (Part-16): 1984
19	Total Coliform	MPN/100 ml	<161	IS 1622 : 1981

Reviewed by  (Mr. Bijaya Kumar Chahataray) Authorized Signatory for Microbiological (Miss. Laxmi Sahoo) Authorized Signatory for Chemical  (Mr. Pradeep Mohapatra)

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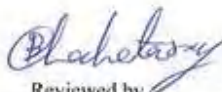
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WCS/LQR/60

TEST REPORT

Report No. : WCS240702C Issue Date : 02.07.2024
NABL ULR No. : TC112252400000093F
Name of the Client : **Raikela Iron Ore Mines (M/S Geetarani Mohanty)**
Address : Raikela, Near Tensa, P.O.-Dengula, Dist- Sundargarh- 770048, Odisha
Sampling Location : **Kuradhi Nala Down-Stream**
Sample Description : Surface Water Date of Sampling : 22.06.2024
Sampling Plan & Method : WCS/QSP/SAMP (WATER) Date of Receiving : 24.06.2024
Environmental Condition : Temperature 29°C, Clear Weather Sample ID No : WCS0624W07C
Sample Collected by : WCS Laboratory Quantity of Sample : 1 Ltr
Date of Testing : 24.06.2024 to 29.06.2024 Sample Condition : Good

SL No.	Parameter	Unit	Result	Test Methods
1	Odour	--	Agreable	IS 3025 (Part-5): 2018
2	Colour	Hazen	4.0	IS 3025 (Part-4): 2021
3	pH Value	--	7.89 at 27.2	IS 3025 (Part-11): 2022
4	Specific Conductivity	µs/cm	129 at 27.3	IS 3025 (Part-14): 2013
5	Dissolve Oxygen as DO	mg/l	6.5	IS 3025 (Part-38): 1989
6	Chemical Oxygen Demand as COD	mg/l	3.6	IS 3025 (Part-58): 2006
7	Biochemical Oxygen Demand as BOD	mg/l	2.4	IS 3025 (Part-44): 1993
8	Total Suspended Solid as TSS	mg/l	25.0	IS 3025 (Part-17): 2022
9	Oil & Grease	mg/l	<4	APHA 24 th Ed. (5520-B): 2023
10	Total Hardness as CaCO ₃	mg/l	44.0	APHA 24 th Ed. (2340-C): 2023
11	Chloride as Cl	mg/l	16.49	IS 3025 (Part-32): 1988
12	Sulphate as SO ₄	mg/l	12.65	IS 3025 (Part-24, Sec-1): 2022
13	Nitrate as NO ₃	mg/l	10.81	APHA 24 th Ed. (4500-NO ₃ -B): 2023
14	Fluoride as F	mg/l	0.16	APHA 24 th Ed. (4500-F-D): 2023
15	Calcium as Ca	mg/l	15.23	APHA 24 th Ed. (3500-Ca-B): 2023
16	Magnesium as Mg	mg/l	1.46	APHA 24 th Ed. (3500-Mg-B): 2023
17	Iron as Fe	mg/l	0.62	IS 3025 (Part-53): 2003
18	Total Dissolved Solid as TDS	mg/l	121.0	IS 3025 (Part-16): 1984
19	Total Coliform	MPN/100 ml	<161	IS 1622 : 1981

Reviewed by  Authorized Signatory for Microbiological (Mr. Bijaya Kumar Chahataray)
Authorized Signatory for Microbiological (Miss. Laxmi Sahoo)
Authorized Signatory for Chemical (Mr. Pradeept Mohapatra)



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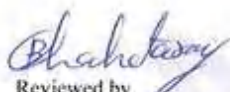
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WCS/LQR/60

TEST REPORT

Report No. : WCS240608 Issue Date : 17.06.2024
NABL ULR No. : TC112252400000090F
Name of the Client : Raikela Iron Ore Mines (M/S Geetarani Mohanty)
Address : Raikela, Near Tensa, P.O.-Dengula, Dist- Sundargarh- 770048, Odisha
Sampling Location : ETP Out-Let
Sample Description : Waste Water Date of Sampling : 08.06.2024
Sampling Plan & Method : WCS/QSP/SAMP (WATER) Date of Receiving : 10.06.2024
Environmental Condition : Temperature 29°C, Clear Weather Sample ID No : WCS0624W02
Sample Collected by : WCS Laboratory Quantity of Sample : 1 Ltr
Date of Testing : 10.06.2024 to 15.06.2024 Sample Condition : Good

Sl. No.	Parameter	Unit	Result	Requirement as per The Environment (Protection) Amendment Rules, 2015, into inland surface water	Test Methods
1	pH Value	—	7.8	6.0 to 9.0	IS 3025 (Part-11): 2022
2	Biochemical Oxygen Demand as BOD ₅ , 27°C	mg/l	7.9	30 (Max)	IS 3025 (Part-44): 1993
3	Chemical Oxygen Demand as COD	mg/l	26.4	250 (Max)	APHA 24 th Ed. (5220-D): 2023
4	Total Suspended Solid	mg/l	27.6	100 (Max)	IS 3025 (Part-17): 2022
5	Total Dissolved Solid as TDS	mg/l	258.0	2100 (Max)	IS 3025 (Part-16): 1984
6	Oil & Grease	mg/l	4.8	10 (Max)	APHA 24 th Ed. (5520-B): 2023


Reviewed by
(Mr. Bijaya Kumar Chahataray)


Authorized Signatory
(Mr. Pradeept Mohapatra)

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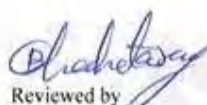
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www.worldconsultancy.com

WCS/LQR/60

TEST REPORT

Report No. : WCS240703 Issue Date : 02.07.2024
NABL ULR No. : TCH12252400000094F
Name of the Client : **Raikela Iron Ore Mines (M/S Geetarani Mohanty)**
Address : Raikela, Near Tensa, P.O.-Dengula, Dist- Sundargarh- 770048, Odisha
Sampling Location : **ETP Out-Let**
Sample Description : Waste Water Date of Sampling : 22.06.2024
Sampling Plan & Method : WCS/QSP/SAMP (WATER) Date of Receiving : 24.06.2024
Environmental Condition : Temperature 29°C, Clear Weather Sample ID No : WCS0624W08
Sample Collected by : WCS Laboratory Quantity of Sample : 1 Ltr
Date of Testing : 24.06.2024 to 29.06.2024 Sample Condition : Good

Sl. No.	Parameter	Unit	Result	Requirement as per The Environment (Protection) Amendment Rules, 2015, Into inland surface water	Test Methods
1	pH Value	--	7.9	6.0 to 9.0	IS 3025 (Part-11): 2022
2	Biochemical Oxygen Demand as BOD ₅ 27°C	mg/l	9.6	30 (Max)	IS 3025 (Part-44): 1993
3	Chemical Oxygen Demand as COD	mg/l	27.2	250 (Max)	APHA 24 th Ed. (5220-D): 2023
4	Total Suspended Solid	mg/l	25.6	100 (Max)	IS 3025 (Part-17): 2022
5	Total Dissolved Solid as TDS	mg/l	239.0	2100 (Max)	IS 3025 (Part-16): 1984
6	Oil & Grease	mg/l	4.2	10 (Max)	APHA 24 th Ed. (5520-B): 2023



Reviewed by
(Mr. Bijaya Kumar Chahataray)



Authorized Signatory
(Mr. Pradeep Mohapatra)

N.B.:

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WCS/LQR/60

TEST REPORT

Report No. : WCS240609 Issue Date : 17.06.2024
NABL ULR No. : TC1122524000000091F
Name of the Client : **Raikela Iron Ore Mines (M/S Geetarani Mohanty)**
Address : Raikela, Near Tensa, P.O.-Dengula, Dist- Sundargarh- 770048, Odisha
Sampling Location : **STP Out-Let**
Sample Description : Waste Water Date of Sampling : 08.06.2024
Sampling Plan & Method : WCS/QSP/SAMP (WATER) Date of Receiving : 10.06.2024
Environmental Condition : Temperature 28°C, Clear Weather Sample ID No : WCS0624W03
Sample Collected by : WCS Laboratory Quantity of Sample : 1 Ltr
Date of Testing : 10.06.2024 to 15.06.2024 Sample Condition : Good

Sl. No.	Parameter	Unit	Result	Requirement as per MoEF&CC, Govt. of India Vide G.S.R. 1265 (E), dated 13.10.2017	Test Methods
1	pH Value	--	7.36	6.5-9.0	IS 3025 (Part-11): 2022
2	Biochemical Oxygen Demand as BOD ₅ , 27°C	mg/l	15.6	30	IS 3025 (Part-44): 1993
3	Chemical Oxygen Demand as COD	mg/l	45.6	<100	APHA 24 th Ed. (5220-D): 2023
4	Total Suspended Solid	mg/l	28	--	IS 3025 (Part-17): 2022
5	Total Dissolved Solid as TDS	mg/l	234	--	IS 3025 (Part-16): 1984
6	Oil & Grease	mg/l	<4	--	APHA 24 th Ed. (5520-B): 2023
7	Faecal Coliform	MPN/100 ml	500	<1000	IS 1622 : 1981 RA 2019

Reviewed by
(Mr. Bijaya Kumar Chahataray)

Authorized Signatory for Microbiological
(Miss. Laxmi Sahoo)

Authorized Signatory for Chemical
(Mr. Pradeept Mohapatra)



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TEST REPORT

Report No. : WCS240704 Issue Date : 02.07.2024
NABL ULR No. : TC112252400000095F
Name of the Client : **Raikela Iron Ore Mines (M/S Geetarani Mohanty)**
Address : Raikela, Near Tensa, P.O.-Dengula, Dist- Sundargarh- 770048, Odisha
Sampling Location : **STP Out-Let**
Sample Description : Waste Water Date of Sampling : 22.06.2024
Sampling Plan & Method : WCS/QSP/SAMP (WATER) Date of Receiving : 24.06.2024
Environmental Condition : Temperature 29°C, Clear Weather Sample ID No : WCS0624W09
Sample Collected by : WCS Laboratory Quantity of Sample : 1 Ltr
Date of Testing : 24.06.2024 to 29.06.2024 Sample Condition : Good

Sl. No.	Parameter	Unit	Result	Requirement as per MoEF&CC, Govt. of India Vide G.S.R. 1265 (E), dated 13.10.2017	Test Methods
1	pH Value	—	7.20	6.5-9.0	IS 3025 (Part-11): 2022
2	Biochemical Oxygen Demand as BOD ₅ , 270C	mg/l	16.1	30	IS 3025 (Part-44): 1993
3	Chemical Oxygen Demand as COD	mg/l	44.0	<100	APHA 24th Ed. (5220-D): 2023
4	Total Suspended Solid	mg/l	22.0	—	IS 3025 (Part-17): 2022
5	Total Dissolved Solid as TDS	mg/l	240.0	—	IS 3025 (Part-16): 1984
7	Oil & Grease	mg/l	<4	—	APHA 24th Ed. (5520-B): 2023
8	Faecal Coliform	MPN/ 100 ml	500.0	<1000	IS 1622 : 1981 RA 2019

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Reviewed by
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Pradeep
Authorized Signatory for Chemical
(Mr. Pradeept Mohapatra)

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Annexure 5: Quality Analysis by NABL accredited Laboratory of July, 2024



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CIN: U72501OR2010PTC011651



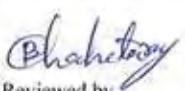
TC-11225

WCS/LQR/60
Report No. : WCS240709A
NABL ULR No. : TC11225240000000111F
Name of the Client : Raikela Iron Ore Mines (M/S Geetarani Mohanty)
Address : Raikela, Near Tensa, P.O.-Dengula, Dist- Sundargarh- 770048, Odisha
Sampling Location : Karo nala Down stream
Sample Description : Surface Water
Sampling Plan & Method : WCS/QSP/SAMP (WATER)
Environmental Condition : Temperature 29°C, Clear Weather
Sample Collected by : WCS Laboratory
Date of Testing : 20.07.2024 to 25.07.2024

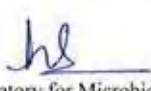
TEST REPORT

Issue Date : 26.07.2024
Date of Sampling : 18.07.2024
Date of Receiving : 20.07.2024
Sample ID No : WCS2407W08A
Quantity of Sample : 1 Ltr
Sample Condition : Good

Sl. No.	Parameter	Unit	Result	Test Methods
1	Odour	--	Agreeable	IS 3025 (Part-5): 2018
2	Colour	Hazen	4	IS 3025 (Part-4): 2021
3	pH Value	--	6.75	IS 3025 (Part-11): 2022
4	Specific Conductivity	µs/cm	168.0	IS 3025 (Part-14): 2013
5	Dissolve Oxygen as DO	mg/l	6.5	IS 3025 (Part-38): 1989
6	Chemical Oxygen Demand as COD	mg/l	4.5	IS 3025 (Part-58): 2006
7	Biochemical Oxygen Demand as BOD	mg/l	2.5	IS 3025 (Part-44): 1993
8	Total Suspended Solid as TSS	mg/l	15	IS 3025 (Part-17): 2022
9	Oil & Grease	mg/l	<4	APHA 24 th Ed (5520-B): 2023
10	Total Hardness as CaCO ₃	mg/l	36	APHA 24 th Ed (2340-C): 2023
11	Chloride as Cl	mg/l	16	IS 3025 (Part-32): 1988
12	Sulphate as SO ₄	mg/l	17.9	IS 3025 (Part-24, Sec-I): 2022
13	Nitrate as NO ₃	mg/l	2.91	APHA 24 th Ed (4500-NO ₃ -B): 2023
14	Fluoride as F	mg/l	0.04	APHA 24 th Ed (4500-F-D): 2023
15	Calcium as Ca	mg/l	12.83	APHA 24 th Ed (3500-Ca-B): 2023
16	Magnesium as Mg	mg/l	0.97	APHA 24 th Ed (3500-Mg-B): 2023
17	Iron as Fe	mg/l	0.49	IS 3025 (Part-53): 2003
18	Total Dissolved Solid as TDS	mg/l	138	IS 3025 (Part-16): 1984
19	Total Coliform	MPN/100 ml	220	IS 1622: 1981



Reviewed by
(Mr. Bijaya Kumar Chahataray)



Authorized Signatory for Microbiological
(Miss. Laxmi Sahoo)



Authorized Signatory for Chemical
(Mr. Pradeept Mohapatra)

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WCS/LQR/60
Report No. : WCS240709B Issue Date : 26.07.2024
NABL ULR No. : TC1122524000000111F
Name of the Client : **Raikela Iron Ore Mines (M/S Geetarani Mohanty)**
Address : Raikela, Near Tensa, P.O.-Dengula, Dist- Sundargarh- 770048, Odisha
Sampling Location : **Tantara Pond**
Sample Description : Surface Water Date of Sampling : 18.07.2024
Sampling Plan & Method : WCS/QSP/SAMP (WATER) Date of Receiving : 20.07.2024
Environmental Condition : Temperature 29°C, Clear Weather Sample ID No : WCS2407W08B
Sample Collected by : WCS Laboratory Quantity of Sample : 1 Ltr
Date of Testing : 20.07.2024 to 25.07.2024 Sample Condition : Good

TEST REPORT

Sl. No.	Parameter	Unit	Result	Test Methods
1	Odour	—	Agreeable	IS 3025 (Part-5): 2018
2	Colour	Hazen	5	IS 3025 (Part-4): 2021
3	pH Value	—	7.45	IS 3025 (Part-11): 2022
4	Specific Conductivity	µs/cm	122	IS 3025 (Part-14): 2013
5	Dissolve Oxygen as DO	mg/l	6.5	IS 3025 (Part-38): 1989
6	Chemical Oxygen Demand as COD	mg/l	2.4	IS 3025 (Part-58): 2006
7	Biochemical Oxygen Demand as BOD	mg/l	2	IS 3025 (Part-44): 1993
8	Total Suspended Solid as TSS	mg/l	25	IS 3025 (Part-17): 2022
9	Oil & Grease	mg/l	<4	APHA 24 th Ed (5520-B): 2023
10	Total Hardness as CaCO ₃	mg/l	62	APHA 24 th Ed (2340-C): 2023
11	Chloride as Cl	mg/l	12.5	IS 3025 (Part-32): 1988
12	Sulphate as SO ₄	mg/l	2.85	IS 3025 (Part-24, Sec-1): 2022
13	Nitrate as NO ₃	mg/l	1.54	APHA 24 th Ed (4500-NO ₃ -B): 2023
14	Fluoride as F	mg/l	0.04	APHA 24 th Ed (4500-F-D): 2023
15	Calcium as Ca	mg/l	23.25	APHA 24 th Ed (3500-Ca-B): 2023
16	Magnesium as Mg	mg/l	0.97	APHA 24 th Ed (3500-Mg-B): 2023
17	Iron as Fe	mg/l	0.285	IS 3025 (Part-53): 2003
18	Total Dissolved Solid as TDS	mg/l	89	IS 3025 (Part-16): 1984
19	Total Coliform	MPN/100 ml	170	IS 1622 : 1981

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Reviewed by
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Authorized Signatory for Microbiological
(Miss. Laxmi Sahoo)

Pradeep
Authorized Signatory for Chemical
(Mr. Pradeep Mohapatra)

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TEST REPORT

Report No. : WCS240709C Issue Date : 26.07.2024
NABL ULR No. : TC11225240000000111F
Name of the Client : Raikela Iron Ore Mines (M/S Geetarani Mohanty)
Address : Raikela, Near Tensa, P.O.-Dengula, Dist- Sundergarh- 770048, Odisha
Sampling Location : Kuradhi Nala Down-Stream
Sample Description : Surface Water Date of Sampling : 18.07.2024
Sampling Plan & Method : WCS/QSP/SAMP (WATER) Date of Receiving : 20.07.2024
Environmental Condition : Temperature 29°C, Clear Weather Sample ID No : WCS2407W08C
Sample Collected by : WCS Laboratory Quantity of Sample : 1 Ltr
Date of Testing : 20.07.2024 to 25.07.2024 Sample Condition : Good

Sl. No.	Parameter	Unit	Result	Test Methods
1	Odour	---	Agreeable	IS 3025 (Part-5): 2018
2	Colour	Hazen	4	IS 3025 (Part-4): 2021
3	pH Value	---	7.65	IS 3025 (Part-11): 2022
4	Specific Conductivity	µs/cm	134 at 27.6	IS 3025 (Part-14): 2013
5	Dissolve Oxygen as DO	mg/l	6.8	IS 3025 (Part-38): 1989
6	Chemical Oxygen Demand as COD	mg/l	3.4	IS 3025 (Part-58): 2006
7	Biochemical Oxygen Demand as BOD	mg/l	2.1	IS 3025 (Part-44): 1993
8	Total Suspended Solid as TSS	mg/l	24	IS 3025 (Part-17): 2022
9	Oil & Grease	mg/l	<4	APHA 24 th Ed. (5520-B): 2023
10	Total Hardness as CaCO ₃	mg/l	48	APHA 24 th Ed. (2340-C): 2023
11	Chloride as Cl	mg/l	16	IS 3025 (Part-32): 1988
12	Sulphate as SO ₄	mg/l	13.63	IS 3025 (Part-24, Sec-1): 2022
13	Nitrate as NO ₃	mg/l	10.79	APHA 24 th Ed. (4500-NO ₃ -B): 2023
14	Fluoride as F	mg/l	0.14	APHA 24 th Ed. (4500-F-D): 2023
15	Calcium as Ca	mg/l	16.03	APHA 24 th Ed. (3500-Ca-B): 2023
16	Magnesium as Mg	mg/l	1.94	APHA 24 th Ed. (3500-Mg-B): 2023
17	Iron as Fe	mg/l	0.58	IS 3025 (Part-53): 2003
18	Total Dissolved Solid as TDS	mg/l	119	IS 3025 (Part-16): 1984
19	Total Coliform	MPN/100 ml	140	IS 1622 : 1981

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Pradeept Mohapatra
Authorized Signatory for Chemical
(Mr. Pradeept Mohapatra)



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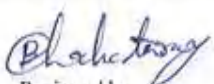
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TEST REPORT

Report No. : WCS240704 Issue Date : 15.07.2024
NABL ULR No. : TC1122524000000106F
Name of the Client : **Raikela Iron Ore Mines (M/S Geetarani Mohanty)**
Address : Raikela, Near Tensa, P.O.-Dengula, Dist- Sundargarh- 770048, Odisha
Sampling Location : **Surface Run off**
Sample Description : Surface Water Date of Sampling : 06.07.2024
Sampling Plan & Method : WCS/QSP/SAMP (WATER) Date of Receiving : 08.07.2024
Environmental Condition : Temperature 28°C, Clear Weather Sample ID No : WCS2407W04
Sample Collected by : WCS Laboratory Quantity of Sample : 1 Ltr
Date of Testing : 08.07.2024 to 13.07.2024 Sample Condition : Good

SL No.	Parameter	Unit	Result	Requirement as per The Environment (Protection) Amendment Rules, 2015, Into inland surface water	Test Methods
1	pH Value	—	6.648	6.0 to 9.0	IS 3025 (Part-11): 2022
2	Total Suspended Solid	mg/l	77.0	100 (Max)	IS 3025 (Part-17): 2022
3	Total Dissolved Solid as TDS	mg/l	308.0	2100 (Max)	IS 3025 (Part-16): 1984
4	Oil & Grease	mg/l	<4.0	10 (Max)	APIHA 23rd Ed. (5520-B): 2017


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TEST REPORT

Report No. : WCS240712 Issue Date : 26.07.2024
NABL ULR No. : TC11225240000000114F
Name of the Client : **Raikela Iron Ore Mines (M/S Geetarani Mohanty)**
Address : Raikela, Near Tensa, P.O.-Dengula, Dist- Sundargarh- 770048, Odisha
Sampling Location : **Surface Run off**
Sample Description : Surface Water Date of Sampling : 18.07.2024
Sampling Plan & Method : WCS/QSP/SAMP (WATER) Date of Receiving : 20.07.2024
Environmental Condition : Temperature 29°C, Clear Weather Sample ID No : WCS2407W11
Sample Collected by : WCS Laboratory Quantity of Sample : 1 Ltr
Date of Testing : 20.07.2024 to 25.07.2024 Sample Condition : Good

Sl. No.	Parameter	Unit	Result	Requirement as per The Environment (Protection) Amendment Rules, 2015, Into inland surface water	Test Methods
1	pH Value	--	6.814	6.0 to 9.0	IS 3025 (Part-11): 2022
2	Total Suspended Solid	mg/l	72.0	100 (Max)	IS 3025 (Part-17): 2022
3	Total Dissolved Solid as TDS	mg/l	285.0	2100 (Max)	IS 3025 (Part-16): 1984
4	Oil & Grease	mg/l	<4.0	10 (Max)	APHA 23rd Ed. (5520-B): 2017

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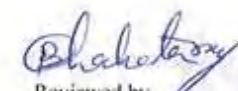
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TEST REPORT

Report No. : WCS240702 Issue Date : 15.07.2024
NABL ULR No. : TC1122524000000104F
Name of the Client : **Raikela Iron Ore Mines (M/S Geetarani Mohanty)**
Address : Raikela, Near Tensa, P.O.-Dengula, Dist- Sundergarh- 770048, Odisha
Sampling Location : **ETP Out-Let**
Sample Description : Waste Water Date of Sampling : 06.07.2024
Sampling Plan & Method : WCS/QSP/SAMP (WATER) Date of Receiving : 08.07.2024
Environmental Condition : Temperature 29°C, Clear Weather Sample ID No : WCS2407W02
Sample Collected by : WCS Laboratory Quantity of Sample : 1 Ltr
Date of Testing : 08.07.2024 to 13.07.2024 Sample Condition : Good

Sl. No.	Parameter	Unit	Result	Requirement as per The Environment (Protection) Amendment Rules, 2015, Into inland surface water	Test Methods
1	pH Value	—	7.5	6.0 to 9.0	IS 3025 (Part-11): 2022
2	Biochemical Oxygen Demand as BOD ₅ , 27°C	mg/l	8.4	30 (Max)	IS 3025 (Part-44): 1993
3	Chemical Oxygen Demand as COD	mg/l	23.9	250 (Max)	APHA 24 th Ed. (5220-D): 2023
4	Total Suspended Solid	mg/l	27.6	100 (Max)	IS 3025 (Part-17): 2022
5	Total Dissolved Solid as TDS	mg/l	254.0	2100 (Max)	IS 3025 (Part-16): 1984
6	Oil & Grease	mg/l	4.1	10 (Max)	APHA 24 th Ed. (5520-B): 2023


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TEST REPORT

Report No. : WCS240710 Issue Date : 26.07.2024
NABL ULR No. : TC11225240000000112F
Name of the Client : **Raikela Iron Ore Mines (M/S Geetarani Mohanty)**
Address : Raikela, Near Tensa, P.O.-Dengula, Dist- Sundargarh- 770048, Odisha
Sampling Location : **ETP Out-Let**
Sample Description : Waste Water Date of Sampling : 18.07.2024
Sampling Plan & Method : WCS/QSP/SAMP (WATER) Date of Receiving : 20.07.2024
Environmental Condition : Temperature 29°C, Clear Weather Sample ID No : WCS2407W09
Sample Collected by : WCS Laboratory Quantity of Sample : 1 Ltr
Date of Testing : 20.07.2024 to 25.07.2024 Sample Condition : Good

Sl. No.	Parameter	Unit	Result	Requirement as per The Environment (Protection) Amendment Rules, 2015, Into inland surface water	Test Methods
1	pH Value	--	7.6	6.0 to 9.0	IS 3025 (Part-11): 2022
2	Biochemical Oxygen Demand as BOD ₅ , 27°C	mg/l	9.7	30 (Max)	IS 3025 (Part-44): 1993
3	Chemical Oxygen Demand as COD	mg/l	27.6	250 (Max)	APHA 24 th Ed. (5220-1): 2023
4	Total Suspended Solid	mg/l	26.4	100 (Max)	IS 3025 (Part-17): 2022
5	Total Dissolved Solid as TDS	mg/l	232	2100 (Max)	IS 3025 (Part-16): 1984
6	Oil & Grease	mg/l	4.3	10 (Max)	APHA 24 th Ed. (5520-B): 2023

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TEST REPORT

Report No. : WCS240703 Issue Date : 15.07.2024
NABL ULR No. : TC1122524000000105F
Name of the Client : **Raikela Iron Ore Mines (M/S Geetarani Mohanty)**
Address : Raikela, Near Tensa, P.O.-Dengula, Dist- Sundargarh- 770048, Odisha
Sampling Location : **STP Out-Let**
Sample Description : Waste Water Date of Sampling : 06.07.2024
Sampling Plan & Method : WCS/QSP/SAMP (WATER) Date of Receiving : 08.07.2024
Environmental Condition : Temperature 28°C, Clear Weather Sample ID No : WCS2407W03
Sample Collected by : WCS Laboratory Quantity of Sample : 1 Ltr
Date of Testing : 08.07.2024 to 13.07.2024 Sample Condition : Good

Sl. No.	Parameter	Unit	Result	Requirement as per MoEF&CC, Govt. of India Vide G.S.R. 1265 (E.), dated 13.10.2017	Test Methods
1	pH Value	—	7.46	6.5-9.0	IS 3025 (Part-11): 2022
2	Biochemical Oxygen Demand as BOD ₅ , 27°C	mg/l	14.7	30	IS 3025 (Part-44): 1993
3	Chemical Oxygen Demand as COD	mg/l	42.9	<100	APHA 24 th Ed. (5220-D): 2023
4	Total Suspended Solid	mg/l	26.2	—	IS 3025 (Part-17): 2022
5	Total Dissolved Solid as TDS	mg/l	236	—	IS 3025 (Part-16): 1984
6	Oil & Grease	mg/l	<4	—	APHA 24 th Ed. (5520-B): 2023
7	Faecal Coliform	MPN/ 100 ml	300	<1000	IS 1622: 1981 RA 2019

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Authorized Signatory for Chemical
(Mr. Pradeep Mohapatra)

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TEST REPORT

Report No. : WCS240711 Issue Date : 26.07.2024
NABL ULR No. : TC1122524000000113F
Name of the Client : **Raikela Iron Ore Mines (M/S Geetarani Mohanty)**
Address : Raikela, Near Tensa, P.O.-Dengula, Dist- Sundergarh- 770048, Odisha
Sampling Location : **STP Out-Let**
Sample Description : Waste Water Date of Sampling : 18.07.2024
Sampling Plan & Method : WCS/QSP/SAMP (WATER) Date of Receiving : 20.07.2024
Environmental Condition : Temperature 29°C, Clear Weather Sample ID No : WCS2407W10
Sample Collected by : WCS Laboratory Quantity of Sample : 1 Ltr
Date of Testing : 20.07.2024 to 25.07.2024 Sample Condition : Good

Sl. No.	Parameter	Unit	Result	Requirement as per MoEF&CC, Govt. of India Vide G.S.R. 1265 (E), dated 13.10.2017	Test Methods
1	pH Value	--	7.85	6.5-9.0	IS 3025 (Part-11): 2022
2	Biochemical Oxygen Demand as BOD ₅ , 270C	mg/l	16.9	30	IS 3025 (Part-44): 1993
3	Chemical Oxygen Demand as COD	mg/l	46.2	<100	APHA 24th Ed. (5220-D): 2023
4	Total Suspended Solid	mg/l	23	--	IS 3025 (Part-17): 2022
5	Total Dissolved Solid as TDS	mg/l	245	--	IS 3025 (Part-16): 1984
7	Oil & Grease	mg/l	<4	--	APHA 24th Ed. (5520-B): 2023
8	Faecal Coliform	MPN/ 100 ml	500	<1000	IS 1622 : 1981 RA 2019

Chahatary

Reviewed by
(Mr. Bijaya Kumar Chahatary)

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Authorized Signatory for Microbiological
(Miss. Laxmi Sahoo)

Pradeept

Authorized Signatory for Chemical
(Mr. Pradeept Mohapatra)

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Annexure 6: Quality Analysis by NABL accredited Laboratory of August, 2024



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(TESTING LABORATORY)
GST NO: 21AADCT4043N1ZE
CIN: U72501OR2010PTC011651



TC-11225

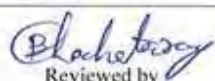
WCS/LQR/60
Report No.
NABL ULR No.
Name of the Client
Address
Sampling Location
Sample Description
Sampling Plan & Method
Environmental Condition
Sample Collected by
Date of Testing

TEST REPORT

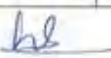
Issue Date : 27.08.2024
WCS240820A
TC11225240000000143F
Raikela Iron Ore Mines (M/S Geetarani Mohanty)
Raikela, Near Tensa, P.O.-Dengula, Dist- Sundargarh- 770048, Odisha
Office Bore Well (Inside Mines Office)
Ground Water
WCS/QSP/SAMP (WATER)
Temperature 29°C, Clear Weather
WCS Laboratory
20.08.2024 to 26.08.2024

Date of Sampling : 17.08.2024
Date of Receiving : 19.08.2024
Sample ID No : WCS2408W13A
Quantity of Sample : 1 Ltr
Sample Condition : Good

Sl. No.	Parameter	Unit	Result	Requirement as per IS 10500:2012 Reaffirmed 2018	Test Methods
1	Colour	Hazen	1	Max, 5	IS 3025 (Part-4): 2021
2	Odour	--	Agreeable	Agreeable	IS 3025 (Part-5): 2018
3	pH Value	--	6.523	6.5-8.5	IS 3025 (Part-11): 2022
4	Turbidity	NTU	0.2	1	IS 3025 (Part-10): 1984 RA 2017
5	Total Dissolved Solid as TDS	mg/l	99.0	500	IS 3025 (Part-16): 1984 RA 2017
6	Ammonia as Total ammonia-N	mg/l	0.47	0.5	IS 3025 (Part-34): 1988 RA 2019
7	Calcium as Ca	mg/l	12.83	75	IS 3025 (Part-40): 1991 RA 2019
8	Chloride as Cl	mg/l	12.0	250	IS 3025(Part-32): 1988 RA 2019
9	Fluoride as F	mg/l	0.14	1.0	APHA 24 th Ed. (4500-F-D): 2023
10	Iron as Fe	mg/l	0.46	1.0	IS 3025 (Part -53): 2003 RA 2019
11	Magnesium as Mg	mg/l	2.43	30	APHA 24 th Ed. (3500-Mg-B): 2023
12	Nitrate as NO3	mg/l	2.32	45	APHA 24 th Ed. (4500-NO3-B): 2023
13	Sulphate as SO4	mg/l	1.68	200	IS 3025 (Part-24 Sec 1):2022
14	Total Alkalinity as CaCO3	mg/l	30.0	200	IS 3025 (Part-23): 1986 RA 2019
15	Total Hardness as CaCO3	mg/l	42.0	200	IS 3025 (Part-21): 2009 RA 2019
16	Total Chromium as Cr	mg/l	<0.02	0.05	IS 3025 (Part-52): 2003 RA 2019
17	Potassium as K	mg/l	23.6	--	IS 3025 (Part-45): 1993 RA 2019
18	Sodium as Na	mg/l	12.5	--	IS 3025 (Part-45): 1993 RA 2019
19	Total Suspended Solid as TSS	mg/l	<5	--	IS 3025 (Part-17): 2022
20	Total Coliform	MPN/100 ml	<2	Shall not be detectable in any 100 ml sample	IS 1622 : 1981 RA 2019



Reviewed by
(Mr. Bijaya Kumar Chahataray)



Authorized Signatory for Microbiological
(Miss. Laxmi Sahoo)



Authorized Signatory for Chemical
(Mr. Pradeep Mohapatra)

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TEST REPORT

Report No. : WCS240820A Issue Date : 27.08.2024
Name of the Client : Raikela Iron Ore Mines (M/S Geetarani Mohanty)
Address : Raikela, Near Tensa, P.O.-Dengula, Dist- Sundargarh- 770048, Odisha
Sampling Location : Office Bore Well (Inside Mines Office)
Sample Description : Ground Water Date of Sampling : 17.08.2024
Sampling Plan & Method : WCS/QSP/SAMP (WATER) Date of Receiving : 19.08.2024
Environmental Condition : Temperature 29°C, Clear Weather Sample ID No : WCS2408W13A
Sample Collected by : WCS Laboratory Quantity of Sample : 1 Ltr
Date of Testing : 20.08.2024 to 26.08.2024 Sample Condition : Good

Sl. No.	Parameter	Unit	Result	Requirement as per IS 10500:2012 Reaffirmed 2018	Test Methods
21	Aluminium as Al	mg/l	<0.02	0.03	IS 3025 (Part 55): 2003 RA 2019
22	Anionic detergents as MBAS	mg/l	<0.02	0.2	Annex K of IS 13428
23	Barium as Ba	mg/l	<0.1	0.7	Annex F of IS 13428* or IS 15302
24	Boron as B	mg/l	<0.1	0.5	IS 3025 (Part 57): 2021
25	Chloramines as Cl ₂	mg/l	<0.02	4.0	IS 3025 (Part 26) * or APHA 4500-Cl ₂ G
26	Copper as Cu	mg/l	<0.01	0.05	IS 3025 (Part 42): 1992 RA 2019
27	Manganese as Mn	mg/l	<0.05	0.1	IS 3025 (Part 59): 2006 RA 2017
28	Mineral oil	mg/l	<0.5	1.0	Clause 6 of IS 3025 (Part 39): 2021
29	Phenolic compounds as C ₆ H ₅ OH	mg/l	<0.001	0.001	IS 3025 (Part 43): 1992 RA 2019
30	Selenium as Se	mg/l	<0.001	0.01	IS 3025 (Part 56): 2003 RA 2019 or IS 15303*
31	Silver as Ag	mg/l	<0.02	0.1	Annex J of IS 13428
32	Sulphide as H ₂ S	mg/l	<0.05	0.05	IS 3025 (Part 29): 1986 RA 2019
33	Zinc as Zn	mg/l	<0.05	5	IS 3025 (Part 49): 1994 RA 2019
34	Cadmium as Cd	mg/l	<0.001	0.003	IS 3025 (Part 41): 1992 RA 2019
35	Cyanide as CN	mg/l	<0.01	0.05	IS 3025 (Part 27): 1986 RA 2019
36	Lead as Pb	mg/l	<0.001	0.01	IS 3025 (Part 47): 1994 RA 2019
37	Mercury as Hg	mg/l	<0.001	0.001	IS 3025 (Part 48): 1994 RA 2019
38	Molybdenum as Mo	mg/l	<0.02	0.07	IS 3025 (Part 2):
39	Nickel as Ni	mg/l	<0.01	0.02	IS 3025 (Part 54): 2003 RA 2019
40	Polynuclear aromatic hydrocarbons as PAH	mg/l	0.0001	0.0001	APHA 6440
41	Total arsenic as As	mg/l	<0.01	0.01	IS 3025 (Part 37): 2022

Chahataray
Reviewed by
(Mr. Bijaya Kumar Chahataray)

Authorized Signatory
(Mr. Pradeep Mohapatra)



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TEST REPORT

Report No. : WCS240820B Issue Date : 27.08.2024
NABL ULR No. : TC1122524000000143F
Name of the Client : Raikela Iron Ore Mines (M/S Geetarani Mohanty)
Address : Raikela, Near Tensa, P.O.-Dengula, Dist- Sundargarh- 770048, Odisha
Sampling Location : Tensa Tube Well
Sample Description : Ground Water Date of Sampling : 17.08.2024
Sampling Plan & Method : WCS/QSP/SAMP (WATER) Date of Receiving : 19.08.2024
Environmental Condition : Temperature 29°C, Clear Weather Sample ID No : WCS2408W13B
Sample Collected by : WCS Laboratory Quantity of Sample : 1 Ltr
Date of Testing : 20.08.2024 to 26.08.2024 Sample Condition : Good

Sl. No.	Parameter	Unit	Result	Requirement as per IS 10500:2012 Reaffirmed 2018	Test Methods
1	Colour	Hazen	1	Max, 5	IS 3025 (Part-4): 2021
2	Odour	--	Agreeable	Agreeable	IS 3025 (Part-5): 2018
3	pH Value	--	6.39	6.5-8.5	IS 3025 (Part-11): 2022
4	Turbidity	NTU	0.3	1	IS 3025 (Part-10): 1984 RA 2017
5	Total Dissolved Solid as TDS	mg/l	119.0	500	IS 3025 (Part-16): 1984 RA 2017
6	Ammonia as Total ammonia-N	mg/l	0.27	0.5	IS 3025 (Part-34): 1988 RA 2019
7	Calcium as Ca	mg/l	21.64	75	IS 3025 (Part-40): 1991 RA 2019
8	Chloride as Cl	mg/l	17.49	250	IS 3025(Part-32): 1988 RA 2019
9	Fluoride as F	mg/l	0.24	1.0	APHA 24 th Ed. (4500-F-D): 2023
10	Iron as Fe	mg/l	0.62	1.0	IS 3025 (Part-53): 2003 RA 2019
11	Magnesium as Mg	mg/l	5.35	30	APHA 24 th Ed. (3500-Mg-B): 2023
12	Nitrate as NO ₃	mg/l	1.3	45	APHA 24 th Ed. (4500-NO ₃ -B): 2023
13	Sulphate as SO ₄	mg/l	2.45	200	IS 3025 (Part-24 Sec 1): 2022
14	Total Alkalinity as CaCO ₃	mg/l	50.0	200	IS 3025 (Part-23): 1986 RA 2019
15	Total Hardness as CaCO ₃	mg/l	74.0	200	IS 3025 (Part-21): 2009 RA 2019
16	Total Chromium as Cr	mg/l	<0.02	0.05	IS 3025 (Part-52): 2003 RA 2019
17	Potassium as K	mg/l	23.6	--	IS 3025 (Part-45): 1993 RA 2019
18	Sodium as Na	mg/l	8.3	--	IS 3025 (Part-45): 1993 RA 2019
19	Total Suspended Solid as TSS	mg/l	<5	--	IS 3025 (Part-17): 2022
20	Total Coliform	MPN/100 ml	<2	Shall not be detectable in any 100 ml sample	IS 1622: 1981 RA 2019

Reviewed by
(Mr. Bijaya Kumar Chahataray)

Authorized Signatory for Microbiological
(Miss. Laxmi Sahoo)

Authorized Signatory for Chemical
(Mr. Pradeept Mohapatra)

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TEST REPORT

Report No. : WCS240820B Issue Date : 27.08.2024
Name of the Client : Raikela Iron Ore Mines (M/S Geetarani Mohanty)
Address : Raikela, Near Tensa, P.O.-Dengula, Dist- Sundergarh- 770048, Odisha
Sampling Location : Tensa Tube Well
Sample Description : Ground Water Date of Sampling : 17.08.2024
Sampling Plan & Method : WCS/QSP/SAMP (WATER) Date of Receiving : 19.08.2024
Environmental Condition : Temperature 29°C, Clear Weather Sample ID No : WCS2408W13B
Sample Collected by : WCS Laboratory Quantity of Sample : 1 Ltr
Date of Testing : 20.08.2024 to 26.08.2024 Sample Condition : Good

Sl. No.	Parameter	Unit	Result	Requirement as per IS 10500:2012 Reaffirmed 2018	Test Methods
21	Aluminium as Al	mg/l	<0.02	0.03	IS 3025 (Part 55) : 2003 RA 2019
22	Anionic detergents as MBAS	mg/l	<0.02	0.2	Annex K of IS 13428
23	Barium as Ba	mg/l	<0.1	0.7	Annex F of IS 13428* or IS 15302
24	Boron as B	mg/l	<0.1	0.5	IS 3025 (Part 57) : 2021
25	Chloramines as Cl ₂	mg/l	<0.02	4.0	IS 3025 (Part 26)* or APHA 4500-Cl G
26	Copper as Cu	mg/l	<0.01	0.05	IS 3025 (Part 42) : 1992 RA 2019
27	Manganese as Mn	mg/l	<0.05	0.1	IS 3025 (Part 59) : 2006 RA 2017
28	Mineral oil	mg/l	<0.5	1.0	Clause 6 of IS 3025 (Part 39) : 2021
29	Phenolic compounds as C ₆ H ₅ OH	mg/l	<0.001	0.001	IS 3025 (Part 43) : 1992 RA 2019
30	Selenium as Se	mg/l	<0.001	0.01	IS 3025 (Part 56):2003 RA 2019 or IS 15303*
31	Silver as Ag	mg/l	<0.02	0.1	Annex J of IS 13428
32	Sulphide as H ₂ S	mg/l	<0.05	0.05	IS 3025 (Part 29) : 1986 RA 2019
33	Zinc as Zn	mg/l	<0.05	5	IS 3025 (Part 49) : 1994 RA 2019
34	Cadmium as Cd	mg/l	<0.001	0.003	IS 3025 (Part 41) : 1992 RA 2019
35	Cyanide as CN	mg/l	<0.01	0.05	IS 3025 (Part 27) : 1986 RA 2019
36	Lead as Pb	mg/l	<0.001	0.01	IS 3025 (Part 47) : 1994 RA 2019
37	Mercury as Hg	mg/l	<0.001	0.001	IS 3025 (Part 48) : 1994 RA 2019
38	Molybdenum as Mo	mg/l	<0.02	0.07	IS 3025 (Part 2) :
39	Nickel as Ni	mg/l	<0.01	0.02	IS 3025 (Part 54) : 2003 RA 2019
40	Polynuclear aromatic hydrocarbons as PAH	mg/l	0.0001	0.0001	APHA 6440
41	Total arsenic as As	mg/l	<0.01	0.01	IS 3025 (Part 37) : 2022

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Reviewed by
(Mr. Bijaya Kumar Chahataray)

Authorized Signatory
(Mr. Pradeep Mohapatra)



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TEST REPORT

Report No. : WCS240820C Issue Date : 27.08.2024
NABL ULR No. : TC1122524000000143F
Name of the Client : **Raikela Iron Ore Mines (M/S Geetarani Mohanty)**
Address : Raikela, Near Tensa, P.O.-Dengula, Dist- Sundargarh- 770048, Odisha
Sampling Location : **Tentulidihi Dug Well**
Sample Description : Ground Water Date of Sampling : 17.08.2024
Sampling Plan & Method : WCS/QSP/SAMP (WATER) Date of Receiving : 19.08.2024
Environmental Condition : Temperature 29°C, Clear Weather Sample ID No : WCS2408W13C
Sample Collected by : WCS Laboratory Quantity of Sample : 1 Ltr
Date of Testing : 20.08.2024 to 26.08.2024 Sample Condition : Good

Sl. No.	Parameter	Unit	Result	Requirement as per IS 10500:2012 Reaffirmed 2018	Test Methods
1	Colour	Hazen	1	Max, 5	IS 3025 (Part-4): 2021
2	Odour	--	Agreeable	Agreeable	IS 3025 (Part-5): 2018
3	pH Value	--	6.9	6.5-8.5	IS 3025 (Part-11): 2022
4	Turbidity	NTU	0.5	1	IS 3025 (Part-10): 1984 RA 2017
5	Total Dissolved Solid as TDS	mg/l	126.0	500	IS 3025 (Part-16): 1984 RA 2017
6	Ammonia as Total ammonia-N	mg/l	0.28	0.5	IS 3025 (Part-34): 1988 RA 2019
7	Calcium as Ca	mg/l	15.23	75	IS 3025 (Part-40): 1991 RA 2019
8	Chloride as Cl	mg/l	12.0	250	IS 3025 (Part-32): 1988 RA 2019
9	Fluoride as F	mg/l	0.28	1.0	APHA 24 th Ed. (4500-F-D): 2023
10	Iron as Fe	mg/l	0.52	1.0	IS 3025 (Part-53): 2003 RA 2019
11	Magnesium as Mg	mg/l	3.4	30	APHA 24 th Ed. (3500-Mg-B): 2023
12	Nitrate as NO ₃	mg/l	2.67	45	APHA 24 th Ed. (4500-NO ₃ -B): 2023
13	Sulphate as SO ₄	mg/l	3.56	200	IS 3025 (Part-24 Sec 1): 2022
14	Total Alkalinity as CaCO ₃	mg/l	35.0	200	IS 3025 (Part-23): 1986 RA 2019
15	Total Hardness as CaCO ₃	mg/l	58.0	200	IS 3025 (Part-21): 2009 RA 2019
16	Total Chromium as Cr	mg/l	<0.02	0.05	IS 3025 (Part-52): 2003 RA 2019
17	Potassium as K	mg/l	11.8	--	IS 3025 (Part-45): 1993 RA 2019
18	Sodium as Na	mg/l	22.5	--	IS 3025 (Part-45): 1993 RA 2019
19	Total Suspended Solid as TSS	mg/l	<5	--	IS 3025 (Part-17): 2022
20	Total Coliform	MPN/100 ml	<2	Shall not be detectable in any 100 ml sample	IS 1622: 1981 RA 2019

Bhahataray
Reviewed by
(Mr. Bijaya Kumar Chahataray)

hl
Authorized Signatory for Microbiological
(Miss. Laxmi Sahoo)

Pradeep
Authorized Signatory for Chemical
(Mr. Pradeep Mohapatra)

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TEST REPORT

Report No. : WCS240820C Issue Date : 27.08.2024
Name of the Client : Raikela Iron Ore Mines (M/S Geetarani Mohanty)
Address : Raikela, Near Tensa, P.O.-Dengula, Dist- Sundargarh- 770048, Odisha
Sampling Location : Tentulidihi Dug Well
Sample Description : Ground Water Date of Sampling : 17.08.2024
Sampling Plan & Method : WCS/QSP/SAMP (WATER) Date of Receiving : 19.08.2024
Environmental Condition : Temperature 29°C, Clear Weather Sample ID No : WCS2408W13C
Sample Collected by : WCS Laboratory Quantity of Sample : 1 Ltr
Date of Testing : 20.08.2024 to 26.08.2024 Sample Condition : Good

Sl. No.	Parameter	Unit	Result	Requirement as per IS 10500:2012 Reaffirmed 2018	Test Methods
21	Aluminium as Al	mg/l	<0.02	0.03	IS 3025 (Part 55) : 2003 RA 2019
22	Anionic detergents as MBAS	mg/l	<0.02	0.2	Annex K of IS 13428
23	Barium as Ba	mg/l	<0.1	0.7	Annex F of IS 13428* or IS 15302
24	Boron as B	mg/l	<0.1	0.5	IS 3025 (Part 57) : 2021
25	Chloramines as Cl ₂	mg/l	<0.02	4.0	IS 3025 (Part 26)* or APHA 4500-Cl ₂ G
26	Copper as Cu	mg/l	<0.01	0.05	IS 3025 (Part 42) : 1992 RA 2019
27	Manganese as Mn	mg/l	<0.05	0.1	IS 3025 (Part 59) : 2006 RA 2017
28	Mineral oil	mg/l	<0.5	1.0	Clause 6 of IS 3025 (Part 39) : 2021
29	Phenolic compounds as C ₆ H ₅ OH	mg/l	<0.001	0.001	IS 3025 (Part 43) : 1992 RA 2019
30	Selenium as Se	mg/l	<0.001	0.01	IS 3025 (Part 56) : 2003 RA 2019 or IS 15303*
31	Silver as Ag	mg/l	<0.02	0.1	Annex J of IS 13428
32	Sulphide as H ₂ S	mg/l	<0.05	0.05	IS 3025 (Part 29) : 1986 RA 2019
33	Zinc as Zn	mg/l	<0.05	5	IS 3025 (Part 49) : 1994 RA 2019
34	Cadmium as Cd	mg/l	<0.001	0.003	IS 3025 (Part 41) : 1992 RA 2019
35	Cyanide as CN	mg/l	<0.01	0.05	IS 3025 (Part 27) : 1986 RA 2019
36	Lead as Pb	mg/l	<0.001	0.01	IS 3025 (Part 47) : 1994 RA 2019
37	Mercury as Hg	mg/l	<0.001	0.001	IS 3025 (Part 48) : 1994 RA 2019
38	Molybdenum as Mo	mg/l	<0.02	0.07	IS 3025 (Part 2) :
39	Nickel as Ni	mg/l	<0.01	0.02	IS 3025 (Part 54) : 2003 RA 2019
40	Polynuclear aromatic hydrocarbons as PAH	mg/l	0.0001	0.0001	APHA 6440
41	Total arsenic as As	mg/l	<0.01	0.01	IS 3025 (Part 37) : 2022

Chahataray
Reviewed by
(Mr. Bijaya Kumar Chahataray)

Pradeep Mohan
Authorized Signatory
(Mr. Pradeep Mohan)



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TEST REPORT

Report No. : WCS240821A Issue Date : 27.08.2024
NABL ULR No. : TC1122524000000144F
Name of the Client : **Raikela Iron Ore Mines (M/S Geetarani Mohanty)**
Address : Raikela, Near Tensa, P.O.-Dengula, Dist- Sundargarh- 770048, Odisha
Sampling Location : **Karo nala Down stream**
Sample Description : Surface Water Date of Sampling : 17.08.2024
Sampling Plan & Method : WCS/QSP/SAMP (WATER) Date of Receiving : 19.08.2024
Environmental Condition : Temperature 29°C, Clear Weather Sample ID No : WCS2408W14A
Sample Collected by : WCS Laboratory Quantity of Sample : 1 Ltr
Date of Testing : 20.08.2024 to 26.08.2024 Sample Condition : Good

Sl. No.	Parameter	Unit	Result	Test Methods
1	Odour	--	Agreeable	IS 3025 (Part-5): 2018
2	Colour	Hazen	4	IS 3025 (Part-4): 2021
3	pH Value	--	6.89	IS 3025 (Part-11): 2022
4	Specific Conductivity	µs/cm	167.0	IS 3025 (Part-14): 2013
5	Dissolve Oxygen as DO	mg/l	5.9	IS 3025 (Part-38): 1989
6	Chemical Oxygen Demand as COD	mg/l	4.0	IS 3025 (Part-58): 2006
7	Biochemical Oxygen Demand as BOD	mg/l	2.1	IS 3025 (Part-44): 1993
8	Total Suspended Solid as TSS	mg/l	13.0	IS 3025 (Part-17): 2022
9	Oil & Grease	mg/l	<4	APHA 24 th Ed. (5520-B): 2023
10	Total Hardness as CaCO ₃	mg/l	34.0	APHA 24 th Ed. (2340-C): 2023
11	Chloride as Cl	mg/l	16.0	IS 3025 (Part-32): 1988
12	Sulphate as SO ₄	mg/l	18.02	IS 3025 (Part-24, Sec-1): 2022
13	Nitrate as NO ₃	mg/l	2.7	APHA 24 th Ed. (4500-NO ₃ -B): 2023
14	Fluoride as F	mg/l	0.05	APHA 24 th Ed. (4500-F-D): 2023
15	Calcium as Ca	mg/l	12.83	APHA 24 th Ed. (3500-Ca-B): 2023
16	Magnesium as Mg	mg/l	0.49	APHA 24 th Ed. (3500-Mg-B): 2023
17	Iron as Fe	mg/l	0.46	IS 3025 (Part-53): 2003
18	Total Dissolved Solid as TDS	mg/l	135.0	IS 3025 (Part-16): 1984
19	Total Coliform	MPN/100 ml	280.0	IS 1622 : 1981

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(Miss. Laxmi Sahoo)

Pradept
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(Mr. Pradept Mohanty)

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TEST REPORT

Report No. : WCS240821B Issue Date : 27.08.2024
NABL ULR No. : TC1122524000000144F
Name of the Client : **Raikela Iron Ore Mines (M/S Geetarani Mohanty)**
Address : Raikela, Near Tensa, P.O.-Dengula, Dist- Sundargarh- 770048, Odisha
Sampling Location : **Tantara Pond**
Sample Description : Surface Water Date of Sampling : 17.08.2024
Sampling Plan & Method : WCS/QSP/SAMP (WATER) Date of Receiving : 19.08.2024
Environmental Condition : Temperature 29°C, Clear Weather Sample ID No : WCS2408W14B
Sample Collected by : WCS Laboratory Quantity of Sample : 1 Ltr
Date of Testing : 20.08.2024 to 26.08.2024 Sample Condition : Good

Sl. No.	Parameter	Unit	Result	Test Methods
1	Odour	—	Agreeable	IS 3025 (Part-5): 2018
2	Colour	Hazen	4	IS 3025 (Part-4): 2021
3	pH Value	—	7.213	IS 3025 (Part-11): 2022
4	Specific Conductivity	µs/cm	126.0	IS 3025 (Part-14): 2013
5	Dissolve Oxygen as DO	mg/l	6.1	IS 3025 (Part-38): 1989
6	Chemical Oxygen Demand as COD	mg/l	3.0	IS 3025 (Part-58): 2006
7	Biochemical Oxygen Demand as BOD	mg/l	2.3	IS 3025 (Part-44): 1993
8	Total Suspended Solid as TSS	mg/l	25.0	IS 3025 (Part-17): 2022
9	Oil & Grease	mg/l	<4	APHA 24 th Ed. (5520-B): 2023
10	Total Hardness as CaCO ₃	mg/l	64.0	APHA 24 th Ed. (2340-C): 2023
11	Chloride as Cl	mg/l	15.0	IS 3025 (Part-32): 1988
12	Sulphate as SO ₄	mg/l	2.54	IS 3025 (Part-24, Sec-1): 2022
13	Nitrate as NO ₃	mg/l	1.37	APHA 24 th Ed. (4500-NO ₃ -B): 2023
14	Fluoride as F	mg/l	0.03	APHA 24 th Ed. (4500-F-D): 2023
15	Calcium as Ca	mg/l	22.44	APHA 24 th Ed. (3500-Ca-B): 2023
16	Magnesium as Mg	mg/l	1.94	APHA 24 th Ed. (3500-Mg-B): 2023
17	Iron as Fe	mg/l	0.272	IS 3025 (Part-53): 2003
18	Total Dissolved Solid as TDS	mg/l	82.0	IS 3025 (Part-16): 1984
19	Total Coliform	MPN/100 ml	140.0	IS 1622 : 1981

Reviewed by
(Mr. Bijaya Kumar Chahataray)

Authorized Signatory for Microbiological
(Miss. Laxmi Sahoo)

Authorized Signatory for Chemical
(Mr. Pradeep Mohapatra)

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TEST REPORT

Report No. : WCS240807 Issue Date : 14.08.2024
NABL ULR No. : TC11225240000000131F
Name of the Client : Raikela Iron Ore Mines (M/S Geetarani Mohanty)
Address : Raikela, Near Tensa, P.O.-Dengula, Dist- Sundargarh- 770048, Odisha
Sampling Location : ETP Out-Let
Sample Description : Waste Water Date of Sampling : 05.08.2024
Sampling Plan & Method : WCS/QSP/SAMP (WATER) Date of Receiving : 07.08.2024
Environmental Condition : Temperature 29°C, Clear Weather Sample ID No : WCS2408W01
Sample Collected by : WCS Laboratory Quantity of Sample : 1 Ltr
Date of Testing : 07.08.2024 to 12.08.2024 Sample Condition : Good

Sl. No.	Parameter	Unit	Result	Requirement as per The Environment (Protection) Amendment Rules, 2015, Into inland surface water	Test Methods
1	pH Value	--	7.4	6.0 to 9.0	IS 3025 (Part-11): 2022
2	Biochemical Oxygen Demand as BOD ₅ , 27°C	mg/l	8.2	30 (Max)	IS 3025 (Part-44): 1993
3	Chemical Oxygen Demand as COD	mg/l	23.2	250 (Max)	APHA 24 th Ed. (5220-D): 2023
4	Total Suspended Solid	mg/l	26.3	100 (Max)	IS 3025 (Part-17): 2022
5	Total Dissolved Solid as TDS	mg/l	264	2100 (Max)	IS 3025 (Part-16): 1984
6	Oil & Grease	mg/l	4.2	10 (Max)	APHA 24 th Ed. (5520-B): 2023


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Authorized Signatory
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TEST REPORT

Report No. : WCS240808 Issue Date : 14.08.2024
NABL ULR No. : TC11225240000000132F
Name of the Client : **Raikela Iron Ore Mines (M/S Geetarani Mohanty)**
Address : Raikela, Near Tensa, P.O.-Dengula, Dist- Sundergarh- 770048, Odisha
Sampling Location : **STP Out-Let**
Sample Description : Waste Water Date of Sampling : 05.08.2024
Sampling Plan & Method : WCS/QSP/SAMP (WATER) Date of Receiving : 07.08.2024
Environmental Condition : Temperature 28°C, Clear Weather Sample ID No : WCS2408W02
Sample Collected by : WCS Laboratory Quantity of Sample : 1 Ltr
Date of Testing : 07.08.2024 to 12.08.2024 Sample Condition : Good

Sl. No.	Parameter	Unit	Result	Requirement as per MoEF & CC, Govt. of India Vide G.S.R. 1265 (E), dated 13.10.2017	Test Methods
1	pH Value	--	7.5	6.5-9.0	IS 3025 (Part-11): 2022
2	Biochemical Oxygen Demand as BOD ₅ , 27°C	mg/l	15.1	30	IS 3025 (Part-44): 1993
3	Chemical Oxygen Demand as COD	mg/l	44.0	<100	APHA 24 th Ed. (5220-D): 2023
4	Total Suspended Solid	mg/l	25.5	--	IS 3025 (Part-17): 2022
5	Total Dissolved Solid as TDS	mg/l	240.0	--	IS 3025 (Part-16): 1984
6	Oil & Grease	mg/l	<4	--	APHA 24 th Ed. (5520-B): 2023
7	Faecal Coliform	MPN/ 100 ml	350.0	<1000	IS 1622 : 1981 RA 2019

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TEST REPORT

Report No. : WCS240823 Issue Date : 27.08.2024
NABL ULR No. : TC1122524000000146F
Name of the Client : **Raikela Iron Ore Mines (M/S Geetarani Mohanty)**
Address : Raikela, Near Tensa, P.O.-Dengula, Dist- Sundargarh- 770048, Odisha
Sampling Location : **STP Out-Let**
Sample Description : Waste Water Date of Sampling : 17.08.2024
Sampling Plan & Method : WCS/QSP/SAMP (WATER) Date of Receiving : 19.08.2024
Environmental Condition : Temperature 29°C, Clear Weather Sample ID No : WCS2408W16
Sample Collected by : WCS Laboratory Quantity of Sample : 1 Ltr
Date of Testing : 20.08.2024 to 26.08.2024 Sample Condition : Good

Sl. No.	Parameter	Unit	Result	Requirement as per MoEF&CC, Govt. of India Vide G.S.R. 1265 (E.), dated 13.10.2017	Test Methods
1	pH Value	~	7.75	6.5-9.0	IS 3025 (Part-11): 2022
2	Biochemical Oxygen Demand as BOD ₅ , 270C	mg/l	17.2	30	IS 3025 (Part-44): 1993
3	Chemical Oxygen Demand as COD	mg/l	47.0	<100	APHA 24th Ed. (5220-D): 2023
4	Total Suspended Solid	mg/l	24.8	--	IS 3025 (Part-17): 2022
5	Total Dissolved Solid as TDS	mg/l	252.0	--	IS 3025 (Part-16): 1984
7	Oil & Grease	mg/l	<4	--	APHA 24th Ed. (5520-B): 2023
8	Faecal Coliform	MPN/ 100 ml	900.0	<1000	IS 1622 : 1981 RA 2019

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TEST REPORT

Report No. : WCS240809 Issue Date : 14.08.2024
NABL ULR No. : TC11225240000000133F
Name of the Client : Raikela Iron Ore Mines (M/S Geetarani Mohanty)
Address : Raikela, Near Tensa, P.O.-Dengula, Dist- Sundargarh- 770048, Odisha
Sampling Location : Surface Run off
Sample Description : Surface Water Date of Sampling : 05.08.2024
Sampling Plan & Method : WCS/QSP/SAMP (WATER) Date of Receiving : 07.08.2024
Environmental Condition : Temperature 28°C, Clear Weather Sample ID No : WCS2408W03
Sample Collected by : WCS Laboratory Quantity of Sample : 1 Ltr
Date of Testing : 07.08.2024 to 12.08.2024 Sample Condition : Good

Sl. No.	Parameter	Unit	Result	Requirement as per The Environment (Protection) Amendment Rules, 2015, Into inland surface water	Test Methods
1	pH Value	---	6.548	6.0 to 9.0	IS 3025 (Part-11): 2022
2	Total Suspended Solid	mg/l	76.0	100 (Max)	IS 3025 (Part-17): 2022
3	Total Dissolved Solid as TDS	mg/l	305.0	2100 (Max)	IS 3025 (Part-16): 1984
4	Oil & Grease	mg/l	<4.0	10 (Max)	APHA 23rd Ed (5520-B): 2017

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(Mr. Pradeep Mohapatra)

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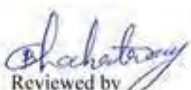
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Report No. : WCS240824 Issue Date : 27.08.2024
NABL ULR No. : TC1122524000000147F
Name of the Client : **Raikela Iron Ore Mines (M/S Geetarani Mohanty)**
Address : Raikela, Near Tensa, P.O.-Dengula, Dist- Sundargarh- 770048, Odisha
Sampling Location : **Surface Run off**
Sample Description : Surface Water Date of Sampling : 17.08.2024
Sampling Plan & Method : WCS/QSP/SAMP (WATER) Date of Receiving : 19.08.2024
Environmental Condition : Temperature 29°C, Clear Weather Sample ID No : WCS2408W17
Sample Collected by : WCS Laboratory Quantity of Sample : 1 Ltr
Date of Testing : 20.08.2024 to 26.08.2024 Sample Condition : Good

SL No.	Parameter	Unit	Result	Requirement as per The Environment (Protection) Amendment Rules, 2015, Into inland surface water	Test Methods
1	pH Value	--	6.824	6.0 to 9.0	IS 3025 (Part-11): 2022
2	Total Suspended Solid	mg/l	69.0	100 (Max)	IS 3025 (Part-17): 2022
3	Total Dissolved Solid as TDS	mg/l	278.0	2100 (Max)	IS 3025 (Part-16): 1984
4	Oil &Grease	mg/l	<4.0	10 (Max)	APHA 23rd Ed. (5520-B): 2017


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Annexure 7: Water Level data of Piezometer within the Lease area

RAIKELA IRON ORE MINES OF M/S GEETARANI MOHANTY (Pre-Monsoon)				
PIEZOMETRIC DATA OF July-2024				
DATA	TIME	Ground Water Level (m)	Water Temperature (degC)	Barometric Pressure (hPa)
01-07-2024	06.00 AM	11.21	28.83	93.88
	06.00 PM	11.63	27.93	93.77
02-07-2024	06.00 AM	11.68	27.71	93.79
	06.00 PM	11.22	28.61	93.71
03-07-2024	06.00 AM	11.45	28.77	93.87
	06.00 PM	11.73	27.63	93.68
04-07-2024	06.00 AM	11.51	27.81	93.96
	06.00 PM	11.73	27.06	93.89
05-07-2024	06.00 AM	11.55	27.16	93.88
	06.00 PM	11.66	27.44	93.30
06-07-2024	06.00 AM	11.51	27.66	93.78
	06.00 PM	11.48	27.68	93.74
07-07-2024	06.00 AM	11.71	27.58	93.56
	06.00 PM	11.74	27.84	93.81
08-07-2024	06.00 AM	11.94	27.95	93.87
	06.00 PM	11.88	27.09	93.99
09-07-2024	06.00 AM	11.30	27.22	93.22
	06.00 PM	11.43	27.35	93.34
10-07-2024	06.00 AM	11.49	27.72	93.19
	06.00 PM	11.74	27.84	93.88
11-07-2024	06.00 AM	11.81	27.88	93.01
	06.00 PM	11.87	27.52	93.68
12-07-2024	06.00 AM	11.53	28.65	93.91
	06.00 PM	11.73	27.68	93.63
13-07-2024	06.00 AM	11.74	27.90	93.31
	06.00 PM	11.73	27.95	93.21
14-07-2024	06.00 AM	11.74	28.40	93.31
	06.00 PM	11.83	28.41	93.61
15-07-2024	06.00 AM	11.83	28.41	93.61
	06.00 PM	11.63	28.59	93.82
16-07-2024	06.00 AM	11.73	28.33	93.56
	06.00 PM	11.61	27.97	93.71
17-07-2024	06.00 AM	11.73	27.95	93.66
	06.00 PM	11.76	28.23	93.51
18-07-2024	06.00 AM	11.93	28.14	93.58
	06.00 PM	11.71	28.26	93.51
19-07-2024	06.00 AM	11.62	28.91	93.63

	06.00 PM	11.74	28.13	93.09
20-07-2024	06.00 AM	11.61	28.31	93.37
	06.00 PM	11.65	27.91	93.24
21-07-2024	06.00 AM	11.55	27.81	93.39
	06.00 PM	11.44	27.70	93.80
22-07-2024	06.00 AM	11.63	27.70	93.30
	06.00 PM	11.77	27.91	93.55
23-07-2024	06.00 AM	11.98	27.25	93.77
	06.00 PM	11.44	27.81	93.54
24-07-2024	06.00 AM	11.42	27.85	93.71
	06.00 PM	11.73	28.38	93.02
25-07-2024	06.00 AM	11.79	28.11	93.08
	06.00 PM	11.31	28.61	93.78
26-07-2024	06.00 AM	11.29	28.94	93.95
	06.00 PM	11.72	28.32	93.07
27-07-2024	06.00 AM	11.72	28.18	93.07
	06.00 PM	11.73	28.34	93.09
28-07-2024	06.00 AM	11.63	27.82	93.52
	06.00 PM	11.73	28.36	93.27
29-07-2024	06.00 AM	11.90	28.01	93.44
	06.00 PM	11.64	27.78	93.90
30-07-2024	06.00 AM	11.35	27.48	93.91
	06.00 PM	11.78	28.90	93.82
31-07-2024	06.00 AM	11.73	27.60	93.48
	06.00 PM	11.74	28.14	93.59

RAIKELA IRON ORE MINES OF M/S GEETARANI MOHANTY (Monsoom)				
PIEZOMETRIC DATA OF August-2024				
DATA	TIME	Ground Water Level (m)	Water Temperature (degC)	Barometric Pressure (hPa)
01-08-2024	06.00 AM	11.79	27.93	93.68
	06.00 PM	11.74	28.38	93.39
02-08-2024	06.00 AM	11.78	28.31	93.37
	06.00 PM	11.16	27.42	93.66
03-08-2024	06.00 AM	11.24	27.61	93.72
	06.00 PM	11.23	27.88	93.46
04-08-2024	06.00 AM	11.79	27.92	93.39
	06.00 PM	11.73	28.14	93.93
05-08-2024	06.00 AM	11.76	28.07	93.09
	06.00 PM	11.22	28.62	93.63
06-08-2024	06.00 AM	11.59	27.53	93.44
	06.00 PM	11.53	28.11	93.28
07-08-2024	06.00 AM	11.73	28.67	93.73
	06.00 PM	11.73	28.24	93.71
08-08-2024	06.00 AM	11.76	28.32	93.87
	06.00 PM	11.77	28.44	93.91.00
09-08-2024	06.00 AM	11.83	28.52	93.86
	06.00 PM	11.73	28.02	94.00
10-08-2024	06.00 AM	11.91	27.71	94.11
	06.00 PM	11.91	28.25	94.17
11-08-2024	06.00 AM	11.64	27.57	94.11
	06.00 PM	11.66	27.70	94.80
12-08-2024	06.00 AM	11.50	27.58	94.84
	06.00 PM	11.75	27.60	94.79
13-08-2024	06.00 AM	11.77	28.08	94.58
	06.00 PM	11.51	28.12	94.22
14-08-2024	06.00 AM	11.55	28.59	93.16
	06.00 PM	11.81	27.82	93.91
15-08-2024	06.00 AM	11.16	27.66	93.53
	06.00 PM	11.11	27.18	93.56
16-08-2024	06.00 AM	11.25	27.41	93.61
	06.00 PM	11.35	27.63	93.77
17-08-2024	06.00 AM	11.55	27.61	93.94
	06.00 PM	11.74	28.34	94.03
18-08-2024	06.00 AM	11.66	28.01	94.14
	06.00 PM	11.61	28.31	94.22
19-08-2024	06.00 AM	11.82	28.55	94.81
	06.00 PM	11.11	28.45	94.56

20-08-2024	06.00 AM	11.75	28.55	94.62
	06.00 PM	11.75	27.65	94.12
21-08-2024	06.00 AM	11.88	27.50	94.26
	06.00 PM	11.41	28.66	94.76
22-08-2024	06.00 AM	11.13	28.53	94.65
	06.00 PM	11.35	28.88	94.91
23-08-2024	06.00 AM	11.59	28.55	94.82
	06.00 PM	11.40	27.55	94.75
24-08-2024	06.00 AM	11.65	27.88	94.40
	06.00 PM	11.78	27.87	94.05
25-08-2024	06.00 AM	11.75	28.10	93.96
	06.00 PM	11.52	28.22	93.99
26-08-2024	06.00 AM	11.26	28.36	93.56
	06.00 PM	11.31	28.79	93.91
27-08-2024	06.00 AM	11.12	28.41	93.61
	06.00 PM	11.35	28.56	93.77
28-08-2024	06.00 AM	11.38	27.78	94.22
	06.00 PM	11.24	27.62	94.70
29-08-2024	06.00 AM	11.56	27.62	94.86
	06.00 PM	11.82	28.35	94.12
30-08-2024	06.00 AM	11.65	28.40	94.18
	06.00 PM	11.48	28.60	94.44
31-08-2024	06.00 AM	11.74	27.61	93.90
	06.00 PM	11.74	27.89	93.78

RAIKELA IRON ORE MINES OF M/S GEETARANI MOHANTY (Monsoom)				
PIEZOMETRIC DATA OF September-2024				
DATA	TIME	Ground Water Level (m)	Water Temperature (degC)	Barometric Pressure (hPa)
01-09-2024	06.00 AM	11.28	27.42	93.45
	06.00 PM	11.29	27.77	93.45
02-09-2024	06.00 AM	11.55	27.75	94.1
	06.00 PM	11.42	27.78	93.78
03-09-2024	06.00 AM	11.55	27.45	93.42
	06.00 PM	11.70	27.62	93.65
04-09-2024	06.00 AM	11.62	27.80	93.54
	06.00 PM	11.58	27.85	93.24
05-09-2024	06.00 AM	11.38	27.46	94.00
	06.00 PM	11.42	27.22	93.24
06-09-2024	06.00 AM	11.40	27.41	93.48
	06.00 PM	11.52	27.36	93.41
07-09-2024	06.00 AM	11.35	27.63	93.46
	06.00 PM	11.29	27.77	93.45
08-09-2024	06.00 AM	11.62	27.75	93.55
	06.00 PM	11.75	28.41	93.62
09-09-2024	06.00 AM	11.85	28.49	93.46
	06.00 PM	11.53	27.71	93.41
10-09-2024	06.00 AM	11.65	27.80	93.55
	06.00 PM	11.26	27.84	93.66
11-09-2024	06.00 AM	11.86	27.85	93.32
	06.00 PM	11.75	28.46	93.87
12-09-2024	06.00 AM	11.74	27.64	94.00
	06.00 PM	11.46	27.15	93.82
13-09-2024	06.00 AM	11.69	28.28	93.59
	06.00 PM	11.75	28.34	93.78
14-09-2024	06.00 AM	11.74	28.07	93.68
	06.00 PM	11.74	28.14	93.64
15-09-2024	06.00 AM	11.78	27.92	93.78
	06.00 PM	11.75	27.78	93.41
16-09-2024	06.00 AM	11.88	27.58	93.34
	06.00 PM	12.00	27.74	93.35
17-09-2024	06.00 AM	11.76	27.74	93.81
	06.00 PM	11.21	28.91	93.55
18-09-2024	06.00 AM	11.71	27.63	93.91
	06.00 PM	11.36	28.12	93.82
19-09-2024	06.00 AM	11.74	27.71	94.19
	06.00 PM	11.74	28.27	93.96
20-09-2024	06.00 AM	11.83	27.80	94.12

	06.00 PM	11.82	27.88	94.23
21-09-2024	06.00 AM	11.09	28.15	93.33
	06.00 PM	11.75	28.42	94.02
22-09-2024	06.00 AM	11.85	28.44	94.22
	06.00 PM	11.77	27.88	94.22
23-09-2024	06.00 AM	11.45	27.60	94.41
	06.00 PM	11.41	27.74	94.71
24-09-2024	06.00 AM	11.45	27.55	94.81
	06.00 PM	11.74	27.72	93.76
25-09-2024	06.00 AM	11.83	27.88	93.87
	06.00 PM	11.79	28.38	93.10
26-09-2024	06.00 AM	11.51	27.81	93.63
	06.00 PM	11.39	28.93	93.29
27-09-2024	06.00 AM	11.62	27.46	93.73
	06.00 PM	11.74	28.35	93.93
28-09-2024	06.00 AM	11.82	28.42	93.27
	06.00 PM	11.74	28.35	93.76
29-09-2024	06.00 AM	11.78	28.12	94.39
	06.00 PM	11.74	28.38	94.49
30-09-2024	06.00 AM	11.96	28.15	94.58
	06.00 PM	11.71	27.59	94.44

RAIKELA IRON ORE MINES			
CSR ACTIVITIES FOR THE YEAR OF 2022-23 (April-23 to March-24)			
SL NO	NATURE OF PROJECT	DESCRIPTION OF THE ACTIVITY	TOTAL
1	SUPPORT FOR DRINKING WATER	Drilling of Bore well at Raikela Village.	397066
		3 nos. of Bore well have been installed at Raikela, Dengula & Kula Village. All Borewell maintence work had done. Which cost is mentioned in the cost column.	40000
		Drilling of Bore well at Raikela Village near Geetarani Chawk	116800
		Overhead water tank with water supply at Raikela Village.	571216
		Overhead water tank with water supply at Geetani Chowk Raikela	357122
2	SUPPORT FOR ELECTRICITY	We have provide electricity to the runnign pump for supply of drinking water at Raikela and Dengula village and making payments towards the electricity charges. The charges of electricity for the month of is mentioned in the cost column.	88295
3	SUPPORT TO HEALTH MEDICAL SERVICES	The patients of the local villages who are dependent on the dispensary for primary treatment. We are providing him primary treatment freely and provided medicines at free of cost. Ambulance services have been provided to the local villagers. The expenses towards medicine, maintenance & HSD cost of the ambulance is mentioned in the cost column.	721602
			0
			0
			0
		MEGA HEALTH CAMP	1020254
4	SUPPORT TO EDUCATION & SKILL DEVELOPMENT	5 nos. of teacher provided to Raikela Primary School and Dengula Govt. high school. The charges of the teacher is mentioned in the cost column.	562000
		The School bus has been provided to bring the children to the schools from the villages under Dengula Panchayat from their house and drop them back at the same. Total expenses towards maintenance and HSD cost is mentioned in the cost column.	398472
		Financial Asst. to a village poor girl (Ms. Pramila Naik) of Dengula Village for higher study	50000
5	SUPPORT TO COMMUNITY WELFARE	2 nos. tailoring training teacher provided to Raikela Tailoring Training Center and 1 nos. tailoring training teacher provided to Dengula Tailoring Training Center The charges of the is teacher mentioned in the cost coloumn.	145000
		Old age allowance provied to 4 nos. old man of Raikela village for their livelihood.	24000
		Dengula Shiva temple priest	112000
		One Driver engaged for Tehsil for smooth movement of Vehicle.	98000
		One Driver engaged for Tractor for Agriculture purpose for periphery village.	63832
		Distribution of Blankets to Raikela Villagers, Dengula Villagers	240398
6	SUPPORT TO INFRASTRUCTUR E	Drilling of Bore well at Serenda under CSR	1002000
		Bus Stop at Geetarani Chowk (Raikela)	303155
		Renovation work at Revenue IB, Bonai	491422
		Renovation of Raja Dharanidhara Club, Bonai (1st)	6074324
		Restoration of the AC street light system at Koira block office.	50410
		Water pipeline Maintainance work at Koira Block	84497
		Renovation of Raja Dharanidhara Club, Bonai (1st)	6074324
		Repairing work of Shade work at Tensa truck owner association, Tank, Plumbing work at Sub-collector office Bonai & paint work at Dengula forest office.	138752
		Brich & Shed work at Tensa for Rourkela Shramik Sangha	117800
			19342741

REPORT

On

Water Audit Study

At

**M/S GEETARANI MOHANTY RAIKELA
MINES**

Odisha

by



Resource Conservation & Management Division
Federation of Indian Chambers of Commerce and Industry
Federation House, Tansen Marg, New Delhi – 110 001

(December 2021)



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Federation of Indian Chambers of Commerce & Industry (FICCI) places on record its sincere thanks to **M/S GEETARANI MOHANTY RAIKELA MINES**, ODISHA for entrusting the task of conducting Resource Audit for “Water Audit Study” as per CGWA guidelines at M/S GEETARANI MOHANTY RAIKELA MINES Odisha during October 2021.

We hereby express our sincere thanks to **Mr Srinibash Sahoo , Mr Ajit Ratha., Miss Sonal Sahoo, Mr Sunit Patel. Mr B.B Sahoo and Mr Pradeept Mohapatra**, of **M/S GEETARANI MOHANTY RAIKELA MINES Odisha** , for their proactive support and courtesy extended to the FICCI team during field study. We also thank other officials from **M/S GEETARANI MOHANTY RAIKELA MINES Odisha** for their cooperation and support provided during data collection. We are also grateful to all those we interacted with during the audit who gave us some operational insights.

MA Patil

Sr. Director

RCM Group, FICCI

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ABBREVIATIONS

ETP	:	Effluent Treatment Plant
kW	:	Kilo Watt
kWh	:	Kilo Watt hour
lpcd	:	litres per capita per day
lpm	:	litres per minute
OHT	:	Overhead Tank
RWH	:	Rainwater Harvesting
RO	:	Reverse Osmosis
SWC	:	Specific Water Consumption

EXECUTIVE SUMMARY

FICCI has conducted a detailed Water Audit Study of the M/S GEETARANI MOHANTY RAIKELA MINES Odisha during October 2021. The study estimated that the total Water use by the mines is about 288 m³/day out of which about 48 % is fresh water and 11 % is recycled water. The main source of freshwater is supplied from groundwater by bore well. The plant consumes about 185m³ of groundwater as per 2020-21. The main water sources and their uses are given in Table below.

Table A: Details of Water Sourcing

S.No.	Source of Water	m ³ /day
1	Bore well Water	180.0
2	Rain water harvesting pond	88.0
2	STP Treated water	13.7
3	ETP Water	6.1
		288.0

The water is mainly used for Road Sprinkling for dust separation, Canteen domestic, Horticulture, Vehicle washing etc. The main water uses area are given in

The total wastewater generation in the plant is about 19.8m³/day, out of which about 11% (7.2m³/day) wastewater generated from Domestic and 4% (19m³/day) wastewater generated from vehicle wash. The breakup of wastewater generation from different sections is provided in below table. The detailed Water balance is discussed in the subsequent chapter.

Table C: Major Wastewater generating areas

S. No.	Major Sections	Wastewater discharged (m ³ /day)	Recycled/Discharge	(m ³ /day)
1	Domestic Use	19.5	Reused in Green Belt	8.2
2	Vehicle Wash	7.2	Reuse in dust suppression	11.5
	Total	26.7		19.7

Water Management Summary

Table 1 : Fact File of Raikela Iron ore mines of M/S GEETARANI MOHANTY

Plant Name and Location	Raikela Iron ore mines of M/S GEETARANI MOHANTY
Plant zone	Safe Zone
Depth of ground water table	91 meter
Type of products	Ore Extraction/Mining
No. of working days/year	300
Annual Production (2020 - Feb 2021)	-
Major Water Usage Area in the Plant	Road Sprinkling for dust separation, Canteen domestic, Horticulture, Vehicle washing etc.
Main Source of Freshwater and sourcing cost (Rs/m3)	Bore well- 180 m3/day & water cost rate Rs 1.00 /m3
Total annual Fresh Water consumption (2020-Feb21)	Bore well: 64010 m3/year
Total Water Use (Fresh water, Recycled RO Reject Water, CETP Treated Water) for Plant	❖ Fresh Bore well water – 120 m3/day ❖ Recycled use of treated water STP – 24 m3/day
Cost of Water at various water use areas	❖ Average Rate of abstraction of bore well water- Rs 1/ m3 ❖ Cost of water used for domestic use – Rs1/ m3 ❖ Cost of STP Treated water- Rs 3.55/ m3 ❖ Cost of ETP treated water- Rs 1.03/ m3
Annual water & wastewater management cost	Rs. 2.16 Lakhs/year
Average Effluent Generation in the STP and ETP generated and Reuse (m3/day)	15 m3/day in the STP & 19 m3/day in the ETP is treated
Power Supply Cost (2020-Jan21)	Rs. 6.50 kWh
Average Specific Water Consumption in M/S of Fresh water Use (2020-Jan 21)	

The water audit study of the plant has identified various water & cost saving opportunities which are discussed in the report. The summary of recommendations is given in table below. **It is estimated that by implementing FICCI suggested low & medium cost schemes; the plant can reduce its freshwater consumption.**

SUMMARY OF RECOMMENDATIONS

Sr. No	Section/Area	Recommendations
1.	Regularly calibrate & maintain existing water flow meters	It was observed that the existing bore well meter are installed and calibrated
2	Maintain logbook of daily ground water abstraction	It was observed that the plant is maintaining data of daily groundwater abstraction
3	Regular ground water quality monitoring and submission of data to CGWA:	The plant regularly checks the water quality of the Groundwater and submitting the reports to CGWA
4	Training and Awareness of the Employees at all Levels and Placing 'Water Saving' Posters/Slogans at various Locations	Mines is regularly conducting Training and Awareness of the Employees, events to promote water conservation like celebration of world water day, world environment day" and Placing 'Water Saving' Posters/Slogans at various Locations
5	Periodically conduct 'Water & Wastewater Audit'	Plant has formed a cell for assessment of potential for water & wastewater management in the plant for water saving & wastewater management.
6	Regular payment of applicable groundwater abstraction charges	The mines need to pay applicable ground water abstraction charges as per CGWA notification.
7	Ensure to comply with the NOC conditions to avoid any penalty	It is suggested that the mines should comply with the applicable NOC conditions to avoid any penalty.
8	Water Savings in the Buildings for Domestic Use	It is suggested to install following water efficient fixtures in the buildings to save domestic water consumption. Overall, 15-20% domestic water consumption
9	Install Drip Irrigation in the garden/horticulture area for efficient water use in landscaping/gardening	It is suggested that the plant should install Drip Irrigation system which is water efficient for gardening/ horticulture. The drip irrigation system will save 30-50% of water.

CHAPTER -1: INTRODUCTION

1. About the Plant: General Plant Details

Raikela iron ore mine over an area of 67.586Ha in village Raikela under Bonai Sub-Division of Sundargarh district was initially executed for a period of 20 years w.e.f. 02.07.1991 in favour of Smt. Geetarani Mohanty. The copy of the lease deed is attached as Annexure-I. On 03.02.1992 Smt. Geetarani Mohanty applied to the Government of Orissa for transfer of the mining lease in favour of the registered partnership firm i.e. M/s. Geetarani Mohanty. Government of Orissa, vide its proceeding dated 17/10/1992 accorded permission for transfer of the mining lease in favour of the partnership firm namely M/s. Geetarani Mohanty with previous approval of Govt. of India in terms of Rule 37 of the MC Rules, 1960. Transfer of Mining Lease Deed was executed on 13/01/1993 in statutory form 'O' under Rule 37 (A) of the MC Rules, 1960 by Smt. Geetarani Mohanty (individual Lessee) as Transferor with the State Govt, represented by Collector, Sundargarh, and the transferee M/s. Geetarani Mohanty, the Partnership Firm, represented by its Managing Partner Sri Srinibash Sahoo. As per the covenants of the transfer deed, after the transfer of the mining lease to the transferee, i.e., the partnership firm, the transferee became the lessee as if the lease had been granted to the transferee as the lessee there under and he had originally executed it such. (It is worth mentioning here that Smt. Geetarani Mohanty resigned from the partnership firm by tendering her resignation letter, acknowledging settlement of her books of accounts and executing a deed of retirement, thereby severing herself from all the activities of the partnership firm M/s. Geetarani Mohanty (hereinafter the lessee). The partnership firm, M/s. Geetarani Mohanty was reconstituted by induction of two new partners with the consent of Smt. Geetarani Mohanty. Since then the reconstituted partnership firm as lessee is carrying out mining operation over the lease hold area w.e.f. 01.04.1993.

The original term of mining lease was expired on 01.07.2011. Therefore, the lessee firm has filed the application on dated 20.05.2010 under Rule 24(A) (6) of M.C. Rules, 1960 before the State Government for its 1st Renewal of the Mining Lease for a period of 20 years w.e.f. 02.07.2011. (The copy of the RML application in form-J along with the Form-D is attached as Annexure-II. However, the 1st Renewal of mining lease application was pending before the State Government. In the meantime, the Mines and Minerals (Development and Regulation) Act, 1957 (in short MMDR Act, 1957) was amended by MMDR Amendment Act, 2015. It is pertinent to mention here that under section 8A(3) of the Amendment Act, 2015 the State Government in department of Steel & Mines has been pleased to extend the validity period of the mining lease up to 01.07.2041 being 50 years from the date of original mining lease i.e. from 02.07.1991 to 01.07.2041. A Copy of the said extension order dated 17.08.2015 is enclosed herewith for your kind perusal and reference as Annexure- III. It may be mentioned here that as per the order of Hon'ble Supreme Court of India in W.P (C) No. 114/2014 dated 16.05.2014 this mines was coming among the 102 non-working mining leases as Annexure R-2. As per the para 3 of the order of the Hon'ble Court. However, Hon'ble Supreme Court of India in I.A no. 110418 of 2018 filed by the lessee firm in W.P (c) No. 114 of 2014 allowed to resume the mining operation subject to compliance of all mandatory requirements vide its order dated 16.01.2019. (A copy of the order dated 16.01.2019 is enclosed herewith for your kind perusal and reference as Annexure-IV). In pursuant to the order from Hon'ble Supreme Court of State Government in department of Steel & Mines, allowed the lessee firm for resumption of mining operation subject to execution of

Supplementary Lease Deed vide no. 1763/SM, dated 08.03.2019 (A copy of the order dated 08.03.2109 is enclosed herewith for your kind perusal and reference as Annexure-V). Collector sundargarh given demand notice to lessee for stamp duty vide letter no. 112/XII-B-118/18, Dt.20.03.2019 and refer as Annexure-VI. Subsequent to the order from State Government, the Supplementary Lease Deed was executed and registered in favor of lessee vide regd. No1721900263 on dated 27.05.2019. (A copy of the Registered Supplementary Lease Deed is enclosed herewith for your kind perusal and reference as Annexure-VII). As per the Supplementary lease deed, the validity of the lease period is now extended up to 01.07.2041. Subsequently, the lessee has got the working permission from the state govt to run the Mines and the lessee has re-open the mines on 19.06.2019.

Statutory clearances

The lessee has obtained all the statutory clearances like Mining Plan approval from IBM, Forest and Environment Clearance from MoEF, Consent to Operate from SPCB. The details of statutory clearances are furnished below:

❖ Surface right obtained

Land details:

Area (hectares)	:	67.586 Ha
Details of forest land	:	66.671 Ha area is under forest as per the DLC record. 0.915 Ha is non-forest.
Ownership occupancy	:	Govt. of Odisha. Mining Lessee – M/s Geetarani Mohanty, Barbil

Out of the total ML area over 67.586Ha, surface Right over an area of 57.50Ha has been granted by the District Magistrate, Sundargarh.

❖ Forest clearance:

Out of the 67.586Ha of Mining Lease area, forest land under DLC category is 66.671Ha and 0.915Ha is non-forest land. Out of the 66.671Ha, DLC Forest land, 43.033Ha had been broken prior to 12.12.1996 and mining operation in this area was being continued. Ministry of Environment and Forest, Govt of India has accorded the Stage-II Forest Clearance over an area of 66.671Ha vide letter No. F No.8-37/2007-FC dated 22.10.2014.

❖ Environmental clearance

The State Level Environment Impact Assessment Authority, Odisha, Bhubaneswar has granted the Environmental Clearance for the production capacity of 2.99MTPA capacity vides SEIAA File No. 41890/08-MINB1/09-2019 dated 23.11.2020. The copy of the Environmental Clearance is enclosed as Annexure-XI. Further the lessee will obtain the Environmental Clearance @ of 4.99MTPA to operate the mines in the said capacity.

❖ Consent to Established form SPCB

The lessee has obtained the consent to established order under section 25 of the water (PCP) Act 1974 and under section 21 of Air (PCP) Act 1981 for the Production of 2.99MTPA (ROM) along with installation crushing and screening plant vide letter No. 8918/IND-II-CTE-6420 Dated 18.09.2020.

❖ Consent to operate from SPCB

The lessee has obtained the consent to operate under section 25/26 of the water (PCP) Act 1974 and under section 21 of Air (PCP) Act 1981 for the production capacity of 2.99MTPA vide the letter No. 875/IND-I-CON-2572 Dated 19.01.2021 and were valid up to 31.03.2022.

1. Water Conservation Initiatives taken by Plant

FICCI took up a detailed Water Audit Study at M/S GEETARANI MOHANTY RAIKELA MINES Odisha,

Table 2: Water Conservation Initiatives taken up by plant

Sr. No.	Water Conservation/Saving Measure Undertaken
❖	Installed Sewage Treatment plant for domestic water recycling
❖	Installed Effluent Treatment plant for Vehicle washing water Recycling
❖	Constructed Rain water harvesting system and reuse of water
❖	Wheel washing system
❖	Water Sprinkling System for roads

During the field study conducted by FICCI, many other water saving options were identified for Raikela Iron ore mines of M/S GEETARANI MOHANTY, Odisha which, if implemented, can lead to substantial water savings. FICCI is pleased to offer its services for conducting Water Audit Study Raikela Iron ore mines of M/S GEETARANI MOHANTY as per CGPA guidelines. FICCI's expertise in Water audit & conservation will complement the in-house efforts of Mines in conserving water, reducing wastewater generation as well as reducing operational costs.

CHAPTER -2: SCOPE OF WORK

1. Scope of Water Audit Study

The main objective of the study is to identify the water uses & water saving opportunities. Scope of work of the study includes the following:

- ❖ On-site training and discussion with facility manager and personnel
- ❖ Water system analysis and Quantification of baseline water map
- ❖ Water use Monitoring and measurements using pressure and flow meters and various other devices
- ❖ Quantification of inefficiencies and leaks in the water system
- ❖ Quantification of water quality loads and discharges
- ❖ Quantification of variability in flows and quality parameters
- ❖ Strategies for water treatment and reuse or direct use
- ❖ Development of detailed water circuit diagram and water balance of the facility
- ❖ Mapping of water quality requirement to develop 'recycle' and 'reuse' opportunities
- ❖ Developing Water consumption and wastewater generation pattern
- ❖ Estimating Specific water use and conservation potential
- ❖ Develop & Maintain monthly MIS on water extracted from borewells, water level, water quality etc.
- ❖ Calculation of Rainwater Harvesting Potential for the site and assessment of the existing structures
- ❖ Evolving Water saving opportunities with method of implementing the proposal with
- ❖ Description and figures related to water management schemes
- ❖ Investment required for water saving schemes/Cost Benefit Analysis
- ❖ Submission of water audit report & its presentation at site (if required)
- ❖ Following opportunities would also be assessed for Industries for water conservation:
 - ❖ Setting up of for water budgeting
 - ❖ Modernization of industrial process to reduce water consumption
 - ❖ Recycling water with a re-circulating cooling system
 - ❖ Ozonation cooling water approach which can result in fivefold reduction in blow down when compared to traditional chemical treatment
 - ❖ Reduction in reuse of de-ionized water by eliminating some plenum flushes, converting from a continuous flow to an intermittent flow system and improving control on the use
 - ❖ Use of wastewater for gardening
 - ❖ Proper processing of effluents to adhere to the nor M/S of disposal

CHAPTER -3: METHODOLOGY OF THE WATER AUDIT STUDY

1. Methodology followed for conducting water audit study

Step 1: Reconnaissance or Walk-through survey

- ❖ Understanding of existing water sourcing, storage and distribution facility.
- ❖ Assessing the water demand and water consumption areas/processes.
- ❖ Preparation of detailed water circuit diagram.

Step 2: Secondary Data Collection through the Discussion with mines executives, past records, Available technical literature/specifications

- ❖ Analyse historic water use and wastewater generation
- ❖ Field measurements for estimating current water use
- ❖ Metered & unmetered supplies.
- ❖ understanding of “base” flow and usage trend at site
- ❖ Past Water Bills
- ❖ Wastewater Treatment scheme & costs etc.

Step 3: Site Water Audit Planning (based on site operations and practices)

- ❖ Preparation of water flow measurement plan to quantify water use at various locations
- ❖ Wastewater flow measurement and sampling plan
- ❖ Instruments availability like Ultrasonic Water Flow Meter, Doppler type Flow meter, Stop Watch, measuring cylinders, Power Analyser etc.

Step 4: Conduction of Detailed Water Audit & Measurements

- ❖ Conduction of field measurements to Quantify water/wastewater stream/S
- ❖ Power Measurement of Pumps/Motors
- ❖ Measurement of suction & discharge pressure at various pumps
- ❖ Wastewater sampling & analysis
- ❖ Preparation of Water Balance Diagram
- ❖ Establishing Water Consumption Pattern
- ❖ Evolving value added “cost of water” at various locations
- ❖ Detection of potential leaks & water losses in the system
- ❖ Assessment of productive and unproductive usage of water
- ❖ Determine key opportunities for water consumption reduction, reuse & recycle with paybacks

Step 5: Preparation of Water Audit Report with Sustainable Water Management Plan

- ❖ Documentation of collected & analysed Water Balancing and Measurement details
- ❖ Projects and procedures to maximize water savings and minimize/eliminate water losses
- ❖ Water Metering and Accounting System
- ❖ Opportunities for Water Conservation based on Reduce/ Recycle/ Reuse/ Regeneration/ Recharge options with Cost Benefit Analysis

Step 6: Water Audit Report Finalization and Submission

- ❖ Incorporation of required changes based on discussions with plant executives
- ❖ Preparation & submission of final report.

❖ Methodology Adopted for Performance Evaluation of Pumps

The Plant has installed number of pumps in various sections to transfer/ circulate the water for different applications. During the audit, flow measurements were conducted at various pumps and performance evaluation of all the major pumps were conducted to estimate their present operating efficiency & cost of pumping. The estimated efficiency is based on operating head, measured flow rate & power consumption of the pumps.

❖ Water Flow Measurement

The water flow measurement was conducted using transit time ultrasonic flow meter at the discharge side of the pumps or any suitable location. The step wise methodology is given below,

- ❖ A suitable location for measurement of flow rate was identified on discharge pipeline of the pump and initial pipe preparation was done by cleaning and filing of pipe at measurement location
- ❖ The circumference of pipe for calculating the external diameter was measured by inch tape and the pipe thickness was measured by digital thickness gauge or by measurement of spare pipe.
- ❖ The parameter like pipe diameter, type of pipe, water temperature, pipe thickness, roughness etc are input in the ultrasonic flow meter
- ❖ Based on above input values, the flow meter reflects the distance between the traducers to be positioned on the pipe while measuring the flow
- ❖ The traducers are placed on the surface of the pipe (filed surface) at the same distance given by flow meter
- ❖ The ultrasonic flow meter displays instantaneous values of water flow rate in m^3/hr . The average of these values may be considered as flow rate of water.

❖ Electrical Power Measurement

The instantaneous electrical power consumption of pumps was measured from the corresponding electrical panel by portable Fluke Make Power analyser by measurement of electrical parameters like voltage, current, power factor, power etc.

❖ Head Measurement

The discharge head of the pump was determined by noting installed pressure gauges at the pump discharge while the suction head was estimated by physical measurement of horizontal and vertical length of suction pipeline. The total operating head was calculated by addition of suction and discharge head.

❖ Efficiency Calculation

The operating efficiency of the pumps was based on measured flow, head & power drawn by pumps is calculated with the help of following formula:

$$\text{Efficiency, \%} = \frac{Q \text{ (m}^3\text{/Hr.)} \times H \text{ (m)} \times 9.81 \times \rho \text{ (kg/m}^3\text{)}}{1000 \times 3600 \times \text{Motor Input Power (kW)}}$$

Where,

Efficiency % = Efficiency of pump set i.e. (Combined efficiency of pump & motor)

Q = Measured Water Flow rate in m³/hr

P = density of water i.e., 1000 kg/m³

H = Total Head developed (m of water column), Discharge + Suction

kW = Actual power measured at motor input.

CHAPTER -4: ASSESSMENT OF PRESENT WATER USAGE

1. Water sourcing and major water use areas

Details of Source of Water: The main source of freshwater for the plant is 2 no. of bore well. The plant sources about 120 m³/day of freshwater from bore wells. The freshwater is mainly used for. Another source is recycled water from STP plant of about 15 m³/day & ETP plant of about 19 m³/day

No. of Borewells and location: The bore well is located near Truck Entry Gate and Wheel washing system the plant. The rated yield is 8 & 20 m³/hr. which concurred with the measurements done by FICCI team using ultrasonic flow meter. The water abstraction limit for bore well is 180 m³/day. The bore well have mechanical meter installed from which reading were taken manual and maintained in logbook.

Table 3: Details of bore well

Bore wells	Location of Bore-wells	Depth of Bore-well	Type of Pump (mono-block/ Submersible etc.)	Pump Rated Capacity (HP)	Rated yield (m ³ /hr)
Bore well 1	21°52'14.35" 85°11'02.85"	91mtr	submersible	2.0	8.0
Bore well 2	21°52'02.68" 85°10'51.88"	New Borewell			

The BGL of pre-monsoon and post-monsoon peizometric reading taken is given in the table given below:

Pre-monsoon readin in the month of May 2020

DATA	TIME	Ground Water Level (m)
01/05/2021	06.00 AM	28.59
	12.00 PM	28.92
	06.00 PM	27.35
	00.00 AM	28.89
02/05/2021	06.00 AM	27.88
	12.00 PM	28.79

	06.00 PM	28.35
	00.00 AM	28.86
03/05/2021	06.00 AM	28.89
	12.00 PM	28.96
	06.00 PM	27.98
	00.00 AM	27.45
04/05/2021	06.00 AM	27.83
	12.00 PM	28.41
	06.00 PM	28.61
	00.00 AM	27.50
05/05/2021	06.00 AM	27.99
	12.00 PM	27.2
	06.00 PM	28.17
	00.00 AM	27.12
06/05/2021	06.00 AM	27.40
	12.00 PM	28.05
	06.00 PM	27.10
	00.00 AM	28.35
07/05/2021	06.00 AM	27.88
	12.00 PM	28.72
	06.00 PM	28.37
	00.00 AM	27.84
08/05/2021	06.00 AM	28.37
	12.00 PM	27.13
	06.00 PM	27.45
	00.00 AM	28.11
09/05/2021	06.00 AM	28.25
	12.00 PM	28.40
	06.00 PM	28.14
	00.00 AM	28.82
10/05/2021	06.00 AM	28.16
	12.00 PM	27.63
	06.00 PM	27.84
	00.00 AM	28.92
11/05/2021	06.00 AM	28.01
	12.00 PM	27.19
	06.00 PM	28.17

	00.00 AM	27.92
12/05/2021	06.00 AM	27.65
	12.00 PM	28.98
	06.00 PM	27.32
	00.00 AM	28.86
13/05/2021	06.00 AM	28.12
	12.00 PM	28.33
	06.00 PM	27.43
	00.00 AM	28.65
14/05/2021	06.00 AM	27.78
	12.00 PM	28.43
	06.00 PM	28.92
	00.00 AM	28.54
15/05/2021	06.00 AM	28.65
	12.00 PM	28.45
	06.00 PM	28.76
	00.00 AM	28.34
16/05/2021	06.00 AM	27.88
	12.00 PM	28.72
	06.00 PM	28.37
	00.00 AM	28.84
17/05/2021	06.00 AM	27.55
	12.00 PM	27.79
	06.00 PM	27.82
	00.00 AM	28.72
18/05/2021	06.00 AM	27.88
	12.00 PM	27.73
	06.00 PM	27.52
	00.00 AM	28.15
19/05/2021	06.00 AM	28.29
	12.00 PM	28.17
	06.00 PM	28.33
	00.00 AM	27.48
20/05/2021	06.00 AM	27.66
	12.00 PM	28.23
	06.00 PM	28.99
	00.00 AM	27.65

21/05/2021	06.00 AM	27.61
	12.00 PM	28.20
	06.00 PM	28.76
	00.00 AM	27.58
22/05/2021	06.00 AM	27.53
	12.00 PM	28.97
	06.00 PM	28.79
	00.00 AM	27.59
23/05/2021	06.00 AM	27.01
	12.00 PM	28.30
	06.00 PM	27.21
	00.00 AM	28.01
24/05/2021	06.00 AM	27.10
	12.00 PM	28.20
	06.00 PM	28.95
	00.00 AM	27.75
25/05/2021	06.00 AM	28.29
	12.00 PM	28.17
	06.00 PM	28.33
	00.00 AM	28.48
26/05/2021	06.00 AM	27.76
	12.00 PM	28.54
	06.00 PM	28.42
	00.00 AM	27.12
27/05/2021	06.00 AM	27.42
	12.00 PM	28.91
	06.00 PM	28.54
	00.00 AM	27.49
28/05/2021	06.00 AM	27.31
	12.00 PM	28.94
	06.00 PM	28.54
	00.00 AM	27.89
29/05/2021	06.00 AM	28.25
	12.00 PM	28.40
	06.00 PM	28.14
	00.00 AM	28.82
29/05/2021	06.00 AM	28.19

	12.00 PM	28.17
	06.00 PM	28.19
	00.00 AM	28.11
30/05/2021	06.00 AM	28.02
	12.00 PM	27.81
	06.00 PM	27.67
	00.00 AM	28.26
31/05/2021	06.00 AM	28.22
	12.00 PM	28.01
	06.00 PM	28.03
	00.00 AM	28.11

Post-monsoon reading for the month of October 2020

DATA	TIME	Ground Water Level (m)
01/10/2021	06.00 AM	5.21
	12.00 PM	5.34
	06.00 PM	5.21
	00.00 AM	5.26
02/10/2021	06.00 AM	5.23
	12.00 PM	5.09
	06.00 PM	5.08
	00.00 AM	5.07
03/10/2021	06.00 AM	5.04
	12.00 PM	5.02
	06.00 PM	4.99
	00.00 AM	4.97
04/10/2021	06.00 AM	4.95
	12.00 PM	4.90
	06.00 PM	4.88
	00.00 AM	4.76
05/10/2021	06.00 AM	4.74
	12.00 PM	4.69
	06.00 PM	4.64
	00.00 AM	4.59

06/10/2021	06.00 AM	4.45
	12.00 PM	4.42
	06.00 PM	4.38
	00.00 AM	4.34
07/10/2021	06.00 AM	4.23
	12.00 PM	4.15
	06.00 PM	4.21
	00.00 AM	4.23
08/10/2021	06.00 AM	4.25
	12.00 PM	4.24
	06.00 PM	4.32
	00.00 AM	4.24
09/10/2021	06.00 AM	4.31
	12.00 PM	4.45
	06.00 PM	4.46
	00.00 AM	4.65
10/10/2021	06.00 AM	4.78
	12.00 PM	4.24
	06.00 PM	4.68
	00.00 AM	4.78
11/10/2021	06.00 AM	4.43
	12.00 PM	4.76
	06.00 PM	4.56
	00.00 AM	4.32
12/10/2021	06.00 AM	4.19
	12.00 PM	4.15
	06.00 PM	4.26
	00.00 AM	4.25
13/10/2021	06.00 AM	5.06
	12.00 PM	5.12
	06.00 PM	5.15
	00.00 AM	5.23
14/10/2021	06.00 AM	5.21
	12.00 PM	5.24
	06.00 PM	5.26
	00.00 AM	5.21
15/10/2021	06.00 AM	5.43
	12.00 PM	5.34

	06.00 PM	5.23
	00.00 AM	4.21
16/10/2021	06.00 AM	5.25
	12.00 PM	4.43
	06.00 PM	4.41
	00.00 AM	4.41
17/10/2021	06.00 AM	4.32
	12.00 PM	4.87
	06.00 PM	4.21
	00.00 AM	4.45
18/10/2021	06.00 AM	4.24
	12.00 PM	4.28
	06.00 PM	4.21
	00.00 AM	4.98
19/10/2021	06.00 AM	4.21
	12.00 PM	5.06
	06.00 PM	5.12
	00.00 AM	5.15
20/10/2021	06.00 AM	5.23
	12.00 PM	5.21
	06.00 PM	5.24
	00.00 AM	5.26
21/10/2021	06.00 AM	5.21
	12.00 PM	5.43
	06.00 PM	5.34
	00.00 AM	5.23
22/10/2021	06.00 AM	4.21
	12.00 PM	4.19
	06.00 PM	4.26
	00.00 AM	4.31
23/10/2021	06.00 AM	4.89
	12.00 PM	4.99
	06.00 PM	5.03
	00.00 AM	4.97
	06.00 AM	4.95
24/10/2021	12.00 PM	5.01
	06.00 PM	5.02
	00.00 AM	4.99

25/10/2021	06.00 AM	4.97
	12.00 PM	5.02
	06.00 PM	4.98
	00.00 AM	4.98
26/10/2021	06.00 AM	4.94
	12.00 PM	5.01
	06.00 PM	4.99
	00.00 AM	4.94
27/10/2021	06.00 AM	4.95
	12.00 PM	5.01
	06.00 PM	4.99
	00.00 AM	4.94
28/10/2021	06.00 AM	4.42
	12.00 PM	4.98
	06.00 PM	4.94
	00.00 AM	4.92
29/10/2021	06.00 AM	4.90
	12.00 PM	4.96
	06.00 PM	4.96
	00.00 AM	4.95
30/10/2021	06.00 AM	4.93
	12.00 PM	4.99
	06.00 PM	5.03
	00.00 AM	4.93
31/10/2021	06.00 AM	4.92
	12.00 PM	5.07
	06.00 PM	4.23
	00.00 AM	4.95

Picture 1: Photos of Bore well



The Piezometer is used to measure pressure via the rise of fluid column. It is m deep and at a distance of more than m from the bore well.

Table 4: Details of piezometer wells (observation well)

Piezometer	Location of piezometer	Depth of piezometer	Distance from the existing bore well (meter)
1	21°52'16.70" 85°11'05.89"	20mtr	1.0mtr

Picture 2: Picture taken during measurements at bore well and picture of Piezometer



Apart from freshwater, the plant also uses STP treated water for horticulture and vehicle washing. Therefore, the total estimated water requirement of the mines is about 294.7 m³/day (freshwater, treated, and recycled water) in various sections of the mines as shown Below.

Table 5: Sources of water at the Mines

S.No.	Source of Water	m ³ /day	Water Quality
1	Bore well Water	180.0	Fresh water
2	Rain water harvesting pond	88.0	Fresh water
2	STP Treated water	13.7	Recycled
3	ETP Water	6.1	Recycled
		287.80	

Figure 1 : Sources of Water (Freshwater, treated water and recycled water)

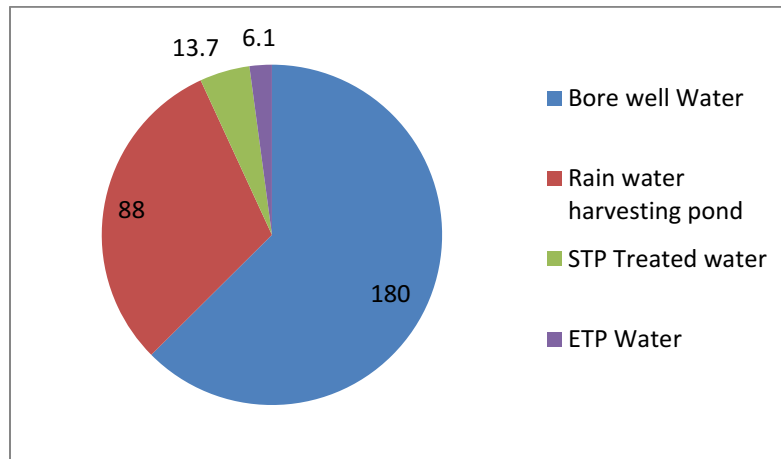
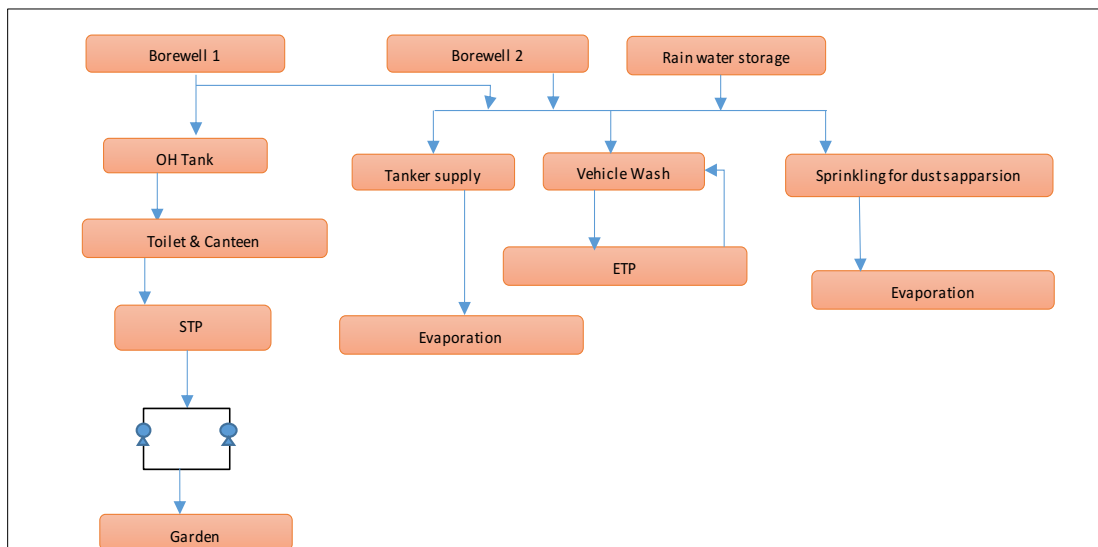


Table 6: Percentages of Freshwater and recycled water

S. No.	Major Sections	Wastewater discharged (m ³ /day)	Recycled/Discharge	M3/day
1	Domestic Use	24.50	Reused in Green Belt	8.2
2	Vehicle Wash	8.20	Reuse of Vehicle washing	0
	Total	32.70		8.2

Figure 2: Existing water circuit diagram of the plant



2. Bore well Water Quality

The plant regularly checks the water quality of the Groundwater.

Table 7: Groundwater quality report

Parameters for bore well water	Unit	Date of sample 07.04.2021	Date of sample 08.06.2021
TDS	mg/l	36	44
Iron	mg/l	<0.05	<0.05
Calcium	mg/l	6.4	8
Alkalinity	mg/l	31	34
Suspended Solids	mg/l	<0.4	<0.4
Fuloride	mg/l	<0.05	<0.05
Arsenic	mg/l	<0.001	<0.001

3. Water Distribution and water balance

During the opening meeting, On-site training and discussion with facility manager was conducted to explain to the plant officials about effective management of groundwater, purpose of water audit and basic guidelines of the CGWA notification.

As per the measurements conducted by FICCI team, water distribution and water balance were prepared for the plant.

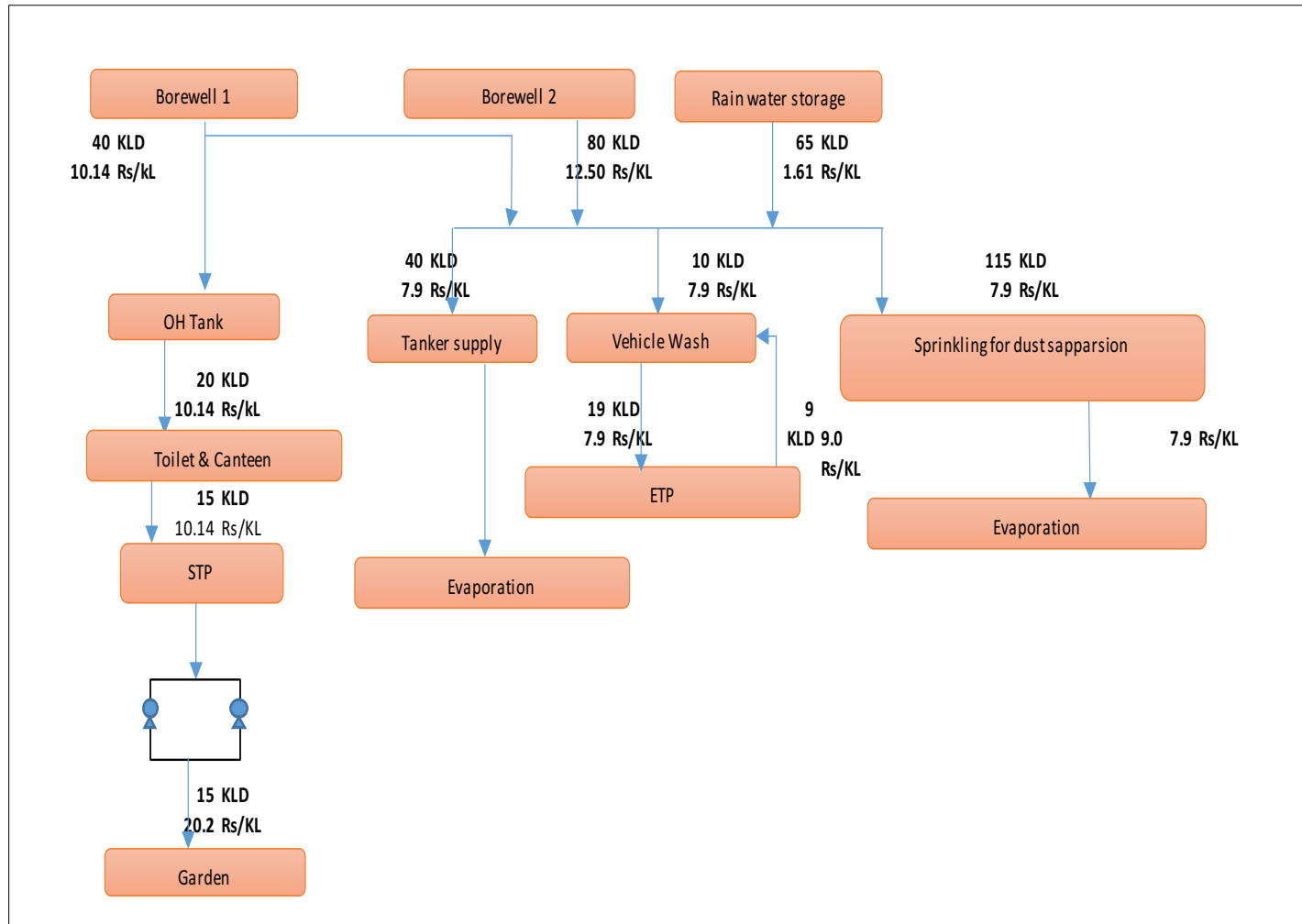
The plant abstracts about 120 m³/day of groundwater from 2 no. of bore wells. Instantaneous water flow was measured using ultrasonic flow meters. The measured flow of bore well is 8 & 20 m³/hr. The bore well has 3 HP motor that runs for about 5 & 4 hours daily. Abstracted bore well water is pumped to KL tank. The water from KL tank is pumped to water storage tank

Table 8: Water Storage Tanks in the Mines

Location	Storage Capacity
Near office	5000l

Raw water is pumped from bore well to KL tank. About total of 11 m³/day ground water is daily pumped into the system. Out of 180 m³/day of total water, 20m³/day is used for domestic applications like hand washing, drinking etc., 8.20 m³/day is used for Vehicle Washing, 211 m³/day of water is used in dust separation, 15m³/day is used for horticulture. All the wastewater from vehicle washing is drained to ETP. After treatment in ETP, treated water is stored and used for vehicle washing. Details of Storage tanks in different units of plant are mentioned in Figure 2.

Figure 2: depicts the existing water and wastewater balance diagram of Mines.



4. Water Metering System

There is one meters in the plant. All meters are mechanical flow meter. The meter readings are recorded regularly. Details of the meter are mentioned in the Table 9 below.

Table 9: Location of Identified Water Meters

Sr. No.	Meter Location	Type of Meter	Regularly recorded (Yes/No)	Calibrated (Yes/No)
2105400633	21°52'14.35" 85°11'02.85"	Digital Flow rate Indicator Totalizer	Yes	Yes

5. Water Use Baseline Data as provided by the Plant

The month-wise meter readings were provided by the plant for the quantity of water drawn from the bore wells. Table 10 below depicts the Total groundwater intakes for FY 2020-2021

Table 10: Monthly water abstraction from bore wells (FY 2020-21)

(m ³ /month)	Bore well Water withdrawn
20-Apr	5400
20-May	5580
20-Jun	5400
20-Jul	4495
20-Aug	4495
20-Sep	5400
20-Oct	5580
20-Nov	5400
20-Dec	5580
21-Jan	5580
21-Feb	5520
21-Mar	5580

6. Water Costing

Water and wastewater cost at plant includes water cess, cost of pumping, cost of raw water treatment, cost of STPR and Cost of ETP. **The actual weighted average cost of abstraction bore well water is estimated to be Rs 1 /m³, cost of Bore well Pumping water supply is Rs 1.86/m³, and the cost of STP is estimated to be about Rs 3.55/m³ and the cost of ETP treatment is about Rs 6.10/m³, as discussed below.** The water and wastewater costing for various user points is shown in Figure 3.

1. Cost of abstraction of Bore well Water

Rates of ground water abstraction charges for other industries and infrastructure projects in safe, semi-critical and critical assessment units is given in table below. Since the M/S GEETARANI MOHANTY RAIKELA MINES Odisha , is in and NOC limit for water abstraction is $180 \text{ m}^3/\text{day}$, which is under range of $< 200 \text{ m}^3/\text{day}$, therefore the cost of groundwater abstraction is **Rs 1/ m^3 as per Table 11** .

Table 11: Cost of bore well water abstraction

S. No.	Category of area Ground water use	Quantum of ground water withdrawal			
		$< 200 \text{ m}^3/\text{day}$	200 to $<1000 \text{ m}^3/\text{day}$	1000 to $<5000 \text{ m}^3/\text{day}$	$5000 \text{ m}^3/\text{day}$ and above
1.	Safe	1.00	2.00	3.00	5.00
2.	Semi-critical	2.00	3.00	5.00	8.00
3.	Critical	4.00	6.00	8.00	10.00

2. Pumping cost-energy

Flow measurements were made during the field study. The Transit time ultrasonic flow meter was used for water flow measurements. Table 12 below summarises the water flow measurements at Pump discharge line. Apart from pump discharges, power measurements including voltage, current and power factor etc were taken. Using the measured data for the pumps, the actual pumping costs are calculated for various pumps. Total cost of pumping is Rs 192990/Annum.

Table 12: Cost of pumping system at M/S GEETARANI MOHANTY RAIKELA MINES

S. No	Pump name	Total Flow	Power Consumption	Sp. Power	Cost of Pumping	Daily Run hours	Daily flow	Daily Pumping Cost	Total Annual Cost
				Consumption					
	Electricity Charges @ 6.50 Rs/kWh	m ³ /h	kW	kWh/m ³	Rs/m ³	h/day	m ³ /day	Rs/day	Rs/yr
1	Bore well Pump no.1	8.00	1.10	0.14	0.86	5.0	40.00	34	10725
2	Bore well Pump no.2	20.00	8.00	0.40	2.50	4.0	80.00	200	62400
3	STP Pump and Blower	2.50	2.40	0.96	6.00	6	15.00	90	34164
4	Rain water Harvesting Pump	12.40	3.20	0.26	1.61	6	68.20	110	41756
								434	149045

3. Cost of Treatment

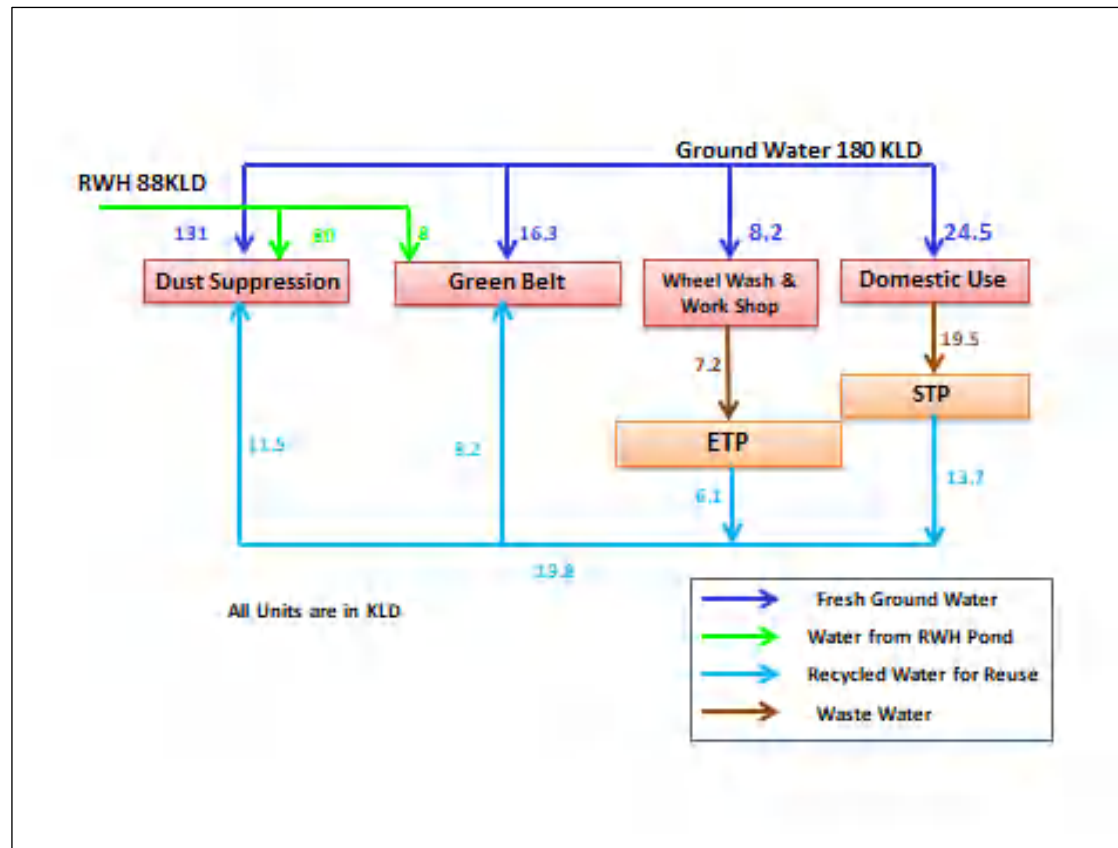
Cost of STP Treated Water

About 15 m³/year water is treated daily at the Effluent treatment Plant. The cost of chemical treatment at ETP is Rs 3.55/m³ and Electrical Cost is Rs 6.50/m³. The total cost of ETP Treated water is Rs 10.05/m³ as shown in table below

Table 13: Cost of STP treated water

	STP			
Average Quantity of treated water (m ³ /day)	15			
Chemical Cost				
Name of Chemical/s	Quantity kg/month	Rate Rs/Kg	Rs/month	Rs/day
Chlorine	45	18	810	29
Total Chemical Cost (Rs/Day)				53
Total Cost of chemical treatment (Rs/m³)				3.55
Electricity Cost				
Power Consumption (Units/day)				15.0
Specific Power Consumption (kWh/m ³)				1.00
Cost per unit (Rs/kWh)				6.5
Electrical cost (Rs/day)				98
Electrical cost (Rs/m ³)				6.50
Total Cost of treatment (Rs/m³)				10.05
Total Cost of treatment (Rs/day)				151

Figure 3: Existing water cost at user location accounting water pumping and treatment cost at Mines



7. Annual Water & Wastewater Management Cost of the Plant

The total annual water and wastewater cost is calculated by the sum of Total Water abstracted, Total Pumping cost and Total Water and Wastewater Treatment cost as mentioned in the previous part. The total annual water cost for plant as shown below in Table 14.

Table 14: Total Annual Water Cost of M/S GEETARANI MOHANTY RAIKELA MINES

S. No.			Total cost	Total Annual Cost	Water Consumption
		Rs/m ³	(Rs/day)	(Rs/year)	(m ³ /day)
1	Cost of Bore well abstraction	1.00	120	39600	120.0
2	Pumping Cost			114881	
	Energy	1.86	344	114881	185
4	Wastewater Treatment			62116	
	STP				
	Cost of chemical treatment at STP	3.55	53	19411	
	Cost of Electrical treatment at STP	6.50	98	35588	15
	ETP				
	Cost of Electrical Treatment	1.03	20	7118	19
	Total Water Cost			2,16,597	

CHAPTER -5: WATER & WASTEWATER TREATMENT & RECYCLING PRACTICES

The plant has installed the following water and wastewater treatment systems for treating the incoming freshwater:

❖ STP

STP Plant- SEWAGE WATER TREATMENT

Plant treats Domestic Sewage in well-designed existing sewage treatment plants (Total Capacity 15 KLD).

In STP there are three major input from plant labour Toilet etc. as per data observation. Average operation of 15 KLD water is treated and bank to gardening. The Description installed STP is given below.

The term treatment means separation of solids and stabilisation of pollutants. In turn stabilisation means the degradation of organic matter until the point at which chemical or biological reactions stop. COD (Chemical Oxygen Demand) is said to be the most general parameter to measure organic pollution. COD describes how much oxygen is required to oxidise all organic and inorganic matter found in the wastewater sample. BOD (Biological Oxygen Demand) describes what can be oxidised biologically, with the help of bacteria and is always a fraction of COD. Usually, BOD is measured as BOD meaning that it describes the amount of oxygen consumed over a five-day measurement period. It is a direct measurement of the amount of oxygen consumed by organisms removing the organic matter in the waste. SS (Suspended Solids) describes how much of the organic or inorganic matter is not dissolved in water and contains settle able solids that sink to the bottom in a short time and non-settle able suspended solids. It is an important parameter because SS causes turbidity in the water causing clogging of filters.

Input –Output Parameters Details of Sewage Treatment

Parameters for STP outlet water	Unit	Date of sample 08.06.2021
COD	mg/l	40
BOD	mg/l	10
TSS	mg/l	28
Oil & Grease	mg/l	<0.1
pH	mg/l	6.7
TDS	mg/l	380

ETP Plant - Effluent Treatment Plant

The ETP consists of primary treatment, physio-chemical treatment , tertiary treatment further description is bar screen chamber, oil and grease trap, collection cum equalization tank, effluent lift pumps, reaction, coagulation and flocculation tank, chemical dosing for reaction tank and flocculation, primary tube settler, aeration tank, membrane bio reactor, centrifuge and centrifuge feed pump. During manufacturing process of EO/EG, effluent gets generated from the process in the Plant.

Effluent Characteristics:

S.NO	PARAMETERS	CHARACTERISTICS	UNITS
1.	pH	6.5 – 8.5	-
2.	BOD 5	<10	mg/l
3.	COD	<50	mg/l
4.	TSS	<5	mg/l
5.	Oil & Grease	Nil	mg/l
6.	TDS	<1300	mg/l

EFFLUENT TREATMENT PLANT The term treatment means separation of solids and stabilization of pollutants. In turn stabilization means the degradation of organic matter until the point at which chemical or biological reactions stop. COD (Chemical Oxygen Demand) is said to be the most general parameter to measure organic pollution. COD describes how much oxygen is required to oxidize all organic and inorganic matter found in the wastewater sample. BOD (Biological Oxygen Demand) describes what can be oxidized biologically, with the help of bacteria and is always a fraction of COD. Usually BOD is measured as BOD5 meaning that it describes the amount of oxygen consumed over a five-day measurement period. It is a direct measurement of the amount of oxygen consumed by organisms removing the organic matter in the waste. SS (Suspended Solids) describes how much of the organic or inorganic matter is not dissolved in water and contains settle able solids that sink to the bottom in a short time and non-settle able suspended solids. It is an important parameter because SS causes turbidity in the water causing clogging of filters.

CLASSIFICATION OF EFFLUENT WATER TREATMENT

Effluent treatment options may be classified into groups of processes according to the function they perform and their complexity:

Primary Treatment – includes simple processes that deal with debris and solid material. The purpose of preliminary treatment is to remove the big size particles. This is usually performed by screening (usually by bar screens) and grit removal. Their removal is important in order to increase the effectiveness of the later treatment processes and prevent damages to the pipes, pumps and fittings.

Physio-chemical Treatment– In Physio-chemical Treatment, first increase the pH up to 9 by lime dosing then add Ferric Chloride & poly electrolyte into Reaction Tank, Coagulation Tank & Flocculation has been

generate by slow mixing into Flocculator. Outlet of Flocculator feed to Primary Tube Settling Tank to remove suspended solids.

Tertiary treatment – is the polishing process whereby treated effluent is further purified to acceptable levels for discharge. It is usually for the removal of specific pollutants e.g. remaining suspended solid, colour and order for the Effluent. Tertiary treatment processes are generally specialized processes.

UNIT DESCRIPTION

BAR SCREEN CHAMBER

The function of the bar screen is to prevent entry of solid particles above a certain size: such as plastic cups, paper dishes, polythene bags, ETC into the ETP. (If these items are allowed to enter the ETP, they clog and damage the ETP pumps, and cause stoppage of the plant.) The screening is achieved by placing a screen made out of vertical bars, placed across the Effluent flow. The gaps between the bars may vary between 10 and 25 mm. ETPs may have two screens: A coarse bar screen with larger gaps between bars, followed by a fine bar screen with smaller gaps between bars. If this unit is left unattended for long periods of time, it will generate a significant amount of odour: it will also result in backing of Effluent in the incoming pipelines and chambers.

OIL AND GREASE TRAP

The oil and grease trap is placed before EQT to arrest solid and fatty matter at source or it is placed after screen chamber so as prevent the fatty matter to enter Equalization chamber. The wastewater output from this unit is taken to the equalization tank. The solids and fats that are separated in this unit are disposed off along with other biodegradable waste, and can be used as feed for piggeries.

COLLECTION CUM EQUALIZATION TANK

The EFFLUENT from the bar screen chamber and oil, grease and grit trap comes to the equalization tank. The equalization tank is the first collection tank in an ETP. Its main function is to act as buffer: To collect the incoming raw Effluent that comes at widely. Equalization tank is used only for buffering the daily fluctuations in the Effluent flow quantity. The equalization tank must be of sufficient capacity to hold the peak time inflow volumes. Equalization tank with a capacity to hold 4-6 hours of average hourly flow should be adequate.

EFFLUENT LIFT PUMPS

EFFLUENT transfer pump is use to lift Effluent from equalization tank to anoxic chamber. It typical pair of pumps (working and standby). The pumping rate can be set at a calibrated uniform flow, so that downstream units are not affected by fluctuating flows. These pumps are submersible pump submersed into the equalization tank.

REACTION, COAGULATION AND FLOCCULATION TANK

It is a chemical water treatment technique typically applied prior to sedimentation and filtration (e.g. rapid sand filtration) to enhance the ability of a treatment process to remove particles. Coagulation is a process used to neutralize charges and form a gelatinous mass to trap (or bridge) particles thus forming a mass large enough to settle or be trapped in the filter. Flocculation is gentle stirring or agitation to encourage the particles thus formed to agglomerate into masses large enough to settle or be filtered from solution.

CHEMICAL DOSING FOR REACTION TANK AND FLOCCULATION

Chemical dosing of Lime, Ferric Chloride & Poly in Reaction, Coagulation and flocculation tank are generally for the chemical treatment. Lime is used to increase the pH in the ETP for the further process and post coagulation and for clarity of water. Ferric Chloride is used as coagulant for much industrial and sanitary waste water treatment application. Due to its high efficiency, effectiveness in clarification, and utility as a sludge dewatering agent. The chemical leaves no residual colour, offers very good turbidity removal. Poly-aluminium chloride is used as a flocculent by which fine particulates are caused to clump together into a floc & increase the sludge water separation. The floc may then float to the top of the liquid (creaming), settle to the bottom of the liquid (sedimentation), or be readily filtered from the liquid.

PRIMARY TUBE SETTLER

Primary tube settler is incorporated before the biological process to settle down the agglomerate form after coagulation and flocculation process purpose and function of the clarifier is threefold: Allow settling of biomass solids in the Mixed Liquor coming out of the flocculation, to the bottom of the clarifier to thicken the settled biomass, in order to produce a thick underflow To produce clear supernatant water, in the overflow from the clarifier feed to Aeration Tank. All the above actions occur due to gravity. The thick biomass is re-circulated back to the aeration tank.

AERATION TANK

Aeration brings water and air in close contact in order to remove dissolved gases (such as carbon dioxide) and oxidizes dissolved metals such as iron, hydrogen sulphide, and volatile organic chemicals (VOCs). Aeration is often the first major process at the treatment plant. During aeration, constituents are removed or modified before they can interfere with the treatment processes.

Aeration brings water and air in close contact by exposing drops or thin sheets of water to the air or by introducing small bubbles of air (the smaller the bubble, the better) and letting them rise through the water. The scrubbing process caused by the turbulence of aeration physically removes dissolved gases from solution and allows them to escape into the surrounding air. Aeration also helps remove dissolved metals through oxidation, the chemical combination of oxygen from the air with certain undesirable

metals in the water. Once oxidized, these chemicals fall out of solution and become particles in the water and can be removed by filtration or flotation.

MEMBRANE BIO REACTOR

The Membrane Bio Reactor Technology is the most advanced development in the field of biological treatment providing treated wastewater for recycling in smaller footprint and under stringent discharge norms.

Tertiary treatment consists of Membrane Bioreactor. The Sewage after the Collection Sump enters into the Anoxic Chamber where it overflow further to Aeration tank for biological Treatment and further over flow to MBR basin. Hollow Fiber membranes are introduced to mixed liquor to separate treated sewage from mixed liquor. Membrane being the absolute physical barriers ensures complete removal of suspended impurities. MBR applications include even retrofits of existing systems as well as installation of new systems, for both meeting the most stringent discharge norms and reuse. Treated wastewater from MBR can be even reused for cooling tower make-up, to generate high purity water through Reverse Osmosis and other non-potable applications. This process can help environment protection by treating wastewater and making it suitable for variety of application and thus conserve precious drinking water. Biological system designed for MBR process operates at higher MLVSS concentration with higher sludge retention time thus produces a low quantum of biological sludge thus reducing the sludge dewatering cost.

MBR technology combines the skills of our membrane specialists to deliver integrated treatment solutions with firm process guarantees such as BOD and TSS less than 5 mg/l and also removal of nutrient (nitrogen & phosphorous) and coliforms etc.

Biological process fluid (mixed liquor) is pumped/Overflow to the Membrane Operating System ("MOS"). The mixed liquor is introduced to membrane, along with air, evenly across the bottom of the tank through a unique two-phase jet system. This mixed liquor fills the membrane tank and flows upward through the membrane sub modules, creating cross-flow dynamics across the membrane surface. This cross- flow continuously scours the membrane surface and prevents solids dehydration at the membrane surface. Applying a low-pressure vacuum to the inside of the membrane fiber pulls water through the membranes and pumps the filtered water to the next process step. Solids, including organics, bacteria, and most viruses, are rejected by the membrane system and retained in the mixed liquor, which overflows the MOS back to the aeration tank.

The Membrane Operating System is an assembly with integral membrane modules arranged in rack assemblies, inserted into the membrane tank.

MOS Mixed Liquor Distribution & Recirculation Jets are designed to distribute the air scour and mixed liquor flow evenly across the membrane sub modules. This feature eliminates potential polarization

(concentration) of suspended solids around the membrane fibers which could be main cause for the failure and damage of individual fibers thus sub modules. Additionally, this feature provides even distribution of mixed liquor solids to each membrane unit, critical so that all membranes see the same process conditions. The return recirculation of mixed liquor ensures influent comes in intimate contact with the concentrated biomass, offering better organism selection and added flexibility in the anoxic cycle for advanced nitrogen removal, when required. This same jet system also acts as an integral part of the membrane cleaning system, providing an efficient scouring of the membranes with chlorine cleaning solution. The integrated cleaning system allows the sub modules to be quickly cleaned in place. Additionally, the clean and efficient procedure eliminates the need for membrane removal from process tanks that can damage membranes and present risks to plant-operators. Relaxation, Maintenance and in site CIP are exclusive features of this MBR Process to ensure consistent water quality and complete membrane life. The entire operation is PLC controlled.

CENTRIFUGE AND CENTRIFUGE FEED PUMP

Biological treatment of wastewater performs produces excess biological solids due to the growth and multiplication of bacteria and other microorganisms in the system. The excess biomass thus produced needs to be bled out of the system, and disposed off efficiently. This is a five-step process: sludge removal, storage, conditioning, dewatering and disposal. Sludge is removed (“bled”) from the system from the sludge recirculation pipeline (through a branch). The sludge is in the form of thick slurry. It is taken into a sludge-holding tank, and kept under aeration (to prevent the living organisms from putrefying) until dewatering operations can be carried out. Before dewatering, polymer or other chemicals may be added for conditioning the sludge, to facilitate the process. Sludge is then dewatered in a Centrifuge.

It consists of three to four parts: Sludge-holding tank with aeration. Centrifuge Feed Pump are used to feed sludge from the sludge holding tank to Centrifuge to dewatering the sludge and convert it into the dry sludge cake.

CHAPTER -6: DATA ANALYSIS & RESULTS

1. Water Consumptive Units and Waste water Mapping

Water consumption pattern

The water consumption pattern shows that out of total water (287.80 m³/day). The water utilization areas are mentioned below in Table 15

Table 15: Water Utilization Scenario at the plant

Key Water Usage Section	Quantity Used (m ³ /day)
Domestic Use	24.50
Vehicle Washing	8.20
Dust separation	211
Horticulture	24.50
Total	287.80

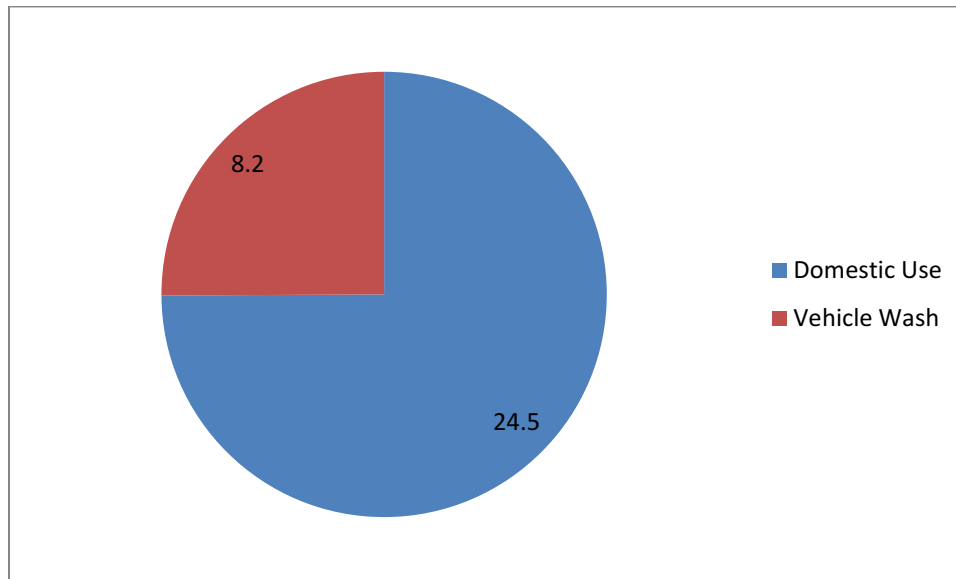
1. Wastewater generation and mapping

The total wastewater generation in the plant is about 34 m³/day, out of which about 44% is generated by domestic use; 56% is generated by process use as given in Table 16 and

Table 16 : Major Wastewater generating areas

S. No.	Major Sections	Wastewater discharged (m ³ /day)	Recycled/Discharge	M3/day
1	Domestic Use	24.50	Reused in Green Belt	8.2
2	Vehicle Wash	8.20	Reuse of Vehicle washing	0
	Total	32.70		8.2

Figure 4: Percentage of wastewater generation



2. Specific Water Consumption in term of Water Use Ratio (WUR) of the Mines

Table 17: Specific Water Consumption - FY 2020-21

Annual Production	Annual Fresh Water Usage	Specific Water Consumption (M3 water/ Ton of product)
3587988	64010	17.84

CHAPTER -7: WATER CONSERVATION OPPORTUNITIES WITH COST BENEFIT ANALYSIS

1. Regularly calibrate & maintain existing water flow meters

The plant has installed water meters at various important locations including bore wells. It is suggested to periodically calibrate the meters and maintain them.

Table 18: List of piezo meters installed in the Raikela Iron ore Mines, M/S GEETARANI MOHANTY

Sr. No.	Meter Location	Type of Meter	Regularly recorded (Yes/No)	Calibrated (Yes/No)
1	21°52'14.35" 85°11'02.85"	Piezometer	Yes	Yes

2. Maintain logbook of daily groundwater abstraction

The plant is suggested to record the water abstraction data, maintain logbook of daily groundwater abstraction and submit the data to CGWA periodically. The following format may be used for maintaining and recording the meter data on daily basis:

Table 19: logbook for water meters

The BGL of pre-monsoon and post-monsoon peizometric reading taken is given in the table given below:

Pre-monsoon readin in the month of May 2020

DATA	TIME	Ground Water Level (m)
01/05/2021	06.00 AM	28.59
	12.00 PM	28.92
	06.00 PM	27.35
	00.00 AM	28.89
02/05/2021	06.00 AM	27.88
	12.00 PM	28.79
	06.00 PM	28.35
	00.00 AM	28.86
03/05/2021	06.00 AM	28.89
	12.00 PM	28.96
	06.00 PM	27.98
	00.00 AM	27.45
04/05/2021	06.00 AM	27.83
	12.00 PM	28.41

	06.00 PM	28.61
	00.00 AM	27.50
05/05/2021	06.00 AM	27.99
	12.00 PM	27.2
	06.00 PM	28.17
	00.00 AM	27.12
06/05/2021	06.00 AM	27.40
	12.00 PM	28.05
	06.00 PM	27.10
	00.00 AM	28.35
07/05/2021	06.00 AM	27.88
	12.00 PM	28.72
	06.00 PM	28.37
	00.00 AM	27.84
08/05/2021	06.00 AM	28.37
	12.00 PM	27.13
	06.00 PM	27.45
	00.00 AM	28.11
09/05/2021	06.00 AM	28.25
	12.00 PM	28.40
	06.00 PM	28.14
	00.00 AM	28.82
10/05/2021	06.00 AM	28.16
	12.00 PM	27.63
	06.00 PM	27.84
	00.00 AM	28.92
11/05/2021	06.00 AM	28.01
	12.00 PM	27.19
	06.00 PM	28.17
	00.00 AM	27.92
12/05/2021	06.00 AM	27.65
	12.00 PM	28.98
	06.00 PM	27.32
	00.00 AM	28.86
13/05/2021	06.00 AM	28.12
	12.00 PM	28.33
	06.00 PM	27.43

	00.00 AM	28.65
14/05/2021	06.00 AM	27.78
	12.00 PM	28.43
	06.00 PM	28.92
	00.00 AM	28.54
	06.00 AM	28.65
15/05/2021	12.00 PM	28.45
	06.00 PM	28.76
	00.00 AM	28.34
	06.00 AM	27.88
16/05/2021	12.00 PM	28.72
	06.00 PM	28.37
	00.00 AM	28.84
	06.00 AM	27.55
17/05/2021	12.00 PM	27.79
	06.00 PM	27.82
	00.00 AM	28.72
	06.00 AM	27.88
18/05/2021	12.00 PM	27.73
	06.00 PM	27.52
	00.00 AM	28.15
	06.00 AM	28.29
19/05/2021	12.00 PM	28.17
	06.00 PM	28.33
	00.00 AM	27.48
	06.00 AM	27.66
20/05/2021	12.00 PM	28.23
	06.00 PM	28.99
	00.00 AM	27.65
	06.00 AM	27.61
21/05/2021	12.00 PM	28.20
	06.00 PM	28.76
	00.00 AM	27.58
	06.00 AM	27.53
22/05/2021	12.00 PM	28.97
	06.00 PM	28.79
	00.00 AM	27.59
	06.00 AM	

23/05/2021	06.00 AM	27.01
	12.00 PM	28.30
	06.00 PM	27.21
	00.00 AM	28.01
24/05/2021	06.00 AM	27.10
	12.00 PM	28.20
	06.00 PM	28.95
	00.00 AM	27.75
25/05/2021	06.00 AM	28.29
	12.00 PM	28.17
	06.00 PM	28.33
	00.00 AM	28.48
26/05/2021	06.00 AM	27.76
	12.00 PM	28.54
	06.00 PM	28.42
	00.00 AM	27.12
27/05/2021	06.00 AM	27.42
	12.00 PM	28.91
	06.00 PM	28.54
	00.00 AM	27.49
28/05/2021	06.00 AM	27.31
	12.00 PM	28.94
	06.00 PM	28.54
	00.00 AM	27.89
29/05/2021	06.00 AM	28.25
	12.00 PM	28.40
	06.00 PM	28.14
	00.00 AM	28.82
29/05/2021	06.00 AM	28.19
	12.00 PM	28.17
	06.00 PM	28.19
	00.00 AM	28.11
30/05/2021	06.00 AM	28.02
	12.00 PM	27.81
	06.00 PM	27.67
	00.00 AM	28.26
31/05/2021	06.00 AM	28.22
	12.00 PM	28.01
	06.00 PM	28.03
	00.00 AM	28.11

Post-monsoon reading for the month of October 2020

DATA	TIME	Ground Water Level (m)
01/10/2021	06.00 AM	5.21
	12.00 PM	5.34
	06.00 PM	5.21
	00.00 AM	5.26
02/10/2021	06.00 AM	5.23
	12.00 PM	5.09
	06.00 PM	5.08
	00.00 AM	5.07
03/10/2021	06.00 AM	5.04
	12.00 PM	5.02
	06.00 PM	4.99
	00.00 AM	4.97
04/10/2021	06.00 AM	4.95
	12.00 PM	4.90
	06.00 PM	4.88
	00.00 AM	4.76
05/10/2021	06.00 AM	4.74
	12.00 PM	4.69
	06.00 PM	4.64
	00.00 AM	4.59
06/10/2021	06.00 AM	4.45
	12.00 PM	4.42
	06.00 PM	4.38
	00.00 AM	4.34
07/10/2021	06.00 AM	4.23
	12.00 PM	4.15
	06.00 PM	4.21
	00.00 AM	4.23
08/10/2021	06.00 AM	4.25
	12.00 PM	4.24
	06.00 PM	4.32
	00.00 AM	4.24

09/10/2021	06.00 AM	4.31
	12.00 PM	4.45
	06.00 PM	4.46
	00.00 AM	4.65
10/10/2021	06.00 AM	4.78
	12.00 PM	4.24
	06.00 PM	4.68
	00.00 AM	4.78
11/10/2021	06.00 AM	4.43
	12.00 PM	4.76
	06.00 PM	4.56
	00.00 AM	4.32
12/10/2021	06.00 AM	4.19
	12.00 PM	4.15
	06.00 PM	4.26
	00.00 AM	4.25
13/10/2021	06.00 AM	5.06
	12.00 PM	5.12
	06.00 PM	5.15
	00.00 AM	5.23
14/10/2021	06.00 AM	5.21
	12.00 PM	5.24
	06.00 PM	5.26
	00.00 AM	5.21
15/10/2021	06.00 AM	5.43
	12.00 PM	5.34
	06.00 PM	5.23
	00.00 AM	4.21
16/10/2021	06.00 AM	5.25
	12.00 PM	4.43
	06.00 PM	4.41
	00.00 AM	4.41
17/10/2021	06.00 AM	4.32
	12.00 PM	4.87
	06.00 PM	4.21
	00.00 AM	4.45
18/10/2021	06.00 AM	4.24
	12.00 PM	4.28

	06.00 PM	4.21
	00.00 AM	4,98
19/10/2021	06.00 AM	4.21
	12.00 PM	5.06
	06.00 PM	5.12
	00.00 AM	5.15
20/10/2021	06.00 AM	5.23
	12.00 PM	5.21
	06.00 PM	5.24
	00.00 AM	5.26
21/10/2021	06.00 AM	5.21
	12.00 PM	5.43
	06.00 PM	5.34
	00.00 AM	5.23
22/10/2021	06.00 AM	4.21
	12.00 PM	4.19
	06.00 PM	4.26
	00.00 AM	4.31
23/10/2021	06.00 AM	4.89
	12.00 PM	4.99
	06.00 PM	5.03
	00.00 AM	4.97
	06.00 AM	4.95
24/10/2021	12.00 PM	5.01
	06.00 PM	5.02
	00.00 AM	4.99
25/10/2021	06.00 AM	4.97
	12.00 PM	5.02
	06.00 PM	4.98
	00.00 AM	4.98
26/10/2021	06.00 AM	4.94
	12.00 PM	5.01
	06.00 PM	4.99
	00.00 AM	4.94
27/10/2021	06.00 AM	4.95
	12.00 PM	5.01
	06.00 PM	4.99
	00.00 AM	4.94

28/10/2021	06.00 AM	4.42
	12.00 PM	4.98
	06.00 PM	4.94
	00.00 AM	4.92
29/10/2021	06.00 AM	4.90
	12.00 PM	4.96
	06.00 PM	4.96
	00.00 AM	4.95
30/10/2021	06.00 AM	4.93
	12.00 PM	4.99
	06.00 PM	5.03
	00.00 AM	4.93
31/10/2021	06.00 AM	4.92
	12.00 PM	5.07
	06.00 PM	4.23
	00.00 AM	4.95

3. Regular ground water quality monitoring and submission of data to CGWA:

The plant is regularly monitoring the groundwater quality of existing bore wells from a NABL accredited laboratory or Govt. approved laboratory. It is required that the plant shall monitor quality of ground water from the abstraction structure(s) once in a year. Water samples from bore wells shall be collected during April/May every year and analysed in NABL accredited laboratories for basic parameters (cations and anions), heavy metals, pesticides/ organic compounds etc. It is also suggested that the Water quality data shall be made available to CGWA through the web portal.

4. Training and awareness of the employees at all levels and placing 'water saving' posters/slogans at various locations:

It is suggested that the plant employees at all levels should be made aware and trained on 'Water Saving & Conservation' and 'Good Housekeeping Practices'. Therefore, it is recommended to periodically organize Awareness Program for office employees including shop floor workers on Water Conservation. It is also suggested that prominent water saving labels/posters should be placed/located in the plant at noticeable locations like process area; near hand washing taps; washroom, reception office etc. This will create awareness & sense of responsibility among staff/employees/visitors.

5. Periodically conduct 'water & wastewater audit'

The plant should periodically conduct 'Water & Wastewater Audits' to assess the efficiency of water usage in processes; reduce water losses in the system and optimize costs & energy consumption. A detailed 'Water & Wastewater Audit' should be done at least once in 2-3 year or as per requirement by

an experienced Audit Team. The plant can create its own internal Audit team for conducting regular comprehensive 'Water & Wastewater Audit' after providing requisite training to the concerned officials.

6. Regular payment of applicable groundwater abstraction charges

The plant needs to pay applicable groundwater abstraction charges as per CGWA notification. The applicable Rates of Ground Water abstraction charges for the plant are Rs 1 per m³ as per the table given below:

Table 20: Rates of Ground Water abstraction charges for other industries & infrastructure projects (Rs per m³)

S. No.	Category of area ↓ Ground water use →	Quantum of ground water withdrawal			
		< 200 m ³ /day	200 to <1000 m ³ /day	1000 to <5000 m ³ /day	5000 m ³ /day and above
1.	Safe	1.00	2.00	3.00	5.00
2.	Semi-critical	2.00	3.00	5.00	8.00
3.	Critical	4.00	6.00	8.00	10.00

7. Ensure to comply with the NOC conditions to avoid any penalty

It is suggested that the plant should comply with the applicable NOC conditions to avoid any penalty. The penalty provisions for non-compliance of NOC are given below:

Table 21: Penalty provision for non-Compliance of No Objection Certificate conditions

S. No.	Item/S	Charges in Rs.
1	Non installation/faulty Digital water Flow meter with telemetry system.	200000
2	Non-disclosure/ construction of additional groundwater abstraction structures ❖ Non-functional Structures. ❖ Defunct/Abandoned Note: Given rates are for unit non-functional/defunct/abandoned structures. This shall be multiplied with total such structures to arrive at consolidated penalty.	200000 100000
3	Reporting of freshwater zones as Brackish / Saline zones in application.	200000
4	Non-Installation of Piezometer.	200000
5	Non-Installation/faulty DWLR/Telemetry system	100000
6	Non-Construction/Inadequate capacity of Recharge / Water conservation structures.	500000

S. No.	Item/S	Charges in Rs.
7	Non maintenance of Recharge structures.	200000
8	Injection of treated/untreated water into the aquifer system. Note: In addition to penalty, the proponent shall bear the cost of aquifer remediation as per the provisions of Environment (Protection) Act, 1986.	1000000
9	Non-Submission of Water level/Water quality Data.	50000
10	Non-maintenance of logbook of daily withdrawal/non submission of Groundwater abstraction data.	50000
11	Non submission of photograph of recharge structure(s).	50000
12	Non-Submission of Self Compliance report.	100000
13	Construction of groundwater abstraction structures by unauthorized/unregistered Drilling Rigs (per structures).	100000
14	Nonregistration of water supply tankers.	500000
15	Submission of false information/ undertaking.	100000

1. Water Savings in the Buildings for Domestic Use

To optimize water use in the buildings for domestic purpose, the following observations and suggestions are made based on the building survey during the water audit:

- ❖ **Optimise water flow in handwashing and other taps:** Water flow rates in hand washing taps vary from 2-10 lpm .It is suggested to install flow restrictors in the hand washing taps of the plant area to reduce the excess flow in hand wash taps to 5 lpm. Generally, the water efficient handwashing taps use 3-5 lpm only.
- ❖ **Reduce water flow in urinals by optimizing the flushing time:** The flush time in the urinals varies from 2.2 seconds/use – 80 seconds/use. It is suggested to optimize the timer for the urinal flushing.
- ❖ **Flush tank capacities are about 6-10 liters/flush –** Use tank bank in existing flush tanks to reduce 2-3 liters water per flush or install water efficient cistern/flush tank with capacity 3/6 liters per flush.

Recommendations: It is suggested to install following water efficient fixtures in the buildings to save domestic water consumption. Overall, 15-20% domestic water consumption will be reduced by installing and maintaining suggested fixtures:

- ❖ **Retrofit flow restrictors in handwashing taps and other taps:** Retrofit high flowrate handwashing taps with ‘aerators and flow restrictors’ so as to have 3-5 lpm flow rate in hand washing taps & other taps in the plant.



- ❖ **Stop use of raw water, instead use recycled, treated wastewater.** It is suggested to use low quality water for flushing instead of good quality filtered water.
- ❖ **Install 'Tank Bank (For Flush Tanks)' or install with Water efficient flushes with dual flush Cistern 3-6 litres capacity flush tanks** – In toilets groundwater is used for flushing and about 7-10 litres of freshwater is flushed per flush. To reduce the flushing water per flush, it is suggested to install scientifically designed easy to install 'Tank-Bank' in the existing flush tanks. By just placing tank bank in the flush tank, we displace and save water equal to the space occupied by the tank bank for every flush. This will save about 20% of flush water in toilets. However, the existing 7-10 litres flush tanks can also be replaced by Water efficient flushes with dual flush Cistern 3-6 litres capacity flush tanks to save water. This will save about 40% of the flush water in toilets.

Table 22: Potential water savings per person per day by replacing Conventional Cistern with Slim dual flush Cistern / Using Flush Tank Bank

Estimated Flush usage per person per day	Conventional Cistern	Slim Dual Flush Cistern		Using Flush Tank Bank
Handle Type	Conventional	Small	Large	
Usage per day per person (Numbers)	5	4	1	5
Cistern Capacity (Litres)	7-10	3	6	6
Water Consumption (Litres)	35-50	12	6	30
Total Water Consumption (Litres/ Person/day)	42.5	18		30
Water Saving (Litres/person/day)		42.5-18 =24.5		42.5-30=12.5
		Reduction in 57% of water use in flushing activity		Reduction in 30% of water use in flushing activity

Picture 3: Tank Bank (For Picture 4: Dual flush Cistern 3-6 liters



Flush Tanks)

1. Install Drip Irrigation in the garden/horticulture area for efficient water use in landscaping/gardening

Existing Scenario: The plant has total area of 675860 meter square out of which about 24770 sq. m is Green Belt. The plant uses a total water for irrigation/landscaping/horticulture.

Recommendation: It is suggested that the plant should install Drip Irrigation system which is water efficient for gardening/horticulture. **The drip irrigation system will save 30-50% of water.** By installing drip irrigation system, the requirement of water for greenbelt (horticulture) could be met from available recycled / treated wastewater. The benefits of the drip irrigation system are given below:

Benefits of a Drip Irrigation System:

- ❖ **Saves Water:** Studies show that drip irrigation systems use 30 – 50% less water than conventional watering methods, such as Nuvoco Vistas Corporation Limited inklers or using open ended hose pipes.
- ❖ **Improves Growth:** Smaller amounts of water applied over a longer amount of time provide ideal growing conditions. Drip irrigation extends watering times for plants, & prevents soil erosion and nutrient runoff. Also, because the flow is continuous, water penetrates deeply into the soil to get well down into the root zone.
- ❖ **Discourages Weeds:** Water is only delivered where it's needed.
- ❖ **Saves Time:** Setting and moving Nuvoco Vistas Corporation Limited inklers is not required. A timer can be added to the system for automatic watering.
- ❖ **Helps control fungal diseases,** which grow quickly under moist conditions. Also, wet foliage can Nuvoco Vistas Corporation Limited disease.
- ❖ **Adaptable:** A drip irrigation system can be modified easily to adjust to the changing needs of a garden or lawn.

CHAPTER 8: IMPLEMENTATION PLAN

Sr. No	Section/Area	Recommendations
1.	Regularly calibrate & maintain existing water flow meters	It was observed that the existing bore well meter are installed and calibrated
2	Maintain logbook of daily groundwater abstraction	It was observed that the plant is maintaining data of daily groundwater abstraction
3	Regular ground water quality monitoring and submission of data to CGWA:	The plant regularly checks the water quality of the Groundwater and submitting the reports to CGWA
4	Training and Awareness of the Employees at all Levels and Placing 'Water Saving' Posters/Slogans at various Locations	Plant is regularly conducting Training and Awareness of the Employees, events to promote water conservation like celebration of world water day, world environment day" and Placing 'Water Saving' Posters/Slogans at various Locations
5	Periodically conduct 'Water & Wastewater Audit'	Plant has formed a cell for assessment of potential for water & wastewater management in the plant for water saving & waste water management.
6	Regular payment of applicable groundwater abstraction charges	The plant needs to pay applicable groundwater abstraction charges as per CGWA notification.
7	Ensure to comply with the NOC conditions to avoid any penalty	It is suggested that the plant should comply with the applicable NOC conditions to avoid any penalty.
8	Water Savings in the Buildings for Domestic Use	It is suggested to install following water efficient fixtures in the buildings to save domestic water consumption. Overall, 15-20% domestic water consumption

Sr. No	Section/Area	Recommendations
9	Install Drip Irrigation in the garden/horticulture area for efficient water use in landscaping/gardening	It is suggested that the plant should install Drip Irrigation system which is water efficient for gardening/horticulture. The drip irrigation system will save 30-50% of water.

ANNEXURES (MEASURED DATA)

Annexure I: Pump Efficiency and other measurements

❖ Pumping Cost

Table 23: Pumping Cost

S. No	Pump name	Total Flow	Power Consumption	Sp. Power	Cost of Pumping	Daily Run hours	Daily flow	Daily Pumping Cost	Total Annual Cost
				Consumption					
	Electricity Charges @ 6.50 Rs/kWh	m ³ /h	kW	kWh/m ³	Rs/m ³	h/day	m ³ /day	Rs/day	Rs/yr
1	Borewell Pump no.1	8.00	1.10	0.14	0.86	5.0	40.00	34	10725
2	Borewell Pump no.2	20.00	8.00	0.40	2.50	4.0	80.00	200	62400
3	STP Pump and Blower	2.50	2.40	0.96	6.00	6	0.00	0	34164
4	Rain water Harvesting Pump	12.40	3.20	0.26	1.61	6	68.20	110	41756
							188.20	344	149045

Annexure:

Fresh Water Details

(m ³ /month)	Bore well Water	Domestic water use	Industrial water use	Others Green Belt
	Withdrawn			
18-Apr	1935	251.55	1490.0	193.5
18-May	1999	259.87	1539.2	199.9
18-Jun	1935	251.55	1490.0	193.5
18-Jul	930	120.9	716.1	93
18-Aug	930	120.9	716.1	93
18-Sep	1550	201.5	1193.5	155
18-Oct	1999	259.87	1539.2	199.9
18-Nov	1935	251.55	1490.0	193.5
18-Dec	1999	259.87	1539.2	199.9
19-Jan	1999	259.87	1539.2	199.9
19-Feb	1806	234.78	1390.6	180.6
19-Mar	1999	259.87	1539.2	199.9

(m ³ /month)	Bore well Water Withdrawn	Domestic water use	Industrial water use	Others
19-Apr	1935	251.55	1489.95	193.5
19-May	1999	259.87	1539.23	199.9
19-Jun	1935	251.55	1489.95	193.5
19-Jul	930	120.9	716.1	93
19-Aug	930	120.9	716.1	93
19-Sep	1550	201.5	1193.5	155
19-Oct	1999	259.87	1539.23	199.9
19-Nov	1935	251.55	1489.95	193.5
19-Dec	1999	259.87	1539.23	199.9
20-Jan	1999	259.87	1539.23	199.9
20-Feb	1806	234.78	1390.62	180.6
20-Mar	1999	259.87	1539.23	199.9

(m ³ /month)	Bore well Water withdrawn	Domestic water use	Industrial water use	others
20-Apr	5400	702.0	4158.0	540.0
20-May	5580	725.4	4296.6	558.0
20-Jun	5400	702.0	4158.0	540.0
20-Jul	4495	584.4	3461.2	449.5
20-Aug	4495	584.4	3461.2	449.5
20-Sep	5400	702.0	4158.0	540.0
20-Oct	5580	725.4	4296.6	558.0
20-Nov	5400	702.0	4158.0	540.0
20-Dec	5580	725.4	4296.6	558.0
21-Jan	5580	725.4	4296.6	558.0
21-Feb	5520	717.6	4250.4	552.0
21-Mar	5580	725.4	4296.6	558.0

Waste water Details

(m ³ /month)	STP Treated water	ETP Treated Water
20-Apr	273.78	282.744
20-May	282.906	292.1688
20-Jun	273.78	282.744
20-Jul	227.8965	235.3582
20-Aug	227.8965	235.3582
20-Sep	273.78	282.744
20-Oct	282.906	292.1688
20-Nov	273.78	282.744
20-Dec	282.906	292.1688
21-Jan	282.906	292.1688
21-Feb	279.864	289.0272
21-Mar	282.906	292.1688

Total No. of buildings						
Building name	No. of employees in building	No. of floors in building	Total no. of washrooms on each floor	No. of taps	No. of urinals	No. of showers
Office	16	2	4	4	4	3
Bachelor accommodation	12	1	6	6	6	-
Driver and operator accommodation	24	2	4	5	4	-

Canteen/ Kitchen Name/Location	Services (Breakfast/ Lunch/ Dinner/ others)	Total no. of visitors per day	Total No. of Taps		
			Drinking water	Utensil Washing	Others
Office canteen	Breakfast, Lunch, Dinner	35	1	1	1

Details of ETP

Effluent Treatment Plant		
Installed Capacity (m ³ /hr)		0.66
Average Quantity of treated wastewater (m ³ /day)		8.2
Chemical Details		
Name of Chemical/s	Quantity kg/month or litres/month	Price (Rs/Kg or Rs/litres)
Power Consumption (Units/day)		
Is treated effluent reused or discharged?		Reused
If reused, provide area of its application & reused quantity (m ³ /day)		Green Belt, Dust Suppression, Wheel wash & toilet flush.
If discharged, provide disposal media like sewerage line, water body, land etc.		

**Please provide Effluent Treatment Scheme and Water Quality data of the Inlet & Outlet of the ETP.*

❖ Details of STP

Sewage Treatment Plant		
Installed Capacity (m ³ /hr)		3.33
Average Quantity of treated sewage (m ³ /day)		14.7
Chemical Details		
Name of Chemical/s	Quantity kg/month or litres/month	Price (Rs/Kg or Rs/litres)
Power Consumption (Units/day)		893
Is treated sewage reused or discharged?		Reused in dust suppression & Green Belt

Total Area under gardening/irrigation (meter square)	24770
Approximate water requirement for the gardening (cubic meter/day)	12
Type of water used in irrigation/gardening (Fresh water/treated wastewater/other)	Recycled/Fresh
Frequency of Gardening per day (once/twice/thrice)	once
Hour of Gardening per day	
Equipment used for gardening (hose pipe/sprinkle/micro-irrigation/other)	hose pipe
Type of irrigation- Drip, Sprinkle, Flood	Flood

❖ Details of Rainwater Harvesting system if implemented:

Total area in meter square:	675860
Green area in meter square:	24770
Rooftop area in meter square:	15000
Open area in meter square:	598100

**SAFE AND OPTIMUM PIT AND DUMP SLOPE DESIGN
FOR RAIKELA IRON ORE MINE OF
M/s GEETARANI MOHANTY**



SPONSERED BY

M/S GEETA RANI MOHANTY

STATION ROAD, BARBIL, KEONJHAR

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JULY 2021

PREPARED BY



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Note: This report is meant for internal use of your organization only and it should not be published in full or part by your organization. It should not be communicated or circulated to outside parties except concerned departments. However, CIMFR reserves the right to publish the results of the investigations for the benefit of the industry. The conclusions and recommendations are based on the results of investigations. It is hoped that the recommendations will be implemented to get the optimum results without hampering production, productivity and safety. The recommendations are the guidelines, which should be implemented in letter and spirit. Since the day-to-day operations are not under the control of CIMFR, the research team will not be held responsible for any untoward incidence caused due to any slope failure.

Dr. M K Chakraborty

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CHAPTER -1: INTRODUCTION

1.1 Background

In these days opencast mining is the main focus in mining industry as they contribute maximum portion of the total production. Besides this due to maximum flexibility in working operation low gestation period and quick rate of invest open cast mining is getting popular. Open cast mining involves removal of overburden. The removed overburden needs to be stored safely. As land available for mining activities has been a great problem to mining industry. So, optimization of dump design is acutely needed to store maximum overburden within a limited space. As a result, analysis of stability of operating slopes and ultimate pit slope design are becoming a major concern. Slope failures cause deprivation of production, additional stripping cost for recovery and excessive handling of failed material, loss of watering in the pits and may cause mine abandonment/premature closure. Besides this in recent years, there are numbers of landslide have taken place everywhere. They mostly happen on the cut slopes or embankment along roads, highway and sometimes within the vicinity of highly populated residential area especially those in the highly terrain. Thus, to minimize the severity or casualty in any landslide a proper realization, supervising and management of slope stability are essential.

1.2 Aim of the Study

The aim of the research work was to evaluate the existing overburden slope practice as well as propose any change to the design of dump slope. Investigation of the safety status of a mine by the help of factor of safety and to propose various safe designs of dump slope. The goal was achieved by addressing the following specific objectives.

- 1) Complete literature review on the topic to understand the problems associated.
- 2) Visit to an open cast mine and collection of sample
- 3) Lab experiments to be carried out to determine various geological parameters of the sample brought from the mine.
- 4) Determination of factor of safety from various geotechnical data of existing dump slope design.
- 5) Propose of various alternate safe design of dump slope

1.3 Methodology

The aim and specific objectives have been achieved by following the step by step process in figure 1.1.

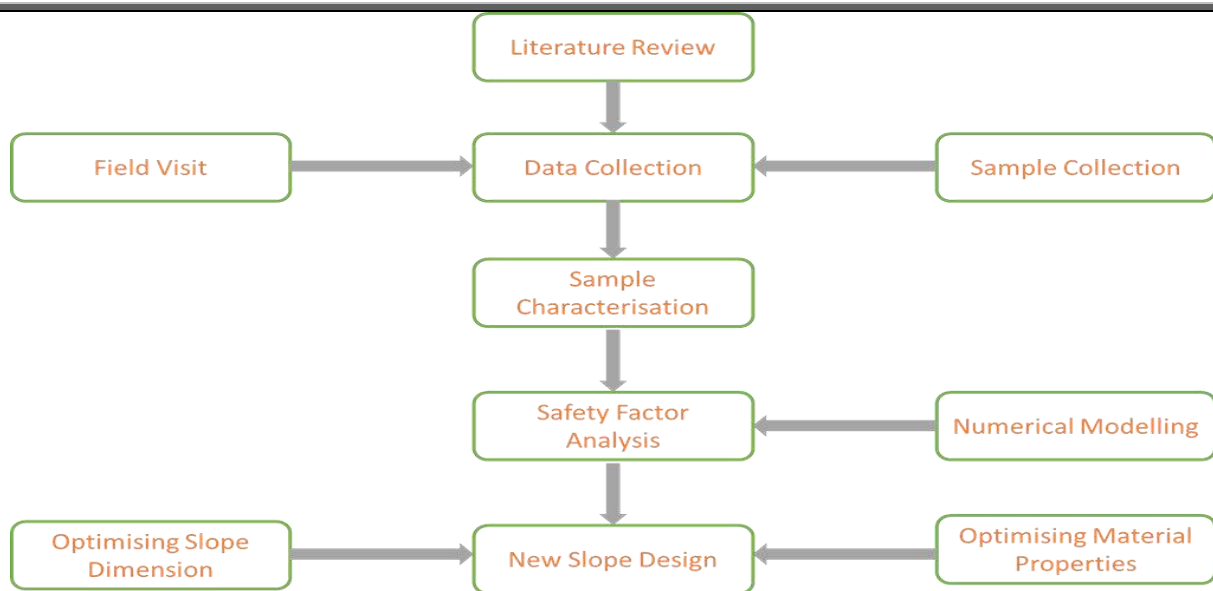


Fig 1.1.

1.4 Literature Review of Dump Stability

The aim and objectives were achieved by the methodology discussed earlier. The available literatures on different aspects of the dump slope and its stability were critically reviewed and fundamental concept as well as different practices followed elsewhere is given below.

The **slope stability analyses** are generally performed to measure the safe and economic design of human-made or natural slopes (e.g. water embankments, open-pit mining, mine excavations, landfills etc.) and the balancing conditions. The term “slope stability” can be defined as the ratio of the resistance offered by the inclined surface to failure by sliding or collapsing. The main aim of slope stability analysis are to locate danger areas, supervising potential failure mechanisms, finding of the slope susceptibility to different triggering mechanisms, designing of optimal slopes with respect to safety, reliability and economics, designing possible protective measures, e.g. barriers and stabilization.

Where the stability of a sloped earth mass is to be researched for the probability of failure by sliding along a circular surface, the principles of engineering statics can be applied to determine if a stable or unstable condition exists. When the total sliding mass is assumed to be a cylindrical shaped, a unit width along the face of the slope is taken for analysis, and the slip surface of the slope cross section is the segment of a circle. The forces affecting the equilibrium of the assumed failure mass are determined and the rotational moments of these forces with respect to a point representing the center of the circular arc are computed. In this procedure the weight of the soil in sliding mass is considered as an external load on the face and top of the slope contribute to

moments which cause movement. The shear strength of the soil on the assumed failure surface provide resistance to the sliding.

A computational method is used to show if failure (sliding) occurs is to equate moments that would resist movement to those that tend to cause movement. The maximum shear strength owned by the soil is used in calculating the resisting moment. Failure is pointed out when moments causing motion, exceed those resisting motion. The factor of safety against sliding or movement is expressed as

$$F = \frac{\text{Movement resisting sliding}}{\text{Movement causing sliding}}$$

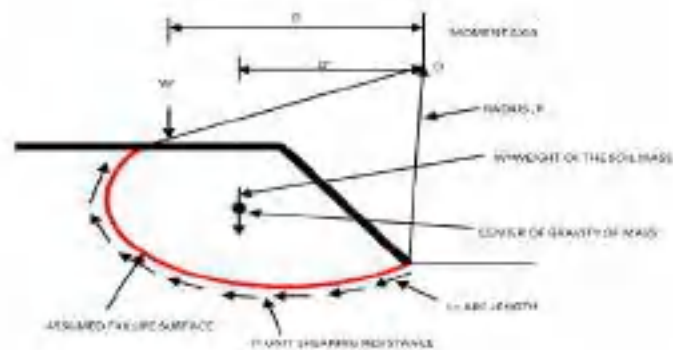


Fig:- 1.2: forces acting on an assumed slope failure mass

Here, W' = External loading on failure area.

D' = Distance between Moment axis and CG of mass.

D = Distance between Moment axis and failure surface.

Moment causing sliding = $(W \times D') + (W' \times D)$

Moment resisting sliding = $i \times L \times R$

A factor of safety of unity means that the assumed failure mass is about to slide. A variation to this method for studying slope stability comprises calculating the shear strength required to provide sliding moments and resisting moments balance (equilibrium). The shearing resistance needed along the slip surface is compared to the shear strength that can be produced by the soil. If the soil shearing strength that can be produced by the soil is more than the shearing resistance required for equilibrium, failure happens with this method.

1.4.1 Factors affecting slope stability

Factors affecting the stability of any slope (McCurthy and David, 2007):

- 1) Gravitational Force.
- 2) Material properties of the dump slope.
- 3) Geology and hydrogeology of the dumping area.

- 4) Inclination of the dump slope.
- 5) Erosion of dump caused by flowing water.
- 6) Lowering of water adjacent to a slope.
- 7) Effects of earthquakes.

The result of all the movements is caused by the soil to move from high points to low points. The component of the gravitational force is very important to be considered that acts in the direction of probable motion. The effects of flowing or seeping water are normally known as very important aspects in slope stability problems. But these problems have not been properly recognized. The main problem with seepage is it causes seepage forces which have major effect than normally realized.

As far as mass movement is concerned, erosion on the surface of the slope can increase the stability of the dump slope by removing certain weight of soil mass. On the other hand, it can decrease the stability by increasing the height of the slope or decreasing the length of failure. This happens by seepage at the toe portion.

Lowering of the ground-water surface can cause increase in weight which is caused by decrease in buoyancy of the soil. The increase in weight results in increase in the shearing stresses which ultimately causes decrease in safety factor. Practically no changes in volume will take place except at a constant slope rate, and in spite of the increase of load, increase in strength may be insignificant.

A decrease in the inter-granular pressure and increase in the neutral pressure supports shear force at a certain volume. For state of liquefaction of soil mass, a different condition will be applicable. This type of condition is likely to be developed if the mass of the soil is subjected to vibration, which mostly happens due to earthquake.

a) Slope Stability Analysis System – GALENA

GALENA is constructed to be a simple, user-favourable yet very efficient slope stability software system. It was initially developed to satisfy the need of BHP (now known as BHP Billiton) geotechnical engineers who eventually see that there were many problems with other slope stability analysis software systems available. Geotechnical engineering seldom gives one unique answer and extensive parametric studies are often required before realistic results are calculated. *GALENA* enables such parametric studies to be undertaken firstly and easily.

The *GALENA* system comprises slope stability problems as they are largely encountered in the field. That is, the total geology normally remains the same; it is the slope surface that needs change in many situations. In *GALENA*, the total geology is specified for the model, including the material properties. Material above the slope surface is ignored since this has been removed or

mined out. In this way, *GALENA* enables a large number of analyses to be undertaken without the need to redefine the model each time. *GALENA* involves the Bishop Simplified, the Spencer-Wright and the Sarma methods of analysis to calculate the stability of slopes. The Bishop method determines the stability of circular failure surfaces, the Spencer-Wright method is applicable for circular and non-circular failure surfaces, and the Sarma method is used for problems where non-vertical slices are required or is used for more complex stability problems. It is possible to analyze more than one layered slopes with tension cracks, earthquake forces, externally distributed loads and forces, and pore pressures from within or above the slope (e.g. dams and river banks) including phreatic surfaces and piezometric pressures. *GALENA* incorporates various techniques for locating the critical failure surface with user-supplied restraints. There is also facility to do back analysis to decide material properties according to desired safety factor. Either effective or total stresses may be used on any material layer. For the total stress case, the increase in undrained shear strength with depth can be simulated using Skempton's relationship by simply entering the value of the plasticity index for that material. Probabilistic analysis can be readily undertaken using either defined material properties, or defined mean values, and standard deviation for the production of density and distribution plots. *GALENA* allows shear strength to be defined using traditional c and ϕ values, the Hoek-Brown (1983) failure criterion (m , s and UCS), or with shear/normal data from curves of any shape.

GALENA comprises three different methods of slope stability analysis:

- i. **BISHOP SIMPLIFIED METHOD** - suitable for circular failure surfaces.
- ii. **SPENCER-WRIGHT METHOD** - suitable for circular and non-circular failure surfaces.
- iii. **SARMA METHOD** - suitable for more complex problems particularly where non-vertical slice boundaries (such as faults or discontinuities) are significant.

In most instances, slope stability problems can be analyzed with one of the above methods. However, for complex slope stability problems where in-situ stresses are significant, it may be more appropriate to use a stress analysis method such as finite element or finite difference etc. Nevertheless, ***GALENA*** will provide fast and accurate answers for most slope stability problems and it has some features that are designed particularly for the practicing geotechnical engineer, which are detailed within this User's manual.

1.5 Literature Review of Slope Stability

Whitman (1984) stated that risk and reliability analyses are theoretically very useful in the course of the initial stages of a project in making decision to continue or not and in assisting the establishment of design criteria. He suggested that reliability can be used as guide for the selection of safety factor reliable with the degree of safety in case if the problem is understood with

enough data but with no standard factor of safety. In case of different slopes, reliability theory can be used to improve consistency in the safety. It is important to differentiate the spatial variability effect and systematic errors effect. In economical point of view, optimization techniques are helpful for making the choice of safety factor. Even if there is any doubt in the computed numerical results, systematic formulation of the reliability problem can very helpful in understanding of it. It is not possible to calculate the actual risk precisely only by analysis in cases where the risk has to be little. Still the outline of risk evaluation can guide the subjective evaluations.

Low (1989) proposed an easy and expedient semi-analytical procedure for embankment's factor of safety built on soft clay. He developed Stability numbers N_1 , N_2 respectively for normalized foundation strength, normalized embankment strength. The safety factor is calculated as the sum of the two products of stability numbers with their corresponding normalized strength. A circular potential slip surface was assumed. The significance of the foundation and embankment strengths can be individually compared during the calculation. The computation can also consider the cases with soft clays of varied undrained shear strength with depth and for c - Φ embankment soils.

Christian et al. (1994) described how laboratory and field data are used for deriving the probabilistic values of soil parameters which are applicable in stability analysis. He explored the first order second moment approach and applied to the embankment dams design. The comparative effect of uncertainties of different parameters is also considered. The uncertainty in the soil properties comprises of scatter and systematic error. The first covers random measurement error and real spatial variability and the latter contains both statistical uncertainty and the effects of bias. For establishing the factor of safety for the design which represent the reliable risks for different modes of failure, reliability analysis is very useful. Reliability index quantifies stability better than factor of safety as it describes safety by the standard deviations separating F from its standard failure value, 1.0. Thus, making it an implicit approach.

Greco (1996) presented an efficient Monte-Carlo method for analysis of slope stability to locate the critical slip surface. The process consists of number of stages where a suitable technique is generated for every new slip surface by a repetitive procedure, depending on generating random numbers. The framework of method was very simple, programmed easily, integrated, and modified for particular necessities. It is sturdy enough for layered soils which are feeble, thin, inclined layers and critical problem for the search of slip surface. The suggested method provides results as good as the best methods of nonlinear programming.

Low et al. (1997) proposed a practical method to calculate the Hasofer-Lind second moment reliability index β using spreadsheets. The proposed technique is dependent on the perception of ellipsoid which is tangential to surface of failure in original space of random variables. By forming

the quadratic arrangement of tilted ellipsoid in the spreadsheet, correlation is considered. Using the non-normal and its corresponding normal relationship, the non-normals are dealt. Spreadsheet's optimization tool performs automatically the numerical partial differentiation and iterative searching. Because of its relative easiness and perceptiveness, the suggested method can be a striking alternative to the established mathematical tools which require closed-form partial derivatives and transformed space.

Low et al. (1997) proposed a powerful spreadsheet technique to reduce the iterations required for the first order reliability method (FORM) and Janbu's generalized procedure of slices (GPS) applicable for slope stability analysis with slip surface which is non-circular. In this method, the principal concepts were made clearer to user, intuitions were obtained. The spreadsheet's optimization tool automatically calculated the optimization partial derivatives. The search for the non-circular critical slip surface for both deterministic and probabilistic is automatic in spite of the point that the expressions for safety factor and the performance functions were implicit. This technique is also applicable for other generalized limit equilibrium methods of slopes.

Liang et al. (1999) established reliability and probability theories to calculate reliability index along with its corresponding probability of failure of multi-layered slopes and embankment dams. A computerized program named RESLOP was introduced which was confirmed by failure case of Congress Street open cut. The stability of King Talal embankment dam was studied using this approach. The uncertainties in the properties were incorporated in the analytical process by using the reliability analysis approach. The obtained reliability index comprises of additional data when compared to the deterministic safety factor which helps in finding the slip surface that is most likely for the slope rather than the surface with the minimum factor of safety alone.

Malkawi et al. (2000) presented a procedure for slope stability analysis in probabilistic approach using Monte Carlo simulation method and first-order second-moment method. A comparison was done with results obtained from these methods with four familiar techniques of slope stability analysis. These are Ordinary method, simplified Janbu's method, Spencer's method and simplified Bishop's method. In case of homogeneous slope, the reliability index β for Ordinary and Bishop Methods were in good agreement but for Janbu and Spencer methods there exists variation between MCSM and FOSM. In case of non-homogeneous slope β is near for Ordinary, Janbu and Bishop Methods but different for Spencer method.

Ramly et al. (2002) introduced a spreadsheet technique for analysis of probabilistic slope stability which is based on MC simulation by using easily obtainable software, @Risk and MS Excel 97. The study takes into account, spatial variability of input parameters and statistical uncertainty because of inadequate data and biases in the correlations and empirical factors used. The

methodology was applied to probabilistic slope stability analysis of the dykes of the James Bay hydroelectric project and for the comparison of the outcomes was done with the first-order second-moment method. Reliability index and probability of unsatisfactory performance were calculated by combining the factor of safety and uncertainty involved in it. The decision-making process can be improved by linking the conventional slope stability analysis and probabilistic based approach for slope engineering practice.

Griffiths et al. (2004) have studied the failure probability with simple and advanced probabilistic analysis methods for a cohesive slope. The simple tool considered strength of complete slope to be only random input variable without local averaging and spatial correlation such that it falls lower than a critical value depending on a lognormal pdf. The 5 Random FEM based on elastoplastic nonlinear analyses using MCS is capable of considering both local averaging and spatial correlation and allows the mechanism of failure to pass through weakest plane in soil. Thus, obtained values of failure probability using simplified analysis based on probabilistic approach are unconservative.

Low (2005) illustrated a practical design process based on reliability for retaining walls using FORM and the Hasofer–Lind index. Random variables which are both normally and non-normally correlated are taken into consideration. Based on Low & Tang work, the probabilistic spreadsheet-based approach attains the similar outcome compared with FORM and the Hasofer–Lind method, but utilises an instinctive perspective of expanding dispersion ellipsoid which significantly make interpretations and computations simpler. Sensitivity analysis for the random variables in reliability analysis was done. The comparison of probabilities of failure obtained from reliability index and Monte Carlo simulations was done.

Foye et al. (2006) presented a structure of Load & Resistance factor design (LRFD) factors based on reliability-based design approach and orderly method for selecting the Probability Density Functions. The uncertainty in the design parameters is dependent on the transformation and material uncertainties. There is an increase in composite variable uncertainty with increase in transformation and material uncertainties. For clay and sand, the uncertainties in bearing capacity equations are systematically analysed. Numerical integration of the fundamental equations has been used to define the PDFs that are necessary to perform a reliability analysis of the bearing capacity of footings.

Xu et al. (2006) proposed a reliability-based approach using response surface method for combining probabilistic stability analysis and FEM in case of embankments. It was presented that the deterministic based analyses of model have great effect on the results of reliability-based analyses for embankments. Any assumption made in analytical model based on deterministic

approach, for example using a non-rigorous method or circular slip surface leads to an inexact valuation of reliability index. Particularly, the analysis considering circular slip surface will overestimate the reliability index if the shape of slip circle highly influences the value of factor of safety. The suggested reliability analysis technique via RSM is mainly useful for combining several deterministic stability analyses like limit equilibrium methods, finite-element method, and FORM to form a probabilistic stability analysis. **Low (2014)** described an instinctive ellipsoidal perception combined with three spreadsheet-automated controlled optimization FORM processes and a SORM method. These methods were compared using some examples of a rock slope, a confined soil element, and embankment on soft ground having spatially auto correlated undrained shear strength in the foundation. Re-formulated Spencer method is considered for the performance function. critical slip surface which is noncircular is searched based on reliability approach. The proposed methods were also compared with MCS.

Ray et al. (2015) explored an analytical study of a cantilever sheet pile wall taking the influence of uncertainties in soil properties into consideration. A factor named probabilistic risk factor (R_f) was proposed by combining the Probability of failure (P_f) of sheet pile wall with the sensitivity (S) of random input variables on the mode of failure. The value of P_f was attained using Finite Element model through Response Surface. F-test analysis was performed to do the Sensitivity analysis of every random variable. The water table positions and the cohesion parameter of foundation soil are the parameters which mostly affect the stability of the pile wall. For varying properties of soil, variations in height of cantilever sheet pile wall and different positions of water table, the suggested risk factor based method is beneficial.

CHAPTER -2: Mine Description & Field Data Collection

Raikela iron ore mine of M/s Geetarani Mohanty over an area of 67.586 hectares is located in village Raikela, PO-Tensa in the district of Sundergarh of Odisha state. The area contains both forest and non-forest land. Out of total lease area, 66.671 ha come in forest land which is falls under in “DLC Forest” and rest 0.915 ha area is under non-forest area. The mining lease area is approachable from Koira town covering a distance of 8 km by Bhadrasahi – Rourkela NH – 215. The area can also be approachable from Tensa town ship which is on NH – 215 at a distance of 2 km. Nearest Railway Station is at Barsuan (Both Passenger and goods train). The leasehold area falls under Survey of India Toposheet No. 73 G/1 and is delineated between latitude $21^{\circ} 51' 54.47556''$ to $21^{\circ} 52' 35.39676''$ N and longitude $85^{\circ} 10' 32.27952''$ to $85^{\circ} 11' 05.16660''$ E. The lease area presents an undulating topography. The highest and lowest elevation is 845m and 625m above M.S.L. respectively. A seasonal nala flows from west to east near southern lease boundary.

2.1 Geology

2.1.1 Regional Geology

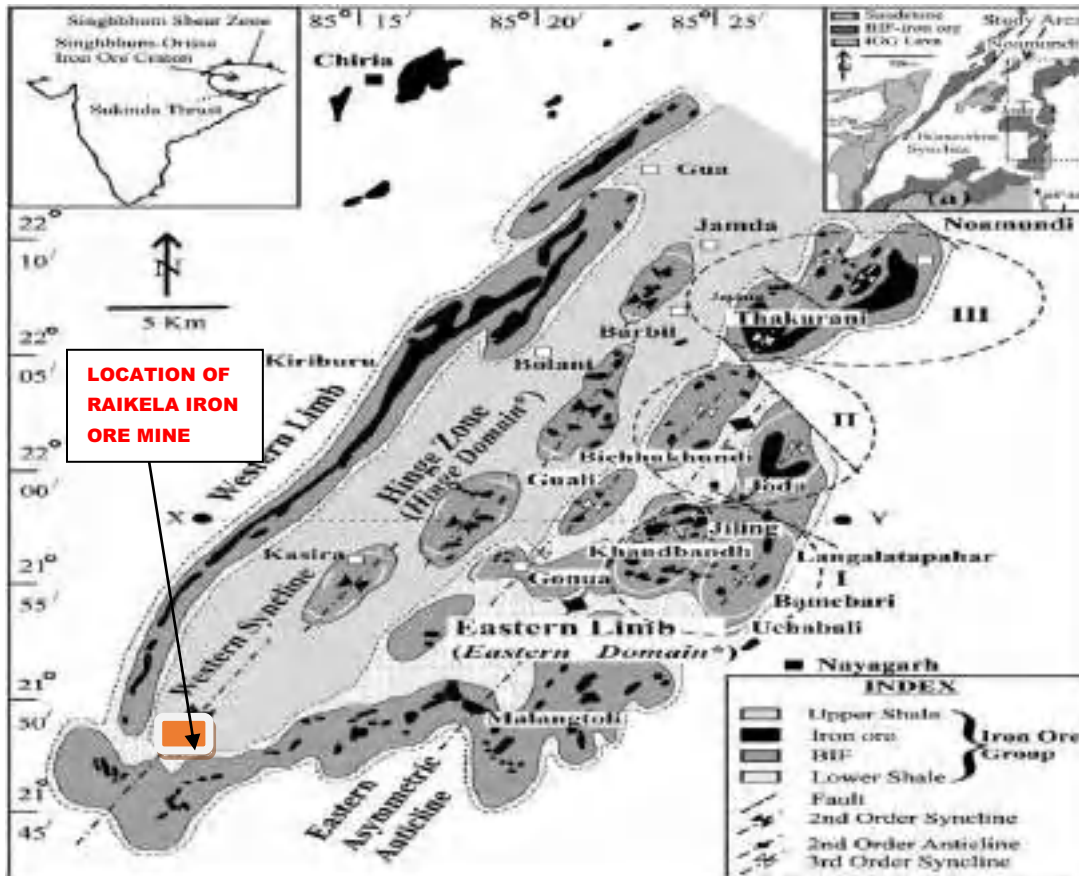
The geological formations of this region represent a part of eastern limb of famous horse shoe shaped, Synclinorium of Pre-Cambrian age. The general strike of the formation is NNE-SSW and dip towards NW.

The various litho-units occurring in this region include Granite, Dolerites, Gabbro Anorthosites, Ultramaffic intrusions, Quartzite, Conglomerates, BHJ, BHQ and Iron ore formations. The regional stratigraphic sequences (by Saha and Sarkar) of Singhbhum-Keonjhar-Bonai area is as follows.

The regional stratigraphy (Sarkar & Saha) is as follows.

End of Singhbhum Orogenic cycle (850 ml years)
Newer dolerites (1660-950 ml years)
Mayurbhanj granites (1200 ml years)
Gabbro Anorthosites (1470 ml years)
Ultra Maffic intrusions
Kolhan group (1500-1600 ml years)
.....unconformity.....
Jaggannathpur lavas, Dhanjori simplipal lavas, Quartzites, conglomerates
.....unconformity.....
Chaibasa formations
.....unconformity.....
Singhbhum granites (2950 ml years)
Iron ore orogeny

Iron ore group
unconformity.....
 Older metamorphic (3200 ml years)
older metamorphic orogeny.....
 Older metamorphic group.



2.1.2 Local Geology

The available field studies conducted indicates that the local structural elements are compatible with the general regional trend of the western limb of the synclinorium. The main rock types found in this mines are BHQ, Hematite (Massive, Laminated and as float ores), Conga and ferruginous laterite. In the ML area, iron ore found as mainly hard massive and laminated variety. The strike varies from $N30^{\circ}E - S30^{\circ}W$ to $N55^{\circ}E - S55^{\circ}W$. The dip is generally westerly but varying from 40° to 55° and in few isolated locations the dip amount is 70° . These normally conform to the regional trend of the rock i.e. BHQ/BHJ.

Lithological successions

The lithological succession established as observed within the leasehold area are compatible with other locations on the western limb of the synclinorium. The general lithological succession is as follows –

Alluvium

Ferruginous Lateritic float ore

Massive / Laminated in-situ ore

BHQ / BHJ / Shale

Control of mineralization

The possible parameters of control of mineralization may be attributed to

- a) Regional and local tectonics,
- b) Leaching and metasomatic replacement of BHQ and there by leading to iron ore formations, as evidenced by the presence of unleached portion of the ore and BHQ in the ore body.

Effects of Weathering

The weathering has led to the formation of Laterite, which is highly erratic in nature, hence irregular/discontinuous pockets of Laterite is a common feature in the iron ore deposits.

Description of rock types

The main rock types such as Laterite, BHQ & Hematite found in Raikela Iron Ore Mines of M/s Geetarani Mohanty are of iron ore series of Singhbhum.

(i) Laterite

The Laterite is reddish, brown, porous, concretionary material. It is exposed in the eastern section of the Raikela Iron Ore Mines whereas Brecciated Laterite (conga) is found in the north eastern part.

(ii) Banded Hematite Quartzite (BHQ)

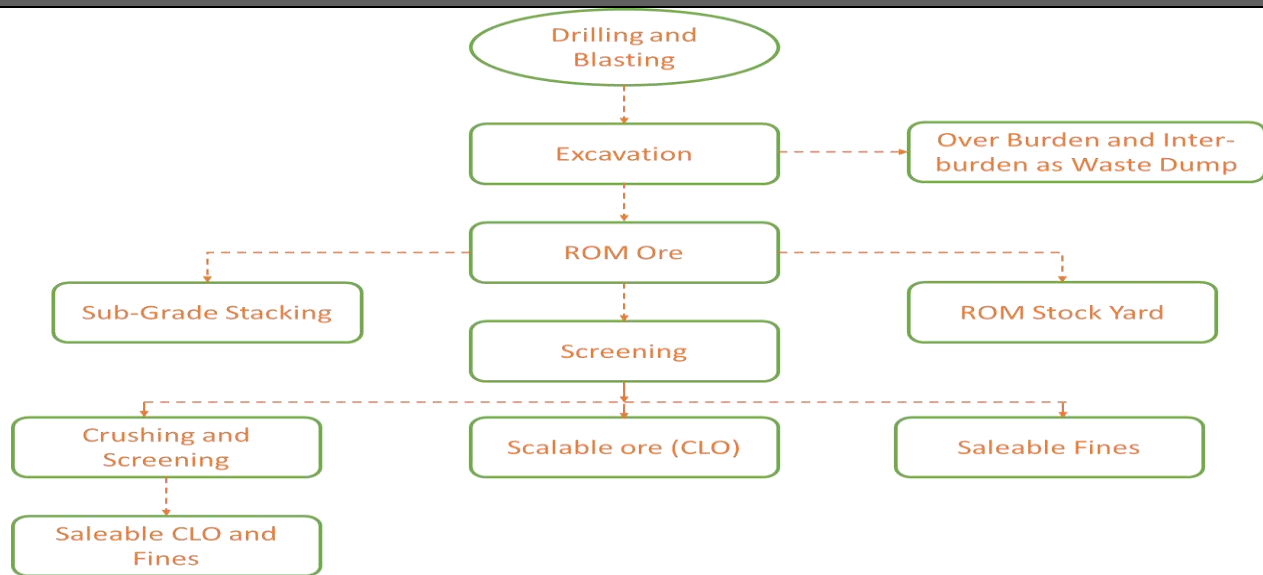
BHQ is found in the east covers a small area. Banded hematite quartzite is found as big boulders. Alternate band of hematite and quartzite is the main characteristic of BHQ. The BHQ is very hard to disintegrate the hematite portion.

(iii) Hematite (Iron Ore)

Hematite is a massive and steel grey color ore ranging from 55% to 65% Fe. Porous laminated variety is also available ranging from low to medium grade of iron content. Iron ore found within the M.L. area is of massive, hard and soft laminated variety.

2.2 Method & Sequence of Mining

The following flow chart depicts the entire process of mining which is in-vogue at present in Raikela Iron ore Mine.



2.3 Production Capacity & Life of the Mine

It has been planned to make enhancement of production from 2.99 MTPA to 4.50 MTPA of iron ore per Annum. During ensuing plan period, the existing quarries i.e. Top quarry and middle quarry have been selected for development. The lessee will obtain Environment Clearance for the production of 4.5 million tone of ROM per annum.

2.4 Objective of the Study

The company approached CSIR-CIMFR for conducting the study and suggesting the suitable scientific method for extraction of Iron ore from the mine. The team of scientist visited the site in the month of May 2021 for reconnaissance survey and to understand the problem and prevailing method of Blasting. The present study has been taken up with the following objectives:

1. To assess the slope stability in mines
2. To suggest the measure to control the soil erosion in mining and surrounding areas.

2.4.1 Scope of The Work

The scope of work is as follows:

- ❖ Visual observation of the status of slope stability at open pits.
- ❖ Geotechnical investigation in to rock mass the open pits.
- ❖ Joint survey of the exposed benches of the open pits.
- ❖ Collection of rock samples to generate the data of compressive strength and density etc. by testing samples in CIMFR Laboratory at Dhanbad.
- ❖ Determination of Rock Mass Rating at selected locations of the open pits.
- ❖ Assessment of status of slope stability at open pits by numerical modelling and other soft computing analytical tools.
- ❖ To suggest measures to control soil erosion in mining areas.

2.4.2 Sample Preparation and collection

The samples were obtained from six different places of the dump during the autumn season. Initially the ground was dug up to half meter to take samples of proper moisture content representing the total dump. The locations from where the samples sourced were selected after careful consideration to represent the whole area. The location was first cleared of soft soil cover, then a trench of about 2 to 3 m deep was dug. Then a hollow cylindrical mould of 6-inch diameter and 10-inch long was put into the ground by continuous and careful hammering. Then the cylindrical mould along with the soil inside of it was taken carefully out of the ground which was then properly packed to prevent the passage of air. The packing was done by the help of plastic gunny bags to ensure airtight packing as shown in figure 3.5 and 3.6. Proper care was taken to ensure that the parameters of the sample doesn't change during bringing it to the lab. The preparation process is shown in the following figure.



CHAPTER – 3: TESTS, PROCEDURES & RESULTS

For estimating the slope stability of the studied mine the following geological parameters are determined.

- ✓ Unit weight ' γ '
- ✓ Cohesion ' c '
- ✓ Friction angle ' ϕ ' (UU test)
- ✓ Angle of repose ' β '
- ✓ Pore water pressure.

The tests - proctor compaction test and triaxial test are depicted below.

3.1 Proctor Compaction Test (ASTM D698)

Test procedure

- 1) 10 lb (4.5 kg) of air-dried soil was obtained in the mixing pan. All the lumps are broken so that it passes No. 4 sieve.
- 2) Approximate amount of water was added to increase the moisture content by about 5%.
- 3) The weight of empty proctor mould without the base plate and the collar was determined.
- 4) Collar and base plate were fixed.
- 5) The first portion of the soil in the Proctor mould was placed and compacted the layer applying 25 blows.
- 6) The layer was scratched with a spatula forming a grid to ensure uniformity in distribution of compaction energy to the subsequent layer. Again, the second layer was placed and 25 blow applied same procedure carried out for the last portion.
- 7) It is ensured that the compacted soil was just above the rim of the mould.
- 8) The collar was detached carefully without disturbing the compacted soil.
- 9) The weight of the mould with the moist soil was determined. The sample was extruded and broken into pieces collect the sample for water content determination preferably from the middle of the specimen.
- 10) Empty moisture cans are weighed. Keep this can in the oven for water content determination.
- 11) The rest of the compacted soil were broken with hand (visually ensure that it passes US Sieve No.4). More water was added to increase the moisture content by 2%.
- 12) Steps 4 to 11 were repeated. During this process the weight increased for some time with the increase in moisture and dropped suddenly. Two moisture increments were taken after the weights starts reducing. At least 4 points were obtained to plot the dry unit weight, moisture content variation.
- 13) After 24 hrs of the sample in the oven was recovered and the weight was determined.
- 14) Then the complete tabulation done



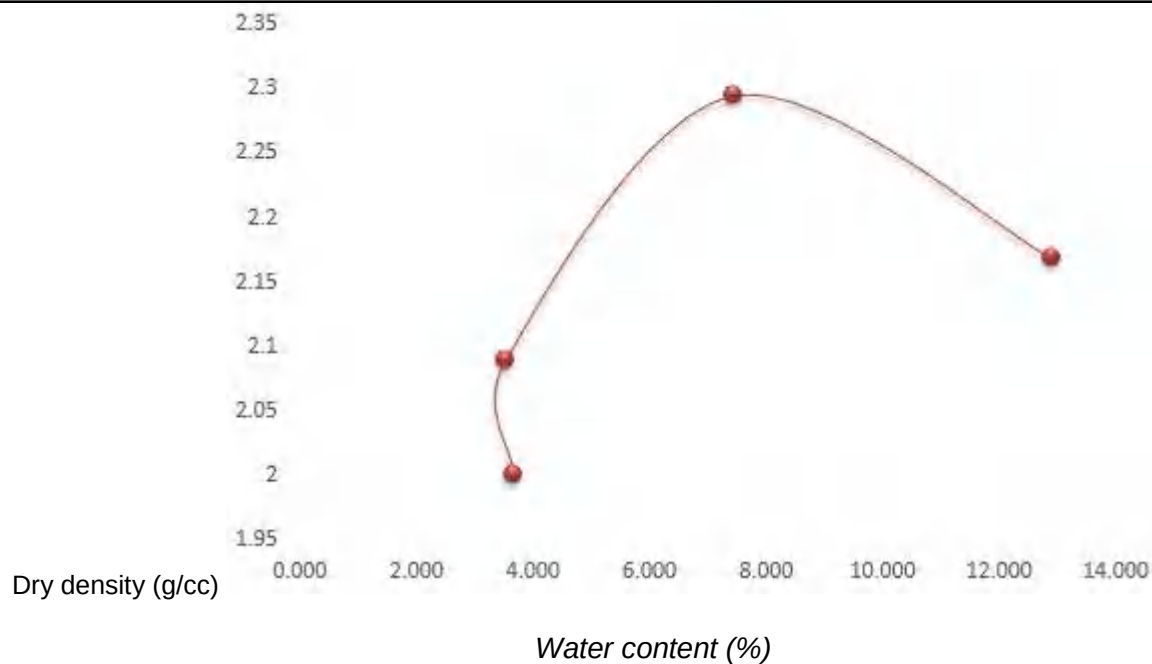
Proctor Compaction Apparatus



Application of blows

Table no:-3.1 Results of proctor compaction test

iron mine dump					
WEIGHT OF SAMPLE,	$W_m = 2.5 \text{ kg}$				
WEIGHT OF EMPTY MOULD,	$W_E = 2.216 \text{ kg}$				
INTERNAL DIAMETER OF MOULD,	$d = 10 \text{ cm}$				
HEIGHT OF MOULD,	$h = 12.6 \text{ cm}$				
VOLUME OF MOULD,	$V = 989.60 \text{ cc}$				
PARAMETER		1	2	6	4
WEIGHT OF MOULD + SOIL,	$W_1 \text{ (gm)}$	4268	4357	4656	4639
WEIGHT OF COMPACTED SOIL,	$W_c \text{ (gm)}$	2052	2141	2440	2423
WET DENSITY,	$d_w = W_c/V \text{ (g/cc)}$	2.074	2.164	2.466	2.448
WEIGHT OF CONTAINER,	$X_1 \text{ (gm)}$	19.61	21.2	20.21	12.49
WEIGHT OF CONTAINER + WET SOIL,	$X_2 \text{ (gm)}$	48.00	80.00	78.00	65.00
WEIGHT OF CONTAINER + DRY SOIL,	$X_3 \text{ (gm)}$	47.00	78.00	74.00	59.00
WEIGHT OF DRY SOIL,	$X_3 - X_1 \text{ (gm)}$	27.39	56.80	53.79	46.51
WATER	$X_2 - X_3 \text{ (gm)}$	1.00	2.00	4.00	6.00
WATER CONTENT,	$W = (X_2 - X_3)/(X_3 - X_1) \text{ (\%)}$	3.651	3.521	7.436	12.900
DRY DENSITY,	$d_d = d_w/(1 + 0.01W) \text{ (g/cc)}$	2.000527	2.089912	2.29498	2.168693



Graph between dry density and moisture content

Thus, the maximum dry density and the optimum water content of the samples determined were 2.2949 g/cc and 7.436 % respectively

3.2 Tri-Axial Test

This test method determines the strength and stress-strain relationships of a cylindrical specimen of undisturbed or re-moulded cohesive soil. Specimens are subjected to a confining fluid pressure in a tri-axial chamber. No drainage of the specimen was permitted during the test. The specimen is sheared in compression without drainage at a constant rate of axial deformation (strain controlled). This test method provides data for calculating un-drained strength properties and stress-strain relations for soils. This test method provides for the measurement of the total stresses applied to the specimen, that is, the stresses are not corrected for pore-water pressure.

Apparatus For conducting the test, the testing system consists of the following five major functional components:

- a) System to house the sample, that is, a tri-axial cell;
- b) System to apply cell pressure and maintain it at a constant magnitude;
- c) System to apply additional axial stress;
- d) System to measure pore water pressure; and
- e) System to measure changes of volume of the soil sample.

Sample Preparation for Tri-axial Testing

The samples are prepared with the use of a cylindrical mould. It has the following specifications as shown below:

Length (cm)	Diameter (cm)	L/D ratio	Volume (cm ³)
10	5	2	196.4

As calculated from proctor compaction Test,

Maximum Dry Density =2.294 g/cc

Optimum moisture content =7.436%

Hence, Mass of the sample needed $2.294 \times 196.4 = 450.54$ gm

Water required =33.5 ml

The cylindrical shaped samples were tested using Tri-axial apparatus. A stress vs. strain curve was plotted. The maximum value of the stress is considered as the deviator stress, from which the corresponding major and minor principal stresses are found out. Minor Principal Stress = Cell confining Pressure.

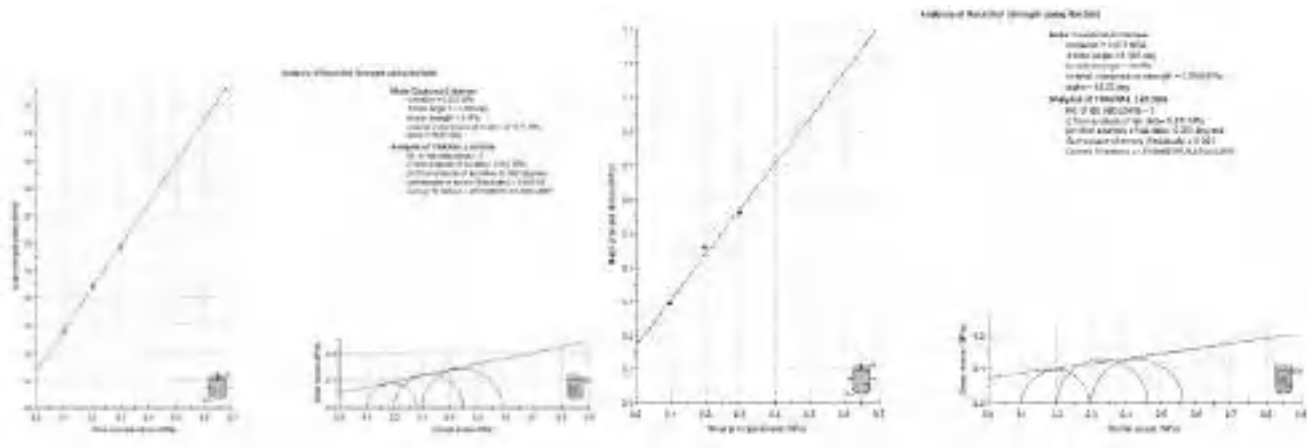
Major Principal Stress = Deviator Stress (Calculated from the stress-strain curve of the triaxial test) + Minor Principal Stress. From the values of the Major and Minor principal stress, the cohesion(c) and friction angle (ϕ) values are calculated using Mohr-Coulomb criterion with the help of Roc-Data (ver 4.0, make: Roc-science Inc, Canada) software.

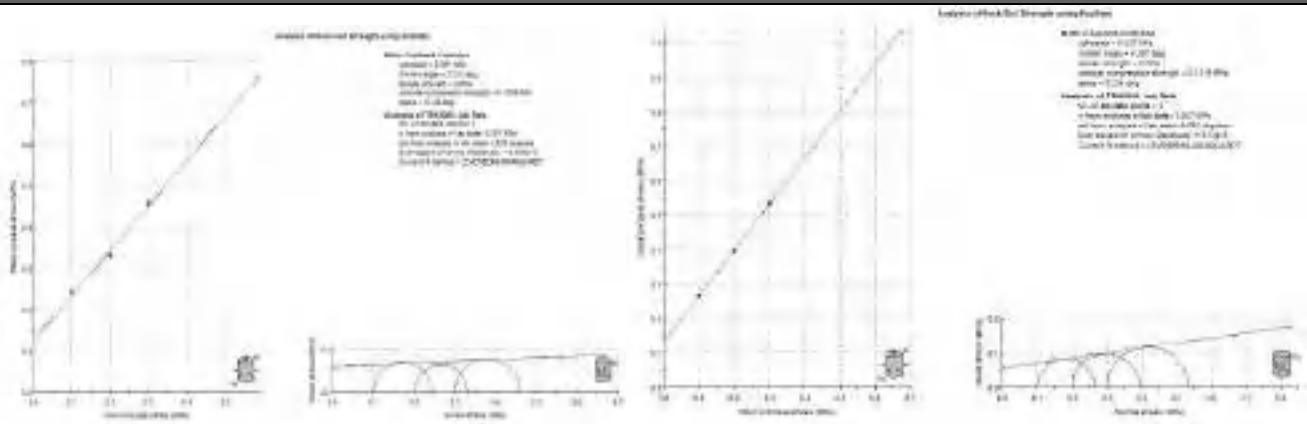
CHAPTER – 4: ANALYSIS OF DATA DESIGN OF AN OPTIMUM DUMP SLOPE

Here analysis of the results from the lab tests are done by the help of two software and they are ROCLAB (ver 4.0) and GALENA (ver 6.0).

4.1 Mohr Coulomb Analyses (roc-lab software)

Mohr –Coulomb analysis was carried out by using the program “Roc-Data”. Here, the Major Principal Stress and Minor principal stress are given as inputs. The different Mohr's circles for different samples are shown below.





Mohr's circle for sample 5

Mohr's circle for sample 6

Results from the Mohr's circle Analysis

Sample no	Cohesion(c) (kpa)	Friction angle (ϕ) (degree)
1	53.233	12.068
2	73.488	8.303
3	52.617	6.927
4	46.137	0.187
5	61.211	2.278
6	56.950	8.297

From the six sample we can consider three sample as hard, medium and soft according to the cohesion and friction angle .so they are

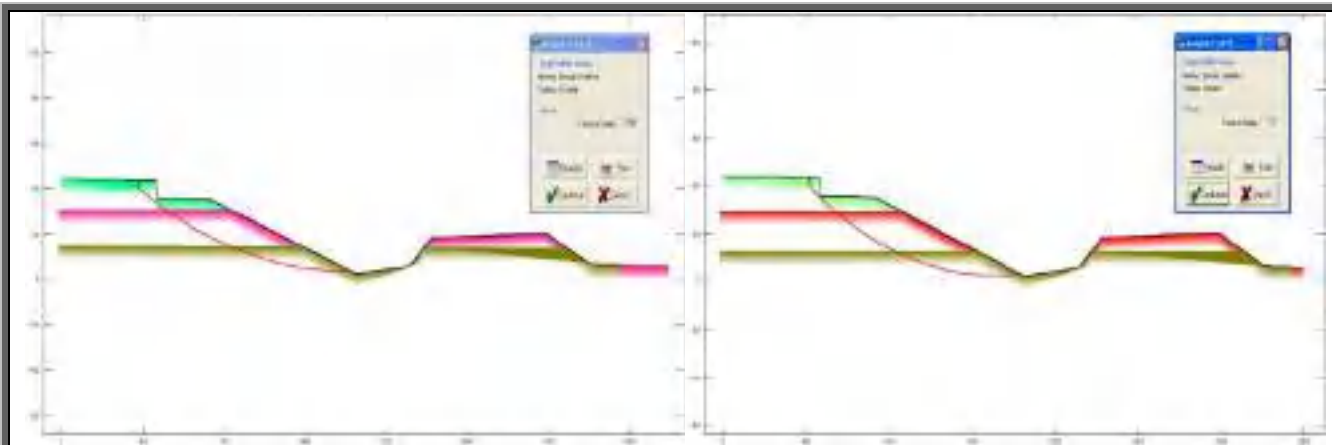
Hard:- C-53.233kpa ϕ -12.068

Mid:- C-65.219kpa ϕ -8.3

Soft:- C-52.617kpa ϕ -6.927

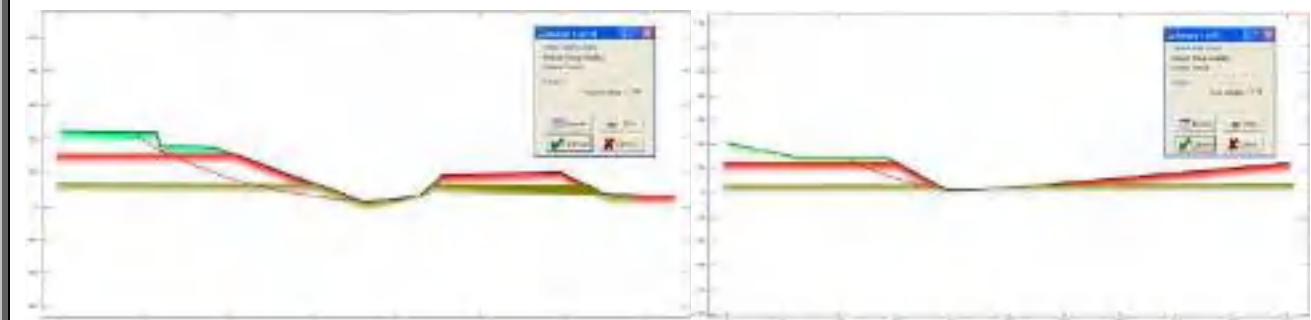
As we have two section plan (ie-xx and yy) we can have 6 profiles by arranging three type of material to different section ie-top, med and bottom.

Analysis of safety factor by using "GALENA" Section xx



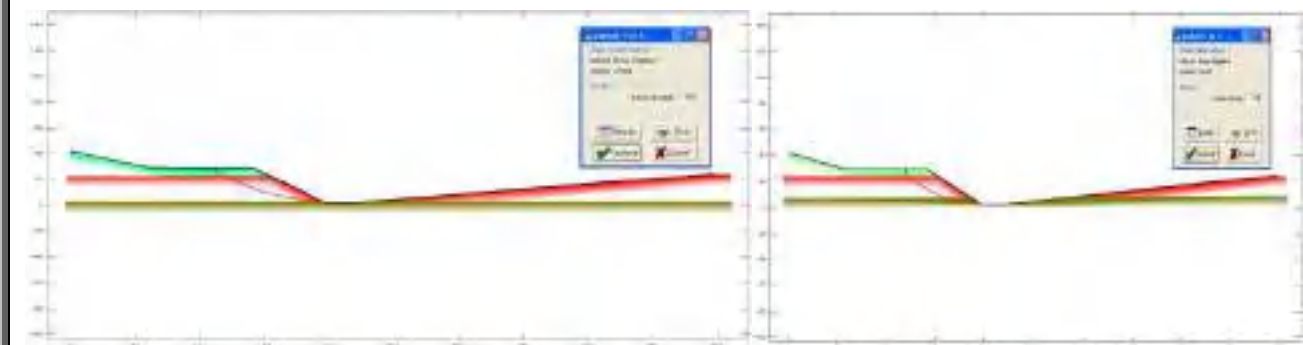
Profile 1

Profile 2



Profile 3

Profile 4



Profile 5

Profile 6

Factor of safety of different sections are

Profile no	Factor of safety
1	1.53
2	1.37
3	1.54
4	1.79
5	1.65
6	1.36

From the above slope stability analysis it is clear that all the six profiles of the two sections (ie- xx and yy) are safe as they all have safety factor more than 1.3.

4.2 Design of an optimum Dump Slope

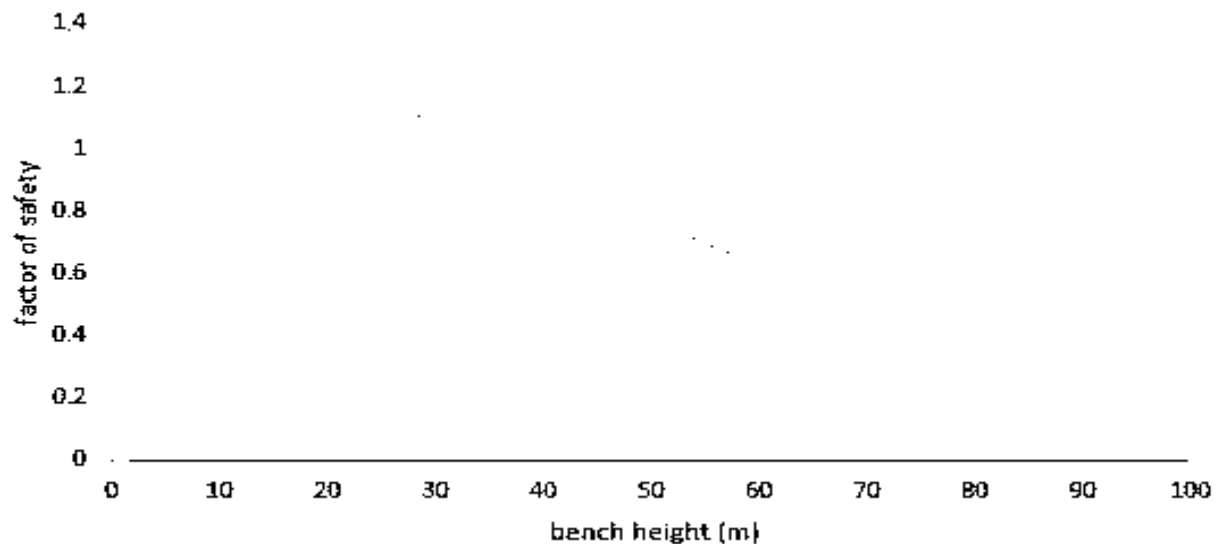
From the existing slope analysis it is clear that the slopes of the mine under study are safe, but with flatter slope angle of about 110. Hence improvement of the slope bench was considered. There are two types of approach for optimizing the dump slope design they are

Optimizing dump slope by changing bench dimension

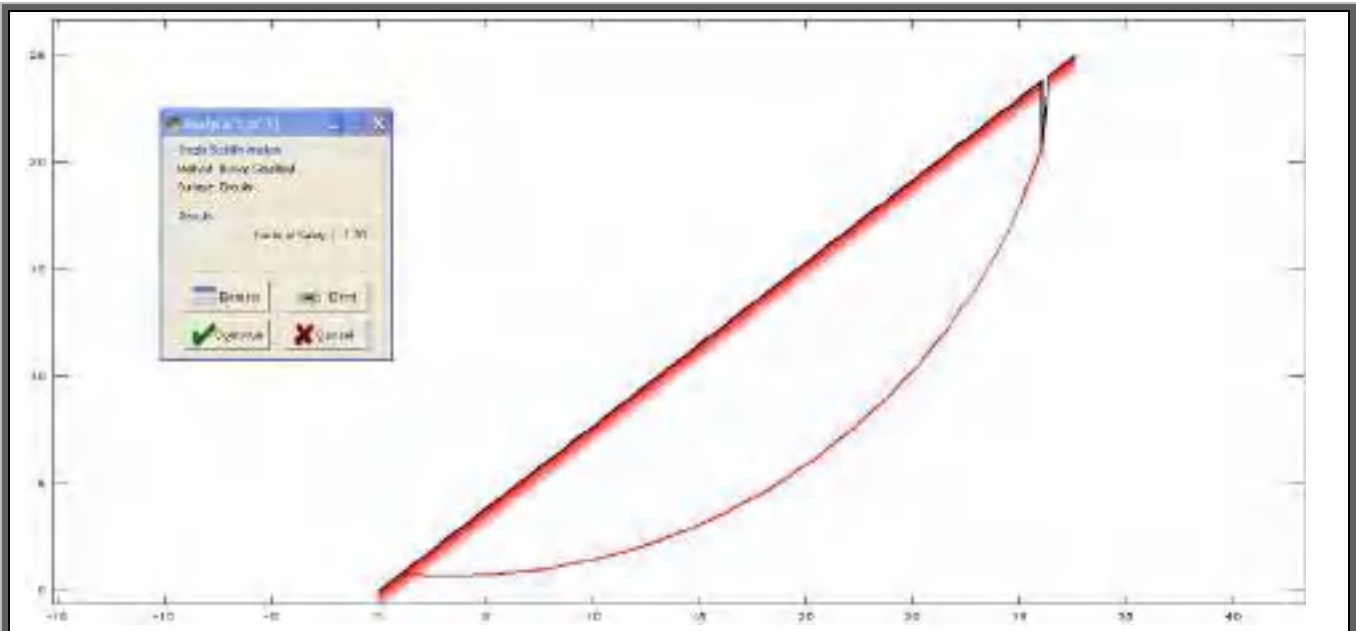
According to DGMS the maximum angle upto which a bench can be build is 37.5 degree. So taking bench angle 37.5 degree the chart of probable design are given for different heights and their safety factors are also mentioned.

Serial no	Height	Slope angle (in degree)	Safety factor
1	90	37.5	0.51
2	85	37.5	0.52
3	80	37.5	0.55
4	70	37.5	0.58
5	60	37.5	0.63
6	30	37.5	1.08
7	25	37.5	1.20

The above analyses show that with the existing overburden material, the benches beyond 30m high are unsafe as the safety factors are less than 1.00. At 30 m high, the safety factor is marginally more than 1.0 i.e. 1.08. But at 25 m the bench is safe with safety factor 1.2



Graphical relation of safety factor and the single bench height is given as below



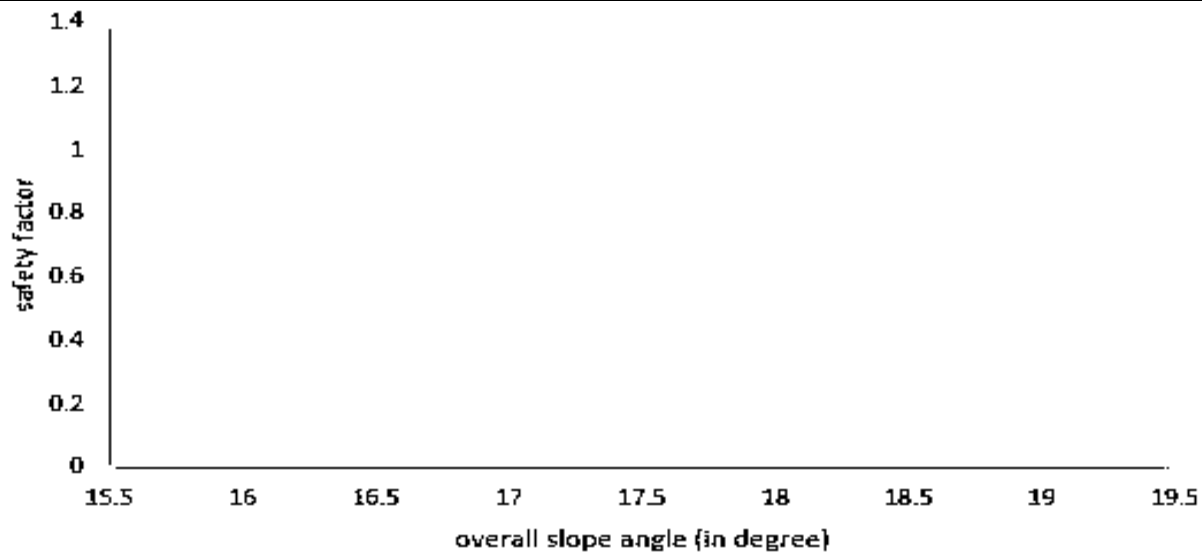
The bench design for 25 m height is given below

4.3 Design of dump according to overall slope angle

Previously the slope angle of the existing dump at 11° which is very less, so further designing is done here for maximum storage of waste with optimized overall slope angle. The usual constraints in designing the dump slope is the horizontal distance available for dumping. The horizontal distance available for dumping is 343 m for section xx and for the section yy it is 497 m. A chart of different bench parameters and there factor of safety is given below

Chart for section xx (available distance=343 m)

Serial no	Height	Slope angle	Safety factor
1	60	18.92	1.04
2	55	17.44	1.14
3	53	16.84	1.18
4	52	16.54	1.20
5	50	15.94	1.25



Graphical relation between different overall slope angle and there respective safety of factor

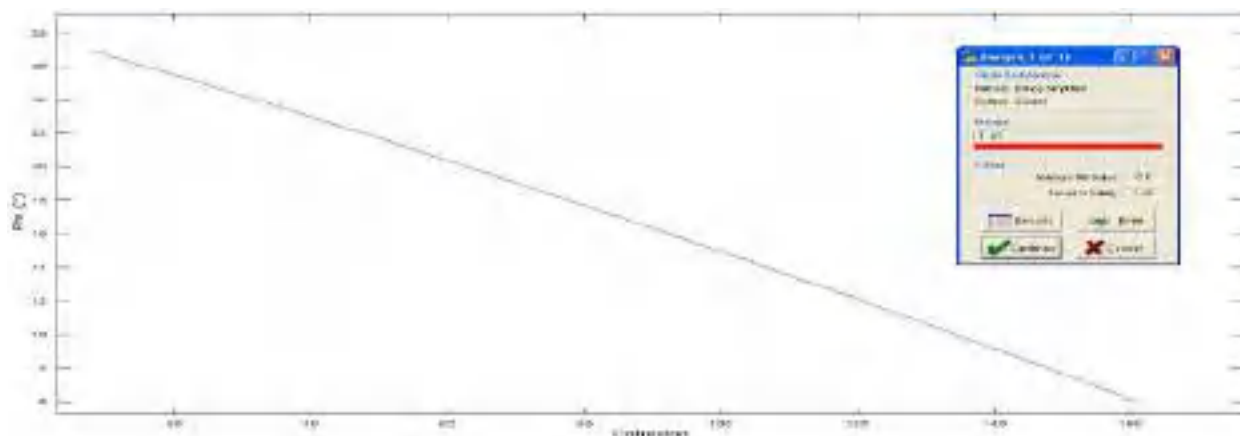
4.4 Optimizing material properties

The material characteristics play a major role in slope stability. Its cohesion and friction angle are two most important parameters in the stability. Hence a back analyses was carried out to determine the different combinations of these two parameters with minimum safety factor of 1.20

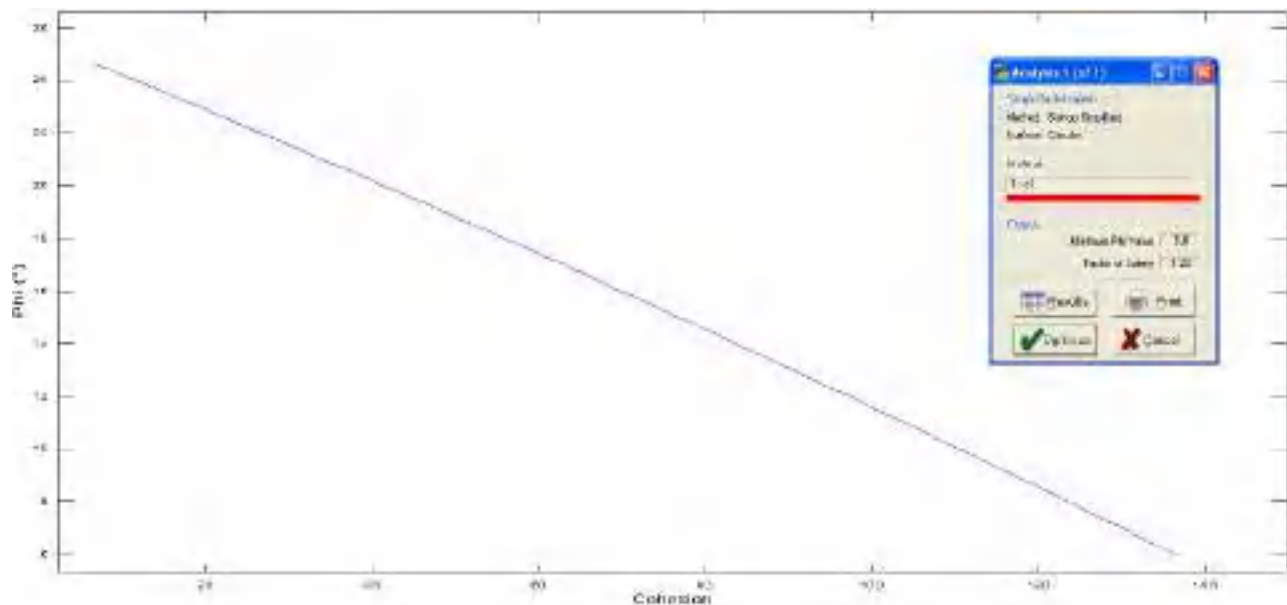
Constants: - Available distance for dumping-343

Minimum friction angle-6 degree

Desired safety factor- 1.2



Height 90m



Height 80m

The above combination we can design a material of desired cohesion and friction angle for making a safe dump slope. From this analysis different combination of cohesion ranging from 0-120 Kpa and frictional angle ranging from 60 -220 are given for two heights i.e.- 80m and 90 m for both sections.

4.5 Analysis of Slope Design

Study was performed for reliability analysis of slope using Finite Element Method, Limit Analysis Method and Analytical method from which Reliability index and Probability of Failure are obtained. To compare the three analyses with the results from literature.

Finite Element Method (FEM)

Finite element method (FEM) is a numerical method for solving a differential or integral equation. It has been applied to a number of physical problems, where the governing differential equations are available. The method essentially consists of assuming the piecewise continuous function for the solution and obtaining the parameters of the functions in a manner that reduces the error in the solution

PLAXIS 2D-V9.02:

PLAXIS is a finite element software for soil and rock that has been used by geotechnical engineers and researchers for more than two decades. It is specifically used for stability and deformation analysis in geotechnical applications. The software was first developed by the Technical University

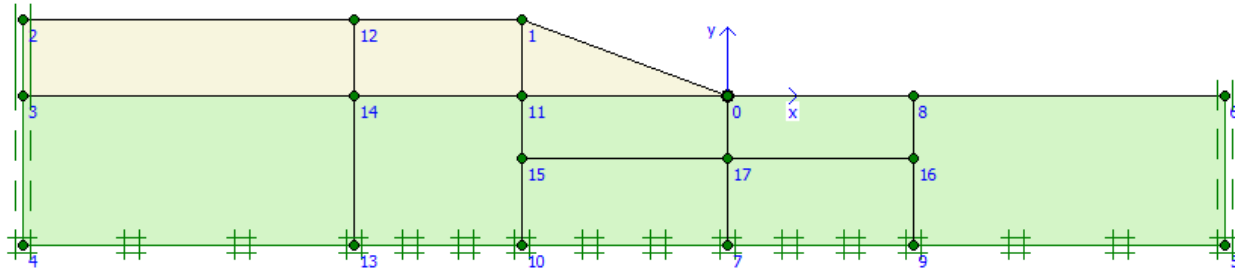
of Delft in 1987 to analyse soft soils of the low lands of Holland (Brinkgreve and Vermeer, 2001). The software then was extended to cover all aspects and applications of geotechnical engineering simulation using a user-friendly interface with the power of finite element. The first version of PLAXIS was commercially available in 1998.

The program uses a convenient graphical user interface that enables users to quickly generate a geometry model and finite element mesh based on a representative vertical cross section of the situation hand. The problem can be modelled either by a plane strain or an axisymmetric model. The program has advantageous feature that enable user to choose different soil model which is dependent on mechanical deformation behaviour of soil for the simulation. The models include Mohr-Coulomb, joint rock, hardening soil, soft soil and modified cam-clay model. Standard boundary conditions are automatically generated by the program. Finite element mesh is easily generated from the input 2D geometry model. Automatic mesh generator with the bandwidth optimizer for the finite-element discretization allows generating finite element mesh (of thousands of element) with option for mesh refinement

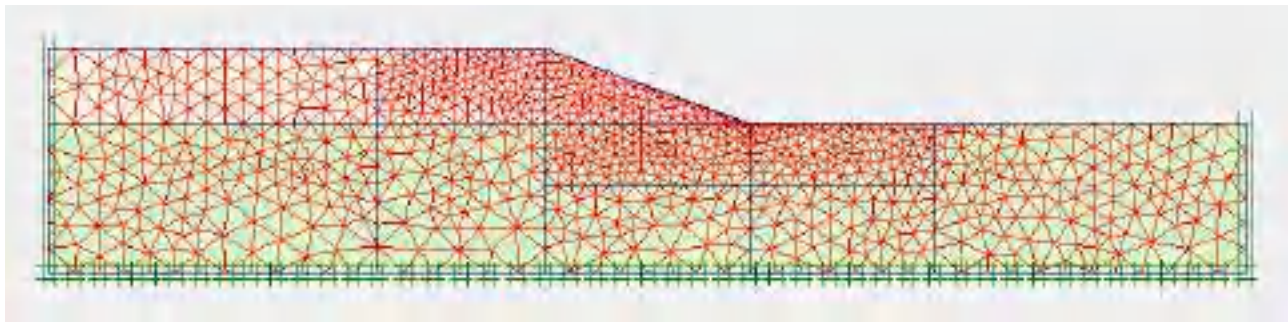
The calculation program is the part of the whole simulation where the analysis of the generated model is performed. The procedure is through definition/calculation of the staged construction step (steps that the model is build up). The program offers three types of calculation for the user in each construction phase: plastic, consolidation and safety. Before final calculation (whole problem), the user can choose specific points that load-displacement curves, stress path and stress strain curves can be generate for those points in output part. The program produces outputs of: deformed mesh of the model, different types of deformation and strain, effective and total stress. Complex finite element models can be generated easily through the program due to relatively simple graphical input procedure and the enhanced output facilities make available a detailed presentation of computational results.

Slope Stability Analysis

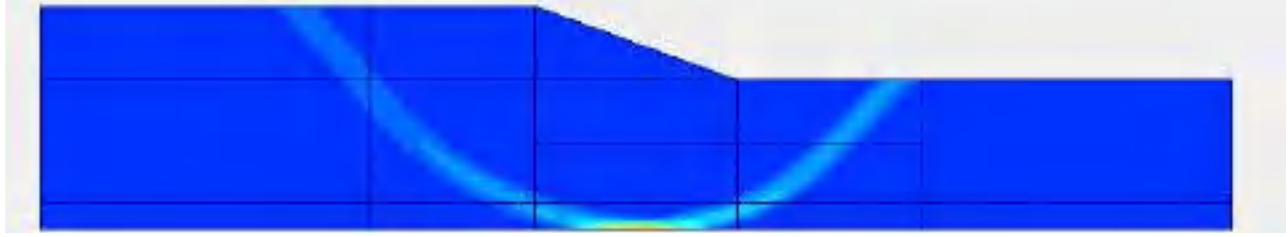
The slope is modelled using the available software PLAXIS 2D-V9.02 as shown in Figure Full fixity is considered at the bottom of the foundation soil and horizontal fixity at the sides of the model. The soil is represented using simple elastic, perfectly plastic Mohr- Coulomb model. The soil is modelled using 15-noded triangular elements with the 12-point integration rule. The Young's Modulus, E of embankment material is taken as 100 MPa and that for foundation material as 30 MPa. The Poisson's ratio, ν of both the materials is considered 0.30.



The mesh is generated using Fine coarseness globally. Clusters are formed in the critical areas of the slope and foundation. These clusters are refined further to increase the no. of elements using cluster refinement. The lines forming the boundaries of the clusters are also refined using the Line refinement. The refinement around the crest and toe nodes of the slope is done using Point refinement. The meshing details are shown in Figure below:



FS = available shear strength /shear strength at failure



Critical Slip Surface of slope

In this work, six input parameters that are considered variables are unit weight (γ) and friction angle of the embankment fill (Φ), the thickness of the clay crust (tcr), the undrained shear strength of marine (SuM) and lacustrine clays (SuL), and the depth of till layer ($Dtill$). Input variables and their statistical parameters are shown in Table

Input variables and their statistical parameters

Input variable	Mean (μ)	Variance (Var)	Standard deviation (σ)
γ (kN/m ³)	20.0	1.00	1.00
Φ (°)	30.0	1.00	1.00
tcr (m)	4.0	0.23	0.48
SuM (kPa)	34.5	66.26	8.14
SuL (kPa)	31.2	74.82	8.65
$Dtill$ (m)	18.5	1.00	1.00

The parameters are assumed as uncorrelated normally distributed. For the six input parameters Full Factorial Design is used to generate $2k = 26 = 64$ sets of data. The points in the experimental design for input parameters tcr and $Dtill$ are estimated as $(\mu+3\sigma)$ and $(\mu-3\sigma)$ and for γ , Φ , SuM , SuL as $(\mu+\sigma)$ and $(\mu-\sigma)$. The design has been done using Matlab (Math works 2010). FOS corresponding to 64 sets of data are analysed using PLAXIS and are tabulated. The Mean $\mu[F]$, Variance $V[F]$ and Standard Deviation $\sigma[F]$ of Factors of safety are estimated using MS Excel.

FOS of Raikala Mine corresponding to 64 sample points using PLAXIS

	γ	Φ	tcr	SuM	SuL	$Dtill$	FOS
Mean	20	30	4.00	34.5	32.4	18.5	1.242
Lower limit	21	31	5.44	42.64	39.85	21.5	-
Upper limit	19	29	2.56	26.36	22.55	15.5	-
1	21	31	5.44	42.64	39.85	21.5	1.336
2	21	31	5.44	42.64	39.85	15.5	1.496
3	21	31	5.44	42.64	22.55	21.5	0.960
4	21	31	5.44	42.64	22.55	15.5	1.117
5	21	31	5.44	26.36	39.85	21.5	1.234
6	21	31	5.44	26.36	39.85	15.5	1.225
7	21	31	5.44	26.36	22.55	21.5	0.867
8	21	31	5.44	26.36	22.55	15.5	1.024
9	21	31	2.56	42.64	39.85	21.5	1.341
10	21	31	2.56	42.64	39.85	15.5	1.501
11	21	31	2.56	42.64	22.55	21.5	0.961

12	21	31	2.56	42.64	22.55	15.5	1.119
13	21	31	2.56	26.36	39.85	21.5	1.188
14	21	31	2.56	26.36	39.85	15.5	1.180
15	21	31	2.56	26.36	22.55	21.5	0.834
16	21	31	2.56	26.36	22.55	15.5	0.977
17	21	29	5.44	42.64	39.85	21.5	1.327
18	21	29	5.44	42.64	39.85	15.5	1.483
19	21	29	5.44	42.64	22.55	21.5	0.951
20	21	29	5.44	42.64	22.55	15.5	1.108
21	21	29	5.44	26.36	39.85	21.5	1.224
22	21	29	5.44	26.36	39.85	15.5	1.213
23	21	29	5.44	26.36	22.55	21.5	0.863
24	21	29	5.44	26.36	22.55	15.5	1.015
25	21	29	2.56	42.64	39.85	21.5	1.330
26	21	29	2.56	42.64	39.85	15.5	1.486
27	21	29	2.56	42.64	22.55	21.5	0.954
28	21	29	2.56	42.64	22.55	15.5	1.112
29	21	29	2.56	26.36	39.85	21.5	1.177
30	21	29	2.56	26.36	39.85	15.5	1.221
31	21	29	2.56	26.36	22.55	21.5	0.832
32	21	29	2.56	26.36	22.55	15.5	0.968
33	19	31	5.44	42.64	39.85	21.5	1.461
34	19	31	5.44	42.64	39.85	15.5	1.625
35	19	31	5.44	42.64	22.55	21.5	1.046
36	19	31	5.44	42.64	22.55	15.5	1.218
37	19	31	5.44	26.36	39.85	21.5	1.353
38	19	31	5.44	26.36	39.85	15.5	1.332
39	19	31	5.44	26.36	22.55	21.5	0.967
40	19	31	5.44	26.36	22.55	15.5	1.113
41	19	31	2.56	42.64	39.85	21.5	1.464
42	19	31	2.56	42.64	39.85	15.5	1.629
43	19	31	2.56	42.64	22.55	21.5	1.050
44	19	31	2.56	42.64	22.55	15.5	1.222
45	19	31	2.56	26.36	39.85	21.5	1.736
46	19	31	2.56	26.36	39.85	15.5	1.282
47	19	31	2.56	26.36	22.55	21.5	0.929
48	19	31	2.56	26.36	22.55	15.5	1.072
49	19	29	5.44	42.64	39.85	21.5	1.451
50	19	29	5.44	42.64	39.85	15.5	1.541
51	19	29	5.44	42.64	22.55	21.5	1.040
52	19	29	5.44	42.64	22.55	15.5	1.208
53	19	29	5.44	26.36	39.85	21.5	1.331
54	19	29	5.44	26.36	39.85	15.5	1.319
55	19	29	5.44	26.36	22.55	21.5	0.962
56	19	29	5.44	26.36	22.55	15.5	1.104
57	19	29	2.56	42.64	39.85	21.5	1.455
58	19	29	2.56	42.64	39.85	15.5	1.544
59	19	29	2.56	42.64	22.55	21.5	1.044
60	19	29	2.56	42.64	22.55	15.5	1.212
61	19	29	2.56	26.36	39.85	21.5	1.416
62	19	29	2.56	26.36	39.85	15.5	1.270
63	19	29	2.56	26.36	22.55	21.5	0.925
64	19	29	2.56	26.36	22.55	15.5	1.063

$\mu[F]=$	1.203
$\sigma[F]=$	0.218
$V[F]=$	0.047

Using the FOS values obtained, regression analysis is done for the response surface model,

$$FOS = 1.39086 + (-0.05875 * \gamma) + (0.01109 * \Phi) + (0.00022 * tcr) + (0.00878 * SuM) \\ + (0.02047 * SuL) + (-0.01557 * Dtil)$$

$$(R^2 = 0.89, R^2_{adj} = 0.879)$$

Solving for the reliability index using solver optimization tool, the value obtained is:

$$\beta = 1.029$$

$$\text{The probability of failure } P_f = \Phi(-1.029) = 0.1517 = 15.17 \%$$

In case of Raikala mines, it is found that the reliability index (2.5) calculated by finite element analysis based on the response surface approximation of the finite-element method is significantly Higher than that (2.32) reported by Ramly et al. (2002), based on Bishop's simplified method. This is because the finite element method predicts the critical failure mechanisms better than the Bishop's simplified method. For multiple soil layers, the factor of safety evaluated by the finite-element method using strength reduction technique depends on, to a certain extent, the values of other input parameters such as Young's moduli, Poisson's ratios, and modulus/strength ratios.

CHAPTER-5: CONCLUSIONS AND RECOMMENDATIONS

1. In this Study a detailed analysis is done on the safety status of the dump slope of the Raikala mine. From the tests the geotechnical parameter are found out and they are $C_{avg}=57.27$ Kpa, frictional angle $avg.=7.60$. From the slope stability analysis it is determined that all the probable profiles have safety factor more than 1.3.

The existing bench have bench angle of 110. So for maximising the deposition of dump in the area here optimisation of bench design is done. Various probable bench design is decided. Firstly, single bench designs are laid out by fixing a certain bench angle ie-37.50. From the analysis it is found out that single bench of height 25 m is safe for maximum allowable angle 37.50 as the safety factor is 1.2. So, for a safe bench design in this mine the bench height shouldn't go above 25 meter as found in case of 30 meters bench height which is having factor of safety -1.08.

Another analysis is done on the basis of overall slope angle and it is determined that the bench of height 52 m with overall slope angle 16.540 for section xx and 66 m with overall slope angle 14.840 can be practicable safely. Besides this optimisation of bench design with respect to material properties is also done. Various combination of cohesion and frictional angle for a desired safety factor has being calculated by the help of back analysis. Different combination of cohesion value ranging from 0-120 Kpa and frictional value ranging from 60- 280 are given. So for designing a bench of maximum height let 80 or 90 m from the back analysis result we can get the desired combination of cohesion and friction angle.

2. Regarding the bench slope stability Raikala mines, it is found that the reliability index (2.5) calculated by finite element analysis based on the response surface approximation of the finite-element method is significantly Higher than that (2.32) reported by Ramly et al. (2002), based on Bishop's simplified method. This is because the finite element method predicts the critical failure mechanisms better than the Bishop's simplified method. For multiple soil layers, the factor of safety evaluated by the finite-element method using strength reduction technique depends on, to a certain extent, the values of other input parameters such as Young's moduli, Poisson's ratios, and modulus/strength ratios.
3. Overall site water management is of critical importance in the control of erosion, sediment generation, and slope stability of diverted channel. Water management is defined as the understanding and control of those processes associated with the interception, diversion, infiltration, and storage of water, generated by either rainfall, groundwater seepage, or the discharge of dewatering practices. When considering surface water management, the most

fundamental requirement is to identify the local hydrologic regimes that are defined by topography and surface drainage patterns.

The use of triangular channels should be avoided at all times as this type of drain is difficult to maintain, results in higher discharge velocities, and unless armored along its length, will suffer from accelerated erosion.

The question of maximum non-scour velocity for drainage channels should be an integral part of drain design. This is particularly so when the soils or waste materials in unlined channels are either dispersible or strongly flocculated. The issue is that there will be accelerated runoff from areas with low permeability surfaces such as hard stand areas, roads, and sealed areas generally. These will have high 'C' values and will contribute high volumes of discharge at quite high velocities in a short period of time. Accordingly, this surface runoff will enter the drainage system with high runoff velocities and a potentially high sediment load.

Summary of Guidelines for Drainage Control

When introducing a drainage and runoff control system, it is useful to start by defining the purpose of the drainage system. Define the total area to be included in the site drainage control system.

- Separate catchment areas that have 'clean' runoff from catchment areas that have 'contaminated' runoff.
- Identify an acceptable 'design storm' in terms of return period.
- Calculate peak discharge (Q) from the catchment areas.
- Define the erodibility of the unlined channel to be constructed.
- Identify the options for drain geometry for lined and unlined drains.
- Identify discharge pathways, bearing in mind the requirement to direct all discharge to a pre-determined and prepared drainage system.
- Identify all hydrology issues that are required to achieve the objective of the system.
- Avoid right-angle bends in drains.
- Avoid abrupt changes in drain gradient unless there is compensation in drain geometry.
- The uncontrolled discharge to 'natural surface' is to be avoided as this will simply put pressure on the system somewhere else. What was controlled channelled flow suddenly becomes uncontrolled overland flow.
- Suspended sediment contained in discharge will be deposited on the floor of the drain with reductions in velocity caused by a change in geometry or a reduction in gradient.
- Trapezoidal channels are easier to maintain and are more tolerant of hydraulic variations.
- Triangular channels are the easiest to construct but are less tolerant of hydraulic variations.

- Parabolic channels are difficult to construct and maintain and are not tolerant of hydraulic variations. Sidewall erosion will rapidly change a parabolic channel to a quasi-trapezoidal channel according to particle size grading within the wetted perimeter.

These guidelines are presented as general principles and it is stressed that without definitive rainfall data, drainage design can only be experienced based. Regardless of the lack of rainfall intensity/duration data, the fundamental design principles remain the same. Channel geometry must be dependent on the reasons for having a drainage system and the ultimate safe transfer and disposal of runoff water to the preferred drainage systems already in place.

The garland drain so constructed should be provided with coco filter. Coco-Filter are designed and developed to find an appropriate solution to the severe ecological problems. Coco Filters are revolutionary eco products used as a structural and rooting mechanism for bioengineered systems. These filters can be used to provide filtration, perimeter protection, settling, reduction in water velocity/erosive forces and habitat protection.

Once installed, Coco Filters act to collect sediment and slow surface water movement and enable the establishment of vegetation. It will provide sufficient protection for the vegetation to grow into the embankments and take over the long term stabilization



Recommendations

- i. It also causes opening between joint planes, which in turn causes reduced effective joint cohesion. Excessive breakage beyond the desired limits may facilitate entry of surface water into the rock mass, which may consequently cause adverse ground water conditions and associated problems for the slope. The slope face should therefore be maintained in a very sound condition using good blasting practice. However the blasting technique proposed very systematic.
- ii. In slopes, where the benches are inactive and have reached ultimate limits, retaining bunds made of rock boulders may be erected/placed so that any rock block after detachment doesn't move on to the lower benches.
- iii. A good drainage system is the key to maintaining stable slopes during the life of an open pit mine. The appropriate drainage measures must be undertaken so that water entering into the slope is kept at a minimum especially during the rainy season. A garland drain may be cut all around the mine to collect surface run-off of rain water before it goes into the mine slopes. The drain may be steeply graded to facilitate water movement and to minimize the chances of interruptions. The drains should be kept clear of any debris and silt. In the case when diversion of rain water away from the pit is not feasible, then a proper drain pattern may be implemented to allow the water to collect in the mine sump.
- iv. Convex slope geometries should be avoided as they create unfavourable stress conditions and may lead to potential slope instabilities. Undercutting of benches at the toe region should be avoided under all circumstances as it creates unstable slope conditions.
- v. Coco-Filter have been proposed for soil erosion and Sediment Control in mining areas

The slopes must be regularly inspected for the development of any tension cracks and any other signs of instability during the normal mining operations as the pit depth increases. In the course of final mining operations, it is suggested that systematic slope monitoring be undertaken to evaluate any possible slope displacement over time. This will help in ascertaining the stability of slopes as the pit depth reaches ultimate and in formulating appropriate preventive and control measures.

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**Detailed Statement**

Name: **GEETA RANI MOHANTY** A/C Branch: **SAHID NAGAR II**
Address: **GROUND FLOOR STATION,ROAD BARBIL, KENDUJHAR, KEONJHAR, 75803 5, ORISSA, INDIA** Branch Address: **ICICI BANK LTD., SANTOSH PLAZA, JANPATH, SATYA NAGAR, BHUBANESWAR, ODISHA - 751007, BHUBANESWAR, ORISSA, INDIA**
A/C No: **728705000112** A/C Type: **CAA**
Jt. Holder: Cust ID: **584669403**
Transaction Date from: **01/05/2025** Branch Code: **7287**
Transaction Period: **From 01/05/2025 To 13/06/2026** IFSC Code: **ICIC0007287**
Statement Request/Download Date: **13/06/2026** Account Currency:

Advanced Search

Amount from: **NA To NA**
Cheque number from: **NA To NA**
Transaction remarks:
Transaction type:

Sl No	Tran Id	Value Date	Transaction Date	Transaction Posted Date	Cheque no / Ref No	Transaction Remarks	Withdrawal (Dr)	Deposit (Cr)	Balance
No Transactions found during the selected date range.									

Page Total

Opening Bal: **4,55,802.00**
Withdrawals: **0.00**
Deposits: **0.00**
Closing Bal: **4,55,802.00**

Legends Used in Account Statement

1. BBPS - Bharat Bill Payment Service
2. BCTT - Banking Cash Transaction Tax
3. BIL - Internet Bill payment or funds transfer to Third party
4. BPAY - Bill payment
5. CCWD - Cardless Cash Withdrawal
6. DTAX - Direct Tax
7. EBA - Transaction on ICICI Direct
8. IDTX - Indirect Tax
9. IMPS - Immediate Payment Service
10. INF - Internet fund transfer in linked accounts
11. INFT - Internal Fund Transfer (Within ICICI Bank)
12. LCCBRN CMS - Local cheque collection
13. LNPY - Linked loan payment
14. MMT - Mobile Money Transfer (Insta FT - IMPS)
15. N chg - NEFT Charges
16. NEFT - National Electronics Funds Transfer System (Other Bank Fund transfer)
17. ONL - Online Shopping transaction (Payment done on third party website)
18. PAC - Personal Accident cover
19. PAVC - Pay any Visa credit card
20. PAYC - Pay to Contact
21. RCHG - Recharge
22. SMO - Smart Money order
23. T Chg - Travel Charges
24. TOP - Mobile recharge
25. UCCBRN CMS - Upcountry cheque collection
26. VAT / MAT / NFS - Cash withdrawal at other bank ATM
27. VPS / IPS - Debit card transaction
28. BIL - To third party is for RIB
29. GIB - Tax & Statutory payment, EPFO, ESIC
30. CMS - Internet bulk payment fund trf

-----End Of Statement-----



Detailed Statement

Name: **GEETARANI MOHANTY CSR ACCOUNT** A/C Branch: **SAHID NAGAR II**
Address: **GROUND FLOOR
STATION,ROAD,BARBIL,BARBIL,KENDU
JHAR,758035,ORISSA,INDIA** Branch Address: **ICICI BANK LTD., SANTOSH PLAZA,
JANPATH, SATYA NAGAR,
BHUBANESWAR, ODISHA -
751007,BHUBANESWAR,ORISSA,INDIA**
A/C No: **728705000094** A/C Type: **CAA**
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Statement Request/Download Date: **13/06/2026** Account Currency: **INR**

Advanced Search

Amount from: **NA To NA**
Cheque number from: **NA To NA**
Transaction remarks:
Transaction type: **DR**

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7	S36580607	06/May/2026	06/May/2026	06/05/2026 12:24:14 PM		INF/NEFT/IN42612650145525/HDFC0008776/70919066 /CSR SALARY APR 2026 /MADHABCHARA	36,958.00		15,44,790.02
8	S36580423	06/May/2026	06/May/2026	06/05/2026 12:24:15 PM		INF/NEFT/IN42612650145534/SBIN0005756/70919066 /CSR SALARY APR 2026 /ANJANADEHUR	5,000.00		15,39,790.02
9	S36581181	06/May/2026	06/May/2026	06/05/2026 12:24:15 PM		INF/NEFT/IN42612650145326/SBIN0002130/70919066 /CSR SALARY APR 2026 /GITAPATRA	15,000.00		15,24,790.02
10	S36581806	06/May/2026	06/May/2026	06/05/2026 12:24:16 PM		INF/NEFT/IN42612650145547/BARBOKOIRAX/70919066 /CSR SALARY APR 2026 /PADMININAIK	13,500.00		15,11,290.02
11	S36581228	06/May/2026	06/May/2026	06/05/2026 12:24:17 PM		INF/NEFT/IN42612650145691/BARBOKOIRAX/70919066 /CSR SALARY APR 2026 /KUNINAIK	8,000.00		15,03,290.02
12	S36582112	06/May/2026	06/May/2026	06/05/2026 12:24:17 PM		INF/NEFT/IN42612650145568/BARBOKOIRAX/70919066 /CSR SALARY APR 2026 /CHANDRABATI	13,500.00		14,89,790.02

13	S3658 0741	06/May/2 026	06/May/2026	06/05/2026 12:24:18 PM		INF/NEFT/IN4261265 0145576/SBIN00021 30/70919066 /CSR SALARY APR 2026 /SANDHYARANI	13,500.00		14,76,290 .02
14	S8866 4851	11/May/2 026	11/May/2026	11/05/2026 05:39:36 PM		INF/NEFT/IN4261315 6647043/HDFC0004 989/agnst electry b/TPWODLCSRPAR KIN	18,109.00		14,58,181 .02
15	S3532 4537	16/May/2 026	16/May/2026	16/05/2026 04:15:49 PM		RTGS/ICICR4202605 1600544843/HDFC0 001819/ABHIMANY USAHO/UN494626 0516161509	5,85,000. 00		8,73,181. 02
16	S6675 4184	20/May/2 026	20/May/2026	20/05/2026 03:53:20 PM		INF/INFT/044485536 721/TRF 073 TO 094 /GEETA RANI MOHA		25,00,000 .00	33,73,181 .02
17	S6680 9282	20/May/2 026	20/May/2026	20/05/2026 04:00:42 PM		INF/NEFT/IN4261405 2741665/SBIN00021 30/AGAINST INVOIC/YASHENTER PRISES	25,00,000 .00		8,73,181. 02
18	S2213 6921	27/May/2 026	27/May/2026	27/05/2026 02:20:27 PM		INF/INFT/044551774 791/TRF TO CSR AC /GEETA RANI MOHA		10,00,000 .00	18,73,181 .02
19	S2216 2937	27/May/2 026	27/May/2026	27/05/2026 02:24:26 PM		RTGS/ICICR4202605 2700536685/SBIN00 02130/YASH ENTERPRISES	10,83,090 .00		7,90,091. 02
20	S2222 0594	27/May/2 026	27/May/2026	27/05/2026 02:32:04 PM		RTGS/ICICR4202605 2700537629/SBIN00 02130/ANITAPATRA Raikela/UN5965260 527143140	2,38,866. 00		5,51,225. 02
21	S1610 3943	05/Jun/20 26	05/Jun/2026	05/06/2026 12:46:14 PM		INF/NEFT/IN4261565 2663874/UBIN0807 451/UN7777260605 124553 by SHRINIBA from Tally Bank Plu/AnandDie	7,700.00		5,43,525. 02
22	C5615 370	06/Jun/20 26	06/Jun/2026	06/06/2026 04:57:59 AM		INF/NEFT/IN4261575 3476546/HDFC0008 776/72675912 /CSR SALARY MAY 2026 /GOPALCHANDR	27,075.00		5,16,450. 02
23	C5627 560	06/Jun/20 26	06/Jun/2026	06/06/2026 04:58:48 AM		INF/NEFT/IN4261575 3478940/HDFC0000 122/72675912 /CSR SALARY MAY 2026 /SAROJAKUMAR	23,954.00		4,92,496. 02
24	C5627 496	06/Jun/20 26	06/Jun/2026	06/06/2026 04:59:57 AM		INF/NEFT/IN4261575 3478929/SBIN00021 30/72675912 /CSR SALARY MAY 2026 /SANDHYARANI	13,500.00		4,78,996. 02
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26	C5627 552	06/Jun/20 26	06/Jun/2026	06/06/2026 05:00:49 AM		INF/NEFT/IN4261575 3478938/SBIN00064 64/72675912 /CSR SALARY MAY 2026 /AJAYKUMARNA	18,922.00		4,55,074. 02
27	C5615 405	06/Jun/20 26	06/Jun/2026	06/06/2026 05:00:53 AM		INF/NEFT/IN4261575 3476439/SBIN00000 07/72675912 /CSR SALARY MAY 2026 /BISWAJITMIS	28,458.00		4,26,616. 02
28	C5615 463	06/Jun/20 26	06/Jun/2026	06/06/2026 05:00:59 AM		INF/NEFT/IN4261575 3476555/HDFC0008 776/72675912 /CSR SALARY MAY 2026 /MADHABCHARA	36,958.00		3,89,658. 02
29	C5615 417	06/Jun/20 26	06/Jun/2026	06/06/2026 05:01:33 AM		INF/NEFT/IN4261575 3476553/BARBOKOI RAX/72675912 /CSR SALARY MAY 2026 /PADMININAIK	13,500.00		3,76,158. 02
30	C5615 538	06/Jun/20 26	06/Jun/2026	06/06/2026 05:01:43 AM		INF/NEFT/IN4261575 3476448/BARBOKOI RAX/72675912 /CSR SALARY MAY 2026 /CHANDRABATI	13,500.00		3,62,658. 02
31	C5615 378	06/Jun/20 26	06/Jun/2026	06/06/2026 05:01:46 AM		INF/NEFT/IN4261575 3476437/SBIN00021 30/72675912 /CSR SALARY MAY 2026 /GITAPATRA	15,000.00		3,47,658. 02
32	C5615 489	06/Jun/20 26	06/Jun/2026	06/06/2026 05:02:32 AM		INF/NEFT/IN4261575 3476558/SBIN00057 56/72675912 /CSR SALARY MAY 2026 /ANJANADEHUR	5,000.00		3,42,658. 02

33	C5615 495	06/Jun/20 26	06/Jun/2026	06/06/2026 05:02:44 AM		INF/NEFT/IN4261575 3476557/BARBOKOI RAX/72675912 /CSR SALARY MAY 2026 /KUNINAIK	8,000.00		3,34,658. 02
34	S5608 8073	09/Jun/20 26	09/Jun/2026	09/06/2026 03:44:13 PM		INF/NEFT/IN4261605 7081196/SBIN00179 43/72908063 /BILL PAYMENT /SUNSPORTS	25,883.00		3,08,775. 02
35	S5608 8094	09/Jun/20 26	09/Jun/2026	09/06/2026 03:44:14 PM		INF/NEFT/IN4261605 7081211/CNRB0018 048/72908063 /BILL PAYMENT /SANDEEPGIFT	365.00		3,08,410. 02
36	S7677 0755	11/Jun/20 26	11/Jun/2026	11/06/2026 11:19:29 AM		INF/INFT/044748074 761/Inb Fund Trf to CSR AC VideINB Trf/GEETA RANI MOHA		25,00,000 .00	28,08,410 .02
37	M3149 578	11/Jun/20 26	11/Jun/2026	11/06/2026 11:58:07 AM	975	CASH PAID:Self 7287 BHUBANESWAR - SAHID NAGAR IICHQ,975	9,00,000. 00		19,08,410 .02
38	S7913 0917	11/Jun/20 26	11/Jun/2026	11/06/2026 03:46:47 PM		INF/NEFT/IN4261625 9129373/HDFC0004 989/agnst electrici/TPWODLCS RPARKIN	7,746.00		19,00,664 .02

Page Total

Opening Bal: **17,03,009.02**
Withdrawals: **58,02,345.00**
Deposits: **60,00,000.00**
Closing Bal: **19,00,664.02**

Legends Used in Account Statement

1. BBPS - Bharat Bill Payment Service
2. BCTT - Banking Cash Transaction Tax
3. BIL - Internet Bill payment or funds transfer to Third party
4. BPAY - Bill payment
5. CCWD - Cardless Cash Withdrawal
6. DTAX - Direct Tax
7. EBA - Transaction on ICICI Direct
8. IDTX - Indirect Tax
9. IMPS - Immediate Payment Service
10. INF - Internet fund transfer in linked accounts
11. INFT - Internal Fund Transfer (Within ICICI Bank)
12. LCCBRN CMS - Local cheque collection
13. LNPY - Linked loan payment
14. MMT - Mobile Money Transfer (Insta FT - IMPS)
15. N chg - NEFT Charges
16. NEFT - National Electronics Funds Transfer System (Other Bank Fund transfer)
17. ONL - Online Shopping transaction (Payment done on third party website)
18. PAC - Personal Accident cover
19. PAVC - Pay any Visa credit card
20. PAYC - Pay to Contact
21. RCHG - Recharge
22. SMO - Smart Money order
23. T Chg - Travel Charges
24. TOP - Mobile recharge
25. UCCBRN CMS - Upcountry cheque collection
26. VAT / MAT / NFS - Cash withdrawal at other bank ATM
27. VPS / IPS - Debit card transaction
28. BIL - To third party is for RIB
29. GIB - Tax & Statutory payment, EPFO, ESIC
30. CMS - Internet bulk payment fund trf

-----End Of Statement-----



Raikela Iron Ore Mines

M/S. GEETARANI MOHANTY

RAIKELA IRON ORE MINES

06767 275896
geetarani.mines@gmail.com | grm@theworld.co.in
Station Road, Barbil, Keonjhar, Odisha, Pin-758035



To,

The Member Secretary,
State Pollution Control Board, Odisha,
Parivesh Bhawan, A/118, Nilakantha Nagar,
Unit-VIII, Bhubaneswar.

Dt: 23.06.2025

Sub: Submission of Annual Environment Statement in respect of our Raikela Iron ore Mines of M/s. Geetarani Mohanty in the district of Odisha.

Sir,

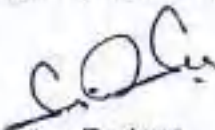
In kind reference to the above cited subject, we are hereby submitting herewith Annual Environment Statement in Form-V for the Financial Year 2024-25 in respect of our Raikela Iron ore Mines of M/s. Geetarani Mohanty for your kind perusal.

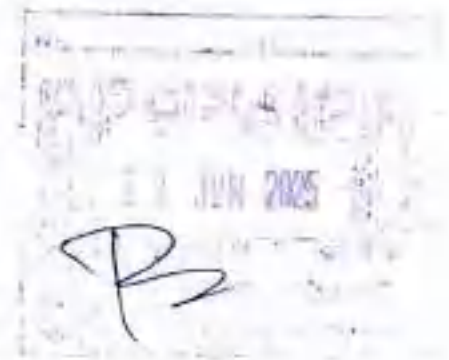
This is for your kind information please.

Thanking you,

Yours faithfully,

For M/s. Geetarani Mohanty
(Raikela Iron ore Mines)


Managing Partner



[FORM-V]

(See Rule 14)

Environment Statement for the financial year ending the 31st March 2025

PART-A

- (i) Name and address of the owner/occupier of the industry, operation or process:
**Raikela Iron Ore Mines of
M/s. Geetaraani Mohanty
At-Station Road, Po-Barbil,
Dist-Keonjhar, Odisha**
- (ii) Industry category Primary -(STC CODE) Secondary-(SIC Code)
- (iii) Production capacity: Units: **4.99 MTPA**
- (iv) Year of establishment: **1993**
- (v) Date of the last Environmental Statement Submitted: **30th April 2024**

PART-B

Water and Raw Material Consumption;

(1) Water Consumption m³/d: **170 CUM/Day**

Process (Mines dust Suppression/ sprinkling & Plantation etc.): **143.7 cum/day**

Cooling: **Not Applicable**

Domestic: **14.4 cum/day**

Note: The mine is not in Operation in the financial year 2018-19

Name of Product	Process water consumption per unit of output	
Iron Ore	Not Applicable	
	During the previous Financial year	During the current financial year
	(1)	(2)
(1)		
(2)		
(ii) Raw material consumption: Not applicable		
Name of raw Material	Name of products	Consumption of raw material per unit of output
		During the previous Financial year
		during the current Financial year
ROM	Sized Iron Ore	

*Industry may use codes if disclosing details or raw material would violate contractual obligations, otherwise all industries have to name the raw materials used.

PART-C

Pollution discharged to environment /unit of output:
(Parameter as specified in the consent issued)

(1) Pollutants	Quantity of Pollutants discharged (mass/day)	Conc. of Pollutants in discharges (mass/volume)	% of variation from prescribed standards with Reasons.
----------------	--	---	--

(a) Water: Not Applicable

(b) Air: Not Applicable

PART-D

Hazardous Wastes

(as specified under Hazardous Waste/ Management and Handling Rules, 1986)

Hazardous waste	Total Quantity	
	During the previous Financial year 2023-24	During the Current financial year 2024-25
(a) From process	-----	-----
(b) From Pollution Control FACILITY		
(C) Used Oil	4800 ltr	25410 ltr
(d) Oil contaminated waste	Nil	

No-such hazardous wastes were generated during the reporting period.

PART-E

Solid Waste

	Total Quantity	
	During the previous Financial year 2021-22	during the current financial year-2022-23
(a) From process:	0	0
(b) From pollution control facility: Not Applicable		
(c) (1) Quantity recycled or re-utilized within the unit. (2) Sold.		Not Applicable

- (3) Disposed: Out of the generated waste, 30% is being used for Haul road maintenance and remaining quantity is disposed at the earmarked dump site as per the approved mining plan.
-

PART-F

Please specify the characteristics (in terms of composition and quantum) of Hazardous as well as solid wastes and indicate disposal practice adopted for both these categories of wastes.

- The quantity of Hazardous waste generated (used oil, oil contaminated waste etc.) is being stored at earmarked place under shed with concrete flooring.
- Out of the generated solid waste, 30% is being used for haul road maintenance and remaining quantity is disposed at the earmark dump site as per the approved mining plan.

PART-G

Impact of the pollution abatement measures taken on conservation of natural resources and on the cost of the production

- Mining operation is being carried out as per approved mining plan of Indian Bureau of Mines, Govt. of India. For control of pollution of Air, regular sprinkling is being carried out. For control of water pollution construction of garland drain & check dam been done to collect the surface run off for setting before discharge.

PART-H

Additional measures/investment proposal for environmental protection including abatement of pollution, prevention of pollution

- Mining operation is being carried out as per approved mining plan of Indian Bureau of Mines, Govt. of India. For control of pollution of Air, regular sprinkling is being carried out. For control of water pollution construction of garland drain & check dam been done to collect the surface run off for setting before discharge.
- Dry fog system has been provided in the mineral handling plant for dust suppression.
- Plantation in safety zone and roof top rain water harvesting structure has been implemented at mine office premises.
- Mist Cannon is used for dust suppression at mines.

PART-I

Any other particulars for improving the quality of the environment

- Step towards Environmental Awareness Programme, project has observed the Various Programme with the plantation campaign in the mines surrounding areas.

Ms. GEETARANI MOHANTY


Managing Partner

Annexure XXVI

BUDGETARY PROVISION FOR GREEN BELT

5 Years Period	Year	Plantation Area	Saplings to be Planted	Survival @ 90 %	Capital Cost in Rs	Recurring Cost in Rs	Budgetary Provision	Location for Plantation/Affores tation
1	21-22	0.346	865					Safety Area
	22-23	0.344	860	774	602000	150500	752500	
	23-24	0.34	850	765	595000	148750	743750	
	24-25	0.33	825	742.5	577500	144375	721875	
	25-26	0.24	600	540	420000	105000	525000	
		Sub Total 1	4000	2822	2194500	548625	2743125	
2	26-27	0	0	0		0	0	21°.86716 N to 21°.871851 N 85°.17599 E to 85°.183089 E
	27-28	6	15000	13500	12000000	3000000	15000000	
	28-29	6	15000	13500	12000000	3000000	15000000	
	29-30	8	20000	18000	16000000	4000000	20000000	
	30-31	6	15000	13500	12000000	3000000	15000000	
		Sub Total 2	65000	58500	52000000	13000000	65000000	
3	31-32	7	17500	15750	16625000	4156250	20781250	21°.86514 N to 21°.87186 N 85°.17731 E to 85°.184501 E
	32-33	7	17500	15750	16625000	4156250	20781250	
	33-34	7.4	18500	16650	17575000	4393750	21968750	
	34-35	8	20000	18000	19000000	4750000	23750000	
	35-36	5	12500	11250	11875000	2968750	14843750	
		Sub Total 3	86000	77400	81700000	20425000	102125000	
	36-41	2.1	5250	4725	4987500	1246875	6234375	Stabilized Dump
		0.89	2225	2002.5	2113750	528437.5	2642187.5	Rain Water Pond
		Sub Total 4	7475	6727.5	7101250	1775312.5	8876562.5	
		Total	162475	145449	142995750	35748938	178744688	

EMERGENCY PREPAREDNESS AND RESPONSE PLAN
of



M/s Geetarani Mohanty Raikela Iron Ore Mines
At. Raikela, Tahasil-Koira, Dist. Sundargarh

Prepared by
M/s My World Consultancy Services Pvt. Ltd.
766 Telengapentha Cuttack 754001
www.wcs.theworld.co.in
Phone: 9124584648

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Prelude

An On-site Emergency Plan is a comprehensive, written document designed to control and minimize the consequences of major industrial accidents within a facility's boundary. It ensures the safety of workers, prevents property damage, and stops hazardous events from spreading outside the facility.

Statutory Framework

Industrial facilities must have robust, documented Emergency Preparedness and Response Plans (EPRP).

The Factories Act, 1948 (Section 41B): Mandates that every occupier of a hazardous factory draw up an *On-site Emergency Plan* and detailed disaster control measures.

MSIHC Rules, 1989 (Rule 13 & 14): industries handling specific quantities of hazardous chemicals must prepare and update an On-site plan.

The Disaster Management Act, 2005: Establishes the apex National Disaster Management Authority (NDMA) which issues guidelines for chemical disaster and industrial risk management.

This Emergency Preparedness Plan (EPP) has been prepared for the proposed Open Cast Iron Ore Mine having a lease area of 67.586 Ha with production capacity of 5.988 million Tonnes Per Annum (MTPA). The plan is based on Hazard Identification and Risk Assessment (HIRA) studies and Disaster Management Plan (DMP) requirements as per applicable statutory provisions under:

- The Mines Act, 1952
- Metalliferous Mines Regulations (MMR), 1961
- DGMS Circulars and Guidelines
- Environmental Clearance conditions of the Ministry of Environment, Forest and Climate Change
- Guidelines of Directorate General of Mines Safety
- National Disaster Management Authority (NDMA) guidelines

The objective of this report is to establish systematic procedures for:

- 1 Prevention of accidents and emergencies
- 2 Minimization of risk to human life, environment, and property
- 3 Effective response during emergencies
- 4 Restoration of normalcy after emergency situations

Product Details

Mining of Iron Ore , opencast mechanized method

Emergency Planning, Preparedness, and Response of M/s Geetarani Mohanty, Raikela Iron Ore Mines at Raikela, Koira, Sundargarh

Particular Details

Project Type:	Open Cast Iron Ore Mine
Lease Area:	67.586 Ha
Production Capacity:	5.988 MTPA
Mining Method:	Fully Mechanized Open Cast Mining
Drilling & Blasting:	Deep hole drilling and controlled blasting
Mineral:	Iron Ore
Working Depth:	570m RL(AMSL As per approved mining plan)

Machinery List

Sl. No	Machinery	Capacity (Cum)	Type of machine	No. of Units
1.	Excavator	3.20	Diesel	3.00
2.	Hyd. Excavator	3.00	Diesel	4.00
3.	Hyd. Excavator-PC200(for plant feeding)	0.90	Diesel	5
4.	Hyd. Excavator-PC200(for plant feeding)	0.90	Diesel	5
5.	Wheel loader	3.00	Diesel	4
6.	Wheel loader	2.50	Diesel	5
7.	Wheel loader	4.50	Diesel	3
8.	Dumper	30.00	Diesel	15
8.	Water Tanker	20000.00	Diesel	1
9.	Water Tanker	20000.00	Diesel	3
10.	Water Tanker	8000.00	Diesel	1
11.	Mobile Crushing Unit	200.00	Diesel	2
12.	Mobile Crushing Unit	400.00	Diesel	2
13.	Mobile Screen Plant	400.00	Diesel	2
14.	Mobile Screen Plant	400.00	Diesel	2
15.	Mobile Screen Plant	350.00	Diesel	1
16.	Mobile Screen Plant	200.00	Diesel	1
17.	Central Processing Unit	500.00	Diesel/Electric	2
18.	Grader	260.00	Diesel	1
19.	Grader	120.00	Diesel	1
20.	Rock breaker	30.00	Diesel/Electric	1
21.	Rock breaker	30.00	Diesel	1

Emergency Planning, Preparedness, and Response of M/s Geetarani Mohanty, Raikela Iron Ore Mines at Raikela, Koira, Sundargarh

22.	DTH Drill	15.00	Diesel	4
23.	Dozer	264.00	Diesel	1
24.	Dozer	264.00	Diesel	3

Manpower Details

S. No.	Particulars		Total No. of persons per day
1	Managerial	1 st class Mines Manager	2
2		Mining Engineer	1
3		2 nd class Manager	4
4		Geologist	2
5		Other	1
6		Mechanical Engineer	5
7		Electrical Engineer	5
8	Supervisory	Foreman	15
9		Mine-mate	17
10	Skilled Workers -	Skilled Workers/Operators -	255
11	Semi-skilled workers	Semi-skilled workers	80
12	Un-skilled Workers	Un-skilled Workers	50
Total			442

Objectives of Emergency Preparedness Plan

- Identification of potential hazards and associated risks
- Development of preventive and mitigation measures
- Protection of employees, nearby communities, and environment
- Establishment of emergency response organization
- Ensuring quick evacuation and rescue operations
- Minimizing production losses and environmental damage
- Coordination with district administration and external agencies

4. Hazard Identification and Risk Assessment (HIRA)

4.1 Methodology

Hazards were identified considering:

- Mining operations

- Machinery movement
- Blasting activities
- Electrical installations
- Slope stability.
- Storage and handling of diesel/explosives
- Natural calamities

Risk assessment was carried out considering:

- Probability of occurrence
- Severity of consequences
- Existing control measures

5. Major Hazards Identified

5.1 Mining Related Hazards

Activity	Hazard	Consequence
Drilling	Fly rock, dust, noise	Injury, respiratory issues
Blasting	Ground vibration, fly rock, misfire	Fatality, structural damage
Excavation	Slope failure	Burial, equipment damage
Haul Road Transport	Vehicle collision, overturning	Injury/fatality
Loading/Unloading	Falling material	Injury
Crusher Operations	Dust and entanglement	Respiratory disease, injury
Electrical System	Electric shock/fire	Fatality/fire
Fuel Storage	Fire/explosion	Property damage/injury

5.2 Natural Hazards

Hazard	Impact
Heavy Rainfall	Flooding, slope instability
Lightning	Injury/fatality
Earthquake	Structural instability
Heat Wave	Heat stress/dehydration
Cyclone/Storm	Damage to infrastructure

6. Risk Assessment Matrix

Severity	Description
Minor	First aid injury

Moderate	Medical treatment injury
Major	Serious injury/property damage
Catastrophic	Fatality/multiple fatalities

Likelihood	Description
Rare	Unlikely occurrence
Possible	Occasional occurrence
Likely	Frequent occurrence

Risk levels are categorized as:

- Low
- Medium
- High
- Extreme

7. Preventive and Mitigation Measures

7.1 Slope Stability Management

- Scientific bench design as per approved mining plan
- Bench height and width maintained as per DGMS norms.
- Regular geotechnical inspection
- Proper drainage to avoid water accumulation.
- Scaling of loose boulders

7.2 Drilling and Blasting Safety

- Controlled blasting techniques
- Use of delay detonators
- Blasting only by licensed blaster
- Blast area barricading and siren system.
- Pre-blast and post-blast inspection
- Proper stemming to control fly rock

7.3 Haul Road Safety

- Proper road gradient and width
- Regular road maintenance

- Speed limit enforcement.
- Installation of reflective signage
- Adequate illumination during night operation
- Defensive driving training

7.4 Fire Prevention Measures

- Fire extinguishers at critical locations.
- Fire hydrant/water tanker arrangement.
- No smoking zones near fuel storage
- Periodic electrical inspection
- Safe diesel storage practices

7.5 Dust and Air Pollution Control

- Water sprinkling on haul roads
- Wet drilling system
- Green belt development
- Dust suppression systems at crusher

7.6 Occupational Health Measures

- Periodic medical examination
- PPE usage enforcement
- Heat stress management.
- First aid facilities
- Health surveillance for dust exposure

8. Emergency Response Organization

8.1 Site Main Controller (SMC)

Mine manager:

- Overall control during emergency
- Coordination with external agencies
- Decision on evacuation

8.2 Incident Controller

Shift In-charge:

- Direct emergency handling at incident site
- Rescue coordination.
- Reporting to SMC

8.3 Emergency Response Team (ERT)

Comprising:

- Safety officer
- Blasting officer
- Mechanical/electrical personnel
- First aid personnel
- Security staff

9. Emergency Communication System

- Mobile phones
- Wireless/VHF communication
- Emergency siren
- Public announcement system

Emergency contact numbers shall be displayed prominently at:

- Mine office
- Workshop
- Fuel station.
- Rest shelters.

10. On-Site Emergency Plan

10.1 Fire Emergency

Actions:

- Raise alarm immediately
- Isolate fuel/electrical supply
- Use appropriate fire extinguishers
- Inform fire station and district authority
- Evacuate non-essential personnel

10.2 Slope Failure

Actions:

- Stop mining operations immediately
- Evacuate danger zone
- Deploy rescue team
- Barricade affected area
- Conduct geotechnical assessment before restart

10.3 Blasting Accident/Misfire

Actions:

- Restrict entry to blast zone
- Follow DGMS misfire handling procedures
- Re-inspection by blaster
- Controlled disposal of explosives if required

10.4 Vehicle Accident

Actions:

- Stop traffic movement
- Provide first aid
- Shift injured to hospital
- Investigate root cause

10.5 Flooding Due to Heavy Rainfall

Actions:

- Suspend mining in affected benches
- Dewatering through pumps
- Ensure drainage clearance
- Relocate machinery to safe area

11. Off-Site Emergency Preparedness

Coordination with:

- District Administration
- Police Department

- Nearby Hospitals
- Fire Brigade
- State Disaster Management Authority

Mutual aid agreements may be established with nearby mines/industries.

12. Evacuation Plan

Assembly Points

Safe assembly points shall be identified:

- Near mine office
- Workshop area
- Designated high ground locations

Evacuation Procedure

- Emergency siren activation
- Controlled movement through designated routes
- Head count verification.
- Medical assistance to injured persons.

13. Medical and First Aid Facilities

- Occupational Health Centre (OHC)
- Ambulance facility
- Trained first aiders
- Tie-up with nearby hospitals
- Emergency medicines and stretchers

14. Training and Mock Drills

Training

Periodic training on:

- Fire fighting
- First aid
- Evacuation procedures
- PPE usage

- Blasting safety

Mock Drills

- Conducted every 6 months
- Evaluation and corrective actions recorded
- Participation of external agencies where required

15. Resource Inventory

Resource	Availability
Fire Extinguishers	At strategic locations
Water Tankers	Available
Ambulance	Available
First Aid Boxes	Available
PPE Kits	Available
Rescue Equipment	Available
Emergency Lighting	Available

16. Environmental Emergency Management

- Oil/diesel spill
- Siltation of nearby drains
- Dust emission during dry season
- Blast vibration impact

Mitigation Measures

- Oil spill kits and containment
- Garland drains and settling ponds
- Regular water sprinkling
- Controlled blasting practices

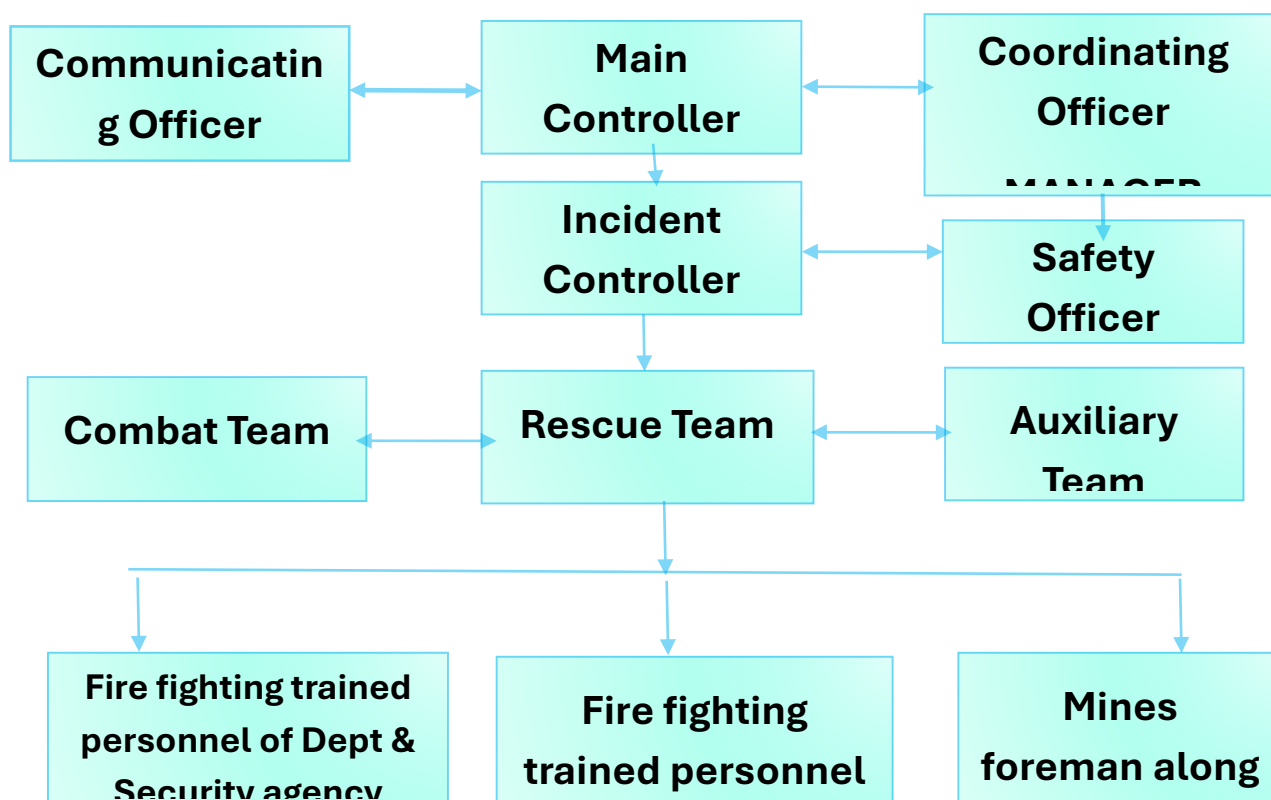
17. Roles and Responsibilities

Personnel	Responsibility
Mine Manager	Overall emergency control
Safety Officer	Safety coordination
Shift In-charge	Incident site management
Medical Officer	Medical response
Security Personnel	Access control
Employees	Follow emergency instructions

18. Restoration and Recovery Plan

Post-emergency actions include:

- Damage assessment
- Rehabilitation of affected area
- Investigation and root cause analysis
- Corrective and preventive action implementation
- Review of DMP and HIRA



19. Emergency Contact Name & Numbers

Police Station: 9437180107(IIC),100
 Fire Brigade: 06767-272631,101
 Ambulance: 9937409256

Company Executives & Officers Office Mobile Numbers

Mr P.K.Sahoo	9437003297
Mr M.K.Satapathy	9178215424
Mr Samir Ku Lenka	7751079913
Mr Prasant Das	8249565985
Mr S.N.Giri	8763014801
Mr Trinath Mohapatra	9438152374

20. Conclusion

The Emergency Preparedness Plan developed for the 67 Ha, 5.988 MTPA Open Cast Iron Ore Mine provides a structured framework for prevention, preparedness, response, and recovery from emergency situations. Proper implementation of HIRA recommendations, regular training, mock drills, and continuous monitoring will significantly reduce risks associated with mining operations and ensure safety of personnel, environment, and infrastructure.

Hazard Identification and Risk Assessment (HIRA) Matrix

For 67 Ha, 5.988 MTPA Open Cast Iron Ore Mine

1. Risk Rating Criteria

Severity (S)

Rating	Description	Consequence
1	Insignificant	Minor first aid injury
2	Minor	Medical treatment case
3	Moderate	Lost time injury
4	Major	Single fatality/major damage
5	Catastrophic	Multiple fatalities/permanent disability

Likelihood (L)

Rating	Description	Frequency
1	Rare	Very unlikely
2	Unlikely	May occur occasionally
3	Possible	Could occur sometime
4	Likely	Occurs regularly
5	Almost Certain	Frequent occurrence

Risk Rating = Severity × Likelihood

Risk Score	Risk Level
1 – 5	Low
6 – 10	Medium
11 – 15	High
16 – 25	Extreme

2. HIRA Matrix for Open Cast Iron Ore Mine

Sl. No.	Activity/Operation	Hazard	Possible Consequences	Existing Control Measures	S	L	Risk Score	Risk Level	Additional Mitigation Measures
1	Drilling Operation	Dust generation	Respiratory illness	Wet drilling, PPE	3	4	12	High	Dust suppression monitoring
2	Drilling Operation	Noise & vibration	Hearing loss	Ear plugs/ear muffs	2	4	8	Medium	Periodic audiometry
3	Blasting	Fly rock	Fatal injury/property damage	Controlled blasting, siren	5	3	15	High	Blast shelter and exclusion zone
4	Blasting	Misfire	Injury/fatality	Qualified blaster supervision	5	2	10	Medium	Strict DGMS SOP compliance
5	Excavation	Slope failure	Burial/fatality	Bench design and inspection	5	3	15	High	Geotechnical monitoring
6	Excavation	Falling boulders	Injury/fatality	Scaling of loose rocks	4	3	12	High	Regular slope scaling
7	Loading Operation	Material fall from excavator	Injury/equipment damage	Safe loading practice	3	3	9	Medium	Operator competency training
8	Haul Road Transport	Dumper overturning	Fatality/injury	Proper road gradient	5	3	15	High	Berm strengthening and speed control
9	Haul Road Transport	Vehicle collision	Injury/fatality	Traffic management system	4	3	12	High	GPS and reverse alarm
10	Haul Road Transport	Poor visibility due to dust	Accident	Water sprinkling	4	3	12	High	Fog lights and reflective signage
11	Crusher Operation	Entanglement in moving parts	Serious injury	Machine guarding	4	2	8	Medium	Interlock system
12	Crusher Operation	Dust emission	Respiratory issues	Dust suppression system	3	4	12	High	Enclosed conveyor system
13	Electrical Installation	Electric shock	Fatality	Earthing and insulation	5	2	10	Medium	Periodic electrical audit
14	Electrical Installation	Short circuit/fire	Fire damage	Circuit breaker system	4	2	8	Medium	Thermal scanning

Emergency Planning, Preparedness, and Response of M/s Geetarani Mohanty, Raikela Iron Ore Mines at Raikela, Koira, Sundargarh

15	Fuel Storage Area	Diesel fire	Injury/property damage	Fire extinguishers	5	2	10	Medium	Foam-based firefighting system
16	Workshop Activities	Welding fire	Burns/fire accident	Hot work permit system	4	2	8	Medium	Fire watch arrangement
17	Heavy Machinery Maintenance	Hydraulic failure	Injury/equipment damage	Preventive maintenance	3	3	9	Medium	Condition monitoring
18	Monsoon Conditions	Mine flooding	Drowning/equipment damage	Garland drains and pumps	5	3	15	High	Emergency dewatering plan
19	Storm/Lightning	Lightning strike	Fatality	Lightning arrestor	5	2	10	Medium	Weather alert system
20	Heat Exposure	Heat stress/dehydration	Health impacts	Drinking water/rest shelter	3	4	12	High	Heat stress management plan
21	Explosive Storage	Explosion/fire	Multiple fatalities	Licensed magazine	5	2	10	Medium	Strict access control
22	Human Error	Unsafe acts	Accident/injury	Safety training	4	3	12	High	Behaviour-based safety program
23	Night Operation	Poor illumination	Accident risk	High mast lighting	3	3	9	Medium	Lux level monitoring
24	Oil Spill	Soil/water contamination	Environmental pollution	Spill containment	3	2	6	Medium	Spill response training
25	Emergency Situation	Delayed response	Escalation of incident	Emergency response team	5	2	10	Medium	Mock drills and ERP review

3. Risk Prioritization

Extreme Risk

- Immediate stoppage and corrective action required.

High Risk

- Strict operational controls and continuous monitoring required.

Medium Risk

- Controlled through SOPs, supervision, and preventive maintenance.

Low Risk

- Routine monitoring sufficient.

4. Key High-Risk Activities in Iron Ore Mine

The following activities require special monitoring and emergency preparedness:

- Drilling and blasting
- Slope stability management
- Haul road transportation
- Flood management during monsoon
- Dust exposure management
- Heavy equipment operation

Monitoring Schedule

Parameter	Frequency
Slope stability inspection	Daily/after rainfall
Haul road inspection	Daily
Dust monitoring	Monthly
Noise monitoring	Quarterly
Electrical safety audit	Half-yearly
Mock emergency drill	Six-monthly
PPE compliance inspection	Daily
Medical examination	Annually

Colour Code Template

Colour Code Template for HIRA Matrix

Open Cast Iron Ore Mine

Risk Level	Risk Score	Colour Code	Meaning	Action Required
Low	1 – 5	 Green	Acceptable Risk	Routine monitoring and standard control measures

Emergency Planning, Preparedness, and Response of M/s Geetarani Mohanty, Raikela Iron Ore Mines at Raikela, Koira, Sundargarh

Medium	6 – 10	 Yellow	Moderate Risk	Management attention required with preventive controls
High	11 – 15	 Orange	Significant Risk	Immediate corrective action and strict supervision required
Extreme	16 – 25	 Red	Intolerable Risk	Stop activity immediately until risk is reduced

Sample Colour-Coded HIRA Matrix

Severity ↓ / Likelihood →	1 Rare	2 Unlikely	3 Possible	4 Likely	5 Almost Certain
5 Catastrophic	 5	 10	 15	 20	 25
4 Major	 4	 8	 12	 16	 20
3 Moderate	 3	 6	 9	 12	 15
2 Minor	 2	 4	 6	 8	 10
1 Insignificant	 1	 2	 3	 4	 5

Suggested Legend for Reports

	Low	Risk
	Medium	Risk
	High	Risk
 Extreme Risk		







PIC 2







PIC 3



PIC 3







PIC 5
Fixed
Sprinkler



Dry
Fogging





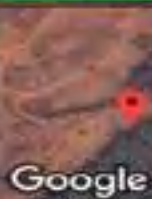
Mobile Sprinkler





GPS Map Camera

Check In



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PIC 9

IRON ORE MINES

TIME 15.02 TEMP 24.0°

AMBIENT AIR QUALITY

Parameter Unit R10

SO₂ mg/m³ 28.99

NO₂ mg/m³ 24.47

08.12.2025. ON





EK PED MAA KE NAAM 2.0

17 SEPTEMBER 2025

PLANTING TREES AND TAKING CARE OF OUR ENVIRONMENT TOGETHER

Creating beautiful world for future generations.

Forest, Environment and Climate Change Department, Government of Odisha



M/S GERANYANI MOHANTY
RAKELA IRON ORE MINES



**GREEN BELT PLANTATION IN THE YEAR
2024-25**

By

**Raikela Iron Ore Mines of
M/s Geetarani Mohanty**

Outside lease area

Area Covered - 2.7 Ha

No. of saplings Planted - 5040

**Supported by:- Forest Range, Barsuan of
Bonai Forest Division**



**GREEN BELT PLANTATION IN THE YEAR
2024-25**

By

**Raikela Iron Ore Mines of
M/s Geetarani Mohanty**

Outside lease area

Area Covered - 1.25 Ha

No. of saplings Planted - 3000

**Supported by:- Forest Range, Barsuan of
Bonai Forest Division**



Lat : 21.870552°

Lon : 85.184019°

Elevation:629

Time 25.05.2026 : 11.32 AM



Lat:21.87015

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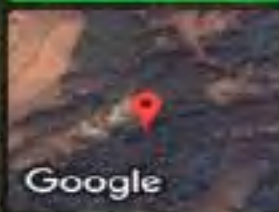
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 REMOTE SOUND MEASUREMENT SYSTEM
 TYPE WITH REAL-TIME DATA
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NEVCO

REMOTE SOUND
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Model - RSMS-01

Manufacturer -

Neelgagan Electronics

Model - RSMS-01

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Model - RSMS-01

Model - RSMS-01

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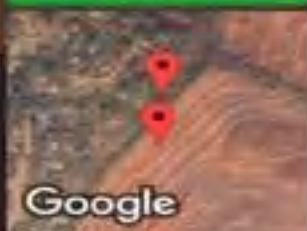
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PHOTOGRAPH SHOWING 30KVA SOLAR POWER



PIC 18

















JAI MAHABADRUGA



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Long 85.18055°

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Google





 **GPS Map Camera**

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