vedanta
transforming element

HZL/SKM/Env/2018 /05/ 131

14.05.2018

To,
Director (MoEFCC),
Regional Office (Central Region)
5th Floor,Kendriya Bhawan,
Sector-H, Aliganj.
Lucknow (UP).
PIN:226024.

Subject : Half yearly EC compliance report of Sindesar Khurd Mine for the period of October 2017 to March 2018.

Reference: Letter No. J-11015/10/2014-IA.II(M) dated 15.01.2016.
J-11015/10/2014-IA.II(M) dated 21.12.2016

Dear Sir,

Please find enclosed herewith half yearly E.C compliance report for the period of October 2017 to March 2018 of Sindesar Khurd Mine with necessary annexures.

Thanking you,

Yours faithfully,

Rajeev Bora
(Unit Head-Sindesar Khurd Mine)

Copy to :-1.Zonal Officer,
Central Pollution Control Board,
3rd Floor,Sahkar Bhawan,North TT Nagar,
Bhopal-462003.
2.The Member Secretary,
Rajasthan State Pollution Control Board,
4th, Institutional Area, Jhalana Doongari,
Jaipur .PIN - 302004.
3. Regional Officer,
Rajasthan State. Pollution Control Board,

Hindustan Zinc Limited
Sindesar Khurd Mine, P.O. Dariba, Teh. Railmagra, Distt. Rajsamand (Rajasthan) - 313 211
T +91-2952 265 275 F +91-2952 265 143 www.hzlindia.com
Registered Office : Yashad Bhawan, Udaipur (Rajasthan) - 313 004
CIN : L27204RJ1966PLC001208

Compliance Report of Environment Clearance

Name of the Project: Sindesar Khurd Mine
Village :Sindesar ,
PO Dariba ,Tehsil : Railmagra,
Dist : Rajsamand. Rajasthan.

Clearance Letter No: J-11015/10/2014-IA.II(M) dated 21.12.2016
J-11015/10/2014-IA.II(M) dated 15.01.2016

Period of Compliance Report: October 2017 to March 2018

A.	Specific Conditions	Status
(i)	Environmental clearance is granted subject to final outcome of Hon'ble Supreme Court of India, Hon'ble High Court of Rajasthan and any other Court of Law, if any, as may be applicable to this project.	Noted
(ii)	This Environmental Clearance is subject to obtaining requisite NBWL Clearance from the Standing Committee of National Board for Wildlife, if any, applicable for this Mining project.	Not Applicable for this Mining Project. Core & Buffer zone area of this project has no National Parks, Sanctuaries, Biosphere Reserves, Wildlife Corridors, Tiger/Elephant Reserves. The Letter has been issued by Office of DFO, Rajsamand in this regard.
(iii)	No mining activities will be allowed in forest area, if any, for which the Forest Clearance is not available.	Not Applicable for this project, as all Mining Activities comes under Non Forest Area.
(iv)	The project proponent shall obtain Consent to Operate from the State Pollution Control Board, Rajasthan and effectively implement all the conditions stipulated therein.	Consent to Operates are obtained from RPCB and compliance of condition stipulated in the same are being ensured.
(v)	The Proponent shall install online Ambient Air Quality Monitoring System and there should be system for display AAQ data within 03 months at least at three locations as per wind direction. Online provisions of pH and turbidity meters at discharge points of STP and ETP and also at water storage ponds in the mining area may be made. Project Proponent should display the result digitally in front of the main gate of the mine site.	3 nos. online monitoring stations installed at site results of the same are being displayed at the main gate. Apart from this Monthly AAQ monitoring from 5 locations from core and buffer zone is being done. Provision to measure PH and turbidity at water ponds and display of the same at main gate has been made.
(vi)	The Project Proponent has to take care of gullies formed on slopes. Dump mass should be consolidated with proper filling/leveling with the help of dozer/compactors. The report on slope and stability monitoring should be sent to MoEFCC and its Regional office every six-month.	Regular monitoring of slope stability of waste dump mass is being done. The waste dump consolidation is being done by compactor and dozer on regular basis. The Survey of waste dump is carried out regularly and records maintained. Report of slope and stability monitoring is attached here in ***Annexure –I.***
(vii)	The reclamation at waste dump sites shall be ecologically sustainable. Scientific reclamation has been followed. The local species may be encouraged and species are so chosen that the slope, bottom of	At present waste dump is in active stage. Inactive waste dump will be reclaimed in scientific manner. Waste rock generated from mining is being used for filling of mine voids

	the dumps and top of the dumps are able to sustain these species. The aspect of the dump is also a factor which regulates some climatic parameters and allows only species adopted to that micro climate. This may be recommended to be studied by hiring Expert Ecology Group.	and also being used in construction work of height raising in tailing dam. Waste remained during closure will be filled back in mine voids at the time of mine closure and scientific reclamation by plantation of suitable species will be ensured at waste dump.
(viii)	There is need for regular monitoring of invertebrates and aquatic life of water bodies including the reservoir located close to the mining lease to establish that fish and other animals including the water is not contaminated with heavy metal. There could be a research on "bio accumulation of heavy metals in invertebrates" to completely establish that there in not impact of mining.	Study conducted and Heavy metals are found within the limit.
(ix)	A specialized Institution may be hired to carry out ecological survey on the plant species to evaluate their growth in terms of stunted, deformed and seed viability. The sensitive species and indicator species to heavy metal pollution may be screened out and plantation accordingly designed. Similarly, uptake of Zinc, Cadmium and lead etc. by crops and vegetables grown in the crop lands around the mining lease may be studied. Bottom sediment analysis of ponds, wells and Rivers to ascertain the level or accumulation of heavy metal may be done.	Crop Samples analyzed. Impact due to mining operation was not observed. Zinc found traceable and Lead, Cadmium found BDL.
(x)	The Proponent shall conduct an Occupational health study with respect to the pressure impact on ear drums as person goes underground and implement the recommendations.	Occupational Health Study on 130 employees conducted & no impact has been observed irrespective of depth of working.
(xi)	Project Proponent shall carry out vibration studies well before approaching any such habitats or other buildings to evaluate the zone of influence and impact of blasting on the neighborhood. Within 500 meters of such sites vulnerable to blasting, vibration avoidance of use of explosives and adoption of alternative means of mineral extraction. A provision for monitoring of each blast should be made so that the impact of blasting on nearby habitation and dwelling units could be ascertained. The convenient of lease deed under Rule 31 of MCR 1960 provides that no mining operations shall be carried out within 50 meters of public works such as public roads and buildings or inhabited sites except with the prior permission from the Competent Authority.	Blast design is being done as per recommendations of CIMFR keeping public infrastructure in view. Due care is taken in designing the blast, optimizing the explosives, selection of detonators and delay to ensure safe vibration limit on surface. Vibration study for each blast is being carried out regularly and every quarterly by CSIR-CIMFR, Dhanbad.
(xii)	Main haulage road in the mine should be provided with permanent water sprinklers and other roads should be regularly wetted with water tankers fitted with sprinklers. The material transfer points should invariable be provided with Bag filters and or dry fogging system. Belt-conveyors should be fully	Permanent water sprinklers are provided at Crushers with venturi spray. Haul roads are being wetted through mobile water sprinkler. Conveyors are covered. Transfer points have dust control system. In addition to above, Also Successful trials have been taken to

	covered to avoid air borne dust; Use of effective sprinkler system to suppress fugitive dust on haul roads and other transport roads shall be ensured.	use *"Dustron"* the reagent suppress the dust on haul road areas by increasing moisture for settling of dust and found effective and started using the same.
(xiii)	The pollution due to transportation load on the environment will be effectively controlled and water sprinkling will also be done regularly. Project should obtain 'PUC" certificate for all the vehicles from authorized pollution testing centers.	Avenue plantation in both sides of roads is developed and PUC certificates for all vehicles are being ensured. All transportation vehicles are covered by tarpaulin.
(xiv)	Project Proponent shall appoint an Occupation Health Specialist for Regular and Periodical medical check-up once in six months and necessary medical care/preventive measures undertaken accordingly. Recommendations of National Institute for Labor for ensuring good occupational environment for mine workers should also be adopted.	Occupation Health specialist is appointed and PME once in six month is being ensured.
(xv)	Proponent shall carryout monitoring of lead in the blood samples of the employees and the villagers in the areas surrounding the mine in their schedule of health check-up. The nearby water bodies shall be monitored every six months and report submitted to Regional office of the MoEF to ascertain impact due to lead contamination.	Analysis of Lead in blood for employees and villagers of surrounding has been conducted. All values are within the permissible limits. Analysis reports of nearby water bodies are being submitted on regular basis. Reports of nearby water bodies are attached here in ***Annexure- II***
(xvi)	Implementation of Action Plan on the issues raised during the Public Hearing shall be ensured. The Project Proponent shall complete all the tasks as per the Action Plan submitted with budgetary provisions during the Public Hearing.	Action plan is in under implementation.
(xvii)	Project Proponent reported that there is Schedule -I species viz. Indian Peafowl, Indian Grey Hornbill, White eyed Buzzed, Black Shouldered Kite, Monitor Lizard and Indian Flap Shell /Turtle in the study area for which Proponent has made Conservation Plan. The Proponent shall implement the Wildlife Conservation Plan along with the funds so allocated with consultation of Chief Wild Life Warden of the State Govt. A copy of action plan shall be submitted to the Ministry of Environment, Forest and Climate Change and its Regional Office, Lucknow and the Chief Wild Life Warden of the Stat Govt.	Conservation plan is submitted to DFO, Rajsamand.Copy of the action plan submitted to Ministry of Environment, Forest and Climate Change Regional office Lucknow along with 1st E.C compliance report on 25.05. 2016.revised conservation plan has also submitted to DFO Rajsamand on 09.01.2018. and is under approval.
(xviii)	Implementation of the outcome of study with regards to "optimization of blast design parameter for the safety and stability of surface structures and subsequent monitoring of vibration on the surface structures for their long term stability" which was carried out by Central Institute of Mining and Fuel Research should be ensured.	Blast design Study by CSIR-CIMFR and implementation of outcomes are being ensured..
(xix)	Continuous monitoring of radioactive elements, if any, shall be undertaken till entire mine is dewatered and report has to be submitted to MoEFCC Regional Office. Periodic monitoring of any adverse impact of	Monitoring if radioactive elements is being ensured and Periodic monitoring of persons is also being done.

	Radon and its daughter products on any worker should be included in the Occupational health Monitoring Programme.	Monitoring Report of radioactive elements is attached here in ***Annexure III***.
(xx)	A Final Mine Closure Plan along with details of Corpus Fund shall be submitted to the Ministry of Environment, forest and Climate Change 5 years in advance of final mine closure for approval.	Shall be ensured before closure.
B.	**General Conditions.**	
(i)	No change in mining technology and scope of working should be made without prior approval of the Environment, Forest and Climate Change.	No change is being done without prior approval from said authorities.
(ii)	No change in the calendar plan including excavation, quantum of mineral Zinc-Lead ore and waste should be made.	Being ensured as per mine plan.
(iii)	Implementation of Environment Management Policy of the Company w.r.t. judicious use for Mineral resources for growth & development synchronizing mining & environment with prosperity.	All the care being taken as per policy with regular monitoring and actions for implementation is being ensured.
(iv)	There shall be planning, developing and implementing facility of rainwater harvesting measures on long term basis in consultation with Regional Director, Central Ground Water Board. And implementation of conservation measures to augment ground water resources in the area of consolation with Central Ground Water Board.	Deepening of nine nos. village ponds in consultation with CGWB implemented in nearby villages.
(v)	Regular monitoring of ground water table should be carried out at the upstream and depth of water available in the dug well is to be measured. Monitoring should be done by establishing a network of existing wells and constructing new piezometers.	Network has been established to monitor ground water table in and around the mines and regular monitoring is being carried out.
(vi)	Monitoring of Ambient Air Quality should be carried out based on the new Notification of 2009, as amended from time to time by the Central Pollution Control Board.	Presently Ambient air monitoring is being done as per standard.
(vii)	For the upliftment of scheduled caste/scheduled tribe population, specific programs have to be taken specially with respect to education, health care, livelihood generation, infrastructure development & promotion of sports & culture for SC/ST population and that these will be intensified in future.	Rs. 0.33 Cr spent for uplift of the community.
(viii)	The project proponent shall ensure that no natural watercourse and/or water resources shall be obstructed due to any mining operations. Catch drains and siltation ponds of appropriate size shall be constructed around the mine working and mineral dumps to prevent run off of water and flow of sediments directly into the river and other water bodies. The water so collected should be utilized for watering the mine area, roads, green belt development etc. the drains shall be regularly	No natural watercourse is obstructed during mining operations. Catch drains for mine working and mineral dump provided to prevent water run-off and flow of sediments directly natural water bodies. Water is being recycled after necessary precaution of settling of silt material.

	desilted particularly after monsoon and maintained properly. The drains, settling tanks and check around the mine and dumps to prevent run off of water and flow of sediments directly into the river and other water bodies and sump capacity should be designed keeping 50% safety margin over and above peak sudden rainfall (based on 50 years date) and maximum discharge in the area adjoining the mine site. Sump capacity should also provide adequate retention period to allow proper settling of silt material. Sedimentation pits shall be constructed at the corners of the garland drains and desilted at regular intervals.	
(ix)	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 maintained.	Being complied.
(x)	Regular monitoring of water quality upstream and downstream of water bodies shall be carried out and record of monitoring data should be maintained and submitted to the Ministry of Environment, Forest and Climate Change, its Regional Office, Lucknow, Central Ground Water Authority, Regional Director, Central Ground Water Board, State Pollution Control Board and Central Pollution Control Board.	Regular monitoring carried out & reports are submitted. Covered in general condition no. v. Report of nearby water bodies are attached here in ***Annexure IIA&IIB***
(xi)	Regular monitoring of ground water level and quality shall be carried out in and around the mine lease by establishing a network of existing wells and constructing new piezometers during the mining operation. The monitoring shall be carried out four times in a year – pre – monsoon (April-May), Monsoon (August), post-monsoon (November) and winter (January) and the data thus collected may be sent regularly to Ministry of Environment, Forest and Climate Change, its Regional Office, Lucknow, Central Ground Water Authority, Regional Director, Central Ground Water Board, State Pollution Control Board and Central Pollution Control Board.	Piezometers have been constructed inside and outside mine lease area and reports are regularly submitted. Please refer reports in ***Annexure IIA&IIB.***
(xii)	Four ambient air quality- monitoring stations should be established in the core zone as well as in the buffer zone for PM_{10}, $PM_{2.5}$, So_x & NO_x monitoring. Location of the stations should be decided based on the meteorological data, topographical features and environmentally and ecologically sensitive targets and frequency of monitoring should be undertaken in consultation with the state Pollution Control Board.	Five Ambient air monitoring stations established in core and buffer zone. Monthly monitoring is being carried out regularly. Covered in general condition no. vi.
(xiii)	Data on ambient air quality PM_{10}, $PM_{2.5}$, So_x & NO_x should be regularly submitted to the Ministry including its Regional office located at Lucknow and the state Pollution control Board/ Central Pollution Control Board once in six months.	All the AAQ monitoring reports are being submitted along with half yearly EC compliance report. Reports are attached here in ***Annexure IV.***
(xiv)	The critical parameter such as PM_{10}, $PM_{2.5}$, So_x &	All said parameters with peak particle

	NO_x in the ambient air within the impact zone, peak particle velocity at 300m distance or within the nearest habitation, whichever is closer shall be monitored periodically. Further, quality of discharged water shall also be monitored [(TDS, DO, pH and Total Suspended Solids (TSS)]. The monitored data shall be uploaded on the website of the company as well as displayed on a display board at the project site at a suitable location near the main gate of the Company in public domain. The circular No. J-20012/1/20060IA.II (M) dated 27.05.2009 issued by Ministry of Environment, Forest and Climate Change, which is available on the website of the Ministry www.envfor.nic.in shall also be referred in this regard for its compliance.	velocity are being monitored. Zero discharge is maintained by Recycling in operations. Data is being displayed on company website and displayed at main gate.
(xv)	Fugitive dust emissions from all the sources should be controlled regularly. Water spraying arrangement on haul roads, loading and unloading and at transfer points should be provided and properly maintained.	Covered in specific condition no. xii.
(xvi)	Measures should be taken for control of noise levels below 85 dBA in the work environment. Workers engaged in operations of HEMM, etc. should be provided with ear plugs/ muffs.	Necessary measures have been taken to control the noise levels below 85 dBA. PPEs including ear plugs/muffs are provided to workers engaged in operations of HEMM, etc.
(xvii)	Plantation shall be raised in a 7.5m wide green belt in the safety zone around the mining lease, backfilled and reclaimed area, around water body, along the roads etc. by planting the native species in consultation with the local DFO/ Agriculture Department. The density of the trees should be around 2500 plants per ha or more. Greenbelt shall be developed all along the mine lease area in a phased manner and shall be completed within first five years.	Till date 70000 Nos plants have been planted in 46 Hectares of acquired area. 4 ha area will further be covered under plantation in next two years.
(xviii)	Industrial waste water (workshop and waste water from the mine) should be properly collected treated so as to conform to the standards prescribed under GSR 422 (E) dated 19th May, 1993 and 31st December, 1993 or as amended from time to time. Oil and grease trap should be installed before discharge of workshop effluents.	Mine water is reused in operations. Oil and grease trap systems provided in workshop and water is being reused for further operations.
(xix)	Personnel working in dusty areas should wear protective respiratory device and they should also be provided with adequate training and information on safety and health aspects.	Job and area specific Training and information is being imparted to all the employees and PPEs are provided.
(xx)	Occupation health surveillance program of the workers should be undertaken periodically to observe any contractors due to exposure to dust and take corrective measures, if needed.	PME is being carried out and no occupational disease has been observed due to the dust exposure.
(xxi)	A separate environmental management cell with qualified personnel should be set-up under the control of a Senior Executive, who will report	Separate Environmental Management Cell is in place.

	directly to the Head of the Organization.	
(xxii)	The funds earmarked for environmental protection measures should be kept in separate account and should not be diverted for other purpose. Year wise expenditure should be reported to the Ministry and its Regional Office located at Lucknow.	Separate Fund is allocated for Environment protection. Year wise details being reported to MOEF&CC.in Environment statement (Form-V).
(xxiii)	The project authorities should inform to the Regional Office located at Lucknow, date of financial closures and final approval of the project by the concerned authorities and the date of start of land development work.	Being expansion project, all approvals are in place.
(xxiv)	The Regional Office of this Ministry located at Lucknow shall monitor compliance of the stipulated conditions. The project authorities should extent full cooperation to the officer(s) of the Regional Office by furnishing the requisite date/ information/ monitoring reports.	Noted for Compliance.
(xxv)	The project proponent shall submit six monthly report on the status of the implementation of the stipulated environmental safeguards to the Ministry of Environment, Forest and Climate Change, its Regional Office, Lucknow, Central Pollution Control Board and State Pollution Control Board.	Half yearly reports are being submitted.
(xxvi)	A copy of clearance letter will be marked to concerned Panchayat/ local NGO, if any, from whom suggestion/ representation has been received while processing the proposal.	Letter has been sent to local panchayat in Jan 2017.
(xxvii)	State Pollution Control Board should display a copy of the clearance letter at the Regional office, District Industry Centre and Collector's office/ Tehsildar's Office for 30 days.	Noted.
(xviii)	The project authorities should advertise at least in two local newspapers widely circulated, one of which shall be in the vernacular language of the locality concerned, within 7 days of the issued of the clearance letter informing that the project has been accorded environmental clearance and s copy of the clearance letter is available with the State Pollution Control Board and also at web site of the Ministry of Environment, Forest and Climate Change at http://envfor.nic.in and a copy of the same should be forwarded to the Regional Office of this Ministry located at Lucknow.	Published on 27.12.2016 in Rajasthan Patrika & Danik Bhasker Rajsamand Edition. Copy of the same has been submitted along last half yearly EC compliance report.

Annexure-I

CENTRAL INSTITUTE OF MINING & FUEL RESEARCH

(Council of Scientific & Industrial Research)

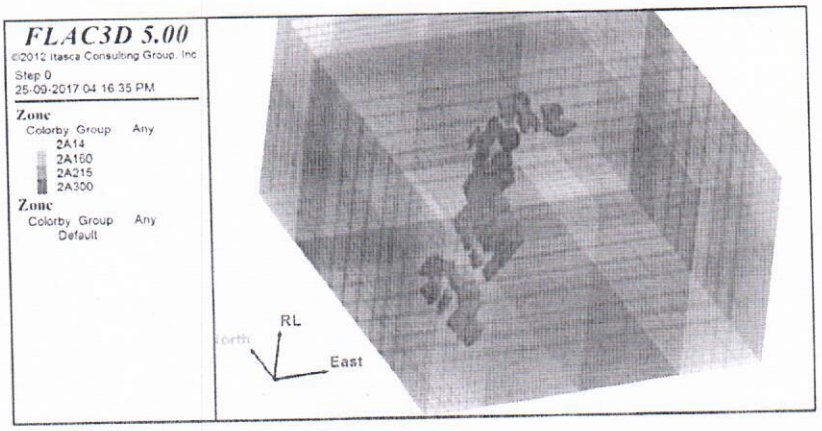
Barwa Road, Dhanbad – 826 001, Jharkhand

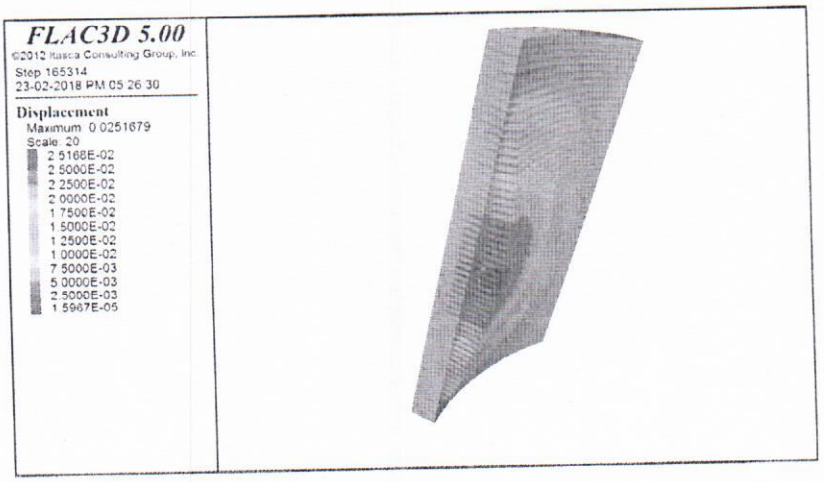
Nagpur Research Center, Unit-1

17/C, Telenkhedi Area, Civil Line, Nagpur 440001, Maharashtra

Sixth Visit Report – 30th Jan to 2nd Feb, 2018, SK Mines, HZL

Order No.: 8520000429 Dated 16.02.2016





February 2018

Sixth Visit Report – 30th Jan to 2nd Feb, 2018, SK Mines, HZL

Order No.: 8520000429 Dated 16.02.2016

By

Dr. John Loui Porathur	**Sr. Principal Scientist**
Dr. (Mrs.) Chandrani P. Verma	**Principal Scientist**
Dr. J.C. Jhanwar	**Sr. Principal Scientist**
Dr. A. K. Soni	**Chief Scientist**
Dr. P. K. Singh	**Director**

(Dr. Chandrani Prasad Verma)

(Dr. John Loui Porathur)

February 2018

This report is meant for internal use of your organisation only and it should not be published in full or part by your organisation or staff. It should not be communicated / circulated to outside parties except concerned government departments. CIMFR reserves the right to publish the results of research for the benefit of the industry.

1.0 FIELD VISIT OBSERVATIONS

A visit was made to SK mines from 30/01/18 to 02/02/18. Following area were visited in underground mines with Shri. Ashok Godugu, Head, Geotech and Mr. Bharat Gaikwad, Filling In-charge.

1. C block drivages and stopes at 85 mRL and at -5 mRL
2. SKA14 development
3. Shotcrete barricade site at 65 mRL (BP6 stope)

2.0 DISCUSSIONS

Various issues that were discussed after the field visit are as follows:

1. Consolidation of waste in BH stopes is necessary to extract ore from vertical pillars VP1, VP2 & VP3. Skin of 5 m adjacent to vertical pillars throughout the height of stope can be consolidated by cemented hydraulic injection. A few perforated pipes may be inserted at different angles and spacing to inject the hydraulic mix. Other alternatives can also be explored for consolidation of waste in primary stopes.

2. Underground workshop location and requirement of supports are discussed. Keeping in view the life of this excavation only non-corrosive bolts are recommended to be used along with wire mesh and shotcrete. Sufficient distance needs to be maintained from nearby stopes for stability of these permanent excavations. MCPD can be reduced to control blast vibrations at these excavations. Monitoring of walls with total station and reflectors is recommended. Pillars between bays can also be monitored with the help of stress meters.

3. Possibility of combination of up and down production ring drilling in C block to manage extraction from mid level of the stopes is discussed. Experience with such production drilling in BP5, BP6 and BP7 is found to be satisfactory and productive.

4. Sequence of mining AP14 & AP15 stopes between 160 mRL to 215 mRL is discussed. AP13 stope extraction can be extended from 190 mRL to 215 mRL. After every 60 m long stope a rib pillar of 8 m width can be left in AP15 stope from 160 mRL to 215 mRL.

5. Draft report on Shotcrete barricade is discussed. SOP on shotcrete barricade along with shotcrete UCS test data is collected. A few shortcomings are noticed in present practice. Corrected design for shotcrete is attached. Modified SOP with final report on barricade design will follow this report.

6. Two R&D works are proposed for the future. First one is comprehensive study on pillar mining below paste fill. This also includes its feasibility and an initial trial in the mid sub-level of stope CP01 of C-block. The second study shall be on optimization of backfill in primary and secondary stopes, with optimum use of development waste.

7. Numerical modeling and stability analysis of stopes in B Block from -55 mRL to 15 mRL is proposed to be done.

8. To facilitate secondary or crown mining in future waste filling in primary should not be practiced. Rather a plug needs to be formed at the bottom from the horizon of the draw level of height 8 – 10 m and the rest of the height may be filled with waste in primary as well as secondary after the above proposed study.

9. In SKA14 block localized shear zones are observed. During development some loose formation is also observed at the shear zones, as the rock mass appears to be poor and jointed. Although wire mesh is used but sagging is observed due to accumulation of fallen rock pieces at many places. At few places opened wire mesh is also observed. Due to scaling of loose rock, width and height of drivage is found to be increased to 6-7 m at few places. Application of shotcrete is must in junctions of such development drives.

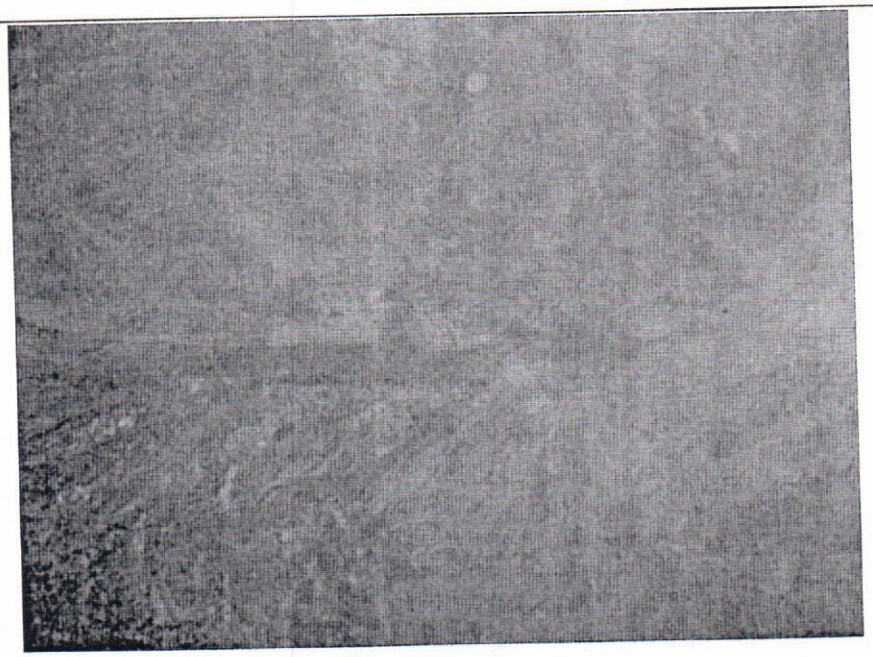


Fig.1 Localised shear zone

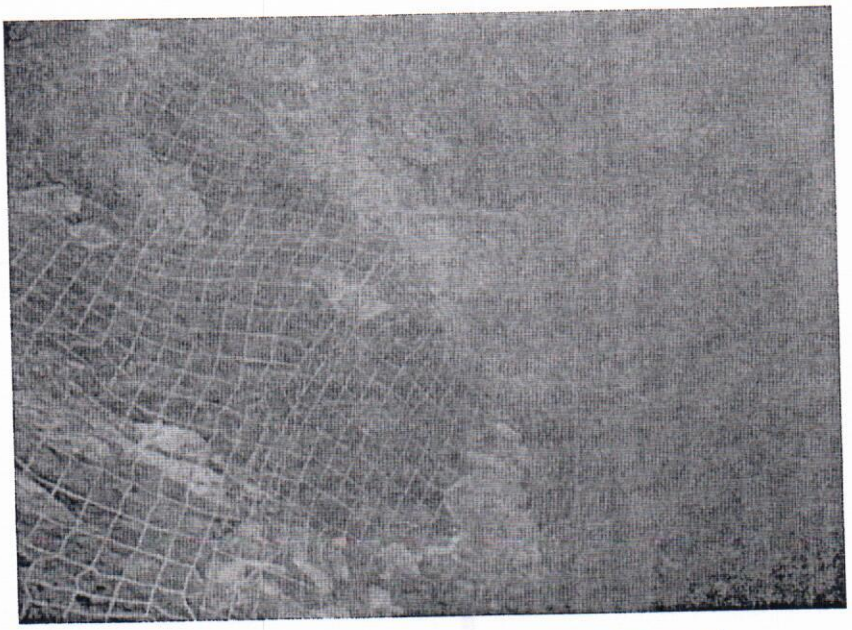


Fig.2 loose rock accumulation on wire mesh

10. Currently secondary mining between 350 – 400 mRL may not be feasible in SKA6 block in order to protect surface structures and to prevent occurrence of subsidence. Possibility and methods for tight filling in voids is also discussed.

11. Northern zone of SKA6 stope from 250 mRL to 375 mRL is having wider orebody of 100 m or so. A workshop exists on surface above this stope block and hence secondary stope mining may not be feasible. Strategy to optimally mine this zone with paste fill is discussed.

12. RMR estimation, determination of physico-mechanical properties, structural mapping including joints study along with core-logging must be made regularly for newly exposed area.

13. Scope of work for next year is also discussed. It includes B-block mining from -55 mRL to 15 mRL, SKA6 mining from 250 mRL to 375 mRL, proposed R&D work on mining below paste fill and backfill optimization, D block mining strategy, AP13 & AP14 stopes mining and estimation of safe distance from shaft pillar.

3.0 FEASIBILITY OF EXTRACTING SKA14 LENS AND SKA2 EXTENSION STOPES OF SINDESHAR KHURD MINE OF HZL

Sindeshar Khurd Mine, HZL has explored in detail a lens at the North extreme side of the mining lease. The proposed stopes to be extracted in SKA14 lens are designated as 14P1, 14P2, 14P5F, 14P5H and 14P6. Along with these 4 stopes in the SKA2 orebody are also proposed to be extracted above 300mRL and up to 325mRL. These extended portions of the stopes are 2P4-Ext, 2P5-Ext, 2P6-Ext and 2P7-Ext. These extended portions of SKA2 stopes are also in close proximity with the proposed SKA14 stopes. As studied by mine management the rock mass properties are similar to that of SKA2 orebody with lower frequency of joints in the rock mass. In this report the feasibility of extracting these stopes with Blast hole open stoping method is studied using 3D numerical modelling.

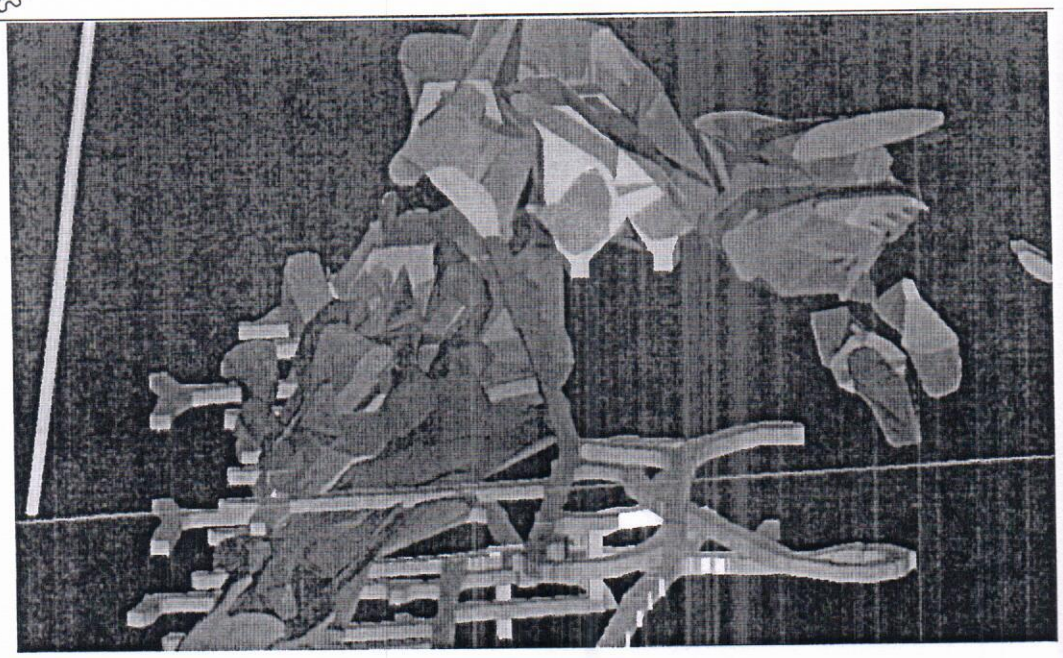


Figure 1: Isometric view of SKA14 Lens and SK2 extended portion

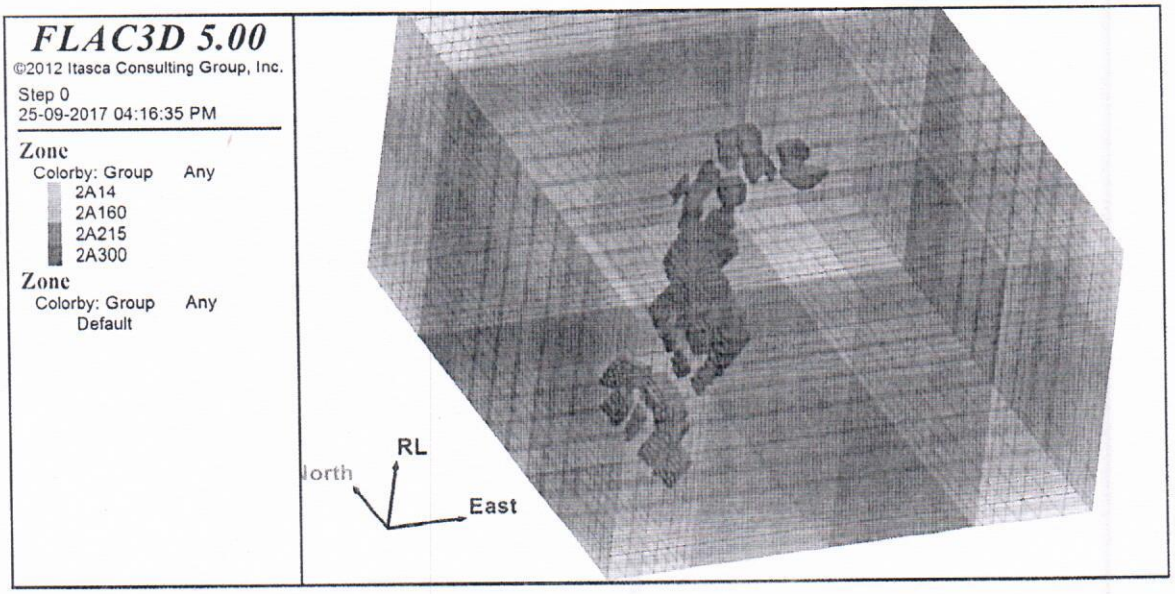


Figure 4: Three-dimensional grid used for modelling

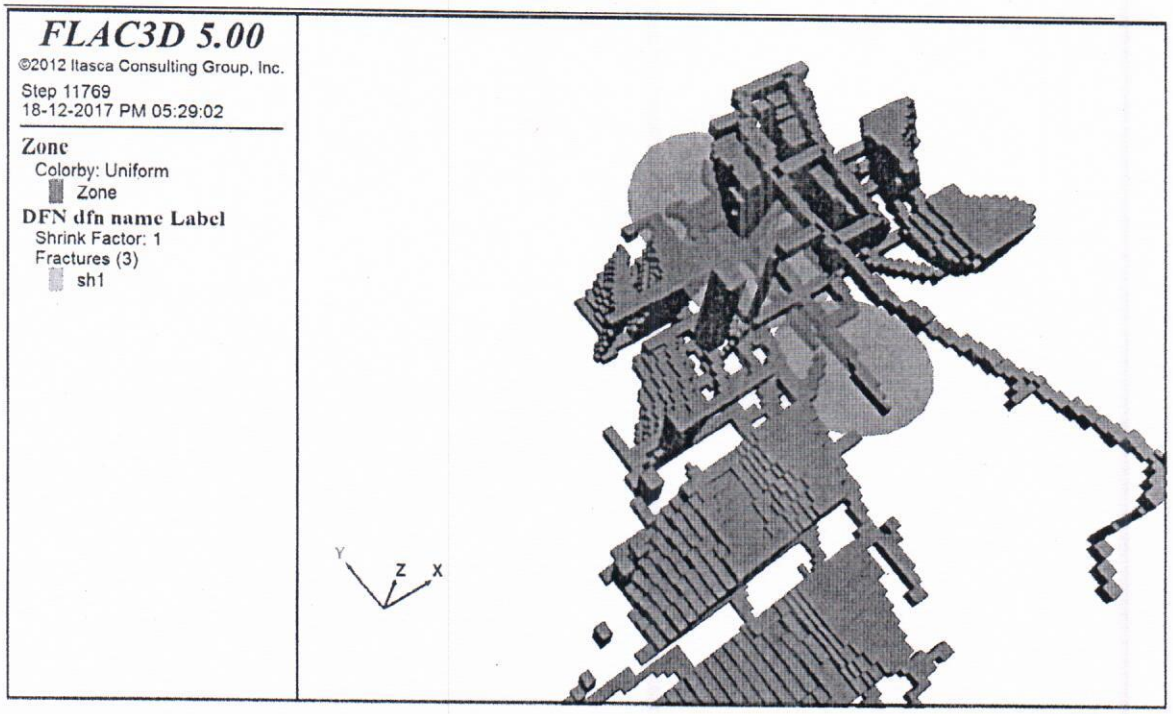


Figure 5: Sheared zones modelled in FLAC3D

From the numerical modelling runs for the feasibility of extracting SKA14 and SKA2 extended portion following conclusions and recommendations are made.

- All the stopes designated in SKA14 (6 stopes) and SKA2 Extension (4 stopes) are mineable with open stoping methods, with the following restrictions:

1. A rib pillar/secondary stope of length 15m need to be left between 14P1 and 14P2 stope. This pillar is suggested between 8150N and 8165N, which is part of 14P3 stope.
2. The horizontal parting between 14P4 and 14P6 need to be maintained to minimum of 12m, to ensure stability in the horizontal parting between them.
3. The SKA2 extended portions of 2P6 and 2P7 may not be extracted now, as they serve as a crown pillar (300-325mRL) separating the SKA2 and SKA14 lens stopes. However they are extractable at a later stage after back filling the open stopes in their immediate neighbourhood using rock/waste fill. The 2P4 and 2P5 extension stopes can be extracted now.
4. In general there should be a minimum of 10m parting in horizontal and vertical direction between adjacent open stopes in any situation. These parting/pillars

are mineable at a later stage, if it contains ore and after backfilling of the open stopes with waste/rock.

- The presence of shear zones does not have any significant global impact on stability. Their influence is found to be mostly localized.

- In all stopes the upper level drives and cross cuts should be cable bolted. Wherever shear/weakness planes are encountered, the roadway portion needs to be wire meshed and shotcreted to arrest further degradation.

- The left out pillars and partings, wherever practically possible, are to be instrumented using stress cells and borehole extensometers to monitor their stability.

4.0 DESIGN AND DEVELOPMENT OF SHOTCRETE BARRICADE FOR PASTEFILL STOPES AT SINDESHAR KHURD MINE, HZL

To facilitate faster extraction and paste backfilling with safety, it is important to design and construct barricades in the cross-cuts prior to paste filling operations. In the current study numerical modelling has been conducted to analyse the failure modes and hydro-static load bearing capacity of concrete and shotcrete barricades; and a safe design and construction sequence for shotcrete barricade specifically for Sindeshar Khurd Mine is presented.

Numerical modeling of piece-wise linear and arched shaped barricades were done and their ultimate load bearing capacity was evaluated under hydro-static loading conditions.

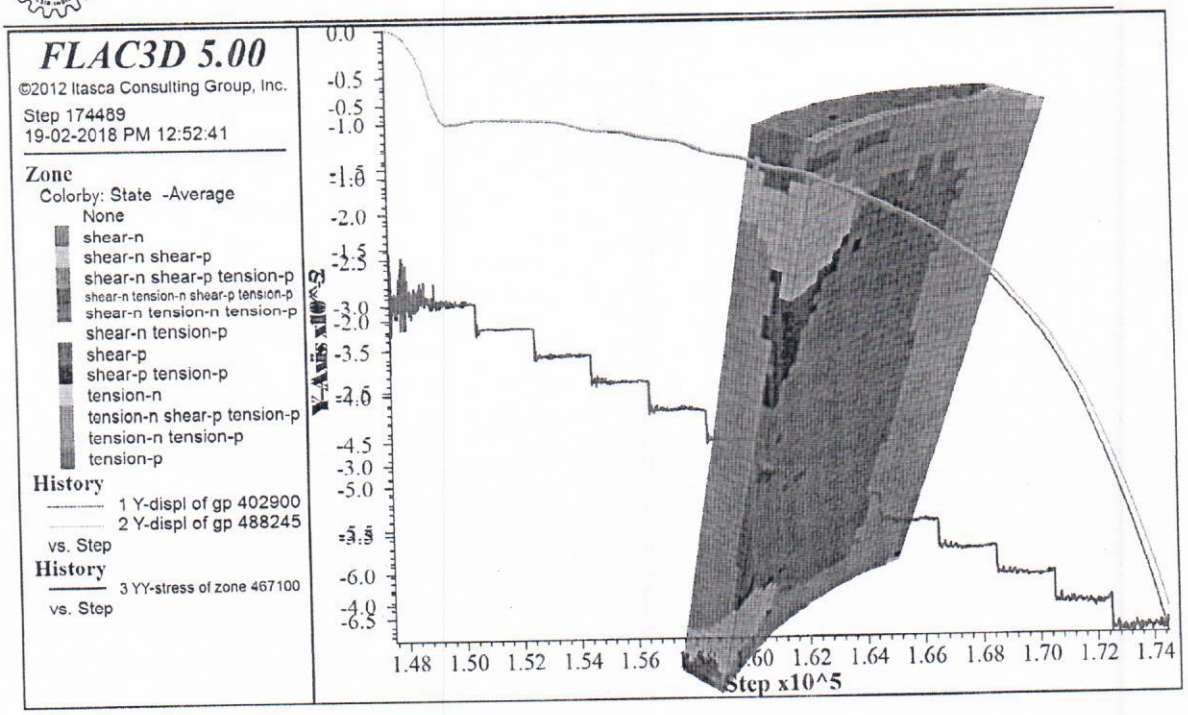


Figure 6 Ultimate failure pressure of 500mm shotcrete thickness

c

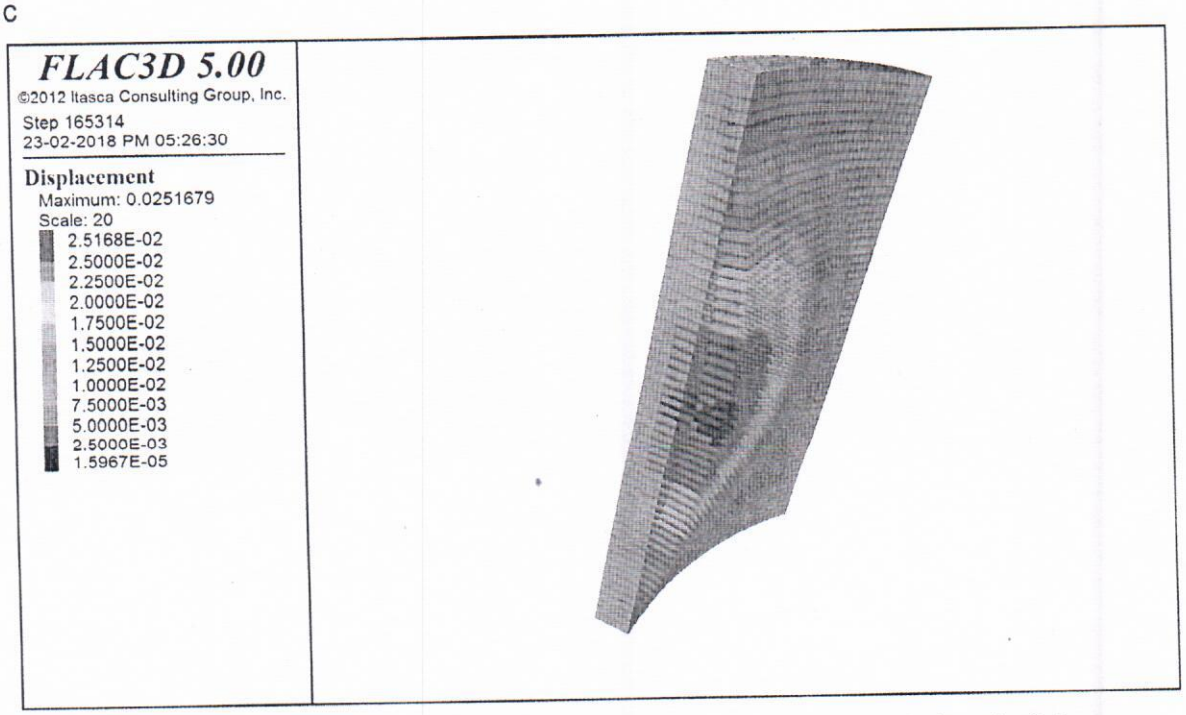


Figure 7 Displacement vectors at the face of the barricade during its failure

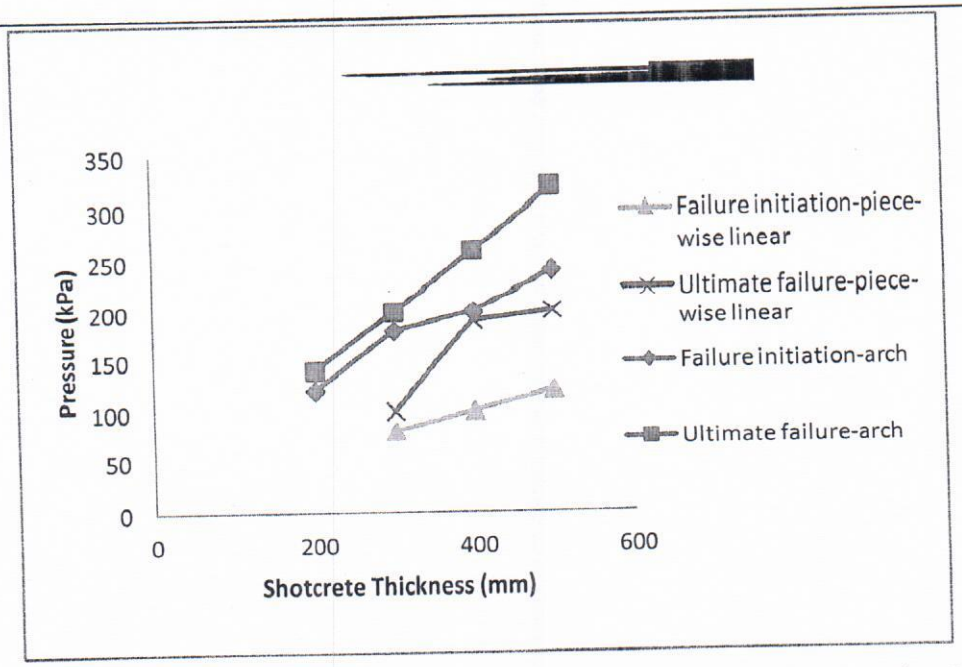


Figure 8 Comparison of arched and piece-wise linear shotcrete barricade strength vis-à-vis shotcrete thickness for 6m X6m roadway

From the above numerical modelling results a suitable barricade design using arch shaped shotcrete spraying has been done specifically for SK Mine. At SK Mine the cross-cuts generally have a dimension of 5.5mX5.5m; however at places where weak or sheared zones are encountered, the roadway width may go up to 6.0m or over 6.5m. It is not advisable to construct a shotcrete barricade at a location where sheared or weak ground is seen. In such case the location of the barricade may be shifted a few meters so as to have the roadway dimension less than 6.5m and a reasonably good rock mass exist. The stope volume at SK Mine is considerably larger and hence the volume of paste fill even for plug formation will be much larger. Extreme care should therefore be taken during plug construction. From the modelling results it has been found that when the plug is arched or piece-wise linear arch pattern, its resistance to tensile failure increases considerably. It is important to anchor the shotcrete barricade to the walls, roof and floor using cement grouted rock bolts. This can give proper anchorage to resist shearing against the shotcrete-rock contact, and also partially makeup the unfavourably undulating rock surface. Though shotcrete has steel fibres embedded (SFRS) as reinforcement materials, it is also required to further strengthen the shotcrete mass using steel frame and wire mesh reinforcement. Reinforcement shall generally be more effective to resist tensile crack

propagation, if they are placed within 50mm (2inches) inside the skin of the concrete/shotcrete structure.

From the literature and also from the recent test results done on shotcrete strength at Dariba Rock mechanics Laboratory, it is clear that plane (SFRS) shotcrete without accelerators can gain its designed strength(after 28 days curing). Within 3 days its strength gains up to 50% of its 28 days strength. All the model runs were done considering a safety factor of 5.0 with respect to 28 days cured strength and 2.5 safety factor corresponding to 3 days curing strength. Hence at the time of plug pouring the barricade should have a minimum safety factor of 2.5. The safety factor further improves as the shotcrete further cures. The plug curing time is taken as 7 days, by that time the shotcrete will have a strength gain of about 70~80% corresponding to safety factor of 3.5~4.0.

Further safety considerations in the barricade design:

1. Numerical modelling has been done for the barricade material as M30 shotcrete and without embedded reinforcements. Hence in reality the ultimate strength of the barricade shall be higher than that obtained from the models.
2. The plug pouring is usually done to a height of 7m, with 2m height above the brow. However in the worst case scenario even if 10m height is poured, the maximum vertical pressure on the floor of the stope shall be 200kPa. The paste fill is not a pure hydro-static material, hence it has been found that only 60% of the vertical load translates to horizontal pressure, which means the maximum load expected on the barricade shall not exceed 120kPa. The shotcrete barricade of 400mm with reinforcement can withstand loads over 240kPa at SF 2.5 with 3 days curing. The effective safety factor thus shall be around 5.0 even after 3 days of curing.
3. The final spray of shotcrete of 100mm shall have minimum 50% strength. That means earlier layers (350mm) shall have strength more than that. The above higher SF considerations are needed due to various other uncertainties. Shotcrete curing in underground may not be as good as that in

laboratory conditions. There could be errors in thickness of shotcrete sprayed, its contact with the roof and sides and the variations in roadway width or height, etc. Further there could be errors in estimation of the height of plug pour due to error in stope volume calculation, ratio of solid to liquid mix in the paste fill, etc. The above safety factors considerations can safely compensate for these errors.

During paste fill pouring for plug formation, the pressure coming onto the Earth Pressure Cell (EPC) should be continuously monitored. If the pressure exceeds 100kPa, the necessary precautions need to be taken and the pouring should be stopped. If the plug formation is not completed, further pouring for finishing the plug should be done only after the pressure drops to 50kPa.

Stages and design of recommended shotecrete barricade construction for SK Mine

It is important that the shotcrete barricade provide adequate resistance against the pastefill pressure and will have good reinforcement and anchorage into the rock mass. Therefore we recommend two steel frames to be constructed, the first one (in-bye side) for holding the wire mesh and hessian for shotcrete spraying and the second one side the shotcrete towards the out-bye side for providing reinforcement as well as anchorage to the rock mass. The radius of curvature of the barricade should be around 5.0~6.0m, which means the arch depth, shall be between 0.7 to 1.0m depending on the roadway width. Two more wire mesh are proposed to provide reinforcement to the shotcrete, those to be placed within 2 inch (50mm) inside from the outbye as well as inbye side. The shotcrete thickness should be a minimum of 400mm. To provide proper bolt anchorage into the rock mass cement encapsulated rock bolting is recommended to a depth not less than 500mm into the roof, floor and sides, especially for the second frame at the out-bye side. The detailed step by step procedure for the shotcrete barricade construction is as given below.

1. Site selection and site preparation
2. Construction sequence shall be from inbye side to outbye side.

3. Drill boreholes into floor in arch pattern (arch depth 0.7 ~ 1.0m) 500mm depth at about 1.0m spacing. This is for construction of frame (in-bye side) for holding the wiremesh and hessian cloth.
4. Drill holes into roof correspondingly above.
5. Drill holes into sides, minimum 500mm depth, at about 1.0m spacing. These holes are for the in-bye side frame
6. Drill a parallel row of holes (minimum 500mm depth) in arch shape in floor and roof into the sides at not less than 350mm distance from the inbye side frame and towards the outbye side. The holes will be at not less than 0.5m spacing along the arch.
7. Insert 20mmϕ bars into roof and floor and 16mmϕ bars into the sides. The bars are to be tied to form a frame at the inbye side.
8. Lay wire mesh (5mmϕ, @100mmX100mm) and tie to the frame.
9. Lay hessian over the mesh skin to skin and secure to the wire mesh.
10. Attach spacers (50mm thickness) to the hessian and the first wire mesh.
11. Lay second row of wire mesh over the spacers and tie to the first layer of wire mesh and the in bye side frame.
12. Insert 20mmϕ bars to the roof and floor and 16mmϕ bars into the sides and grout them with cement capsules (grouted holes) and tie them to form the second frame at the outbye side.
13. Lay and tie the third row of wire mesh over the second frame.
14. Fix bleed pipes (at least 3 Nos) with a fine wire net at the inbye end (to prevent pastefill entering the pipe) and a valve or a pressure gauge at the outbye end (for water draining).
15. Spray shotcrete from hessian cloth towards out bye side in stages (100mm sprays per shift). The shotcrete should be sprayed until the second frame and the third wire mesh are fully buried to a depth of about 50mm (2 in).
16. Curing time should be at least 3 days after the final spray and before the pastefill pour. The final layer of shotcrete should gain at least 50% of its full strength (28 days strength) prior to pouring the pastefill.

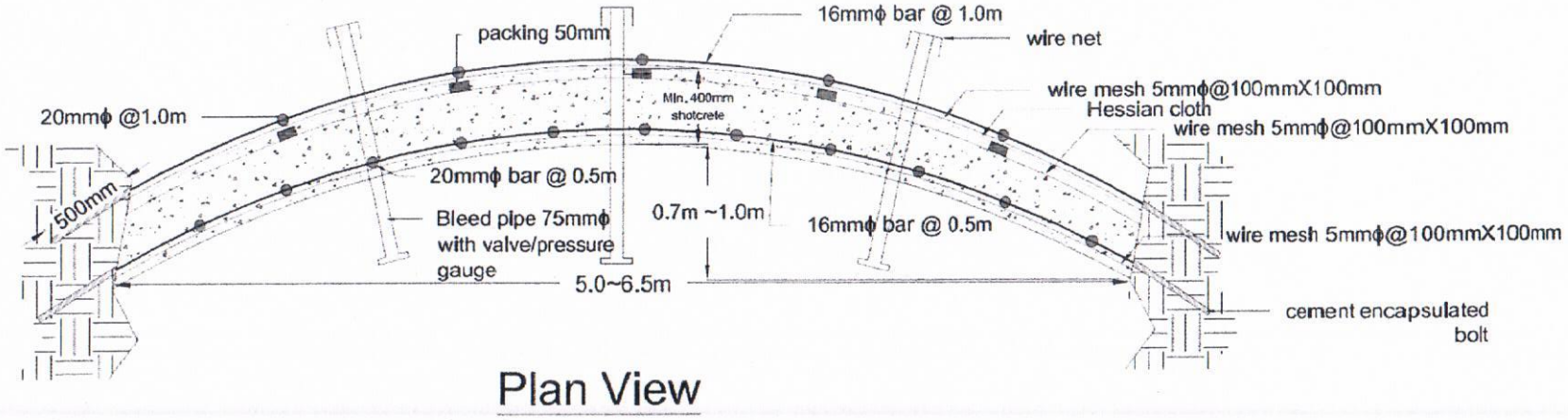


Figure 2 Plan view of shortcrete barricade for SK Mine

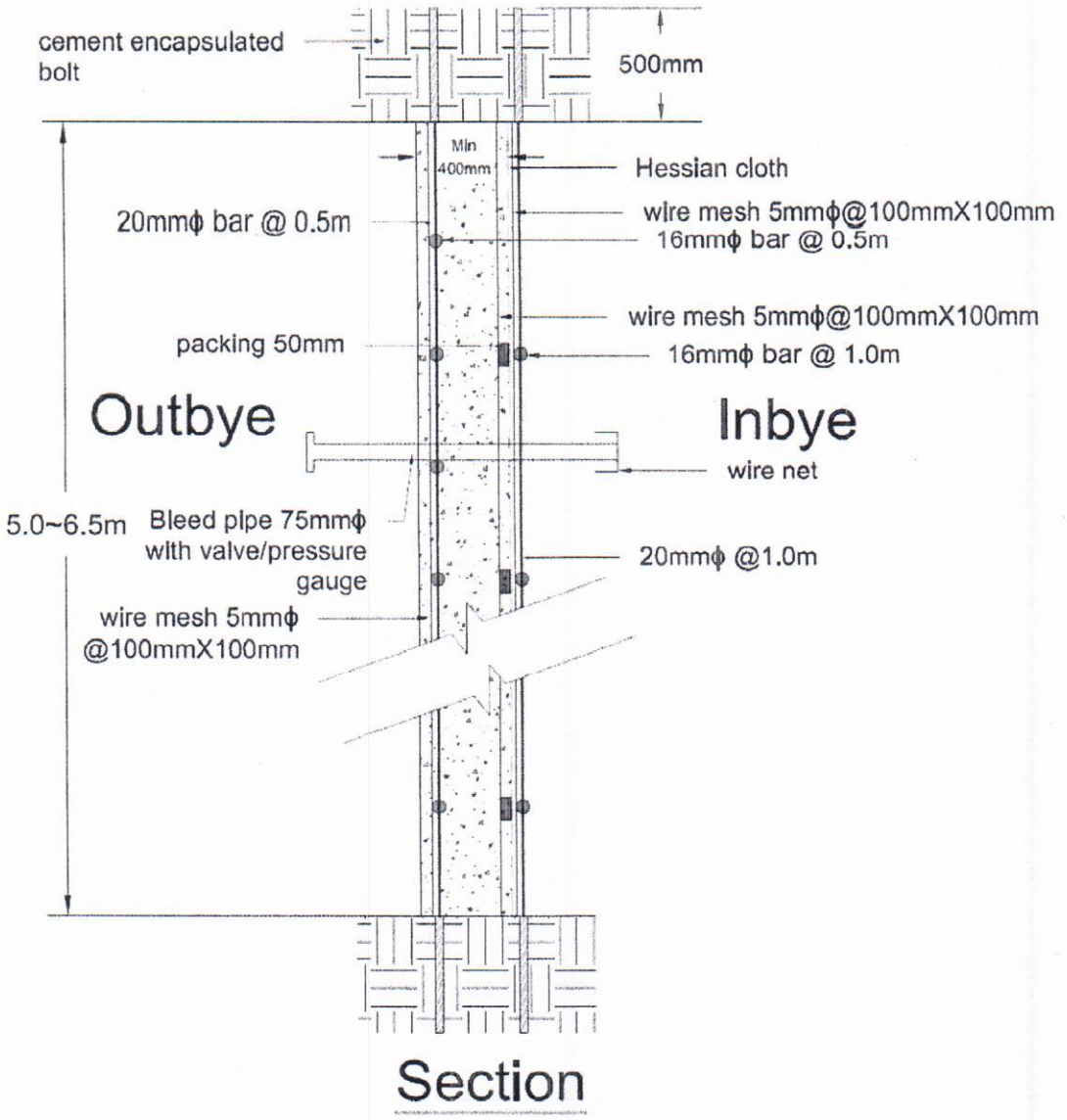


Figure 10 Section view of shortcrete barricade for SK Mine

Other precautions to be followed during barricade construction

1. Avoid fractured rock conditions of floor, wall and back for locating barricades.
2. Introduction of drain/inspection pipe is mandatory to prevent hydrostatic pressure built up behind barricades. Free flowing water must be drained out from fill material or surrounding strata using values. One or two pressure gauges may also be used to check the water pressure.

3. Thickness of shotcrete at different heights should be ensured through depth gauges.

4. Shotcrete should be allowed to gain sufficient strength of at least 15 MPa before pouring the plug. Barricade must be allowed to cure after final spray for at least 72 hrs prior to filling.
5. Initial plug formation must be about 2m above stope brow and barricade height and should be ensured before continuing further pouring. Atleast 7 days should be given for plug curing.
6. Every barricade must be monitored with at least one EPC to visualise hydrostatic pressure built-up on upstream side.
7. Fill rate should be monitored to ensure poured fill material is allowed sufficient time to cure.
8. Health of barricade and surrounding strata should be visually inspected regularly.
9. During pouring a non-entry zone should be established near barricade.
10. Another set of test data on strength of shotcrete should be generated after addition of accelerator in mortor.
11. Anchoring must be grouted with quick setting cement capsules.
12. Bleed pipe should be monitored every shift for initial 10 days and then daily till the stope is filled to its full height.
13. If the water from bleed pipe do not stop even after plug formation further pouring of paste should be stopped and necessary arrangement should be made to drain the water from stope.
14. CMS data need to be taken before start of filling in each stope. After every pour the height of filling must be checked against poured volume. Height of plug must be ensured through volume computation of void in stope and volume of paste poured in plug formation. Top level of plug should be at least 2 m above stope brow level.
15. Before filling all stope brows are to be checked properly for any muck lying.
16. In addition to EPC readings, pouring data from start time to close time is required to be maintained date wise. EPC readings should be recorded live during plug pouring.

17. Flushing of lines at the end of pour may lead to excess water. An outlet for drainage paste line flush water needs to be provided necessarily.

Annexure-II

ANNEXURE –III

RESULTS OF CHEMICAL ANALYSIS OF WATER SAMPLES COLLECTED DURING PRE-MONSOON, 2017
ANALYZED BY NABL ACCREDITED LABORATORY – NABL, TC-5788
R.K.CONSULTANTS-CHEMICAL ANALYSIS DIVISION

(IIA)

S. NO.	PARAMETERS	UNIT	SK-1	SK-2	SK3	SK-4	SK-5	SK-6	SK-7
			RKC/262	RKC/263	RKC/264	RKC/265	RKC/266	RKC/267	RKC/268
1	pH	-	7.71	8.10	7.55	8.30	7.66	7.98	7.96
2	EC at 25°C	µS/cm	1300	1500	770	2300	1210	2876	1530
3	TDS	mg/L	790	1009	474	1845	747	1726	918
4	Colour	Hazan	< 5	< 5	< 5	< 5	< 5	< 5	< 5
5	Turbidity	NTU	2.0	1.5	3.1	2.1	3.5	2.2	3.1
6	Total Alkalinity	mg as $CaCO_3$/l	500	400	320	410	420	240	550
7	Calcium, Ca	mg/L	48	62	112	28	26	190	24
8	Magnesium, Mg,	mg/L	24	26	23	49	15	70	19
9	Total Hardness	mg as $CaCO_3$/l	218.4	261.6	374.3	270.9	126.5	762	137.9
10	Chlorides, Cl	mg/L	71	128	43	35	113	125	57
11	Sulphate, SO_4	mg/L	80	273	27	256	89	195	185
12	Nitrate, NO_3	mg/L	32	7.0	40	26	3.0	2.0	1.0
13	Iron, Fe	mg/L	0.22	0.25	BDL	0.28	BDL	0.25	0.21
14	Fluoride, F	mg/L	1.25	1.41	0.88	1.12	1.22	0.40	1.24
15	Lead, Pb	mg/L	BDL	BDL	BDL	BDL	BDL	BDL	BDL
16	Cadmium , Cd	mg/L	BDL	BDL	BDL	BDL	BDL	0.002	BDL
17	Zinc, Zn	mg/L	0.01	0.06	0.05	0.08	0.58	0.17	0.04
18	Copper , Cu	mg/L	0.02	0.03	BDL	0.02	BDL	0.90	BDL
19	Chromium, Cr^{+6}	mg/L	BDL	BDL	BDL	0.01	ND	0.03	BDL
20	Nickel, Ni^{+}	mg/L	BDL	BDL	BDL	BDL	BDL	0.01	BDL
21	Manganese, Mn	mg/L	ND	ND	0.05	0.09	BDL	0.03	BDL

BDL – Below Detection Level

Annexure-II (IIA)

ANNEXURE –III

RESULTS OF CHEMICAL ANALYSIS OF WATER SAMPLES
ANALYZED BY NABL ACCREDITED LABORATORY – NABL, TC-5788
R.K.CONSULTANTS-CHEMICAL ANALYSIS DIVISION

IIA

S. NO.	PARAMETERS	UNIT	SK-8	SK-9	SK-10	SK-11	SK-12	SK-13
			RKC/269	RKC/270	RKC/271	RKC/272	RKC/273	RKC/274
1	pH	-	7.96	7.25	7.82	7.22	7.52	8.20
2	EC at 25°C	µS/cm	2700	980	1080	1130	1270	1230
3	TDS	mg/L	1750	630	693	746	835	760
4	Colour	Hazan	< 5	< 5	< 5	< 5	10	< 5
5	Turbidity	NTU	2.3	3.2	3.8	3.9	3.2	3.4
6	Total Alkalinity	mg as $CaCO_3$/l	520	250	430	350	550	560
7	Calcium, Ca	mg/L	158	138	104	142	36	22
8	Magnesium, Mg,	mg/L	72	26	40	26	22	15
9	Total Hardness	mg as $CaCO_3$/l	690.2	451.6	424	461.6	180.2	116.5
10	Chlorides, Cl	mg/L	369	85	57	85	67	50
11	Sulphate, SO_4	mg/L	163	118	128	155	120	63
12	Nitrate, NO_3	mg/L	30	14	1.0	6.0	1.0	10
13	Iron, Fe	mg/L	0.21	BDL	BDL	0.03	0.024	BDL
14	Fluoride, F	mg/L	1.02	0.78	1.20	1.08	1.45	1.40
15	# Lead, Pb	mg/L	BDL	BDL	BDL	BDL	BDL	BDL
16	# Cadmium , Cd	mg/L	BDL	BDL	BDL	BDL	BDL	BDL
17	# Zinc, Zn	mg/L	3.5	6.0	0.45	5.50	4.75	0.13
18	# Copper , Cu	mg/L	0.08	BDL	BDL	BDL	BDL	BDL
19	# Chromium, Cr^{+6}	mg/L	ND	ND	ND	ND	ND	ND
20	# Nickel, Ni^{+}	mg/L	ND	ND	ND	ND	ND	ND
21	Manganese, Mn	mg/L	ND	ND	ND	ND	0.20	ND

BDL – Below Detection Limit.

(IIB)

Annexure-IV. Results of chemical analysis of 13 water samples collected from S.K Mine during post-monsoon period 2017

S. No.	Parameter	Unit	SK-1	SK -2	SK -3	SK -4	SK -5	SK -6	SK -7	Acceptable limit as per IS 10500, 2012	Permissible limit as per IS10500, 2012
1.	pH	....	7.25	7.23	7.11	6.85	7.29	7.36	7.11	6.5 to 8.5	No relaxation
2.	Electrical Conductivity	µS/cm	1491	1410	1055	2658	625	2744	1468	...	...
3.	TDS	mg/l	904	916	690	1728	406	1715	950	500, Max	2000
4.	Color	Hazen	<5	<5	<5	<5	<5	<5	<5	5	15
5.	Turbidity	NTU	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.0	5.0
6.	Total Alkalinity (as CaCO3)	mg/l	484	552	448	572	188	484	508	200, Max	600.0
7.	Calcium (As Ca)	mg/l	52.0	65	98.0	104.0	32	188	25.0	75.0	200.0
8.	Magnesium (as Mg)	mg/l	37.0	31.0	16.0	55.0	16.0	85	23.0	30.0	100.0
9.	Total Hardness (as CaCO3)	mg/l	281.7	289.6	310.6	485.5	145.6	818.5	156.8	200.0	600.0
10.	Chlorides (as Cl)	mg/l	81	120	51	45	100	130	170	250, Max	1000
11.	Sulphate (as SO_4)	mg/l	89	185.0	33.0	351	90	206	126.90	200, Max	400
12.	Nitrate (as NO_3)	mg/l	20.21	11.0	14	35	5.5	8.0	5.0	45, Max	No relaxation
13.	Iron(as Fe)	mg/l	BDL	0.16	0.21	0.26	0.19	BDL	BDL	0.30	No relaxation
14.	Fluoride (as F)	mg/l	1.30	1.28	0.90	119	0.96	0.7	0.94	1.0	1.5
15.	Lead (as Pb)	mg/l	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.01	No relaxation
16.	Cadmium (as Cd)	mg/l	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.003	No relaxation
17.	Zinc (as Zn)	mg/l	0.25	0.08	1.12	0.25	0.63	0.16	0.17	5	15
18.	Copper (as Cu)	mg/l	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.05	1.5
19.	Chromium (as Cr)	mg/l	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.05	No relaxation
20.	Nickel (as Ni)	mg/l	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.02	No relaxation
21.	Manganese (Mn)	mg/l	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.1	0.3

(IIB)

(IIB)

S. No.	Parameter	Unit	SK -8	SK -9	SK -10	SK -11	SK -12	SK -13	Acceptable limit as per IS 10500, 2012	Permissible limit as per IS10500, 2012
1.	pH	....	7.57	7.37	7.12	7.35	7.15	7.65	6.5 to 8.5	No relaxation
2.	Electrical Conductivity	µS/cm	1635	1470	1709	1265	910	920	...	...
3.	TDS	mg/l	1063	960	1068	790	610	575	500, Max	2000
4.	Color	Hazen	<5	<5	<5	<5	<5	<5	5	15
5.	Turbidity	NTU	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.0	5.0
6.	Total Alkalinity (as CaCO3)	mg/l	440	544	632	244	491	343	200, Max	600.0
7.	Calcium (As Ca)	mg/l	75	33.1	287	61	41	54	75.0	200.0
8.	Magnesium (as Mg)	mg/l	31	28	23	21	24	27	30.0	100.0
9.	Total Hardness (as CaCO3)	mg/l	314.6	197.55	811.8	238.6	200.9	245.7	200.0	600.0
10.	Chlorides (as Cl)	mg/l	86	62	112	91	81	110	250, Max	1000
11.	Sulphate (as SO_4)	mg/l	198.0	162.0	225.0	110	95	80	200, Max	400
12.	Nitrate (as NO_3)	mg/l	20.0	16.0	31.0	15	10	12	45, Max	No relaxation
13.	Iron(as Fe)	mg/l	BDL	0.08	0.29	0.10	0.15	0.13	0.30	No relaxation
14.	Fluoride (as F)	mg/l	1.03	1.07	1.15	1.20	1.10	0.95	1.0	1.5
15.	Lead (as Pb)	mg/l	BDL	BDL	BDL	BDL	BDL	BDL	0.01	No relaxation
16.	Cadmium (as Cd)	mg/l	BDL	BDL	BDL	BDL	BDL	BDL	0.003	No relaxation
17.	Zinc (as Zn)	mg/l	0.16	0.08	0.11	1.10	0.91	0.82	5	15
18.	Copper (as Cu)	mg/l	BDL	BDL	BDL	BDL	BDL	BDL	0.05	1.5
19.	Chromium (as Cr)	mg/l	BDL	BDL	BDL	BDL	BDL	BDL	0.05	No relaxation
20.	Nickel (as Ni)	mg/l	BDL	BDL	BDL	BDL	BDL	BDL	0.02	No relaxation
21.	Manganese (Mn)	mg/l	BDL	BDL	BDL	BDL	BDL	BDL	0.1	0.3

(IIB)

National Accreditation Board for Testing and Calibration Laboratories

(A Constituent Board of Quality Council of India)

CERTIFICATE OF ACCREDITATION

R. K. CONSULTANTS (CHEMICAL ANALYSIS DIVISION)

has been assessed and accredited in accordance with the standard

ISO/IEC 17025:2005

"General Requirements for the Competence of Testing & Calibration Laboratories"

for its facilities at

17E/777, C.H.B., Jodhpur, Rajasthan

in the field of

TESTING

Certificate Number	TC-5788 *(in lieu of T-2531)*		
Issue Date	01/06/2017	**Valid Until**	31/05/2019

This certificate remains valid for the Scope of Accreditation as specified in the annexure subject to continued satisfactory compliance to the above standard & the relevant requirements of NABL.

(To see the scope of accreditation of this laboratory, you may also visit NABL website www.nabl-india.org)

Signed for and on behalf of NABL

N. Venkateswaran
Program Director

Anil Relia
Chief Executive Officer

NABL

National Accreditation Board for Testing and Calibration Laboratories

(An Autonomous Body under Department of Science & Technology, Govt. of India)

CERTIFICATE OF ACCREDITATION

SCS ENVIRO SERVICES PRIVATE LIMITED

has been assessed and accredited in accordance with the standard

ISO/IEC 17025:2005

"General Requirements for the Competence of Testing & Calibration Laboratories"

for its facilities at

7, Kesar Vihar, Ramnagariya Road, Jagatpura, Jaipur, Rajasthan

in the discipline of

CHEMICAL TESTING

(To see the scope of accreditation of this laboratory, you may also visit NABL website www.nabl-india.org)

Certificate Number T-3770

Issue Date 29/01/2016

Valid Until 28/01/2018

This certificate remains valid for the Scope of Accreditation as specified in the annexure subject to continued satisfactory compliance to the above standard & the additional requirements of NABL.

Signed for and on behalf of NABL

N. Venkateswaran
Program Manager

Anil Relia
Director

Prof. S. K. Joshi
Chairman

Annexure-III

Safety Status Report (SSR)

(Nucleonic Gauge Facility)

This status report should be submitted by the authorized user of the nucleonic devices through eLORA system in the **first week of January & July** every year, as per the terms and conditions of the authorization issued under the Atomic Energy (Radiation Protection) Rules, 2004.

Name of Institution:	Sindesar Khurd Mines
e-LORA Institution Number	RJ-35620
SSR Reporting period	Feb'18

	Inventory of the Nucleonic Gauges/Sources	
1.	Total number of Nucleonic Gauge (NG) devices/sources in possession of your institution:	32
2.	Total number of NG devices/sources not in use:	0
3.	Total number of NG devices/sources which are disused and to be disposed off :	0
4.	Steps being taken to dispose of disused sources, if any:	NA
	Radiation protection, surveillance and physical security (tick the appropriate)	
5.	Whether periodic radiation protection survey performed for all NG devices/sources and records are maintained?	Yes / No
6.	Whether Personal monitoring services availed for radiation workers (as applicable)	Yes / No / NA
7.	Whether adequate physical security measures provided for NG devices/ sources?	Yes / No
8.	Whether Radiation symbol and warning, in English, Hindi and regional language displayed on source housing and at the fencing/at the access point of NG Devices?	Yes / No
9.	Emergency procedures with contact details of responsible person displayed at appropriate location in the institution?	Yes / No
10.	Whether the representatives of AERB inspected the Nucleonic Device installations?	Yes / No
11.	If yes, dates of inspection	NA
12.	Any other information:	

13. DETAILS OF NUCLEONIC GAUGES

S.No	Make & Model of nucleonic devices	Number of nucleonic devices	Sr. number of nucleonic device	Source & Activity	* Stray Radiation Level from External housing of device (µSv/hr)		Location/ Plant name	Reference No. of NOC issued by AERB/BARC	Present status of the device (In use)
					5 cm	100cm			
1	Berthold LB491	1	463-02-10	Cs137 & 15 mCi	0.367	0.351	U/F HYDROFILL	AERB/RSD/NG /NR435/2010/ 2641 Dt.22/03/2010	In Use
2	Berthold LB492	1	464-02-10	Cs137 & 15 mCi	0.298	0.282	U/F HYDROFILL	AERB/RSD/NG /NR435/2010/ 2641 Dt.22/03/2011	In Use
3	Berthold LB493	1	465-02-10	Cs137 & 15 mCi	0.126	0.11	REGRIND CYCLONE	AERB/RSD/NG /NR435/2010/ 2641 Dt.22/03/2012	In Use
4	Berthold LB494	1	466-02-10	Cs137 & 10 mCi	0.119	0.103	PR-SEC CYCLONE STR-1	AERB/RSD/NG /NR435/2010/ 2641 Dt.22/03/2013	In Use
5	Berthold LB495	1	467-02-10	Cs137 & 10 mCi	0.903	0.887	PR-SEC CYCLONE STR-2	AERB/RSD/NG /NR435/2010/ 2641 Dt.22/03/2014	In Use
6	Berthold LB496	1	468-02-10	Cs137 & 10 mCi	0.301	0.307	TDPH	AERB/RSD/NG /NR435/2010/ 2641 Dt.22/03/2015	In Use
7	Berthold LB497	1	469-02-10	Cs137 & 10 mCi	0.512	0.518	TDPH	AERB/RSD/NG /NR435/2010/ 2641 Dt.22/03/2016	In Use
8	Berthold LB498	1	470-02-10	Cs137 & 10 mCi	0.834	0.84	TDPH	AERB/RSD/NG /NR435/2010/ 2641 Dt.22/03/2017	In Use
9	Berthold LB499	1	471-02-10	Cs137 & 10 mCi	0.403	0.409	TAILING THICKENER	AERB/RSD/NG /NR435/2010/ 2641 Dt.22/03/2018	In Use

10	Berthold LB500	1	472-02-10	Cs137 & 6mCi	0.652	0.658	ZN THICKENER	AERB/RSD/NG /NR435/2010/ 2641 Dt.22/03/2019	In Use
11	Berthold LB501	1	473-02-10	Cs137 & 20mCi	0.216	0.222	Pb THICKENER	AERB/RSD/NG /NR435/2010/ 2641 Dt.22/03/2020	In Use
12	Berthold LB502	1	1017-06-10	Cs137 & 10mCi	0.251	0.240	TAILING THICKENER	AERB/RSD/NG /NR435/2011/ 2067 Dt.15/02/2011	In Use
13	E&H FQG31	1	TB616	Cs137 & 200mCi	1.32	1.309	LOW	AERB/RSD/NG /NR435/2010/ 9983 Dt.14/10/2010	In Use
14	E&H FQG32	1	TB617	Cs137 & 200mCi	1.35	1.339	HIGH	AERB/RSD/NG /NR435/2010/ 9983 Dt.14/10/2011	In Use
15	Berthold LB505	1	1372-08-12	Cs137 & 20mCi	0.318	0.307	CYCLONE FEED HYDROFILL	AERB/RSD/NG /NR435/2012/ 10504 Dt.23/08/2012	In Use
16	Berthold LB506	1	1373-08-12	Cs137 & 20mCi	0.308	0.297	CYCLONE FEED HYDROFILL	AERB/RSD/NG /NR435/2012/ 10504 Dt.23/08/2013	In Use
17	Berthold LB507	1	1374-08-12	Cs137 & 10mCi	0.137	0.278	HYDROFILL	AERB/RSD/NG /NR435/2012/ 10504 Dt.23/08/2014	In Use
18	Berthold LB508	1	1375-08-12	Cs137 & 10mCi	0.163	0.304	HYDROFILL	AERB/RSD/NG /NR435/2012/ 10504 Dt.23/08/2015	In Use
19	Berthold LB509	1	1514-08-13	Cs137 & 50mCi	0.871	1.012	PASTE FILL-TAILING THICKNER	AERB/RSD/NG /NR435/2013/ 11772 Dt.02/09/2013	In Use
20	Berthold LB510	1	1515-08-13	Cs137 & 50mCi	0.89	1.031	PASTE FILL-TAILING THICKNER	AERB/RSD/NG /NR435/2013/ 11772 Dt.02/09/2014	In Use

21	Berthold LB511	1	1516-08-13	Cs137 & 20mCi	0.65	0.791	PASTE FILL	AERB/RSD/NG /NR435/2013/ 11772 Dt.02/09/2015	In Use
22	Berthold LB512	1	1599-09-13	Cs137 & 20mCi	0.509	0.650	PASTE FILL	AERB/RSD/NG /NR435/2013/ 12841 Dt.24/09/2013	In Use
23	FQG60	1	LB000D01145	Cs137 & 5mCi	1.85	0.15	LEAD Thickener Stream2	16-NGPROC-128695	In Use
24	FQG60	1	LB000C01145	Cs137 & 1mCi	1.69	0.018	Tailing Thickener Stream2	16-NGPROC-128694	In Use
25	FQG60	1	LB000901145	Cs137 & 3mCi	1.29	0.021	Zinc Thickener Stream2	16-NGPROC-128693	In Use
26	FQG61	1	LB004B0113F	Cs137 &30mCi	0.281	0.005	Cyclone Feed Pump Stream2	16-NGPROC-128687	In Use
27	FQG61	1	LB004A0113F	Cs137 &10mCi	0.049	0.051	Regrind Cyclone Feed Pump	16-NGPROC-128693	In Use
28	FQG60	1	LB000601145	Cs137 &2mCi	0.975	0.012	Combined Tailing Disposal Pump	16-NGPROC-128692	In Use
29	FQG60	1	LB000701145	Cs137 &2mCi	0.925	0.025	Combined Tailing Disposal Pump	16-NGPROC-128691	In Use
30	FQG60	1	LB000801145	Cs137 &2mCi	0.917	0.03	Combined Tailing Disposal Pump	16-NGPROC-128690	In Use
31	FQG60	1	LB000A01145	Cs137 &3mCi	1.385	0.078	At Paste fill pump discharge line	16-NGPROC-128688	In Use
32	FQG60	1	LB000B01145	Cs137 &3mCi	1.151	0.082	At Paste fill pump discharge line	16-NGPROC-128689	In Use

I hereby certify that the above particulars are true to the best of my knowledge and belief and are in complete conformity with the applicable terms and conditions of authorization and that the sources in our possession have been physically verified by me and found satisfactory from radiation safety point of view.

Unit Head
Sindesar Khurd Mine
Hindustan Zinc Limited
P.O. Dadia-313211
Dist. Rajsamand (Raj.)

Radiation Safety Officer

Signature:
Name: JAGRATI SACHETI
Date: 27/02/12

Employer/Licensee

Signature:
Name: RAJEEV BOKA
Date: 27/02/12

(Seal of the Institution)

Annexure-IV

TEAM TEST HOUSE

(Unit of Team Institute of Science & Technology Pvt. Ltd.)

TC-5025

Recognised by Ministry of Environment and Forest, Government of India as Environmental Laboratory

NABL RSPCB ISO 9001:2008 OHSAS 18001:2007 JDA/UDH

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Website : www.teamtesthouse.com

Lab.: G1-584, Sitapura Industrial Area
Tonk Road, JAIPUR-302022 Raj.
Ph.: 94602-22039, 94602-22049
E-mail : teamtesthouse@gmail.com
E-mail : director@teamtesthouse.com

TEST REPORT

Report No. :	A/2922
Job Identification. :	9680/17-18
Date :	06-03-2018
Issued To :	M/S Hindustan Zinc Limited (Sindesar Khurd Mines) P.O. - Dariba - 313211 Distt. Rajsamand (Rajasthan)
Type of Unit :	Mines
Type of Sample :	Ambient Air Quality Monitoring
Date of Sample Collection/Monitoring :	20-02-2018
Date of Sample Receipt :	23-02-2018
Date of Test :	23-02-2018 to 06-03-2018
Sample Collected By :	Satyendra Kumar Sharma
Point of Collection :	Sindesar Khurd Village, Sindesar Khurd Mine (Residential Area)

RESULTS

S.No	Parameters	Observed Value	Testing Protocol	Limits as per National Ambient Air Quality Standard, 2009
1	Carbon Monoxide [microgram/m3]	340	IS 5182 (Part 10) : 1999	2000
2	Nitrogen Dioxide as NO2 [microgram/m3]	15.28	IS 5182 (Part 6) : 2006 Reaffirmed 2012	80.00
3	Suspended Particulate Matter (SPM) [microgram/m3]	363.61	IS 5182 (Part 4) : 1999 Reaffirmed 2014	-
4	Particulate Matter (PM2.5) [microgram/m3]	44.02	CPCB Guidelines	60.00
5	Sulphur Dioxide [microgram/m3]	6.27	IS 5182 (Part 2) : 2001 Reaffirmed 2012	80.00
6	Particulate Matter (PM 10) [microgram/m3]	65.22	IS 5182 (Part 23)-2006 Reaffirmed 2012	100.00

Notes :-

The results listed refer only to the tested sample (s) & parameters (s). Endorsement of products is neither inferred nor implied.

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The samples will be destroyed after 15 days from the date of issue of test report unless otherwise specified.

Senior Analyst

Authorized Signatory
(Report No: A/2922)

TEAM TEST HOUSE
(Unit of Team Institute of Science & Technology Pvt. Ltd.)

TC-5025

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TEST REPORT

Report No. : A/2921
Job Identification. : 9679/17-18
Date : 06-03-2018
Issued To : M/S Hindustan Zinc Limited (Sindesar Khurd Mines)
P.O. - Dariba - 313211
Distt. Rajsamand (Rajasthan)
Type of Unit : Mines
Type of Sample : Ambient Air Quality Monitoring
Date of Sample Collection/Monitoring : 21-02-2018
Date of Sample Receipt : 23-02-2018
Date of Test : 23-02-2018 to 06-03-2018
Sample Collected By : Satyendra Kumar Sharma
Point of Collection : Bamania Kalan Village Sindesar Khurd Mine (Residential Area)

RESULTS

S.No	Parameters	Observed Value	Testing Protocol	Limits as per National Ambient Air Quality Standard, 2009
1	Carbon Monoxide [microgram/m3]	300	IS 5182 (Part 10) : 1999	2000
2	Nitrogen Dioxide as NO2 [microgram/m3]	16.18	IS 5182 (Part 6) : 2006 Reaffirmed 2012	80.00
3	Suspended Particulate Matter (SPM) [microgram/m3]	265.98	IS 5182 (Part 4) : 1999 Reaffirmed 2014	-
4	Particulate Matter (PM2.5) [microgram/m3]	46.8	CPCB Guidelines	60.00
5	Sulphur Dioxide [microgram/m3]	6.11	IS 5182 (Part 2) : 2001 Reaffirmed 2012	80.00
6	Particulate Matter (PM 10) [microgram/m3]	83.6	IS 5182 (Part 23)-2006 Reaffirmed 2012	100.00

Notes :-

The results listed refer only to the tested sample (s) & parameters (s). Endorsement of products is neither inferred nor implied.

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The samples will be destroyed after 15 days from the date of issue of test report unless otherwise specified.

Senior Analyst

Authorized Signatory
(Report No: A/2921)

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TEST REPORT

Report No. : A/2923
Job Identification. : 9681/17-18
Date : 06-03-2018
Issued To : M/S Hindustan Zinc Limited (Sindesar Khurd Mines)
P.O. - Dariba - 313211
Distt. Rajsamand (Rajasthan)
Type of Unit : Mines
Type of Sample : Ambient Air Quality Monitoring
Date of Sample Collection/Monitoring : 20-02-2018
Date of Sample Receipt : 23-02-2018
Date of Test : 23-02-2018 to 06-03-2018
Sample Collected By : Satyendra Kumar Sharma
Point of Collection : Rajpura Village, Sindesar Khurd Mine (Residential Area)

RESULTS

S.No	Parameters	Observed Value	Testing Protocol	Limits as per National Ambient Air Quality Standard, 2009
1	Carbon Monoxide [microgram/m3]	270	IS 5182 (Part 10) : 1999	2000
2	Nitrogen Dioxide as NO2 [microgram/m3]	12.51	IS 5182 (Part 6) : 2006 Reaffirmed 2012	80.00
3	Suspended Particulate Matter (SPM) [microgram/m3]	283.94	IS 5182 (Part 4) : 1999 Reaffirmed 2014	-
4	Particulate Matter (PM2.5) [microgram/m3]	33.24	CPCB Guidelines	60.00
5	Sulphur Dioxide [microgram/m3]	8.66	IS 5182 (Part 2) : 2001 Reaffirmed 2012	80.00
6	Particulate Matter (PM 10) [microgram/m3]	61.68	IS 5182 (Part 23)-2006 Reaffirmed 2012	100.00

Notes :-

The results listed refer only to the tested sample (s) & parameters (s). Endorsement of products is neither inferred nor implied.

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The samples will be destroyed after 15 days from the date of issue of test report unless otherwise specified.

Senior Analyst

Authorized Signatory
(Report No: A/2923)

TEAM TEST HOUSE

(Unit of Team Institute of Science & Technology Pvt. Ltd.)

TC-5025

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TEST REPORT

Report No. :	A/2924
Job Identification. :	9682/17-18
Date :	06-03-2018
Issued To :	M/S Hindustan Zinc Limited (Sindesar Khurd Mines) P.O. : Dariba - 313211 Distt . Rajsamand (Rajasthan)
Type of Industry :	Mines
Type of Sample :	Ambient Air Quality Monitoring
Date of Sample Collection/Monitoring :	20-02-2018
Date of Sample Receipt :	23-02-2018
Date of Test :	23-02-2018 to 06-03-2018
Sample Collected By :	Satyendra Kumar sharma
Point of Collection :	Mine Area Boundary in NE Direction Sindesar Khurd Mine (Industrial Area)

RESULTS

S.No	Parameters	Observed Value	Testing Protocol	Limits as per National Ambient Air Quality standard, 2009
1	Carbon Monoxide [microgram/m3]	310	IS 5182 (Part 10) :1999	2000
2	Nitrogen Dioxide as NO2 [microgram/m3]	14.96	IS 5182 (Part 6) : 2006	80.00
3	Suspended Particullate Matter (SPM) [microgram/m3]	235.5	IS 5182 (Part 4) : 1999	-
4	Particulate Matter (PM2.5) [microgram/m3]	41.0	CPCB Guidlines	60.00
5	Sulphur Dioxide [microgram/m3]	4.73	IS 5182 (Part 2) : 2001	80.00
6	Particulate Matter (PM 10) [microgram/m3]	74.32	IS 5182 (Part 23)	100.00
7	Lead as Pb [microgram/m3]	0.26	IS 5182 (Part 22)	1.0

Notes :-

The results listed refer only to the tested sample (s) & parameters (s). Endorsement of products is neither inferred nor implied.

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The samples will be destroyed after 15 days from the date of issue of test report unless otherwise specified.

Senior Analyst

Authorized Signatory
(Report No: A/2924)

TEAM TEST HOUSE
(Unit of Team Institute of Science & Technology Pvt. Ltd.)

TC-5025

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TEST REPORT

Report No. :	A/2925
Job Identification. :	9683/17-18
Date :	06-03-2018
Issued To :	M/S Hindustan Zinc Limited (Sindesar Khurd Mines) P.O. : Dariba - 313211 Distt . Rajsamand (Rajasthan)
Type of Industry :	Mines
Type of Sample :	Ambient Air Quality Monitoring
Date of Sample Collection/Monitoring :	19-02-2018
Date of Sample Receipt :	23-02-2018
Date of Test :	23-02-2018 to 06-03-2018
Sample Collected By :	Satyendra Kumar Sharma
Point of Collection :	Near Encline (Acquired Area) Sindesar Khurd Mine (Industrial Area)

RESULTS

S.No	Parameters	Observed Value	Testing Protocol	Limits as per National Ambient Air Quality standard, 2009
1	Carbon Monoxide [microgram/m3]	350	IS 5182 (Part 10) :1999	2000
2	Nitrogen Dioxide as NO2 [microgram/m3]	16.58	IS 5182 (Part 6) : 2006	80.00
3	Suspended Particullate Matter (SPM) [microgram/m3]	319.2	IS 5182 (Part 4) : 1999	-
4	Particulate Matter (PM2.5) [microgram/m3]	32.46	CPCB Guidlines	60.00
5	Sulphur Dioxide [microgram/m3]	4.83	IS 5182 (Part 2) : 2001	80.00
6	Particulate Matter (PM 10) [microgram/m3]	71.45	IS 5182 (Part 23)	100.00
7	Lead as Pb [microgram/m3]	0.43	IS 5182 (Part 22)	1.0

Notes :-

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The samples will be destroyed after 15 days from the date of issue of test report unless otherwise specified

Senior Analyst

Authorized Signatory
(Report No: A/2925)