OCM/ENV/ 1208 /2022

Dated: 30.11.2022

To,

The Joint Director(s)
Ministry of Environment, Forest & Climate Change,
Eastern Regional Office,
Bhubaneswar

Sub.: Submission of Six-monthly compliance report to the conditions stipulated in the grant order of Environmental Clearance (EC) pertaining to Ostapal Chromite Mines of M/s FACOR LTD.

Ref.: EC identification No.:EC22B001OR120821, dated 04.04.2022

Dear Sir,

With reference to the captioned subject & cited reference, we are herewith submitting six monthly compliance reports pertaining to Ostapal Chromite Mines of M/s. FACOR Ltd for the period from April'2022 to Spetember'2022 for your kind perusal.

This is for your Kind information & necessary action.

Thanking You

Yours faithfully,
for Ferro Alloys Corporation Ltd.

MINES MANAGER
OSTAPAL CHROMITE MINES

Encl.: A/a

CC: (1) The Member Secretary SEIAA, ODISHA
(2) The Member Secretary, State Pollution Control Board, ODISHA

M/s. Ferro Alloys Corporation Ltd. (A subsidiary of Vedanta Ltd.)
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Website: www.facorgroup.in, CIN: U45201OR1955PLC008400

Name of the Project : OSTAPALCHROMITEMINES, M/S.FACORLTD.
Project Code : Mining (Non-Coal)
EC Identification No. : EC22B001OR120821, dated 4.04.2022
Compliance Report : Apr'2022 to Sept'2022

Sl No	Conditions	Compliance Status
A	**Specific Conditions**	
1	The mine shall explore implementation of membrane-based technology for removing hexavalent chromium from tailing pond, Surface run off & mine drainage water as proposed	In this connection, NIT, Rourkela has been engaged since Dt 18.12.2021 , to provide the suitable technology, vide P.O. No. 4800020530
2	The mine shall submit copy of the letter to NIT. Rourkela and their response thereof engaging them for the purpose of reduction of hexavalent chromium from tailing pond, surface run off, and mine drainage to SEIAA within one month time period	Engagement order to NIT Rourkela & their response is already submitted to SEIAA . It is enclosed as **Annexure -1**
3	The mine shall submit copy of study report conducted by NIT, Rourkela for the purpose of reduction of hexavalent chromium iron tailing pond, Source run off & mine drainage water once study is Over and implement the recommendations of the study. The project proponent shall submit implementation & action plan report to SEIAA	Copy of the final report is enclosed for reference as **Annexure- 2**. As per the final report all the precautions/recommendations are being implemented. All the suggested precautions are being implemented and maintained as follows: - • Discharge of tailing in separate pond • Impervious layer is laid at the bottom of the tailing pond to prevent the mixing of tailing water to the ground water. • Proper SOP of tailing management is maintained.  

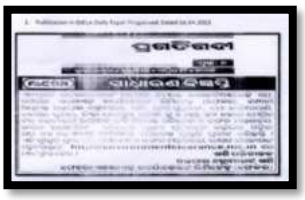
4	Since, mining has already intersected the ground water table; the steps proposed augmentation of ground water resources are not adequate. The project proponent shall put adequate number of recharge pits beyond the zone of influence based on a detailed hydro-geological study. The project proponent shall submit the measures to be undertaken for augmentation of ground water resources along with action plan to SEIAA within one month time period.	we have conducted a Hydrogeological study and based upon the comprehensive report on ground water condition we have augmented and implemented the recommendations. As per the study the rain-water harvesting structures are as follows: • Check-Dams • Garland Drains • Settling Pit • Roof Top Rainwater Harvesting The measures of the ground water augmentation report already submitted to SEIAA vide ref. No – OCM/ENV/897/2022 dated – 30.04.2022 **Annexure - 3**
5	The mine shall take adequate measures to minimize the discharge of waste water to Damsala nallah.	In addition to water supplying for irrigation, It is planned to install one water treatment plant, so as to use the mine wastewater for domestic purpose. So, that discharge to Damasala nallah will be minimize. Further, Afforestation will be done more than the proposal, for which treated waste water will be used, as a result discharge to Damsala Nallah will be minimized. The detailed are mentioned in **Annexure - 4**
6	All the compliances submitted/ committed by PP shall be strictly adhered to by them.	It is agreed & strictly followed.
7	Waste should be dumped on the earmarked sites within the mining lease area and no waste should be dumped outside the lease area	All the generated waste are being disposed inside the Mine only per approved Mining Plan. The details are enclosed in **Annexure - 5**

8	The Project Proponent shall start the plantation and cover at least 50% of the proposed area under plantation in the next 5 years. The density of the plantation should not be less than 2500 saplings/Ha. The species to be selected for the plantation should be in consultation with local forest department or any other expert agency engaged for the same. The Project Proponent shall keep the record of saplings planted survival rate area covered under plantation location etc ln addition to this gap filling needs to be done to as and when require for maintaining the density of plantation. **The PP shall submit the drone images of area before and after the plantation. PP shall carry out pilot study for phyto remediation of hexavalent chromium through IMMT CSIR. Bhubaneswar**. The budget earmarked for the plantation shall be kept in separate bank account and audited annually. **PP shall submit the detail such as photographs (before & after with gee location date &time)**, **details of expert agency engaged details of species planted**, number of species planted survival rate density of plantation and outcome of the pilot study etc. to the Regional Office of MoEF & CC Bhubaneswar and SEIAA Odisha before 1s July & 1 December of every year for the activities carried out during previous year	Presently around 34 Ha./46% of the total area covered with plantation. Density of the plantation is more than 2500/Ha. Species are provided by local Forest Department. All the data of sapling planted & survival rate is being recorded. Drone image for before plantation has been enclosed in Annexure No.-5A. And IIMT CSIR , Bhubaneswar has been engaged to carry out the Phyto remediation of hexavalent Chromium, enclosed as Annexure No. -5A . To complete the project, it will take one year. After getting the final result, it will be intimated. All the details are mentioned in **Annexure – 5A**
9	Approval/permission of CGWA/SCWMA shall be obtained before drawing ground water for the project activities. State pollution control board (SPCB) concerned shall not issue Consent to Operate (CTO) till the project Proponent obtains such permission.	NOC for the CGWA is applied for renewal on 22.07.2022 it is approved by CGWB BBSR and now it is under approval from CGWA Delhi. The details are mentioned in **Annexure - 6**
10	The amount proposed under Corporate Environment Responsibility (CER) head should be kept in a separate bank account and should be audited annually. The PP should annually submit the audited statement and details of implementation of CER activities along with proof of activities viz. photographs (before & after with geo-location date & time), purchase documents, photographs & Geo-location of the infrastructures facilities developed, etc. to the Regional Office of MoEF & CC Bhubaneswar and SEIAA, Odisha before 1st July & 1 December of every year for the activities carried out during previous year.	Separate General Ledger Account & separate Cost center for this fund has been maintained & which is also audited annually. Audit report along with all activities with supporting documents will be submitted annually.

11	The amount (except occupational health) proposed under Environmental Management Plan (EMP) head should be kept in a separate bank account and should be audited annually. The PP should annually submit the audited statement and detailed environment monitoring report along with proof of activities viz photographs (before & after with geo-location date & time), purchase documents, sampling reports, photographs& Geo-location of the infrastructures/facilities developed, details of persons engaged in Environment Management Cell etc. to the Regional Office of MoEF & CC, Bhubaneswar and SEIAA, Odisha before 1st July of every year for the activities carried out during previous year.	Separate General Ledger Account & separate Cost centre for this funds has been maintained & which is also audited annually. Audit report along with all activities with supporting documents will be submitted annually.
12	The amount proposed under Occupational Health plan head should be kept in a separate bank account and should be audited annually. The PP should annually submit the audited statement and detailed environment monitoring report along with proof of activities viz. photographs (before & after with geo-location date & time), purchase documents, sampling reports, photographs& Geo-location of the infrastructures/facilities developed. details of persons engaged in Environment Management Cell etc. to the Regional Office of MoEF & CC, Bhubaneswar and SEIAA Odisha before 1st July of every year for the activities carried out during previous year	Separate General Ledger Account & separate Cost centre for this fund has been maintained & which is also audited annually. Audit report along with all activities with supporting documents will be submitted annually.
13	The Project Proponent shall set up an Environmental Management Cell comprises of persons having qualification and experience in the field of environment along with supporting staff. The details of the same needs to be submitted to the SEIAA Odisha within 3 months of the grant of EC	It is complied. Environment Management cell is enclosed in **Annexure – 7.** It is already submitted to SEIAA within the given timeline.
14	The Sub-Committee of SEAC will visit the site within 6 months from the date of issue of Environmental Clearance to ensure implementation of agreed measures However either during the visit of the SEAC Sub-committee and/or at any time if it noticed that stipulated conditions on which EC is granted is not in place or found otherwise, steps will be taken for revocation of EC granted	All the conditions are strictly being followed and maintained.

15	The Project Proponent shall implement the short term and long term measures proposed to be taken in order to get rid from the adversity of Cr (V) contamination needs to be implemented and status report of the same along with benefit occurred needs to be submitted to Regional Office of MoEF & CO Bhubaneswar and SEAA Odisha annually.	NIT, Rourkela & IIMT, CSIR,-Bhubaneswar have been engaged to carry out the study & to suggest the measure to be taken for reduction of contamination. All the measures suggested by NIR Rourkela have been implemented. IIMT, CSIR study is under process, after getting the suggestion, measures will be implemented.And all the benefits will be intimated accordingly.
16	The Project Proponent shall keep a record of each blasting viz. location, number of holes, delay assigned of each hole, explosive quantity of each hole, blasting pattern etc.	It is complied. The record is being kept and maintained. The details are enclosed in **Annexure - 8**
17	This Environmental Clearance (EC) is subject to orders/ judgment of Hon'ble Supreme Court of India, Hon ble High Court, Hon'ble NGT and any other Court of Law, Common Cause Conditions as may be applicable.	It is complied
18	The Project proponent complies with all the statutory requirements and judgment of Hon'ble Supreme Court dated 2nd August,2017 in Writ Pettion (Civil) No. 114 of 2014 in matter of Common Cause versus Union of India & Or before commencing the mining operations, if applicable to the Project.	Complied. Letter submitted to Member secretary , Vide letter No.: FACOR/Bhadrak/Legal/109/2022, Dated: 25.4.2022. The details are enclosed in **Annexure - 9**
19	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 Write Petition (Civil) No. 114 of 2014 in matter of Common Cause versus Union of India & 0rs as may be applicable.	Complied. Letter submitted to Member secretary, Vide letter No.: FACOR/Bhadrak/Legal/109/2022, Dated: 25.4.2022 The details are enclosed in **Annexure - 9**
20	This Environmental Clearance shall become operational only after receiving formal NBWL Clearance from MoEF & CC subsequent to the recommendations of the Standing Committee of National Board for Wildlife. if applicable to the Project	It is not applicable as our lease area do not fall under and wildlife area so NBWL clearance is not required.
21	This Environmental Clearance shall become operational only after receiving formal Forest Clearance (FC) under the provision of Forest Conservation Act 1980, if applicable to the project	It is complied. We have obtained FC on 7th Feb 2006, from the Govt. of Odisha. The details are enclosed in **Annexure - 10**

22	Project Proponent (PP) shall obtain Consent to Operate after grant of EC and effectively implement all the conditions stipulated therein. The mining activity shall not commence prior to obtaining Consent to Establish/ Consent to Operate from the concerned State Pollution Control Board	CTE obtained on dated 31.03.2022. CTO Obtained on 28.06.2022 & valid till 31.03.2026 The details are enclosed in **Annexure - 11**
23	The PP shall adhere to the provision of the Mines Act. 1952, Mines and Mineral (Development & Regulation), Act. 2015 and rules & regulations made there under PP shall adhere to various circulars issued by Directorate General Mines Safety (DGMS) and Indian Bureau of Mines from time to time	It is complied. The PP is strictly adhered to the provisioned to the Mines Act, 1952 & Mines and Mineral Act, 2015 & regulations made there under from time to time.
24	The Project Proponent shall obtain consents from all the concerned land owner before start of mining operations as per the provisions of MMDR Act 1957 and rules made there under in respect of lands which are not owned by it.	It is complied. The PP has obtain the consent from all concerned land owners before starting of the mining operations. The details are enclosed in **Annexure - 12**
25	The Project Proponent shall follow the mitigation measures provided in MoEF & CC's Office Memorandum No 2-1013/57/2014-IA I (M). dated 29 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 habitation and villages are surrounded by the mine lease area"	There are no villages in the mine lease area. However, EIA study has been carried out by domain expert. And as per the suggestion of EIA study report, mitigative measures have been taken to avoid the “Impact of mining activities on Habitations” & villages in the Buffer one.
26	The copies of the environmental clearance shall be submitted by the project proponents to the heads of the local bodies, panchayats and municipal bodies in addition to the relevant offices of the government who in turn has to display the same foe 30 days from the date of receipt	It is complied. It is Submitted to The Collector & District Magistrate, Jajpur , The Sub-Collector, Jajpur, The Tahasildar, Sukinda & The Sarapanch, Kaliapani on dated 07.04.2022 for information. The details are enclosed in **Annexure - 13**
27	State Pollution Control Board shall be responsible for display of this EC letter at its Regional office, District Industries Centre and Collector's office/ Tahasildar's Office for 30 days.	NA for PP.

28	The Project Authorities should widely advertise about the grant of this EC letter by printing the same m 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.environmentclearance.nic.in) A copy of the advertisement may be forwarded to the concerned MoEF & CC Regional Office for compliance and record.	It is complied. Advertisement have been published in two local newspapers within 7 days of issue of the clearance letter.   Copy of the advertisement forwarded to the concerned authority is enclosed as **Annexure - 14**
29	The Project Proponent shall inform the MoEF& CC/SEIAA, Odisha for any change in ownership of the mining lease. In case there is any change in ownership or mining lease is transferred than mining operation shall only be carried out after transfer of EC as per provisions of the para 11 of EIA Notification, 2006 as amended from time to time	There is no change in ownership.
B	**Statutory Condition:**	
(i)	**Air Quality Monitoring and preservation**	
30	The Project Proponent shall instal a minimum of 1 (one) online Ambient Air Quality Monitoring Stations to monitor critical parameters relevant for mining operations, of air pollution viz PM10, PM25. NO2 CO and SO2 etc. as per the methodology mentioned in NAAQS Notification No. B-29016/20/90/POCIH 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	1 Online AAQMS is installed to monitor the critical parameters relevant for mining operations such as PM10, PM25. NO2 CO and SO2 AAQ Monitored is installed in other place & also digitally displayed board placed in front of the main gate.  
31	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 PM10 and PM2.5 are evident such as haul road, loading and unloading point and transfer points. The Fugitive dust emissions from each sources shall be regularly controlled by installation of required equipment/machineries and preventive maintenance. Use of Suitable water-soluble	It is complied. Two nos. of water sprinkler (12 KL Capacity each) have been engaged for regular sprinkling of water on the as haul road, loading and unloading point. Further, fugitive dust emission is being monitored regularly. Preventive maintenance is being carried out regularly. The details are enclosed in **Annexure - 15**

	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 MoEF & CC/ Central Pollution Control Board	
II	**Water Quality Monitoring and Preservation**	
32	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 MoEF & CC 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.	NOC is obtained from CGWA. Vide Ref No.: CGWA/NOC/MIN/REN/1/2021/6481. The NOC is enclosed as **Annexure - 6**
33	Regular monitoring of the flow rate of the springs and perennial nallahs flowing in and around the mine lease shall be carried out and records maintain. The natural water bodies and or streams which are flowing in an around the village, should not be disturbed. The Water Table shoud be nurtured so as not to go down below the pre-mining period. In case of any water scarcity in the area, the Project Proponent has to provide water to the villagers for their use. A provision for regular monitoring of water table in open dug wall located in village should be incorporated to ascertain the impact of mining over ground water table 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/ State Pollution Control Board	It is complied. We don't have any perennial nallahs in and around the lease, we have only seasonal nallahs. There is no scarcity of water, and the water table is in proper level. Further, drinking water is provided to the nearby villages. The details are enclosed in **Annexure - 16**

34	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/ State Pollution Control Board	It is complied. Ground water level & quality being monitored regularly. And report also submitted. The details are enclosed in **Annexure - 16**
35	The Project Proponent shall undertake regular monitoring of natural water course water resources/ springs and perennial nallahs existing/ flowing in and around the mine lease and maintain its records The project proponent shall undertake regular monitoring of water quality upstream and downstream of water bodies passing within and nearby/ adjacent to the mine lease and maintain its records. Sufficient number of gullies shall be provided at appropriate places within the lease for management of water PP shall carryout regular monitoring wrt pH and included the same in monitoring plan 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 MoEF & CC SEIAA Odisha. 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 be sent regularly to ministry of environment, forest and climate change and its regional office, SEIAA, Odisha, Central Ground Water Board, State Pollution Control Board and central pollution control board. Clearly showing the trend analysis on six-monthly basis.	It is complied. Water quality of Damasala Nallah is being Monitored & report submitted. The details of monitoring the upstream & downstream water bodies are enclosed in **Annexure – 17** There is no water bodies inside the lease area.Further, the available pit seepage water & Ground water are being monitored 4 times a year. Report of monitoring is being submitted to the Board & Regional office of MoEF & CC.
36	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	It is complied. One NABL accredited Lab. M/s visionteck Pvt Ltd is engaged to ensure the quality of the mines discharge water. And all the parameters mentioned are monitored. Monitoring data uploaded in the Website: https://www.facorgroup.in/esg/compliances/ And displayed through digital display board near main gate. The details are enclosed in **Annexure - 18**

	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.	
37	The project proponent shall construct retaining wall and settling pond within the lease area. Further. check dams shall be constructed at strategic locations in which rain water passes in rainy season. Quality of the mine drainage water shall be monitored on real-time basis& also monitored through NABL Lab. Mine drainage water shall be used only after treatment through ETP for various industrial uses	Retaining wall is constructed along the periphery of the dump, settling pond is there in the lease also check dam is constructed at strategic locations through which rain water passes in rainy season. Also the mine drainage water is monitored on real time basics along with through NABL Lab and it is used for industrial purpose only after treatment. The details are enclosed in **Annexure - 19**
38	Detail design of the existing retaining wall and the proposed for the expansion from a chartered Civil Engineer shall be submitted within 6 months from the date of issue of Environmental Clearance to ensure that no silt after wash up & treatment is escaped from the core/ buffer zone of the mines.	The existing retaining wall is certified from a Chartered Civil Engineer. The Certificate is enclosed as Annexure – 20 Further, there is no proposal for retaining wall in the coming mining plan period.
39	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, MoEF& CC annually.	It is complied. Annual report on recharge amount will be submitted to Regional office,MoEF, annually.
40	Industrial waste water(workshop and waste water from the mine) should be properly collected and treated in an ETP as proposed 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.	It is complied.All the industrial water are channelized and properly collected and treated in an ETP. Oil & Grease trap is also provided. The details are enclosed in **Annexure - 18**
41	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.	It is complied. The water balance chart is maintained and monitored on monthly basics. And the action plan for the reduction of water is made and submitted to the MoEF & SPCB. The details are enclosed in **Annexure - 21**

Iii	**Noise and Vibration Monitoring Prevention**	
42	The peak particle velocity at 500m distance or within the nearest habitation whichever is closer shall be monitored periodically as per applicable DGMS guidelines.	A scientific study on ground vibrational effects of blasting is carried out by NIT Rourkela periodically. Also it is being monitored by instrument (Micro Mate) internally.  The details are enclosed in **Annexure - 22**
43	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.	It is Complied. Noise monitoring is done by VisionTek both in day and night and the noise limit falls under the prescribed standards The details are enclosed in **Annexure - 23**
44	The Project Proponent shall take measures for control of noise levels below 85 dBA in the work environment The worker 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.	It is compiled. Noise level is being monitored and it shows below the prescribed limits. All the workers are working in HEMM are provided with ear plugs and the workers working in dusty are provided with protective respiratory devices. The details are enclosed in **Annexure - 23**
iv	**Mining Plan**	
45	The Project Proponent shall adhere to the working parameters of mining plan which was submitted at the time of EC appraisal wherein year-wise plan was mentioned for total excavation ie. quantum of mineral, waste over burden inter burden and top soil etc. No change in basic mining proposal like mining technology total excavation, mineral & waste production, lease area and scope of working (viz method of mining. overburden & dump management, O.B & dump mining, mineral transportation mode. ultimate depth of mining etc) shall not be carried out without prior approval of the Ministry of Environment Forest and Climate Change which entail adverse environmental impacts,even if it is a part of approved mining plan modified after grant of EC or granted by State Govt in the form to Short Term Permit (STP), Query license or any other name.	It is complied. Mining activities is being carried out as per the approved mining plan. There is no such changes, and in case of any changes, prior permission/approval will be taken from MoEF & CC. The details are enclosed in **Annexure - 24**

46	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 vernfication	It is not applicable, as there is no FMCP required now.
47	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-v backfilling vis-à-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/ SEIAA, Odisha	It is not Applicable presently. There is only one active open cast pit. So, no back filling is done. Further, land use area is also governed as per the approved Mining Plan.
V	**Land Reclamation**	
48	The Overburden (O.B.) 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 dumps like height, width and angle of slope shall be governed as per the approved Mining Plan as per the guidelines/circulars issued by D.G.M.S. w.r.t. safety in mining operations shall be strictly adhered to maintain the stability of top soil/OB dumps. The topsoil shall be used for land reclamation and plantation.	It is complied. The OB generated is stacked in OB dump site with proper height, width and angle of slope as per the approved mining plan. All the generated top soil is used for afforestation purpose. The details are enclosed in **Annexure - 24**
49	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. safety in mining operations shall be strictly adhered to maintain the stability of waste dumps.	It is complied. The OB generated during the mining operation is stacked at the OB dump site which is having proper height, width and angle of slope as per the approved mining plan & other circulars. The details are enclosed in **Annexure - 24**
50	The reclamation of waste dump sites shall be done in scientific manner as per the Approved Mining Plan cum Progressive Mine Closure Plan.	It is being followed.

51	The slope of dumps shall be vegetated in scientific manner with stable 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/levelling of dump mass. In critical areas, use of geo textiles/geo-membranes / clay inners/ Bentonite etc. shall be undertaken for stabilization of the dump.	It is complied. We use geo-textile & silpaulin to prevent erosion & surface run-off. Also the geo-textile & silpaulin helps to stabilize the dump by preventing the rain water to percolate in the dump. In long term effect these Geo-Textile decompose with the soil and makes the soil more fertile which in turns acts as a manure for the plants planted in the benches of the dump.  GEOTEXTILES USED ON DUMP TERRACES The details are enclosed in **Annexure - 25**
52	The Project Proponent shall carry out slope stability study in case the dump height is more than 30 meters. The slope stability report shall be submitted to concerned regional office of MoEF & CC. Govt. of India, Bhubaneswar as well as SEIAA, Odisha.	It is complied. Slope Stability study has been conducted by CIMFR,Dhanbad. And report is already submitted to the MoEF & SEIAA The details are enclosed in **Annexure - 26**
53	Catch drains, settling tanks and siltation ponds of appropriate size shall be constructed around the mine working, mineral yards and topsoil/OB /waste dumps to prevent runoff 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.	It is complied. We have already implemented catch drains & settling ponds of appropriate size to prevent runoff of water and flow of sediments directly into the water bodies. Further, all the drains & settling ponds are being desilted regularly. The details are enclosed in **Annexure - 19**
54	Check dams of appropriate size, gradient and length shall be constructed around mine pit and OB dumps to prevent storm run-off and sediment low 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 corners of the garland drains.	It is complied. Check-dams of appropriate size, gradient and length is constructed around mine pit, OB Dump & garland drain, here to arrest the slime/suspended solid particles flowing through the streams. Considering peak rainfall, the surface run off study has been conducted by domain expert, the settling pond & others measures are designed & constructed accordingly. The details are enclosed in **Annexure - 19**
55	Storm water and leached water for treatment shall be led in separate pipes and where required, retaining wall, settling pond and check dam shall be constructed within the lease hold area for conservation of rainwater and prevention of soil loss.	It is complied. Storm Water drains are there where required & retaining wall, settling pond & check dam are constructed in the lease hold area. The details are enclosed in **Annexure - 19**

56	The top soil, if any, shall temporarily be stored at earmarked site(s) within the mine lease only and should not be kept unutilized for long. The physical parameters of the top soil dumps like height, width and angle of slope shall be governed as per the approved Mining Plan and as per the guidelines framed by DGMS w.r.t. safety in mining operations shall be strictly adhered to maintain the stability of dumps. The topsoil shall be used for land reclamation and plantation purpose	It is complied. There is no generation of top soil during the period April'22 to Sept'22. All the generated top soil is utilized for afforestation purpose. The details are enclosed in **Annexure - 24**
57	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 their mining activities and restore the land to a condition which is fit for growth of fodder, flora, fauna etc.	It is NA for us as of now It will be taken care as per after ceassion of Mining activities in consultation with competent authority.
58	Slope study by an expert of repute of water dumps to be done and submitted within six months from the date of issue of EC to SEAC/SEIAA	It is complied. Slope Stability Study is conducted, and the report already submitted SEIAA. The details are enclosed in **Annexure - 26**
vi	**TRANSPORTATION**	
59	No Transportation of the minerals shall be allowed in case of roads passing through 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) cetificate for all the vehicles from authorized pollution testing centers	Transportation is being carried out on the same road as used before the expansion i.e TOMKA-MANGALPUR Highway. Road connecting to TOMKA-MANGALPUR highway, is being always maintained to avoid dust generation. Further, water sprinkling is being carried out to mitigate the dust generation. An amount of 180 Crore is already sanction for the same road to widen & strengthen it, from DMF.  ଖଣିଅଞ୍ଚଳ ବିକାଶରେ ଖର୍ଚ୍ଚ ହେବ ୬୩୫ କୋଟି And also, another bridge connecting to Mines transportation road is already under construction.   ବିରୁ ସେତୁ ଓ ରଗଡା ସୌନ୍ଦର୍ଯ୍ୟୀକରଣ ଶିଳାନ୍ୟାସ All the vehicle used for mines & vehicle carrying mineral having valid PUC Certificates which are ensured regularly.

60	The Main haulage road within the mine lease should be provided with a permanent water arrangement for dust suppression. Other roads within the mine lease should be wetted regulary 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.	For dust suppression system, we are having two permanent mobile water tankers which sprinkles out the water in the haul roads regularly in a scheduled way.For water supplying , one fixed water point is also provided. Other than that we have 4 AAQMS located at different locations of the mine which monitors the quality of the ambient air. There is no transportation being carried out through belt conveyor. So, it is not applicable. The details are enclosed in **Annexure - 27**
61	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.	Complied. It is done effectively and in a controlled manner. Also water sprinkling is done regularly. PP has also obtained PUC for all the vehicles from authorized pollution testing centres. The details are enclosed in **Annexure - 27**
62	Haulage road shall be developed and maintained perennially and perpetually by the proponent in construction with the concerned authority of the Govt. and to this effect, the proponent shall submit an undertaking in form of a legal affidavit.	The haulage road is developed and maintained regularly. Legal affidavit is attached. The details are enclosed in **Annexure - 28**
63	Traffic Density study if not done by domain expert, then the expert to be ratified/ authenticated by domain expert and submitted within a month time.	It is complied. Traffic density study has been conducted by domain expert & submitted along with final EIA. The details are enclosed in **Annexure - 29**

VII	Green Belt	
64	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 Ministry irrespective of the stipulation made in approved mine plan	It is complied. Green belt (Plantation) has been developed all along the mining lease boundary. As per forest act all along the forest boundary line 7.5 m safety zone is there. 
65	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	It is complied. Community Plantation programme are being carried out with consultation of Forest Department & Gram Panchayat. Sufficient funds provision is there to take care of the plantation. The details are enclosed in **Annexure – 29 A**
66	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 regards 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.	It is not applicable as there is no grazing land within the lease area.

67	The Project Proponent shall undertake all precautionary measures for conservation and protection of endangered flora and fauna and Schedule-I species during mining operation. A Wildlife Conservation Plan shall be prepared for the same clearly delineating action to be taken for conservation of flora and fauna. The Plan shall be approved by Chief Wild Life Warden of the State Govt. and implemented in consultation with the State Forest and Wildlife Department. A copy of Wildlife Conservation Plan and its implementation status (annual) shall be submitted to the Regional Office of the Ministry.	Wild life Conservation plan has been prepared by accredited Consultant and It is approved from the office of the principle chief conservation of forest. Approval Ref Vide No.: 10183/CWLW-FDWC-FD-0033-2022, dated 11.11.2022. The copy of the approval is enclosed as **Annexure - 30**
VIII	**Public Hearing and human health issues**	
68	The Project Proponent shall appoint an Occupational Health Specialist for Regular as well as Periodical medical examination of the workers engaged in the mining activities as per the DGMS guidelines. The records shall be maintained properly. PP shall also carryout Occupational health check-ups in respect of workers which are having ailments like BP, diabetes, habitual smoking, etc. The check-ups shall be undertaken once in six months and necessary remedial preventive measures be taken. A status report on the same may be sent to MoEF & CC Regional Office and DGMS on half-yearly basis.	One Occupational Health specialist (Dr. Parameswar Sethi) is appointed as per DGMS guideline. Check-up are under taken once in six month & necessary preventive measures are taken. Status report is sent to MoEF & DGMS on half-yearly basis.
69	A commitment in form of an undertaking for periodical occupational health check-up of the employee and the local people shall be done through an occupational health expert.	All the employees & local people are being undertaken for periodical health check up through an occupational health expert.. 

70	The Project Proponent must demonstrate commitment to work towards Zero Harm from their mining activities and carry out Health Risk Assessment (HRA) for identification workplace hazards and assess their potential risks to health and determine appropriate control measure to protect the health and wellbeing of workers and nearby community. The proponent shall maintain accurate and systematic records of the HRA.The HRA for neighbourhood has to focus on Public Health Problems like Malaria Tuberculosis. HIV, Anaemia, Diarrhoea in children under five respiratory infections due to bio-mass cooking. The proponent shall also create awareness and educate the nearby community and workers for Sanitation Personal Hygiene, Hand washing not to defecate in open, Women Health and Hygiene (Providing Sanitary Napkins), hazard of tobacco and alcohol use. The Proponent shall carryout base line HRA for all the category of workers and thereafter every five years.	The PP is committed to work for zero harm from the mining activities and carrying out appropriate measures for Risk assessment and identification of workplace hazards and asses the potential risks for health and taking appropriate control measures to protect the health of workers and the near by community. The PP is conducting HRA among the neighbourhoods to focus on malaria, Dengue, Tuberculosis, HIV, Anaemia, Diarrhoea and ARIs in children and adults. Regular awareness program is being conducted in the nearby villages for sanitization, personal hygiene, hand washing, not to defecate in open places, women health, hazards of smoking tobacco, drinking alcohol. Awareness program are being taken for control of malaria and Dengue and Tuberculosis.  

71	The Proponent shall carry out Occupational health surveillance which be a part of RA and include Biological Monitoring where practical and feasible and the tests and investigations relevant to the exposure (e g for Dust a XRay chest,For Noise Audiometric; for Lead Exposure Blood Lead, For Welders Full Ophthalmologlo Assessment; for Manganese Miners a complete Neurological Assessment by a Certified Neurologist, and Manganese (Mn) estimation in Blood; For Inorganic Chromium-Fortnightly skin inspection of hands and forearme by a responsible person. Except routine teste all tests would be carried out in a Lab accredited by NABH. Records of Health Surveillance must be kept for 30 years, including the results of and the records of Physical examination and tests. The record of exposure due to materials like Asbestos, Hard Rock Mining, Silica, Gold, Kaolin, Aluminium, Iron, Manganese, Chromium, Lead, Uranium need to be handed over to the Mining Department of the State in case the life of the mine is less than 30 years. It would be obligatory for the State Mines Departments to make arrangements for the safe and secure storage of the records including X-Ray. Only conventional X-Ray will be accepted for record purposes and not the digital one). X-Ray must meet ILO criteria (17 xl4 inches and of good quality)	The PP has taken necessary steps to carry out occupational health surveillance for works engaged in mines activities like audiometric tests for blasters(noise), x-ray chest for hexavalent chromite exposure, fortnightly skin inspection by Medical officer of our dispensary. All the routine examination of stool, urine, sputum and chest x-ray are being done in every six months for food handlers, the PP is taking steps for chest x-ray, examination of sputum, stool, audiometric test and full lung function test for blasters and full opthalmolocal tests for Drivers and Operators.

72	The Proponent shall maintained a record of performance indicators for workers which includes (a) there should not be a significant decline in their Body Mass Index and it should stay between 18.5-24.9 (b) the Final Chest X-Ray compared with the base line X-Ray should not show any capacities (c) At the end of their leaving job there should be no Diminution in their Lung Functions Forced Expiratory Volume in one second (FEV1),Forced Vital Capacity (FVC), and the ratio) unless they are smokers which has to be adjusted, and the effect of age, (d)their hearing should not be affected. As a proof an Audiogram (first and last need to be presented), (e) they should not have developed any Persistent Back Pain Neck Pain, and the movement of their Hip, Knee and other joints should have normal range of movement, (f) they should not have suffered loss of any body part. The record of the same should be submitted to the Regional Office, MoEF & CC annually along with details of the relief and compensation paid to workers having above indications	All the employees are being examined before appointment in the mining activities by an occupational specialist. The PP is maintaining a record of performance indicators for workers which include their Body Mass index, chest x-ray etc.
73	The Project Proponent shall ensure that 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	It is complied. A quarterly monitoring is done upon the dust fall analysis the details is attached. Also person working in dusty area wears protective respiratory devices during work. 
74	Project Proponent shall make provision for the housing for workers/labors or shall construct labor camps within/outside (company owned land) with necessary baslc 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	All most all the workers/labors are coming from local area. So, colony is not required for them.

75	The proponent shall implement the mitigative measures as suggested in the Study Report on effect of chromite mines to nearest human habitation	The mitigative measures have been to protect from chromium mines to nearest human habitation.
IX	**Corporate Environment Responsiblitiy (CER)**	
76	As per the MoEF & CC, Govt. of India Office Memorandum dated 30,.09.2020, the project proponent is enquired to prepare and implement Corporate Environment Responsibility (CER) Plan. The activities proposed under CER shall be restricted to the affected area around the project. The company shall undertake all relevant measures for improving the socio-economic conditions of the surrounding area. CSR activities shall be undertaken by involving local villages and administration. The activities proposed for CER shall be implemented and to be completed within three years and annual report of implementation of the same along with documentary proof viz. photographs, purchase documents, latitude & longitude of infrastructure developed & road constructed needs to be submitted to Regional Office MoEF & CC annually along with audited statement and to the District Collector. It should be posted on the website of the project proponent.	CER action plan has been prepared and submitted in EIA. Activities proposed under CER is restricted to only affected area. All the improvement is being undertaken by involving local community.  All the CER proposal will be completed within the timeline. Work is under progress and it is a continuous process and the report will be submitted to MoEF & CC and district collector at year end. And the same will be posted in website.
77	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 MoEF & CC, Bhubaneswar, SPCB Odisha along with the Six Monthly Compliance Report.	EMP action plan to be prepared & approved from competent authority & implemented accordingly. Year wise funds earmarked is kept in separate account provision.After year end the progress plan will be submitted. The details are enclosed in **Annexure - 31**
X	**Miscellaneous**	
78	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	It is complied. We are having a digital map for the entire lease and submitted to IBM. The details of the land use pattern are attached The details are enclosed in **Annexure - 32**
79	The Project Authorities should inform to the Regional Office regarding date of financial closures and final approval of the project by the concerned authorities and the date of start of land development work.	It is NA as of now. Currently the mines is in running condition and therefore, the final closer is not required.
80	The project proponent shall establish a solar power plant with 30KVA capacity within the lease area as proposed.	As there is no colony inside the lease, so persons are staying outside the lease area where there in solar power plant installed which is 40 KVA

81	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. SPOB& Regional Office of the Ministry of Environment & Forest. Odisha in hard and soft copies on 1 June and 1 December of each calendar year .The proponent shall also upload the Compliance report including results of monitored data as applicable in the website of the Ministry for monitoring of EC Conditions	It is being complied. The six monthly compliance report is submitted along with all the environment monitoring report. And it is also uploaded in the website.
82	The environmental statement for each Financial year ending 31 March in Form-V as mandated to be submitted by the project proponent to the Odisha State Polluton Control Board as prescribed under the Environment (Protection) Rules 1986, as amended subsequently, shall also be put on the website of the company along with the status of compliance of EC conditions and shall also be sent to the respective to the MoEF & COC & its concerned Regional Office, Central Pollution Control Board and State Pollution Control Board.	It is being complied. It is uploaded in the website before the FY ending 31st march Website link: https://www.facorgroup.in/esg/compliances/ Also the Environment Statement copy is attached. The details are enclosed in **Annexure - 33**
83	The proponent shall submit/upload six monthly reports on the status of compliance of the stipulated Environmental Clearance conditions, including results of monitored data on their website and shall update the same periodically. It shall simultaneously be sent to the Regional Office of MoEF &CC, Govt. of India, the respective Zonal Office of CPCB and the SPCB. The criteria pollutant levels namely: SPM, RSPM, SOz. NOx (ambient levels as well as stack emissions) or critical sectoral parameters, indicated for the project shall be monitored and displayed at a convenient location near the main gate of the company in the public domain	It is complied. After Submitting the six monthly compliance report for the period April'22 to September'22 ,it is uploaded in the website & it is uploaded periodically, and same is also submitted to RO, MoEF CC. All the critical parameters are monitored and also displayed near main gate.
84	The Project Proponent shall submit six monthly compliance reports on the status of the implementation of the stipulated environmental safeguards to the MoEF &CC & its concerned Regional Office, SEIAA, Odisha, Central Pollution Control Board and State Pollution Control Board	It is complied. Six monthly compliance report is submitted to MoEF & CC & its concerned RO, SEIAA OSPCB & CPCB
85	The SEIAA, Odisha may revoke or suspend this EC. if implementation of any of the above conditions is not satisfactory. The SEIAA, Odisha reserves the right to alter modify the above conditions or stipulate any further condition in the interest of environment protection.	It is complied. All the implementations are as per the standards & satisfactory.
86	The project proponent shall augment infrastructure on drinking water, health care	It is being implemented as per action plan.

	and education in nearby villages as per time bound action plan submitted	
87	The project proponent shall obtain permission from DGMS under 106(2b) to carry out blasting operation within the lease area.	It is complied. We have obtained the blasting permission The details are enclosed in **Annexure - 34**
88	The site will be visited by the sub-Committee of SEAC after six months to review the progress of recommendations of SEAC on specific conditions	It is complied. All the condition mentioned are implemented & strictly followed
89	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	It is complied. It is ensured to extend the full support to the authority as per their requirement.
90	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 Polution) Act 1981, the Environment (Protection) Act 1986 and the Public Lability 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	It is being complied.
91	This Environmental Clearance (EC) is subject to orders/judgment of Hon'ble Supreme Court of India, Hon'ble High Court. Hon'ble NGT and any other Court of Law, Common Cause Conditions as may be applicable	No appeal filed against this Environment Clearance in the National Green Tribunal. Hence complied.
92	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	No appeal filed against this Environment Clearance in the National Green Tribunal. Hence complied.

MINES MANAGER

OSTAPAL CHROMITE MINES

OCM/ENV/ 885 /2022 Date: 25/04/2022

To
The member Secretary,
SEIAA, Bhubaneswar.

SUB: Letter/Po handed over to NIT Rourkela to carry out reduction of hexavalent chromium from tailing pond, surface run off and mine discharge water of Ostapal Chromite Mine M/s FACOR Ltd.

Ref: Environment Clearance No - 66461/75-MINB1/02-2022 dated on – 3.02.2022, Special Condition Point No – 2

Dear Sir,

We would like to intimate that we have engaged NIT Rourkela since 13.12.2022 to carry out the reduction of hexavalent chromium from tailing pond, surface run off and mine discharge water vide PO No: 4800020530, PO delivery priod is 31.07.2022.
In response to our PO handover/Supply, the work has been carried out by NIT, Rourkela and submitted one interim report. But final result yet to received.

After obtaining the final report we will submit the same.

- Annexure 1 – Purchase Orde (PO)
- Annexure 2 – Response Letter of NIT Rourkela

This is for your kind information

Thanking You

Yours faithfully,
Ferro Alloys Corporation Limited

Head Environment

vedanta
transforming elements

FACOR
FERRO ALLOYS CORPORATION LIMITED
D.P.Nagar,Randia-756135, Dist- Bhadrak
Odisha, INDIA. Phone: 06784 240320/240347/240272,
Fax: 06784 240626. E-Mail: facor.corporate@vedanta.co.in
CIN: L45201OR1955PLC008400

PURCHASE ORDER

PO Number : 4800020530
PO Date : 13.12.2021

Vendor Code : 734607
Vendor Name : National Institiute of Technology

Vendor Address :SRICCE OFFICE, 2nd floor,NIT C
ROURKELA - Orissa,769008
India.

Your Reference :

Our Reference :

PO Currency :Indian Rupee

PO Validity :13.12.2021 To 31.07.2022
Delivery Place : OSTAPAL
: KALIAPANI JAJPUR Orissa 755047 India

VALID FROM : 13.12.2021
VALID TO : 31.07.2022

I) PO CONFIRMATION/ACKNOWLEDGEMENT:
You shall receive an email confirmation after release of each Purchase Order from our end. Email will provide you a link, from which you can log into SRM portal and view and/or download the PO. For downloading or saving the PO, please click on "PRINT" option. Immediately after receipt of PO, you have to provide "CONFIRMATION" to all items. Alternately, you may directly log into your account in SRM portal through our official website https://sesagoaironore.com/procurement/vendor-e-portal/ and provide "CONFIRMATIONS". In case no confirmation is received from you within 2 days of receipt of PO, then PO shall be deemed accepted to you. However, without giving "CONFIRMATION", ASN as follows, cannot be created, and it has to be done without exception.

Confirmations, acknowledgement and ASN shall not be applicable for Service line items of the PO

II) PRE-DELIVERY CONDITION:

1) At the time of dispatch of material. You have to log into SRM system, open "Create ASN" tab and enter dispatch details, like DC No., DC date, Vehicle No., Quantity, LR No. & LR Date against each proposed delivery item, and saved, when system will generate a unique no. This is called as Advance Shipping Notice (ASN), and same has to be imprinted on every Invoice.

ASN shall not be applicable for Service POs

NATIONAL INSTITUTE OF TECHNOLOGY
Rourkela – 769 008, Odisha

Dr. Angana Sarkar
Assistant Professor
Dept of Biotechnology and Medical Engineering
National Institute of Technology
Rourkela-769008, Orissa
&
Dr S Jayanthu, FIE, C.Eng
PhD, M Tech, BE (Mining)
MS (Counseling & Psychoth
Former Scientist of CM
NATIONAL M
PROFES
De

Website-www.nit
Email: sark
Ph: 0

To
The HOD
Environment Management Dept
Ostapal Chromite Mine
M/s. FACOR-Vedanta

Dear Sir,

Sub: Scientific Report of study for Hexavalent Chromium reduction at Ostapal Chromite Mine of M/s. FACOR-Vedanta

Many thanks for your mail regarding Consultancy service and scientific study for Hexavalent Chromium reduction at Ostapal Chromite Mine of M/s. FACOR-Vedanta dated 18th December, 2021 (**PO No. 4800020530)**.

Sample collection has been collected from the mine site and preliminary study on physicochemical parameters of the samples has been conducted. Screening of chromium reducing bacteria are in process. Kindly find the report on initial study.

Awaiting your favorable response
Thanking you
Sincerely yours

Angana Sarkar

(ANGANA SARKAR-PI)

(SINGAM JAYANTHU-Co-PI)

NATIONAL INSTITUTE OF TECHNOLOGY
Rourkela – 769 008, Orissa
PABX:0661-2465999

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https://www.nitrkl.ac.in/FProfile.aspx?e=sjayanthu

No. NITR/MN/SJAY/L/2022/ 12.04.2022

To,
Sri Muthumari M
Head O & M Mines
FACOR Mines, Ostapal Chromite mine
Vedanta resource limited –Kalayapani (Po)Jajpur (Dist)
Muthumari.M@vedanta.co.in

Sub: Request for endorsement related to collaboration in the project on "**Removal of chromium from water contaminated by opencast mining using hybrid constructed wetland"- reg**

Dear Sir,

Many thanks for your kind consent on endorsement for the studies to be conducted on above subject, as per our discussions over phone yesterday-11.4.22. Our Transdisciplinary group of faculty including mining engineering, Civil Engineering, Biomedical department etc want to submit a project proposal on chromium removal from water contaminated with chromium by opencast mining activities using a low-cost nature-based system constructed wetland. We are going to use some lab made filler media in our system which has good adsorption ability along with microbes and plants in the system that either bio-remediate or uptake the toxic chromium from the contaminated water. Therefore, system will remove the chromium by physical adsorption, microbial bioremediation and phytoremediation. Altogether they will provide a highly efficient removal system.

In this regard, it is proposed to conduct the studies in two phases. In 1st phase, water will be collected from mine site and all treatments will be carried out in the laboratory. In 2nd phase, a pilot scale system will be setup at the mine site for real water treatment. As discussed before, a copy of endorsement, draft proposal etc are enclosed herewith for your kind perusal inviting Vedanta group to become a collaborator (Industry partner) for this project that we are going to submit to the Ministry of Mines GoI, shortly.

We look forward for your kind consent and endorsement for the above studies to eb conducted with the water samples from your mine sites.
Thanking you
Yours Sincerely,

(SINGAM JAYANTHU)
Encl: as above

Susanta Biswal

From: Avijit Bhunia (Facor)
Sent: Tuesday, September 27, 2022 9:10 AM
To: Susanta Biswal
Subject: FW: Timeline for the Consultancy PO-4800020530
Attachments: Consultancy timeline.pptx; Consultancy Report_Vedanta Mine 2nd report.pdf

FYKI

Sensitivity: Internal (C3)

-----Original Message-----
From: Angana Sarkar <sarkara@nitrkl.ac.in>
Sent: 26 September 2022 16:26
To: Avijit Bhunia (Facor) <Avijit.Bhunia@vedanta.co.in>
Cc: Muthumari M <Muthumari.M@vedanta.co.in>
Subject: Timeline for the Consultancy PO-4800020530

External Sender: Use caution with links/attachments

Dear Sir,
The consultancy work will be completed by the November, 2022. The complete timeline is attached with this mail.

Thank you.

Regards
Dr. Angana Sarkar
Assistant Professor
Department of Biotechnology & Medical Engineering

NATIONAL INSTITUTE OF TECHNOLOGY
Rourkela – 769 008, Odisha

Dr. Angana Sarkar
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To
The HOD
Environment Management Dept
Ostapal Chromite Mine
M/s. FACOR-Vedanta

Dear Sir,

Sub: Scientific Report of study for Hexavalent Chromium reduction at Ostapal Chromite Mine of M/s. FACOR Ltd.

Many thanks for your mail regarding Consultancy service and scientific study for Hexavalent Chromium reduction at Ostapal Chromite Mine of M/s. FACOR Ltd dated 18th December, 2021 (**PO No. 4800020530)**.

Sample collection has been collected from the mine site and preliminary study on physicochemical parameters of the samples has been conducted. Screening of chromium reducing bacteria are in process. Kindly find the report on initial study.

Thanking you
Sincerely yours

(ANGANA SARKAR-PI)

(SINGAM JAYANTHU-Co-PI)

Project title: Scientific study to Reduce Hexavalent Chromium Percentage from Tailing Dam, Surface runoff and mine drainage water (PO No. 4800020530)

2. Sponsored by-- M/s. Ferro Alloy Corporation Ltd at Odisha, Sukinda Chromite Valley in Jajpur district of Odisha

Ref: e- mail; dated 18 th December, 2021

3.Project duration -- 9 months

4. Objective: To study Reduce Hexavalent Chromium Percentage from Tailing Dam, Surface runoff and mine drainage water

Introduction

Release of heavy metals to the environment has been persistently expanding these days as a consequence of advancement in technological and industrial sector areas. This causes a serious threat to the public, soil and environment. **Gergen & Harmanescu** (**2012**) and **Rai et al**. (**2015**) classified heavy metals into two categories by that these metals have no beneficial role and are positively toxic to lives, such as Arsenic (As), Chromium (Cr), Cadmium (Cd), Lead (Pb), Nickel (Ni), and Mercury (Hg). In contrast, metals such as Iron (Fe), Manganese (Mn), trivalent Chromium (Cr +3), Zinc (Zn), Cobalt (Co), and Copper (Cu) are essential for plant and animal life but may become toxic if the concentrations exceeds the permissible limits. Heavy metal toxicities depend on several factors, including chemical species, route of exposure, dose, nutritional status, gender and genetics. Arsenic, chromium, mercury, cadmium and lead are prioritized in term of public health significance because of their high degree of toxicity (**Tchounwou et al., 2012**). Due to industrial and mining activities, toxic heavy metals such as As, Cr, Cd, Ni, Cu, Zn, Co, Hg, and Pb have caused widespread air, water, and soil contamination (Rai et al. 2015).

Chromium exists in six oxidation states, among them the most stable states are Cr (III) and Cr (VI). In the environment Cr(III) occurs naturally whereas Cr(VI) is produced by industrial processes. Chromium toxicity is connected with its valence state: Cr (III) is less toxic, whereas Cr (VI) is highly toxic and also mobile (**Shanker et al., 2005**). Hexavalent chromium is considered as a human carcinogen (WHO, 1974). Chromium (Cr) enters into natural ecosystems from industrial activities such as iron and steel manufacturing, mining, textile dyeing, electroplating, chromium plating, metal plating, wood preservation, chrome leathering, battery, textile and dye manufacturing, smelting processes, leather tanning, fuel production, industrial outflow and other anthropogenic sources (OECD 2003). The permissible chromium concentrations as specified by the Central Pollution Control Board (CPCB) are 0.05 mg/L for drinking water, 0.1 mg/L for inland surface water, 2 mg/L for public sewers and 1 mg/L for marine coastal areas (CPCB,2008). Toxicity of Cr associated with human health includes skin cancer, lung cancer, asthma, sneezing, ulcers, itching etc. The permissible limits of Cr from different organizations which deals with environmental pollutions and resources i.e. United State Environment Protection Agency (USEPA), World Health Organizations (WHO), Indian Council

of Medical Research (ICMR), Bureau of Indian Standards (BIS) and Central Pollution Control Board (CPCB) with their human health risk problems are summarized in **Table 1**.

Table 1: Permissible limits and human health risks of different heavy metals (**Maity et al., 2020**)

Metal ion	Source	USEPA (mg/L)	WHO (mg/L)	ICMR (mg/L)	BIS (mg/L)	CPCB (mg/L)	Human Health Risk
Cr^{6+}	Chemical refractory, electroplating, leather tanning, battery, textile, dye and metallurgical discharges	0.1	0.05	--	0.05	0.05	Lung cancer, skin cancer, asthma, ulcers, sneezing, itching

The combination of both the reduction processes i.e. physical and chemical, is one of the most crucial conventional methods for the removal of Cr^{6+} from wastewater. But, nowadays application of these processes is no longer used due to the usage of toxic chemicals that are expensive and release of secondary effluents. Alternative techniques applied for the removal of these heavy metals are chemical precipitation, ion exchange, solvent extraction, reverse osmosis, micro-precipitation, electro-dialysis, adsorption, etc. **(Rangabhashiyam et al., 2014)**. Out of the above methods, the adsorption technique is considered as an alternative to the methods of physical and chemical techniques due to its low cost and its efficiency **(Kadimpati et al., 2013)**. The adsorbent may be derived from microbial or plant biomass and also from metal-based nanosorbent hence this reduces the cost of raw materials, the possibility of reusing the adsorbent and higher process flexibility of this technique **(Maity et al., 2020).**

Study area

Ferro Alloy Corporation Ltd -FACOR is operating 2 chromite ore mines, namely Ostapal and Kalarangiatta, in Jajpur district of Odisha. At mine site, Chrome Ore Beneficiation plant with 20TPH capacity has been installed, which is generating more than 50000 ton of tailing per year

which is being stored in tailing dam. A project has been taken to reduce the Cr+6 from surface runoff, mine drainage water and tailing dam.

Fig. 01: Sampling site at Ostapal chromium mine, Odisha

Scopes of the work in current project

. PROPOSED METHODOLOGY FOR ANALYSIS OF MINE TAILING FROM THE DAM

Mine leachates will be collected from the several bottom drainage points of the tailing dam and drainage system as per the standard procedure with different time intervals over a certain period. The tailing water as well as the overburden samples will be characterized thoroughly for studying its environmental effect. Thorough analysis on (i) physical, (ii) Elemental and (iii) biological contents of the tailing water as well as the overburden samples will be carried out. Screening of suitable biosorbents for future application will be done. Performance analysis of the selected biosorbents will be conducted at lab scale with the field tailing water sample. The following work can further be extended for hexavalent chromium bioremediation:

Isolation and characterization of the hexavalent chromium reducing bacteria for their application in microbe mediated remediation

- **Application of suitable bio sorbents for total chromium removal.**
- **Designing of in-situ bioremediation strategy and implementation of pilot scale Cr^{6+} removal at field**

Following are the work elements for conducting the above study:

a) Required data including properties of the tailing water and overburden samples would be collected from the mine authorities,

b) Physical parameters: pH, Temperature, acidity/alkalinity, Salinity, Dissolved oxygen (DO), oxidation reduction potential (ORP), Total suspended soild (TSS), Total Dissolved solid (TDS), Biological oxygen demand (BOD) and Chemical oxygen demands (COD), cations and anions etc., will be measured for the sample at different time points during the sample collection.

c) Elemental analysis: Elemental analysis of the tailing water and overburden material will be analyzed using Atomic Absorption Spectroscopy (AAS).

d) Biological analysis of the sample will be carried out using standard plate count method to find the microbial load present in the sample.

e) Hexavalent chromate reducing bacteria will be isolated, identified and characterized from the sample

f) Suitable bio-absorbents will be screened for chromium removal

Objective 1: Isolation and characterization of the hexavalent chromium reducing bacteria for their application in microbe mediated remediation

Methodology

1. Sample collection and analysis

Mine soil and tailing water samples were collected from Ostapal chromite mine (21^0 03'47.16 N, $85^0$47'29.58" E) located at Gurujunga, Odisha (755028). The samples were collected from mine, water and soil into a sterile polypropylene bottle. Concentrated HNO_3 (0.1% v/v) was added through an aliquot, for preservation and to prevent any oxidation and another aliquot was preserved without any acid at 4^0C, for further use in microbial analysis. Water quality parameters including the physicochemical properties like pH, total dissolved solids (TDS), conductivity and salinity, and heavy metals presence was analyzed for the mine water sample

collected. Prior to heavy metal analysis for the mine soil collected, the soil samples were acid digested by the following the protocol of **Edgell** (**1988**). The heavy metal measurement was done by Atomic Absorption Spectrometer (AAS) (A Analyst 200, Perkin Elmer) in National Institute of Technology Rourkela laboratory facility.

Fig. 02: Sample collection at Ostapal Chromite Mine, Odisha

2. Enrichment

The samples were initially enriched with Reasoner's 2A (R2A) medium of 200ml with the supplement of 0.55 g Cr (VI) as Potassium Dichromate (K2Cr2O7). According to WHO, the

permissible limit of Cr is 0.05 mg/l, under aerobic conditions at 30^0 C for 72hr at 120 rpm. Then the samples were serial diluted and plated on the R2A agar medium.

3. Maximum tolerance concentration (MTC) Assay

The agar plates were then spiked with varying concentrations of Cr(VI), ranging from 50 ppm, 100 ppm, 150 ppm, 200 ppm and 250 ppm for MTC Assay. These agar plates were then modified for each concentration and the strains were streaked by a grown-up to the log phase. Finally, these plates were incubated for 24 hrs at 30^0 C.

4. Characterization of bacterial strain

4.1 Virulence test

The significance of this test is to ensure safety during the handling of strain for future analysis of potent strains. A total no. of six different test of virulence were conducted. Namely, lipase production test, DNase test, lecithinase production test, protease production test, Shiga toxin production test, and Coomassie brilliant blue (CBB) R250 test were conducted. These tests help in identifying the non-virulence nature of the strains for further work. The compositions of these tests are mentioned in **Table 2**.

Table 2: Virulence Test compositions

Sl. No.	Virulence test	Composition
1	Protease Test	SM Powder – 1g/L; Tryptone – 5g/L; Yeast extract – 1.5g/L; Glucose – 1g/L; NaCl – 5%; Casein – 1%; Agar – 1.5%

2	Lipase Test	Peptone – 5g; Yeast – 3g; Tributyain – 1%; Agar – 1.5%
3	Lecithinase production Test	Egg Yolk agar base – 83.44; Egg Yolk emulsion – 10%
4	Shiga Toxin Test	Mac Conkey Sorbitol agar – 50.03g
5	DNase Assay	Toluidine – 0.1g; DNase – 42.05
6	CBB R250	R2A – 3.12; CBB – 0.01%; Agar – 1.5%

4.2 Biochemical assay

4.2.1 Gram staining tests

The gram staining test is used to determine the morphology of the cell wall. Gram staining or Gram's procedure is a technique which considers the characteristics of cell walls of bacteria to determine whether it’s gram-positive and gram-negative in order to divide them as two groups.

Light microscopy is used to examine gram stain results. The shape, size, and clumping pattern of bacteria as well as gram stain group etc. can be easily determined as the bacteria are colored. Hence, Gram stain is widely used as a vital diagnostic tool in medical clinics and laboratories. Even if the stain doesn't always identify bacteria, knowing whether they're gram-positive or gram-negative is usually enough to prescribe an antibiotic that works.

This approach is based on peptidoglycan reactions in bacteria's cell walls. Different steps such as staining of bacteria, fixing the color using mordant, decolorization of the cells, and application of counterstain etc. are involved in the Gram staining test.

The crystal violet main stain binds to peptidoglycan and colors the cells as purple. Both gram-positive and gram-negative bacteria turn violet due to abundantly present peptidoglycan. The mordant used here is called Gram's iodine (iodine and potassium iodide). Gram-positive cell produces crystal violet-iodine molecule. The cells are then decolorized using alcohol or acetone. Due to considerably less peptidoglycan in the cell walls of gram-negative bacteria, this process effectively makes them colorless; whereas, in case of gram-positive bacteria some color is still present after this phase (60-90 % of the cell wall). The phase of decolorization causes the thick cell walls of gram-positive cells to dry, resulting in shrinking and trap the stain-iodine complex inside. The bacteria are colored pink with a counterstain after the decolorizing procedure (typically safranin, but sometimes fuchsine). Both gram-positive and gram-negative bacteria pick up the pink stain; however it is not visible over the gram-positive bacterium's darker purple. The correct staining process will result in purple color for gram-positive bacteria and pink color for gram-negative bacteria.

4.2.2 IMViC tests

The IMViC reactions are a collection of four helpful reactions which helps to verify and confirm the members of the Enterobacteriaceae family. A set of assays was used to investigate the physiological features of bacteria belonging to the Enterobacteriaceae family, particularly Escherichia and Enterobacteria. They're made to distinguish Gram-negative gut bacteria from the Enterobacteriaceae family, which includes a huge number of taxa that are biochemically and genetically similar. The IMViC tests are divided into four categories. Each letter in the acronym "IMViC" represents one of these exams. The I, M,V and C in IMViC tests stand for the four reactions such as the Indole test, Methyl Red test, Voges Proskauer test, and Citrate utilisation test respectively. The letter I is solely used for rhyming.

4.2.3 Antibiotic sensitivity tests

It is the test for bacteria’s susceptibility to different antibiotic. It is also known as antibiotic susceptibility test or antibiotic sensitivity test. The results of sensitivity testing may allow a doctor to convert from empiric therapy, which prescribes antibiotics based on clinical suspicion of infection and common causative bacteria, to directed therapy, which prescribes antibiotics

based on knowledge of the organism and its sensitivities. There are a total of 25 antibiotic sensitivity tests.

Table 3: All antibiotic sensitivity test with their code.

Antibiotic name	**Code**
Lincomycin 10 mcg	L-10
Rifampin 5 mcg	RIF5
Norfloxacin 10 mcg	NX10
Doxycycline 30 mcg	DOX30
Polymyxin B 300 units	PB300
Ofloxacin 5 mcg	OF5
Nalidixic acid 30 mcg	NA30
Roxithromycin 30 mcg	RO30
Cefixime 5 mcg	CFM5
Chloramphenicol 30 mcg	C30
Azithromycin 15 mcg	AZM15
Ampicillin 10 mcg	AMP10
Ciprofloxacin 5 mcg	CIP5
Vancomycin 30 mcg	VA30
Kanamycin 30 mcg	K30
Gentamicin 10 mcg	GEN10
Streptomycin 10 mcg	S10
Cefalexin 30 mcg	CN 30
Trimethoprim/ Sulphamethoxazole	COT 25
Cloxacillin 10 mcg	COX 10
Tetracyclin 30mcg	TE 30
Erythromycin 15 mcg	E 15
Penicillin 10 units	P 10
Ceftazidime / Tazobactum 30/10 mcg	CAT 30/10
Amoxycillin/ Clavulanate 20/10 mcg	AMC 20/10

5. DNA isolation and sequencing

Genomic DNA isolation:

The method of genomic DNA extraction helps us to isolate genomic DNA from cellular materials, RNA and proteins. It involves some basic steps, firstly it disrupts of the cell structure to lysate the cell, during the process protection od DNA, the soluble DNA is separated from the cell debris and other cell materials and purified DNA is eluted.

As DNA is a soluble substance, DNA purification rely on precipitation and centrifugation steps. To separate the cell lysate and other cellular materials to obtain a pure sample of genomic DNA. Either we use "salting out" or organic extraction to get soluble DNA from cellular proteins. Finally, the DNA is isolated by ethanol precipitation.

Then solid phase extraction is done which involves the binding of DNA to a solid support such as cellulose matrices and silica. After binding, it was followed by washing and elution DNA from solid support. These methods involve vaccum or magnetic method and centrifugation to separate the bounded DNA from, the other cellular material.

Different methods chosen for any given situation for DNA extraction, always depends on no. of sample, sample type and the downstream, process we follow.

6. Polymerase Chain reaction (PCR)

PCR is an amplifying laboratory procedure. It is a widely used method to rapidly make billions of copies of any specific DNA sample. Scientists use this method to amplify any sample and study it in details. It starts with denaturing the DNA strands at high temperature. In this high temperature the hydrogen bond between the double strands breaks to form 2 single strands. It uses short synthetic DNA fragments also known as primers. It generally selects a segment of genome to be amplified. The segment is then runs for multiple rounds of DNA synthesis to amplify that segment.

It is based on using the ability of DNA polymerase to synthesis new strands complementary to template DNA. DNA polymerase can add a nucleotide only on pre-existing 3'OH group, but for this it needs a primer to which it can add nucleotide. A heat-stable DNA polymerase, like Taq polymerase which originally is an enzyme isolated from thermophilic bacteria. It could denature under high temperature during denaturation process, if the polymerase was heat- susceptible.

PCR includes many application such as gene cloning and manipulation, construction of DNA-based phylogenies, gene mutagenesis, DNA cloning for sequencing or functional analysis of genes, analysis of genetic fingerprinting and monitoring or diagnosing the genetic disorder. Also PCR has the ability to detect pathogen or nucleic acid test for diagnosis of infection diseases.

7. Hexavalent chromium reduction test

The isolated strains from water and soil were tested for its reduction potential from hexavalent to trivalent form of chromium. For the reduction potential test, the initial concentration of hexavalent chromium was kept at 20 mg/L. The reduction kinetics was studied for a total duration of 72 hours. The samples were collected at 0, 2.30, 6, 12, 24, 36, 48, 60, and 72 hour.

The hexavalent chromium reduction estimation was carried out using 1,5-diphenylcarbazide (DPC) method were the absorbance was taken at 540nm.

Results

1. Water quality parameters analysis

The water quality parameter results are summarized in **Table 4**. Chromium concentration was found much higher (almost 6 times) in mine tailing water than the mine overburden sediment. Mine tailing water also contain significant amount of cadmium, while arsenic concentration is bellow toxic level asper WHO. Mine tailing water is having high TDS and conductivity.

Table 4: Water quality parameter results with WHO guidelines

Parameters	Unit	WHO Permissible Limits	Mine Tailing Water	Mine Overburden Soil
Physicochemical Parameters				
pH	--	6.5 – 9.2	7.07	--
Total Dissolved Solids (TDS)	mg/L	1000	157.2	--
Conductivity	µS	--	103.7	--
Salinity	psu	--	0.05	--
Heavy Metals				
Chromium	mg/L	0.05	3.094	0.616
Arsenic	µg/L	10	7.3	BDL*
Cadmium	mg/L	0.003	0.161	<0.001

* Below detection limit

2. Enrichment media

Serial dilution in order from 10^{-1} to 10^{-10} of the individual colonies of chromium resistance bacteria from an enriched sample of groundwater was observed using the pour plate technique. The colonies which were obtained are cultured individually on R2A plates.

3. Spread plate

The colonies that are individually cultured on R2A were then spread on different plates of different dilution rates. The spread plates were then incubated for 3 days and microbial colonies

were then observed. After observation, the non-overlapping colonies were inoculated.

Fig. 03: Spread plate culture

4. Streak plate

After isolating, the non-overlapping strain from the colonies. The strain was streaked multiple times to obtain a pure culture. The streaking was done by repetition of quadrant streaking.

Fig. 04: Streak plate culture

5. Maximum Tolerance Concertation (MTC)

MTC of heavy metal was chosen at the greatest concentration that permitted observable bacterial growth after 48 to 96 hours of incubation. For assessing the MTCs of bacteria, the increasing concentrations of chromium were first filter sterilized and then fed to nutrient agar that had been autoclaved and cooled at room temperature.

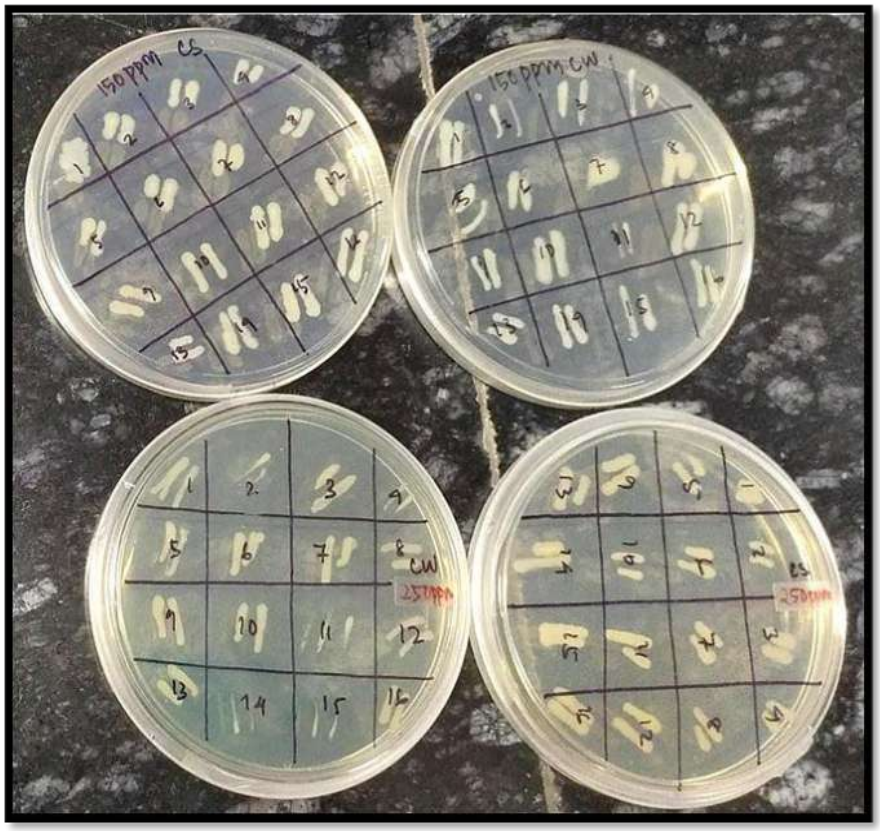

Fig. 05: MTC of bacterial culture

6. Virulence test

Virulence refers to a pathogen's or microbe's ability to cause harm to a host. Virulence, in most circumstances, relates to how much harm a disease causes to its host, especially in animal systems. Pathogenicity, or an organism's ability to cause disease, is determined by virulence factors. In the context of gene systems, virulence refers to a pathogen's ability to infect a resistant host.

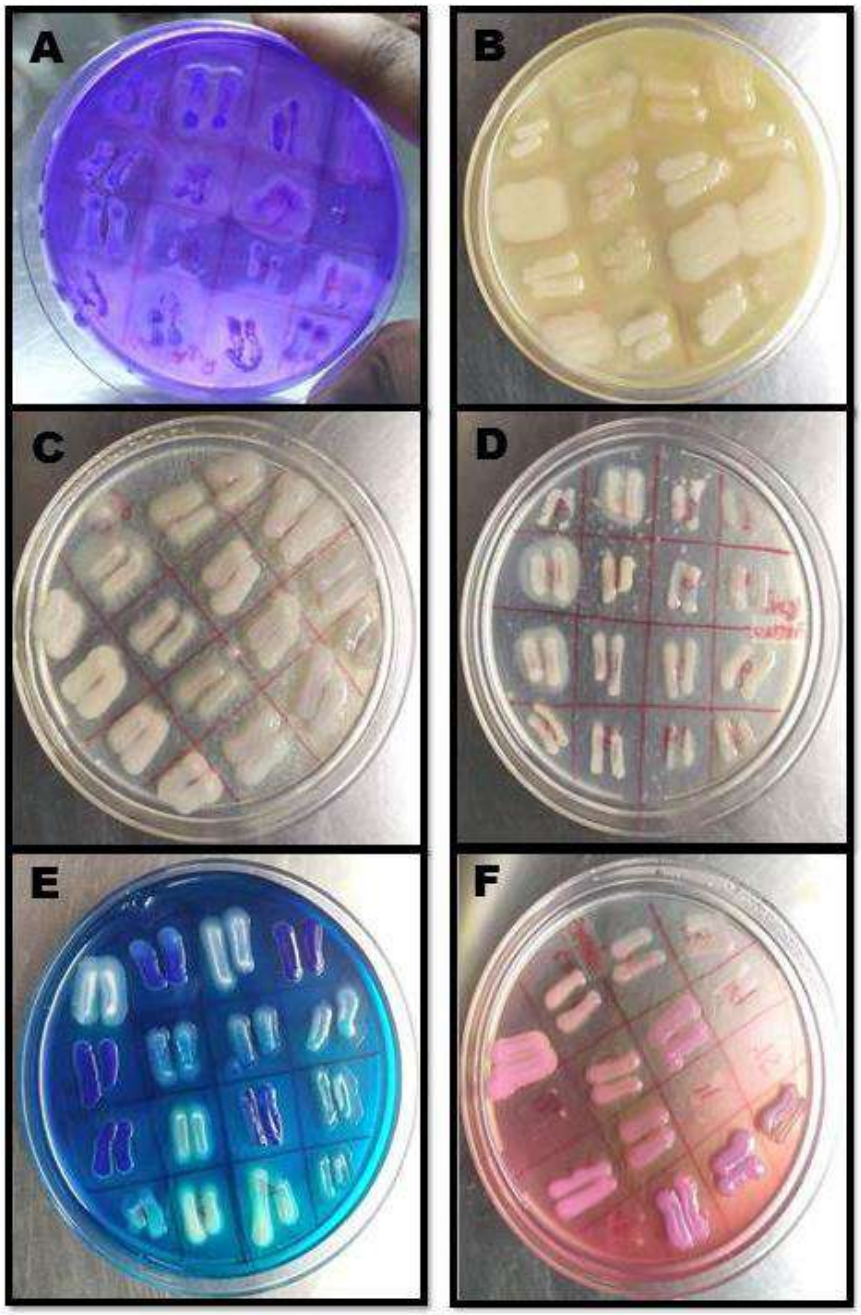

Fig. 06: Virulence Test for the strain isolated from tailing mine water sample, A – CBB Test; B – Lecithinase production test; C- Lipase Test; D – Protease Test; E – Dnase; F – Shiga Toxin.

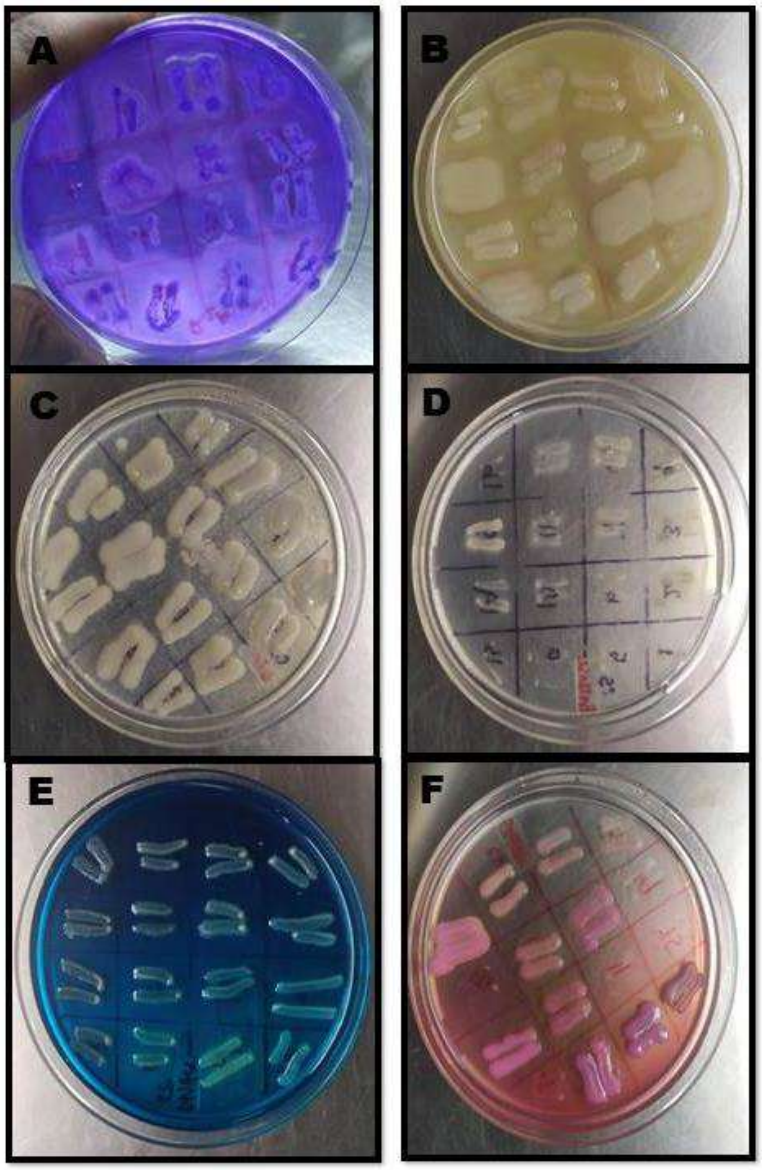

Fig. 07: Virulence Test for the strain isolated from tailing mine soil sample, A – CBB Test; B – Lecithinase production test; C- Lipase Test; D – Protease Test; E – Dnase; F – Shiga Toxin.

IMViC test

The IMViC tests are a group of assays used to identify coliform organisms in microbiology labs. A coliform is a gram-negative rod that produces gas in 48 hours from lactose. The presence of specific coliforms indicates faecal contamination. "IMViC" is the abbreviation for each of these tests. The letters "I," "M," "V," and "C" stand for indole, methyl red, Voges-Proskauer, and

citrate, respectively. Because the Citrate test requires placing coliform samples "in Citrate," the lower case I stands for "in." These tests are reliable for detecting members of the Enterobacteriaceae family.

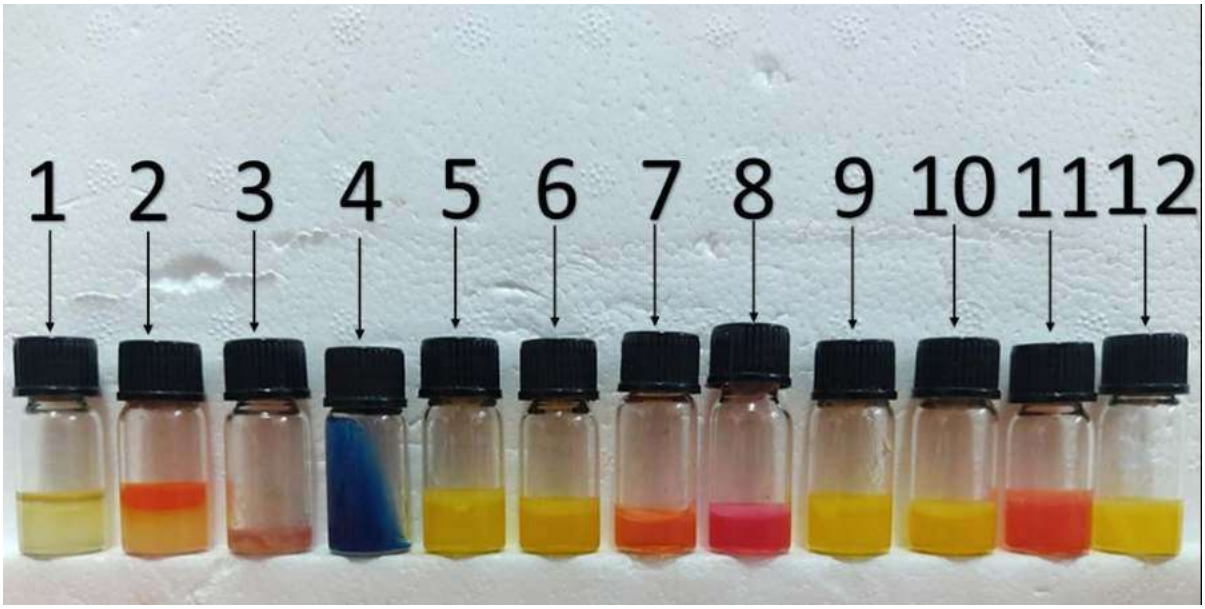

Fig. 08: IMViC Test of the strain isolated from tailing mine water sample.

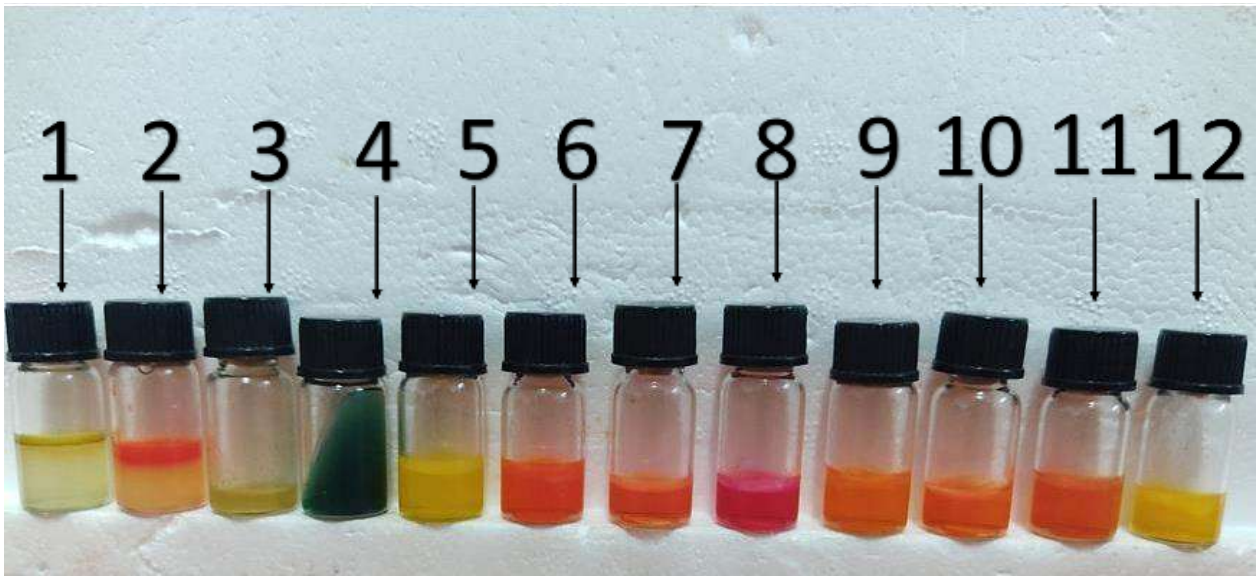

Fig. 09: IMViC Test of the strain isolated from mine soil sample.

Table 5: IMViC Test results for the strains isolated from mine soil and tailing water

Sl. No.	Test	Results	
		WATER	SOIL
1	Indole	No colour change	No colour change
2	Methyl Red	Colour changes to red	Colour changes to red
3	VP	Colour changes	No colour change
4	Citrate	Colour changes to green	No colour change; remains blue
5	Glucose	Colour changes from yellow to red	No colour changes; can't utilize the carbohydrate
6	Adonitol	Colour changes to red from yellow	No colour change
7	Arabinose	No colour change	No colour change
8	Lactose	No colour change	No colour change
9	Sorbitol	Colour changes to red	No colour change
10	Mannitol	Colour changes to red	No colour change
11	Rhamnose	No colour change	No colour change
12	Sucrose	Colour changes to red	Colour changes to red

Antibiotic sensitivity test

It is the measurement of susceptibility of bacteria to antibiotic. It used to check if the bacteria is resistance to some antibiotic or not. It has a huge application in medical laboratory and uses the culture methods to test if the bacteria is resistance to specific bacteria or not. In culture method we generally measures the diameter of the area without bacterial growth. This diameter is also known as zones of inhibition around the paper disc, containing antibiotics on agar plates incubated with culture.

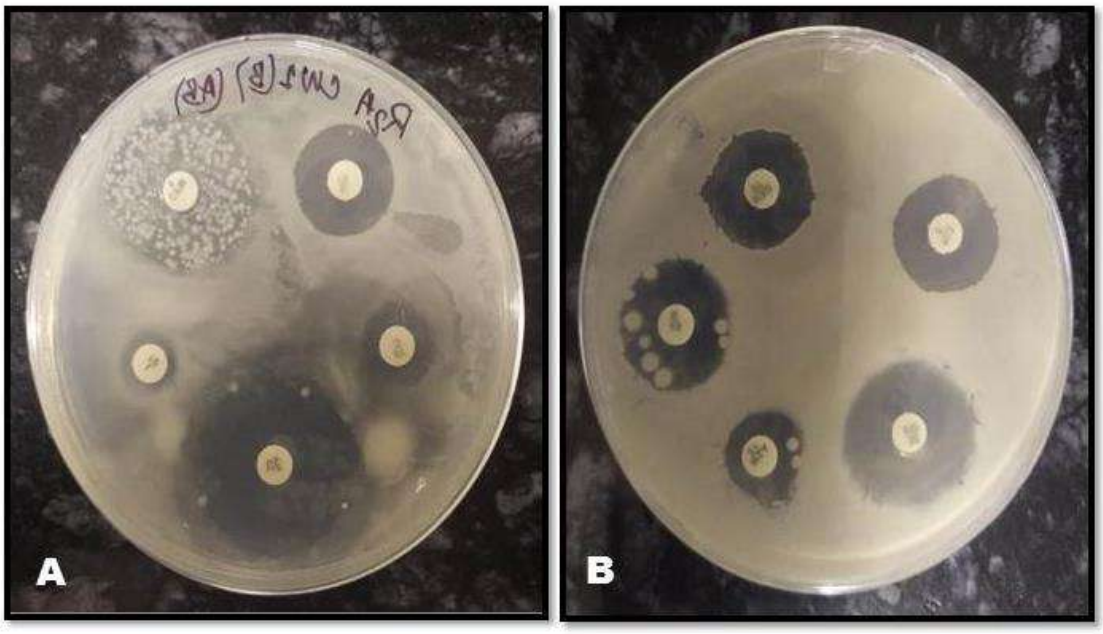

Fig. 10: Antibiotic sensitivity test for both strain (A) chromium water and (B) chromium soil.

Table 6: Results of antibiotic sensitivity of both the strains isolated from mine soil and tailing water

CODE	ANTIBIOTIC SENSITIVITY	RESULTS (diameter in cm)	
		WATER	SOIL
L-10	Lincomycin 10 mcg	1	1.3
RIF5	Rifampin 5 mcg	1.6	0.8
NX10	Norfloxacin 10 mcg	3.3	3
DOX30	Doxycycline 30 mcg	1.3	1.6
PB300	Polymyxin B 300 units	1.5	1.4
OF5	Ofloxacin 5 mcg	3	2.3
NA30	Nalidixic acid 30 mcg	3.3	1.4
RO30	Roxithromycin 30 mcg	0.8	1.1
CFM5	Cefixime 5 mcg	3	2
C30	Chloramphenicol 30 mcg	1.5	1.7

AZM15	Azithromycin 15 mcg	1.2	1.4
AMP10	Ampicillin 10 mcg	1.1	0.4
CIP5	Ciprofloxacin 5 mcg	4.2	1.
VA30	Vancomycin 30 mcg	1.7	0.7
K30	Kanamycin 30 mcg	2.6	2.3
GEN10	Gentamicin 10 mcg	1.9	1.1
S10	Streptomycin 10 mcg	2	1.5
CAT 30/10	Ceftazidime / Tazobactum 30/10 mcg	2.8	1.6
AMC 20/10	Amoxycillin/ Clavulanate 20/10 mcg	2.2	2.1
CN 30	Cefalexin 30 mcg	1.1	2.2
COT 25	Trimethoprim/ Sulphamethoxazole	3.5	1.7
COX 10	Cloxacillin 10 mcg	0	1.2
TE 30	Tetracyclin 30mcg	0.9	0.8
E 15	Erythromycin 15 mcg	1	1
P 10	Penicillin 10 units	0	0

Gram staining

The method staining used for classification. It broadly classified into two groups: namely gram negative and gram positive. It differentiates the group of bacteria by considering the physical and chemical properties of cell wall. Gram negative bacteria have a thinner peptidoglycan layer, hence it helps in washing out crystal violet stain on addition of ethanol. Followed by colorization of cell wall on addition of safranin. Whereas, gram positive has a thick peptidoglycan which helps the cell wall retains the primary stain.

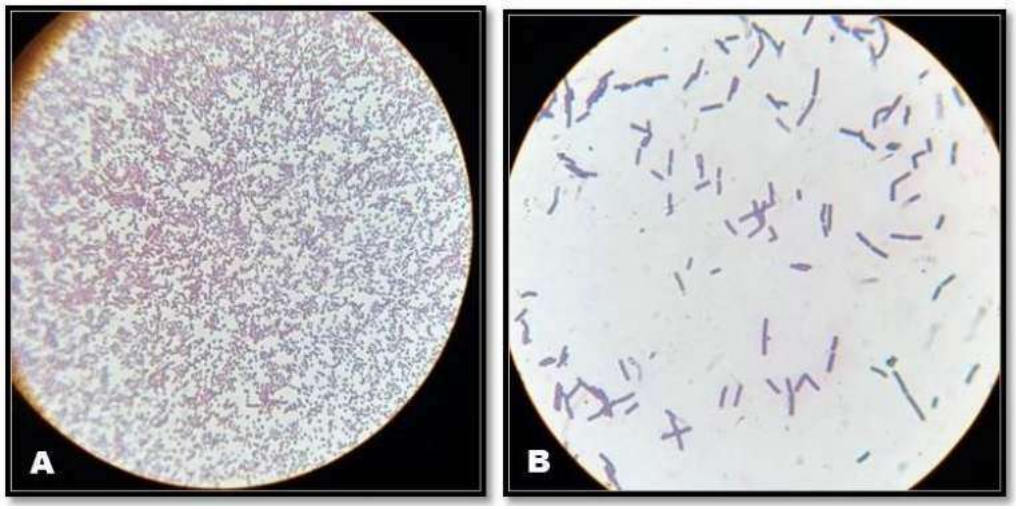

Fig. 11: Gram staining results for both strain (A) mine water sample and (B) mine soil sample

Gel electrophoresis

It is the method used for analysis and separation of macromolecules such as RNA, DNA and proteins. It is based on their size and charge. It can be used in clinical chemistry to separate the protein based on charge and size and for biochemistry used to separate RNA and DNA fragments by charge and size.

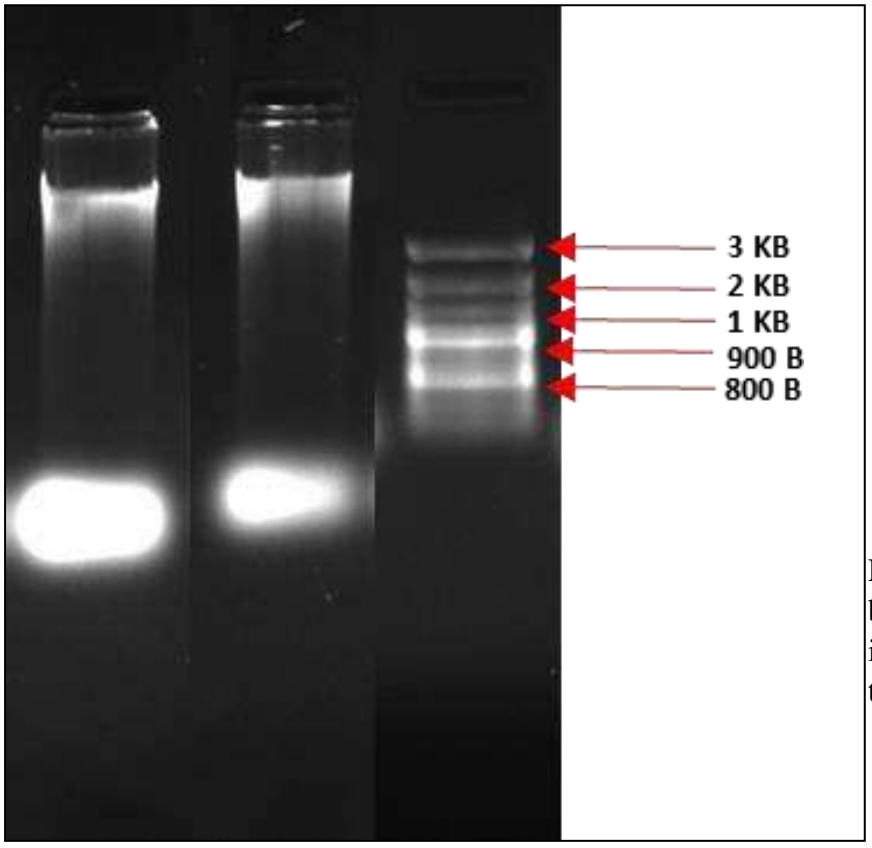

Fig. 12: Gel electrophoresis of both of both the strains isolated from mine soil and tailing water

Polymerase chain reaction (PCR)

Extracted DNA was amplified using hot start PCR with universal primers for the 16S rRNA gene. The amplified DNA was separated using gel electrophoresis and a band was observed with the size of the amplified gene between 2Kb to 1Kb.

Phylogenetic identification

The study of the evolution of organisms and their connections among or within groups.

Using heritable features like shape, DNA sequence and protein amino acid link between species were determined with the help of a phylogenetic tree. It is a diagram which depict the evolutionary group of a group of organisms. We check to which group of organisms our strain is more related to.

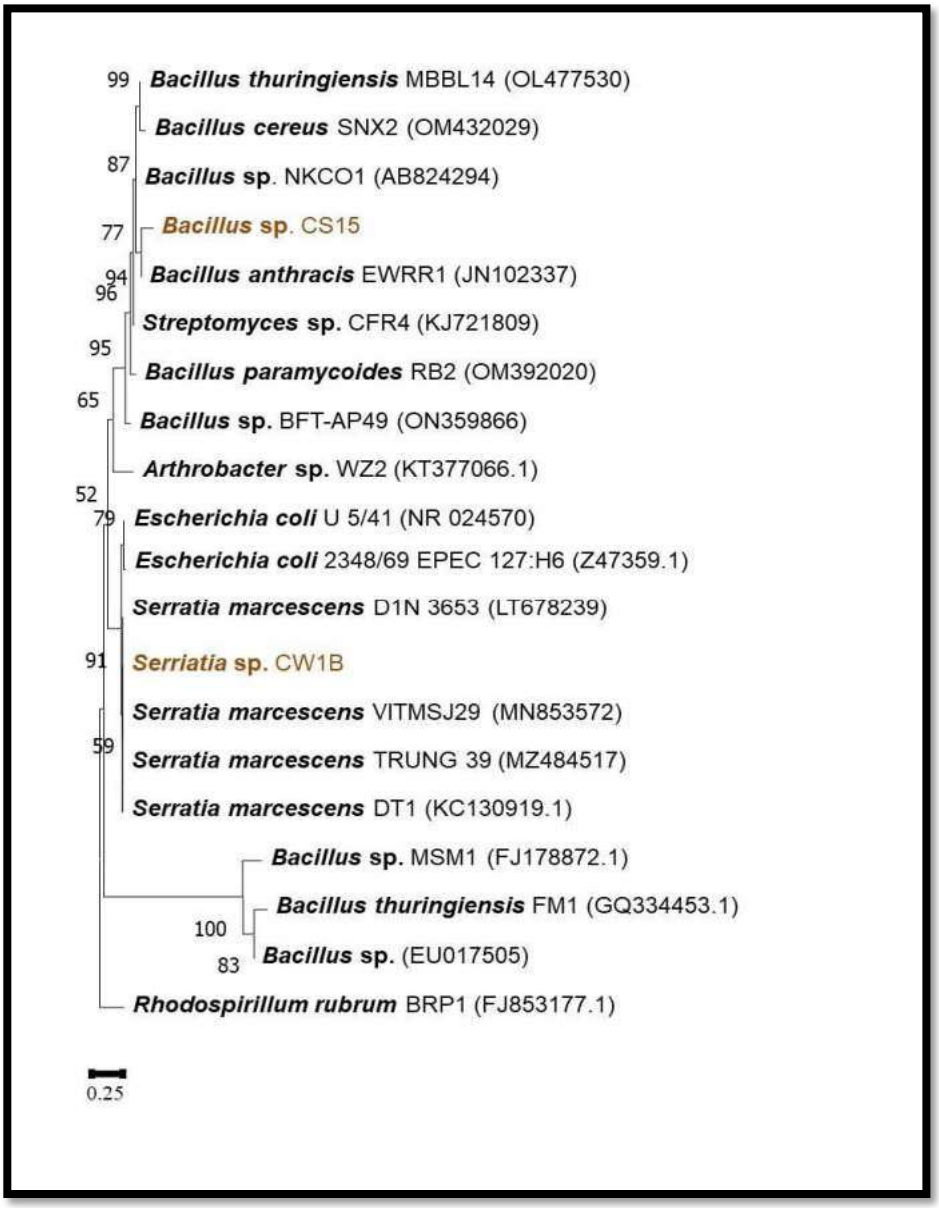

Fig. 13: Phylogenetic tree

Hexavalent chromium reduction test

The isolated strains from water and soil samples indicated encouraging results in reducing the initial hexavalent chromium concentration of 20 mg/L. The strain isolated from water samples was able to reduce the initial concentration to 0.01 mg/L in 72 hours with a reduction percentage of 99.95%, whereas the strain isolated from soil samples was able to reduce the initial concentration to 0.005 mg/L in 72 hours with a reduction percentage of 99.975% as shown in Fig. 14 and Fig. 15.

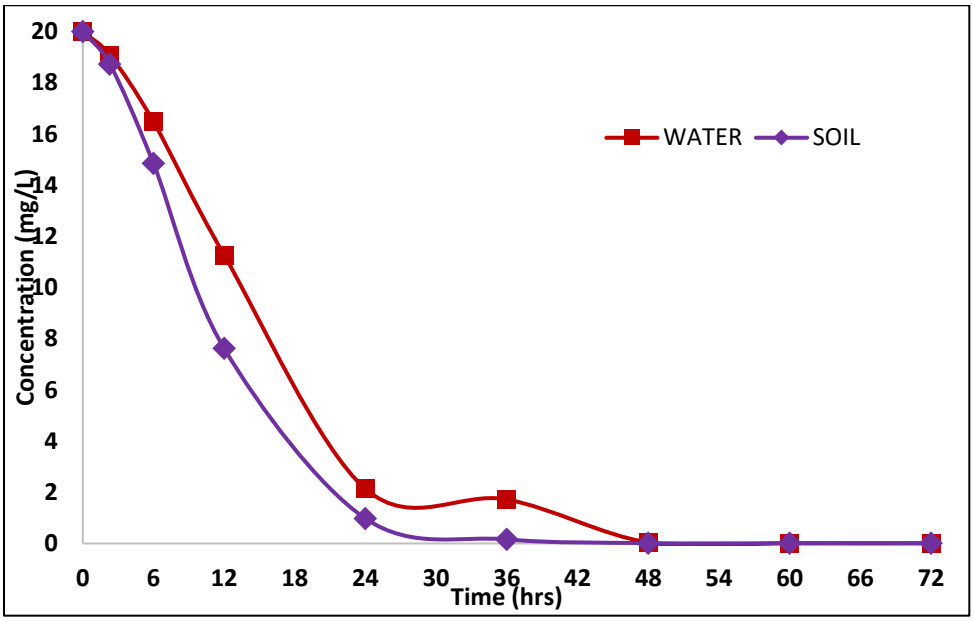

Fig. 14: Hexavalent chromium reduction with time

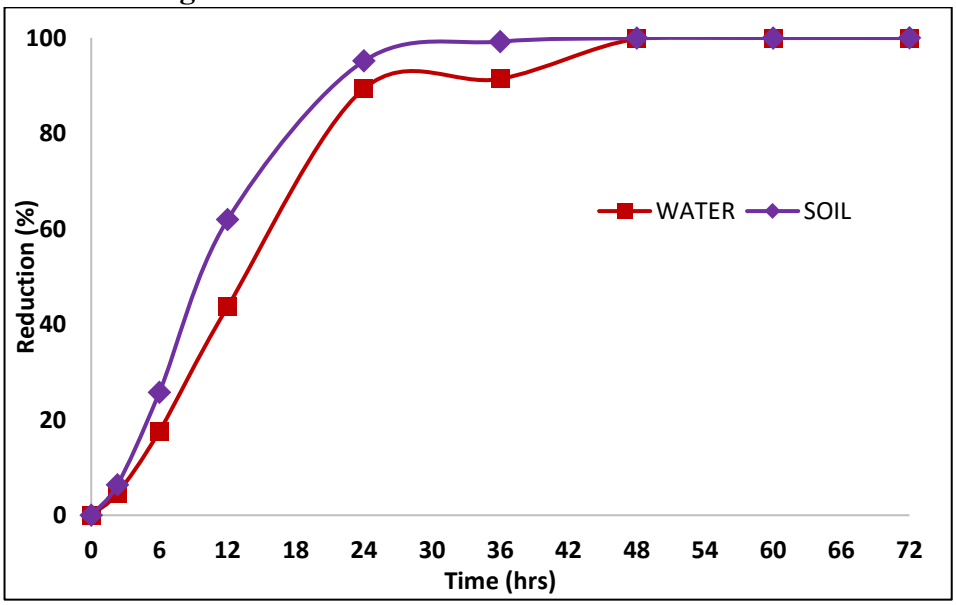

Fig. 15: Hexavalent chromium reduction percentage with time

Objective 2: Application of suitable bio sorbents for total chromium removal

Methodology

1. Preparation of biosorbent

The removal efficiency of different trace metals from the aqueous solutions were studied using the stems of *Colocasia esculenta* and *Artocarpus heterophyllus* seeds. *Colocasia esculenta* stems were collected from the National Institute of Technology Rourkela campus areas (LAT: 22°15'03.4"N; LONG: 84°54'21.9" E). *Artocarpus heterophyllus* seeds were gathered from the campus of the National Institute of Technology Rourkela (Latitude: 22° 15' 9.41807" N; Longitude: 84° 54' 26.4455" E). The collected stems and seeds were trimmed into uniform size and then thoroughly washed first with tap water after that with distilled water in order to remove the impurities and other sticky particles which if present on the stem surface. The biomass is then dried, first for 2 days under natural sunlight followed by in a hot air oven at 80^0C for 10-12 h. The dried biomass was then grounded using a mixer grinder and sieved to obtain a particle size lesser than 300µm. The biosorbent was then stored inside an airtight plastic container for further use.

2. Preparation of adsorbate stock solution

Chromium metal ion stock solution was prepared with potassium dichromate ($K_2Cr_2O_7$) supplied by SIGMA Life Science. The stock solution concentration of all the metal solution was 1000 mg/L (except As^{5+} which was 1000 µg/L). The stock solution was stored at acidic conditions (pH of below 6) to prevent it from metal precipitation. Adjustment of pH of the stock solutions were carried out using 0.1M HCl and 0.1M NaOH. Preparation of test solutions and different initial concentrations, the concerning trace metal stock solutions were further diluted with the use of distilled water.

3 Characterization of the biosorbent

Scanning Electron Microscope (SEM) (JEOL JSM – 6480LV, USA) of the *Colocasia esculenta* stem biomass and *Artocarpus heterophyllus* seeds was performed to study the surface morphology before and after the adsorption of the trace metal ions. Before the analysis of SEM, the samples were coated with platinum (18nm of thickness) at an application rate of 30mA for 150 seconds. The samples were coated to enhance their conductivity under the analysis of SEM. The coating of the samples was done inside an auto fine coater (JEOL JFC - 1600) followed by drying ahead of SEM analysis. Further analysis of the biosorbent before and after the adsorption was done by Energy-dispersive X-ray spectroscopy (EDX) (Oxford Instruments).

4. Optimization of different parameters

Parameters optimization in the adsorption study was carried out individually in a series using *Colocasia esculenta* biomass and *Artocarpus heterophyllus* seeds in a 50mL conical flask containing a working volume of 10mL. The optimization process was conducted in five different process parameters. Effect of adsorbent dosage (0.1 – 0.5 g/10mL), contact time (2 – 12 h), temperature (20 – 40^0C), pH (6.5 – 8.5), and initial concentration (5 – 50 mg/L*) were studied to determine the optimum conditions for the maximum removal of concerning trace metal ions from the aqueous solutions. The adsorbate concentration for all parameters except initial concentration optimization was kept constant at 10 mg/L. All the experiments were carried out in triplicate forms to reduce the maximum error that occurred during the experimental procedure. The agitation speed of 120 rpm was maintained throughout the study using a shaking incubator (RIS – 24 Plus, Remi). The working solution pH was adjusted to the required value by the addition of 0.1M HCl or 0.1M NaOH using a pH meter (Systronics μ pH System 361). The samples were taken out after specific time intervals and filtered. Concentrations of trace metal ions before and after adsorption were determined using atomic absorption spectroscopy (AAS) (AAnalyst 200, Perkin Elmer). The amount of trace metal ions adsorbed (q_e) in mg/g were calculated using the equation (1) **(Dastkhoon et al., 2017)**:

$$q_e = \frac{C_0 - C_F}{m} * v \ldots . (1)$$

Where, C_0 and C_F are the initial and final trace metal concentrations in the aqueous solution (mg/L) respectively, m is the mass of the adsorbent used (g) and V is the volume of working solution of the trace metal (L). Trace metal ion removal (%) after the adsorption from the aqueous solution were determined using the equation (2):

$$Removal\ \% = \frac{C_0 - C_F}{C_0} * 100 \ \ldots . (2)$$

Where, C_0 and C_F are the initial and final trace metal concentrations in the aqueous solution (mg/L) respectively.

5. Isotherm studies

Adsorption isotherm model studies provide the details regarding the adsorption mechanisms, adsorbent affinities, and surface properties. So, it is important to determine the equilibrium data with various isotherm models. These isotherm models establish a mathematical correlation whose importance lies in the designing and modeling of the biosorbents. In the present study, two parameter isotherm models of nonlinear form like Langmuir, Freundlich, Temkin, Dubinin-Radushkevich (**Table 7**) were tested with the equilibrium data experimentally obtained.

Table 7: Different isotherm models equation and its significance

SL No.	Isotherm Models	Model Equations	Parameters
1	**Langmuir**	$L: q_e = \frac{Q_0 b_L C_e}{1+b_L C_e}$ $NL: \frac{C_e}{q_e} = \frac{C_e}{Q_0} + \frac{1}{Q_0 b_L}$ $R_L = \frac{1}{1+b_L C_i}$	q_e is the amount of metal contaminant adsorbed per gram of biosorbent at equilibrium (mg/g), Q_0 is the monolayer coverage capacity (mg/g),b_L is the Langmuir isotherm constant (L/mg), C_e is the equilibrium concentration of the adsorbate (mg/L), R_L is the equilibrium constant, also termed as the separation factor and C_i is the initial concentration of the adsorbate (mg/L). K_f and 1/n are the Freundlich constants that indicate the adsorption capacity and intensity respectively. R is the atmospheric gas constant (8.314 J/mol K), T is the temperature (K), b_T is the Temkin isotherm constant (J/mol) and A_T is the Temkin isotherm equilibrium binding constant (L/mg). Q_m is the maximum adsorption capacity (mg/g), K is the mean free energy of adsorption coefficient (mol^2/KJ^2) and ε is the Polanyi potential (J/mol) and E is the mean adsorption energy (KJ/mol).
2	**Freundlich**	$L: q_e = K_f C_e^{1/n}$ $NL: log\ q_e = log\ K_f + \frac{1}{n} log\ C_e$	
3	**Temkin**	$L: q_e = \frac{RT}{b_T}\ ln(A_T C_e)$ $NL: q_e = \frac{RT}{b_T} lnA_T + \frac{RT}{b_T} lnC_e$	
4	**Dubinin-Radushkevich**	$L: q_e = Q_m\ exp^{-K\varepsilon^2}$ $NL: ln\ q_e = ln\ Q_m - K\varepsilon^2$ $\varepsilon = RT\ ln(1 + \frac{1}{C_e})$ $E = \frac{1}{\sqrt{2K}}$	

**L: Linear model equation; **NL: Nonlinear model equation*

6. Error Analysis

In the study of adsorption isotherm, the fit of these models to the experimental data is checked by the analysis of error functions **(Vieira et al., 2014)**. In the present study, the fit quality of these models was evaluated using error functions coefficient of determination (R^2) and average relative error (ARE) **(Batool et al., 2020; Alves et al., 2019).**

$$R^2 = \frac{\sum_{i=1}^{n}(q_{e.\exp} - q_{e.aexp})^2 - \sum_{i=1}^{n}(q_{e.\exp} - q_{e.model})^2}{\sum_{i=1}^{n}(q_{e.\exp} - q_{e.aexp})^2} \ldots . (3)$$

$$ARE = \frac{100}{n} \sum_{i=1}^{n} \left| \frac{q_{e.model} - q_{e.exp}}{q_{e.exp}} \right|_i \quad \ldots . (4)$$

Where, $q_{e.exp}$ is each value of q_e measured experimentally, $q_{e.model}$ is each value of q_e predicted by the fitted model, $q_{e.aexp}$ is the average value of q_e measured experimentally and n is the number of experimental points.

7. Adsorption Thermodynamics

The nature and mechanism of the adsorption process and the temperature effect on the adsorptive removal information is provided by the thermodynamic parameters. The thermodynamic parameters viz., Gibbs free energy change (ΔG^0), enthalpy change (ΔH^0), and entropy change (ΔS^0) were evaluated for the above information from the experimental outputs determined by the following equations **(Eftekhari et al., 2020)**:

$$\ln K_d = -\frac{\Delta H^0}{RT} + \frac{\Delta S^0}{R} \ldots . (5)$$

Where R is the atmospheric gas constant (8.314 J/mol K), T is the temperature (K) and K_d is the distribution coefficient which could be determined by

$$K_d = \frac{C_0 - C_e}{C_0} \frac{V}{m} \ldots . (6)$$

The enthalpy and entropy change were evaluated from the slope and intercept respectively by plotting *ln K_d vs. 1/T*.

The ΔG^0 value was then calculated using equation (7)

$$\Delta G^0 = \Delta H^0 - T\Delta S^0 \ldots . (7)$$

8. Adsorption Kinetics

This study of adsorption kinetics is considered to be a crucial analysis for the characterization of adsorption rate in a sorption reaction. It is an important analysis for designing the batch adsorption process and describes the effect of reaction time controlling the rate of uptake by the biosorbent. To evaluate the adsorption kinetics of trace metal ions onto the *Colocasia esculenta* stem biomass and *Artocarpus heterophyllus* seeds, pseudo-first order and pseudo-second order adsorption kinetics models were prepared.

8.1 Pseudo-first order kinetics

The pseudo-first order model rate equation **(Alves et al., 2019)** is expressed as

$$log(q_e - q_t) = log\, q_e - \frac{k_1}{2.303} t \ldots . (8)$$

Where, q_e is the amount of metal contaminant adsorbed per gram of biosorbent at equilibrium (mg/g), q_t is the amount of metal contaminant adsorbed per gram of biosorbent at time t (mg/g), t is the adsorption time (min) and k_1 (min) is the pseudo-first order rate constant. The pseudo-first order model is studied by plotting *log (q_e - q_t) vs. t* **(Eftekhari et al., 2020)**.

8.2 Pseudo-second order kinetics

This model of pseudo-second order estimates the adsorption behavior throughout the adsorption process **(Loffredo et al., 2020)**. This model of kinetics is expressed by the equation

$$\frac{t}{q_t} = \frac{1}{k_2 q_e^2} + \frac{t}{q_e} \quad \ldots . (9)$$

$$h = k_2 q_e^2 \quad \ldots . (10)$$

Where, q_e is the amount of metal contaminant adsorbed per gram of biosorbent at equilibrium (mg/g), q_t is the amount of metal contaminant adsorbed per gram of biosorbent at time t (mg/g), t is the adsorption time (min) and k_2 (min) is the pseudo-second order rate constant and h is the initial adsorption rate (mg/ g min). The pseudo-second order model is studied by plotting *t/q_t vs. t* **(Eftekhari et al., 2020)**.

9. Statistical Analysis

The biosorption experiments were conducted in triplicates and the results obtained were calculated in the form of mean. Through Y-error bars, the mean and the standard deviation (SD) values have been portrayed in the batch adsorption and optimization figures. The statistical analysis had been carried out using Analysis of Variance (ANOVA) and a probability value of less than or equal to 0.05 (p-value ≤ 0.05) was acquired as a significant difference.

Results

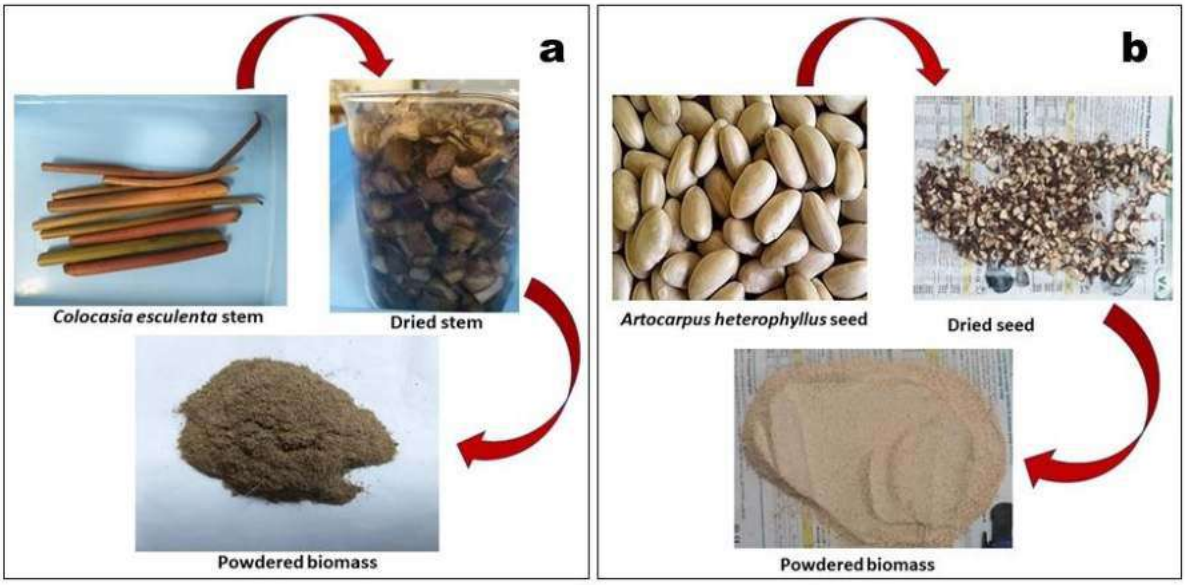

Fig. 16: Sample Preparation for (a) *Colocasia esculenta* stem biomass and (b) *Artocarpus heterophyllus* seeds

1. Biosorbent characterization

Scanning electron microscopy- Energy-dispersive X-ray Spectroscopy (SEM-EDX)

The surface morphology and structures of *Colocasia esculenta* stem biomass and *Artocarpus heterophyllus* seeds without and with adsorption of Cr^{6+} from aqueous solutions were studied as shown in **Fig. 17 a,b and Fig. 18 a,b** . SEM image of raw adsorbent revealed the presence of heterogeneous, irregular clusters as well as numerous complex honeycomb-like structures with cavities which provides wide spaces for adhesion (**Fig. 17 and 18 a**). The honeycomb-like structures present in the raw biosorbent were void in nature and were filled with the trace metal ions all along the pores. Due to swelling of biosorbent in aqueous medium surface area increased as a result they were able to adsorb trace metal ions relatively of large quantity **(Banerjee et al., 2016)**. The spectra images of EDX analysis showed the presence of distinct characteristic peaks of the concerning trace metal ions present on the surface of the biosorbent when loaded with Cr^{6+} while no trace metal was observed in the raw sample (**Fig. 19 a,b and Fig. 20 a,b**).

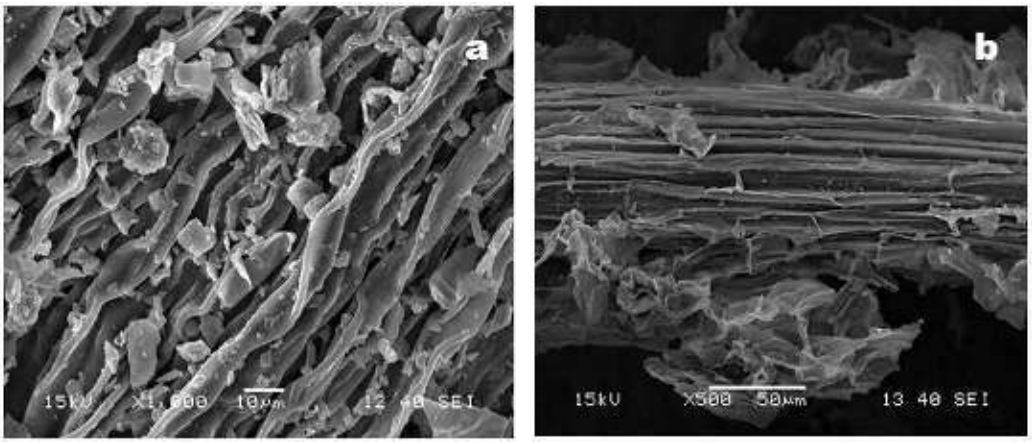

Fig. 17: SEM image of *Colocasia esculenta* stem biomass (a) raw adsorbent and after adsorption of (b) Cr^{6+}

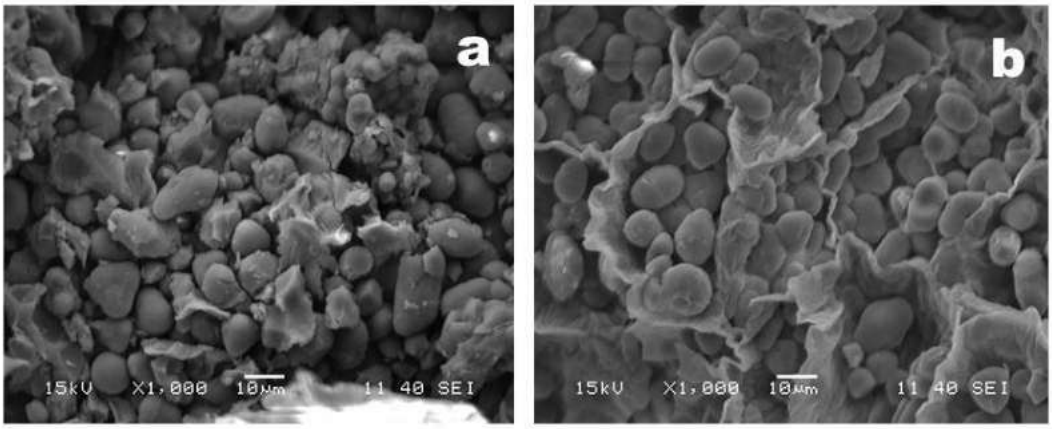

Fig. 18: SEM image of *Artocarpus heterophyllus* seeds (a) raw adsorbent and after adsorption of (b) Cr^{6+}

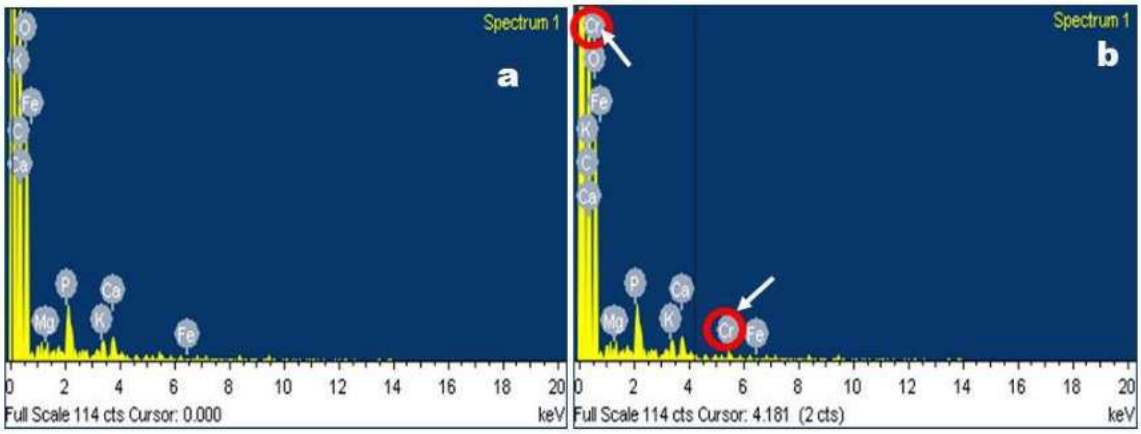

Fig. 19: EDX image of *Colocasia esculenta* stem biomass (a) raw adsorbent and after adsorption of (b) Cr^{6+}

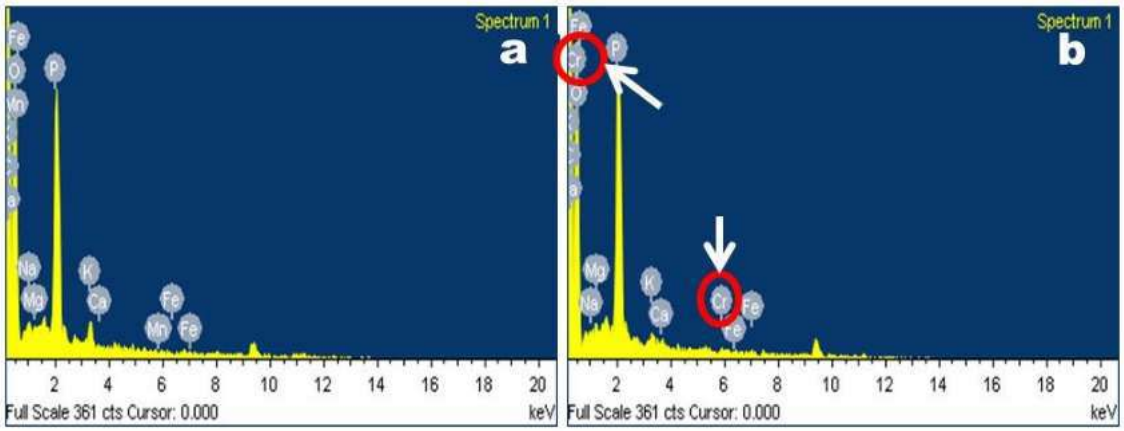

Fig. 20: EDX image of *Artocarpus heterophyllus* seeds (a) raw adsorbent and after adsorption of (b) Cr^{6+}

2. Optimization of different parameters

Table 8: Different parameters optimization results for *Colocasia esculenta* stem biomass and *Artocarpus heterophyllus* seeds

Sl. No.	Parameters	Effect of adsorbent dose	Effect of contact time	Effect of temperature	Effect of pH	Effect of initial concentration
	Variable conditions	**0.1 – 0.5 g**	**2 – 12 hrs**	**20 – 40^{0}C**	**6.5 – 8.5**	**5 – 50 mg/L**
	Adsorbent					
1	*Colocasia esculenta* stem biomass	**0.5 g**	**4 hrs**	**30^{0}C**	**7.5**	**20 mg/L**
2	*Artocarpus heterophyllus* seeds	**0.5 g**	**8 hrs**	**30^{0}C**	**7.5**	**30 mg/L**

3. Isotherm studies

Table 9: Isotherm constant values of various isotherm models for biosorption of Cr^{6+} by *Colocasia esculenta* stem biomass and *Artocarpus heterophyllus* seeds

Models	Variables	Values		Coefficient of Determination R^2	
		Colocasia esculenta stem biomass	*Artocarpus heterophyllus* seeds	*Colocasia esculenta* stem biomass	*Artocarpus heterophyllus* seeds
Langmuir	Q_0 (mg/g)	0.232	0.403	0.993	0.992
	b_L (L/mg)	0.311	0.290		
	R_L, for C_0 values (mg/L*)				
	5	0.356	0.256		
	10	0.217	0.147		
	20	0.122	0.103		
	30	0.084	0.079		
	50	0.052	0.064		
Freundlich	K_f (mg/g)	0.080	0.110	0.961	0.986
	n	2.851	2.109		
Temkin	A_T (L/mg)	2.899	2.265	0.969	0.991
	b_T (KJ/mol)	47.801	25.679		
Dubinin-Radushkevich	K (mol^2/KJ)	0.000001	0.0000007	0.985	0.970
	Q_m (mg/g)	0.185	0.276		
	E (KJ/mol)	707.107	845.154		
	n_{FH}	-1.530	0.110		

Table 10: Comparisons of adsorption capacities of different adsorbents for Cr^{6+} removal

Adsorbent used	Adsorption Capacity (mg/g)	References
Activated avocado seeds	26.6	Boeykens et al. 2019
Rice husk ash	3.04	Srivastava et al. 2008
Apricot stones	0.9	Pertile et al. 2021
Water hyacinth	2.45	Parameswari et al. 2021
Zizania caduciflora	2.7	Liu et al. 2014
Orange peel	1.7	Pertile et al. 2021
Oak sawdust	1.7	Argun et al. 2007
Eggshell	1.45	Daraei et al. 2015

Wheat bran modified with tartaric acid	5.28	Kaya et al. 2014
Walnut shells	2.0	Pertile et al. 2021
Alstonia scholaris leaves	1.45	Rehman et al. 2013
Polyalthia longifolia leaves	0.16	Rehaman et al. 2011
Allium cepa seeds	0.67	Sheikh et al. 2021
Colocasia esculenta stem powder	0.232	Maity et al. 2021
Artocarpus heterophyllus seed powder	0.403	Maity et al. 2022 (Communicated)

4. Error Analysis

Table 11: Error analysis of adsorption isotherm models of Cr^{6+} on raw *Colocasia Esculenta* stem biomass and *Artocarpus heterophyllus* seeds

Models	R^2		ARE (%)	
	Colocasia Esculenta stem biomass	*Artocarpus heterophyllus* seeds	*Colocasia Esculenta* stem biomass	*Artocarpus heterophyllus* seeds
Langmuir	0.975	0.990	1.09	0.248
Freundlich	0.959	0.968	1.80	2.822
Temkin	0.969	0.949	0.95	0.028
Dubinin-Radushkevich	0.953	0.955	8.67	30.833

5. Adsorption Thermodynamics

The positive values were obtained for ΔH^0 and ΔS^0 (**Table 12**) indicating that the whole process is endothermic while negative values for ΔG^0 were obtained for adsorption of Cr^{6+} indicating that the reaction is spontaneous. An increase in temperature affected the rate of reaction as observed through the values for ΔG^0 which indicates that the affinity of the metal ions was decreased along with the spontaneity of the process (**Banerjee et al. 2016**). From the study, the positive values of ΔH^0 and ΔS^0 indicated the endothermic nature of the biosorption process.

Table 12: Study of thermodynamic parameters

Adsorbent	ΔG^0 (KJ/mol)					ΔH^0 (KJ/mol)	ΔS^0 (KJ/mol K)
	20 ^{0}C	25 ^{0}C	30 ^{0}C	35 ^{0}C	40 ^{0}C		
Colocasia esculenta stem biomass	-15.453	-15.722	-15.992	-16.261	-16.531	0.337	0.054
Artocarpus heterophyllus seeds	-9.563	-9.730	-9.897	-10.064	-10.231	0.217	0.033

6. Adsorption Kinetics

The pseudo-first order model was not sufficient to fit the equilibrium data as the regression coefficient R^2 values seemed to be less (**Table 13**); this could be due to the fact of boundary layer limitations which controls the biosorption process. In many scenarios, the pseudo-first order kinetics model does not fit well to the complete range of contact time and is commonly functional at the preliminary stages of the adsorption process **(Loffredo et al., 2020)**. Hence, it could be predicted that pseudo-first order model kinetics was not suitable for the biosorption of Cr^{6+} ions onto the biosorbents.

The pseudo-second order kinetics plot (**Table 13**), showed kinetics of Cr^{6+} adsorption onto the biosorbent seems to better fit this model of kinetic and comparative higher values of R^2 supported this theory. This model study indicated that the biosorption process was governed by forces driven covalently either through valence forces or electron exchanges via electron sharing at the junction of solid-liquid interface **(Dil et al., 2019; Loffredo et al., 2020)** i.e. between the biosorbent and Cr^{6+} ions.

Table 13: Pseudo-first order and pseudo-second order kinetic models

Adsorbent	Pseudo-first order			Pseudo-second order		
	k_1 (min)	q_e (mg/g)	R^2	k_2 (g/mg/min)	q_e (mg/g)	R^2
Colocasia esculenta stem biomass	0.0001	0.521	0.979	0.039	0.279	0.997
Artocarpus heterophyllus seeds	0.0001	0.909	0.811	0.0861	0.379	0.981

7. Disposal of the used biosorbent

The effective disposal of the spent biosorbents is extremely essential in the adsorption-based treatment. Usually, disposals through landfills, regeneration by desorption process for reusing and recycling, and finally incineration are the most feasible strategies to manage the used biosorbents (**Hussain et al. 2022**). The present biosorbent possessing green characteristic features have no disposal issues.

Conclusion

Biosorption efficiency for the removal of hexavalent chromium was studied for *Colocasia esculenta* stem biomass and *Artocarpus heterophyllus* seeds. Both the adsorbents showed encouraging results, but *Artocarpus heterophyllus* seeds proved to be a better selection for the removal of Cr^{6+}. Thermodynamics and kinetics study revealed the spontaneous nature of the adsorption process along with the endothermic nature and it was studied that the reaction was following pseudo-second-order kinetics. The *Artocarpus heterophyllus* could be utilized at a large scale as an environment-friendly, efficient, and cost-effective biosorbent material for the successful remediation of heavy metals.

Objective 3: Designing of in-situ bioremediation strategy and implementation of pilot scale Cr^{6+} removal at field

Different biosorbents were used to remediate the hexavalent chromium from the aqueous samples keeping the initial concentration fixed at 10 mg/L for the test. The different biosorbents includes powder of combretum leaves, water hyacinth stem, jackfruit seed, neem leaves, Acalypha leaves, water hyacinth leaves, guava leaves, *Colocasia esculenta* stem, and mixture of all. The different biosorbents were collected from the from the National Institute of Technology Rourkela campus areas. The collected leaves, stems and seeds were trimmed into uniform size and then thoroughly washed first with tap water after that with distilled water in order to remove the impurities and other sticky particles which if present on the stem surface. The biomass is then dried, first for 2 days under natural sunlight followed by in a hot air oven at 80^0C for 10-12 h. The dried biomass was then grounded using a mixer grinder and sieved to obtain a particle size lesser than 300µm. The biosorbent was then stored inside an airtight plastic container for further use. The conditions for the tests includes, dosage 1g/20ml, time 8hrs, temperature 30^0C, and initial concentration of 10 mg/L. The results obtained is shown in Fig. 21. The best results was obtained for the mixture of biosorbents, for which the removal percentage was calculated to be 94.54%. The removal percentages was observed to be 73.59%, 71.89%, 54.99%, 51.77%, 81.42%, 64.27%, 73.13%, and 56.90% for combretum leaves, water hyacinth stem, jackfruit seed, neem leaves, acalypha leaves, water hyacinth leaves, guava leaves, and *Colocasia*

esculenta stem respectively. This mixture of biosorbents or individual biosorbents could be used for the remediation of hexavalent chromium from the aqueous environment successfully.

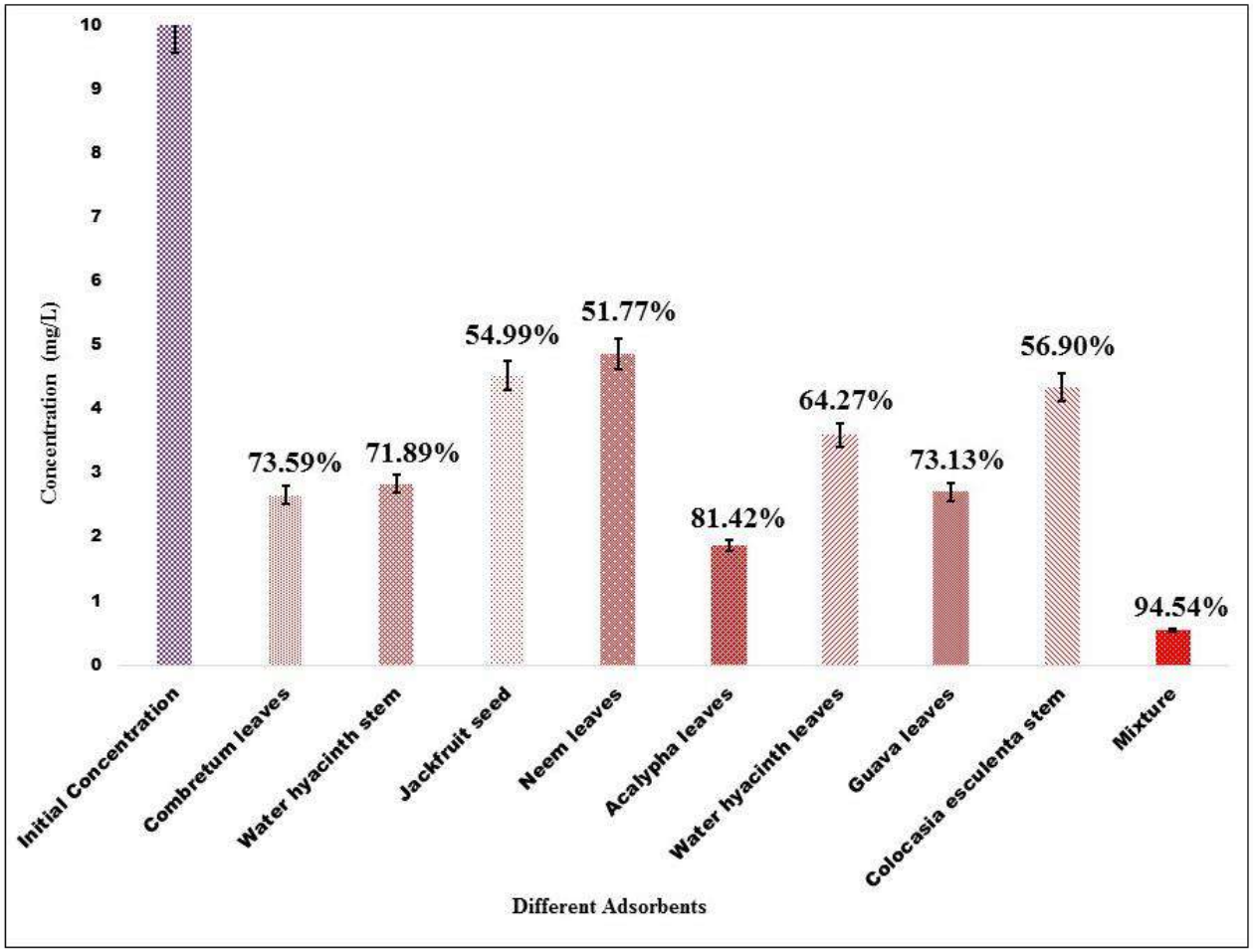

Fig. 21: Various biosorbents used for the bioremediation of hexavalent chromium

General precaution:

- Discharge of tailing in separate pond
- Impervious layer to be laid at the bottom of the tailing dam to prevent the mixing of tailing water to the ground water.
- Proper SOP of tailing management should be maintained.

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OCM/ENV/ 897 /2022 Date: 30.04.2022

To
The Member Secretary
SEIAA, Bhubaneswar

SUB: Submission of the measures undertaken for augmentation of the ground water resources along with the action plan Ostapal Chromite Mines M/s FACOR Ltd.

Dear Sir,

With respect to the cited subject mentioned above, we would like to intimate your good office that we have conducted Impact assessment study with Ground water modelling by accredited consultant of CGWA i.e M/s Geoclimate Risk Solutions Pvt Ltd. As per the study report there is no impact on Ground water to withdraw the permitted quantity as Per CGWA NOC.
The rain water harvesting structures considered during the study are as follows:

- Check-Dams
- Garland Drains
- Settling Pit

And further as per the recommendation of the study report, we have implemented roof-top rain water harvesting structure to augment the Ground water recharge.

Garland Drain

Check Dam

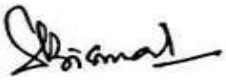
Settling Pit

Roof Top Rain Water Harvesting

This is for your kind consideration please.

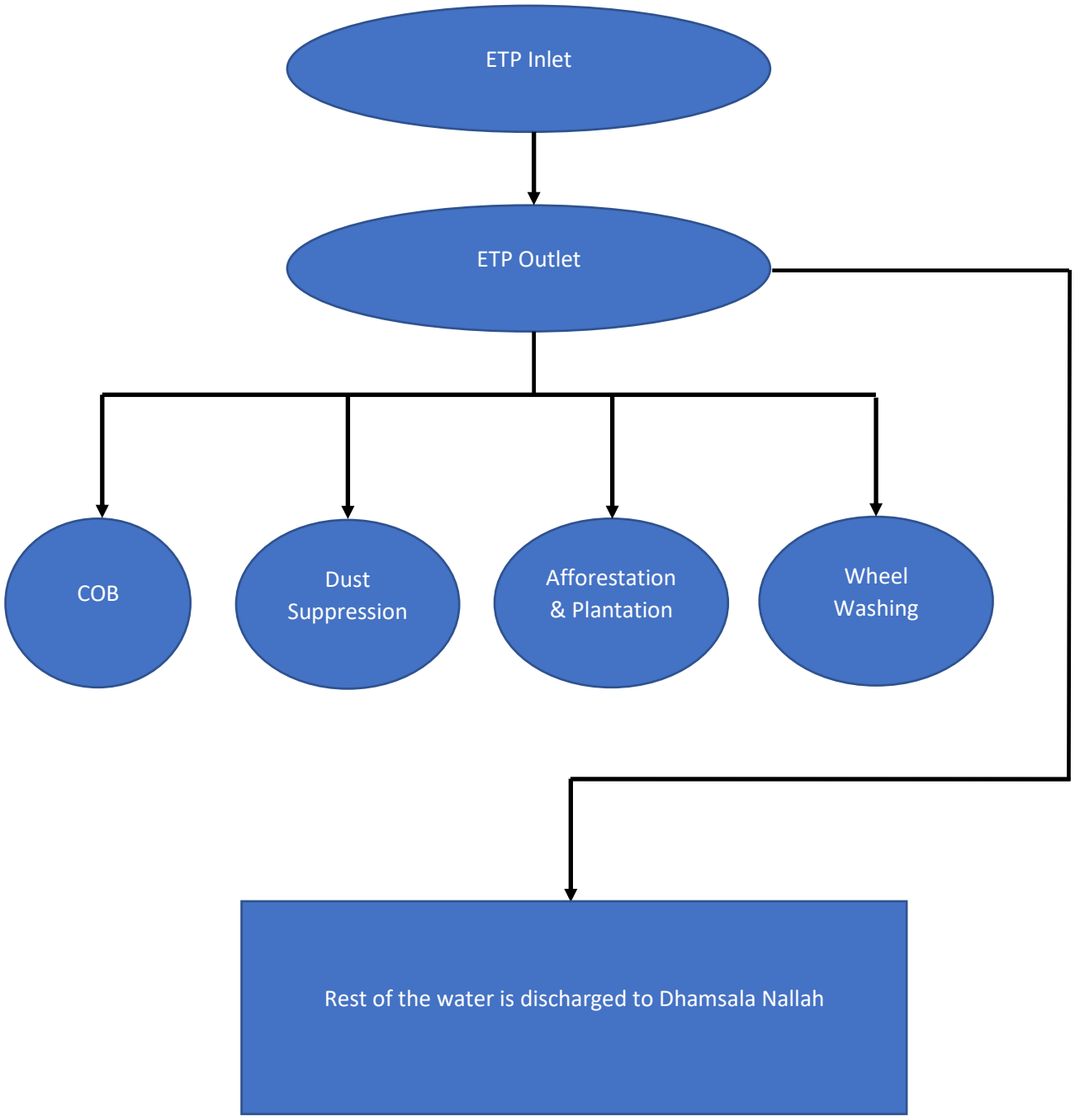
Thanking You

Yours Faithfully
Ferro Alloys Corporation



Head Environment

Adequate Measure taken to discharge the waste water to Dhamsala Nallah



Note:-

- WTP to be installed to treat the ETP Outlet water for drinking purpose
- Increase in the size and length of the Haul Road so more quantity of water is required for Dust Suppression
- Also the plantation number is increased so more water quantity is required for Afferostation/Plantation

4.1.4 Disposal of Waste

Ostapal Chromite Mines has 2 No. of Dumps, one is North Dump and another is South Dump. At present on South dump no more dumping is being carried out over it only stabilization work is being carried out but North dump is active dump. However, further optimization of dump space is carried out in order to accommodate waste quantity. Similarly, North dump the North – Eastern portion is active. The land chosen for dumping the waste material is proved as non-mineralized area. Exploration has already been done over the waste dump area to prove it as non-mineralized area. Please follow the exploration chapter of Bore Hole Nos. 99,100,104,115,118,122,133,137,154 & 155 covered with Meterage 1373.70 shows that no significance of ore deposit below the waste dump yard. The complete waste generated in the plan period will be accommodated within mine lease.

	Waste (cum)				
Year	Total generation	Backfilling	Storage (dumping)	Utiliza tion	Storage Outside UPL/Within UPL
June-2021-2022	412,700	-	412,700	-	Outside UPL
2022-2023	495,000	-	495,000	-	Outside UPL
2023-2024	500,000	-	500,000	-	Outside UPL
2024-2025	500,000	-	500,000	-	Outside UPL
2025-2026	490,000	-	490,000	-	Outside UPL
Total	**2,397,700**	**-**	**2,397,700**	**-**	

It is planned to shift most of mine infrastructure to out of lease area like office etc. to accommodate waste. If require COB will also be shifted to create dump space within mine lease. Hence, it is planned to extend North dump towards North-East side & North-West side, South dump towards East side & South-West side and also height extension of both of dump

FACOR Biswanath Sahoo Vinod Saini

BISWANATH SAHOO VINOD SAINI

OCM/ENV/ 885 /2022 Date: 25/04/2022

To
The member Secretary,
SEIAA, Bhubaneswar.

SUB: Letter/Po handed over to NIT Rourkela to carry out reduction of hexavalent chromium from tailing pond, surface run off and mine discharge water of Ostapal Chromite Mine M/s FACOR Ltd.

Ref: Environment Clearance No - 66461/75-MINB1/02-2022 dated on – 3.02.2022, Special Condition Point No – 2

Dear Sir,

We would like to intimate that we have engaged NIT Rourkela since 13.12.2022 to carry out the reduction of hexavalent chromium from tailing pond, surface run off and mine discharge water vide PO No: 4800020530, PO delivery priod is 31.07.2022.
In response to our PO handover/Supply, the work has been carried out by NIT, Rourkela and submitted one interim report. But final result yet to received.

After obtaining the final report we will submit the same.

- Annexure 1 – Purchase Orde (PO)
- Annexure 2 – Response Letter of NIT Rourkela

This is for your kind information

Thanking You

Yours faithfully,
Ferro Alloys Corporation Limited

Head Environment

vedanta
transforming elements

FACOR
FERRO ALLOYS CORPORATION LIMITED
D.P.Nagar,Randia-756135, Dist- Bhadrak
Odisha, INDIA. Phone: 06784 240320/240347/240272,
Fax: 06784 240626. E-Mail: facor.corporate@vedanta.co.in
CIN: L45201OR1955PLC008400

PURCHASE ORDER

PO Number : 4800020530
PO Date : 13.12.2021

Vendor Code : 734607
Vendor Name : National Institiute of Technology

Vendor Address :SRICCE OFFICE, 2nd floor,NIT C
ROURKELA - Orissa,769008
India.

Your Reference :

Our Reference :

PO Currency :Indian Rupee

PO Validity :13.12.2021 To 31.07.2022
Delivery Place : OSTAPAL
: KALIAPANI JAJPUR Orissa 755047 India

VALID FROM : 13.12.2021
VALID TO : 31.07.2022

I) PO CONFIRMATION/ACKNOWLEDGEMENT:
You shall receive an email confirmation after release of each Purchase Order from our end. Email will provide you a link, from which you can log into SRM portal and view and/or download the PO. For downloading or saving the PO, please click on "PRINT" option. Immediately after receipt of PO, you have to provide "CONFIRMATION" to all items. Alternately, you may directly log into your account in SRM portal through our official website https://sesagoaironore.com/procurement/vendor-e-portal/ and provide "CONFIRMATIONS". In case no confirmation is received from you within 2 days of receipt of PO, then PO shall be deemed accepted to you. However, without giving "CONFIRMATION", ASN as follows, cannot be created, and it has to be done without exception.

Confirmations, acknowledgement and ASN shall not be applicable for Service line items of the PO

II) PRE-DELIVERY CONDITION:

1) At the time of dispatch of material. You have to log into SRM system, open "Create ASN" tab and enter dispatch details, like DC No., DC date, Vehicle No., Quantity, LR No. & LR Date against each proposed delivery item, and saved, when system will generate a unique no. This is called as Advance Shipping Notice (ASN), and same has to be imprinted on every Invoice.

ASN shall not be applicable for Service POs

NATIONAL INSTITUTE OF TECHNOLOGY
Rourkela – 769 008, Odisha

Dr. Angana Sarkar
Assistant Professor
Dept of Biotechnology and Medical Engineering
National Institute of Technology
Rourkela-769008, Orissa
&
Dr S Jayanthu, FIE, C.Eng
PhD, M Tech, BE (Mining)
MS (Counseling & Psychoth
Former Scientist of CM
NATIONAL M
PROFES
De

Website-www.nit
Email: sark
Ph: 0

To
The HOD
Environment Management Dept
Ostapal Chromite Mine
M/s. FACOR-Vedanta

Dear Sir,

Sub: Scientific Report of study for Hexavalent Chromium reduction at Ostapal Chromite Mine of M/s. FACOR-Vedanta

Many thanks for your mail regarding Consultancy service and scientific study for Hexavalent Chromium reduction at Ostapal Chromite Mine of M/s. FACOR-Vedanta dated 18th December, 2021 (**PO No. 4800020530)**.

Sample collection has been collected from the mine site and preliminary study on physicochemical parameters of the samples has been conducted. Screening of chromium reducing bacteria are in process. Kindly find the report on initial study.

Awaiting your favorable response
Thanking you
Sincerely yours

Angana Sarkar

(ANGANA SARKAR-PI)

(SINGAM JAYANTHU-Co-PI)

NATIONAL INSTITUTE OF TECHNOLOGY
Rourkela – 769 008, Orissa
PABX:0661-2465999

Dr S Jayanthu, FIE, C.Eng
PhD, M Tech, BE (Mining)
MS (Counseling & Psychotherapy)
Former Scientist of CMRI & NIRM
Chief Editor of Indian Mining &Engg Journal
NATIONAL MINERAL AWARDEE

PROFESSOR , and Former HOD
Dept of Mining Engineering

FAX :0661-2472928/2462999
Website-www.nitrkl.ac.in
Email sjayanthu@nitrkl.ac.in
Ph: 0661-2462600-01-11 (Dept)-2463611 ®, 9938303259
https://www.nitrkl.ac.in/FProfile.aspx?e=sjayanthu

No. NITR/MN/SJAY/L/2022/ 12.04.2022

To,
Sri Muthumari M
Head O & M Mines
FACOR Mines, Ostapal Chromite mine
Vedanta resource limited –Kalayapani (Po)Jajpur (Dist)
Muthumari.M@vedanta.co.in

Sub: Request for endorsement related to collaboration in the project on "**Removal of chromium from water contaminated by opencast mining using hybrid constructed wetland"- reg**

Dear Sir,

Many thanks for your kind consent on endorsement for the studies to be conducted on above subject, as per our discussions over phone yesterday-11.4.22. Our Transdisciplinary group of faculty including mining engineering, Civil Engineering, Biomedical department etc want to submit a project proposal on chromium removal from water contaminated with chromium by opencast mining activities using a low-cost nature-based system constructed wetland. We are going to use some lab made filler media in our system which has good adsorption ability along with microbes and plants in the system that either bio-remediate or uptake the toxic chromium from the contaminated water. Therefore, system will remove the chromium by physical adsorption, microbial bioremediation and phytoremediation. Altogether they will provide a highly efficient removal system.

In this regard, it is proposed to conduct the studies in two phases. In 1st phase, water will be collected from mine site and all treatments will be carried out in the laboratory. In 2nd phase, a pilot scale system will be setup at the mine site for real water treatment. As discussed before, a copy of endorsement, draft proposal etc are enclosed herewith for your kind perusal inviting Vedanta group to become a collaborator (Industry partner) for this project that we are going to submit to the Ministry of Mines GoI, shortly.

We look forward for your kind consent and endorsement for the above studies to eb conducted with the water samples from your mine sites.
Thanking you
Yours Sincerely,

(SINGAM JAYANTHU)
Encl: as above

Susanta Biswal

From: Avijit Bhunia (Facor)
Sent: Tuesday, September 27, 2022 9:10 AM
To: Susanta Biswal
Subject: FW: Timeline for the Consultancy PO-4800020530
Attachments: Consultancy timeline.pptx; Consultancy Report_Vedanta Mine 2nd report.pdf

FYKI

Sensitivity: Internal (C3)

-----Original Message-----
From: Angana Sarkar <sarkara@nitrkl.ac.in>
Sent: 26 September 2022 16:26
To: Avijit Bhunia (Facor) <Avijit.Bhunia@vedanta.co.in>
Cc: Muthumari M <Muthumari.M@vedanta.co.in>
Subject: Timeline for the Consultancy PO-4800020530

External Sender: Use caution with links/attachments

Dear Sir,
The consultancy work will be completed by the November, 2022. The complete timeline is attached with this mail.

Thank you.

Regards
Dr. Angana Sarkar
Assistant Professor
Department of Biotechnology & Medical Engineering

ANNEXURE - 6

भारत सरकार
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:	Ostapal Chromite Mines		
Project Address:	Gurujanga, Sukinda, Jajpur		
Village:	Gurujanga	Block:	Sukinda
District:	Jajapur	State:	Odisha
Pin Code:			
Communication Address:	Gurujanga, Sukinda, Jajpur, Sukinda, Jajapur, Odisha - 755028		
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/1/2021/6481			
2.	Application No.:	21-4/1456/OR/MIN/2017	3.	Category: (GWRE 2020)	Safe
4.	Project Status:	Existing Ground Water	5.	NOC Type:	Renewal
6.	**Valid from:**	02/08/2020	7.	**Valid up to:**	01/08/2022

8. Ground Water Abstraction Permitted:

Fresh Water		Saline Water		Dewatering		Total	
m³/day	m³/year	m³/day	m³/year	m³/day	m³/year	m³/day	m³/year
100.00	36500.00			3300.00	1204500.00		

9. Details of ground water abstraction /Dewatering structures

	Total Existing No.:4						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
Dewatering Structure*	0	0	0	0	2	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

10.	Ground Water Abstraction/Restoration Charges paid (Rs.):	1371050.00

11.	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	2	0	1	1

(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

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 m 3 /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 failing 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) Wherever feasible, requirement of water for greenbelt (horticulture) shall be met from recycled / treated waste water.

17) 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.

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 16 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).

(Non-compliance of the conditions mentioned above is likely to result in the cancellation of NOC and legal action against the proponent.)

OCM/ENV/ 865 /2022 Date: 16.04.2022

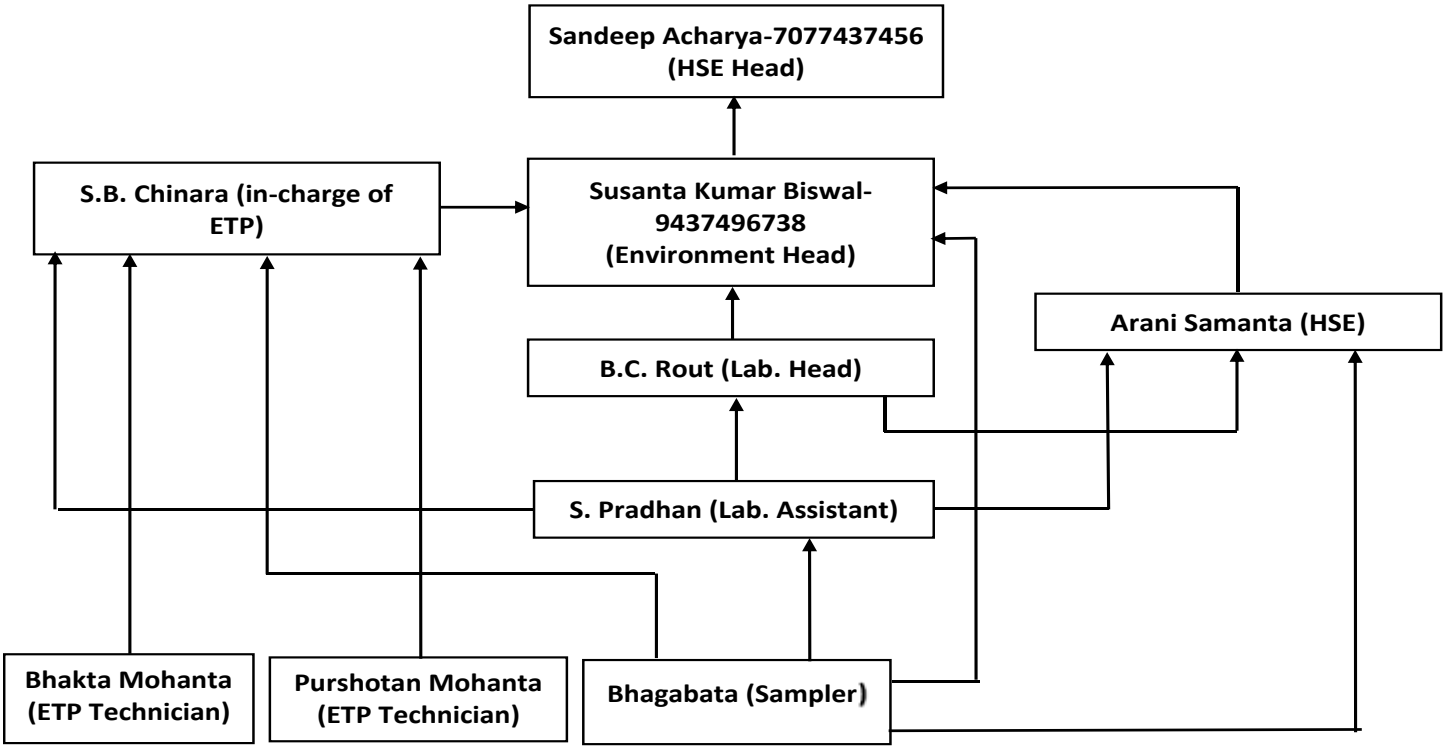
To
The Member Secretary,
SEIAA, Bhubaneswar

SUB: Submission of the details of the Environment Management Cell comprises of person having qualification & experience in the field of environment of Ostapal Chromite Mine M/s FACOR Ltd.

Dear Sir,

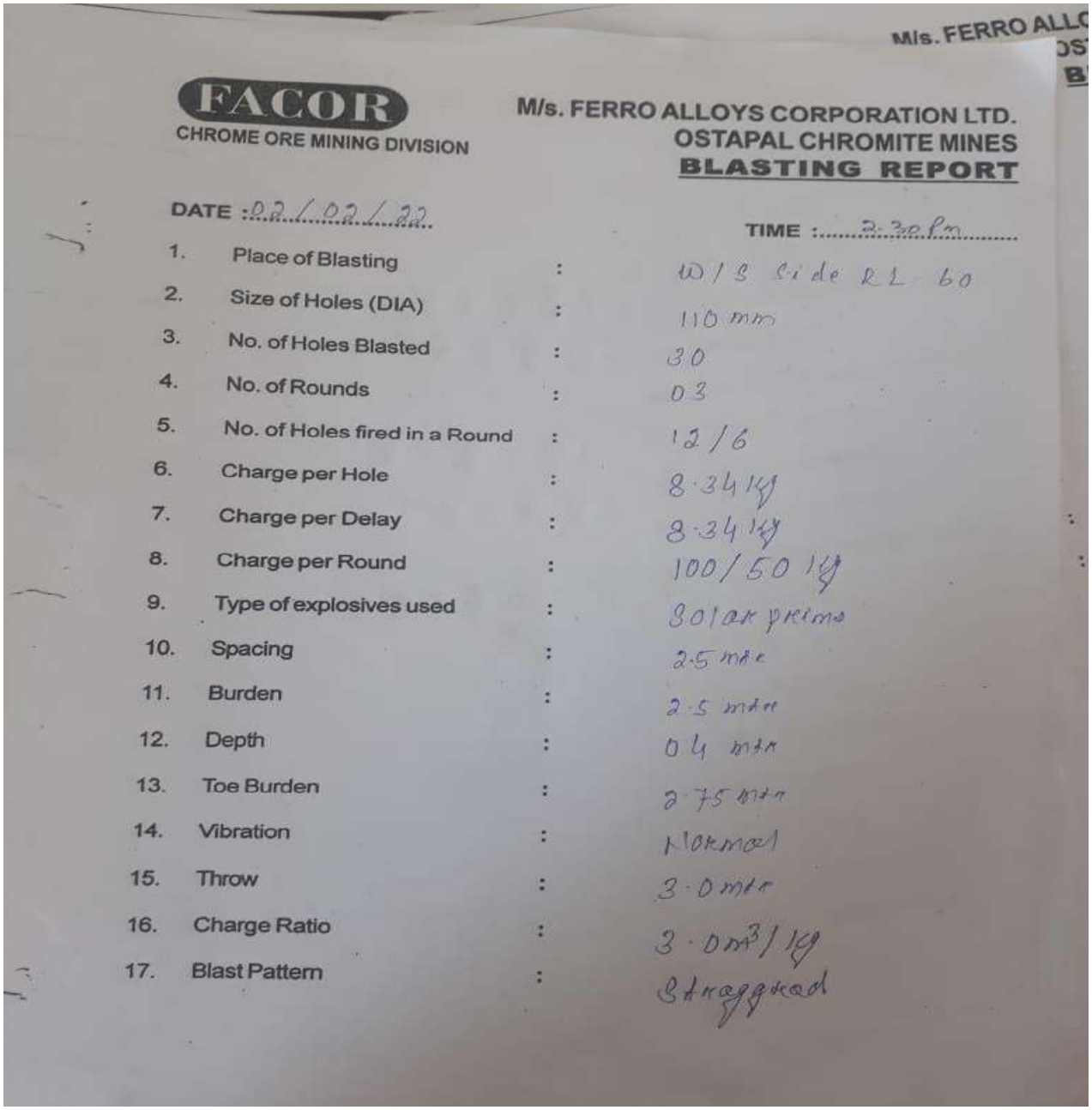
With respect to the cited subject mentioned above, we would like to intimate your good office about the details and organizational chart of the environment management cell of Ostapal Chromite Mine M/s FACOR Ltd.
The details of the Organizational Chart is mentioned Below with details:

Organizational Chart of Environment Management Cell



Head Environment
Ostapal Chromite Mines
Ferro Alloys Corporation

ANNEXURE - 8



M/s. FERRO ALLO
OST
B

FACOR
CHROME ORE MINING DIVISION

M/s. FERRO ALLOYS CORPORATION LTD.
OSTAPAL CHROMITE MINES
BLASTING REPORT

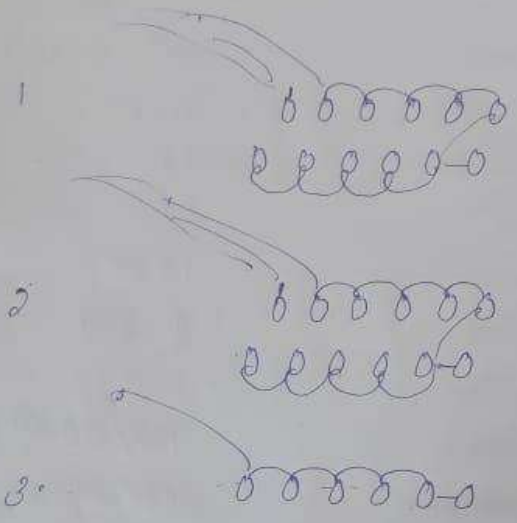
DATE : 02/02/22

TIME : 2:30 Pm

1.	Place of Blasting	:	D/S Side RL 60
2.	Size of Holes (DIA)	:	110 mm
3.	No. of Holes Blasted	:	30
4.	No. of Rounds	:	03
5.	No. of Holes fired in a Round	:	12/6
6.	Charge per Hole	:	8.34 kg
7.	Charge per Delay	:	8.34 kg
8.	Charge per Round	:	100/50 kg
9.	Type of explosives used	:	Solar prime
10.	Spacing	:	2.5 mtr
11.	Burden	:	2.5 mtr
12.	Depth	:	04 mtr
13.	Toe Burden	:	2.75 mtr
14.	Vibration	:	Normal
15.	Throw	:	3.0 mtr
16.	Charge Ratio	:	3.0 m^3/kg
17.	Blast Pattern	:	Staggered

ANNEXURE - 8

18. Rough Sketch showing the Drilling & Firing Pattern :-



Blaster | Foreman | Asst. Mines Manager | Mines Manager

FACOR/ Bhadrak/ Legal /109 /2022 **Dtd. 25.04.2022**

To
Dr. K. Murugesan,
Member Secretary,
State Environment Impact Assessment Authority (SEIAA), Odisha,
Ministry of Environment, Forest and Climate Change, (MOEF&CC),
Government of India.

Ref : EC Identification No. EC22B001OR120821, dtd. 04/04/2022.

Sub : Requisition to delete Specific Condition no.18 and 19 from the Environment Clearance dtd. 04.04.2022 granted to Ostapal Chromite Mines of M/s. Ferro Alloys Corporation Limited in compliance to the various Court Orders.

Dear Sir,

At the outset, the management of. Ferro Alloys Corporation Ltd. ("FACOR") wish to thank the State Environment Impact Assessment Authority (SEIAA), Odisha for grant of Environment Clearance to our Ostapal Chromite Mines vide EC Identification No. EC22B001OR120821 dtd. 04/04/2022 for enhancement of production from 0.2 MTPA to 0.240 MTPA of Chromite Ore (ROM).

We also do hereby assure and undertake before your good office that we shall comply all the terms and conditions stipulated in the aforesaid Environment Clearance (EC) dtd. 04.04.2022 within due time.

On a perusal of the above-referred EC document, there are 2 conditions viz. Specific Conditions no.18 and 19, requiring us to comply with directions of the Hon'ble Supreme Court in WP 114/2014 as below:

Specific Condition No. 18:

"The Project proponent complies with all the statutory requirements and judgements of the Hon'ble Supreme Court dated 2nd August 2017 in Writ Petition (Civil) No. 114 of 2014 in matter of Common Cause versus Union of Indian & ors. Before commencing the mining operations, if applicable to the project."

Specific Condition No. 19:

"The State Government concerned shall ensure that mining operations 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 the strict compliance of judgement of the Hon'ble Supreme Court dates 2nd August , 2017 in Writ Petition (Civil) No 114 of 2014 in the matter of common Cause versus union of India & Ors. as may be applicable".

We humbly submit that the these two conditions, are not applicable to the present Project Proponent as the liabilities arising out of the said judgement has been extinguished consequent to the Corporate Insolvency Resolution Process ("CIRP") which FACOR underwent recently; the same has been later reiterated by the Hon'ble High Court of Odisha in W.P. (C) 20286 of 2020 (FACOR Vs. State of Odisha), as below:

M/s. Ferro Alloys Corporation Ltd. (A subsidiary of Vedanta Ltd.)
Sensitivity: Internal (C3)
Registered Office:
D.P. Nagar, PO: Randia, Dist.: Bhadrak, Odisha, India - 756 135
T +91-6784 240320/240347, Email: facor.mines@vedanta.co.in / facor.ccp@vedanta.co.in
Website: www.facorgroup.in, CIN: U45201OR1955PLC008400.

1. That, pursuant to an application U/s-7 of the Insolvency and Bankruptcy Code (IBC) - 2016 filed by Rural Electrification Corporation Limited ("REC") FACOR, the Hon'ble National Company Law Tribunal, Kolkata Bench (NCLT, Kolkata), vide its order dated 6th July, 2017 initiated Corporate Insolvency Resolution Process ("CIRP") against FACOR and declared moratorium under Section-14 of the Insolvency and Bankruptcy Code, 2016 (IBC- 2016). Copy of the NCLT order dt.06-07-2017 is enclosed herewith as **Annexure-1.**

2. That subsequently, Hon'ble National Company Law Tribunal ("NCLT") Cuttack Bench, vide Para no.19 of its order dtd. 30.01.2020 has approved the Resolution Plan submitted by M/s. Sterlite Power Transmission Limited (a group of Vedanta Ltd.) under IBC-2016. Copy of the NCLT order dt.30.01.2020 is enclosed herewith as **Annexure-2**.

3. That, according to the provisions of IBC-2016, r/w the Approved Resolution Plan ("ARP") of FACOR, all statutory dues owed by the company to various Government Authorities prior to the Plan Effective Date i.e the date on which the Approved Resolution Plan was accepted and approved by Hon'ble NCLT Cuttack, has been extinguished.

4. That Hon'ble NCLT Cuttack bench vide Para -19 of the said order has also instructed that the Approved Resolution Plan of FACOR shall be binding on the Corporate Debtor and its employees, members all creditors including Central and State Government and local authorities, guarantors and other stake holders.

5. That subsequent to the judgment dt. 02.08.2017 passed by Hon'ble Supreme Court of India in W.P. no.114 of 2014 in the matter of Common Cause Vrs. Union of India and others, Deputy Director of Mines, Jajpur Road Circle has demanded **Rs. 200,56,57,434/-** vide notice no.555 dtd. 10.04.2018, towards payment for compensation of u/s 21(5) of MMDR Act 1957 for excess mining in violation to the Environment Clearance granted by Ministry of Environment and Forest (MOEF). MOEF for the period from 2000-2001 upto 2010-2011.

6. That being aggrieved by the said demand notice we have filed Revision application before the Revisional Authority of Ministry of Mines, Govt. of India, New Delhi on dt.24.04.2018 vide R.A no. 22/(40) /2018/RC-I. After hearing, the Revisional Authority, Ministry of Mines had granted interim-stay vide its order dt.10.05.2018 to the impugned demand notice of DDM till further order.

7. That meanwhile relying upon the order dt.30.01.2020 passed by Hon'ble NCLT Cuttack, supported by various Supreme Court Judgments and the express provisions of IBC-2016, FACOR has raised the issue before the Hon'ble High Court of Orissa vide W.P. (C) No. 20286 of 2020 in the matter of Ferro Alloys Corporation Ltd Vs. State of Odisha regarding various statutory/ mining dues demanded by Government Authorities related to periods prior to the 'plan effective date'. We had also prayed before Hon'ble High Court to quash those demands pertaining to prior period of plan effective date.

8. That after hearing both the parties, Hon'ble High Court of Odisha vide its judgement dtd. 10.12.2021 in WP 20286 of 2020 (FACOR Vs. State of Odisha), has held that, ***"In terms of***

M/s. Ferro Alloys Corporation Ltd. (A subsidiary of Vedanta Ltd.)
Registered Office:
D.P. Nagar, PO: Randia, Dist.: Bhadrak, Odisha, India - 756 135
T +91-6784 240320/240347, Email: facor.mines@vedanta.co.in / facor.ccp@vedanta.co.in
Website: www.facorgroup.in, CIN: U45201OR1955PLC008400.

Section 31 of the IBC, the ARP is binding on all creditors including Central Government and the State Government. Since all of the impugned demands raised against FACOR pertain to the period prior to the Plan Effective date i.e. 31st January 2020, all such demands stand automatically extinguished in terms of the ARP".

9. That, consequently, vide para 33 of the said judgement, Hon'ble Court has decided that, " ***The demand raised against the Petitioner (FACOR) by the Opposite Parties on the strength of the decision of the Supreme Court in Common Cause are unsustainable in law and are hereby set aside".*** Copy of the High Court order dt.10.12.2021 is enclosed herewith for your ready reference as **Annexure-3**.

10. That subsequently the matter with respect to demand notice issued against Ostapal chromite Mines U/s- 21 (5) of MMDR Act, 1957 for production in excess of EC in pursuance of the Common Cause Judgement was heard by the Revisional Authority Ministry of Mines, Govt. of India New Delhi in Revision application No.22/40/2018/RC-I.

11. That vide its order dated 23.12.2021 the Revisional Authority has expressly declared the said demand notice of DDM Jajpur as infructuous. Further it was held that, ***"In view of the above, it appears that the amounts mentioned in the demand notices are not included in the resolution plan and stand extinguished. Hence, the State Government cannot take any steps to recover the amounts."*** . Copy of the said order dtd.23.12.2021 is enclosed herewith as **Annexure-4** for your kind perusal and reference.

Thus, it is abundantly clear from the above-stated facts, provisions of law and orders of Hon'ble High Court of Odisha and Revisional Authority, Ministry of Mines that there is no further requirement for FACOR to comply with the directions of Hon'ble Supreme Court in WP 114/2014.

Hence, we would like to request your good office to kindly delete Specific Condition No. 18 & 19 from the Environment Clearance (EC) dtd.04.04.2022 granted by your good office, since these two conditions are not applicable to Ostapal Chromite Mines of M/s. Ferro Alloys Corporation Ltd.

Thanking You
Yours faithfully

For Ferro Alloys Corporation Ltd

Authorised Signatory

Copy : Ministry of Environment and Forest, New Delhi.

M/s. Ferro Alloys Corporation Ltd. (A subsidiary of Vedanta Ltd.)
Sensitivity: Internal (C3)
Registered Office:
D.P. Nagar, PO: Randia, Dist.: Bhadrak, Odisha, India - 756 135
T +91-6784 240320/240347, Email: facor.mines@vedanta.co.in / facor.ccp@vedanta.co.in
Website: www.facorgroup.in, CIN: U45201OR1955PLC008400.

ANNEXURE - 10

D R

F. No. 8-86/1996-FC (Vol. II)
Government of India
Ministry of Environment & Forests
(F.C. Division)

Paryavaran Bhawan,
C.G.O. Complex, Lodhi Road,
New Delhi-110003

Dated : 7th February 2006

To

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

Sub : Diversion of 64.354 ha of forest land for Ist renewal of mining lease for mining of Chromite Ore in Ostapal Chromite Mine in favour of M/s Ferro Alloys Corporation Limited (FACOR) in Jaipur District, Orissa.

Sir,

Kindly refer to your letter No. 10F(Cons) 67/2005/15539/F&E dated 02.09.2005 whereunder the above proposal was forwarded to this office seeking prior approval of the Central Government in accordance with the Section-2 of the Forest (Conservation) Act, 1980 and to say that the above proposal was examined by the Forest Advisory Committee (FAC) constituted under Section-3 of the Act.

2. After careful consideration of the proposal of the State Government and on the basis of the recommendation of the Forest Advisory Committee, the Central Government granted in-principle approval vide letter of even no. dated 03.10.2005 subject to certain conditions. The compliance of these conditions was submitted vide State Government's letter No. 10F(Cons)67/2005/1031/F&E dated 19.01.2006. After consideration of the proposal and compliance of various conditions by the State Government, the Central Government hereby conveys its approval under Section-2 of the Forest (Conservation) Act, 1980 for diversion of 64.354 ha of forest land for Ist renewal of mining lease for mining of Chromite Ore in Ostapal Chromite Mine in favour of M/s Ferro Alloys Corporation Limited (FACOR) in Jaipur District, Orissa, subject to the fulfilment of following conditions :-

(i) Legal status of the forest land shall remain unchanged.

(ii) The non-forest land identified for Compensatory Afforestation shall be declared as Protected Forest under Indian Forest Act, 1927, as directed while granting approval on 04.05.1998. Compliance report in this regard may be sent to this office within 3 months.

(iii) The mining lease period under the Forest (Conservation) Act, 1980 shall be co-terminus with the current lease granted under MMRD Act, 1957.

(iv) The State Government shall transfer amount of NPV and other funds to Compensatory Afforestation Fund Management and Planning Authority (CAMPA), which has already been constituted and notified by the Central Government on 23.04.2004. Till such time, the CAMPA intimates the Head of Accounts for deposition of funds, the funds will be maintained in the form of fixed deposits in the name of Nodal Officer or concerned Divisional Forest Officer of the State Government. The funds realized towards the NPV shall not be utilized by the State Government.

(v) RCC pillars of 4 feet height shall be erected to demarcate the area by the user agency at the project cost and will be marked with forward and back bearings.

(vi) The user agency shall raise, fence and maintain a safety zone around the mining area and will also raise and maintain the plantation over an area one and half times in extent

PTO

to that of the safety zone at the project cost. The condition of raising safety zone and raising plantation on forest land 1.5 times the area of safety zone as stipulated earlier should be complied with immediately and a compliance report should be sent to this office within 3 months.

(vii) The concurrent reclamation plan shall be executed by the user agency from the very 1st year and an annual report shall be sent to the Nodal Officer and the RCCF, Bhubaneswar. If it is found from the annual report that the concurrent reclamation plan is not being adhered to by the user agency, the mining activities shall remain suspended till such time, the annual programme is completed for that year.

(viii) The top soil shall be protected at the project cost.

(ix) The comprehensive Wildlife Management Plan of conservation of wildlife and their habitat for Sukinda mining belt shall be implemented at the project cost.

(x) No labour camps shall be established on the forest land.

(xi) All necessary measures should be taken by the user agency to protect the environment.

(xii) Sufficient firewood shall be provided by the user agency to the labourers at the project cost after purchase from the State Forest Department/Forest Development Corporation.

(xiii) The user agency shall ensure that there should be no damage to the available wildlife.

(xiv) The forest land shall not be used for any purpose other than that specified in the proposal and the land use shall be as mentioned in the State Government's letter No. 10F(Cons)/67/2005/1037/F&E dated 19.01.2006.

(xv) The State Government shall ensure that Compensatory Afforestation as stipulated for the State should be taken up and the targets are achieved. The amount to be deposited by the different user agencies should be realised from them immediately. A compliance report may be sent to this office in this regard.

(xvi) The forest land thus diverted shall be non-transferable. Whenever and whatever extent of the forest land not required, shall be surrendered to the State Forest Department under intimation to this Ministry.

Yours faithfully,

(Pankaj Asthana)
Assistant Inspector General of Forests

Copy to :-

1. The Principal Chief Conservator of Forests, Government of Orissa, Bhubaneshwar.
2. The Nodal Officer, Forest Department, Government of Orissa, Bhubaneshwar.
3. The Chief Conservator of Forests (Central), Regional Office, Bhopal.
4. User Agency.
5. Guard File.
6. Monitoring Cell.
7. PS to IGF (FC)

(Pankaj Asthana)
Assistant Inspector General of Forests

ANNEXURE - 11

FAX : 2562822/2560955
Tel : 2564033/2563924
EPABX : 2561909/2562847
E-mail: paribesh1@ospcboard.org
Web site : www.ospcboard.org

OFFICE OF THE
STATE POLLUTION CONTROL BOARD, ODISHA

[Forest, Environment & Climate Change Department, Govt. of Odisha]
Parivesh Bhawan, A/118, Nilakantha Nagar, Unit-VIII,
Bhubaneswar - 751 012

BY SPEED POST/
THROUGH ONLINE

No. 5181 / IND-II-CTE - 6642 Date 31.03.2022/

CONSENT TO ESTABLISH ORDER

In consideration of the online application no. **3907466** for obtaining Consent to Establish for **Ostapal Chromite Mines of M/s FACOR Ltd.,** the State Pollution Control Board is pleased to convey 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 **increase in production from 0.2 MTPA to 0.240 MTPA Chromite Ore (ROM) with maximum excavation of 0.579 Million cum per Annum through opencast mining method over a mining lease area of 72.843 ha., At – village Gurujanga, Tahasil-Sukinda** in the district of **Jajpur** with the following conditions.

GENERAL CONDITIONS:-

1. **This Consent to Establish is valid for the product, method of mining and capacity mentioned in the application form. This order is valid for five years, which means the proponent shall commence mining activities for the proposal within a period of five years from the date of issue of this consent to establish order. If the proponent fails to commence mining activities for the proposal within five years then a renewal of this consent to establish shall be sought by the proponent.**
2. The mine shall comply to the provisions of Environment Protection Act, 1986 and the rules made there under with their amendments from time to time such as the Hazardous and Other Wastes (Management and Trans boundary Movement) Rules, 2016, Hazardous Chemical Rules /Manufacture, Storage and Import of Hazardous Chemical Rules, 1989 etc. and amendments there under. The mine shall also comply to the provisions of Public Liability Insurance Act, 1991, if applicable.
3. 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.
4. **This Consent to Establish is subject to statutory and other clearances from Govt. of Odisha and/or Govt. of India, as and when applicable.**

BY REGD. POST WITH AD

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: 2562822, 2560955 E-mail: paribesh1@ospcboard.org, Website: www.ospcboard.org

CONSENT ORDER

No. 11221 / IND-I-CON- 1163 Dt. 28.06.2022 /

CONSENT ORDER NO. 366

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.4076086, dated 13.03.2022, online reply dated 05.04.2022 and your letter No. OCMM/ENV/961/2022, dated 30.05.2022.

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: OSTAPAL CHROMITE MINES OF M/S. FACOR LTD.

Name of the Occupier & Designation: SRI AJAYA KUMAR PATRA, MINES MANAGER

Address: AT: GURUJANG, PO: KALIAPANI, DIST: JAJPUR

This consent order is valid for the period up to 31.03.2026.

This consent order supersedes the earlier consent order issued vide letter No.4047, dated 16.03.2022.

Details of Products Manufactured:

Sl. No	Product	Quantity
01.	Chrome ore(ROM)	0.24 MTPA [Maximum excavation of 0.579 million cum per annum excavation]

Details of Mineral Handing Plants/Units:

01.	Operation of COB Plant of capacity	0.1 MTPA (chrome ore concentrate)

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.

DISTRICT MINING OFFICE: BADAMBADI: CUTTACK 753 012.

No. 2718 /Mines, Dt. 2-12-85

From
Shri A. K. Das, I.A.S,
Collector, Cuttack.

To
M/s. Ferro Alloys Corporation Ltd.,
59 Forest Park, Bhubaneswar-9.

Sub:- Grant of surface right permission over 48.63 acres of land out of the total area of land 160 acres in village Gurjang and Ostapal in Cuttack district in favour of M/s. FACOR Ltd.

Ref:- Your letter No.SF/60/2263 dt. 29.9.85.

Sir,

With reference to your letter cited above, you are hereby granted with permission for surface right over an area of 48.63 acres land, the detailed land particulars are enclosed herewith on the terms and conditions under clause 2 of Part III of the Mining lease Deed, in the old worked out area where fresh clearance of forest vegetation is not involved subject to payment of the cost of compensatory plantation dues and the following conditions of lease deed without prejudice to the final decession on the writ petition.

1. You shall indemnify and reimburse Govt, and third party as laid down in clause 2 of part VIII, clause 3 and 15 of part VII and clause 4 and 6 of part III of the main lease deed.

2. You shall pay compensatory plantation cost for the area under surface right and value of the forest growth to the Divisional Forest Officer, Keonjhar.

LAND SCHEDULE:

Village	Khata No.	Plot No.	Total area.	Classification of the land as per R.O.R.	Area recommended.
1	2	3	4	5	6
Gurjang	13	1	Ac.222.50	Sal Jungle	Ac.5.63
Ostapal	1	33	Ac.097.00	-do-	Ac.43.00
				Total:	Ac.48.63

Yours faithfully,

COLLECTOR, CUTTACK.

DISTRICT OFFICE(MINING SECTION)
JAJPUR ROAD,DIST-JAJPUR

OFFICE ORDER No. 7850 /Mines Dt. 19.12 /98

Surface right permission over an area of Ac.10.66 or 4.314 hects. within the mining lease hold of Ostapal Chromite Mines is hereby accorded in favour of M/s. FACOR Ltd. for mining operation as applied for subject to the following terms and conditions. The details of the land schedule of the surface right granted area are given below.

LAND SCHEDULE

Village	Name of the tenants	Khata No.	Misam	Plot No.	Area in Acs.
Kurujang	Ananta Mohanta	1	Sarada-II	317	0.34
-do-	-do-	1	Sarada-II	320	0.18
-do-	Kailash Ch.Mohanta	3	-do-	318	0.26
-do-	-do-	3	-do-	321	0.50
-do-	Guru Dehuri	7	-do-	230	0.08
-do-	Gouranga Mohanta and others,	8	-do-	316	0.13
-do-	-do-	8	-do-	319	0.39
-do-	Darshani Mohanta	12	-do-	307	0.06
-do-	-do-	12	-do-	309	0.09
-do-	-do-	12	-do-	312	0.06
-do-	Dhaneswar Mohanta	14	-do-	304	0.02
-do-	-do-	14	-do-	306	0.04
-do-	-do-	14	-do-	311	0.12
-do-	Naba Pradhan	15	-do-	334	0.23
-do-	Pitt Dehuri	16	-do-	328	0.58
-do-	Banamali Mohanta	19	-do-	305	0.07
-do-	-do-	19	-do-	308	0.05
-do-	-do-	19	-do-	310	0.09
-do-	-do-	19	-do-	313	0.02
-do-	Bhika Dehuri	23	-do-	253	1.77
-do-	Mangulı Pradhan	24	-do-	302	0.09
-do-	Mukha Dehuri	27	-do-	226	0.04
-do-	-do-	27	-do-	229	0.07
-do-	-do-	27	-do-	329	0.44

Gurujanga	Rupa Dehuri	28	Sarada-II	237	0.06
-do-	-do-	28	-do-	232	0.05
-do-	Laxmidhar Dehuri and others.	30	-do-	231	0.05
-do-	-do-	30	-do-	228	0.05
-do-	-do-	30	-do-	233	0.06
-do-	Sujan Dehuri	32	-do-	254	0.12
-do-	Hadibandhu Dehuri	34	-do-	336	0.045
-do-	-do-	34	-do-	337	1.71
-do-	Hadibandhu Pradhan	35	-do-	335	0.72
-do-	-do-	35	-do-	332	2.37
-do-	-do-	35	-do-	216	0.05
			Total :		10.66 Acs. or 4.314

1. Surface right granted area within the M.L. area should be properly demarcated by in the field before handing over possession to the lessee.

2. Forest growth if any within the surface right granted area should not be disturbed without obtaining permission from the concerned forest authority.

3. The lessee shall indemnify and reimburse to Govt. and third parties as laid down in Clause-2 of Part-VIII, Clause-3 and 15 of Part- VII and Clause- 4 to 6 of Part-III of the lease deed.

COLLECTOR, JAJPUR

Memo No. 2451 /Mines Dated 13/12/98

Copy to Chief Executive, Mines, M/s. FACOR Ltd., Laxmi Bhavan, Kuansa, Phadrak for information with reference to their letter No. 3725 dt. 25.8.97.

13/12/98

COLLECTOR, JAJPUR

Memo No. /Mines. Dated /98

Copy to the Divisional Forest Officer, Athagarh/ Tahasildar, Sukinda, Jajpur Road for information.

OFFICE OF THE DEPUTY DIRECTOR MINES ; JAJPUR ROAD CIRCLE

JAJPUR ROAD

VIDE-LETTER No. ~~Mines, Dated the 21st January, 1999~~

I, Shri M.R.Mohanty, Dy.Director Mines, Jajpur Road Circle do hereby deliver the possession of an of 10.66 Acr. or 4.314 Hcts. of land for Chromite in Vill-Gurjanga in Sukinda Tahasil of Jajpur District to-day the 21st January, 1999 to Shri C.Sharma, Asst.General Manager-cum-Mines Manager, Ostapal Chromite Mines, M/s.FACOR Ltd., as granted by the Collector, Jajpur vide Order No.7850 dtd. 19-12-98 for Surface Operation in presence of witness from both sides.

HANDED-OVER

(M.R.MOHANTY)
Dy.DIRECTOR MINES
JAJPUR ROAD
Deputy Director Mines
J-Road,

TAKEN-OVER

21/1/99
MINES MANAGER
Ferro Alloys Corporation Ltd
OSTAPAL CHROMITE MINES

Rec. Copy
1/2/99

WITNESS

01. [illegible] 21.1.99

01. K. Patra 21/1/99 Mines Manager M. Aiket

02. [illegible] 21.1.99

02. 21/1/99 (Prasant Kumar Parel) Surveyor FACOR

[illegible] 21/1/99
S/o Late Harihar Mahanto
vill. Gurjanga

DISTRICT OFFICE (MINING SECTION)
JAJPUR ROAD

No. 2712 /2003-DMM Dated the 29th April 03

PROCEEDINGS

Pursuant to the letter No.8/86 96-FC dt.4.5.98 of Govt.of India Ministry of Environment & Forests,New Delhi for diversion of forest land over 60.424 hects under Section-2 of F.C Act 1980 addressed to Secretary Forest Govt.of Orissa, Bhubaneswar and subsequently;

i)Allowed by Ministry of Environment and Forest New Delhi vide letter No.8/86/96 FC dt.28.7.99 addressed to Secretary Forest,Govt.of Orissa,Bhubaneswar to work in the unbroken forest land.

ii)environmental clearance accorded for expansion of chromite mines of M/s Ferro Alloys Corporation Ltd.vide No.J/11012/36/2001 IA II(M) dt.5.4.02 addressed to the Chief Executive of Mines of M/s FACOR Ltd.

iii)Allowed by Divisional Forest Officer,Athagarh Division to work over 44.647 hects of unbroken forest land leaving 4.07 hets forest land for safty zone,communicated vide his Memo No.3589 dt.19.4.02 addressed to Deputy Director of Mines and (IV) Sri Ashok Kumar Agraval recorded herein who is also Chief Executive of Mines of FACOR Ltd has given consent for grant of surface right for mining over 0.76 acs in plot No.349 of Khata No.35/1 and after careful consideration,surface right permission over an area of 107.14 acre or 43.359 hect within the mining lease hold area over 72.813 hets in village Gurujanga and Forest Block is hereby accorded in favour of FACOR Ltd.for mining operation on following terms and conditions,the details of land schedule of surface right area granted are given below;

Land Schedule

As per Sabik Settlement

a)Forest Block 27/1 - 76.99 acres.
(Baitari protected forest)

b)Village Gurujanga:

Plot No.	Khata No.	Name of the tenant	Class	Area
1/1	11	Anabadi Sal Jungle.		30.15

As per Sabik settlement:
a)Forest Block 27/1 : 76.99 Acrs. Total : 107.14 Acrs. 43.359 hect.

Village: Gurujanga.

Khata No.	Name of the Tenant	Plot No.	Kissam	Area in Acres.	Remarks.
1	2	3	4	5	6
36	Abada Jogya Anabadi	377/P	Patita	0.03	Part
36	-do-	396/	do-	0.60	
36	-do-	400	-do-	0.38	
36	-do-	409	-do-	0.11	
39	Rakhita	314	Jungle-1	0.11	Part
39	-do-	315	-do-	0.17	
39	-do-	323	-do-	0.10	
39	-do-	324	-do-	0.11	
39	-do-	325	-do-	0.10	
39	-do-	326	-do-	0.33	
39	-do-	327	-do-	0.95	
39	-do-	330	-do-	0.04	
39	-do-	338	-do-	0.05	Part
39	-do-	339	-do-	0.03	-do-
39	-do-	340	-do-	0.03	-do-
39	-do-	342	Nahara	0.02	-do-
39	-do-	343	Jungle-1	0.09	-do-
39	-do-	344	-do-	0.16	
39	-do-	345	-do-	1.39	
39	-do-	347	-do-	1.63	
39	-do-	349	-do-	0.18	
39	-do-	350	-do-	1.56	Part
39	-do-	351	-do-	0.18	
39	-do-	352	-do-	2.92	Part
39	-do-	353	-do-	0.41	
39	-do-	354	-do-	1.91	
39	-do-	355	-do-	0.3[illegible]	
39	-do-	356	-do-	0.34	
39	-do-	357	-do-	0.20	
39	-do-	361	-do-	0.75	
39	-do-	370	-do-	0.2[illegible]	Part
39	-do-	380	-do-	0.2[illegible]	
39	-do-	381	-do-	0.1[illegible]	
39	-do-	382	-do-	0.1[illegible]	
39	-do-	383	-do-	0.10	
39	-do-	384	-do-	0.12	

39	Rakhit	385	Jungal-1	0.07	
39	-do-	386	-do-	0.13	
39	-do-	387	-do-	0.15	
39	-do-	388	-do-	0.37	
39	-do-	389	-do-	0.10	
39	-do-	390	-do-	0.33	Part
39	-do-	391	-do-	0.33	
39	-do-	392	-do-	0.15	Part.
39	-do-	393	-do-	0.30	
39	-do-	394	-do-	0.12	
39	-do-	395	-do-	0.03	Part
39	-do-	397	-do-	0.28	
39	-do-	398	-do-	0.06	Part
39	-do-	399	-do-	0.23	
39	-do-	401	-do-	0.19	
39	-do-	402	-do-	0.11	
39	-do-	403	-do-	0.11	
39	-do-	404	-do-	0.10	
39	-do-	405	-do-	0.14	
39	-do-	406	-do-	0.11	
39	-do-	407	-do-	0.31	
39	-do-	408	-do-	0.17	
39	-do-	411	-do-	0.71	
39	-do-	412	-do-	1.66	Part
39	-do-	413	-do-	0.76	Part
39	-do-	416	-do-	0.04	
39	-do-	417	-do-	0.77	
39	-do-	418	-do-	1.01	
39	-do-	419	Gramya Jungal	0.63	
39	-do-	420	Jungal-1	1.53	Part
39	-do-	421	Gramya Jungal	0.04	
39	-do-	452	-do-	0.30	
35/1	Ashok Kumar Agarwala	343	Jungle-1	0.76	

Total :- 30.15
12.202 Hects.

Grand Total:-
Forest Block - 76.99 Acres
Village Jungle 30.15
107.14

Terms and Conditions

The surface right granted over 107.14 for . . acres within the M.L. area should be demarcated in the field before handing over possession to leasee.

The forest growth if any within the surface right granted area should not be disturbed without prior permission of the forest Authority.

No actifity what so ever shall be done by the lessee over 4.07 hects.of forest land which is earmarked for safty zone.

The lessee shall observe all such terms and conditions as laid down in model form K of M.L deed.

The surface right is granted till the subsistence of the lease period.

Sd/-
COLLECTOR,JAJPUR

Memo No. 2713 /2003 Mines Dated. 29.4.03

Copy to M/sFACOR Ltd for information and necessary action with reference to their letter No.408 dt.4.6.2002.

29/4/03
COLLECTOR,JAJPUR
29.04.03

Memo No. _____/2003-Mines Dated.

Copy forwarded to the Joint Secretary to Govt.Steel & Mines Deptt,Orissa,Bhubaneswar for information and necessary action.

COLLECTOR,JAJPUR

Memo No. _____/2003- Mines Dated.

Copy forwarded to the D.F.O,Athagarh and Tahsildar Sukinda,Jajpur-road for information and necessary action.

COLLECTOR,JAJPUR.

DISTRICT OFFICE (MINING SECTION)
JAJPUR ROAD

No. 8271 / Mines Date: 3/8/11

From The District Magistrate and
Collector, Jajpur.

To M/s. Ferro Alloys Corporation Ltd.
Owner of Ostapal Chromite Mines
At: Laxmi Bhawan, PO: Kuans,
Dist: Bhadrak

Sub: Grant of surface right permission over 3.25 Acrs. or 1.315 hects of forest land of Ostapal Chromite Mines of M/s. FACOR Ltd. under Sukinda Tahasil in Jajpur District.

Sir,

With reference to your application dt: 16.07.11 and revised application dt: 22.07.2011 on the subject indicated above, the surface right permission is hereby accorded over an area of 1.315 hects. or 3.25 Acrs. of forest land coming within 64.354 hects. of forest area approved by MOEF, Govt. of India vide order No. F No. 8-86/1996-FC (Vol-II) dt: 07.02.2006 within total lease hold area over 180 Acrs. or 72.843 hects. in respect of Ostapal Chromite Mines of M/s. FACOR Ltd. as marked on the map and land schedule detailed below.

The surface right permission is granted as per Clause-2 of Part-III of Mining lease deed executed on dt: 13.08.1985 to 12.08.2005 for 20 years and extended under deemed extension as per rule 24 (A) (6) of MCR 1960 subject to the following condition and observance of terms and condition of lease covenants, Mines & Minerals (D&R) Act. 1957 and relevant rules made there under.

1. Surface right area within the Mining lease shall be demarcated in the field before handing over possession to the lessee.
2. All conditions stipulated by MOEF, Govt. of India vide letter No. F No. 8-86/1996-FC (Vol-II) dt: 07.02.2006 in forest clearance over 64.354 Hects. shall be observed by the lessee in respect of the forest area.
3. Surface rent as prescribed in MM (D&R) Act. 1957 and M.C. Rules 1960 shall be paid from the date of issue.

Contd...P/2

Granted area land schedule as per Sabik settlement and Corresponding to Hal settlement records.

As per sabik Settlement Record					As per Hal Settlement Record				
Village Name	Khata No.	Plot No.	Kisam	Name of Tenants	Khata No.	Plot No.	Kisam	Name of Tenants	Area (in Acrs.
Gurujanga No. 16	13	1/P	Sal Jungle	Anabadi Govt.	39	331	Jungle-1	Rakhit	0.25
					39	332	Jungle-1	Rakhit	0.18
					39	333	Jungle-1	Rakhit	0.13
					38	358/P	Jungle	Sarbasadharana	0.30
					39	359/P	Jungle	Rakhit	2.21
					38	360/P	Jungle	Sarbasadharana	0.18
								Total Area	**3.25 Acrs.**

Yours faithfully

District Magistrate &
Collector, Jajpur

Memo No. _____/ Mines Date: _____/11

Copy forwarded to the Divisional Forest Officer, Cuttack Forest Division, Cuttack./ the Tahasildar, Sukinda for information and necessary action.

District Magistrate &
Collector, Jajpur

In pursuance of District office order No. 8271/Mines dt: ... the Collector, Jajpur regarding surface right permission over 3.25 Acrs. or ... in village Gurujanga under Sukinda Tahasil in Jajpur District granted in ... FACOR Ltd. within lease hold area of 72.843 hects. of Ostapal Chromite ... I do hereby hand over the possession of above granted surface ... hects. or 3.25 Acrs. to M/s. Ferro Alloys Corporation Ltd. ... by Sri. Anil Kumar Pati, AGM of Ostapal Chromite Mines of aforesaid ... on 17.08.11 in presence of the following witness.

Deputy Director Mines
Jajpur Road

Taken over the possession of granted surface right area ... hects. in village Gurujanga under Sukinda Tahasil in Jajpur ... hold area of Ostapal Chromite Mines over 72.843 hects. for ... 08.2011.

17/08/2011
ASST.GENERAL MANAGER
M/s FACOR
OSTAPAL CHROMITE

For: M/s. Ferro Alloys Corporation Ltd.

A B S T R A C T

Sl.No.	Letter Ref. No. & Date	AREA	
		Acre	Hectares
(A)	**SURFACE RIGHT GRANTED**		
1.	Letter No.8271 Dtd.03.08.2011	3.25	1.315
2.	Letter No. 2712 Dtd. 29.04.2003	107.14	43.359
3.	Letter No. 7850 Dtd.19.12.1998	10.66	4.314
4.	Letter No. 2718 Dtd. 02.12.1985	48.63	19.680
	TOTAL:	**169.68**	**68.668**
(B)	**SURFACE RIGHT NOT GRANTED**		
5.	Safety Zone	10.06	4.07
6.	Debasthali	0.26	0.105
	TOTAL :	**10.32**	**4.175**
	GRAND TOTAL :	**180.00**	**72.843**

ANNEXURE - 13

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OSTAPAL CHROMITE MINES
P.O. - KALIAPANI-755047
DIST. JAJPUR, ODISHA, INDIA

FACOR
CHROME ORE MINING DIVISION

OCM / ENV / 836 / 2022 **Date: 05.04.2022**

To

1.The Collector and District Magistrate,
Dist.-Jajpur, Odisha.

2.The Sub-Collector, Jajpur,
Dist.-Jajpur, Odisha.

3. The Tahasildar, Sukinda,
Dist.-Jajpur, Odisha.

4. The Sarpanch, Kaliapani Gram Panchayat,
Tahasil- Sukinda, District -Jajpur, Odisha.

Ref : EC Identification No. EC22B001OR120821, dtd. 04/04/2022.

Sub.: Intimation regarding Grant of Environmental Clearance (EC) by SEIAA Odisha under the provisions of EIA Notification-2006 for increase in production from 0.20 MTPA to 0.24 MTPA Chromite Ore (ROM) with maximum excavation of 0.579 Million Cub Mt per Annum and Beneficiated Chrome Ore 0.10 MTPA from Ostapal Chromite Mine of M/s Ferro Alloys Corporation Ltd,Jajpur,ODISHA.

Received 7.4.2022 O/o Sub Collector

Respected Sir,

We would like to intimate your good office vide this letter that the State Environment Impact Assessment Authority(SEIAA), Odisha, coming under the Ministry of Environment, Forest and Climate Change, Government of India has granted the Environment Clearance (EC) to Ostapal Chromite Mine of M/s Ferro Alloys Corporation Ltd. (FACOR) vide EC Identification No. EC22B001OR120821 on dtd. 04/04/2022 for enhancement of production from 0.2 MTPA to 0.240 MTPA of Chromite Ore (ROM) with maximum excavation of 0.579 Million Cub Mt per Annum and Beneficiated Chrome Ore 0.10 MTPA from Ostapal Chromite Mine. This EC is also available in the official portal of Ministry of Environment, Forest and Climate Change, i.e http://environmentclearance.nic.in.

The said Environment Clearance has been issued by SEIAA, Odisha to our Ostapal Chromite Mines under the provisions of EIA Notification-2006. Incompliance to the Specific Condition no.26 of this EC, we are furnishing herewith the copies of the Environment Clearance No. EC22B001OR120821, dtd. 04/04/2022 for the kind perusal and records of the Government offices and Heads of the local bodies

Received of this copy of EC may kindly be acknowledged herewith.

Thanking You

Yours faithfully,
for Ferro Alloys Corporation Ltd

O/C

05/04/2022
[MUTHUMARI.M]
Agent
Ostapal Chromite Mine

Received LND. 836 dt. 5.4.2022

07.04.2022

Received
PR Section
Collectorate Jajpur

Encl: As above

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OSTAPAL CHROMITE MINES
P.O. - KALIAPANI-755047
DIST. JAJPUR, ODISHA, INDIA

FACOR
CHROME ORE MINING DIVISION

OCM/ENV/ 848 /2022 **Date:09.04.2022**

To

The Member Secretary,
SEIAA,Bhubaneswar

Sub.: Advertise about the Grant of EC in respect of Ostapal Chromite Mine of M/s FACOR Ltd ,Jajpur of Odisha.

Ref.: (i). EC Identification No.:EC22B001OR120821, SEIAA File No.:66461/75-MINB1/02-2022, Date 4.04.2022
(ii). EC Specific Condition No.:28

Dear Sir,

We would like to submit the reference copy of advertisement of Grant of EC for enhancement in production from 0.2 MTPA to 0.240 MTPA of Chromite Ore(ROM) with Maximum Excavation of 0.579 Million Cum per Annum and Beneficiated Chrome Ore of 0.1 MTPA from the Ostapal Chromite Mine of M/s. FACOR Ltd.,Jajpur,Odisha.

Reference of Advertisement has been enclosed as Annexure No.-1.

This is for your Kind information.

Thanking You,

Yours faithfully,
For Ferro Alloys Corporation Limited

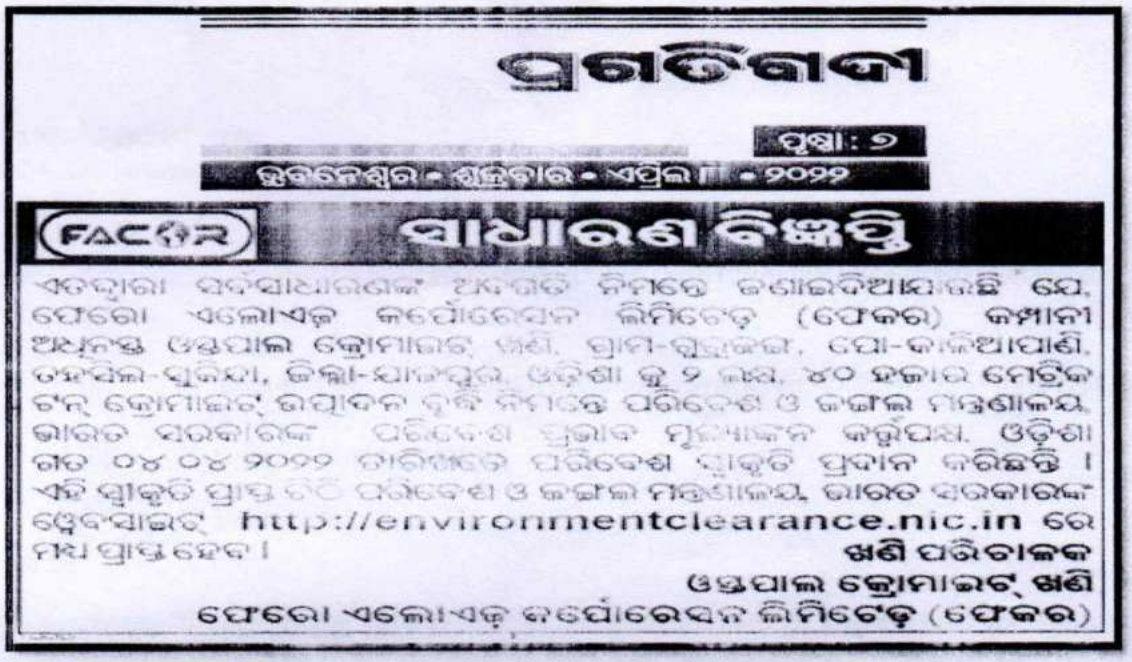
M. Muthumari 09/04/2022
[MUTHUMARI.M]
(Authorized Signatory)

Encl: A/a

Annexure No.-1

PAPER ADVERTISEMENT

1. Publication in Odiya Daily Paper Pragativadi Dated 08.04.2022



ପ୍ରଗତିବାଦୀ

ପୃଷ୍ଠା: ୭

ଭୁବନେଶ୍ୱର • ଶୁକ୍ରବାର • ଏପ୍ରିଲ ୮ • ୨୦୨୨

FACOR

ସାଧାରଣ ବିଜ୍ଞପ୍ତି

ଏତଦ୍ଦ୍ୱାରା ସର୍ବସାଧାରଣଙ୍କ ଅବଗତି ନିମନ୍ତେ ଜଣାଇଦିଆଯାଉଛି ଯେ, ଫେରୋ ଏଲୋଏଜ୍ କର୍ପୋରେସନ ଲିମିଟେଡ୍ (ଫେକର) କମ୍ପାନୀ ଅନ୍ତର୍ଗତ ଓସ୍ତପାଲ କ୍ରୋମାଇଟ୍ ଖଣି, ଗ୍ରାମ-ସୁରୁଜଲ, ପୋ-କାଳିଆପାଣି, ତମ୍ବରିଲ-ସୁକିନ୍ଦା, ଜିଲ୍ଲା-ଯାଜପୁର, ଓଡ଼ିଶା କୁ ୨ ଲକ୍ଷ, ୪୦ ହଜାର ମେଟ୍ରିକ ଟନ୍ କ୍ରୋମାଇଟ୍ ଉତ୍ପାଦନ ବୃଦ୍ଧି ନିମନ୍ତେ ପରିବେଶ ଓ ଜଙ୍ଗଲ ମନ୍ତ୍ରଣାଳୟ, ଭାରତ ସରକାରଙ୍କ ପରିବେଶ ପ୍ରଭାବ ମୂଲ୍ୟାଙ୍କନ କର୍ତ୍ତୃପକ୍ଷ, ଓଡ଼ିଶା ଗତ ୦୪ ୦୪ ୨୦୨୨ ତାରିଖରେ ପରିବେଶ ଛାଡ଼ପତ୍ର ପ୍ରଦାନ କରିଛନ୍ତି । ଏହି ଛାଡ଼ପତ୍ର ପ୍ରାପ୍ତ ହେଁ ପରିବେଶ ଓ ଜଙ୍ଗଲ ମନ୍ତ୍ରଣାଳୟ, ଭାରତ ସରକାରଙ୍କ ୱେବସାଇଟ୍ http://environmentclearance.nic.in ରେ ମଧ୍ୟ ପ୍ରାପ୍ତ ହେବ ।

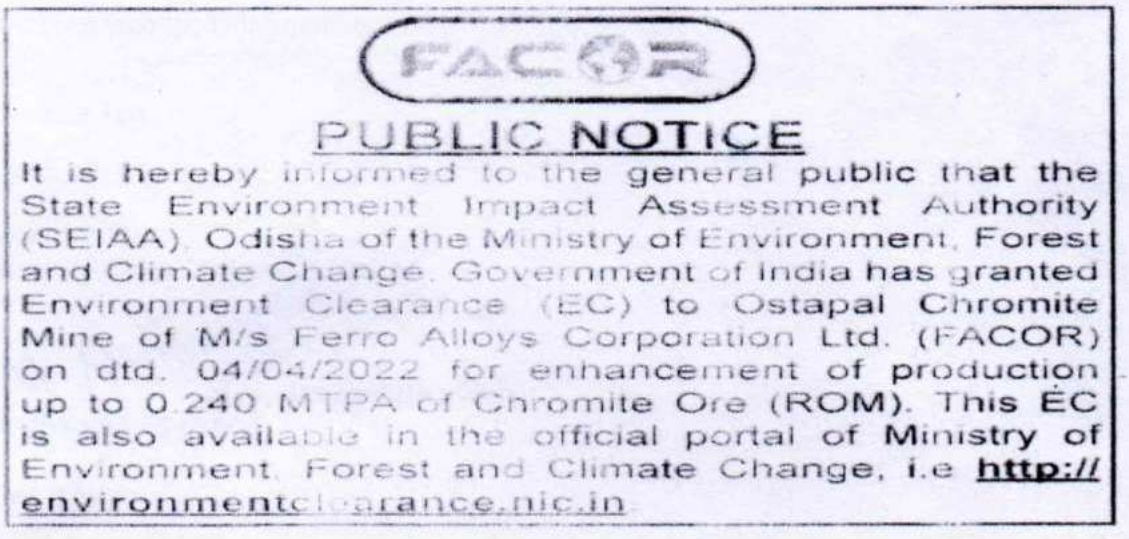
ଖଣି ପରିଚାଳକ

ଓସ୍ତପାଲ କ୍ରୋମାଇଟ୍ ଖଣି

ଫେରୋ ଏଲୋଏଜ୍ କର୍ପୋରେସନ ଲିମିଟେଡ୍ (ଫେକର)

Link is : https://pragativadi.com/epaper/epaper_news/1/2022-04-08

2.Published in English daily paper Orissa Postdated 08.04.2022



FACOR

PUBLIC NOTICE

It is hereby informed to the general public that the State Environment Impact Assessment Authority (SEIAA), Odisha of the Ministry of Environment, Forest and Climate Change, Government of India has granted Environment Clearance (EC) to Ostapal Chromite Mine of M/s Ferro Alloys Corporation Ltd. (FACOR) on dtd. 04/04/2022 for enhancement of production up to 0.240 MTPA of Chromite Ore (ROM). This EC is also available in the official portal of Ministry of Environment, Forest and Climate Change, i.e **http://environmentclearance.nic.in**

Link : http://odishapostepaper.com/edition/4041/orissapost/page/5

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OSTAPAL CHROMITE MINES
P.O. - KALIAPANI-755047
DIST. JAJPUR, ODISHA, INDIA

FACOR
CHROME ORE MINING DIVISION

OCM/ENV/ 854 /2022 **Date:11.04.2022**

To

The Joint Director,
Ministry of Environment, Forest & Climate Change,
Eastern Regional Office,
Bhubaneswar

Sub.: Advertise about the Grant of EC in respect of Ostapal Chromite Mine of M/s FACOR Ltd, Jajpur of Odisha.

Ref.: (i) EC Identification No.:EC22B001OR120821, SEIAA File No.:66461/75-MINB1/02-2022, Date 4.04.2022
(ii) EC Specific Condition No.:28

Dear Sir,

We would like to submit the reference copy of advertisement of Grant of EC for enhancement in production from 0.2 MTPA to 0.240 MTPA of Chromite Ore(ROM) with Maximum Excavation of 0.579 Million Cum per Annum and Beneficiated Chrome Ore of 0.1 MTPA from the Ostapal Chromite Mine of M/s FACOR Ltd., Jajpur, Odisha.

Reference of Advertisement has been enclosed as Annexure No.-1.

This is for your Kind information.

Thanking You,

Yours faithfully,
For Ferro Alloys Corporation Limited

M. Muthumari 11/04/2022
[MUTHUMARI.M]
(Authorized Signatory)

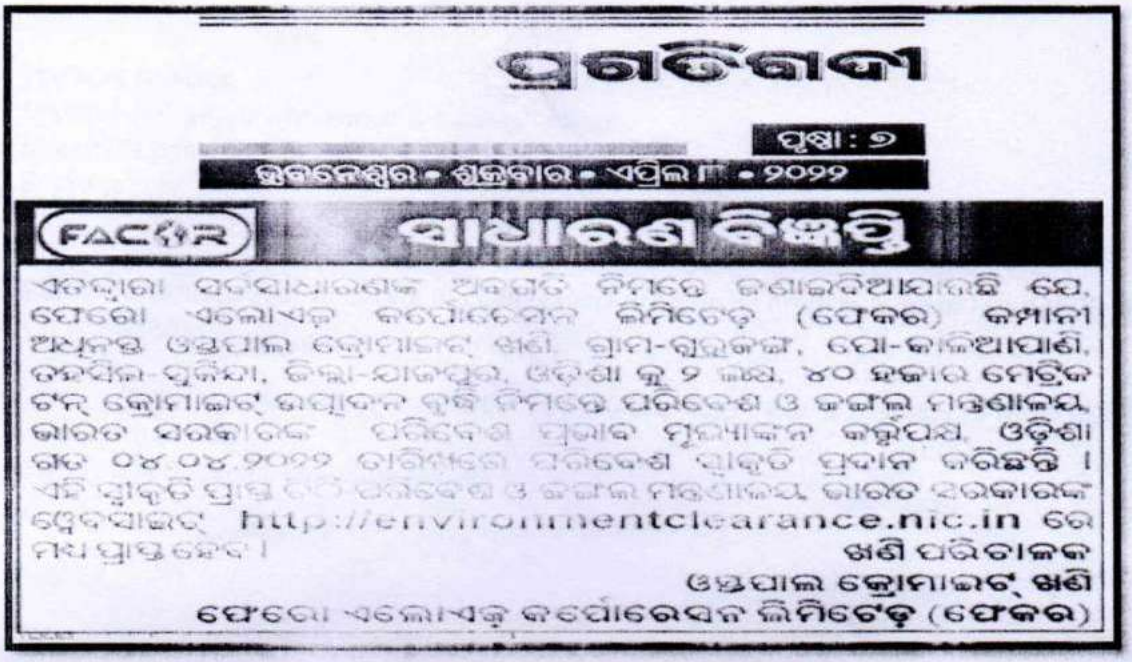
Encl: A/a

Ferro Alloys Corporation Limited
Charge Chrome Plant, D.P. Nagar, Randia - 756 135, Dist. Bhadrak, Odisha, India.
Phone : 06784 240320/240347/240272, Fax : 06784 240626.
E-mail : Facor.corporate@vedanta.co.in I Website : www.facorgroup.in
CIN : L45201OR1955PLC008400

Annexure No.-1

PAPER ADVERTISEMENT

1. Publication in Odiya Daily Paper Pragativadi Dated 08.04.2022



ପ୍ରଗତିବାଦୀ

ପୃଷ୍ଠା : ୭

ଭୁବନେଶ୍ୱର • ଶୁକ୍ରବାର • ଏପ୍ରିଲ ୮ • ୨୦୨୨

FACOR

ସାଧାରଣ ବିଜ୍ଞପ୍ତି

ଏତଦ୍ଦ୍ୱାରା ସର୍ବସାଧାରଣଙ୍କ ଅବଗତି ନିମନ୍ତେ ଜଣାଇଦିଆଯାଉଛି ଯେ, ଫେରୋ ଏଲୋଏଜ୍ କର୍ପୋରେସନ ଲିମିଟେଡ୍ (ଫେକର) କମ୍ପାନୀ ଅନୁକୂଳ ଓଷ୍ଟପାଲ କ୍ରୋମାଇଟ୍ ଖଣି, ଗ୍ରାମ-ଗୁରୁଜଙ୍ଗ, ପୋ-କାଲିଆପାଣି, ତହସିଲ-ପୁରୀଧା, ଜିଲ୍ଲା-ଯାଜପୁର, ଓଡ଼ିଶା କୁ ୨ ଲକ୍ଷ, ୪୦ ହଜାର ମେଟ୍ରିକ ଟନ୍ କ୍ରୋମାଇଟ୍ ଉତ୍ପାଦନ ବୃଦ୍ଧି ନିମନ୍ତେ ପରିବେଶ ଓ ଜଙ୍ଗଲ ମନ୍ତ୍ରଣାଳୟ, ଭାରତ ସରକାରଙ୍କ ପରିବେଶ ପ୍ରଭାବ ମୂଲ୍ୟାଙ୍କନ କର୍ତ୍ତୃପକ୍ଷ, ଓଡ଼ିଶା ଗତ ୦୪.୦୪.୨୦୨୨ ତାରିଖରେ ପରିବେଶ ଛାଡ଼ପତ୍ର ପ୍ରଦାନ କରିଛନ୍ତି । ଏହି ଛାଡ଼ପତ୍ର ପ୍ରାପ୍ତ ହେବା ପରିବେଶ ଓ ଜଙ୍ଗଲ ମନ୍ତ୍ରଣାଳୟ, ଭାରତ ସରକାରଙ୍କ ୱେବସାଇଟ୍ http://environmentclearance.nic.in ରେ ମଧ୍ୟ ପ୍ରାପ୍ତ ହେବ ।

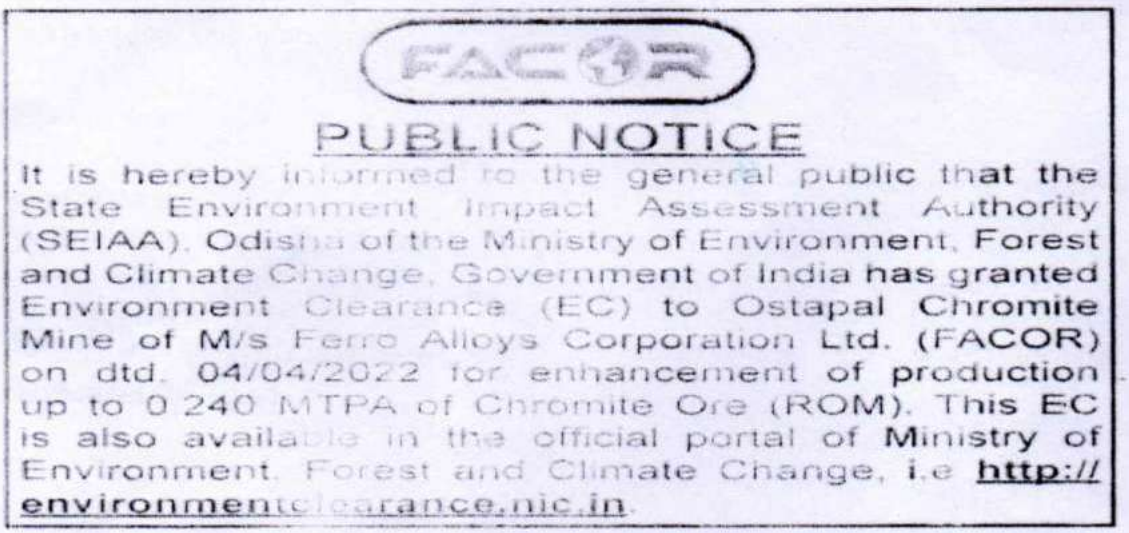
ଖଣି ପରିଚାଳକ

ଓଷ୍ଟପାଲ କ୍ରୋମାଇଟ୍ ଖଣି

ଫେରୋ ଏଲୋଏଜ୍ କର୍ପୋରେସନ ଲିମିଟେଡ୍ (ଫେକର)

Link is : https://pragativadi.com/epaper/epaper_news/1/2022-04-08

2.Published in English daily paper Orissa Postdated 08.04.2022



FACOR

PUBLIC NOTICE

It is hereby informed to the general public that the State Environment Impact Assessment Authority (SEIAA), Odisha of the Ministry of Environment, Forest and Climate Change, Government of India has granted Environment Clearance (EC) to Ostapal Chromite Mine of M/s Ferro Alloys Corporation Ltd. (FACOR) on dtd. 04/04/2022 for enhancement of production up to 0.240 MTPA of Chromite Ore (ROM). This EC is also available in the official portal of Ministry of Environment, Forest and Climate Change, i.e **http://environmentclearance.nic.in**.

Link : http://odishapostepaper.com/edition/4041/orissapost/page/5

Water Consumption for Dust suppression OSTAPAL CHROMITE MINE		
For the Year 2022-23		
Months	**Ostapal Mines**	
	Trips	**KL**
April	521	6252
May	281	3372
June	272	3264
July	36	432
August	17	204
September	76	912
October	158	1896
Nov		0
Dec		0
Jan		0
TOTAL	1361	16332
Avg per trip day		
Avg KL per day		

OCM/CGWB/ 1444 /2022 Date: 08.11.2022

To
The Member Secretary,
State Pollution Control board,
Bhubaneswar, Odisha

SUB:- Submission of Ground water Level & Quality Monitoring report for the period July'22 to September'22 in respect to Ostapal Chromite Mine of M/s. FACOR Ltd.

Dear Sir,

We are submitting the ground water level and quality monitoring report carried out by NABL lab for the period July'22 to September'22 for your kind information.

Monitoring reports are attached as annexure 1 & annexure 2

1.) Annexure 1 – Ground Water Level
2.) Annexure 2 – Ground Water Quality

Thanking You,

Yours Faithfully
Ferro Alloys Corporation LTD

Head Environment

cc:- RO, Kalinganagar, Jajpur, ODISHA

VEDANTA LIMITED (Formerly known as Sesa Sterlite Limited/Sesa Goa Limited)
Ferro Alloys Corporation Limited, Charge Chrome Plant, P.O. Nagar, Randia - 756 135,Dist. Bhadrak, Odisha, India. Phone : 06784 240320/240347/240272, Fax : 06784 240626.
E-Mail : Facor.corporate@vedanta.co.in | Website : www.facorgroup.in

Ref : Envlab/22/R -8337 **Date : 10.10.2022**

GROUND WATER LEVEL REPORT- SEPT 2022

1. Name of Client : **M/s FERRO ALLOYS CORPORATION LIMITED , BHADRAK**
2. Name of the Project : **OSTAPAL CHROMITE MINES , KALIAPANI, JAJPUR**
3. **Date of Sampling : 21.09.2022**
4. Sample Collected by : VCSPL Representative in presence of Client's Representative

SL. No.	Locations	Unit	DOS	Analysis Result
1	Bore well Near Workshop of Mines	mt/bgl	21.09.2022	11.2
2	Bore well Near Main Gate of OCM	mt/bgl	21.09.2022	10.9
3	Open Well Near Ostia Village	mt/bgl	21.09.2022	5.5
4	Open Well Near Ostapal Village	mt/bgl	21.09.2022	5.6
5	Tube well inside Shiva Temple of the Village Gurujanga	mt/bgl	21.09.2022	11.3
6	Tube well outside Shiva Temple of the Village Gurujanga	mt/bgl	21.09.2022	11.1
7	Eastern side of the Quarry (PZ-1)	mt/bgl	21.09.2022	5.4
8	Southern side of the Quarry (PZ-2)	mt/bgl	21.09.2022	4.9
9	Watstern side of the Quarry (PZ-3)	mt/bgl	21.09.2022	5.2

Reviewed By

roved By

Ref : Envlab/22/R-8330 **Date : 10.10.2022**

GROUND WATER QUALITY ANALYSIS REPORT- SEPT 2022

1. Name of Client : **M/s FERRO ALLOYS CORPORATION LIMITED , BHADRAK**
2. Name of the Project : **OSTAPAL CHROMITE MINES , KALIAPANI, JAJPUR**
3. Sampling Location : **GW1:** Bore well Near Work Shop of the Mines
   GW2: Bore Well Near Main Gate of OCM
   GW3: Open Well Near Ostia Village
4. Method of Sampling **: APHA 1060 B**
5. **Date of Sampling : 21.09.2022**
6. Date of Analysis **: 22.09.2022 TO 28.09.2022**
7. Sample Collected by : VCSPL Representative in presence of Client's Representative

Sl. No.	Parameter	Testing Method	Unit	Standard as per IS -10500:2012 Amended on 2015 & 2018		Analysis Result		
				Acceptable Limit	Permissible Limit	GW1	GW2	GW3
Essential Characteristics								
1	Colour	**Visual Comparison Method** APHA 23RD Ed,2017 : 2120 B, C	Hazen	5	15	<5	<5	<5
2	Odour	**Threshold Odour Test** APHA 23RD Ed,2017 :2150 B	--	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
3	Taste	**Flavor Threshold Test** APHA 23RD Ed,2017 : 2160 C	--	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
4	Turbidity	**Nephelometric Method** APHA 23RD Ed,2017 :2130 B	NTU	1	5	3.2	2.6	3.5
5	pH Value at 25^0C	**pH Meter** APHA 23RD Ed,2017 : 4500H^+B	--	6.5-8.5	No Relaxation	6.79	6.91	6.96
6	Total Hardness (as $CaCO_3$)	**EDTA Titrimetric Method** APHA 23 Ed,2017 : 2340 C	mg/l	200	600 Relaxation	182	192	186
7	Iron (as Fe)	**By AAS Method** APHA 23RD Ed,2017 : 3111 B, APHA 23RD Ed,2017 : 4500cI B	mg/l	1.0	No	0.25	0.22	0.27
8	Chloride (as Cl)	**Argentometric Method** APHA 23RD Ed,2017 : 4500Cl, B	mg/l	250	1000	50	45	40
9	Residual, free Chlorine	**Iodometric Method** APHA 23RD Ed,2017 : 2540 C	mg/l	0.2	1	0.20	0.22	0.24
Desirable Characteristics								
10	Dissolved Solids	**Gravimetric Method** APHA 23RD Ed,2017 : 3500Ca B	mg/l	500	2000	271	332	273
11	Calcium (as Ca)	**EDTA Titrimetric Method** APHA 23RD Ed,2017 : 3500Mg B	mg/l	75	200	47.9	45.2	49.1
12	Magnesium (as Mg)	**Calculation Method**	mg/l	30	100	15.6	19.2	15.4
13	Copper (as Cu)	**By AAS Method** APHA 23RD Ed,2017: 3111 B	mg/l	0.05	1.5	BDL	BDL	BDL
14	Manganese (as Mn)	**Persulfate Method** APHA 23RD Ed,2017: 4500SO_4^{2-} E	mg/l	0.1	0.3	BDL	BDL	BDL
15	Sulphate (as SO_4)	**Turbidimetric Method** APHA 23RD Ed,2017: 4500 NO_3	mg/l	200	400	29.2	30.1	31.9
16	Nitrate (as NO_3)	**By UV-Screen Method** E	mg/l	45	No Relaxation	8.2	7.6	6.9
17	Fluoride (as F)	**Distillation followed by Spectophotometric Method** APHA 23RD Ed,2017: 4500F^- C	mg/l	1.0	1.5	0.15	0.12	0.20
18	Phenolic Compounds (as C_6H_5OH)	**Chloroform Extraction by Colorimetric Method** APHA 23RD Ed,2017: 5530 B,D	mg/l	0.001	0.002	BDL	BDL	BDL
19	Mercury (as Hg)	**AAS Method** APHA 23RD Ed,2017: 3112 B	mg/l	0.001	No Relaxation	BDL	BDL	BDL
20	Cadmium (as Cd)	**AAS Method** APHA 23RD Ed,2017: 3111 B	mg/l	0.003	No Relaxation	BDL	BDL	BDL
21	Selenium (as Se)	**By AAS Method** APHA 23RD Ed,2017: 3500 Se C	mg/l	0.01	No Relaxation	BDL	BDL	BDL

22	Arsenic (as As)	**By AAS Method** APHA 23RD Ed,2017: 3114 B	mg/l	**0.01**	**No Relaxation**	BDL	BDL	BDL
23	Cyanide (as CN)	**Distillation followed by Spectophotometric Method** APHA 23RD Ed,2017: 4500 CN^- C,D	mg/l	**0.05**	**No Relaxation**	BDL	BDL	BDL
24	Lead (as Pb)	**By AAS Method** APHA 23RD Ed,2017 3111 B	mg/l	**0.01**	**No Relaxation**	BDL	BDL	BDL
25	Zinc (as Zn)	**By AAS Method** APHA 23RD Ed,2017: 3111 B APHA 23RD Ed,2017: 5540 C	mg/l	**5**	**15**	1.4	2.2	2.0
26	Anionic Detergents (as MBAS)	**Anionic Surfactants as MBAS**	mg/l	**0.2**	**Relaxation**	BDL	BDL	BDL
27	Hexavalent chromium as Cr^{+6}	APHA 3500 Cr B	mg/l	**0.05**	**No Relaxation**	BDL	BDL	BDL
28	Mineral Oil	**Partition Gravimetric Method** APHA 23RD Ed,2017: 5520 B	mg/l	**0.5**	**No**	BDL	BDL	BDL
29	Alkalinity	**Titration Method**	mg/l	**200**	**600**	170	205	180
30	Aluminium as(Al)	**AAS Method** APHA 23RD Ed,2017: 3111 D	mg/l	**0.03**	**0.2**	BDL	BDL	BDL
31	Boron (as B)	**Curcumin Method** APHA 23RD Ed,2017: 4500B, B	mg/l	**0.5**	**2.4**	BDL	BDL	BDL
32	Total Coliform as TC	**MPN Method** APHA 23RD Ed,2017 : 9221 b	MPN/ 100ml	Shall not be detectable in any 100ml	--	ND	ND	ND

CL – Colourless, ND – Not detected.

BDL (Below detection limit) Values :(Cu<0.02 mg/l , Mn<0.025 mg/l, C_6H_5OH<0.05 mg/l, Hg<0.004mg/l, Cd<0.01 mg/l ,Se<0.001 mg/l, As<0.004 mg/l,Pb<0.02 mg/l, Zn<0.03 mg/l, Cr^{+6}<0.01 mg/l, Al<0.1 mg/l , B<0.1 mg/l, $NO_3$1 mg/l)

Reviewed B

Approved By

Ref : Envlab/22/R- 8331 **Date : 10.10.2022**

GROUND WATER QUALITY ANALYSIS REPORT- SEPT 2022

1. Name of Client : **M/s FERRO ALLOYS CORPORATION LIMITED , BHADRAK**
2. Name of the Project : **OSTAPAL CHROMITE MINES , KALIAPANI, JAJPUR**
3. Sampling Location : **GW4:** Open Well Near Ostapal Village
   GW5: Tube Well inside the Shiva Temple of Village Gurujanga
   GW6: Tube Well outside Shiva Temple of Village Gurujanga
4. Method of Sampling **: APHA 1060 B**
5. **Date of Sampling : 21.09.2022**
6. Date of Analysis **: 22.09.2022 to 28.09.2022**
7. Sample Collected by : VCSPL Representative in presence of Client's Representative

Sl. No.	Parameter	Testing Method	Unit	Standard as per IS -10500:2012 Amended on 2015 & 2018		Analysis Result		
				Acceptable Limit	Permissible Limit	GW4	GW5	GW6
Essential Characteristics								
1	Colour	**Visual Comparison Method** APHA 23RD Ed,2017 : 2120 B, C	Hazen	5	15	<5	<5	<5
2	Odour	**Threshold Odour Test** APHA 23RD Ed,2017 :2150 B	--	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
3	Taste	**Flavor Threshold Test** APHA 23RD Ed,2017 : 2160 C	--	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
4	Turbidity	**Nephelometric Method** APHA 23RD Ed,2017 :2130 B	NTU	1	5	2.2	3.1	2.5
5	pH Value	**pH Meter** APHA 23RD Ed,2017 : 4500H^+ B	--	6.5-8.5	No Relaxation	7.22	7.36	7.27
6	Total Hardness (as $CaCO_3$)	**EDTA Titrimetric Method** APHA 23RD Ed,2017 : 2340 C	mg/l	200	600	112	94	78
7	Iron (as Fe)	**By AAS Method** APHA 23RD Ed,2017 : 3111, B	mg/l	1.0	No Relaxation	0.22	0.23	0.17
8	Chloride (as Cl)	**Argentometric Method** APHA 23RD Ed,2017 : 4500Cl^- B	mg/l	250	1000	45	50	55
9	Residual, free Chlorine	**Iodometric Method** APHA 23RD Ed,2017 : 4500Cl, B	mg/l	0.2	1	0.24	0.25	0.20
Desirable Characteristics								
10	Dissolved Solids	**Gravimetric Method** APHA 23RD Ed,2017 : 2540 C	mg/l	500	2000	186	124	112
11	Calcium (as Ca)	**EDTA Titrimetric Method** APHA 23RD Ed,2017 : 3500Ca B	mg/l	75	200	35	30	21
12	Magnesium (as Mg)	**Calculation Method** APHA 23RD Ed,2017 : 3500Mg B	mg/l	30	100	6.0	4.7	6.2
13	Copper (as Cu)	**By AAS Method** APHA 23RD Ed,2017: 3111 B	mg/l	0.05	1.5	BDL	BDL	BDL
14	Manganese (as Mn)	**Persulfate Method** APHA 23RD Ed,2017: 3500Mn B	mg/l	0.1	0.3	BDL	BDL	BDL
15	Sulphate (as SO_4)	**Turbidimetric Method** APHA 23RD Ed,2017: 4500 $SO4^{2-}$ E	mg/l	200	400	4.2	3.9	4.1
16	Nitrate (as NO_3)	**By UV-Screen Method** APHA 23RD Ed,2017: 4500 NO_3^- E	mg/l	45	No Relaxation	1.51	0.82	0.67
17	Fluoride (as F)	**Distillation followed by Spectophotometric Method** APHA 23RD Ed,2017: 4500F^- C	mg/l	1.0	1.5	0.015	0.018	0.014
18	Phenolic Compounds	**Chloroform Extraction by**	mg/l	0.001	0.002	BDL	BDL	BDL

	(as C_6H_5OH)	APHA 23RD Ed,2017: 5530 B,D						
19	Mercury (as Hg)	**AAS Method** APHA 23RD Ed,2017: 3112 B	mg/l	**0.001**	**No Relaxation**	BDL	BDL	BDL
20	Cadmium (as Cd)	**AAS Method** APHA 23RD Ed,2017: 3111 B	mg/l	**0.003**	**No Relaxation**	BDL	BDL	BDL
21	Selenium (as Se)	**By AAS Method** APHA 23RD Ed,2017: 3500 Se C	mg/l	**0.01**	**No Relaxation**	BDL	BDL	BDL
22	Arsenic (as As)	**By AAS Method** APHA 23RD Ed,2017: 3114 B	mg/l	**0.01**	**No Relaxation**	BDL	BDL	BDL
23	Cyanide (as CN)	**Distillation followed by Spectophotometric Method** APHA 23RD Ed,2017: 4500 CN^- C,D	mg/l	**0.05**	**No Relaxation**	BDL	BDL	BDL
24	Lead (as Pb)	**By AAS Method** APHA 23RD Ed,2017 3111 B	mg/l	**0.01**	**No Relaxation**	BDL	BDL	BDL
25	Zinc (as Zn)	**By AAS Method** APHA 23RD Ed,2017: 3111 B	mg/l	**5**	**15**	2.1	2.5	2.2
26	Anionic Detergents (as MBAS)	**Anionic Surfactants as MBAS** APHA 23RD Ed,2017: 5540 C	mg/l	**0.2**	**--**	BDL	BDL	BDL
27	Hexavalent chromium as Cr^{+6}	APHA 3500 Cr B	mg/l	**0.05**	**No Relaxation**	BDL	BDL	BDL
28	Mineral Oil	**Partition Gravimetric Method** APHA 23RD Ed,2017: 5520 B	mg/l	**0.5**	**No Relaxation**	BDL	BDL	BDL
29	Alkalinity	**Titration Method** APHA 23RD Ed,2017:2320 B	mg/l	**200**	**600**	70	30	45
30	Aluminium as(Al)	**AAS Method** APHA 23RD Ed,2017: 3111 D	mg/l	**0.03**	**0.2**	BDL	BDL	BDL
31	Boron (as B)	**Curcumin Method** APHA 23RD Ed,2017: 4500B, B	mg/l	**0.5**	**2.4**	BDL	BDL	BDL
32	Total Coliform as TC	**MPN Method** APHA 23RD Ed,2017 : 9221 b	MPN/ 100ml	Shall not be detectable in any 100ml sample	--	ND	ND	ND

CL – Colorless, ND – Not detected.

BDL (Below detection limit) Values :(Cu<0.02 mg/l , Mn<0.025 mg/l, C_6H_5OH<0.05 mg/l, Hg<0.004mg/l, Cd<0.01 mg/l ,Se<0.001 mg/l, As<0.004 mg/l,Pb<0.02 mg/l, Zn<0.03 mg/l, Cr^{+6}<0.01 mg/l, Al<0.1 mg/l , B<0.1 mg/l, $NO_3$1 mg/l)

Reviewed By

ved By

Ref : Envlab/22/R- 8332 **Date : 10.10.2022**

GROUND WATER QUALITY ANALYSIS REPORT- SEPT 2022

1. Name of Client : **M/s FERRO ALLOYS CORPORATION LIMITED , BHADRAK**
2. Name of the Project : **OSTAPAL CHROMITE MINES , KALIAPANI, JAJPUR**
3. Sampling Location : **GW7:** Eastern Side of the Quarry (PZ-1)
   GW8: Southern Side of the Quarry (PZ-2)
   GW9: Western Side of the Quarry (PZ-3)
4. Method of Sampling **: APHA 1060 B**
5. **Date of Sampling : 21.09.2022**
6. Date of Analysis **: 22.09.2022 to 28.09.2022**
7. Sample Collected by : VCSPL Representative in presence of Client's Representative

Sl. No.	Parameter	Testing Method	Unit	Standard as per IS -10500:2012 Amended on 2015 & 2018		Analysis Result		
				Permissible Limit	Permissible Limit	GW7	GW8	GW9
Essential Characteristics								
1	Colour	**Visual Comparison Method** APHA 23RD Ed,2017 : 2120 B, C	Hazen	**5**	**15**	<5	<5	<5
2	Odour	**Threshold Odour Test** APHA 23RD Ed,2017 :2150 B	--	**Agreeable**	**Agreeable**	Agreeable	Agreeable	Agreeable
3	Taste	**Flavor Threshold Test** APHA 23RD Ed,2017 : 2160 C	--	**Agreeable**	**Agreeable**	Agreeable	Agreeable	Agreeable
4	Turbidity	**Nephelometric Method** APHA 23RD Ed,2017 :2130 B	NTU	**1**	**5**	2.7	3.2	2.6
5	pH Value	**pH Meter** APHA 23RD Ed,2017 : 4500H^+ B	--	**6.5-8.5**	**No Relaxation**	7.11	7.29	7.32
6	Total Hardness (as $CaCO_3$)	**EDTA Titrimetric Method** APHA 23 Ed,2017 : 2340 C	mg/l	**200**	**600 Relaxation**	124	116	94
7	Iron (as Fe)	**By AAS Method** APHA 23RD Ed,2017 : 3111 B APHA 23RD Ed,2017 : 3500Fe B	mg/l	**1.0**	**No**	0.25	0.22	0.19
8	Chloride (as Cl)	**Argentometric Method**	mg/l	**250**	**1000**	50	55	40
9	Residual, free Chlorine	**Iodometric Method** APHA 23RD Ed,2017 : 4500Cl, B	mg/l	**0.2**	**1**	0.19	0.18	0.19
Desirable Characteristics								
10	Dissolved Solids	**Gravimetric Method** APHA 23RD Ed,2017 : 2540 C	mg/l	**500**	**2000**	223	187	155
11	Calcium (as Ca)	**EDTA Titrimetric Method** APHA 23RD Ed,2017 : 3500Ca B	mg/l	**75**	**200**	35	31	28
12	Magnesium (as Mg)	**Calculation Method** APHA 23RD Ed,2017 : 3500Mg B	mg/l	**30**	**100**	8.9	9.4	5.9
13	Copper (as Cu)	**By AAS Method** APHA 23RD Ed,2017: 3111 B	mg/l	**0.05**	**1.5**	BDL	BDL	BDL
14	Manganese (as Mn)	**Persulfate Method** APHA 23RD Ed,2017: 3500Mn B	mg/l	**0.1**	**0.3**	BDL	BDL	BDL
15	Sulphate (as SO_4)	**Turbidimetric Method** APHA 23RD Ed,2017: 4500 SO_4^{2-} E	mg/l	**200**	**400**	4.2	4.5	4.21
16	Nitrate (as NO_3)	**By UV-Screen Method** APHA 23RD Ed,2017: 4500 NO_3^- E	mg/l	**45**	**No Relaxation**	1.49	0.86	0.81
17	Fluoride (as F)	**Distillation followed by Spectrophotometric Method** APHA 23RD Ed,2017: 4500F^- C	mg/l	**1.0**	**1.5**	0.015	0.016	0.012
18	Phenolic Compounds (as C_6H_5OH)	**Chloroform Extraction by Colorimetric Method** APHA 23RD Ed,2017: 5530 B,D	mg/l	**0.001**	**0.002**	BDL	BDL	BDL
19	Mercury (as Hg)	**AAS Method** APHA 23RD Ed,2017: 3112 B	mg/l	**0.001**	**No Relaxation**	BDL	BDL	BDL
20	Cadmium (as Cd)	**AAS Method** APHA 23RD Ed,2017: 3111 B	mg/l	**0.003**	**No Relaxation**	BDL	BDL	BDL
21	Selenium (as Se)	**By AAS Method** APHA 23RD Ed,2017: 3500 Se C	mg/l	**0.01**	**No Relaxation**	BDL	BDL	BDL

22	Arsenic (as As)	**By AAS Method** APHA 23RD Ed,2017: 3114 B	mg/l	**0.01**	**No Relaxation**	BDL	BDL	BDL
23	Cyanide (as CN)	**Distillation followed by Spectophotometric Method** APHA 23RD Ed,2017: 4500 CN^- C,D	mg/l	**0.05**	**No Relaxation**	BDL	BDL	BDL
24	Lead (as Pb)	**By AAS Method** APHA 23RD Ed,2017 3111 B	mg/l	**0.01**	**No Relaxation**	BDL	BDL	BDL
25	Zinc (as Zn)	**By AAS Method** APHA 23RD Ed,2017: 3111 B	mg/l	**5**	**15**	3.4	4.2	4.5
26	Anionic Detergents (as MBAS)	**Anionic Surfactants as MBAS** APHA 23RD Ed,2017: 5540 C	mg/l	**0.2**	**--**	ND	ND	ND
27	Hexavalent chromium as Cr^{+6}	APHA 3500 Cr B	mg/l	**0.05**	**No Relaxation**	BDL	BDL	BDL
28	Mineral Oil	**Partition-Gravimetric Method** APHA 23RD Ed,2017: 5520 B	mg/l	**0.5**	**No Relaxation**	ND	ND	ND
29	Alkalinity	**Titration Method** APHA 23RD Ed,2017:2320 B	mg/l	**200**	**600**	55	50	40
30	Aluminium as(Al)	**AAS Method** APHA 23RD Ed,2017: 3111 D	mg/l	**0.03**	**0.2**	BDL	BDL	BDL
31	Boron (as B)	**Curcumin Method** APHA 23RD Ed,2017: 4500B, B	mg/l	**0.5**	**2.4**	BDL	BDL	BDL
32	Total Coliform as TC	**MPN Method** APHA 23RD Ed,2017 : 9221 b	MPN/ 100ml	Shall not be detectable in any 100ml sample	--	ND	ND	ND

CL – Colorless, ND – Not detected.

BDL (Below detection limit) Values :(Cu<0.02 mg/l , Mn<0.025 mg/l, C_6H_5OH<0.05 mg/l, Hg<0.004mg/l, Cd<0.01 mg/l ,Se<0.001 mg/l, As<0.004 mg/l,Pb<0.02 mg/l, Zn<0.03 mg/l, Cr^{+6}<0.01 mg/l, Al<0.1 mg/l , B<0.1 mg/l, $NO_3$1 mg/l)

Reviewed By

ved By

ANNEXURE - 17

OCM/ENV/1447/2022 Date: 09.11.2022

To
The Member Secretary
SEIAA Bhubaneswar

SUB:- Submission of Surface water quality report of Dhamsala Nallah Upstream & Downstream for the period July'22 to September'22 in respect to Ostapal Chromite Mine of M/s. FACOR Ltd.

Dear Sir,

We are submitting the Surface water quality report of Dhamsala Nallah Upstream (Upto 100 mtr UP) & Dhamsala Nallah Downstream (Upto 100 mtr Down) carried out by NABL lab for the period July'22 to September'22 for your kind information.

Thanking You,

Yours Faithfully
Ferro Alloys Corporation LTD

Head Environment

M/s. Ferro Alloys Corporation Ltd. (A subsidiary of Vedanta Ltd.)
Registered Office:
D.P. Nagar, PO: Randia, Dist.: Bhadrak, Odisha, India - 756 135
T +91-6784 240320/240347, Email: facor.mines@vedanta.co.in / facor.ccp@vedanta.co.in

Ref : Envlab/22/R- 8342 **Date : 10.10.2022**

SURFACE WATER QUALITY ANALYSIS REPORT- SEPT 2022

1. Name of Client : **M/s FERRO ALLOYS CORPORATION LIMITED , BHADRAK**
2. Name of the Project : **OSTAPAL CHROMITE MINES , KALIAPANI, JAJPUR**
3. Sampling Location : **SW1:** Damsala Nallah Upstream Water (100 mtr Up)
   SW2: Damsala Nallah Downstream Water (100 mtr Down)
   (With impact of other mines discharge)
4. Method of Sampling : **APHA 1060 B**
5. **Date of Sampling** : **21.09.2022**
6. Date of Analysis : **22.09.2022 to 28.09.2022**
7. Sample Collected by : VCSPL Representative in presence of Client's Representative

Sl. No	Parameter	Testing Method	Unit	Standards as per IS-2296:1992 Class –'C'	Analysis Results	
					SW-1	SW-2
1	Colour (max)	**Visual Comparison Method** APHA 23RD Ed,2017 : 2120 B, C	Hazen	**300**	<5	5
2	pH Value at 25°C	**pH Meter** APHA 23RD Ed,2017 : 4500H^+ B	--	**6.0-9.0**	7.33	7.37
3	Suspended solids	**Gravimetric Method** APHA 23RD Ed,2017 : 2540 D	mg/l	**--**	48	63
4	Dissolved Oxygen (minimum)	**Modified Winkler Method** APHA 23RD Ed,2017 : 2540 C	mg/l	**4.0**	6.4	6.2
5	Turbidity	**Nephelometric Method** APHA 23RD Ed,2017: 2130 B	NTU	**--**	5.8	9.2
6	Chloride (max)	**Titrimetric Method** APHA 23RD Ed,2017: 4500Cl^- B	mg/l	**600**	10	15
7	Total Dissolved Solids	**Gravimetric Method** APHA 23RD Ed,2017: 2540 C	mg/l	**1500**	89	123
8	BOD (3) days at 27°C (max)	IS 3025(P-44) : 1993 RA 2003	mg/l	**3.0**	BDL	BDL
9	Arsenic as As	**By AAS Method** APHA 23RD Ed,2017: 3114 B	mg/l	**0.2**	BDL	BDL
10	Lead as Pb(max)	**By AAS Method** APHA 23RD Ed,2017 3111 B	mg/l	**0.1**	BDL	BDL
11	Cadmium as Cd (max)	**By AAS Method** APHA 23RD Ed,2017: 3111 B	mg/l	**0.01**	BDL	BDL
12	Hexa Chromium as Cr^{+6}	**Diphenyl Carbazide Method** APHA 23RD Ed,2017: 3500Cr B	mg/l	**0.05**	BDL	BDL
13	Copper as Cu (max)	**By AAS Method** APHA 23RD Ed,2017: 3111 B	mg/l	**1.5**	BDL	BDL
14	Zinc as Zn(max)	**By AAS Method** APHA 23RD Ed,2017: 3111 B	mg/l	**15**	BDL	BDL
15	Selenium as Se (max)	**By AAS Method** APHA 23RD Ed,2017: 3500 Se C	mg/l	**0.05**	BDL	BDL
16	Cyanide as CN (max)	**Distillation followed by Spectophotometric Method** APHA 23RD Ed,2017: 4500 CN^- C,D	mg/l	**0.05**	BDL	BDL
17	Fluoride as F (max)	**Distillation followed by Spectophotometric Method** APHA 23RD Ed,2017: 4500F^- C	mg/l	**1.5**	0.11	0.15
18	Sulphates (SO_4) (max)	**Turbidimetric Method** APHA 23RD Ed,2017: 4500 $SO4^{2-}$ E	mg/l	**400**	0.58	0.69

19	Phenolic Compounds as C_6H_5OH (max)	**Chloroform Extraction By Colorimetric Method** APHA 23RD Ed,2017: 5530 B,D	mg/l	**0.005**	BDL	BDL
20	Iron as Fe (max)	**By AAS Method** APHA 23RD Ed,2017: 3500Fe, B	mg/l	**0.5**	0.39	0.04
21	Nitrate as NO_3, (max)	**By UV-Screen Method** APHA 23RD Ed,2017: 4500 NO_3^- E	mg/l	**50**	1.7	1.4
22	Anionic Detergents (max)	**Anionic Surfactants as MBAS** APHA 23RD Ed,2017: 5540 C	mg/l	**1.0**	ND	ND
23	Total Coli form	**By Multiple Tube Fermentation Technique** APHA 23RD Ed,2017: 9221 B	MPN/ 100 ml	**5000**	540	920

CL – Colorless, ND – Not detected.

BDL (Below detection limit) Values :(Cu<0.02 mg/l , Mn<0.025 mg/l, C_6H_5OH<0.05 mg/l, Hg<0.004mg/l, Cd<0.01 mg/l ,Se<0.001 mg/l, As<0.004 mg/l,Pb<0.02 mg/l, Zn<0.03 mg/l, Cr^{+6}<0.01 mg/l, Al<0.1 mg/l , B<0.1 mg/l, $NO_3$1 mg/l)

Reviewed By

Approved By

ANNEXURE - 18

OCM/CGWB/1446/2022 Date: 08.11.2022

To
The Regional Director
Central Ground Water Board
South Eastern Region
Bhujal Bhawan, Khandagiri Square
Bhubaneswar – 751001

SUB:- Submission of water quality report of mines discharge water for the period July'22 to September'22 in respect to Ostapal Chromite Mine of M/s. FACOR Ltd.

Dear Sir,

We are submitting the water quality monitoring report of mines discharge water carried out by NABL lab for the period July'22 to September'22 for your kind information.

Monitoring reports are attached as annexure 1 & annexure 2

1.) Annexure 1 – ETP Inlet Water analysis report (Mines Dewatering)
2.) Annexure 2 – ETP Outlet water analysis report

Thanking You,

Yours Faithfully
Ferro Alloys Corporation LTD

Head Environment

M/s. Ferro Alloys Corporation Ltd. (A subsidiary of Vedanta Ltd.)
Registered Office:
D.P. Nagar, PO: Randia, Dist.: Bhadrak, Odisha, India - 756 135
T +91-6784 240320/240347, Email: facor.mines@vedanta.co.in / facor.ccp@vedanta.co.in

Ref : Envlab/22/R- 8333 **Date : 10.10.2022**

EFFLUENT WATER ANALYSIS REPORT SEPT 2022

1. Name of the Client : **M/s FERRO ALLOYS CORPORATION LIMITED , BHADRAK**
2. Name of the Project : **OSTAPAL CHROMITE MINES , KALIAPANI, JAJPUR**
3. Sampling Location : **WW-1**: ETP Inlet
4. Method of sampling : APHA 1060 B
5. Date of Sampling : 21.09.2022
6. Date of Analysis : 22.09.2022 to 28.09.2022
7. Sample Collected by : VCSPL Representative in presence of Client representative

Sl No	Test Parameter	Test Method	Unit	WW-1
1	Color	**Visual Comparison Method** APHA 23RD Ed,2017 : 2120 B, C	Hazen	10
2	Odour	**Threshold Odour Test** APHA 23RD Ed,2017 :2150 B		Pungent Smell
3	pH at 25^0C	**pH Meter** APHA 23RD Ed,2017 : 4500H+ B	--	9.76
4	Total Suspended Solids (as TSS)	**Gravimetric Method** APHA 23RD Ed,2017 : 2540 D	mg/l	55
5	Copper (as Cu)	**By AAS Method** APHA 23RD Ed,2017 3111 B	mg/l	BDL
6	Fluoride (as F)	**Distillation followed by Spectrophotometric Method** APHA 23RD Ed,2017: 4500F- C	mg/l	0.47
7	Total Residual Chloride	**Iodometric Method** APHA 23RD Ed,2017 : 4500Cl, B	mg/l	0.2
8	Iron (as Fe)	**By AAS Method** APHA 23RD Ed,2017 : 3111, B	mg/l	1.63
9	Manganese (as Mn)	**Persulfate Method** APHA 23RD Ed,2017: 3500Mn B	mg/l	BDL
10	Nitrate Nitrogen (as NO_3)	**By UV-Screen Method** APHA 23RD Ed,2017: 4500 NO_3^- E	mg/l	12.9
11	Phenolic Compound (as C_6H_5OH)	**Chloroform Extraction by Colorimetric Method** APHA 23RD Ed,2017: 5530 B,D	mg/l	BDL
12	Selenium (as Se)	**By AAS Method** APHA 23RD Ed,2017: 3500 Se C	mg/l	BDL
13	Cadmium (as Cd)	**AAS Method** APHA 23RD Ed,2017: 3111 B	mg/l	BDL
14	Cyanide (as CN)	**Distillation followed by Spectophotometric Method** APHA 23RD Ed,2017: 4500 CN- C,D	mg/l	BDL
15	Lead (as Pb)	**By AAS Method** APHA 23RD Ed,2017 3111 B	mg/l	BDL
16	Mercury (as Hg)	**AAS Method** APHA 23RD Ed,2017: 3112 B	mg/l	BDL
17	Nickel (as Ni)	**By AAS Method** APHA 23RD Ed,2017 3111 B	mg/l	BDL
18	Arsenic (as As)	**By AAS Method** APHA 23RD Ed,2017: 3114 B	mg/l	BDL
19	Total Chromium (as Cr)	**By AAS Method** APHA 23RD Ed,2017 3111 B	mg/l	1.38
20	Zinc (as Zn)	**By AAS Method** APHA 23RD Ed,2017 3111 B	mg/l	0.40
21	Hexavalent Chromium (as Cr^{+6})	**Diphenyl Carbazide Method** APHA 23RD Ed,2017: 3500Cr B	mg/l	0.65

22	Vanadium (as V)	**By AAS Method** APHA 23RD Ed,2017 3111 D	mg/l	BDL
23	Temperature	By Thermometer APHA 23RD Ed,2017 2550 B		35
24	Dissolved Oxygen	**Modified Winkler Method** APHA 23RD Ed,2017: 4500 O, C		6.8
25	Biochemical Oxygen Demand as BOD(3days at 27^0 C)	IS 3025(P-44) : 1993 RA 2003	mg/l	12.4
26	Chemical Oxygen Demand (as COD)	**Open Reflux Method** APHA 23RD Ed,2017: 5220 C	mg/l	240
27	Oil & Grease (as O & G)	**Gravimetric Method (Solvent Extraction)** APHA 23RD Ed,2017:5520-B	mg/l	12.0
28	Ammonical Nitrogen (as NH_3-N)	**TKN Instrument (Distillation) followed by Titrimetric Method** APHA 23RD Ed,2017 : 4500NH_3C	mg/l	7.9
29	Total Kjeldahl Nitrogen (as N)	**TKN Instrument (Digestion)** APHA 23RD Ed,2017: 4500 N_{ORG} C	mg/l	12.6
30	Sulphide (as S)	**Iodometric Method** APHA 23RD Ed,2017 : 4500 S^{2-}	mg/l	BDL
31	Free Ammonia (as NH_3)	**By Calculation**	mg/l	6.6
32	Particulate Size of Suspended Solids	Gravimetric Method APHA 23RD Ed,2017 : 2540 D	µ	<850
33	Bio- assay Test	IS 6582 (Part 2) 2001, Ed.2.1 (2002-12)	%	No fish Survived after 96 hours in 100% effluent

CL – Colorless, ND – Not detected.

BDL (Below detection limit) Values :(Cu<0.02 mg/l , Mn<0.025 mg/l, C_6H_5OH<0.05 mg/l, Hg<0.004mg/l, Cd<0.01 mg/l ,Se<0.001 mg/l, As<0.004 mg/l,Pb<0.02 mg/l, Zn<0.03 mg/l, Cr^{+6}<0.01 mg/l, Al<0.1 mg/l , B<0.1 mg/l, $NO_3$1 mg/l)

Reviewed By

pproved By

Ref : Envlab/22/R- 8334 **Date : 10.10.2022**

EFFLUENT WATER DISCHARGE ANALYSIS REPORT SEPT 2022

1. Name of the Client : **M/s FERRO ALLOYS CORPORATION LIMITED , BHADRAK**
2. Name of the Project : **OSTAPAL CHROMITE MINES , KALIAPANI, JAJPUR**
3. Sampling Location : **WW-1**: ETP Mines Final Discharge Water
4. Method of sampling : APHA 1060 B
5. Date of Sampling : 21.09.2022
6. Date of Analysis : 22.09.2022 to 28.09.2022
7. Sample Collected by : VCSPL Representative in presence of Client representative

Sl. No.	Parameters	Testing Methods	Unit	Standards (In land Surface water)	Analysis Results
					EW-1
1	Colour	**Visual Comparison Method** APHA 2120 B; 23rd Edition, 2017	Hazen	**Colourless**	10
2	Odour	**Threshold Odour Method** APHA 2150 B; 23rd Edition, 2017	--	**Odourless**	pungent smell
3	pH at 25^{0}C	**pH Meter** APHA 4500 H^+B; 23rd Edition, 2017	--	**5.5-9.0**	7.84
4	Total Suspended Solids	**Gravimetric Method** APHA 2540 D; 23rd Edition, 2017	mg/l	**100**	34
5	Copper as Cu	**By AAS Method** APHA 3111 B; 23rd Edition, 2017	mg/l	**3**	BDL
6	Fluoride as F	**Distillation followed by Spectophotometric Method** APHA 4500 F^- C,D; 23rd Edition, 2017	mg/l	**2**	0.31
7	Total Residual Chlorine	**Iodometric Method** APHA 23RD Ed,2017 : 4500Cl, B	mg/l	**1**	ND
8	Iron as Fe	**By AAS Method** APHA 3111 B; 23rd Edition, 2017	mg/l	**3**	0.42
9	Manganese as Mn	**By AAS Method** APHA 3111 B; 23rd Edition, 2017	mg/l	**2**	BDL
10	Nitrate as NO_3	**By UV-Screen Method** APHA 4500 NO_3^- B; 23rd Edition, 2017	mg/l	**10**	7.26
11	Phenolic Compounds as C_6H_5OH	**Distillation Followed by Spectophotometric Method** APHA 5530-B, D; 23rd Edition, 2017	mg/l	**1**	BDL
12	Selenium as Se	**By AAS Method** APHA 3500 Se C; 23rd Edition, 2017	mg/l	**0.05**	BDL
13	Cadmium as Cd	**By AAS Method** APHA 3111 B; 23rd Edition, 2017	mg/l	**2.0**	BDL
14	Cyanide as CN	**Distillation Followed by Spectophotometric Method** APHA 4500 –CN-C,E; 23rd Edition, 2017	mg/l	**0.2**	BDL
15	Lead as Pb	**By AAS Method** APHA 3111 B; 23rd Edition, 2017	mg/l	**0.1**	BDL
16	Mercury as Hg	**By AAS Method** APHA 3112 B; 23rd Edition, 2017	mg/l	**0.01**	BDL
17	Nickel as Ni	**By AAS Method** APHA 3111 B; 23rd Edition, 2017	mg/l	**3**	BDL
18	Arsenic as As	**By AAS Method** APHA 3114 B; 23rd Edition, 2017	mg/l	**0.2**	BDL
19	Total Chromium as Cr	**By AAS Method** APHA 3111 B; 23rd Edition, 2017	mg/l	**2**	0.25
20	Zinc as Zn	**By AAS Method** APHA 3111 B; 23rd Edition, 2017	mg/l	**5**	0.021
21	Hexavalent Chromium as Cr^{+6}	**By AAS Method** APHA 3500 Cr B; 23rd Edition, 2017	mg/l	**0.05(AS**	BDL
22	Vanadium as V	**By AAS Method** APHA 3500 V; 23rd Edition, 2017	mg/l	**0.2**	BDL

23	Temperature	**By Thermometer** APHA 2550 B; 23rd Edition, 2017	°C	**Shall not exceed 5^0C above the receiving water temperature**	35
24	Dissolved Oxygen	**Modified Winkler Method** APHA 4500 O. C; 23rd Edition, 2017	mg/l	**--**	6.8
25	Biochemical Oxygen Demand as BOD	**Oxygen Depletion Method** IS 3025 (Part 44):2003	mg/l	**30**	4.0
26	Chemical Oxygen Demand as COD	**Open Reflux Method** APHA 5220 B; 23rd Edition, 2017	mg/l	**250**	24
27	Oil & Grease	**Gravimetric Method (Solvent Extraction)** APHA 5520 B; 23rd Edition, 2017	mg/l	**10**	4.0
28	Ammonical Nitrogen as N	**By TKN Method** APHA 4500-NH_3 C; 23rd Edition, 2017	mg/l	**50**	3.8
29	Total Kjeldahl Nitrogen as N	**By TKN Method** APHA 4500-N_{org} C; 23rd Edition, 2017	mg/l	**100**	4.5
30	Sulphide as S	**By Methylene Blue Method** APHA 4500-S D; 23rd Edition, 2017	mg/l	**2**	BDL
31	Free Ammonia as NH_3	**By Calculation**	mg/l	**10**	4.1
32	Particulate Size of Suspended Solids	**Gravimetric Method** APHA 2540 D; 23rd Edition, 2017	µ	**Shall pass 850 micron IS Sieve**	<850
33	Bio-assay Test	**Evaluating Acute Toxicity** IS 6582 (P-2) 2008	%	**90% survival of fish after 96 hours in 100% effluent**	96% Survival of Fish after 96 Hrs in 100% Effluent

CL – Colorless, ND – Not detected.

BDL (Below detection limit) Values :(Cu<0.02 mg/l , Mn<0.025 mg/l, C_6H_5OH<0.05 mg/l, Hg<0.004mg/l, Cd<0.01 mg/l ,Se<0.001 mg/l, As<0.004 mg/l,Pb<0.02 mg/l, Zn<0.03 mg/l, Cr^{+6}<0.01 mg/l, Al<0.1 mg/l , B<0.1 mg/l, $NO_3$1 mg/l)

Reviewed By

roved By

Retaining Wall

Garland Drain

Real Time Monitoring of the ETP Data

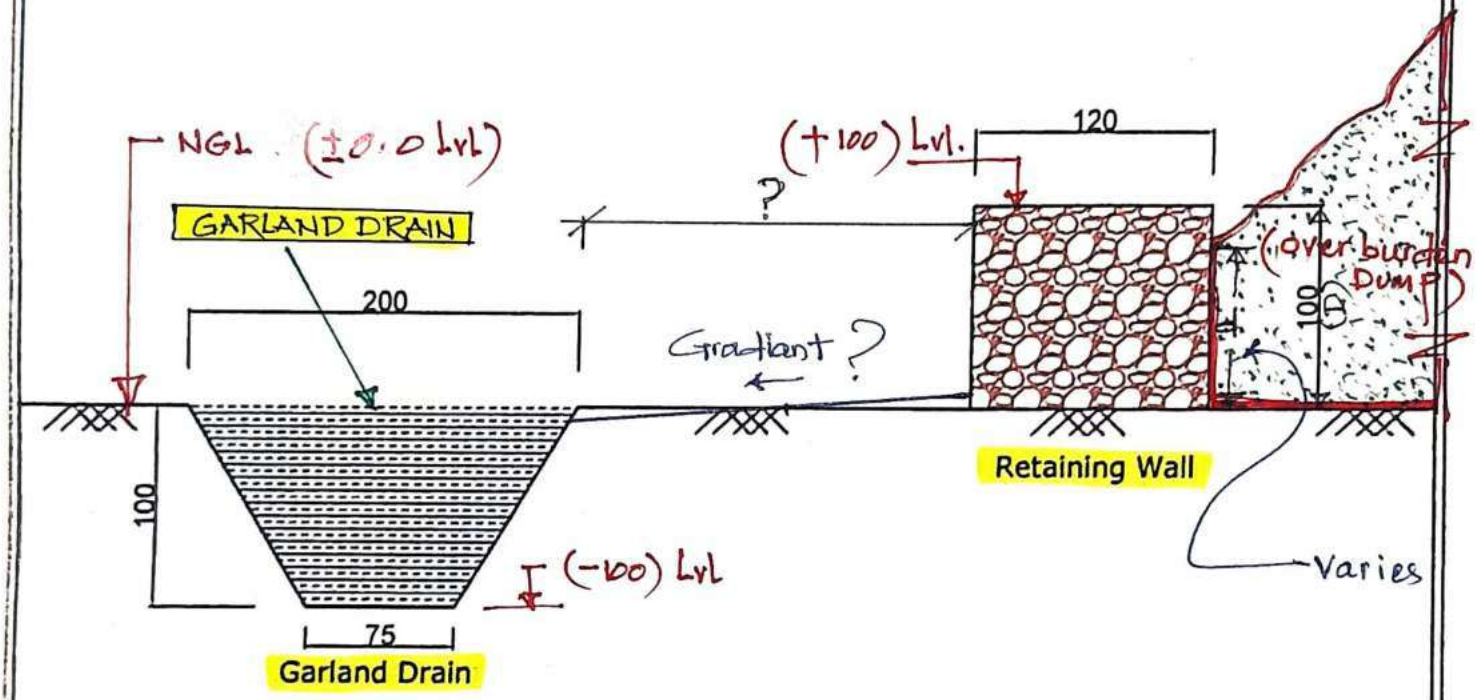
Settling Pond

ETP of Ostapal Chromite mines

30 NOV 2022

OSTAPAL CHROMITE MINE
M/S FACOR LTD.

CROSS SECTIONAL DIMENSION OF GARLAND DRAIN AND RETAINING WALL



MINES MANAGER
M/S. FACOR LTD.
OSTAPAL CHROMITE MINE
PO:-KALIAPANI-755017
DIST-JAJPUR (ORISSA)

NOT TO SCALE

ALL DIMENSIONS ARE IN CM

30 NOV 2022

AGE CONSULTANT * BHUBANESWAR * Dt. 30/11/22 Er. Jena

AGE CONSULTANT Er. S.C. CHAU PATTANAYAK M.TECH.,MIE,MICI,M'CON, C(I),FIV,MIE
CHARTERED ENGINEER & INCOME TAX VALUER
Regd. No.-AM-80670/9 & 25/2003-04-CAT-1

OCM/ENV/1142/2022 Date: 08.08.2022

To
The Joint Director (s)
Ministry of Environment, Forest & Climate Change
Govt. of India
Eastern Regional Office
Bhubaneswar - 751023

SUB: Submission of Measures taken for the reduction of consumption of water for Ostapal Chromite Mines M/s Ferro Alloys Corporation Limited.

Ref: EC Statutory Condition B.41 of Ostapal Chromite Mines M/s Ferro Alloys Corporation Limited.

Dear Sir,

With respect to the cited subject mentioned above, we would like to intimate your good office that we are maintaining & monitoring the water balance chart of every month and also we have planned some measures for the reduction of water consumption of Ostapal Chromite Mines M/s Ferro Alloys Corporation Limited.

The Details of the water consumption action plan is attached in the **annexure - 1**

This is for your kind consideration please.

Thanking You

Yours Faithfully

Mines Manager
Ostapal Chromite Mines
Ferro Alloys Corporation

OCM/ENV/1145/2022 Date: 08.08.2022

To
The Member Secretary
Odisha State Pollution Control Board
A/118, Nilakanthanagar, Unit-VIII
Bhubaneswar

SUB: Submission of Measures taken for the reduction of consumption of water for Ostapal Chromite Mines M/s Ferro Alloys Corporation Limited.

Ref: EC Statutory Condition B.41 of Ostapal Chromite Mines M/s Ferro Alloys Corporation Limited.

Dear Sir,

With respect to the cited subject mentioned above, we would like to intimate your good office that we are maintaining & monitoring the water balance chart of every month and also we have planned some measures for the reduction of water consumption of Ostapal Chromite Mines M/s Ferro Alloys Corporation Limited.

The Details of the water consumption action plan is attached in the **annexure - 1**

This is for your kind consideration please.

Thanking You

Yours Faithfully

Mines Manager
Ostapal Chromite Mines
Ferro Alloys Corporation

ACTION PLAN FOR WATER REDUCTION PLAN

Water savings can be achieved in mining through a combination of different

(1) Changing behaviour,

(2) Modifying and/or replacing equipment with water saving equipment to reduce overall water consumption

(3) To assure the strategies, optimize water and minimize costs, it is important to assess current water use and set goals.

(4) Water Recycle & Re-use practice to be adopted

Changing User Behaviour

- Awareness raising among operators to use water-efficient strategies and/or equipment to optimize water use helps in changing the user behaviour.
- Display poster for awareness
- Build understanding among employees and co-workers about the importance of water conservation. Make them aware of water scarcity issues and the impact of water conservation practices.
- Educate employees so that they will be able to identify problems and innovate solutions to reduce water use within the company.

Modifying and/or replacing equipment with water saving equipment to reduce water consumption

- Typical operational changes for reducing water consumption at the operational level are developing a regular inspection programme for piping and hoses.
- Install water saving toilet systems (low flush, vacuum, dehydration, adjust flush valves).
- Install tap aerators and high efficiency showerheads
- Choose conveying systems that use water efficiently
- Replace high-volume hoses with high-pressure, low-volume cleaning systems

To assure the strategies, optimize water and minimize costs, it is important to assess current water use and set goals

- Apply/Installation of water meter in all intakes point to access the use.
- Using of NALCO Chemicals in tailing pond for maximum recovery of water
- Reducing water consumption for cleaning finding multiple uses for water.
- Record keeping for water abstraction & use for domestic & industrial use for Mine individually.
- Specific water consumption target set for Mine individually.

Water Recycle & Re-use practice to be adopted for Reduces Water Use:

- Wastewater treatment plant i.e ETP & STP installation & Operation practice to be made
- Treated water should be used for Industrial use instead of fresh water.
- Surplus discharge treated water shall be used for Agriculture as required by local community instead of fresh water from Borewell.

Mines Manager
Ostapal Chromite Mines
Ferro Alloys Corporation

Interim Report on

Scientific Study on Ground Vibrational Effects of Blasting at Ostapal Chromite Mine and its Control/Mitigation

Ferro Alloys Corporation (FACOR)

January, 2022

Dr. Mahesh Kumar Shriwas
(Principal Investigator)

Prof. Singam Jayanthu
(Co-Principal Investigator)

Department of Mining Engineering
National Institute of Technology
Rourkela-769008, Odisha
Website-www.nitrkl.ac.in, Ph: 7008951710

INVESTIGATION STATEMENT

The scientific work documented in this interim report titled **"Scientific Study on Ground Vibrational Effects of Blasting at Ostapal Chromite Mine and its Control/Mitigation"** was carried out by the National Institute of Technology–Rourkela at the request of M/s **Ferro Alloys Corporation Ltd.** This interim report is classified as confidential and is meant for the internal use of the organization to which it is submitted. This interim report, in full or in part thereof, can neither be quoted nor published anywhere by anybody other than the investigator. It should not be communicated /circulated to agencies other than the concerned government departments. NIT-Rourkela reserves the right to publish the results of the present study.

Dr. Mahesh Kumar Shiriwas
(Principal Investigator)

Dr. Mahesh Kumar Shriwas
Assistant Professor
Department of Mining Engineering
NIT, Rourkela, Odisha-769008

13.01.2022

Prof. Singam Jayanthu
(Co-Principal Investigator)

Dr. SINGAM JAYANTHU
Professor, Mining Engg. Department
National Institute of Technology
ROURKELA-769008, ODISHA
Tel: 0661-2462611

Table of Contents

1.0 Introduction

This interim report forms a part of the project work related to scientific study on ground vibrations due to blasting at Ostapal Chromite Mine, Ferro Alloys Corporation Limited (FACOR). Ostapal Chromite Mine, in Sukinda ultramafic complex, is located in Kaliapani village of Jajpur district of Odisha. The objective of this study is to estimate the explosive charge per delay for bringing down the ground vibrations within the safe limits of peakparticle velocity and frequency. A field visit was made during November 2021 to collect the general information about the mine, and monitor ground vibrations induced by blasting.

A field visit was done on 20-21, November 2021 to study various blast parameters related to the blasting of benches in the pit to understand the effect of blast on the surrounding structures peak particle velocity and frequency of ground vibrations due to blast at different distances from the blast site were measured with suitable instruments in the field. Fig 1 shows the location of the mine. A few more blasts shall be monitored before submission of final report, final report will be submitted with the result of data analysis.

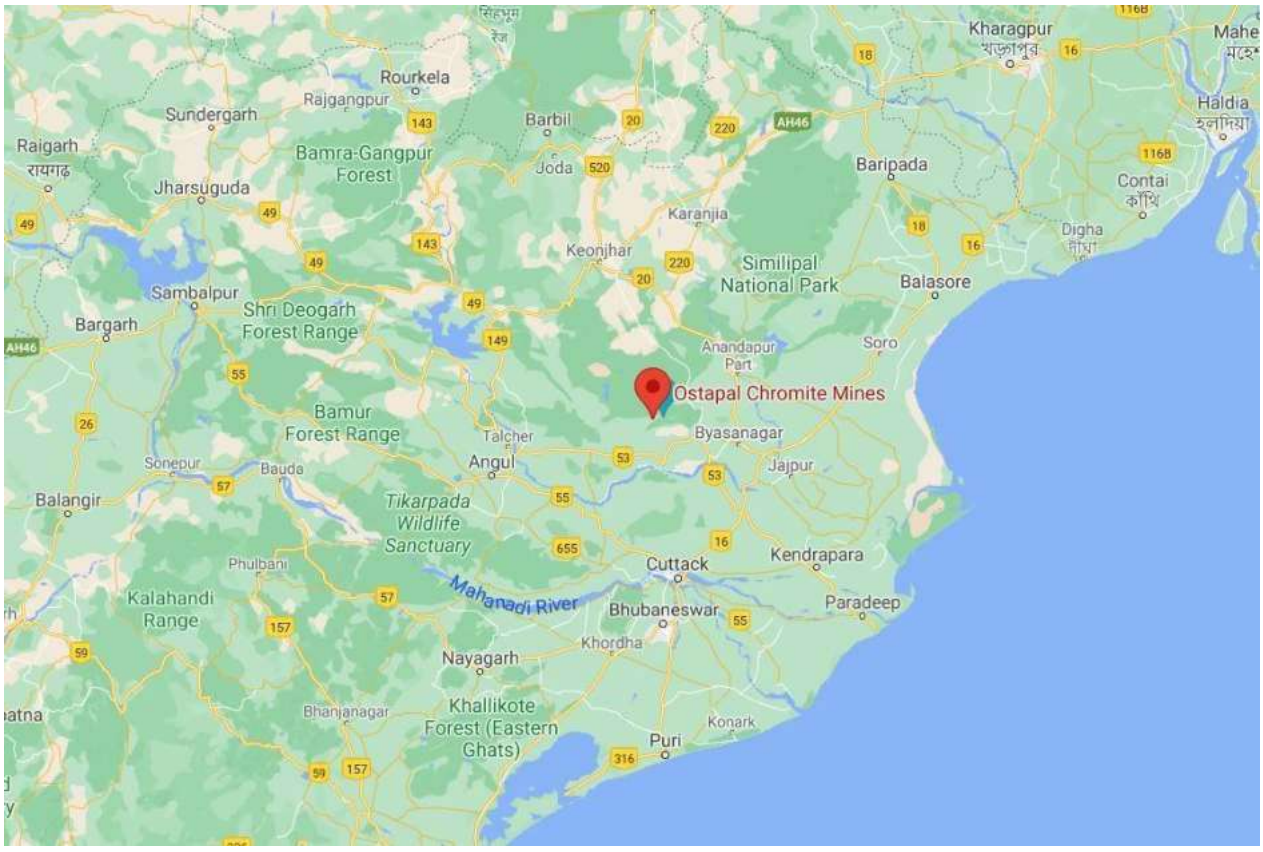


Fig 1(A): Location of Ostapal Chromite Mine

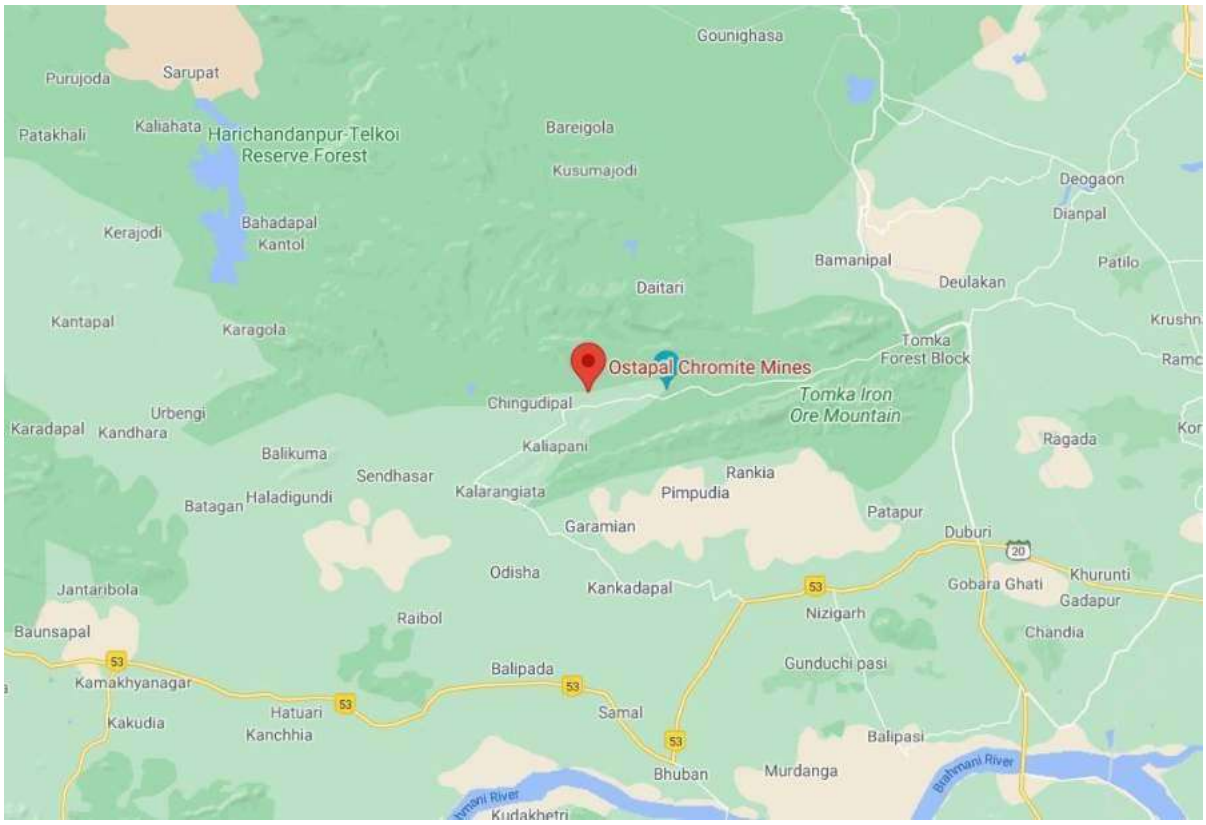


Fig 1(B): Location Map of Ostapal Chromite Mine (Close View)

2.0 Geo-Mining Details

2.1 Location & Communication

Ostapal Chromite Mine, in Sukinda ultramafic complex, is located in Kaliapani village of Jajpur district of Odisha. The mining lease was granted in the year 1985 and subsequently, mining was started using the opencast method with HEMM deployment and is continuing till date. The mine is connected with the nearest rail network at Jajpur-Keonjhar Road Railway Station on Howrah–Bhubaneswar–Chennai line of SE railway by an all-weather road of 100 km via Duburi and Tomka. The leasehold area is linked with Daitari-Paradeep Express Highway. State capital at Bhubaneswar and district headquarter at Jajpur is located at road distances of 150 km and 53 km respectively from the leasehold area of Ostapal Mine.

2.2 Method of Mining

The opencast mining of chromite ore is being carried out by removing the overburden, side burden/intermediate burden by making suitable benches in all directions of the quarry. Waste materials are removed from the quarry directly by shovel/dumper/dozer combination to the dump yard. Similarly, ores are removed from the quarry. Hard portions of the quarry which cannot be directly excavated by the machines require drilling and blasting with large diameter holes. Blasted fragments are removed by the machine to the waste dump yard. Fig 2 shows the location of the site for the experimental blast.

Shovels are utilized with a bucket capacity of 1.5 m^3 with digging height capability up to 10m. 110mm diameter drilling machine is used for drilling of shot holes. Plaster shooting/pop shooting is done for secondary blasting. Tire-mounted front-end loaders are used for re-handling purposes. Other machineries which are utilized in the mine are compressors, diesel and electric pumps, explosive van, etc.

The bench heights are typically kept with 7-8m height, 8-10m width and overall slope of 26^0 to 30^0. Drains and barriers are constructed all along the longitudinal direction of one side of the bench edge for smooth flow of water to the next lower bench and safe running of vehicles on the quarry benches. The process continues till reaching the pit bottom. Benches are connected with each other with short ramps of 1 in 10 gradients. Main ramps/ haul roads are kept with 1 in 14 gradient. Sufficient side drains and cross drains are also provided to keep the road dry in all seasons including the rainy season. Fig 3 shows the joint survey conducted and closed view of benches.

Fig 2: Site of experimental blast

3(A)

3(B)

Fig 3(A&B): Joint survey and close view of the benches

Required data related to Ostapal Chromite Mine and explosive/blasting parameters were provided by the concerned authorities. The blasting operation will be monitored and statistical analysis of the PPV in terms of frequency content, and charge/delay based on an adequate number of blasts will be conducted for optimization of the blasting pattern for designing controlled blasting techniques to protect structures.

3.0 Blasting Practices at the mine

The usual drilling pattern is burden 3.0 m and Spacing 2.0 to 2.5 m and subgrade drilling is 10%. Fig 4 (A, B & C) shows preparation for the experimental trial blast.

4(A)

4(B)

4(C)

Fig 4(A, B &C): Preparation for experimental trial Blast

Solar Prime is a packaged slurry explosive used having diameter of 83mm with the VOD of 3.5km/sec. All the activities of blasting shall be carried out in accordance with regulations of MMR 1961. Blast-induced ground vibrations and fly rock are greatly controlled by the latest blasting techniques like using NONEL detonators, Noiseless trunk line detonators, and vibrations monitoring with MINIMATE. Blasting shelters shall be provided at suitable points for safe blasting. Sufficient sentries shall be posted to cover the blasting zone of 500m. The blasting zone is demarcated with red flags for easy identification. Besides the blasting timing indicating boards are posted at main entries and at danger zone areas. Before blasting, warning whistles/siren is given three times for alerting the persons nearer to the danger zone.

The Ostapal Chromite mine of FACOR, and rock breaker for handling of oversize fragments. Bench height at the mine site is about 7m to 8m with Burden of 3m, spacing of 2.5m and quantity of charge per hole between 15kg to 40kg for 110mm drill diameter. Staggered pattern and square grid pattern of holes are drilled. The blast holes depth is about 3m to 10m including 10% sub grade drilling. Each blast is monitored for ground vibration and fragmentation and necessary care is taken based on the report obtained. Minimate is being used for measurement of ground vibration in the mines. Fig 5 shows location of blast vibrations and instrument sites.

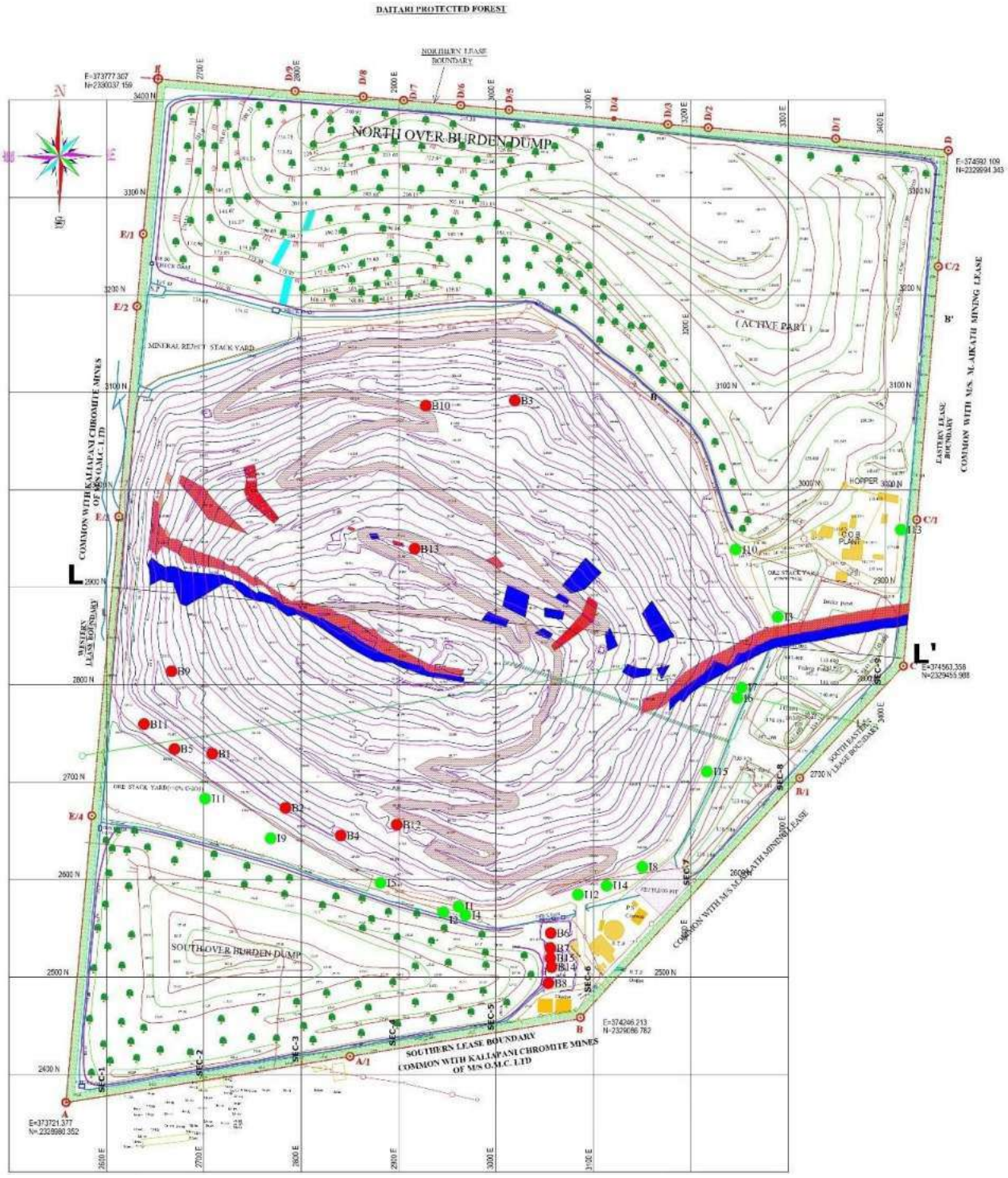


Fig 5: Blast Vibrations Site with Instrument Stations

4.0 Ground Vibrations and Air Overpressure

4.1 Generation of Ground Vibrations

When an explosive charge detonates, intense dynamic waves are set around the blast hole, due to sudden acceleration of the rock mass. The energy liberated by the explosive is transmitted to the rock mass as strain energy. The transmission of the energy takes place in the form of the waves (Fig 6). The energy carried by these waves crushes the rock, which is the immediate vicinity of the hole, to a fine powder. The region in which it takes place is called 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 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 generation of the cracks to a lesser extent but they are not in a position to cause the 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.

4.2 Ground Vibration Waves

Blast induced ground vibrations, which are propagated in rock, can be divided into three categories:

i. Compression waves
ii. Shear waves and
iii. Rayleigh waves

The motion of the ground particle takes 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 of 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 get larger.

The three important wave characteristics, which are significant for blast damage, are amplitude, frequency and duration. The amplitude, which is given as acceleration, particle velocity or displacement, depends on detonating charge, length of the charge, confinement, damping conditions in the ground, the building response and the distance between the object and blasting. 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 corresponding frequency.

4.3 Prediction of Ground Vibrations

A number of investigators have been studied ground vibrations from blasting and also theoretical analysis has been developed to explain the experimental data. The energy released is considered to be proportional to the square root of charge. Fig 5 shows pictorial representation of the various zones and the phenomenon of reflection of waves. 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 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. The corresponding relation known as USBM predictor equation takes up following form:

$$A = K\left(\frac{D}{Q^{0.5}}\right)^{\beta}$$

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 predictor equation is used in India for calculating maximum safe charge per delay for different distances according 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*.

4.4 Damage Criteria

The damage criteria were proposed by many organizations including USBM, DGMS, and Indian Standards etc. based on the permissible PPV in mm/s and frequency of the ground vibrations for various types of structures. The criteria based on the permissible PPV in mm/s and frequency of the ground vibrations for various types of structures as per DGMS (1997) as presented below in Table 1 and 2 are generally followed to estimate safe charge per delay to limit the ground vibrations within safe limit in Indian geo-mining conditions. Fig 6 represents various waves zone.

Table 1: Damage criteria vis-à-vis Buildings / Structures not belonging to the owner

Type of Structure	Dominant Excitation Frequency		
	<8 Hz	**8 to 25 Hz**	**> 25 Hz**
a) Domestic Houses	5	10	15
b) Industrial Building	10	20	25
c) Sensitive Structure	2	5	10

Table 2: Damage criteria vis-à-vis Buildings / Structures belonging to the owner

Type of Structure	Dominant Excitation Frequency		
	<8 Hz	**8 to 25 Hz**	**> 25 Hz**
a) Domestic Houses	10	15	25
b) Industrial Building	15	25	50

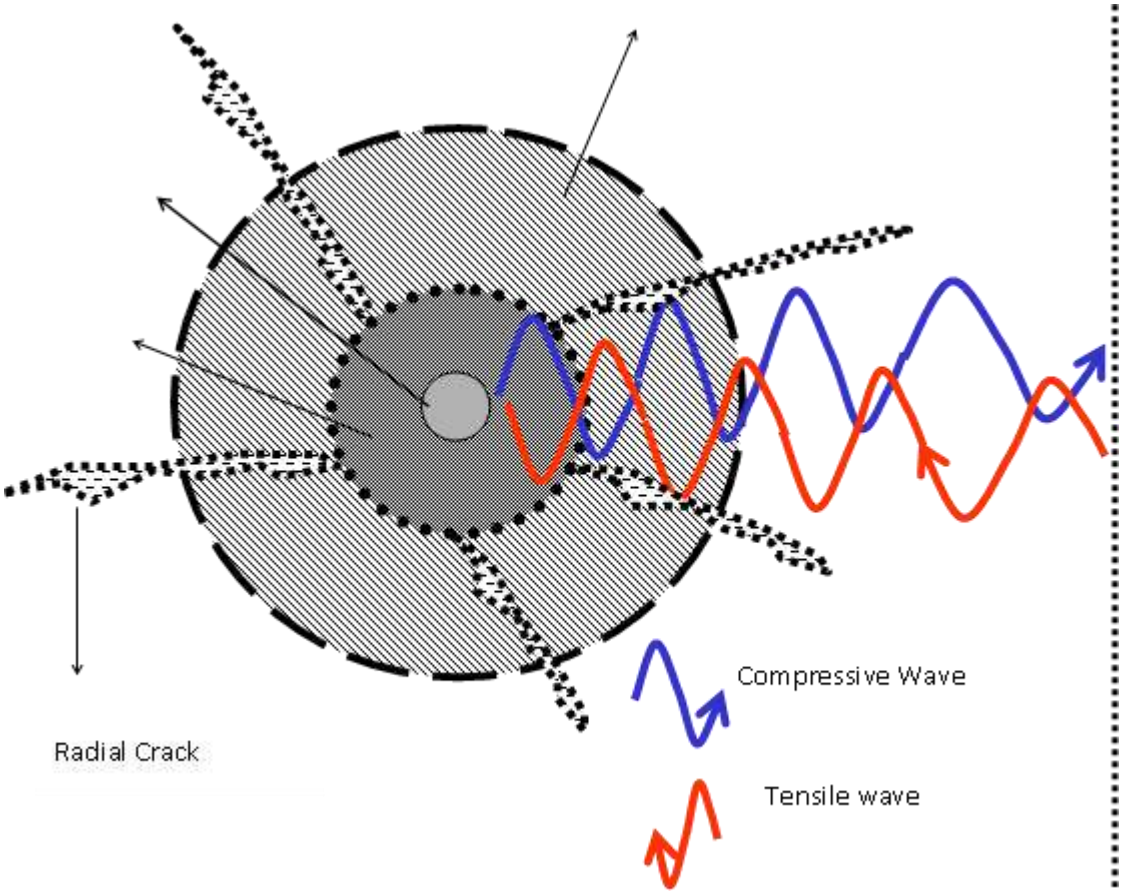


Fig 6: Pictorial representation of the various zones and the phenomenon of reflection of waves

4.5 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 blast site are non-controllable parameters. However, the control on the ground vibrations can be established with the help of controllable parameters as given below:

i. Charge Weight
ii. Delay Interval
iii. Type of Explosive
iv. Burden, Spacing and Specific charge
v. Coupling
vi. Confinement
vii. Spatial Distribution of Charges

4.6 Reduction of Ground Vibrations

To protect a structure, it is necessary to minimize the ground vibrations from the blast. The acceptable techniques for reduction and control of vibrations are:

I. Reduce the charge per delay: This is the most important measure for the purpose. Charge per delay can be controlled by:
    i. Reducing the hole depth.
    ii. Using small diameter holes
    iii. Delayed initiation of deck charges in the blast holes
    iv. Using more numbers of delay detonators series
    v. Using sequential blasting machine
II. Reduce explosive confinement by:
    i. Reducing excessive burden and spacing
    ii. Removing buffers in front of the holes
    iii. Reducing stemming but not to the degree of increasing air-blast and fly rock
    iv. Reducing sub-grade drilling
    v. Allowing at least one free face
    vi. Using decoupled charges
    vii. Drilling holes parallel to the bench face
    viii. Accuracy in drilling
III. Limit the explosive confinement to bedrock if the overburden can be excavated by other means.
IV. Square patterns produce more vibrations
V. Limit frequency of blasting
VI. Time the blasts with high ambient noise levels
VII. Use controlled blasting techniques
VIII. Use a low VOD and low density explosive

4.7 Air-Overpressure

Pressure waves emanated in the atmosphere by the detonating charge is called air-overpressure/noise. The intensity of noise depends upon the quantity of the charge and its confinement. The frequency of the pressure waves in the range of to 20 Hz. To 20 kHz are in the audible range. The air overpressure is calculated in dB (A) or Pa.
The dB (A) is calculated by the following formula:

$$dB = 20\log\left(P/P_o\right)$$

Where, P is measured pressure and P_o is the reference pressure of 0.00002 Pa.
A low level of air-over pressure plays an important role in causing distress because of rattling windows. At present we don't have any standards regarding levels of air-over pressure. However, type of the damage that occurs by air-overpressure (as established by different researchers) is reproduced in Table 3. The principle sources of air-over pressure are:

- Detonation of unconfined charges.
- Too short stemming or improper stemming material
- Venting of high velocity gases through poorly designed blasts.

Table 3: Type of Damage Due to Air over pressure

Structural Damage	Value in dB-L
Plaster Cracks	180
Loose Windows Sash Rattles	176
Failure of Badly Installed Window Panes	140-145
Failure of Correctly Installed Window Panes	Over 168
All Window Panes Fail	176

The techniques to control air-over pressure are:

i. Use of NONEL in place of D-cord in the blasts near the residential area.
ii. Reduction in the size of the blast.
iii. Avoiding top initiation.
iv. Avoiding excessive delays between the rows.
v. Avoiding blasting in early morning, late afternoon and evening when temperature inversions are likely to occur.
vi. Avoiding blasting when the wind is blowing towards residential area as the sound wavestravel in the direction of the wind.

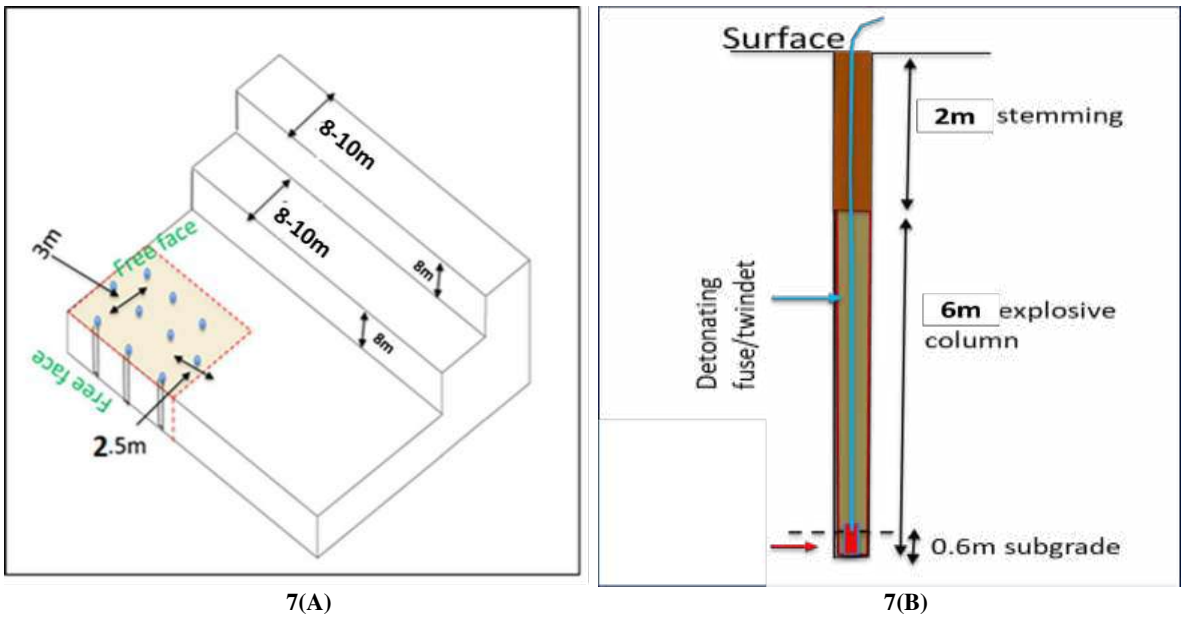
5.0 Drilling and Blasting Parameters

Table 4 shows drilling and blasting parameters in Ostapal Chromite mine

Table 4: Drilling and Blasting Parameters in Ostapal Chromite Mine

(i)	Drilling Parameters	• Types of Drill= DTH drill • Hole depth= 4-8m • Pattern= 3m x 2.5m • Hole Dia= 110m
(ii)	Blasting Parameters	• Stemming length= 1-2m • Types of explosive: Slurry • Initiation system= Non electric initiation with DF, Cord relay with ED and NONEL and Electric delay detonator of different sequence • Size of explosive cartridge: 83mm x 450mm (2.78kg)

Fig 7(A&B) shows Typical isometric view and section view of blast hole.



7(A) 7(B)

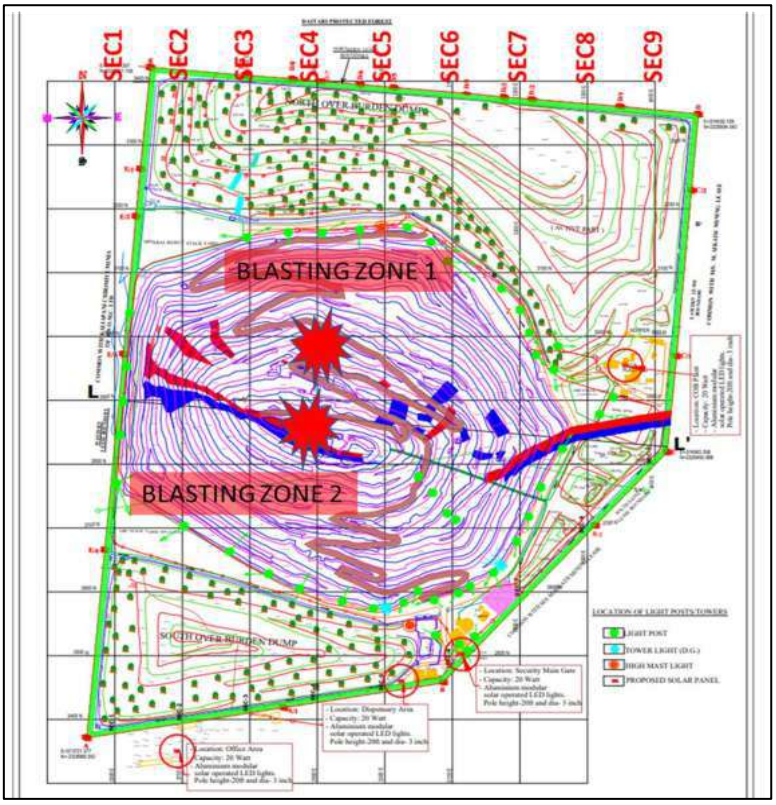
Fig 7: Typical isometric view and section view of blast hole

5.1 Blasting Zones Inside the Mine

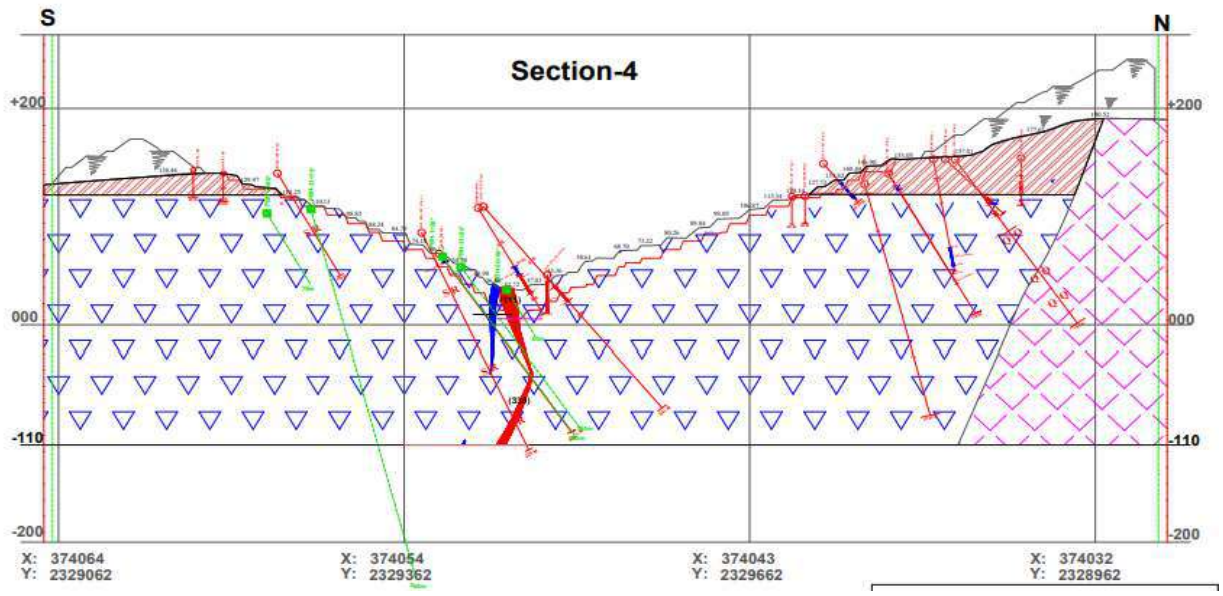
Drilling- blasting is required for only 20% of the total excavation volume is required in Ostapal Mine, as the rock strength parameters are quite favorable for free cutting by shovel. Fig 8(A&B) shows hard zones which require blasting is mainly near section 4, which has been shown in red marked area. Geomechanical parameters of different rock types are shown in Table 5:

Table 5: Geomechanical parameters of different rock type

Rock Type	Density (kg/m3)	UCS (Mpa)	Remarks
Weathered Zone	1300-1400	<1	No blasting requirement. Can be easily excavated by shovel
Laterite	2100-2300	<5	No blasting requirement. Can be easily excavated by shovel
Limonite	2000-21--	<10	No blasting requirement. Can be easily excavated by shovel
Quartzite	2800-2900	80-160	Drilling and Blasting Required to break the rockmass
Peridotite	2400-2600	100-200	Drilling and Blasting Required to break the rockmass
CRM (Fri)	1500- 3500	5-20	No blasting requirement. Can be easily excavated by shovel



8(A)



8(B)

Fig 8(A&B): Hard zones which require blasting is mainly near section 4, which has been shown in red marked area

6.0 Ground Vibration and its Effective Control

Although drilling- blasting is required for only 20-30% of the total excavation volume but that can also affect the domestic and other public structures in nearby villages. Hence its effective control is must without fail to limit the vibration level within prescribed limit as defined by statutory body.

In this study, it has been targeted to estimate the safe charge per delay, using regression analysis, for the conditions of Ostapal Chromite Mine. The data collection process is still in the process. However, in this draft report, PPV has been calculated using already proven formula for the nearby public structures. There are two villages and one public road near the mine, within 1km radius of the blasting zone.

Blast induced vibration depends on the following factors and blasting parameters.

a. Distance of the point of interest from the blast
b. Maximum charge per delay
c. Site specific constant/ rock strength parameters

From last few decades different research are going on this subject and a lot of thumb rules and methods have been outlined to determine the vibration level in terms of Peak Particle Velocity (PPV). One of the most widely used method is defined by USBM as mentioned below:

$$PPV = K\left(\frac{R}{\sqrt{Qmax}}\right)^{-\beta}$$

Where-
PPV = peak particle velocity (mm/s)
R = distance between blast face and monitoring point (m)
Qmax = maximum explosive charge used per delay (kg),
and K, β = site constants
Specific values for this mine are (received from old reports)—

1. R= distance of different "point of interest" as mentioned in table no…
2. Qmax= Maximum Charge Per Delay
3. K= 160
4. B= 1.26

According to this formula peak particle velocity at different distance from the blast zones of this mine, can be determined but before calculation important public/domestic structures are mentioned below:

6.1 Nearby Public/ Domestic Structures, Distances, and Expected Peak Particle Velocity

The nearby villages are: Gurujang village, Ostapal Village, and one public road currently passing near the mine lease area. Table 6 shows distance of nearby domestic and public structures from the nearest blasting zone & Fig 10 shows blasting zones and nearby public/domestic structures.

Table 6: Distance of nearby domestic and public structures from the nearest blasting zone

Sl. No.	Domestic/ public structures	Nearest distance from the blast zone
1	Gurujang Village (Part A)	≥315m
2	Gurujang Village (Part B)	≥450m
3	Ostapal Village	≥800m
4	Public Road	≥315m
5	Office Structures	≥300m
6	Other industrial Buildings/structures of Ostapal	≥280m

Fig 10: Blasting zones and nearby public/domestic structures

6.2 Calculated PPV

Table 7 shows the calculated PPV as per USBM methods which are in use throughout the world & Table 8 shows The DGMS compliance criteria for various structures in different conditions (DGMS Circular No. 7 of 1997).

Table 7: Calculated PPV as per USBM

Sl No	Domestic/ public structures	Nearest distance from the blast zone	PPV (USBM method- 1980)
1	Gurujang Village (Part A)	≥315m	1.34
2	Gurujang Village (Part B)	≥450m	0.85
3	Ostapal Village	≥800m	0.41
4	Public Road	≥315m	1.34
5	Office Structures	≥300m	1.42
6	Other industrial Buildings/structures of Ostapal	≥280m	1.55

As Per the Statutory Guideline Maximum Allowable PPV.

Table 8: The DGMS compliance criteria for various structures in different conditions (DGMS Circular No. 7 of 1997)

Type of Structure	**Dominant Excitation Frequency, Hz**		
	<8 Hz	8-25 Hz	>25 Hz
A. Building/Structures not belonging to the owner			
Domestic house/structures (Kuchha, Brick & Cement)	5	10	15
Industrial Building(RCC	10	20	25

& Framed structures)			
Objects of historical importance & sensitive structures	2	5	10
B. Buildings belonging to the owner with a limited span of life			
Domestic house/structures (Kuchha, Brick & Cement)	10	15	25
Industrial Building(RCC & Framed structures)	15	25	50

As per the guideline of DGMS (as mentioned in the abovementioned table- for domestic structures the maximum allowable limit in minimum frequency range is 5 mm/s. But in every case for both the mines, peak particle velocity is <3mm. So it is obvious that using maximum charge per delay also PPV in vulnerable areas are always within limit.

6.3 Other Controls:

Not only this, TSML has implemented other operational controls also to ensure 100% compliance on limiting blast induced vibration. Blast induced vibration is dependent on:

i. Charge Weight
ii. Burden, spacing and specific charge
iii. Delay Interval
iv. Coupling
v. Type of Explosive
vi. Confinement
vii. Direction of blast progression
viii. Spatial distribution of charges

The techniques used for reduction and control of vibrations are—

I. **Drilling and charging pattern**:

Holes in a multi-row pattern (2 to 3 rows) are drilled in a staggered manner. Usually, the explosives charge length is limited to 2/3rd of the hole depth (8.8m) and the explosive quantity works out to 29.57 or 30 kgs to have a powder factor of 7 T/kg. of explosive. Deck charging is adopted to distribute the explosive charge to the desired length of a column. Booster charges are kept at different decks as per need and the column charge is that of SME Use of NONEL and multi delay detonators in a hole is practiced to produce better fragmentation effect, fly rock within safe limit with reduced vibration.

II. **Charge per round:**

Maximum 5 holes per round is blasted in one blast to minimize blast vibration

III. **Blasting pattern, manner and sequence of firing:**

'V' pattern firing is in practice which is much safe, and fragmentation is good and throw is within control. Sequential blasting is done by using electric delay detonator or NONEL in the system of blasting to reduce vibration and fly rock.

IV. **Avoiding Secondary blasting:**

Rock breaker is used to loosen the large boulders occurring in the mineralized zone.

V. **Optimization of the charge per delay:**

- Optimum hole depth.
- Small diameter holes
- Delayed initiation of deck charges in the blast holes
- Using more numbers of delay detonators series
- Using sequential blasting machine

VI. **Explosive confinement reduction:**

- Reducing excessive burden and spacing
- Removing buffers in front of the holes
- Reducing stemming but not to the degree of increasing air-blast and fly rock
- Reducing sub-grade drilling
- Allowing at least one free face
- Using decoupled charges
- Drilling holes parallel to the bench face
- Accuracy in drilling

VII. **Air-over pressure reduction:**

- Using NONEL in place of D-cord in the blasts.
- Reduction in the size of the blast.
- Avoiding top initiation.
- Avoiding excessive delays between the rows.

VIII. **Controlled blasting Technique:**

'V' pattern firing is in practice which is much safe and fragmentation is good and throw is within control. Sequential blasting is done by using electric delay detonator or NONEL system of initiation to reduce vibration and fly rock. Proper charging, stemming and controlled blasting with NONEL system of initiation is established for getting optimum blast results and minimization of hazards while preventive measures like marking of danger zone, arrangement of warning signals by hooting etc. shall is adopted. Mobile blasting shelters is provided within the blasting zone. Since the area is in protected forest area, vibration monitoring at sensitive locations is carried out scientifically to check adverse effects if any during blasting and a blast vibration study is carried out during the ensuing plan period by some of the reputed Scientific Institute to determine the allowable PPV, maximum charge per delay, total charge per round etc. during blasting.

IX. **Environmental & Safety Measures:**

- Blasting shall be preferably done before sun set.
- Controlled blasting technique shall be adopted for blasting to reduce vibration as well as noise level.
- Nonel system shall be used to split a large vibration package in to a number of small vibration levels for the reduction of ground vibration.
- Blasting shall be carried out by the persons with Blaster's Certificate of Competency/ competent person as per MMR' 1961.
- Safety tools shall be kept adequately near the blasting site at the time of charging.
- Blasting is proposed to be done after proper signaling and warning in order to ensure that no person or animals are within the blasting danger zone.
- Whistle or siren shall be blown for removal of the man and animals into safety zone
- Misfires shall be handled carefully as per stipulated procedures in MMR' 1961

7.0 Conclusion

1. Blasting requirement is very rare in this mine. Although 20-30% of the total planned volume has been targeted for blasting but actual blasting requirement shall be much lower than that because of the soft nature of the strata.
2. The requirement of blasting in Ostapal is only in between section 3-4 in HW &FW side in Pit. From these two points maximum nos of domestic and public structures are situated more than 300-800m distance, where expected PPV value is always <2mm (as mentioned in Table No 07).
3. Control blasting technique is ensured by the Drilling-blasting in-charge, who is holder of First Clast managers competency certificate. Different techniques to control- blast Induced ground vibration is well established and those are being used in Ostapal mine for vibration control.
4. Well trained blasting crew and robust SOPs always helping in effective implementation of planned techniques.
5. By undertaking blasting at the designated 'Hours of Blasting', posting adequate number of guards at entry to the mine the neighboring habitat, and passersby are prohibited to enter the safety zone of 300m as mentioned in DGMS guideline.
6. As per the guidelines related to deephole blasting mentioned in the permission from DGMS under 106(2)(b) are being followed.

8.0 Recommendations

Following are salient findings and recommendations on the basis of the scientific experimental study conducted for blasting of benches in Ostapal Chromite Mine, Ferro Alloys Corporation Ltd.

1. Blasting operation with blasting parameters; 2.5 m spacing, and 3.0 m burden for bench heights of 7-8 m was observed to be safe with Solar Prime explosive of about 15-40 kg of charge per delay beyond 100 m distance from the blast site.
2. Maximum charge per delay can be further optimized by hit and trial method on spacing burden optimization experiment and experiment on stemming material
3. Proper free face should be ensured for every blasting. Presently it is being maintained and the same practice shall be continued.
4. All blasts conducted during the experimental studies were safe with respect to

Vibration, Air overpressure, and Fly rock.

5. It is recommended to maintain or use the estimated charge per delay 15-40Kg for containing PPV within 5mm/sec for protection of structures nearby mine.

9.0 Acknowledgments

We acknowledge the support of officers of M/s Ostapal Chromite Mine, Ferro Alloys Corporation Ltd, their keen interest, and informative discussions related to this study.

10.0 References

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2. Jayanthu S., Scientific study on effect of blasting operations at Jayanthipuram LimeStone Mine, Ramco Cements limited (Unpublished).
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4. Jayanthu, S., Scientific study on blasting, Baphlimali Bauxite Mines under M/s UtkalAlumina International Limited (Unpublished).

ANNEXURE - 23

Ref : Envlab/22/R- 8336 **Date : 10.10.2022**

NOISE QUALITY ANALYSIS REPORT- SEPT 2022

1. Name of Client : **M/s FERRO ALLOYS CORPORATION LIMITED , BHADRAK**
2. Name of the Project : **OSTAPAL CHROMITE MINES , KALIAPANI, JAJPUR**
3. **Date of Sampling : 21.09.2022**
4. Sample Collected by : VCSPL Representative in presence of Client's Representative

Location ID	Location	Result in dB (A)	
		Day Time (6.00 am to 10.00pm)	Night Time (10.00pm to 6.00 am)
N1	**Open Cast Quarry**	69	62
N2	**COB Plant**	68	57
N3	**Mines Loading & Unloading**	65.6	62.3
N4	**At Project Site**	67.2	60.8
N5	**Ostapal Village**	55.2	50.1
N6	**Gurujanga Village**	52.3	49.8
N7	**Gurujanga Village II**	51.8	49.6
N8	**Sukurangi Village**	53.6	47.4
N9	**Talangi Village**	50.4	48.9
N10	**Sukurangi Village II**	52.6	47.6
N11	**Kaliapani Village**	50.9	45.5
N12	**Kaliapani Colony**	51.4	46.9
N13	**Ostia Village**	50.6	44.8

AMBIENT NOISE LEVEL STANDARD

Category Area/Zone	Limit in dB (A)	
	Day Time (6.00 am to 10.00pm)	Night Time (10.00pm to 6.00 am)
Industrial Area	75	70
Residential Area	55	45
Commercial Area	65	55
Silence Zone	50	40

Reviewed By

Approved By

ANNEXURE - 24

MODIFICATION OF REVIEW OF MINING PLAN WITH PROGRESSIVE MINE CLOSURE PLAN

[Under Rule 17(3) of Minerals (Other than Atomic & Hydrocarbons Energy Minerals) Concession Rules, 2016, Along with Progressive Mine Closure Plan under Rule 23 of MCDR 2017]

[illegible]

VILLAGE: GURUJANGA; TEHSIL: SUKINDA
DISTRICT: JAJPUR; STATE: ODISHA

PERIOD OF PROPOSAL - YEAR 202[illegible] TO 202[illegible]

MINERAL: CHROMITE (MAJOR MINERAL)

IBM MINE CODE	11-ORI-19005
IBM REGD. NO. UNDER RULE 45 OF MCDR, 1988	IBM-173-2011
LEASE NUMBER OF STATE GOVT.	781
CATEGORY OF MINE	[illegible]
MINING LEASE AREA	72.843 HECTARES
DATE OF EXECUTION OF M.L.	[illegible] AUGUST [illegible]
EXPIRY OF THE LEASE	[illegible] AUGUST 2025
NON-FOREST LAND WITHIN THE LEASE AREA	4.419 HECTARES
FOREST LAND WITHIN THE LEASE AREA	68.424 HECTARES
DIVERSIFIED FOREST AREA	64.354 HECTARES

VOLUME - I (TEXT)

LESSEE

M/s. FERRO ALLOYS CORPORATION LIMITED

[illegible]

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[illegible]

भारत सरकार GOVERNMENT OF INDIA
खान मंत्रालय MINISTRY OF MINES
भारतीय खान ब्यूरो INDIAN BUREAU OF MINES
क्षेत्रीय खान नियंत्रक के कार्यालय
OFFICE OF THE REGIONAL CONTROLLER OF MINES

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[illegible]
[illegible]

No. [illegible] Date: [illegible].2021

सेवा में

Shri [illegible], Nominated Owner and Director
M/s [illegible] Alloys [illegible] Limited
At- [illegible] Nagar, P.O.- [illegible], Dist- [illegible] (Odisha)

विषय: Approval of modification in review of Mining Plan of [illegible] Chromite Mine along with Progressive Mine Closure Plan (PMCP) over an area of [illegible] in Jajpur district of Odisha State submitted by M/s [illegible] Alloys Corporation Ltd. under Rule 17(3) of Mineral Concession Rules, 2016.

संदर्भ: i) Your letter No. [illegible]/2021 dated 25.06.2021 received on 28.06.2021.
ii) This office letter of even no. dated 28.06.2021
iii) This office letter of even no. dated [illegible].2021 addressed to the Director of Mines, Govt. of Odisha, copy endorsed to you.
iv) This office letter of even no. dated 16.07.2021
v) Your letter No. [illegible]/2021 dated [illegible] received on 27.07.2021.

महोदय,

In exercise of the powers delegated to me vide Gazette Notification No. S.O. 1857(E) dated 18.05.2016, I hereby approve the modification in review of Mining Plan including Progressive Mine Closure Plan of [illegible] Chromite Mine over an area of [illegible] ha of M/s Ferro Alloys Corporation Ltd. in Jajpur district of Odisha State submitted under Rule 17(3) of Mineral Concession Rules, 2016. This approval is subject to the following conditions:

I. The modification in review of Mining Plan is approved without prejudice to any other law applicable to the mine/area from time to time whether made by the Central Government, State Government or any other authority and without prejudice to any order or direction from any court of competent jurisdiction.
II. The proposals shown on the plates and/or given in the document is based on the lease map/sketch submitted by the applicant/lessee and is applicable from the date of approval.
III. It is clarified that the approval of aforesaid modification of review of Mining Plan does not in any way imply the approval of the Government in terms of any other provision of Mines & Minerals (Development & Regulation) Act, 1957 or the Mineral Concession Rules, 2016 or any other laws including Forest (Conservation) Act, 1980, Environment (Protection) Act, 1986 or the rules made there under, Mines Act, 1952 and Rules & Regulations made there under.
IV. Indian Bureau of Mines does not undertake verification of the mining lease boundary on the ground and does not undertake any responsibility regarding correctness of the boundaries of the leasehold shown on the ground with reference to lease map & other plans furnished by the applicant/lessee.

Silpaulin

Geo-Textile

M/s. Ferro Alloys Corporation Ltd. (A subsidiary of Vedanta Ltd.)
Registered Office:
D.P. Nagar, PO: Randia, Dist.: Bhadrak, Odisha, India - 756 135
T +91-6784 240320/240347, Email: facor.mines@vedanta.co.in / facor.ccp@vedanta.co.in
Website: www.facorgroup.in, CIN: U45201OR1955PLC008400.

OCM/ENV/ 1141 /2022 Date: 08.08.2022

To
The Joint Director (s)
Ministry of Environment, Forest & Climate Change
Govt. of India
Eastern Regional Office
Bhubaneswar - 751023

SUB: Submission of Slope Stability Study Report of Ostapal Chromite Mines M/s Ferro Alloys Corporation Limited.

Ref: EC Statutory Condition B.52 of Ostapal Chromite Mines M/s Ferro Alloys Corporation Limited.

Dear Sir,

With respect to the cited subject mentioned above, we would like to intimate your good office that we have conducted a slope stability study by CSIR Central Institute of Mining & Fuel Research as our dump height is more than 30 meters.

The Report is attached in the PDF file.

This is for your kind consideration please.

Thanking You

Yours Faithfully

Mines Manager
Ostapal Chromite Mines
Ferro Alloys Corporation

vedanta
transforming elements

FACOR

OCM/ENV/ 1140 /2022

Date: 08.08.2022

To
The Member Secretary
SEIAA, Bhubaneswar

SUB: Submission of Slope Stability Study Report of Ostapal Chromite Mines M/s FACOR Ltd.

Ref: EC Statutory Condition B.52 of Ostapal Chromite Mines M/s FACOR Ltd.

Dear Sir,

With respect to the cited subject mentioned above, we would like to intimate your good office that we have conducted a slope stability study by CSIR Central Institute of Mining & Fuel Research as our dump height is more than 30 meters.

The Report is attached in the PDF file.

This is for your kind consideration please.

Thanking You

Yours Faithfully
Ferro Alloys Corporation

Mines Manager
Ostapal Chromite Mines

M/s. Ferro Alloys Corporation Ltd. (A subsidiary of Vedanta Ltd.)
Registered Office:
D.P. Nagar, PO. Randia, Dist.: Bhadrak, Odisha, India - 756 135
T +91-6784 240320/240347, Email: facor.mines@vedanta.co.in / facor.ccp@vedanta.co.in
Website: www.facorgroup.in, CIN: U45201OR1955PLC008400

OCM/ENV/ 1037/2022

Date: 27.06.2022

To,

The Joint Director(s)
Ministry of Environment, Forest & Climate Change,
Eastern Regional Office,
Bhubaneswar

Sub.: Community area Plantation development at near by village -Regarding

Ref.: EC Identification No. EC22B001OR120821, EC Condition: No.65

Respected Sir,

We would like to intimate your good office that, as discussed with Local **SARAPANCH** (Kaliapani Panchayat of Sukinda Block,Dist.-Jajpur), on dated 04.06.2022, a total of around 700 nos. of native fruit Bearing Saplings have been distributed on behalf of Ostapal Chromite Mine of M/s FACOR Ltd, to the local villagers to develop community plantation/Garden which can be used by locals in future.

Some of the glimpses along with media coverage are enclosed as Annexure -1 , for your kind Reference.

This is for your kind information.

Yours faithfully,
For Ferro Alloys Corporation Limited

Head-Environment

CC : The Sarapanch, Kaliapani Panchayat, Sukinda, Jajpur

Annexure No.-1

ସକାଳ
THE SAKALA
Jajpur - 05 Jun 2022 - Page 4

ବିଶ୍ୱ ପରିବେଶ ସୁରକ୍ଷା ଦିବସରେ ଚାରା ବଣ୍ଟନ

କାଳିଆପାଣି,୪।୬(ସମିସ): ଆଜି ଝିଁସ ପଞ୍ଚାୟତ ଓସ୍ତାପାଳ ଗ୍ରାମରେ ବେଦାନ୍ତ ଫେକର କମ୍ପାନୀ ତରଫରୁ ଗ୍ରାମବାସୀମାନଙ୍କୁ ବିଭିନ୍ନ ଫଳ ଜାତୀୟ ଚାରା ବଣ୍ଟନ କରାଯାଇଛି। ପ୍ରାୟ ୭ ଶହଟି ଚାରା ମଧ୍ୟରୁ ଆମ୍ବ, ପିଜୁଳି, ଲେମ୍ବୁ ଲିଚୁ ଏବଂ ଡାଳିମ୍ବ ଆଦି ଗଛର ଚାରା ଲୋକଙ୍କ ମଧ୍ୟରେ ବଣ୍ଟନ କରାଯାଇଥିଲା। ବେଦାନ୍ତ ଫେକର କ୍ରୋମାଇଟ ମାଇନ୍ସ ଓସ୍ତପାଳ ନିକଟରେ ଥିବା ଜଙ୍ଗଲ କୁ ବଞ୍ଚାଇ ରଖିବା ଏବଂ ନୂତନ ଫଳ ଗଛ ସୃଷ୍ଟି କରି ପରିବେଶକୁ ବିଶୁଦ୍ଧ ଅମ୍ଳଜାନ ଯୋଗାଇ ଦେବା ଲକ୍ଷ୍ୟରେ କମ୍ପାନୀ ଏହି କାର୍ଯ୍ୟକ୍ରମ ଆୟୋଜିତ କରିଥିଲା। ଏହି କାର୍ଯ୍ୟକ୍ରମରେ କମ୍ପାନୀର ଖଣି ବିଭାଗ ମୁଖ୍ୟ ମୃତ୍ୟୁନଗି ଏମ ଓସ୍ତପାଳର ଯୁବକ ସଂଘର କର୍ମକର୍ତ୍ତା ଏବଂ ମହିଳା ସମିତି ସଭ୍ୟମାନଙ୍କୁ ଆଗାମୀ ଦିନରେ ଏହି କାର୍ଯ୍ୟକ୍ରମ ଜାରିରହିବ ବୋଲି ପ୍ରତିଶ୍ରୁତି ଦେଇଥିଲେ। କମ୍ପାନୀ ତରଫରୁ ପରିବେଶ ବିଭାଗ ଅଧିକାରୀ ସୁଶାନ୍ତ ମିଶ୍ର ପରିବେଶ ସୁରକ୍ଷା ବିଷୟରେ ଆଲୋଚନା କରି ଏହାର ଆବଶ୍ୟକତା ଏବଂ ଉପକାରୀତା ବିଷୟରେ ମନ୍ତବ୍ୟ ରଖିଥିଲେ।

OCM/ENV/ 1212 /2022

Date: 07.09.2022

To
The Forest Range Officer, Sukinda
Jajpur

SUB: Afforestation letter for sampling providing in Ostapal Chromite Mines, M/s FACOR Ltd.

REF: Letter No OCM/ENV/ 975 /2022, dated on 06.06.2022

Dear Sir,

With reference to the above mentioned subject, we would like to thank you wholeheartedly for providing & approving us the lists of samples which is to be planted in our Ostapal Chromite mining lease area.

The Lists are:-

- Gambhari, Acacia
- Debdaru, Nima
- Amba, Sal
- Kaju, Amba
- Simuli, Babur
- Amla, Nima

Thanking You

Your Faithfully

Head Environment
Ostapal Chromite Mines
Ferro Alloy Corporation

ANNEXURE - 30

OFFICE OF THE PRINCIPAL CHIEF CONSERVATOR OF FORESTS (WILDLIFE)
& CHIEF WILDLIFE WARDEN, ODISHA
Government of Odisha, Forest, Environment & Climate Change Department
Aranya Bhawan, Plot No.1420, Sheed Nagar, Bhubaneswar-751007
Phone: 0674-2566792, Website: www.wildlife.odisha.gov.in, Email: cwlife@wildlife.orissa.nic.in

No. 14189 / CWLW-FDWLD-FD-0030-2022
Bhubaneswar, Dated the 14th November, 2022

To
The Director (Mines)
M/s TACOR Ltd
Jeen Bhawan, Kalinga, Bhadrak - 756100

Sub: Mining of Chromite over in Deragol Chromite Mines of M/s Tamil Alloys Corporation Limited in Jajpur District - Approval of Site Specific Wildlife Conservation Plan

Sir,

It is to inform that you have to implement mitigation measures as per the Site Specific Wildlife Conservation Plan approved in compliance to Standard Term Reference for Mining Project prescribed by SEIAA, Odisha in their letter No.3980/SEIAA dt.29.01.2022.

2. As per proposal to carry out approved activities of DFO(WL) & CWW, Odisha for the Site Specific Wildlife Conservation Plan in respect of the above project at financial outlay of ₹522.294 lakh (Rupees five crore twenty two lakh ninety four thousand four hundred only) as detailed below:-

Sl. No.	Name of the Division	Cost of approved activities
i.	In project impact area in Cuttack Division	₹227.542 lakh
ii.	In project impact area in Dhenkanal Division	₹125.333 lakh
iii.	In project impact area in Keonjhar WL Division	₹186.809 lakh
	Total cost:	₹522.294 lakh

3. Activities in the project area will be executed by the project proponent under the guidance of DFO, Cuttack Division. Amount of ₹522.294 lakh (Rupees five crore twenty two lakh ninety four thousand four hundred only) shall be deposited in State CAMPA fund only through e-portal (http://parivesh.nic.in) for implementation of various activities within the project impact area by the Forest Department through concerned D-Os.

4. The following conditions may be noted for future compliance
   a. If there would be need for Site Specific Wildlife Conservation Plan after expiry of the present plan period, the User agency will have to submit a fresh proposal such plan at least one year before the expiry of the existing Conservation Plan and deposit the amount as per the approval. In case of delay it will be dealt as per law for violations of Forest (Conservation) Act, 1980 and Environment (Protection) Act, 1986.
   b. The User agency has to give an undertaking to bear the differential cost in case of enhancement of wages and during implementation of this plan.

Yours faithfully

Chief Copy of approved Plan

Conservator of Forests (Wildlife)

P.T.O.

Memo No. 10134 dt. 19/12/2022

Copy forwarded for information and necessary action to -

1. OSD cum-Special Secretary to Government of Odisha, TE&CC Department
2. PCCF (FD & WL, FC Act), O/o the PCCF & HoFF, Odisha
3. Regional Chief Conservator of Forests, Angul Circle with reference to Memo No.6781 dt. 12.12.2022 of DFO, Cuttack Division
4. Regional Chief Conservator of Forests, Sambalpur Circle with reference to this office Memo No.8387 dt.19.09.2022
5. Divisional Forest Officer(s), Cuttack/ Dhenkanal/ Keonjhar/ WL Division alongwith copies of approved SSWCP

Conservator of Forests (Wildlife)

OMCM/ENV. / 1342 /2022 Dated. 22.09.2022

ACTION PLAN FOR IMPLEMENTATION OF EMP WITH RESPONSIBILTY MATRIX

Category	Ref.	KPI	Action plan	Responsibility
Preventaion of AIR, WATER & NOISE Pollution	EIA: Chapter :4.2 (Impact of the Project)	Preventation of Air Pollution	Wet suppression by sprinklers, limiting drop heights, use of wind breaks near piles, limiting slope.	Mine Manager
			Avoiding spillage from vehicles, optimizing travel distances through appropriate site layout plan and design, wheel and truck washing, vehicular emission control by maintenance	
			Wet drilling will be undertaken to reduce dust resuspension.	
			Plnatation programe to be undertaken to reduce the wind spped so as to reduce ait pollution	Head Environment
	EIA: Chapter :4.2 (Impact of the Project)	Preventation of Water Pllution	Retaining wall & Garland drain construction & maintanace	Lead Civil
			Settling pits and drains will be regularly desilted	MINES MANAGER
			Piezometer construction proposed to monitor water level in	Head - Environment
			Effluents will be treated in ETP & quality will be Check on rea	Lead Environment
			Ground water will be checked on quaterly basis to confirm th	Head - Environment
	EIA: Chapter :4.2 (Impact of the Project)	Preventation of Noise Pollution	Noise will be controlled by selecting low-noise equipment wherever possible	Head - Engineering
			Equipment will be maintained to reduce the chances of noise and vibration.	Head - Engineering
			Green belt will be developed, which acts as pollution sinks	Head - Environment
			Noise level survey by NABL Lab.	Head - Environment

Ecological Management	EIA: Chapter :4.2 (Impact of the Project)	Ecological Enviornment safeguard	Mock drill on forest fire control, firefighting and corresponding training will be organized by the User agency through subject experts every year in consultation with Forest staffs	Head -Security
			Tree planting on Dump surface and both sides of haul Road,	Head - Environment
			Sprinkling of water on haul road and on vacant areas to suppress dusts	MINES MANAGER
			To assist Forest staff in fire control measures	Head - Environment
			Wherever plantations will be taken up not only tree species will be planted, other varieties i.e., grasses, herbs, shrubs, climbers etc. are also to be planted to maintain biodiversity of the area and maintain a ground flora.	Head - Environment
Solid waste Management	EIA: Chapter :4.2 (Impact of the Project)	Prevntaion of Soil erosion	(1) Total dump height will be of 90 m. (2)Individual bench slope of 34° to 37.5° respectively.	MINES MANAGER
			(3) Retaining wall Maintanance job to be done	Lead Civil
			(4) 7190 Nos. Saplings will be planted in the dead faces available of the dump (in 5 yr plan) (6) Dumps will be stabilized by plantation.	Head Enviponment
			(6)Geotextile is being used for stabilization of dump terraces(As & when required)	Head -Technical Services
			(7) Soil Analysis by NABL Lab	
Socio - Economic	EIA: Chapter :4.2 (Impact of the Project)	Social security Provide	Education 7.5 7.5 8.0 Health 14.0 4.5 4.5 Drinking water 2.7 2.7 2.7 Infrastructure 3.2 0.6 1.6 Livelihood support 6.7 6.7 6.7 Total 32.10 36.40 21.40	Head -CSR
Safety & Disaster Mangement	EIA: Chapter :4.7.1 (Impact of the Project)	For mitigating measures, responding to and recovering from an emergency	1. Balsting study & Monitoring 2.Pit slope study & recommendation implementation	Head -Technical services

22/09/2022

[MUTHUMARI.M]

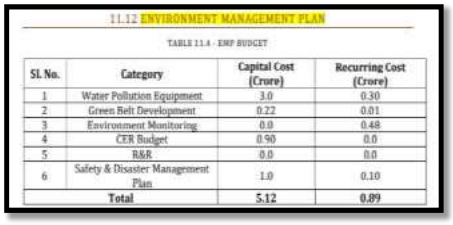
Authorized Signatory & Agent

Ostapal Chromite Mine

OMCM/ENV. / 1228 /2022 **Dated. 16. 09.2022**

ACTION PLAN FOR IMPLEMENTATION OF EC CONDITIONS OF OSTAPAL CHROMITE MINE

Sl No	Conditions	Action Plan	Responsibilty Matri
A	**Specific Conditions**		
1	The mine shall explore implementation of membrane-based technology for removing hexavalent chromium from tailing pond, Surface run off & mine drainage water as proposed	In this connection, NIT, Rourkela has been engaged since Dt 18.12.2021 , to provide the suitable technology.	Head -Envireonment
2	The mine shall submit copy of the letter to NIT. Rourkela and their response thereof engaging them for the purpose of reduction of hexavalent chromium from taling pond, surface run off, and mine drainage to SEIAA within one month time period	As Per NIT Rourkela, Interim report obtained . Final report will tobtained by 30.11.2022 After getting the Response, same will be submitted to SEIAA within one Month	Head -Envireonment
3	The mine shall submil copy of study report conducled by NIIT, Rourkela for the purpose of reduction of hexavalent chromium irom tailing pond, Surace run off & mine drainage water once study is Over and implement the recommendations of the study. The project proponent shall submit implementation & action plan repod to SEIAA	After getting the Final report, accordingly.And then action taken report will be submitted to SEIAA.	Head -Envireonment
4	Since, mining has already intersected the ground water table; the steps proposed augmentation of ground water resources are not adequate. The project proponent shall put adequate number of recharge pits beyond the zone of influence based on a detailed hydro-geological study. The project proponent shall submit the measures to be undertaken for augmentation of ground water resources along with action plan to SEIAA within one month time period.	Hydrogeological study has been conducted accredited consultant of CGWA & Domain expert. All the suggested measures has been implemented for augmentation of Ground water accordingly. And it is submitted to SEIAA	Head -Envireonment
5	The mine shall take adequate measures to minimize the discharge of waste water to Damsala nallah.	More plantation programme will carried out for which more water will be used. Further, more water will be used for dust suppression as the hual road will be increased. So, that discharge to Damasala nallah will be minimize.	Head -Technical service Head -Environment
6	All the compliances submitted/ committed by PP () shall be strictly adhered to by them.	It is agreed & strictly followed.	Mines Manager
7	Waste should be dumped on the earmarked sites within the mining lease area and no waste should be dumped outside the lease area	All the generated waste will be disposed inside the Mine only per approved Mining Plan	Mines Manager
8	The Project Proponent shall start the plantation and cover at least 50% of the proposed area under plantation in the next 5 years. The density of the plantation should not be less than 2500 saplings/Ha. The species to be selected for the plantation should be in consultation with local forest department or any other expert agency engaged for the same. The Project Proponent shall keep the record of saplings planted survival rate area covered under plantation location etc laddition to this gap filling needs to be done to as and when require for maintaining the density of plantation. The PP shall submit the drone images of area before and after the plantation. PP shall carry out pilot study for phyto remediation of hexavalent chromium through IMMT CSIR. Bhubaneswar. The budget earmarked for the plantation shall be kept in separate bank account and audited annually.PP shall submit the detail such as photographs (before & after with gee location date &time), details of expert agency engaged details of species planted, number of species planted survival rate density of plantation and outcome of the pilot study etc. to the Regional Office of MoEF&CC Bhubaneswar and SEIAA Odisha before 1s July & 1 December of every year for the activities carrned out during previous year	Presently around 34 Ha./46% of ythe total area covered with plantation. Density of the plantation is more than 2500/Ha. All the data of sapling planted & survivial rate is being recored. Drone image boefore plantation & after plantation to be kept **Pilot study for phyto remediation to be carried out through IIMT, BBSR** Separate funds have been provided for Plantation purpose in maintaing separate cost centre which is also audited.	Head -Technical service Head -Environment
9	Approval/permission of CGWA/SCWMA shall be obtained before drawing ground water for the project activities. State Rollution entrol Roard (SPCB) concerned shall not issue Consent to Operate (CTO)til the project Proponent obtains such permisSIon.	Renewal application to be submitted within the time to obtain NOC	Head -Environment
10	The amount proposed under Carporate Environment Responsibility (CER) heaad should be kept in a separate bank account and should be audited annually. Thee PP should annually submit the audited statement and detalils of implementation of CER activities along with proof of activities viz. photographs (before & after with geo-location date & time), purchase documents, photographs & Geo-location of the infrastructuresfacilities developed, etc. to the Regional Office of MoEF&CC Bhubaneswar and SEIAA, Odisha before 1st July & 1 December of every year for the activities carried out during previous year.	CER expenses to be Kept in separate Cost Centre & will be audited annually once. Before & after photographs to be kept. Photograph, PO to be provide in Six Monthly return	Head -CSR

11	The amount (except occupational health) proposed under Environmental Management Plan (EMP) head should be kept in a separate bank account and should be audited annually. The PP should annually submit the audited statement and detailed environment monitoring report along with proof of activities viz photographs (before & after with geo-location date & time), purchase documents, sampling reports, photographs& Geo-location of the infrastructures/facilities developed, details of persons engaged in Environment Management Cell etc. to the Regional Office of MoEF&CC, Bhubaneswar and SEIAA, Odisha before 1st July of every year for the activities carried out during previous year.	Detailed environment monitoring report along with proof of activities viz photographs (before & after with geo-location date & time), purchase documents, sampling reports, photographs& Geo-location of the infrastructures/facilities developed to be kept for record & submission to SEIAA Once in aYear  11.12 ENVIRONMENT MANAGEMENT PLAN TABLE 11.4 : EMP BUDGET SL No. / Category / Capital Cost (Crore) / Recurring Cost (Crore) 1 Water Pollution Equipment 3.0 0.30 2 Green Belt Development 0.22 0.01 3 Environment Monitoring 0.0 0.48 4 CER Budget 0.90 0.0 5 R&R 0.0 0.0 6 Safety & Disaster Management Plan 1.0 0.10 Total 5.12 0.89	Head Environment
12	The amount proposed under Occupational Health plan head should be kept in a separate bank account and should be audited annually. The PP should annually submit the audited statement and detailed environment monitoring report along with proof of activities viz. photographs (before & after with geo-location date & time), purchase documents, sampling reports, photographs& Geo-location of the infrastructures/facilities developed. details of persons engaged in Environment Management Cell etc. to the Regional Office of MoEF&CC, Bhubaneswar and SEIAA Odisha before 1st July of every year for the activities carried out during previous year	1.) It is being operated in a separate cost center and the audit report will be submitted to the authority. 2.) Its is complied. The report for this financial year 2022-23 will be submitted before 1st July'23.	Head Environment
13	The Project Proponent shall set up an Environmental Management Cell comprises of persons having qualification and experience in the field of environment along with supporting staff. The details of the same needs to be submitted to the SEIAA Odisha within 3 months of the grant of EC	Letter no 865 send to SEIAA on 16th April 2022	Head Environment
14	The Sub-Committee of SEAC will visit the site within 6 months from the date of issue of Environmental Clearance to ensure implementation of agreed measures However either during the visit of the SEAC Sub-committee and/or at any timne if it noticed that stipulated conditions on which EC is granted is not in place or found otherwise, steps will be taken for revocation of EC granted	It is a continous process so we ensure that the same is being followed.	Head Environment
15	The Project Proponent shall implement the short term and long term measures proposed to be taken in order to get rid from the adversity of Cr (V) contamination. needs to be implemented and status report of the same along with benefit occurred needs to be submitted to Regional Ofice of MoEF&cO Bhubaneswar and SEAA Odisha annually.	As discussed with NIT Rourkela the project will take another 2-3 months time. After getting the final report the same will be implemented.	Head Technical Service Department
16	The Project Proponent shall keep a record of each blasting viz. location, number of holes, delay assigned of each hole, explosive quantity of each hole, blasting pattern etc.	All this information are maintained in bound page register in prescribed format under regulation 169 (b) of MMR'1961. It is complied. The record is being kept and maintained in the file	Mines Manager
17	This Environmental Clearance (EC) is subject to orders/ judgment of Hon'ble Supreme Court of India, Hon ble High Court, Hon ble NGT and any other Court of Law, Common Cause Conditions as may be applicable.	It is Complied	Head Legal
18	The Project proponent complies with all the statutory requirements and judgment of Hon'ble Supreme Court dated 2nd August,2017 in Writ Pettion (Civil) No. 114 of 2014 in matter of Common Cause versus Union of India & Or before commencing the mining operations, if applicable to the Project.	Letter has been submitted to Moef	Head Legal
19	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 &0rs as may be applicable.	Letter has been submitted to Moef	Head Legal
20	This Environmental Clearance shall become operational only after receiving formal NBWL Clearance from MoEF & cC subsequent to the recommendations of the Standing Committee of National Board for VWildlife. if applicable to the Project	It is not applicable as the lease hold area do not fall under and wildlife area so NBWL clearance is nor required.	

21	This Environmental Clearance shall become operational only after receiving formal Forest Clearance (FC) under the provision of Forest Conservation Act 1980, if applicable to the project	It is complied. We have obtained FC on 7th Feb 2006, from the Govt. of Odisha.	Head Environment
22	Project Proponent (PP) shall obtain Consent to Operate after grant of EC and effectively implement all the conditions stipulated therein .The mining activity shall not commence prior to obtaining Consent to Establish/ Consent to Operate from the concerned State Pollution Control Board	CTE obtained on dated 31.03.2022. CTO Obtained on 28.06.2022 & valid till 31.03.2026	Head Environment
23	The PP shall adhere to the provision of the Mines Act. 1952, Mines and Mineral (Development & Regulation), Act. 2015 and rules & regulations made there under PP shall adhere to various circulars issued by Directorate General Mines Safety (DGMS) and indian Bureau of Mines from time to time	It is being mainatined.	Mines Manager
24	The Project Proponent shall obtain consents from all the concerned land owner before start of mining operations as per the provisions of MMDR Act 1957 and rules made there under in respect of lands which are not owned by it.	Surface right is obtained. So, it is complied	Mines Manager
25	The Project Proponent shall follow the mitigation measures provided in MoEF & CC's Office Memorandum No 2-1013/57/2014-IA I (M). dated 29 October 2014 titled "Impact of mining activities on Habtations-lssues related to the mining Projects wherein Habitations and villages are are the part of mine lease areas or habitation and villages are surrounded by the mine lease area"	It is NA as we don't have any village in the mine lease area. Further, EIA report has been conducted and as per the report mitigative measure has been taken.It is also being mainatianed	Head -encvironment
26	The copies of the environmental clearance shall be submitted by the project proponents to the heads of the local bodies, panchayats and municipal bodies in addition to the relevant offices of the government who in turn has to display the same foe 30 days deom the date of receipt	It is Submitted to The Collector & District Magistarte, Jajpur , The Sub-Collector,Jajpur, The Tahasildar, Sukinda & The Sarapanch , Kaliapani on dated 07.04.2022 for information	
27	State Pollution Control Board shall be responsible for display of this EC letter at its Regional ofice, District Industrles Centre and Collector's office/ Tahasildar's Offics for 30 days.	Not applicable for PP	
28	The Project Authorities should widely advertise about the grant of this EC letter by printing the same m 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.environmentclearance.nic.in) A copy of the advertisement may be fonwarded to the concened MoEF & CC Regional Office for compliance and record.	Advertisement published on dated 08.04.2022 on Pragativadi (Odiya Paper) & Orissa Post (English Paper)	
29	The Project Proponent shall inform the MoEF& CC/SEIAA, Odisha for any change in ownership of the mining lease. In case there is any change in ownership or mining lease is transferred than mining operation shall only be carried out after transfer of EC as per provisions of the para 11 of EIA Notification, 2006 as amended from time to time	It is not applicable	

B	**Statutory Condition:**		
(i)	Air Quality Monitoring and preservation		
30	The Project Proponent shall instal a minimum of 1 (one) online Ambient Air Quality Monitoring Stations to monitor critical parameters relevant for mining operations, of air pollution viz PM10, PM25. NO2 CO and SO2 etc. as per the methodology mentioned in NAAQS Notification No. B-29016/20/90/POCIH 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	One online AAQ Monitoring station to be be installed .by 30.09.2022. AAQ Monitored in other place & also digitally displayed infornt of the Maingate.	Head Environment
31	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 PM10 and PM2.5 are evident such as haul road, loading and unloading point and transfer points. The Fugitive dust emissions from ah sources shall be regularly controlled by installation ot 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 polution level conform to the standards prescribed by the MoEF&CC/ Central Pollution Control	Water sprinklers are being engaged for dust suppression. It is being maininatined properly	Mines Manager

II	Water Quality Monitoring and Preservation		
32	In case, immediate mining scheme envisages intersection of ground water table, then Environmental Clearance shall become operational only after receving 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 MoEF&CC 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.	NOC Is obtained from CGWA	Head Environment
33	Regular monitoring of the flow rate of the springs and perennial nallahs flowing in and around the mine lease shall be carried out and records maintain. The natural water bodies and or streams which are flowing in an around the village, should not be disturbed. The Water Table shoud be nurtured so as not to go down below the pre-mining period. In case of any water scarcity in the area, the Project Proponent has to provide water to the villagers for their use. A provision for regular monitoring of water table in open dug wall located in village should be incorporated to ascertain the impact of mining over ground water table 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/ State Pollution Control Board	We don't have any perennial nallahs in and around the lease, we have only seasonal nallahs. There is no scarcity of water and the water table is in proper level also drinking water is provided to the nearby village. Water table is being monitored regularly by NABL Lab	Head Environment
34	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/ State Pollution Control Board	Ground water level & quality being monitored regularly.And report also submitted quarterly	Head Environment
35	The Project Proponent shall undertake regular monitoring of natural water course water resaurces/ springs and perennial nallahs existing/ flowing in and around the mine lease and maintain its records The project proponent shall undertake regular monitoring of water quality upstream and downstream of water bodies passing within and nearby/ adjacent to the mine lease and maintain its records. Sufficient number of gulies shall be provided at appropriate places within the lease for management of water PP shall carryout regular monitoring wrt. pH and included the same in monitoring plan The parameters to be monitored shall include their water quality vis a-vis suitability for usage as per CPCB eriteria 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 MoEF&CC SEIAA Odisha. 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 be sent regularly to ministry of environment, forest and climate change and its regional office, SEIAA, Odisha, Central Ground Water Board, State Pollution Control Board and central pollution control board. Clearly showing the trend analysis on six-monthly basis.	Water quality of Damasala Nallah is being Monitored & report submitted.	Head Environment
36	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.	As we have engaged visionteck to ensure the quality of the mines discharge water. And all the parameters mentioned are monitored.	Head Environment
37	The project proponent shall construct retaining wall and settling pond within the lease area. Further. check dams shall be constructed at strategic locations in which rain water passes in rainy season. Quality of the mine drainage water shal be monitored on real-time basis& also monitored through NABL Lab. Mine drainage water shall be used only after treatment through ETP for various industrial uses	Already Retaining wall alonge the side of the dump is constructed along with the the garland drain. Also we have settling pond. Check dams is also constructed at strategic locations through which rainwater passes through. The quality of the mine drainage water is being monitored on	Head Environment
38	Detail design of the existing retaining wall and the proposed for the expansion from a chartered Civil Engineer shall be submitted within 6 months from the date of issue of Environmental Clearance to ensure that no silt after wash up & treatment	there is no proposed retaining wall. Also the extising retaining wall design is being done by chartered civil engineering	Head Civil
39	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, MoEF& CC annually.	It is being mainatianed. But one annual report on recharge amount to be submitted to MoEF . Along with Oct to March report , it will be submitted.	Head Environment
40	Industrial waste water(workshop and waste water from the mine) should be properly collected and treated in an ETP as proposed 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.	It is being mainatined.The mines waste water is treated in the ETP as per the prescribed standards mentioned in the CTO conditions, also we have installed Oil & Grease trap foe workshop effluents	Head Environment
41	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.	The water balance chart is maintained and monitored on monthly basics. And the action plan for the reduction of water is made and submitted to the MoEF & SPCB Letter No 1142 is MoEF & Letter No 1145 is SPCB	Head Environment

iii	**Noise and Vibration Monitoring Prevention**		
42	The peak particle velocity at 500m distance or within the nearest habitation whichever is closer shall be monitored periodlcally as per aplicable DGMS guidelines.	A scientific study on ground vibrational effects of blasting is carried out by NIT Rourkela periodically (Yearly Once) Also vibration measuring insturment (Micro Mate) is in odering state and it will reach by september end. From October the monitoring will be carried out internally	Mine Manager
43	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.	Noise monitoring is done by VisionTek both in day and night and the noise limit falls under the prescribed standards. Illumination survey also being cerred out regularly.	Head Environment Head-Electrical
44	The Project Proponent shall take measures for control of noise levels below 85 dBA in the work environment The worker 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.	Noise level is being monitored and it shows below the prescribed limits. All the workers are working in HEMM are provided with ear plugs and the workers working in dusty are are provided with protective respiratory devices.	Head Environment Head-Safety
iv	Mining Plan		
45	The Project Proponent shall adhere to the working parameters of mining plan which was submitted at the time of EC appraisal wherein year-wise plan was mentioned for total excavation ie. quantum of mineral, waste over burden inter burden and top soil etc. No change in basic mining proposal like mining technology total excavation, mineral & waste production, lease area and scope of working (viz method of mining. overburden & dump management, O.B & dump mining, mineral transportation mode. ultimate depth of mining etc) shall not be carried out without prior approval of the Ministry of Environment Forest and Climate Change which entail adverse environmental impacts,even if it is a part of approved mining plan modified after grant of EC or granted by State Govt in the form to Short Term Permit (STP), Query license or any other name	Mining activities is being carried out as per the approved mining plan. There is no such changes, and t incase of any changes, prior permission will be taken from MoEF CC.	Mines Manager
46	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 vernfication	It is not applicble , as there is no FMCP required now. During requirement , it will be followed strictly.	Head Technical services Head Geology
47	The land-use of the mine lease area at various Stages of mining scheme as wel as at the end-of-life shall be governed as per the approved Mining Plan. The excavation vis-a-v backfilling vis-à-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/ SEIAA, Odisha	Approved Mining Plan will be followed strictly.	Head Technical services Head -Survey Head Environment
V	**Land Reclamation**		
48	The Overburden (O.B.) generated during the mining operations shall be stacked at eamarked OB dump site(s) only and it should not be kept active for a long period of time. The physical parameters of the OB dumps like height, width and angle of slope shall be governed as per the approved Mining Plan as per the guidelines/circulars issued by D.G.M.S w.r.t. safety in mining operations shall be strictly adhered to maintain the stability of top soil/OB dumps. The topsoil shall be used for land reclamation and plantation.	The OB generated is stacked in OB dump site with proper height, width and angle of slope as per the approved mining plan. Monthly report to be generated & submitted by Head-survey & Mine planning team	Mines Manager Head -Survey
49	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. safety in mining operations shall be strictly adhered to maintain the stability of waste dumps.	The OB generated during the mining operation is stacked at the OB dump site which is having proper height, width and angle of slope as per the approved mining plan & other circulars.	Mines Manager Head -Survey
50	The reclamation of waste dump sites shall be done in scientific manner as per the Approved Mining Plan cum Progressive Mine Closure Plan.	The OB dump has been suitably terraced and stabilized through plantation and grass patching in the inactive dump slopes as per approved Mining Plan. It will be mainatianed.	Mines Manager Head -Technical services
51	"The slope of dumps shall be vegetated in scientific manner with stable native speces 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 gulies formed on slopes should be adequately taken care of as it impacts the overall stablity 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 iners/ Bentonite etc. shall be undertaken for stabilization of the dump."	We use geo-textile & silpaulin to prevent erosion & surface run-off. Also the geo-textile & silpaulin helps to stabilize the dump by preventing the rain water to percolate in the dump. In long term effect these Geo-Textile decompose with the soil and makes the soil more fertile which in turns acts as a mannure for the plants planted in the benches of the dump.	Head-Technical services. Head-Environment
52	The Project Proponent shall carry out slope stability study in case the dump height is more than 30 meters. The slope stability report shall be submitted to concerned regional office of MoEF & CC. Govt. of India, Bhubaneswar as well as SEIAA, Odisha.	WeThe study has been conducted by CIMFER .Report also submitted.	Head Environment

53	Catch drains, settling tanks and siltation ponds of appropriate size shall be constructed around the mine working,mineral yards and topsoil/OB /waste dumps to prevent runoff of water and flow of sediments directly into the water bodies (Nallah/ Riverl 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-silited regularly, particularly after monsoon season, and maintained properly.	Catch Drains, settling tanks and siltations ponds of appropriate size are constructed around the mine working yard, mineral yard and dump to prevent runoff of water and flow of sediments directly into the water body. Also the collected water is being utlised for domestic use like plantation, dust suppression & wheel washing after treatment. Further, it will be desilted after evry moonsson i.e within Dec-Jan'2022	Head Environment
54	Check dams of appropriate size, gradient and length shall be constructed around mine pit and OB dumps to prevent stom run-off and sediment low 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 corners of the garland drains.	Check-dams of appropriate size, gradient and length is constructed around mine pit, OB Dump & garland drain, here to arrest the slime/suspended solid particles flowing through the streams.	Head-Technical services Head Environment
55	Storm water and leached water for treatment shall be led in separate pipes and where required, retaining wall, settling pond and check dam shall be constructed within the lease hold area for conservation of rain water and prevention of soil loss.	Storm Water drains are there where required & retaining wall, settling pond & check dam are constructed in the lease hold area. It will be mainatined properly.	Head-Technical services
56	The top soil, if any, shall temporarily be stored at earmarked site(s) within the mine lease only and should not be kept unutilized for long. The physical parameters of the top soil dumps like height, width and angle of slope shall be governed as per the approved Mining Plan and as per the guidelines framed by DGMS w.r.t. safety in mining operations shall be strictly adhered to maintain the stability of dumps. The topsoil shall be used for land reclamation and plantation purpose	There is no Top soil avaibale at site. And will no generation plan in coming plan period.	Head Environment
57	"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 their mining activities and restore the land to a condition which is fit for growth of fodder, flora, fauna etc."	It will be taken care as per after ceassion of Mining activities inconsultaion with competent authority.	Head Environment
58	Slope study by an expert of repute of waste dumps to be done and submitted within six months from the date of issue of EC to SEAC/SEIAA	Slope Stability Study is conducted and the report will be submitted during six monthly EC Compliance Submission.	Head Environment
vi	TRANSPORTATION		
59	No Transportation of the minerals shall be allowed in case of roads passing through 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 trafic 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) cetificate for all the vehicles from authorized pollution testing centers	Request letter will be submitted to Concern Authority. Other point like Pollution Monitoring is being carried out by NABL Lab as per guideline. Dust sprinkling is being carried as per requirement and which will be conitued. PUC Certificate is vaiable for all the Vehciles.	Head Legal Head- CSR Head- Environment
60	The Main haulage road within the mine lease should be provided with a permanent water arrangement for dust suppresslon. Other roads within the mine lease should be wetted regulary with tanker-mounted water sprinkling system. The other areas of dust generation lke crushing zone, materlal transfer points, material yards etc. should invariably be provided with dust suppression arrangements. The air pollution control equipments like bag flters, 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.	Permanenet water sprinkling arrangement to be done in Main haul road. For dust suppression system we use mobile water tankers which sprinkles out the water in the haul roads regularly in a scheduled way Other than that we have 4 AAQMS located at different locations of the mine which monitors the quality of the ambient air. There is no transportation being carried out through belt conveyor.So, it is not applicable. Mial sent to Saini Ji 25.07.2022	Mines Manager
61	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.	It is done effectively and in a controlled manner. Also water sprinkiling is done regularly. PUC for all the vehicles from authorized pollution testing centers is available . It will be Monitored regularly.	Mines Manager
62	Haulage road shall be developed and maintained perennially and perpetually by the proponent in construction with the concerned authority of the Govt. and to this effect, the proponent shall submit an undertaking in form of a legal affidavit.	The haulage road is continously and permanently being developed and maintained. Discuss with Meher Babu Regarding Legal affidavit	Head Legal
63	Traffic Density study if not done by domain expert, then the expert to be ratified/ authenticated by domain expert and submitted within a month time.	Traffic density study has been conducted by domain expert & submitted along with final EIA.	

VII	**Green Belt**		
64	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 Ministry irrespective of the stipulation made in approved mine plan	7.5 mtr wide green belt has been developed all along the safety zone. And it is being mainatined.	Head Environment
65	The Project Proponent shall carryout plantation/ afforestation in backflled 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	There is no back filled area & reclaimed area of mining lease, around water body, along the roadsides, in community areas etc it is NA . Further,during planation programe in the Mine , it is being discussed with Forest Department/Gram Panchayat. All other points are complied.	Head Environment
66	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 consuitation with the State Government. In this regard, Project proponent should essentially implement the directions of the Hon'ble Supreme Court with regards to acquisition of grazing land. The sparse trees on such grazing ground, which provide mid-day shelter from the scorching sun, should be scrupulouslt guarded/procted against felling and plantation of such trees should be promoted.	There is no such grazing land within the lease area of Ostapal chromite mines. As such the question of development of such grazing land w.r.t Ostapal mines does not arise. Hence not applicable.	
67	The Project Proponent shall undertake all precautionary measures for conservation and protection of endangered flora and fauna and Schedule-I species during mining operation. A Wildlife Conservation Plan shall be prepared for the same clearly delineating action to be taken for conservation of flora and fauna. The Plan shall be approved by Chief Wild Life Warden of the State Govt.and implemented in consultation with the State Forest and Wildlife Department. A copy of Wildlife Conservation Plan and its implementation status (annual) shall be submitted to the Regional Office of the Ministry.	Wild life Conservation plan has been prepared by acrrediated Consultant and submitted for approval.After getting the approval , recommendations will be implemnted accordingly.	Head Environment
VIII	Public Hearing and human health issues		
68	The Project Proponent shall appoint an Occupational Health Specialist for Regular as well as Periodical medical examination of the workers engaged in the mining activities as per the DGMS guidelines. The records shall be maintained properly. PP shall also carryout Occupational health check-ups in respect of workers which are having ailments like BP, diabetes, habitual smoking, etc. The check-ups shall be undertaken once in six months and necessary remedial preventive measures be taken. A status report on the same may be sent to MoEF & CC Regional Office and DGMS on half-yearly basis.	All the employees and workers those are engaged in mining activities being conducted AME & PME by occupational health specalists of Utkal Ployclininc which is having NABH accrediated lab facilities. FACOR has appointed Dr. Prameshwar Sethi as occupational medical officer for regular medical examination of workers engaged in mining activitied vide the Appointment Order No.- 305PVO/30/3/2022. All the records of AME & PME are kept properly both manually and digitally. The company medical officer is carring our healt check-ups program regularly those who having ailments like HTN, DM, Hyperlipidiamia & skin infections, habutual smoking habits & skin infection. The check-ups are being conducted every six month interval and necessery preventive measures are given to the staffs along with advice. All the reports are kept properly. Check-up shall be under taken once in six month & necessary preventive measures to be taken.	Doctor Head Safety
69	A commitment in form of an undertaking for periodical occupational health check up of the employee and the local people shall be done through an occupational health expert.	All the employees are being examined before appointment in the mining activities by an occupational specialist..	Doctor Head Safety
70	The Project Proponent must demonstrate commitment to work towards Zero Harm from their mining activities and carry out Health Risk Assessment (HRA) for identification workplace hazards and assess their potential risks to health and determine appropriate control measuresto protect the health and wellbeing of workers and nearby community.The proponent shall maintain accurate and systematic records of the HRA .The HRA for neighborhood has to focus on Public Health Problems like Malaria Tuberculosis. HIV, Anaemia, Diarrhoea in children under five respiratory infections due to bio mass cooking. The proponent shall also create awareness and educate the nearby community and workers for Sanitation Personal Hygiene, Hand washing not to defecate in open,Women Health and Hygiene (Providing Sanitary Napkins), hazard of tobacco and alcohol use. The Proponent shall caryout base line HRA for all the category of workers and thereafter every five years.	HIRA has been conducted on all the current activities in our Mines. Also we have obtained IMS certificate after completion of HRA. Other than that an ergonomic study has been conducted by KBS Group for our mines and the recommendations are implemented. Also Qualitative & Quantative industrial hyegine study has been conducted by M/s Sure Safety for mines. The FACOR is commited to work for zero harm from the mining activities and carrying out appropriate measures for Risk assessment and identification of workplace hazards and asses the potential risks for health and taking appropriate control measures to protect health of workers and the near by community.FACOR is conducting HRA among the neighbourhoods to focus on and adults.Regular awareness proggame is being conducted in the nearby villagees for sanitization,personal hygiene,hand washing,not to defecate in open places,womens health,hazards of smoking tobacco,drinking alcohol. Awareness proggames are	Doctor Head Safety

71	"The Proponent shall carry out Occupational health suryeillance which be a part of RA and include Biological Monitoring where practical and feasible and the tests and investigations relevant to the exposure (e g for Dust a XRay chest,For Noise Audlometric; for Lead Exposure Blood Lead, For Welders Full Ophthalmologlo Assessment; for Manganese Miners a complete Neurologlcal Assessment by a Certified Neurologlst, and Manganese (Mn) estimation in Blood; For Inorganic Chromlum-Fortnightly skin inspectlon of hands and forearme by a responsible person. Except routine teste all teets would be carrled out in a Lab accredited by NABH. Records of Health Surveillance must be kapt for 30 years, including the results of and the records of Physical examination and tests. The record of exposure due to materials like Asbestos, Hard Rock Mining, Sillca, Gold, Kaolin, Aluminium, Iron, Manganese, Chromium, Lead, Uranium need to be handed over to the Mining Department of the State in case the life of the mine is less than 30 years. It would be obligatory for the State Mines Departments to make arangements for the safe and secure storage of the records including X-Ray. Only conventional X-Ray will be accepted for record purposes and not the digital one). X-Ray must meet ILO criteria (17 xl4 inches and of good quality)"	FACOR is taking necessary steps to carry out occupational health surveillance for works engaged in mines activities li like audiometric tests for blasters(noise),x-ray chest for hexavalent chromite exposure, fortnightly skin inspection by Medical officer of our dispensary.all the routine examination of stool,urine,sputum and chest x-ray are being done in every six months for foodhandlers, FACOR is taking steps for chest x-ray,examination of sputum,stool,audiometric test and full lung function test for blasters and full opthalmolocal tests for Drivers and Operators.	Doctor Head Safety
72	The Proponent shall maintained a record of performance indicators for workers which includes (a) there should not be a significant decline in their Body Mass Index and it should stay between 18.5-24.9, (b) the Final Chest X-Ray compared with the base line X-Ray should not show any capacities, (c) At the end of their leaving job there should be no Diminution in their Lung Functions Forced Expiratory Volume in one second (FEV1),Forced Vital Capacity (FVC), and the ratio) uniless they are smokers which has to be adjusted, and the effect of age, (d)their hearing should not be affected. As a proof an Audiogram (first and last need to be presented), (e) they should not have developed any Persistent Back Pain Neck Pain, and the movement of their Hip, Knee and other joints should have normal range of movement, (f) they should not have suffered loss of any body part. The record of the same should be submitted to the Regional Office, MoEF&CC annually along with details of the relief and compensation paid to workers having above indications	All the employees are being examined before appointment in the mining activities by an occupational specialist. Also maintaing a record of performance indicators for workers which include their Body Mass index,chest x-ray.	Doctor
73	The Project Proponent shall ensure that 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	During start of every shift daily Tool Box Talk takes place where it is addressed that person working in dusty area should wear resperatory devices, also safety traings are also given by the safety officer about the importance of wearing respiratory	Head Safety Mine Manager
74	Project Proponent shall make provision for the housing for workers/labors or shall construct labor camps within/outside (company owned land) with necessary baslc 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	All most all the workers/labors are coming from local area. So, colony is not required for them.	Mine Manager
75	The proponent shall implement the mitigative measures as suggested in the Study Report on effect of chromite mines to nearest human hatbitation	The PP has implemented the mitigative measures to protect from chromium mines to nearest human habitation. It will be monitored on real time basis.	Head -Enviroenment
IX	**Corporate Environment Responsiblitiy (CER)**		
76	As per the MoEF& CC, Govt. of India Ofice Memorandum dated 30,.09.2020, the project proponent is equired to prepare and implement Corporate Environment Responsiblity (CER) Plan. The activities proposed under CER shall be restricted to the affected area around the project. The company shall undertake all relevant measures for improving the socio-economic conditions of the surrounding area. CSR activities shall be undertaken by involving local villages and administration. The activities proposed for CER shall be implemented and to be completed within three years and annual report of implementation of the same along with documentary proof viz. photographs, purchase documents, latitude & longitude of infrastructure developed & road constructed needs to be submitted to Regional Office MoEF & CC annually along with audited statement and to the District Collector. It should be posted on the website of the project proponent.	The CER plan is prepared for 3 years and it is there in the Environment Management Plan (EMP) and it is also a part of our approved Environmental Impact Assessment (EIA). Work is under progress and it is a continuous process and we will submit the report to MoEF & CC and district collector at year end.	Head- CSR
77	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 fo any other purpose. Year wise progress of implementation of action plan shall be reported to the Regional Office of MoEF & CC, Bhubaneswar, SPCB Odisha along with the Six Monthly Compliance Report.	EMP action plan to be prepared & Responsibilty fixed for implementation . It is duly Approved. Yearwise funds earmarked shall be kept in separate account.Yearwise progess report will be submitted	Head Environment

X	Miscellaneous		
78	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	It is prepared . Further, KML file to be prepared & submitted once in every 5 year. We are having a digital map for the entire lease. Letter no 1142 send to MoEF on 08.08.2022	Head-Survey
79	The Project Authorities should inform to the Regional Office regarding date of financial closures and final approval of the project by the concerned authorities and the date of start of land development work.	Life of the Mine is More than 10 years in present Method. Further, it will enhance by adoption of New Technology.Before, 2 years of the closing FMCP to be submitted for approval from	
80	The project proponent shall establish a solar power plant with 30KVA capacity within the lease area as proposed.	As there is no colony inside the lease, so persons are staying outside the lease area where there in solar power plant installed of capacity having 40 KVA. And it will be maintained	Head -Maintanace processing Unit & Electrical Engineer
81	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. SPOB& Regional Office of the Ministry of Environment & Forest. Odisha in hard and soft copies on 1 June and 1December of each calendar year .The proponent shall aso upload the Compliance report including results of monitored data as applicable in the website of the Ministry for monitoring of EC Conditions	Sic Monthly Compliance Report will be submitted after completion of Every Six Month. Report will be submitted to SEIAA, SPCB & MOEF & CC , Regional Office.	Head - Environment
82	The environmental statement for each Financial year ending 31 March in Fom-V as mandated to be submitted by the project proponent to the Odisha State Pollution Control Board as prescribed under the Environment (Proection) Rules 1986, as amended subsequently, shall also be put on the website of the company along with the status of compliance of EC conditions and shall also be sent to the respective to the MoEF & COC & its concerned Regional Office, Central Pollution Control Board and State Pollution Control Board.	Environment Statement to be prepared & submitted the concerned authority 1) Member secretary ,SPCB 2) RO, SPCB,3) MoEF & CC 4) CPCB . Further, to be uploaded in Company Website.	Head -Environemt
83	The proponent shall submit/upload six monthly reports on the status of compliance of the stipulated Environmental Clearance conditions, including results of monitored data on their website and shall update the same periodically. It shall simultaneously be sent to the Regional Office of MoEF &CC, Govt. of India, the respective Zonal Office of CPCB and the SPCB. The criteria pollutant levels namely: SPM, RSPM, SO_2, NOx (ambient levels as well as stack emissions) or critical sectoral parameters, indicated for the project shall be monitored and displayed at a convenient location near the main gate of the company in the public	EC Compliance to be uploaded in Website along with Monitoring data. And To send MoEF & CC, BBSR , SBPB BBSR, Digitral display board to be upadted periodically	Head- Environemnt
84	The Project Proponent shall submit six monthly compliance reports on the status of the implementation of the stipulated environmental safeguards to the MoEF& CC &its concerned Regional Office, SEIAA, Odisha, Central Pollution Control Board and State Pollution Control Board	Six Monthy compliance to be prepared & submitted the concerned authority 1) MoEF & CC, BBSR 2)SEIAA 3)SPCB ,BBSR	
85	The SEIAA, Odisha may revoke or suspend this EC, if implementation of any of the above conditions is not satisfactory. The SEIAA, Odisha reserves the right to alter /modify the above conditions or stipulate any further condition in the interest of environment protection.	All the condition to be filled up.	All person identied in Responsibily Matrix
86	The project proponent shall augment infrastructure on drinking water, health care and education in nearby villages as per time bound action plan submitted	It is continuous processes, and it is being implemented as per action plan As per CER plan submitted through EIA report, action to be	Head- CSR
87	The project proponent shall obtain permission from DGMS under 106(2b) to carry out blasting operation within the lease area.	Complied, We have valid permission under 106(2b) to carry out blasting operation within area.	Mines Manager
88	The site will be visited by the sub-Committee of SEAC after six months to review the progress of recommendations of SEAC on specific conditions	All the condition to be implemented before 6 months	All person identied in Responsibily Matrix
89	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	All the condition to be implemented before 6 months	All person identied in Responsibily Matrix
90	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 Cout of india High Court and any other Court of Law relating to the subject matter	It is being Complied. And it will follow all rule & regulation as ammended from time to time	Head -Legal & Head- Environment &
91	This Environmental Clearance (EC) is subject to orders/judgment of Hon'ble Supreme Court of India, Hon'ble High Court, Hon'ble NGT and any other Court of Law, Common Cause Conditions as may be applicable		Head Legal
92	Any appeal against this environmentail 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	No appeal filed against this Environment Clearance in the National Green Tribunal. Hence complied.	Head Legal

M. Muthumary 16/09/2022
[MUTHUMARI.M]

Authorized Signatory & Agent
Ostapal Chromite Mine

OCM/ENV/ 1142 /2022

Date: 08.08.2022

To
The Joint Director (s)
Ministry of Environment, Forest & Climate Change
Govt. of India
Eastern Regional Office
Bhubaneswar - 751023

SUB: Submission of Land Use Pattern report of Ostapal Chromite Mines M/s Ferro Alloys Corporation Limited.

Ref: EC Statutory Condition B.78 of Ostapal Chromite Mines M/s Ferro Alloys Corporation Limited.

Dear Sir,

With respect to the cited subject mentioned above, we would like to intimate your good office that we are submitting the land use pattern as per the approved mining plan of Ostapal Chromite Mines M/s Ferro Alloys Corporation Limited.

The Details of the land use patter of Ostapal Chromite mine is mentioned in the **annexure - 1**

This is for your kind consideration please.

Thanking You

Yours Faithfully

Mines Manager
Ostapal Chromite Mines
Ferro Alloys Corporation

M/s. Ferro Alloys Corporation Ltd. (A subsidiary of Vedanta Ltd.)
Registered Office:
D.P. Nagar, PO: Randia, Dist.: Bhadrak, Odisha, India 756 135
T +91-6784 240320/240347, Email: facor.mines@vedanta.co.in / facor.ccp@vedanta.co.in
Website: www.facorgroup.in, CIN: U45201OR1985PLC008400

Annexure – 1
Land Use Patter of Ostapal Chromite Mine

Sl.No.	Description	Area In Hectares		
		Present land degradation	Land degradation at the end of proposal period	At the end of Conceptual Period (upto 2031)
1	Area under Mining.	30.179	34.539	34.539
2	Storage for top soil.	-	-	-
3	Overburden/ dump.	27.048	28.585	30.551
4	Mineral Storage.	2.805	1.561	1.561
5	Infrastructure (Work shop, Admn.Bldg. etc).	0.198	-	-
6	Roads.	1.538	0.304	0.304
7	Railways.	-	-	-
8	Green Belt (Safety Zone).	4.070	4.070	4.070
9	Tailing Pond.	1.502	-	-
10	Effluent Treatment Plant with Settling Pit.	0.437	0.360	0.360
11	Mineral Separation Plant (COB)	1.421	0.410	-
12	Township area.	-	-	-
13 others	i. Drain.	1.028	1.290	0.790
	ii. Barrier/retaining wall.	0.946	0.907	0.407
	iii. Peripheral area.	1.671	0.817	0.261
	TOTAL :	72.843	72.843	72.843

FACOR

Biswanath Sahoo
Geologist, Q.P.

Vinod Salni
Mining Engineer, Q.P.

OCM/ENV/1357/2022 **Date: 29.09.2022**

To

The Member Secretary
State Pollution Control Board, Odisha
Paribesh Bhawan, Unit-VIII
BHUBANESWAR – 751 012

Sub: Submission of Annual Environmental Statement in Form-V for the Year 2021-22 in respect of **Ostapal Chromite Mine M/s. FACOR Ltd.**

Dear Sir,

With reference to the captioned subject, we are herewith submitting the Environmental Statement in the prescribed format Form-V, duly filled in, for the year 2021-22 in respect of **Ostapal Chromite Mines** M/s. Ferro Alloys Corporation Limited for your kind perusal.

This is for your kind information & perusal please.

Thanking you,

Yours faithfully,
for Ferro Alloys Corporation Ltd

Mines Manager Ostapal Chromite Mines

Enclosure: As above

Copy to: 1) Regional Officer, OSPCB, Kalinganagar – Jajpur
2) MoEF & CC Eastern Regional Office by Email.

FORM –V

ENVIRONMENTAL STATEMENT OF OSTAPAL CHROMITE MINES OF M/S.FACOR LTD., ENVIRONMENT STATEMENT FOR THE FINANCIAL YEAR ENDING ON 31ST MARCH 2022

(PART –A)

i)	Name & Address of the Owner/Occupier of the Industry operation or Process	M/s. FERRO ALLOYS CORPORATION LTD., D.P.Nagar, Randia Bhadrak
ii)	Industry Category Primary – (SIC Code) Secondary – (SIC Code)	CHROMITE MINING INDUSTRY
iii)	Production Capacity – Unit	2 Lakh TPA Chrome Ore from Mines 1.00 Lakh TPA Beneficiated Chrome Ore From COB Plant
iv)	Year of Establishment	13th August, 1985
v)	Date of last Environmental Statement submitted	27.09.2021 (For the Financial Year 2020-21)

(PART – B)
WATER & RAW MATERIAL CONSUMPTION

(i) Water Consumption M^3/day:

A	**WATER CONSUMPTION: FY 2021-22**		
	Water Consumption M3/day	**Total In a Year (Cub Mt)**	**Avg Cub mt/Day**
	a) Process (Beneficiation plant)	75670	208
	b) Cooling, dust suppression, afforestation etc	1852	5
	c) Domestic	26326	72
	Total Consumption	**103848**	**285**

B	**PROCESS WATER CONSUMPTION PER PRODUCT OUTPUT**		
	Name of the Products	During the Previous Financial Year 2020-21	During the Current Financial Year 2021-22
	a) Chrome ore Concentrate from COB Plant (Cub Mt /MT)	1.39	1.56
	b) Chrome ore from Mines (Cub Mt /MT)	0.441	0.52

ii) Raw Material Consumption:

FACOR is involved in extraction of Chrome Ore from Mine /quarry .Mining is not a Manufacturing Process thus there are no such raw materials involved in the process. However, there are number of Indirect raw materials/Consumables used to support the process of Mining & beneficiation of Ore. The details consumable raw materials as follows:

	Indirect Raw Materials /consumables	
Sl No.	**Name of the Raw materail/Consumable**	**During 2021-22**
1	Disel (Litres)	582773
2	Gas (Cu. M)	190
3	Lubricant Oil (Litres)	2494
4	Grease (Kg)	447
5	Electricity (Consumed) (Kwh)	804061
6	Electricity (Generated) (Kwh)	23395
7	Explosive (Kg) (Detonator, Safety fuse)	53800 kg (5570 nos.,14725mtrs)
8	Tyre Nos.	16

(PART – C)
POLLLUTION DISCHARGED TO ENVIRONMENT/UNIT OF OUTPUT
(PARAMETER AS SPECIFIED IN THE CONSENT ISSUED)

a)	Water *	Annual Avg. in Kg/day	Annual Avg. in mg/l	Annual Avg. (%)
1	Suspended Solids	43.2	22.5	Below prescribed standard
2	Oil & Grease	8.8	4.6	-do-
3.	B.O.D	8.9	4.65	-do-
4.	C.O.D	34	17.7	-do-
5.	Hexavalent Chromium (Cr^{+6})	0.002	0.001	-do-
6.	Total Chromium (Cr)	0.6	0.3	-do-

b) AIR ** - Not applicable. since it is a Mining Industry.

NOTE * All the analyzed parameters of Mines pumped out water are well within the prescribed limit except hexavalent Chromium, for which ETP has been commissioned. Analysis report of final discharge water (after treatment) is enclosed as ANNEXURE – I.

** Air quality analysis report of core & Buffer Zone is enclosed as ANNEXURE – 2A & 2B

(PART – D)
HAZARDOUS WASTES

AS SPECIFIED UNDER HAZARDOUS WASTES/MANAGEMENT & HANDLING RULES, 2008

Sl.No.	Hazardous Wastes	TOTAL QUANTITY (Kg.)	
		During the previous Financial Year 2020-21	During the Current Financial Year 2021-22
(a)	FROM PROCESS:		
I)	Filter & filter materials containing oil	30.0	19.70
II)	Used oil/waste oil from vehicles	345	264
(b)	From Pollution Control facilities (ETP Sludge)	24,600	19480

(PART – E)
SOLID WASTES

Sl.No.	P A R T I C U L A R S	TOTAL QUANTITY	
		During the previous Financial Year 2020-21	During the Current Financial Year 2021-22
(a)	FROM PROCESS:		
I)	Overburden	2.865 Lac M^3	4.75 Lac M^3
II)	Tailings	0.150 Lac Tons	0.291 Lac Ton
(b)	From Pollution Control facilities (ETP SLUDGE)	24.600 Tons	19.48 Tons
(c)			
(i)	Qnty. Recycled/or reutilized within the Unit	Nil	NIL
(ii)	Sold	Nil	NIL
(iii)	Disposed – Overburden	2.865 Lac M^3	4.75 Lac M^3
(iV)	Disposed - Tailings	0.150 Lac Tons	0.291 Lac Ton

(PART – F)

Please specify the characteristics (in terms of composition and quantity) of Hazardous as well as Solid wastes and indicate disposal practice adopted for both these categories of wastes.

Sl.No.	Name of Hazardous/ Solid Wastes	Composition	Quantity	Disposal Practice
a) i)	HAZARDOUS WASTES: Filter & filter materials containing oil	-	19.70 Tons	Filter materials generated during repairing & maintenance of vehicles are being disposed of in an impervious lined pit.
ii)	Used Oil/Waste oil	-	0.264 Tons	Used oil/waste oil from vehicles & transformers have been collected in barrels and kept under a covered shed to sell to a Regd. Authorized Dealer.
iii)	ETP Sludge	Clay soil	19.48 Tons	ETP sludge is being disposed of in impervious lined pit for onward disposed to authorized agency by SPCB.
b) i)	SOLID WASTES: Overburden	Laterite & weathered ultra-basic rock	4.75 Lac M^3	The solid wastes are generated as overburden is dumped in specified area of non-mineralized zones. After terracing and benching, massive afforestation is being carried out over these dumps.
ii)	Tailings	Sandy with Clay	0.291 Lac Tons	Tailings are being disposed of in Tailing Ponds after treatment with $FeSo_4$ solution.

(PART – G)

IMPACT OF THE POLLUTION ABATEMENT MEASURES TAKEN ON CONSERVATION OF NATURAL RESOURCES AND ON THE COST OF PRODUCTION

- Fully utilization of Low Grade ore by Beneficiation, use of mine drainage water in beneficiation, recovery of tailing water & recirculation in beneficiation plant. Mine water discharge to outside after treatment.

(PART – H)

ADDITIONAL MEASURES/INVESTMENT PROPOSAL FOR ENVIRONMENTAL PROTECTION INCLUDING ABATEMENT OF POLLUTION, PREVENTION OF POLLUTION

(a) Expense of Rs. 65.90 lakh during the year 2021-22 for environmental protection including abatement of pollution & prevention of pollution.

(b) Action taken to monitor the Environmental parameters. Monitoring is being carried out for environmental Parameters of Air Quality, Water Quality, Noise level Measurement on quarterly basis.

(PART – I)
ANY OTHER PARTICULARS FOR IMPROVING THE QUALITY OF THE ENVIRONMENT

	Action taken for massive afforestation	Extensive plantation program has been done and shall be taken upon available spaces, on dumps, roads, and also surrounding areas
	Measures taken to control of the fugitive emission at different places of Mines.	In order to suppress the air borne dust from the haulage roads and mine roads, there are arrangements for water spraying system through tankers and spraying of water is being done in regular intervals.
	Action taken for disposal of the excavated material not required for industrial purpose	The overburden waste which are not required for industrial purpose are dumped within the leasehold area at the earmarked site and terraced by forming benches and reclaimed with different plant species.
	Method adopted for controlling of dust pollution due to drilling	• Wet drilling is being practiced with a jet of water which is continuously directed at the cutting edge to suppress dust generation. • The cutting tools are being regularly grinded to maintain its sharpness by cross checking against gauges. • Compressed air pressure is being adequately supplied to the cutting tools. • Drill cutting are being regularly cleaned
	Method adopted for controlling of dust pollution due to blasting	Water spraying before & after blasting is being practiced to reduce the possible dust generation.
	Action taken to remove Cr^{+6} from Quarry pumped out water and surface runoff water.	An upgraded ETP is being operating to reduce Cr^{+6} from Quarry pumped out water and surface runoff water by dosing $FeSo_4$ solution. Also enhanced the ETP capacity from 400 KL/Hr to 600 KL/hr

ANNEXURE – 1

EFFLUENT WATER ANALYSIS REPORT AS PER IS-2490 &MOEF GUIDELINE 19.05.93

Visiontek Consultancy Services Pvt. Ltd.

(Committed For Better Environment)

Certified for : ISO 9001:2015, ISO 14001:2015, ISO 45001:2018 (OH&S), ISO/IEC 17025:2017

Accredited by : NABET-A Grade, MOEF & CC/CPCB & SPCB-A Grade

- Infrastructure Engineering
- Water Resource Management
- Environmental & Social Study
- Surface & Sub-Surface Investigation
- Quality Control & Project Management
- Renewable Energy
- Agricultural Development
- Information Technology
- Public Health Engineering
- Mine Planning & Design
- Mineral/Sub-Soil Exploration
- Waste Management Services

Laboratory Services
Environment Lab
Food Lab
Material Lab
Soil Lab
Mineral Lab
&
Microbiology Lab

Ref : Envlab/22/R-1529

Date : 28.04.2022

5. ETP Water Quality Analysis :

ETP1: ETP Mines Final Discharge Water								
Sl. No.	Parameters	Unit	Standards (In land Surface water)	Analysis Results 21-Jun	Analysis Results 21-Sep	Analysis Results 21-Dec	Analysis Results 22-Mar	Annual Average
1	Colour	Hazen	Colourless	5	5	5	10	6.25
2	Odour	--	Odourless	pungent smell	pungent smell	pungent smell	pungent smell	pungent smell
3	pH at 25°C	--	5.5-9.0	7.89	7.81	8.1	7.98	7.945
4	Total Suspended Solids	mg/l	100	20	18	20	32	22.5
5	Copper as Cu	mg/l	3	<0.05	<0.05	<0.05	<0.05	<0.05
6	Fluoride as F	mg/l	2	0.28	0.21	0.28	0.38	6.25
7	Total Residual Chlorine	mg/l	1	ND	ND	ND	ND	ND
8	Iron as Fe	mg/l	3	0.54	0.52	0.34	0.42	0.455
9	Manganese as Mn	mg/l	2	<0.05	<0.05	<0.05	<0.05	<0.05
10	Nitrate as NO_3	mg/l	10	7.9	7.1	7.34	7.46	7.45
11	Phenolic Compounds as C_6H_5OH	mg/l	1	<0.001	<0.001	<0.001	<0.001	<0.001
12	Selenium as Se	mg/l	0.05	<0.01	<0.01	<0.01	<0.01	<0.01
13	Cadmium as Cd	mg/l	2	<0.001	<0.001	<0.001	<0.001	<0.001
14	Cyanide as CN	mg/l	0.2	<0.05	<0.05	<0.05	<0.05	<0.05
15	Lead as Pb	mg/l	0.1	<0.01	<0.01	<0.01	<0.01	<0.01
16	Mercury as Hg	mg/l	0.01	<0.001	<0.001	<0.001	<0.001	<0.001
17	Nickel as Ni	mg/l	3	<0.05	<0.05	<0.05	<0.05	<0.05
18	Arsenic as As	mg/l	0.2	<0.05	<0.05	<0.05	<0.05	<0.05
19	Total Chromium as Cr	mg/l	2	0.36	0.31	0.28	0.28	0.3075
20	Zinc as Zn	mg/l	5	0.028	0.022	0.021	0.024	0.02375
21	Hexavalent Chromium as Cr^{+6}	mg/l	0.1	<0.001	0.018	<0.001	<0.001	<0.001
22	Vanadium as V	mg/l	0.2	<0.001	<0.001	<0.001	<0.001	<0.001
23	Temperature	Oc	Shall not exceed 5degree C above the receiving water temperature	36	34	24	33	31.75
24	Dissolved Oxygen	mg/l		6.9	6.2	7.1	6.1	6.575
25	Biochemical Oxygen Demand as BOD	mg/l	30	6	3.8	6.6	2.2	4.65
26	Chemical Oxygen Demand as COD	mg/l	250	20	14	20.8	16	17.7
27	Oil & Grease	mg/l	10	5.2	4.6	4.8	3.8	4.6
29	Ammonical Nitrogen as N	mg/l	50	1.6	1.2	1.4	2.4	1.65
30	Total Kjeldahl Nitrogen as N	mg/l	100	5.4	4.6	5.4	3.9	4.825
31	Sulphide as S	mg/l	2	<0.001	<0.001	<0.001	<0.001	<0.001
32	Free Ammonia as NH_3	mg/l	10	4.6	4.1	5.4	4.4	4.625
33	Particulate Size of Suspended Solids	µ	Shall pass 850 micron IS Sieve	<850	<850	<850	<850	<850
34	Bio-assay	%	90% survival of fish after 96 hours in 100% effluent	98% Survival of Fish after 96 Hrs in 100% Effluent	92% Survival of Fish after 96 Hrs in 100% Effluent	94% Survival of Fish after 96 Hrs in 100% Effluent	98% Survival of Fish after 96 Hrs in 100% Effluent	98% Survival of Fish after 96 Hrs in 100% Effluent

Reviewed By

Approved By

ANNEXURE-2A

AMBIENT AIR QUALITY (CORE ZONE)

Visiontek Consultancy Services Pvt. Ltd.

(Committed For Better Environment)

Certified for : ISO 9001:2015, ISO 14001:2015, ISO 45001:2018 (OH&S), ISO/IEC 17025:2017

Accredited by : NABET-A Grade, MOEF & CC/CPCB & SPCB-A Grade

- Infrastructure Engineering
- Water Resource Management
- Environmental & Social Study
- Surface & Sub-Surface Investigation
- Quality Control & Project Management
- Renewable Energy
- Agricultural Development
- Information Technology
- Public Health Engineering
- Mine Planning & Design
- Mineral/Sub-Soil Exploration
- Waste Management Services

Laboratory Services: Environment Lab, Food Lab, Material Lab, Soil Lab, Mineral Lab & Microbiology Lab

Ref : Envlab/22/R-1510 Date : 28.04.2022

YEARLY COMPLIANCE REPORT FROM APRIL 2021 TO MARCH 2022

M/s FERRO ALLOYS CORPORATION LIMITED , BHADRAK

OSTAPAL CHROMITE MINES , KALIAPANI, JAJPUR

1. Ambient Air Quality (Core Zone) :

AMBIENT AIR QUALITY (CORE ZONE)									
AAQ1: Near Dispensary									
Parameters	Unit	CPCB AAQ Standard 2009	21-Apr	21-May	21-Jun	21-Jul	21-Aug	21-Sep	Average
PM_{10}	µg/m³	100	74.2	73.8	73	59.7	59.8	61.5	**67.00**
$PM_{2.5}$	µg/m³	60	44.5	44.8	43.8	35.8	35.9	36.9	**40.28**
SO2	µg/m³	80	11.4	11.8	11.6	9.1	8.5	6.4	**9.80**
NOX	µg/m³	80	14.6	14.2	14.2	11.6	12	13.1	**13.28**
CO	mg/m³	4	1.18	1.24	1.3	0.86	0.79	0.32	**0.95**
O3	µg/m³	100	5.1	5.2	5.2	5.2	5.3	BDL	**5.20**
NH3	µg/m³	400	20.6	20.8	22	15.7	16.5	BDL	**BDL**
Pb	µg/m³	1	BDL	BDL	BDL	BDL	BDL	BDL	**BDL**
Ni	ng/m³	20	BDL	BDL	BDL	BDL	BDL	BDL	**BDL**
As	ng/m³	6	BDL	BDL	BDL	BDL	BDL	BDL	**BDL**
Bap	ng/m³	5	BDL	BDL	BDL	BDL	BDL	BDL	**BDL**
C6H6	µg/m³	1	BDL	BDL	BDL	BDL	BDL	BDL	**BDL**

AMBIENT AIR QUALITY (CORE ZONE)									
AAQ1: Near Dispensary									
Parameters	Unit	CPCB AAQ Standard 2009	21-Oct	21-Nov	21-Dec	22-Jan	22-Feb	22-Mar	Average
PM_{10}	µg/m³	100	62.5	66.7	62.2	64.5	61.1	62.2	**63.20**
$PM_{2.5}$	µg/m³	60	37.5	40	37.3	38.7	36.7	37.3	**37.92**
SO2	µg/m³	80	12.6	11.5	11.5	10.7	11.5	11.4	**11.53**
NOX	µg/m³	80	13.3	13.4	13.5	13.1	13.6	13.5	**13.40**
CO	mg/m³	4	1.02	1.04	1.14	1.3	1.2	1.2	**1.15**
O3	µg/m³	100	5.2	5.3	4.8	4.9	4.6	5.3	**5.02**
NH3	µg/m³	400	21.2	20.3	21.3	22.3	20	21	**BDL**
Pb	µg/m³	1	BDL	BDL	BDL	BDL	BDL	BDL	**BDL**
Ni	ng/m³	20	BDL	BDL	BDL	BDL	BDL	BDL	**BDL**
As	ng/m³	6	BDL	BDL	BDL	BDL	BDL	BDL	**BDL**
Bap	ng/m³	5	BDL	BDL	BDL	BDL	BDL	BDL	**BDL**
C6H6	µg/m³	1	BDL	BDL	BDL	BDL	BDL	BDL	**BDL**

Reviewed By

Approved By

Ref : Envlab/22/R-1511 Date : 28.04.2022

AMBIENT AIR QUALITY (CORE ZONE)									
AAQ2: Near Weighbridge									
Parameters	Unit	CPCB AAQ Standard 2009	21-Apr	21-May	21-Jun	21-Jul	21-Aug	21-Sep	Average
PM_{10}	$\mu g/m^3$	100	48.8	48.2	49.1	41.6	53	68	**51.45**
$PM_{2.5}$	$\mu g/m^3$	60	29.3	30.4	29.4	25	25.8	40.8	**30.12**
SO2	$\mu g/m^3$	80	11.8	12.1	10.9	9.2	8.9	6	**9.82**
NOX	$\mu g/m^3$	80	7.4	8.1	8.8	9.8	9.9	13.1	**9.52**
CO	mg/m^3	4	1.12	1.16	1.1	0.93	0.88	0.27	**0.91**
O3	$\mu g/m^3$	100	4.2	4.6	4.9	5	4.88	BDL	**BDL**
NH3	$\mu g/m^3$	400	19.4	18.8	19.8	15.3	15.7	BDL	**BDL**
Pb	$\mu g/m^3$	1	BDL	BDL	BDL	BDL	BDL	BDL	**BDL**
Ni	ng/m^3	20	BDL	BDL	BDL	BDL	BDL	BDL	**BDL**
As	ng/m^3	6	BDL	BDL	BDL	BDL	BDL	BDL	**BDL**
Bap	ng/m^3	5	BDL	BDL	BDL	BDL	BDL	BDL	**BDL**
C6H6	$\mu g/m^3$	1	BDL	BDL	BDL	BDL	BDL	BDL	**BDL**

AMBIENT AIR QUALITY (CORE ZONE)									
AAQ2: Near Weighbridge									
Parameters	Unit	CPCB AAQ Standard 2009	21-Oct	21-Nov	21-Dec	22-Jan	22-Feb	22-Mar	Average
PM_{10}	$\mu g/m^3$	100	39.3	37.3	37.3	48.1	38	48	**41.33**
$PM_{2.5}$	$\mu g/m^3$	60	23.6	22.4	23.2	28.9	22.8	29.3	**25.03**
SO2	$\mu g/m^3$	80	9	9	9.6	8.4	9.2	9.7	**9.15**
NOX	$\mu g/m^3$	80	8.2	7.1	6.9	7.5	7.8	7.3	**7.47**
CO	mg/m^3	4	0.94	1.03	1.05	1.1	1	1.1	**1.04**
O3	$\mu g/m^3$	100	4.4	4.7	4.5	5.1	4	5	**BDL**
NH3	$\mu g/m^3$	400	16.2	16.5	17.1	16.9	16.3	16.8	**BDL**
Pb	$\mu g/m^3$	1	BDL	BDL	BDL	BDL	BDL	BDL	**BDL**
Ni	ng/m^3	20	BDL	BDL	BDL	BDL	BDL	BDL	**BDL**
As	ng/m^3	6	BDL	BDL	BDL	BDL	BDL	BDL	**BDL**
Bap	ng/m^3	5	BDL	BDL	BDL	BDL	BDL	BDL	**BDL**
C6H6	$\mu g/m^3$	1	BDL	BDL	BDL	BDL	BDL	BDL	**BDL**

VISIONTEK CONSULTANCY SERVICES PVT. LTD. Reviewed By

VISIONTEK CONSULTANCY SERVICES PVT. LTD. Approved By

Ref : Envlab/22/R-1512

Date : 28.04.2022

AMBIENT AIR QUALITY (CORE ZONE)									
AAQ3: At Middle of the Opencast Quarry									
Parameters	Unit	CPCB AAQ Standard 2009	21-Apr	21-May	21-Jun	21-Jul	21-Aug	21-Sep	Average
PM_{10}	µg/m³	100	61.2	60.9	62.4	51.9	53.5	66.6	**59.42**
$PM_{2.5}$	µg/m³	60	36.7	36.9	37.5	31.1	32.1	39.9	**35.70**
SO2	µg/m³	80	10.6	11.2	10.8	9.3	8.9	6.7	**9.58**
NOX	µg/m³	80	11.8	10.9	14.3	12.6	11.3	13.6	**12.42**
CO	mg/m³	4	1.22	1.18	1.2	0.89	0.91	0.43	**0.97**
O3	µg/m³	100	5.4	5.3	5.4	5.5	5.44	BDL	**BDL**
NH3	µg/m³	400	21.6	20.8	20.7	18.8	17.5	BDL	**BDL**
Pb	µg/m³	1	BDL	BDL	BDL	BDL	BDL	BDL	**BDL**
Ni	ng/m³	20	BDL	BDL	BDL	BDL	BDL	BDL	**BDL**
As	ng/m³	6	BDL	BDL	BDL	BDL	BDL	BDL	**BDL**
Bap	ng/m³	5	BDL	BDL	BDL	BDL	BDL	BDL	**BDL**
C6H6	µg/m³	1	BDL	BDL	BDL	BDL	BDL	BDL	**BDL**

AMBIENT AIR QUALITY (CORE ZONE)									
AAQ3: At Middle of the Opencast Quarry									
Parameters	Unit	CPCB AAQ Standard 2009	21-Oct	21-Nov	21-Dec	22-Jan	22-Feb	22-Mar	Average
PM_{10}	µg/m³	100	58	58.5	58.8	56.7	55.2	56.4	**57.27**
$PM_{2.5}$	µg/m³	60	34.8	35.1	35.3	34	33.1	33.9	**34.37**
SO2	µg/m³	80	11.5	11	11	10.9	12.1	10.5	**11.17**
NOX	µg/m³	80	13.4	13.5	14.5	12.8	12.5	12.4	**13.18**
CO	mg/m³	4	1.08	1.16	1.1	1	1.1	1.3	**1.12**
O3	µg/m³	100	5.9	5.2	5.1	4.8	5.4	5.2	**BDL**
NH3	µg/m³	400	50.7	24.1	19.6	21.2	19.7	22.7	**BDL**
Pb	µg/m³	1	BDL	BDL	BDL	BDL	BDL	BDL	**BDL**
Ni	ng/m³	20	BDL	BDL	BDL	BDL	BDL	BDL	**BDL**
As	ng/m³	6	BDL	BDL	BDL	BDL	BDL	BDL	**BDL**
Bap	ng/m³	5	BDL	BDL	BDL	BDL	BDL	BDL	**BDL**
C6H6	µg/m³	1	BDL	BDL	BDL	BDL	BDL	BDL	**BDL**

Reviewed By

Approved By

Visiontek Consultancy Services Pvt. Ltd.

(Committed For Better Environment)

Certified for : ISO 9001:2015, ISO 14001:2015, ISO 45001:2018 (OH&S), ISO/IEC 17025:2017

Accredited by : NABET-A Grade, MOEF & CC/CPCB & SPCB-A Grade

- Infrastructure Engineering
- Water Resource Management
- Environmental & Social Study
- Surface & Sub-Surface Investigation
- Quality Control & Project Management
- Renewable Energy
- Agricultural Development
- Information Technology
- Public Health Engineering
- Mine Planning & Design
- Mineral/Sub-Soil Exploration
- Waste Management Services

Laboratory Services
Environment Lab
Food Lab
Material Lab
Soil Lab
Mineral Lab
&
Microbiology Lab

Ref : Envlab/22/R-1513

Date : 28.04.2022

AMBIENT AIR QUALITY (CORE ZONE)									
AAQ4: At Middle of the COB Plant									
Parameters	Unit	CPCB AAQ Standard 2009	21-Apr	21-May	21-Jun	21-Jul	21-Aug	21-Sep	Average
PM_{10}	$\mu g/m^3$	100	72.6	71.8	71.9	51.4	51.4	61.9	**63.5**
$PM_{2.5}$	$\mu g/m^3$	60	43.6	42.8	43.1	30.8	30.8	37.2	**38.1**
SO2	$\mu g/m^3$	80	10.4	10.6	11.7	9.4	9.4	7.4	**9.8**
NOX	$\mu g/m^3$	80	13.6	13.2	14.9	15.4	15.4	13	**14.3**
CO	mg/m^3	4	1.18	1.16	1.2	0.9	0.9	0.38	**0.95**
O3	$\mu g/m^3$	100	5.5	5.2	5.7	5.6	5.55	BDL	**BDL**
NH3	$\mu g/m^3$	400	21.8	22.1	23.3	21.3	21.3	BDL	**BDL**
Pb	$\mu g/m^3$	1	BDL	BDL	BDL	BDL	BDL	BDL	**BDL**
Ni	ng/m^3	20	BDL	BDL	BDL	BDL	BDL	BDL	**BDL**
As	ng/m^3	6	BDL	BDL	BDL	BDL	BDL	BDL	**BDL**
Bap	ng/m^3	5	BDL	BDL	BDL	BDL	BDL	BDL	**BDL**
C6H6	$\mu g/m^3$	1	BDL	BDL	BDL	BDL	BDL	BDL	**BDL**

AMBIENT AIR QUALITY (CORE ZONE)									
AAQ4: At Middle of the COB Plant									
Parameters	Unit	CPCB AAQ Standard 2009	21-Oct	21-Nov	21-Dec	22-Jan	22-Feb	22-Mar	Average
PM_{10}	$\mu g/m^3$	100	63.5	63	65.3	65.1	65.4	70.4	**65.5**
$PM_{2.5}$	$\mu g/m^3$	60	38.1	37.8	39.2	39.1	39.2	42.2	**39.3**
SO2	$\mu g/m^3$	80	10.5	11.6	11.2	11.1	10.7	11.7	**11.1**
NOX	$\mu g/m^3$	80	13.1	15.3	15.1	14.2	15	14.1	**14.5**
CO	mg/m^3	4	1.04	0.87	0.98	1.2	1.1	1	**1.03**
O3	$\mu g/m^3$	100	5.3	6	6	6	5.5	5.3	**BDL**
NH3	$\mu g/m^3$	400	24.6	24	23.8	22.5	22	23.6	**BDL**
Pb	$\mu g/m^3$	1	BDL	BDL	BDL	BDL	BDL	BDL	**BDL**
Ni	ng/m^3	20	BDL	BDL	BDL	BDL	BDL	BDL	**BDL**
As	ng/m^3	6	BDL	BDL	BDL	BDL	BDL	BDL	**BDL**
Bap	ng/m^3	5	BDL	BDL	BDL	BDL	BDL	BDL	**BDL**
C6H6	$\mu g/m^3$	1	BDL	BDL	BDL	BDL	BDL	BDL	**BDL**

Reviewed By

Approved By

ANNEXURE-2B

AIR QUALITY (BUFFER ZONE)

Visiontek Consultancy Services Pvt. Ltd.

(Committed For Better Environment)

Certified for : ISO 9001:2015, ISO 14001:2015, ISO 45001:2018 (OH&S), ISO/IEC 17025:2017

Accredited by : NABET-A Grade, MOEF & CC/CPCB & SPCB-A Grade

- Infrastructure Engineering
- Water Resource Management
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- Mine Planning & Design
- Mineral/Sub-Soil Exploration
- Waste Management Services

Laboratory Services
Environment Lab
Food Lab
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Soil Lab
Mineral Lab
&
Microbiology Lab

Ref : Envlab/22/R-1514 Date : 28.04.2022

2. Ambient Air Quality (Buffer Zone)

AMBIENT AIR QUALITY (BUFFER ZONE)									
AAQ1: Near Village Ostia									
Parameters	Unit	CPCB AAQ Standard 2009	21-Apr	21-May	21-Jun	21-Jul	21-Aug	21-Sep	Average
PM_{10}	µg/m³	100	69.8	66.4	65.2	58.2	57.9	49.1	61.1
$PM_{2.5}$	µg/m³	60	41.9	40.8	41.2	38.2	38.8	28.6	38.3
SO2	µg/m³	80	8.2	8.3	8.8	8.1	8.6	6.1	8.0
NOX	µg/m³	80	15.2	14.8	15.4	13.8	14.1	9.6	13.8
CO	mg/m³	4	0.59	0.51	0.56	0.48	0.49	BDL	BDL
O3	µg/m³	100	6.1	6.4	6.6	6.2	6.6	BDL	BDL
NH3	µg/m³	400	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Pb	µg/m³	1	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Ni	ng/m³	20	BDL	BDL	BDL	BDL	BDL	BDL	BDL
As	ng/m³	6	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Bap	ng/m³	5	BDL	BDL	BDL	BDL	BDL	BDL	BDL
C6H6	µg/m³	1	BDL	BDL	BDL	BDL	BDL	BDL	BDL

AMBIENT AIR QUALITY (BUFFER ZONE)									
AAQ1: Near Village Ostia									
Parameters	Unit	CPCB AAQ Standard 2009	21-Oct	21-Nov	21-Dec	22-Jan	22-Feb	22-Mar	Average
PM_{10}	µg/m³	100	66.6	62.4	62.6	61.9	62.2	62.2	**63.0**
$PM_{2.5}$	µg/m³	60	40.6	40.8	39.4	39.8	39.6	39.6	**40.0**
SO2	µg/m³	80	8.4	8.6	8.4	8.8	8.4	8.4	**8.5**
NOX	µg/m³	80	14.6	14.2	14.2	14.6	14.6	14.6	**14.5**
CO	mg/m³	4	0.54	0.54	0.54	0.54	0.54	0.54	BDL
O3	µg/m³	100	6.4	6.7	6.4	6.6	BDL	BDL	BDL
NH3	µg/m³	400	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Pb	µg/m³	1	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Ni	ng/m³	20	BDL	BDL	BDL	BDL	BDL	BDL	BDL
As	ng/m³	6	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Bap	ng/m³	5	BDL	BDL	BDL	BDL	BDL	BDL	BDL
C6H6	µg/m³	1	BDL	BDL	BDL	BDL	BDL	BDL	BDL

Reviewed By

Approved By

Visiontek Consultancy Services Pvt. Ltd.

(Committed For Better Environment)

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- Renewable Energy
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- Information Technology
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- Mine Planning & Design
- Mineral/Sub-Soil Exploration
- Waste Management Services

Laboratory Services
Environment Lab
Food Lab
Material Lab
Soil Lab
Mineral Lab
&
Microbiology Lab

Ref : Envlab/22/R-1515

Date : 28.04.2022

AMBIENT AIR QUALITY (BUFFER ZONE)									
AAQ2: Near Village Kaposi									
Parameters	Unit	CPCB AAQ Standard 2009	21-Apr	21-May	21-Jun	21-Jul	21-Aug	21-Sep	Average
PM_{10}	µg/m³	100	54.4	53.2	54.6	52.2	43.4	42.8	**50.1**
$PM_{2.5}$	µg/m³	60	32.6	33.4	35.2	33.8	25.1	25.4	**30.9**
SO2	µg/m³	80	8.1	8.4	8.9	8.4	5.8	5.6	**7.5**
NOX	µg/m³	80	12.1	12.6	13.2	12.8	10.4	9.8	**11.8**
CO	mg/m³	4	0.51	0.54	0.59	0.52	BDL	BDL	**BDL**
O3	µg/m³	100	BDL	BDL	BDL	BDL	BDL	BDL	**BDL**
NH3	µg/m³	400	BDL	BDL	BDL	BDL	BDL	BDL	**BDL**
Pb	µg/m³	1	BDL	BDL	BDL	BDL	BDL	BDL	**BDL**
Ni	ng/m³	20	BDL	BDL	BDL	BDL	BDL	BDL	**BDL**
As	ng/m³	6	BDL	BDL	BDL	BDL	BDL	BDL	**BDL**
Bap	ng/m³	5	BDL	BDL	BDL	BDL	BDL	BDL	**BDL**
C6H6	µg/m³	1	BDL	BDL	BDL	BDL	BDL	BDL	**BDL**

AMBIENT AIR QUALITY (BUFFER ZONE)									
AAQ2: Near Village Kaposi									
Parameters	Unit	CPCB AAQ Standard 2009	21-Oct	21-Nov	21-Dec	22-Jan	22-Feb	22-Mar	Average
PM_{10}	µg/m³	100	53.6	54.6	53.6	53.6	53.6	54.2	**53.9**
$PM_{2.5}$	µg/m³	60	34.1	33.4	33.2	32.8	32.8	31.6	**33.0**
SO2	µg/m³	80	8.9	8.8	8.6	8.8	8.9	8.9	**8.8**
NOX	µg/m³	80	14.1	14.1	14.1	13.8	13.8	13.4	**13.9**
CO	mg/m³	4	0.58	0.64	0.58	0.62	0.61	0.61	BDL
O3	µg/m³	100	BDL	BDL	BDL	BDL	BDL	BDL	BDL
NH3	µg/m³	400	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Pb	µg/m³	1	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Ni	ng/m³	20	BDL	BDL	BDL	BDL	BDL	BDL	BDL
As	ng/m³	6	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Bap	ng/m³	5	BDL	BDL	BDL	BDL	BDL	BDL	BDL
C6H6	µg/m³	1	BDL	BDL	BDL	BDL	BDL	BDL	BDL

Reviewed By

Approved By

Visiontek Consultancy Services Pvt. Ltd.

(Committed For Better Environment)

Certified for : ISO 9001:2015, ISO 14001:2015, ISO 45001:2018 (OH&S), ISO/IEC 17025:2017

Accredited by : NABET-A Grade, MOEF & CC/CPCB & SPCB-A Grade

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- Water Resource Management
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- Surface & Sub-Surface Investigation
- Quality Control & Project Management
- Renewable Energy
- Agricultural Development
- Information Technology
- Public Health Engineering
- Mine Planning & Design
- Mineral/Sub-Soil Exploration
- Waste Management Services

Laboratory Services
Environment Lab
Food Lab
Material Lab
Soil Lab
Mineral Lab
&
Microbiology Lab

Ref : Envlab/22/R-1516

Date : 28.04.2022

AMBIENT AIR QUALITY (BUFFER ZONE)									
AAQ3: Near Kaliapani Township									
Parameters	Unit	CPCB AAQ Standard 2009	21-Apr	21-May	21-Jun	21-Jul	21-Aug	21-Sep	Average
PM_{10}	µg/m³	100	80.6	78.2	77.6	56.4	46.9	60.2	**66.7**
$PM_{2.5}$	µg/m³	60	48.4	49.2	48.8	34.8	27.4	32.2	**40.1**
SO2	µg/m³	80	11.4	10.8	10.6	8	6.9	8.1	**9.3**
NOX	µg/m³	80	17.6	17.2	16.8	12.4	12.1	13.1	**14.9**
CO	mg/m³	4	1.32	1.28	1.24	0.56	BDL	BDL	**1.10**
O3	µg/m³	100	5.9	6.1	6.1	5.2	6.4	5.8	**BDL**
NH3	µg/m³	400	22.8	20.9	21.2	21.2	BDL	20.9	**BDL**
Pb	µg/m³	1	BDL	BDL	BDL	BDL	BDL	BDL	**BDL**
Ni	ng/m³	20	BDL	BDL	BDL	BDL	BDL	BDL	**BDL**
As	ng/m³	6	BDL	BDL	BDL	BDL	BDL	BDL	**BDL**
Bap	ng/m³	5	BDL	BDL	BDL	BDL	BDL	BDL	**BDL**
C6H6	µg/m³	1	BDL	BDL	BDL	BDL	BDL	BDL	**BDL**

AMBIENT AIR QUALITY (BUFFER ZONE)									
AAQ3: Near Kaliapani Township									
Parameters	Unit	CPCB AAQ Standard 2009	21-Oct	21-Nov	21-Dec	22-Jan	22-Feb	22-Mar	Average
PM_{10}	µg/m³	100	62.8	62.8	62.2	62.8	61.8	55.2	**61.3**
$PM_{2.5}$	µg/m³	60	43.6	41.9	41.6	41.6	40.9	33.1	**40.5**
SO2	µg/m³	80	9.4	9.2	8.9	8.8	9.6	12.1	**9.7**
NOX	µg/m³	80	13.8	14.8	13.8	13.8	14.8	12.5	**13.9**
CO	mg/m³	4	1.16	1.26	1.24	1.16	1.31	1.1	BDL
O3	µg/m³	100	6.1	6.8	6.8	6.6	6.8	5.4	BDL
NH3	µg/m³	400	21.2	21.4	21.4	21.4	21.8	19.7	BDL
Pb	µg/m³	1	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Ni	ng/m³	20	BDL	BDL	BDL	BDL	BDL	BDL	BDL
As	ng/m³	6	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Bap	ng/m³	5	BDL	BDL	BDL	BDL	BDL	BDL	BDL
C6H6	µg/m³	1	BDL	BDL	BDL	BDL	BDL	BDL	BDL

Reviewed By

Approved By

Visiontek Consultancy Services Pvt. Ltd.

(Committed For Better Environment)

Certified for : ISO 9001:2015, ISO 14001:2015, ISO 45001:2018 (OH&S), ISO/IEC 17025:2017

Accredited by : NABET-A Grade, MOEF & CC/CPCB & SPCB-A Grade

- Infrastructure Enginering
- Water Resource Management
- Environmental & Social Study
- Surface & Sub-Surface Investigation
- Quality Control & Project Management
- Renewable Energy
- Agricultural Development
- Information Technology
- Public Health Engineering
- Mine Planning & Design
- Mineral/Sub-Soil Exploration
- Waste Management Services

Laboratory Services
Environment Lab
Food Lab
Material Lab
Soil Lab
Mineral Lab
&
Microbiology Lab

Ref : Envlab/22/R-1517

Date : 28.04.2022

AMBIENT AIR QUALITY (BUFFER ZONE)									
AAQ4:Near Village Ostapal									
Parameters	Unit	CPCB AAQ Standard 2009	21-Apr	21-May	21-Jun	21-Jul	21-Aug	21-Sep	Average
PM_{10}	µg/m³	100	60.8	61.2	60.8	60.2	60.8	44.6	**63.1**
$PM_{2.5}$	µg/m³	60	36.5	37.4	38.6	33.8	35.9	26.9	**38.5**
SO2	µg/m³	80	7.2	7.1	7.4	7.2	7.8	5.1	**15.2**
NOX	µg/m³	80	11.9	12.4	12.6	11.8	13.4	9.6	**19.8**
CO	mg/m³	4	0.52	0.51	0.51	0.42	0.49	BDL	**BDL**
O3	µg/m³	100	5.4	5.8	5.6	5.2	5.4	BDL	**BDL**
NH3	µg/m³	400	BDL	BDL	BDL	BDL	BDL	BDL	**BDL**
Pb	µg/m³	1	BDL	BDL	BDL	BDL	BDL	BDL	**BDL**
Ni	ng/m³	20	BDL	BDL	BDL	BDL	BDL	BDL	**BDL**
As	ng/m³	6	BDL	BDL	BDL	BDL	BDL	BDL	**BDL**
Bap	ng/m³	5	BDL	BDL	BDL	BDL	BDL	BDL	**BDL**
C6H6	µg/m³	1	BDL	BDL	BDL	BDL	BDL	BDL	**BDL**

AMBIENT AIR QUALITY (BUFFER ZONE)									
AAQ4:Near Village Ostapal									
Parameters	Unit	CPCB AAQ Standard 2009	21-Oct	21-Nov	21-Dec	22-Jan	22-Feb	22-Mar	Average
PM_{10}	µg/m³	100	55.2	58.8	56.2	55.8	55.8	49.6	**55.2**
$PM_{2.5}$	µg/m³	60	40.8	40.6	38.8	40.2	40.8	29.6	**38.5**
SO2	µg/m³	80	8.1	8.2	7.4	8.4	8.4	6.6	**7.9**
NOX	µg/m³	80	11.8	10.8	10.8	11.8	10.9	11.6	**11.3**
CO	mg/m³	4	0.54	0.46	0.42	0.44	0.54	BDL	BDL
O3	µg/m³	100	5.4	5.4	4.8	5.6	5.8	BDL	BDL
NH3	µg/m³	400	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Pb	µg/m³	1	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Ni	ng/m³	20	BDL	BDL	BDL	BDL	BDL	BDL	BDL
As	ng/m³	6	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Bap	ng/m³	5	BDL	BDL	BDL	BDL	BDL	BDL	BDL
C6H6	µg/m³	1	BDL	BDL	BDL	BDL	BDL	BDL	BDL

Reviewed By

Approved By

ANNEXURE - 34

भारत सरकार
Govt. of India
श्रम एवं रोजगार मंत्रालय
Ministry of Labour & Employment
खान सुरक्षा महानिदेशालय
Directorate-General of Mines Safety

NO: 180020|SEZ|Bhubaneshwar Region|Exemp|2021|8922 Date: 28/05/2021

From

Director of Mines Safety,

Bhubaneswar Region

To

Agent,

Ostapal Chromite Mine,

M/s Ferro Alloys Corporation Limited,

P.O. Kaliapani,

Dist: Jajpur (Odisha)- 755047.

Subject: Permission under Regulation 106(2)(b) of the Metalliferous Mines Regulations, 1961 for using Heavy Earth Moving Machineries(HEMMs) in conjunction with deep hole blasting at Ostapal Chromite Mine of M/s Ferro Alloys Corporation Limited.

Sir,

Please refer to your application no.142526 dated 23.03.2021 and plans/sections submitted therewith, on the above subject.

The matter has since been examined on the basis of information furnished in your application under reference and as shown on the plans and sections submitted by you.

In exercise of the powers conferred on the Chief Inspector of Mines (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 authorisation granted to me by the Chief Inspector of Mines (also designated as Director-General of Mines Safety) under Section 6(1) of the Mines Act, 1952, I, in supersession of permission granted earlier on the above subject, hereby permit you to work Ostapal Chromite Mine of M/s Ferro Alloys Corporation Limited, by deployment of Heavy Earth Moving Machineries (HEMMs) in conjunction with deep hole blasting within the mine boundary as marked by points A, A/1, B, B/1, C, C/1, C/2, D, D/1, D/2, D/3, D/4, D/5, D/6, D/7, D/8, D/9, E, E/1, E/2, E/3, E/4 & closes at A on plan No. OCM/SP-2/3/DGMS/02/2021 dated 28.02.2021 subject to the conditions as stipulated herein, being strictly complied with:

1.0 GENERAL:

1.1 Except where otherwise provided for in this conditional permission, all Provisions of the Metalliferous Mines Regulations, 1961 shall be strictly complied with.

1.2 Safety Management Plan shall be prepared and maintained as per the DGMS Circular No. 05 of 2016.

1.3 No working shall be made or extended within 45 m of any building/structure of permanent nature, not belonging to owner of the mine without permission in writing from this Directorate under Regulation 109 of the Metalliferous Mines Regulations, 1961.

1.4 No deep hole blasting shall be done within 300m of any surface buildings, structures, public roads, etc, not belonging to the owner unless separate permission under relevant Regulation 164 of Metalliferous Mines Regulations, 1961 is obtained from this Directorate. Owners of structures and dwellings, not belonging to the owner of the mine and habitants/occupants of such dwellings/buildings shall be indemnified against damage to property/injury to persons, if any, arising out of blasting operations.

1.5 The mine shall be kept under the charge of a person holding First Class Manager's Certificate of Competency under the Metalliferous Mines Regulations, 1961, who shall be assisted by adequate number of Assistant Managers, Surveyors, Foremen, Mining Mates and Engineers as per the said Regulations. The manager shall exercise daily personal supervision in the mine and he shall not take up any appointment in any capacity whatsoever in another mine. Where by reason of absence or for any other reason the Manager is unable to exercise daily personal supervision, a person holding a valid Manager's Certificate shall be authorized to act as Manager of the Mine in compliance with Regulation 34(7) and if no such qualified person is available, the mine workings shall be kept suspended.

1.6 No person shall be employed in the mine unless his attendance is recorded in the registers maintained in prescribed Form at the time when the person, against whom the entry is made, enters or leaves the mine as required under Section 48 of the Mines Act, 1952 and Rule 78 of the Mines Rules, 1955 read with DGMS Circular No.01 of 2017. The entries in the Form shall be made at suitable points in the premises of the mine at reasonable distance from work place by a person who is paid by the Owner or the Agent and is answerable to the Manager and not by a contractor's employee.

1.7 No work whatsoever shall be done where the provision of Regulation 127 of the Metalliferous Mines Regulations, 1961 are attracted due to the presence of river, jore, reservoir and nallah in the vicinity. The entire ground lying within 15.0 m of HFL of all the rivers, nallas, water reservoirs and jores shall be filled up and raised and consolidated to a R.L of at least 3.0m above the highest flood level.

1.8 Emergency Management Plan shall be prepared and implemented as per the DGMS (Tech.) (S&T) Circular No. 08 of 2016.

2.0 OPENCAST WORKINGS:

2.1 Height and Width of Benches: