

SPEED POST

Ref : HZL/RA/ENV/MoEF/2019-20/ 215

November 28, 2019

To,

**The Director  
Govt. of India  
Ministry of Environment, Forest and Climate Change  
Regional Office, Kendriya Bhawan ,  
5<sup>th</sup> floor, Sector- H, Aliganj  
LUCKNOW (UP)**

**Sub: Six monthly environmental compliance reports from April-19 to September -19.**

**Ref : Env. clearance vide No. : J-11015/267/2008-IA.II (M) Dtd 11.12.2009.  
Amendment dated : 05.03.2012 , 22.08.2014, 12.12.2014 and 28.12. 2015.**

Dear Sir / Madam,

Please find enclosed herewith the compliance status report of above referred Environmental Clearance granted by the Ministry of Environment, Forest and Climate Change for the period of **April-19 to September -19** along with soft copy in a CD.

Hope you find this in order.

Thanking you,

Your faithfully

  
(Sujal Shah)  
Director, Agucha SBU  
Hindustan Zinc Limited  
Rampura Agucha Mine  
PO- Agucha  
Dist. - Bhilwara (Raj.)

Cc to:

1. In-Charge ( Zonal office)  
Central Pollution Control Board  
Zonal Office (Central)  
3rd Floor, Sahkar Bhawan,  
North T.T. Nagar,  
Bhopal – 462 003 (MP)

2. Member Secretary  
Rajasthan Pollution Control Board  
Area, Jhalana doogri  
Japur (Raj.)

- 3. The Regional officer  
Rajasthan Pollution Control Board  
18, Azad Nagar, Pannadhay Circle  
Mining Engineer Office Road  
(Near Telephone Exchange) Bhilwara

**Hindustan Zinc Limited**  
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**HINDUSTAN ZINC LIMITED  
RAMPURA AGUCHA MINE**

**MoEF Environmental Clearance for Expansion of Rampura Agucha Lead and Zinc  
Opencast and Underground Mining Project (from 5.00 to 6.15 mTPA) and Beneficiation  
Capacity of Beneficiation Plant (from 5.00 to 6.50mTPA)  
Env Clearance Vide No. J-11015/267/2008-IA.II (M) Dtd 11.12.2009**

<b>SNo</b>	<b>Condition</b>	<b>Status</b>
i	The project proponent shall obtain Consent to Establish and Consent to Operate from the Rajasthan State Pollution Control Board and effectively implement all the conditions stipulated therein	Consent to establish obtained from RSPCB. Consent to Operate granted by RSPCB vide File F(Mines)/Bhilwara(Hurda)/12(1)/2015-2016/1229-1233 dated 25/06/2019 for mining activity. RSPCB. Consent to Operate granted by RSPCB vide File F(CPM)/Bhilwara(Hurda)/2(1)/2019-2020/2498-2500 dated 22/10/2019 for Beneficiation plant , and the conditions stipulated are implemented.
ii	The environmental clearance is subject to approval of the State Land use Department, Government of Rajasthan for diversion of agricultural land for non-agricultural use.	Land purchased within Mine Lease area and converted in name of HZL for mining
iii	The project proponent shall ensure that no natural watercourse and/or water resources shall be obstructed due to any mining operations.	No natural watercourse or water resources are obstructed due to mining operations.
iv	The top soil shall temporarily be stored at earmarked site(s) only and it should not be kept unutilized for long. The topsoil shall be used for land reclamation and plantation.	Top soil utilized on waste dump for its stabilization and plantation.
v	The over burden generated during the mining operation shall be stacked at earmarked dump site(s) only and it should not be kept active for a long period of time and its phase-wise stabilization shall be carried out. The maximum height of the dump should not exceed 100m having 5 terraces as recommended by the Central Institute of Mining and Fuel Research, Dhanbad. The recommendations made by the Central Institute of Mining and Fuel Research, Dhanbad shall be effectively implemented. The over burden dump shall be scientifically vegetated with suitable	Amendment in this condition was granted in EC vide letter No J-11015/267/ 2008-I-A.II (M) dated 22 <sup>nd</sup> August, 2014. The maximum height of the dump shall not exceed 140 m (in two lifts of 20m each). Compliance report enclosed. As annexure VIII. Waste dump vegetated fase manner. Waste dump are covered by

	native species to prevent erosion and surface run off. Monitoring and management of rehabilitated areas shall continue until the vegetation becomes self-sustaining. Compliance status shall be submitted to the Ministry of Environment & Forests and its Regional Office located at Lucknow on six monthly basis	applicable of geotextiles.
vi	The void left unfilled in an area of 25 ha shall be converted into water body. The higher benches of excavated void/mining pit shall be terraced and plantation done to stabilize the slopes. The slope of higher benches shall be made gentler. Peripheral fencing shall be carried out along the excavated area.	Will be complied during the mine closure.
vii	Catch drains and siltation ponds of appropriate size should be constructed to arrest silt and sediment flows from mine working and over burden dump. The water so collected should be utilized for watering the mine area, roads, green belt development etc. The drains should be regularly desilted particularly after monsoon and maintained properly. Garland drain (size, gradient and length) shall be constructed for both mine pit and over burden dump and sump capacity should be designed keeping 50% safety margin over and above peak sudden rainfall (based on 50 years data) and maximum discharge in the area adjoining the mine site. Sump capacity should also provide adequate retention period to allow proper settling of silt material. Sedimentation pits should be constructed at the corners of the garland drains and desilted at regular intervals.	Garland drain of adequate size is constructed along the waste dump toe & mining pit, along with siltation pond that provides adequate retention time for settling of silts and rain water collection lined sump of about 15000 Cum volume. The water collected is utilized for watering the mine area, roads, green belt development etc Annexure –IX
viii	Dimension of the retaining wall at the toe of dump and OB benches within the mine to check run-off and siltation should be based on the rain fall data.	The retaining wall at the toe of the OB dump is constructed along with garland drain.
ix	Regular monitoring of subsidence movement on the surface over working area and impact on water bodies/vegetation/ structures/ surrounding shall be continued till movement ceases completely. In case of observation of any high rate of subsidence movement, appropriate measures shall be taken to avoid loss of life and material. Cracks shall be effectively plugged with ballast and clayey soil/suitable material.	A comprehensive assessment and monitoring of subsidence movement on the surface over working area is done by a dedicated team comprising of Rock mechanic engineers. There has been no subsidence or movement observed.
x	All the mine entries shall be above the highest	The underground mine

	flood level to avoid any anticipated flooding of mine from the surface water during the rainy season	opening is at 392 mRL against highest flood level at Agucha reservoir of 391 mRL. Further, A peripheral bund is constructed around the mine pit for protection of the mine from flooding due to rain water.
xi	In areas where subsidence is anticipated in shallow mineral occurrence, such areas be identified and provided with garland drains to ensure draining of water and avoid ingress of the same in to the underground mine.	No subsidence is anticipated in the proposed area. Garland drain is already constructed as a safety measure to avoid ingress of water into underground mining.
xii	The project authorities shall check the possibility of existence of fault(s) before deciding about the thickness of safe barrier required to be maintained between the working face and the water bodies, if any, in consultation with the Director General Mines & Safety (DGMS). De-pillaring should also be carried out after taking prior approval of the DGMS.	Mining activities are carried out as per Mine plan as approved by IBM. De-pillaring, if required shall be carried out after prior approval of the DGMS.
xiii	The project proponent shall carry out conditioning of the ore with water to mitigate fugitive dust emission, without affecting flow of ore in the ore processing and handling areas.	Water sprinklers are installed on conveyer belts, transfer points, and conditioning of ore is done during crushing to mitigate fugitive dust.
xiv	The effluent from the ore beneficiation plant shall be treated to conform to the prescribed standards and the tailings slurry shall be transported through a closed pipeline to the tailing dam.	Tailings are being disposed through closed pipe line to the earmarked Tailing dam after necessary treatment.
xv	The decanted water from the tailing dam shall be re-circulated and there should be zero discharge from the tailing dam. Acid mine water, if any, shall be neutralized and reused within the plant.	Tailing dam water is completely reused in process plant and zero discharge is maintained. There is no acid mine drainage occurring in the mine.
xvi	Plantation shall be raised in an area of 670.7ha including a green belt of adequate width by planting the native species around ML area, OB dump, around tailing dam, around beneficiation plant, roads etc. in consultation with the local DFO / Agriculture Department. In addition, the township area shall also be adequately planted. The density of the trees should be around 1500	Green belt developed all along the acquired mine lease area. Progressive plantation is being carried out on waste dump benches every year as per plan submitted. Till date 299.20ha. land is under plantation. Plantation in



	plants per ha. Green belt shall be developed all along the mine lease area in a phased manner and shall be completed within first five years.	remaining area will be completed by closure of mine. Additional plantation has been done in 37.70 ha in the township and along road sides. Annexure -X
xvii	Regular water sprinkling should be carried out in critical areas prone to air pollution and having high levels of SPM and RPM such as haul road, loading, unloading and transfer points and other vulnerable areas. It should be ensured that the Ambient Air Quality parameters conform to the norms prescribed by the Central Pollution Control Board in this regard.	Water sprinkling is carried out by 4 Nos. of 40 KL water sprinkler on Haul roads to mitigate air pollution in mine area. Dust extraction system and Water sprinkling nozzles are installed at the crusher, transfer points and coarse stock piles for dust suppression. The parameters of Ambient Air quality monitored are within the prescribed norm of CPCB. Annexure-XI
xviii	The project authority should implement suitable conservation measures to augment ground water resources in the area in consultation with the Regional Director, Central Ground Water Board.	Till date 3 Nos. of anicuts have been constructed for groundwater augmentation in consultation with the CGWB. Annexure -XII
xix	Regular monitoring of ground water level and quality shall be carried out in and around the project area (mine lease, beneficiation plant and tailing dam) by establishing a network of existing wells and installing new piezometers during the operation. The periodic monitoring [(at least four times in a year- pre-monsoon (April-May), monsoon (August), post-monsoon (November) and winter (January); once in each season)] shall be carried out in consultation with the State Ground Water Board/Central Ground Water Authority and the data thus collected may be sent regularly to the Ministry of Environment and Forests and its Regional Office Lucknow, the Central Ground Water Authority and the Regional Director, Central Ground Water Board. If at any stage, it is observed that the groundwater table is getting depleted due to the mining activity; necessary corrective measures shall be carried out.	Regular groundwater monitoring is being done by piezometers and wells outside and inside the lease area. Report enclosed as Annexure - I  Six monthly reports are submitted to MoEF & CPCB. Quarterly report being sent to RSPCB, CGWA and CGWB.
xx	The project proponent shall ensure that no	No additional water is drawn.

	additional water is drawn for the expansion project. The additional requirement of water will be met out of the water saved by adopting water conservation measures.	The additional requirement of water if any in future will be met out by water conservation measures.
xxi	Suitable rainwater harvesting measures on long term basis shall be planned and implemented in consultation with the Regional Director, Central Ground Water Board.	Various rainwater harvesting measures are implemented including the construction of rainwater collection pond of about 1.3 Lakh cum in the township, 65,000 and 15,000 cum storm water ponds in the mine lease area. Annexure XIII
xxii	Regular monitoring of groundwater quality around the tailing dam shall be carried out in consultation with Central Ground Water Authority and records maintained. It shall be ensured that the groundwater quality is not adversely affected due to the project	Groundwater quality is regularly monitored around the tailing dam through piezometers within ML area and wells inside as well as outside the lease area. The groundwater quality report is being submitted to MoEF, CPCB RSPCB, CGWA and CGWB on regular basis.
xxiii	Groundwater and surface water in and around the mine shall be regularly monitored at strategic locations for heavy metals such as Ni, Co, Cu, Zn and Cd. The monitoring stations shall be established in consultation with the Regional Director, Central Ground Water Board and State Pollution Control Board	Ground and surface water is regularly monitored for heavy metals. Report enclosed as in point no xix.
xxiv	Vehicular emissions should be kept under control and regularly monitored. Measures shall be taken for maintenance of vehicles used in mining operations and in transportation of mineral. The vehicles should be covered with a tarpaulin and shall not be overloaded	Periodic preventive maintenance of vehicles is part of our operations. All the trucks are covered with tarpaulin while transportation of concentrates to the smelters and no overloading is allowed. Annexure XIV
xxv	Blasting operation should be carried out only during the daytime. Controlled blasting should be practiced. The mitigative measures for control of ground vibrations and to arrest fly rocks and boulders should be implemented	Blasting operation is carried out with various mitigation measures as per DGMS guidelines to ensure the fly rocks are arrested. The vibrations monitored are well within the prescribed limits by DGMS.
xxvi	Drills shall either be operated with dust extractors	Wet drilling system is

	or equipped with water injection system	adopted.
xxvii	Digital processing of the entire lease area using remote sensing technique should be done regularly once in three years for monitoring land use pattern and report submitted to Ministry of Environment and Forests and its Regional Office, Lucknow	Noted. The land use & land cover change study carried out in 2018. Copy already submitted on 28/05/2018. Annexure-XV
xxviii	The tailing dam shall be lined by LDPE lining on the sides as the height of the dam is raised. The ultimate height of the dam shall be maintained to 51m and provided with garland drains. The disaster management plan for tailing dam shall be prepared and implemented	The sides of the tailing dam are lined with HDPE. The present height of tailing dam is 51 meter. Garland drains are constructed around the tailing pond with pumping arrangement to collect any seepage and rainwater runoff back to tailing pond. Disaster management plan for the tailing pond is prepared and implemented. Annexure XVI
xxix	The recommendations of the study report of NEERI, Nagpur on pollution vulnerability of aquifer shall be effectively implemented and action taken report submitted to the Ministry and its Regional Office, Lucknow on six monthly basis	Complied on the recommendations of NEERI i.e. network of piezometer established and report submitted on six monthly basis. Report enclosed as point no xix.
xxx	The project proponent shall regularly analyse the waste generated from the mining (at least once a year) for heavy metals such as Ni, Co, Cu, Pb, Zn and Cd and the data thus collected may be sent regularly to Ministry of Environment and Forests and its Regional Office, Lucknow. It should be ensured that the parameters conform to the prescribed norms	Being analysed and report is submitted on six monthly basis. Annexure II
xxxi	The recommendations of the study report on blood lead levels of children to monitor levels of lead in human system carried out by National Institute of Occupational Health, Ahemdabad shall be effectively implement and action taken report submitted to the Ministry and its Regional Office, Lucknow on six monthly basis.	As recommended by the NIOH, regular health checkups are carried out for the mine personnel and regular health checkup organized in nearby villages to keep a track of the health status. Annexure XXI
xxxii	Pre-placement medical examination and periodical medical examination of the workers engaged in the project shall be carried out and records maintained. For the purpose, schedule of health examination of the workers should be drawn and	Pre-placement medical examination and periodical medical examination of the employees are being carried out at regular interval as per

	followed accordingly	the Mine Act.
xxxiii	Sewage treatment plant shall be installed for the colony. ETP shall also be provided for the workshop and the wastewater generated during mining operation	Sewage treatment plant of 425 KLD capacity in colony and 300 KLD in mine area operating efficiently. Oil & Grease Traps installed and water reused in process. Annexure XVII
xxxiv	Provision shall be made for the housing of construction labour within the site with all necessary infrastructure and facilities such as fuel for cooking, mobile toilets, mobile STP, safe drinking water, medical health care, crèche etc. The housing may be in the form of temporary structures to be removed after the completion of the project	No construction labour housing is proposed in mining area. However, the sanitation and drinking water facility is provided to the workers, working at site.
xxxv	Acid mine water, if any, has to be treated and disposed of after conforming to the standard prescribed by the competent authority	No acid mine water generated & mine pit water is used in process plant.
xxxvi	The critical parameters such as RSPM (Particulate matter with size less than 10µm i.e., PM <sub>10</sub> and with size less than 2.5µm i.e., PM <sub>2.5</sub> ), NOX 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-20012/1/2006-IA.II(M) dated 27.05.2009 issued by Ministry of Environment and Forests, which is available on the website of the Ministry <a href="http://www.envfor.nic.in">www.envfor.nic.in</a> shall also be referred in this regard for its compliance	Monitoring of Ambient air at 3 locations inside mine and 3 locations outside the mine area is regularly carried out. Monitoring report is enclosed as Annexure III. Peak Particle velocity of blast vibration is being monitored for every blast & records are maintained. No effluent, treated or untreated, is discharged outside the project area as Zero discharge is maintained at all times. Monitoring data are displayed at Main Gate. Annexure XVIII.
xxxvii	A Final Mine Closure Plan along with details of Corpus Fund should be submitted to the Ministry of Environment & Forests 5 years in advance of final mine closure for approval	A Final Mine Closure Plan along with details of Corpus Fund will be submitted to the Ministry of Environment & Forests 5 years in advance of final mine closure for approval.

<b>General Conditions</b>		
i	No change in mining technology and scope of working should be made without prior approval of the Ministry of Environment & Forests	Noted
ii	No change in the calendar plan including excavation, quantum of mineral lead and zinc ore and waste should be made	Noted
iii	Conservation measures for protection of flora and fauna in the core & buffer zone should be drawn up in consultation with the local forest and wildlife department	Noted, Plantation of natural species in consultation with local forest department is being implemented. No schedule –I animals present in core and buffer zone.
iv	Atleast four ambient air quality-monitoring stations should be established in the core zone as well as in the buffer zone for RSPM (Particulate matter with size less than 10µm i.e., PM <sub>10</sub> and with size less than 2.5µm i.e., PM <sub>2.5</sub> ) SO <sub>2</sub> & NO <sub>x</sub> 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	Six Ambient air monitoring locations, three in core zone and buffer zone each are selected in consultation with the SPCB, considering the meteorological data and the human settlements as sensitive targets. There are no ecologically sensitive targets. AAQ monitoring is carried out every fortnightly.
v	Data on ambient air quality [(RSPM (Particulate matter with size less than 10µm i.e., PM <sub>10</sub> and with size less than 2.5µm i.e., PM <sub>2.5</sub> ) SO <sub>2</sub> & NO <sub>x</sub> ] 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	The AAQ monitoring data is submitted every six monthly to MoEF Lucknow , CPCB Bhopal and SPCB Jaipur.
vi	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	Same as in point xvii above.
vii	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	Various measures including installation of silencers, mufflers, vibration pads, noise insulation, acoustic enclosures and suitable PPE's are provided at design and operating stage for reducing the noise levels at work place below 85dB(A). Annexure IV
viii	Industrial waste water (workshop and waste water	Oil & Grease trap exists at

	from the mine) should be properly collected, treated so as to conform to the standards prescribed under GSR 422 (E) dated 19 <sup>th</sup> May, 1993 and 31 <sup>st</sup> December, 1993 or as amended from time to time. Oil and grease trap should be installed before discharge of workshop effluents	workshop drain and overflow water is being used in process plant. Water Analysis is enclosed. Annexure V Oil trap photo attached as Annexure –XIX.
ix	Personnel working in dusty areas should wear protective respiratory devices and they should also be provided with adequate training and information on safety and health aspects. Occupational health surveillance program of the workers should be undertaken periodically to observe any contractions due to exposure to dust and take corrective measures, if needed	All the personal protective equipments are provided to all the workmen, Vocational Training is mandatory for all the workmen as per the Mines Rules. Periodical medical examination being done regularly as per Mine Act.
x	A separate environmental management cell with suitable qualified personnel should be set-up under the control of a Senior Executive, who will report directly to the Head of the Organization	Environment Management Cell has been set up having adequate qualified Executives and a Senior executive who reports to Location Head directly.
xi	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	Noted, Environmental funds are earmarked for environment work only. Environmental expenditure is reported on six monthly basis enclosed as Annexure VI
xii	The project authorities should inform to the Regional Office located at Lucknow regarding date of financial closures and final approval of the project by the concerned authorities and the date of start of land development work	Noted
xiii	The Regional Office of this Ministry located at Lucknow shall monitor compliance of the stipulated conditions. The project authorities should extend full cooperation to the officer (s) of the Regional Office by furnishing the requisite data / information / monitoring reports	Noted
xiv	The project proponent shall submit six monthly reports on the status of compliance of the stipulated EC conditions including results of monitored data (both in hard copies as well as by e-mail) to the Ministry of Environment and Forests, its Regional Office Lucknow, the respective Zonal Office of CPCB and the SPCB. The	Being submitted regularly to MoEF Lucknow, CPCB Bhopal and SPCB Jaipur. Last report submitted on May 2019 The status of compliance of the EC conditions are uploaded on company's website and same



	proponent shall upload the status of compliance of the EC 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 the Ministry of Environment and Forests, Lucknow, the respective Zonal Officer of CPCB and the SPCB	is regularly updated.
xv	A copy of the clearance letter shall be sent by the proponent to concerned Panchayat, Zila Parisad/ Municipal Corporation, Urban Local Body and the Local NGO, if any, from whom suggestions/representations, if any, were received while processing the proposal. The clearance letter shall also be put on the website of the Company by the proponent	EC letter sent to all the authorities on 01/01/2010
xvi	The State Pollution Control Board should display a copy of the clearance letter at the Regional office, District Industry Centre and the Collector's office/ Tehsildar's Office for 30 days	Shall provide necessary support, if any.
xvii	The environmental statement for each financial year ending 31 <sup>st</sup> March in Form-V as is mandated to be submitted by the project proponent to the concerned State Pollution 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 Regional Office of the Ministry of Environment and Forests, at Lucknow by e-mail	Noted, Last Environment Statement submitted on 14 <sup>th</sup> September 2019. The EC, Compliance status and statement are uploaded on company's website. Annexure XX
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 issue of the clearance letter informing that the project has been accorded environmental clearance and a copy of the clearance letter is available with the State Pollution Control Board and also at web site of the Ministry of Environment and Forests at <a href="http://envfor.nic.in">http://envfor.nic.in</a> and a copy of the same should be forwarded to the Regional Office of this Ministry located at Lucknow	Complied and the Copy of the advertisement was sent to MoEF, Lucknow vide letter No HZL/RAM/Env/Exp/2009 Advertised in two News paper on 03.01.2010
3	The Ministry or any other competent authority may alter/modify the above conditions or stipulate any further condition in the interest of	Noted.

	environment protection	
4	Failure to comply with any of the conditions mentioned above may result in withdrawal of this clearance and attract action under the provisions of the Environment (Protection) Act, 1986	Noted
5	The above conditions will be enforced inter-alia, under the provisions of the Water (Prevention & Control of Pollution) Act, 1974, the Air (Prevention & Control of Pollution) Act, 1981, the Environment (Protection) Act, 1986 and the Public Liability Insurance Act, 1991 along with their amendments and rules made thereunder and also any other orders passed by the Honorable Supreme Court of India/ High Court of Rajasthan and any other Court of Law relating to the subject matter	Noted
6	Any appeal against this environmental clearance shall lie with the National Environment Appellate Authority, if preferred within a period of 30 days as prescribed under Section 11 of the National Environment Appellate Authority Act, 1997	Noted

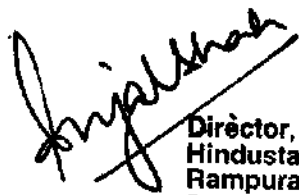
*Anjali*

Director, Agucha SBU  
Hindustan Zinc Limited  
Rampura Agucha Mine  
PO- Agucha  
Distt. - Bhilwara (Raj.)

**HINDUSTAN ZINC LIMITED  
RAMPURA AGUCHA MINE**

MoEF Environmental Clearance Compliance to amendment in EC vide letter No J-11015/267/2008-I-A.II (M) dated 5 March, 2012

Sr. No	Condition	Status
i	In the environment clearance letter dated 11 <sup>th</sup> December, 2009, in para number 1, the words "The mineral will be transported through the road." will be substituted by the words "The mineral will be transported through the rail".	Amendments granted by MoEF vide letter dated 28.12.2015 "The mineral will be transported both through road and rail". Railway line commissioned but not operative.
ii (a)	All the requisite prior clearance from the concerned authorities, as may be applicable to such project shall be obtained and the conditions, if any, stipulated there under shall be effectively implemented.	All the requisite prior clearance from the concerned authorities, as may be applicable to such project shall be obtained and the conditions, if any, stipulated there under shall be effectively implemented.
ii (b)	The project affected people whose land will be acquired for laying of the railway track shall be compensated as per the National / State Policy in this regard.	Compensation given to land owners done by RIICO, GOR as per the norms.
ii (c)	The company shall submit within 3 months their policy towards Corporate Environment Responsibility which should inter alia provide for (i) Standard operating process / process to bring into focus any infringement / deviation / violation of the environmental or forest norms / conditions, (ii) Hierarchical system or administrative order of the company to deal with the environmental issues and for ensuring compliance with the EC conditions and (iii) System of reporting of non compliance s / violations of environmental norms to the Board of Directors of the company and / or shareholders or stakeholders.	Policy towards Corporate Environment Responsibility enclosed.



**Director, Agucha SBU  
Hindustan Zinc Limited  
Rampura Agucha Mine  
PO- Agucha  
Distt. - Bhilwara (Raj.)**

## **Mechanism for addressing Environmental Issues**

HZL has a Health Safety and Environment Policy, given below, signed by its CEO and forms the guidelines for the entire organization. A well laid mechanism is implemented uniformly across all units of HZL for the implementation of the policy.

All operating units of Hindustan Zinc Limited are certified for ISO-14001 Environmental Management system (EMS). The Management Representative (MR) of the certification system is an experienced environmental officer with due authority to implement and drive a responsible EMS. The MR is duly supported by a committee constituting the operations and maintenance officers of the unit. The system has a well laid documented procedure for identification of all environmental aspect, Impacts and implementation of suitable mitigation measures.

The company has three level monitoring mechanism for addressing environmental concerns starting at unit level, HZL corporate level and Vedanta group company level. Depending on the scale and nature of the issue, the concern is escalated to different level right up to the Board of the company and also the shareholders of the company in the general body meetings.

The compliances to Environment Clearance and all environmental licenses are reviewed and monitored regularly and reports are submitted to the respective regulatory authorities at every unit, by a dedicated environmental professional, who reports directly to the unit head. The compliance is periodically reviewed and audited by Corporate Environment Department, which reports to the top management of the company. A Corporate Sustainability Committee, chaired by the CEO of the company, oversees all sustainability issues including Environment, Safety and Health and also reviewing any policy matters.

Any non-compliances/show cause/notices/complaints received from regulatory authority or any stakeholder is addressed jointly by the unit and corporate environment department. Such issues are also reported and the actions taken are reviewed by the top management every month. Further, all show cause, complaint letters and notices from any stakeholder, along with the action taken report is submitted to the Board Of Directors of the company every quarterly. All major concerns are reported to the stakeholders through the annual general body meetings of the company.

## Health, Safety & Environment (HSE) Policy

Hindustan Zinc is committed to conduct all business activities in a responsible manner, which ensures the health and safety of our stakeholders and the environment. In order to achieve that, we shall:

- Ensure Zero Harm to personnel and environment.
- Demonstrate visible HSE leadership that HSE is our core value.
- Comply with all HSE rules, regulations, obligations and requirements and will strive to go beyond compliance to the relevant requirements and shall continually improve our HSE management systems.
- Incorporate appropriate HSE Criteria<sup>i</sup> for all business decisions for selection of plant, technology, contractors and personnel.
- Identify and evaluate HSE risks for all activities<sup>ii</sup> and take actions to eliminate /mitigate risks and hazards.
- Encourage, train, equip and empower personnel, including contractors & contract employees, to adopt a healthy and safe working approach both on and off the job. The HSE performance of individual personnel shall decide his career advancement.
- Conserve natural resources and eliminate waste through reduction, recycling and reuse methods, which are environment-friendly and energy-efficient.



## Health, Safety & Environment (HSE) Guiding Principles:

- Management shall demonstrate its strong commitment towards HSE at all times.
- All injuries, occupational illnesses and adverse environmental incidents are preventable.
- Reporting and investigation of all incidents is an obligation.
- We are responsible and accountable for preventing injuries, occupational illnesses and adverse environmental incidents.
- We are empowered and obligated to stop any job being carried out in an unsafe manner.
- HSE values shall never be compromised.
- Adherence to HSE management system is a condition of employment.

We personally commit to applying the policy & principles for building positive HSE culture at Hindustan Zinc and report wherever applicable.

i - these criteria are applicable to the product distribution and logistics/entire product life cycle from extraction to product distribution and logistics

ii - the policy is not only applicable to our existing operational sites/new projects but also all the due-diligence, mergers and acquisitions and non-managed operations / licensees / third-party manufacturers / joint ventures / outsourcing partners



Date: 1<sup>st</sup> July, 2019

  
**Sunil Duggal**  
Chief Executive Officer & Whole-Time Director

**HINDUSTAN ZINC LIMITED**  
**RAMPURA AGUCHA MINE**  
**WELL WATER ANALYSIS REPORT-April-19 to Sep-19**

S. No	1		2		3		4		5		6	
	GWD		HP-1		WW-16		WW-23		PRK1		KOT-1	
Code	May-19	Aug-19	May-19	Aug-19	May-19	Aug-19	May-19	Aug-19	May-19	Aug-19	May-19	Aug-19
Month	7.90	7.20	7.60	7.40	7.80	7.40	7.50	7.60	7.90	7.20	7.90	7.40
pH	360	384	302	276	406	349	369	378	464	340	368	390
Alkalinity	154	164	134	154	260	241	82	77	242	202	220	200
Chlorides	171	160	126	140	175	169	79	64	189	164	210	207
Sulphate	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
CN	0.010	0.009	0.010	0.009	0.008	0.008	0.008	0.007	0.009	0.007	0.010	0.007
Pb	0.090	0.080	0.090	0.100	0.090	0.080	0.110	0.090	0.090	0.080	0.110	0.100
Zn	0.120	0.070	0.110	0.080	0.110	0.100	0.100	0.080	0.100	0.060	0.100	0.080
Fe	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Cd	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Cu	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Co	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Ni	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL

All figures are in mg/l except pH

*Qubid*



HINDUSTAN ZINC LIMITED  
RAMPURA AGUCHA MINE  
PIEZOMETER WATER ANALYSIS REPORT October -18 to March-19

S. No.	I		2		3		4		5	
	E1		G1		H1		K		A	
Code	May-19	Aug-19	May-19	Aug-19	May-19	Aug-19	May-19	Aug-19	May-19	Aug-19
Months	7.90	7.40	7.90	7.20	7.30	7.90	7.40	7.30	7.60	7.40
pH	392	290	431	439	602	591	419	427	249	231
Chlorides	263	207	198	178	121	142	164	172	220	214
Sulphate	479	377	544	593	516	476	189	197	298	279
CN	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Pb	0.010	0.010	0.010	0.010	0.008	0.007	0.008	0.007	0.009	0.008
Zn	0.110	0.090	0.110	0.080	0.110	0.080	0.110	0.080	0.100	0.100
Fe	0.090	0.070	0.110	0.070	0.110	0.070	0.120	0.090	0.100	0.090
Cd	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Cu	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Co	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Ni	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
As	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Hg	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Ca	110	109	120	101	122	102	36	40	101	87
Mg	60	49	54	43	56	44	49	36	71	60

All figures are in mg/l except pH

*Wakil*

HINDUSTAN ZINC LTD  
RAMPURA AGUCHA MINE

Annexure I ( 3/3)

WELL WATER LEVEL MONITORING

(Below the ground level in meters)

Months	W-10	W-22	W-13	W-14	W-15	W-16	W-23	GWD	PRK-1	KOT-1
Apr-19	8.70	8.30	7.30	11.20	9.60	10.60	8.30	12.80	8.00	8.20
May-19	9.40	9.40	8.40	13.40	10.40	12.30	9.40	14.20	9.90	11.30
June-19	10.30	9.00	7.60	11.90	9.40	11.30	9.10	12.40	8.60	9.70
Jul-19	6.40	4.20	7.30	6.40	6.30	8.20	7.40	7.20	6.90	7.00
Aug-19	3.90	3.40	5.40	3.20	4.70	5.20	5.30	4.00	4.20	5.20
Sep-19	2.10	1.90	3.20	1.70	3.20	2.40	3.80	2.30	3.10	3.20

*Indira*

Annexure - II

Analysis of Waste Dump Rocks

Location : Waste Dump

Element	Range
Pb	0.0002% - 0.0005%
Zn	0.0710% - 0.0820%
Cu	0.0005% - 0.0030%
Cd	0.0001% - 0.0005%
Ni	0.0020% - 0.0045%
Co	0.0010% - 0.0030%

Walid

HINDUSTAN ZINC LIMITED  
RAMPURA AGUCHA MINE

Annexure- III

AIR MONITORING : AMBIENT AIR & STACK : April-19 to Sep-19

Locations->	Mine Site										Main Gate										Mine Tower									
	month/ year	SPM (ug/m3)	PM <sub>10</sub> (ug/m3)	PM <sub>2.5</sub> (ug/m3)	SO <sub>2</sub> (ug/m3)	NO <sub>x</sub> (ug/m3)	CO (ug/m3)	SPM (ug/m3)	PM <sub>10</sub> (ug/m3)	PM <sub>2.5</sub> (ug/m3)	SO <sub>2</sub> (ug/m3)	NO <sub>x</sub> (ug/m3)	CO (ug/m3)	SPM (ug/m3)	PM <sub>10</sub> (ug/m3)	PM <sub>2.5</sub> (ug/m3)	SO <sub>2</sub> (ug/m3)	NO <sub>x</sub> (ug/m3)	CO (ug/m3)	SPM (ug/m3)	PM <sub>10</sub> (ug/m3)	PM <sub>2.5</sub> (ug/m3)	SO <sub>2</sub> (ug/m3)	NO <sub>x</sub> (ug/m3)	CO (ug/m3)					
Apr-19	1st week	231.30	79.99	36.82	7.40	9.85	310.00	231.37	84.17	33.07	5.60	8.40	374.00	239.92	79.66	33.31	6.60	8.40	375.00											
	1st	265.24	78.37	35.90	7.18	14.85	320.00	222.94	70.12	35.44	2.95	14.78	340.00	286.15	87.16	34.28	5.81	13.35	380.00											
May-19	1st	241.45	86.94	37.33	8.80	7.80	366.00	233.14	83.87	37.31	6.80	10.10	342.00	226.20	83.67	37.26	7.00	9.50	410.00											
	1st	258.45	82.58	24.52	6.37	10.17	310.00	254.81	90.75	30.50	6.12	12.82	290.00	291.67	87.00	32.02	4.26	17.44	320.00											
Jun-19	1st	249.60	88.41	33.09	8.20	10.20	340.00	243.94	77.75	32.73	7.00	12.00	360.00	226.20	83.67	29.02	7.00	9.50	410.00											
	1st	278.26	81.20	47.79	7.52	15.38	310.00	227.10	84.91	37.46	6.86	15.56	320.00	267.95	83.06	42.16	6.25	18.04	310.00											
Jul-19	1st	203.33	68.98	33.18	6.60	7.30	290.00	196.11	67.51	24.88	6.40	12.40	290.00	197.75	68.16	29.03	5.50	7.30	310.00											
	1st	106.59	70.67	34.74	3.00	8.50	280.00	90.26	53.55	18.97	3.38	10.96	310.00	112.44	63.99	29.97	3.50	9.16	270.00											
Aug-19	1st	131.10	64.38	21.66	5.46	10.93	240.00	126.80	70.01	24.17	5.16	12.82	260.00	173.86	60.35	22.36	7.32	10.08	210.00											
	1st	198.65	68.18	28.77	6.20	8.20	290.00	183.99	67.15	24.87	5.50	8.40	310.00	199.03	65.06	24.98	4.50	9.50	270.00											
Sep-19	1st	191.01	67.06	33.17	5.40	10.20	290.00	197.61	68.16	24.77	5.50	10.40	240.00	212.74	82.87	29.02	4.20	8.40	360.00											
	1st	155.09	58.82	23.93	6.60	16.08	260.00	150.60	65.67	21.43	4.36	12.65	240.00	111.91	54.90	20.44	6.60	12.80	320.00											

Locations->	Agucha village										Kothiyaa village										Bherakhera village									
	month/ year	SPM (ug/m3)	PM <sub>10</sub> (ug/m3)	PM <sub>2.5</sub> (ug/m3)	SO <sub>2</sub> (ug/m3)	NO <sub>x</sub> (ug/m3)	CO (ug/m3)	SPM (ug/m3)	PM <sub>10</sub> (ug/m3)	PM <sub>2.5</sub> (ug/m3)	SO <sub>2</sub> (ug/m3)	NO <sub>x</sub> (ug/m3)	CO (ug/m3)	SPM (ug/m3)	PM <sub>10</sub> (ug/m3)	PM <sub>2.5</sub> (ug/m3)	SO <sub>2</sub> (ug/m3)	NO <sub>x</sub> (ug/m3)	CO (ug/m3)	SPM (ug/m3)	PM <sub>10</sub> (ug/m3)	PM <sub>2.5</sub> (ug/m3)	SO <sub>2</sub> (ug/m3)	NO <sub>x</sub> (ug/m3)	CO (ug/m3)					
Apr-19	1st	197.98	76.19	28.99	6.60	7.60	280.00	191.21	67.08	24.75	6.40	8.50	240.00	183.93	59.60	29.03	6.50	7.10	290.00											
	1st	204.45	69.67	31.39	5.25	9.87	210.00	177.00	64.58	23.60	5.22	12.83	210.00	165.00	61.40	34.10	5.40	10.78	210.00											
May-19	1st	204.96	76.59	24.91	5.50	7.80	230.00	199.52	66.24	28.89	7.60	6.40	240.00	181.55	62.43	24.58	6.40	7.00	250.00											
	1st	188.17	67.97	24.76	6.11	11.15	150.00	179.61	64.96	26.08	7.86	11.08	170.00	196.87	73.77	24.01	5.21	14.59	160.00											
Jun-19	1st	193.58	66.64	24.17	4.00	8.00	235.00	207.41	67.59	33.01	6.00	8.50	265.00	190.04	66.24	24.76	4.60	9.00	290.00											
	1st	190.72	71.93	31.71	4.26	13.81	210.00	201.91	67.66	24.37	14.10	12.38	190.00	197.16	66.50	24.31	5.92	12.38	200.00											
Jul-19	1st	174.33	57.08	20.71	4.60	6.30	250.00	186.30	60.23	28.78	5.30	7.40	265.00	189.66	60.14	20.74	4.60	9.30	27.00											
	1st	155.45	44.18	23.03	5.40	20.32	330.00	204.77	57.67	29.64	7.96	17.93	320.00	195.56	64.92	28.37	8.23	15.01	300.00											
Aug-19	1st	131.20	56.32	24.55	5.13	10.43	150.00	125.52	43.74	16.36	5.12	10.25	190.00	135.88	45.10	20.46	5.11	8.03	130.00											
	1st	174.28	60.23	28.11	4.80	7.40	230.00	168.27	57.76	21.87	6.00	8.50	190.00	164.00	53.49	20.11	4.40	7.40	190.00											
Sep-19	1st	172.61	56.16	20.71	4.20	7.80	240.00	166.01	49.34	20.45	5.20	6.40	215.00	176.68	52.88	24.87	6.40	8.20	264.00											
	1st	113.96	43.72	23.77	5.27	9.67	170.00	99.45	41.21	21.81	4.19	8.28	150.00	116.54	42.15	15.46	5.03	9.72	130.00											

*Wdwin*

STACK MONITORING SPM

Month-Yr	Pr Crusher (SPM)	S. Crusher (SPM)	New Pr Crusher (SPM)	
Apr-19	1st	27.94	37.50	37.50
	1st	36.10	41.24	41.84
May-19	1st	38.24	39.05	27.62
	1st	40.43	28.36	55.71
Jun-19	1st	29.76	38.00	42.86
	1st	38.79	25.89	27.32
Jul-19	1st	31.43	36.84	26.79
	1st	27.30	36.01	33.33
Aug-19	1st	26.29	24.05	25.89
	1st	20.63	25.83	34.29
Sep-19	1st	38.66	31.67	22.86
	1st	38.79	35.27	24.48

**Annexure-IV**

S. No.	Area of Monitoring	NOISE LEVEL AT WORK ENVIRONMENT IN dB(A)							Equipment Condition
		Apr-19	May-19	Jun-19	Jul-19	Aug-19	Sep-19		
1.	<b>BENEFICIATION PLANT</b>								
	a. Mill Ambient	77.4/71.3	75.1/69.2	72.1/69.3	74.2/69.0	74.8/69.1	76.1/70.3	Plant is in running condition.	
	b. Mill- Grinding Area	84.4	83.9	82.1	82.0	82.3	80.3	--do--	
	c. Operators cabin mill area	78.9	79.4	78.2	78.5	79.7	78.2	--do--	
	d. Flotation cell area	82.2	82.5	82.1	82.5	81.1	82.5	--do--	
	e. AFM's cabin cell area	75.5	75.2	75.1	74.6	74.8	75.2	--do--	
	f. Shift engineer's room	77.3	77.5	77.1	74.8	76.7	77.1	--do--	
	g. Control room	72.2	72.5	74.5	72.5	71.4	72.6	--do--	
	h. Work Shop	76.4	74.2	75.3	75.0	74.5	75.2	--do--	
2	<b>PRIMARY CRUSHER</b>								
	a. Primary Crusher I Control Room	66.7/63.9	67.5/63.1	65.5/62.8	66.0/62.5	66.5/63.1	66.5/63.8	Crusher in running condition	
	b. Primary Crusher II Control Room	66.1/63.1	67.6/63.9	66.6/63.5	66.0/63.0	66.2/63.1	66.6/63.5	Crusher in running condition	
3	<b>SEC./TERT. CRUSHER</b>								
	a. Shift Room Sec. Crusher	76.2/75.3	75.4/73.2	77.2/73.1	74.0/73.1	74.2/73.6	76.2/75.1	Crusher in running condition	
	b. Secondary crusher control room	73.40	73.10	74.80	73.70	73.60	73.80	--do--	
	<b>Ambient Mine Pit</b>	77.4/71.3	75.1/69.2	72.1/69.3	74.2/69.0	74.8/69.1	76.1/70.3		

*Redin*

Annexure - V

Env. SUMP WATER ANALYSIS (April-19 to Sep-19)

	Apr-19	May-19	Jun-19	Jul-19	Aug-19	Sep-19
pH	7.6	7.4	7.6	7.3	7.5	7.8
Oil & Grease	4.3	3.9	4.1	3.2	3.3	3.9
Alkalinity	229	264	201	299	274	301
Chlorides	542	589	629	732	621	633
Hardness	643	676	701	892	719	732
TDS	893	967	1091	1211	901	905
Pb	0.01	0.01	0.02	0.01	0.02	0.01
Zn	1.9	2.1	3.2	2.3	2.8	2.4
Fe	0.12	0.14	0.17	0.13	0.16	0.11
Cd	0.01	0.01	0.01	0.01	0.01	0.01

All value are in mg/l except pH

**Remarks :** Collected Water is pumped to reclaim reservoir and recycled back to plant for reuse. Zero discharge is maintained.

*Wadhwa*



Annexure -VI

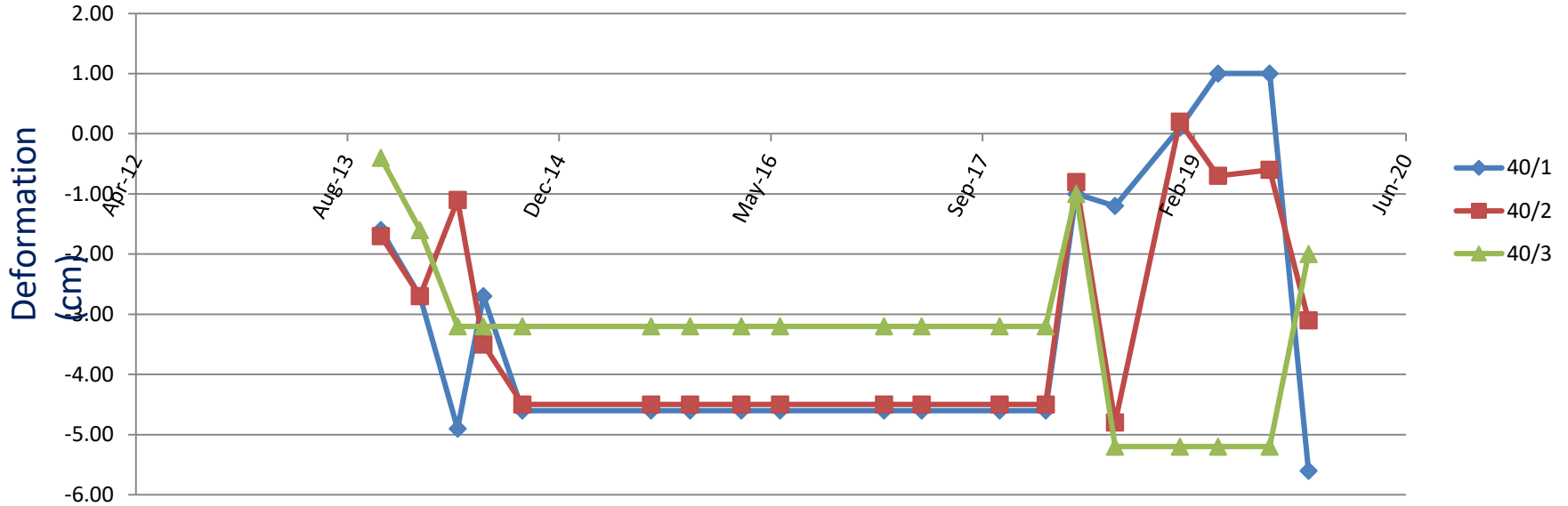
ENVIRONMENTAL EXPENDITURE DETAILS

Partiulars	2019-20					
	April-19 to Sep-19					
Expenditure	Apr-19	May-19	Jun-19	Jul-19	Aug-19	Sep-19
	5.08	10.78	8.57	6.74	28.52	4.91
<b>TOTAL Rs (Lacs)</b>						64.60

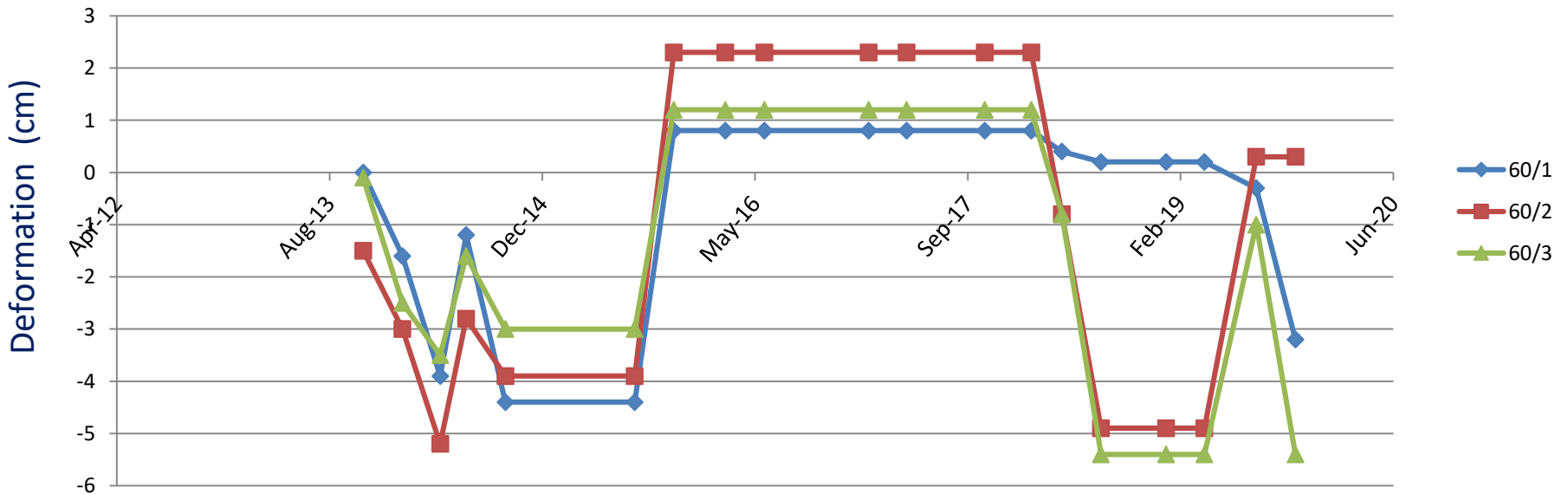
*Wadhvani*

Dump Slope monitoring Data:  
Radar & Prism data  
for MOEF\_Nov 2019

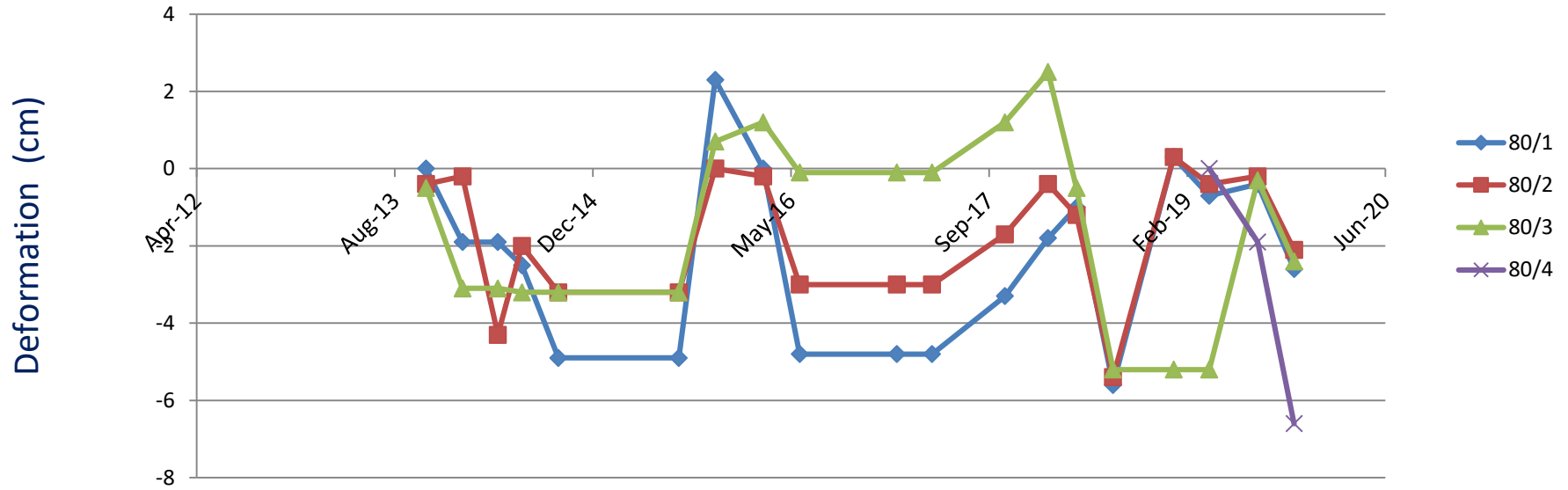
**MOVEMENT : MONITORING TREND OF WASTE DUMP AT 40m LIFT BY PRISMS**



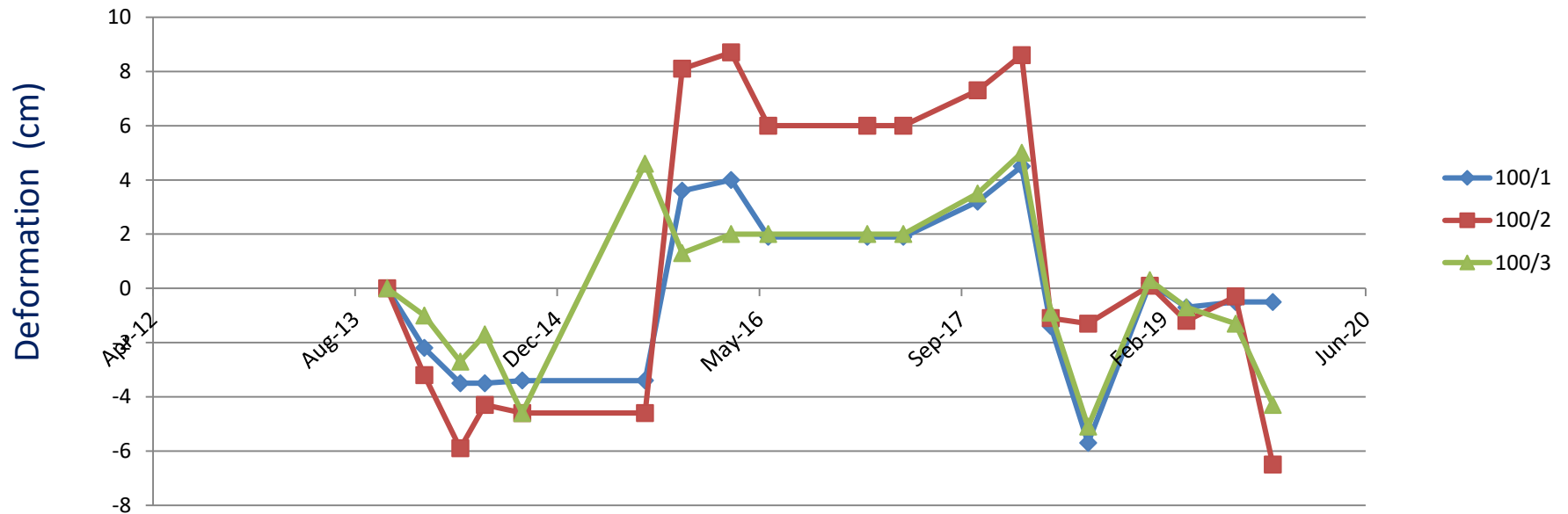
**MOVEMENT: MONITORING TREND OF WASTE DUMP AT 60m LIFT BY PRISMS**



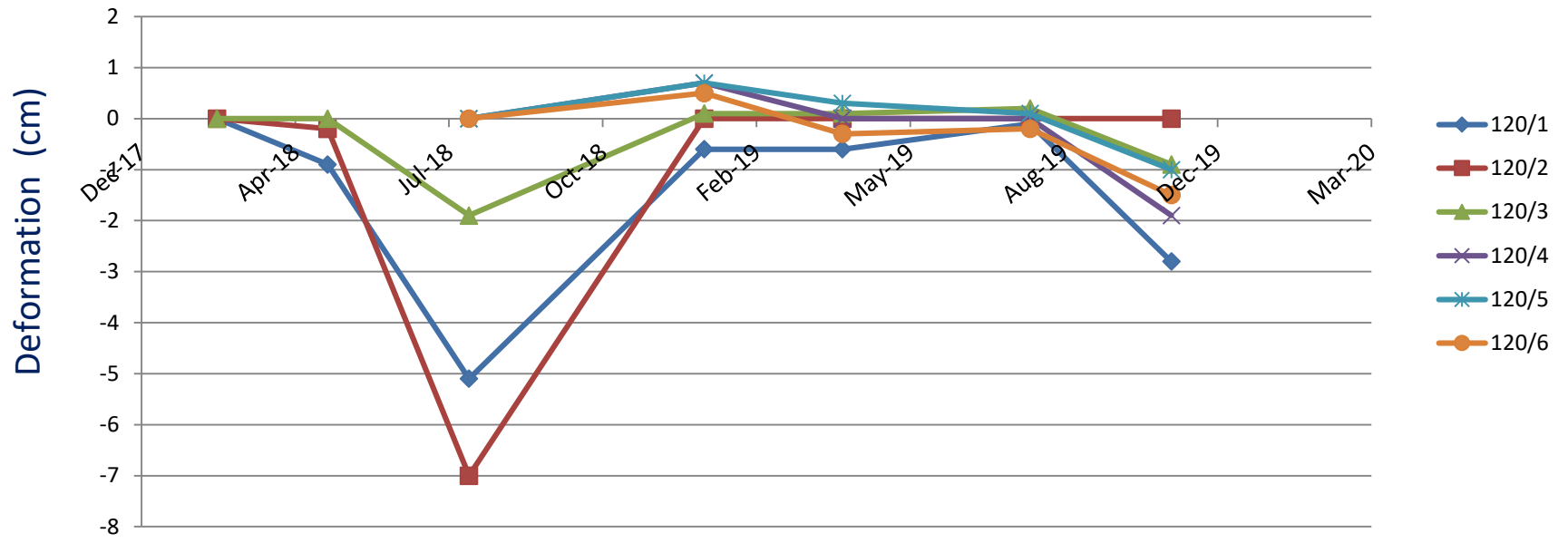
### MOVEMENT: MONITORING TREND OF WASTE DUMP AT 80m LIFT BY PRISMS



### MOVEMENT : MONITORING TREND OF WASTE DUMP AT 100m LIFT BY PRISMS



### MOVEMENT : MONITORING TREND OF WASTE DUMP AT 120m LIFT BY PRISMS

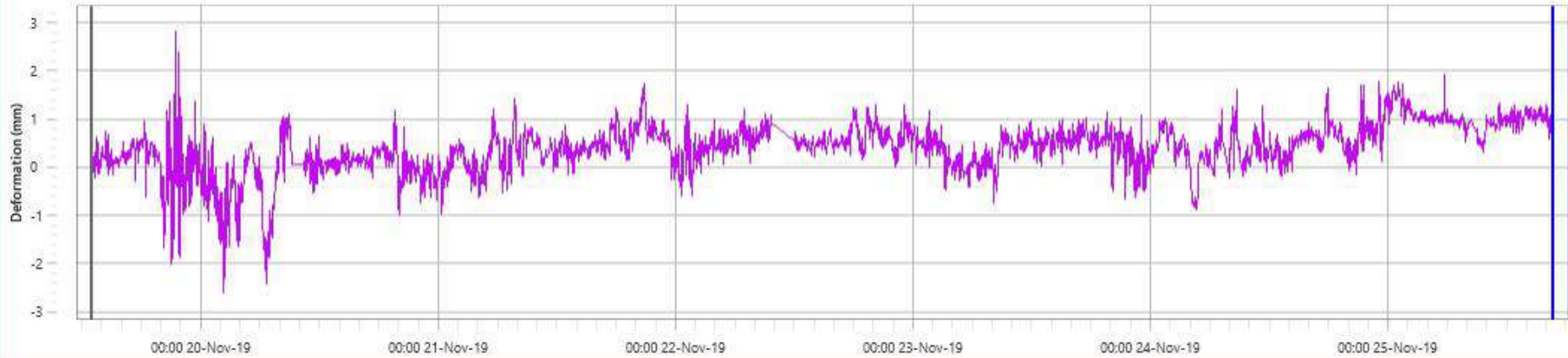


# Slope Stability Radar monitoring on waste Dump Area



X: 57 | Y: 1 | D: -0.3 mm | A: 50.182 | R: 865.21 m | C: 0.995 | (7.53x7.44)m

FIGURES - ENHANCED DEFORMATION



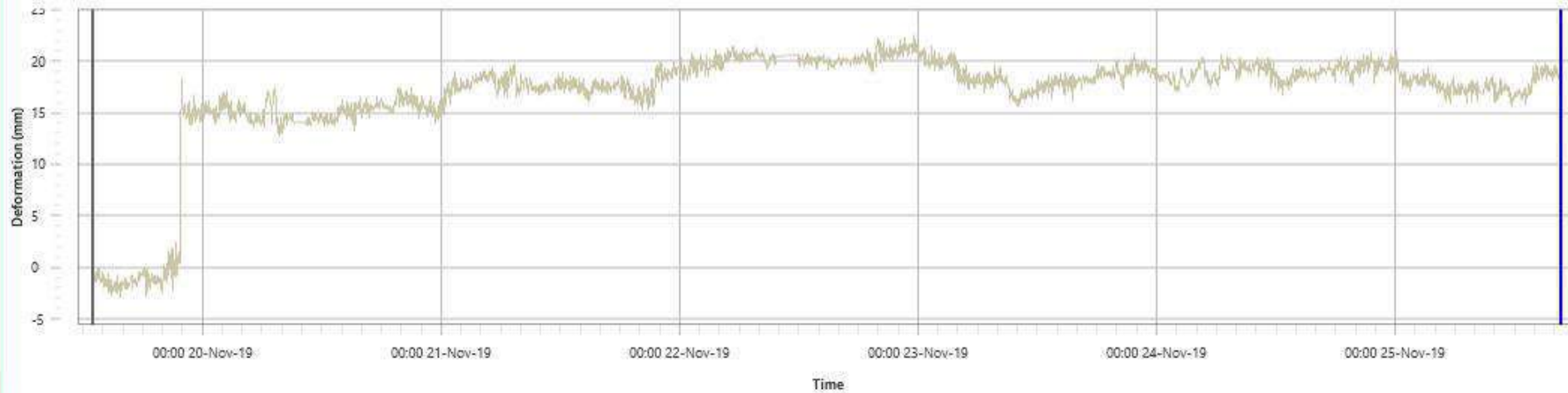


# Slope Stability Radar monitoring on waste Dump Area



X: 38 | Y: 1 | D: -2.3 mm | A: 50.632 | R: 834.53 m | C: 0.998 | (7.26x7.17)m

## FIGURES - ENHANCED DEFORMATION



AGM-EHS  
P/26/12

**No. J-11015/267/2008-IA.II (M)**

Government of India  
Ministry of Environment & Forests

Paryavaran Bhavan,  
C.G.O. Complex, Lodi Road,  
New Delhi-110 003.

Dated the 11<sup>th</sup> December, 2009

To

M/s Hindustan Zinc Limited  
Rampura Agucha Mine,  
P.O. Agucha -311029,  
District Bhilwara,  
Rajasthan  
E-mail: rrkumar@vedanta.co.in

**Subject: Expansion of Rampura Agucha Lead and Zinc Opencast and Underground Mining Project (from 5.0million TPA to 6.15 million TPA) and Beneficiation Capacity of Beneficiation Plant (from 5.0million TPA to 6.50million TPA) of M/s Hindustan Zinc Limited located in Village Agucha, Tehsil Hurda, District Bhilwara, Rajasthan -environmental clearance regarding.**

Sir,

This has reference to your letter No. HZL/RAM/Env/2009 dated 27.09.2009 and subsequent letters dated 10.10.2009 and 30.10.2009 on the subject mentioned above. The Ministry of Environment and Forests had earlier prescribed terms of reference (TORs) to the project on 22.12.2008 for undertaking detailed EIA study for the purpose of obtaining environmental clearance. The proposal is for grant of environment clearance for enhancement of production of lead and zinc ore from 5.0 million TPA to 6.15 million TPA and enhancement of capacity of beneficiation plant from 5.0 million TPA to 6.5 million TPA. The project was earlier accorded environmental clearance by the Ministry on 19<sup>th</sup> April, 1983 for (0.9million TPA production); 18<sup>th</sup> March, 1999 (1.35million TPA production); 1<sup>st</sup> March, 2005(3.75million TPA production) and 27.07.2007 for production of 5.0million TPA capacity of lead and zinc ore. The total mine lease area of the project is 1200ha, out of which 231.3ha is an agricultural land, 89.37ha is surface water bodies and 879.33ha is others (9.83ha is wasteland and 869.5ha is private land (mining activities). No forestland is involved. It has been reported that the existing surface rights area is 869.5ha and it is proposed to acquire surface rights for another 155ha area (149.72ha within mine lease and 5.28ha outside side the mine lease for plantation). Area proposed for excavation is 102.53ha, an area of 2ha is kept for storage of topsoil, 375.71ha for overburden dumps, 6.5ha for mineral storage, 29.23ha for infrastructure, 4ha for roads, 262ha for green belt, 178.13ha for tailings pond, 39ha for mineral beneficiation plant, 8ha for township and 181.44ha is others (0.66ha open space, 89.37ha water body and 86.13ha is agricultural land). In addition, township for company

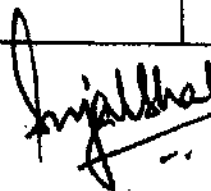
..2/-

**HINDUSTAN ZINC LIMITED DRAMPURA AGUCHA MINE**

MoEF Environmental Clearance Compliance to amendment in condition no (v) in EC vide letter No J-11015/267/2008-I-A.II (M) dated 22<sup>nd</sup> August, 2014

<b>SNo</b>	<b>Condition</b>	<b>Status</b>
i	The Open crack, whenever developed in the partially consolidated new dump mass, should be consolidated with proper filling/ leveling with the help of dozer/ compactors.	In such case, we shall consolidate with proper filling/ leveling with the help of dozer.
ii	Dump foundation preparation should be done by excavating and removing soil before dumping, to improve the frictional resistance at the base of dump. It should be filled with over burden containing stones.	Being Complied
iii	There should not be any dumping in pool water or on slushy ground.	No dumping is done in water pooled / slushy ground
iv	Discontinuous dumping should be avoided to check water accumulation between two isolated dumps.	Dumping is done at a single earmarked area.
v	During rainy season, an officer should be deputed to go in and around the dump site every morning to see the effectiveness of drain. If any blockage is observed, immediately steps should be taken to make it effective.	Mining officer is always deputed during rainy season to ensure smooth flow of runoff water.
vi	The dump should be surveyed periodically to produce up-to-date and accurate dump geometry.	Survey team survey the dump once in a month to produce up-to-date and accurate dump geometry.
vii	The slope and stability monitoring by Radar should be done and its report should be sent to MoEF and its Regional Office every six – months.	Report enclosed as Annexure VII
viii	The dump design should be reviewed by CIMFR or any other scientific agency after reaching dump height of 120m and its report sent to MoEF and its Regional office.	Complied. Waste dump design and slope stability is being reviewed yearly by CIMFR and report being submitted to MoEF Regional Office. Latest report is attached as Annexure XXII

ix	Waste dump has to be managed as per the guidelines of DGMS and quarterly monitoring report to be submitted to DGMS and regional office	Waste dump is being managed as per the DGMS guidelines and quarterly monitoring report shall be submitted to DGMS and regional office.
x	On stabilized dumps, more species such as Pongamia, Bombax ceiba, Tamarind, Arjun, Gravillea robusta and Amla to be planted.	Agreed. We shall plant the specified species along with the ones we are planting.
xi	The Radar monitoring system should satisfactorily sub-serve the dual objectives viz. (a) Investigative monitoring to provide an understanding of the slope behavior over time and typical response to external events (e.g. Precipitation and seasonal fluctuations) and (b). Predictive Monitoring: To provide a warning of a change in behavior, enabling the possibility of limiting or intervening to prevent hazardous sliding. The data so analyzed should be provided with reference to the above.	The analyzed data is enclosed annexure No VII
xii	Paved drains are to be provided to protect the slope surface against rain-cuts and seepage during rains to make a safe way to discharge top and surface water to the bottom of the dump. Constant vigilance on the condition of dumps with special reference to accumulation of water and development of cracks.	Paved drains shall be provided. Constant vigilance shall be given on the dump condition with special reference to water accumulation and development of cracks.
xiii	Regular Monitoring of above mentioned specific conditions shall be included in the monitoring plan and report submitted to the Ministry of Environment, Forest and Climate Change and its Regional Office located at Lucknow on six monthly basis.	Regular monitoring of the above mentioned conditions conducted and report is enclosed.

  
 Director, Agucha SBU  
 Hindustan Zinc Limited  
 Rampura Agucha Mine  
 PO- Agucha  
 Distt. - Bhitwara (Ra.)

**Annexure –IX**



Garland Drain Photo



**Annexure -X**



Plantation Photos

**Annexure-XI**



40KL Water sprinkler



Anicut Photos



Pond Photo

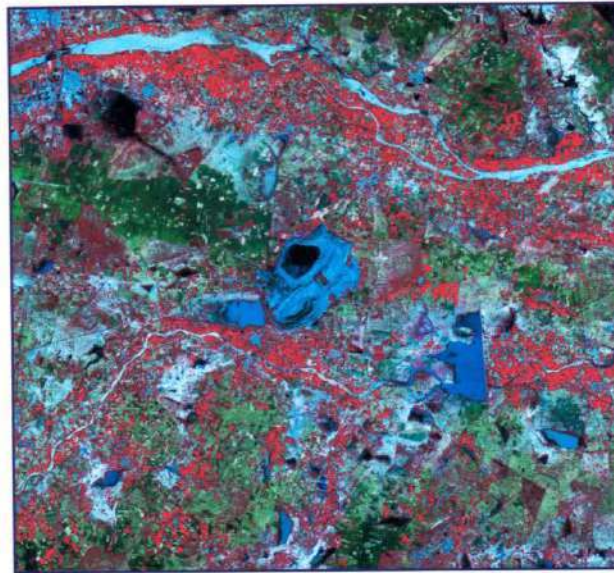




Truck covered with tarpaulin



**Land use mapping by digital processing of 15 km. radius of Rampura-Agucha mine, district Bhilwara using remote sensing techniques and showing the changes in land use during last three years**



**Sponsor: Hindustan Zinc Limited, Rampura-Agucha Mine, Bhilwara**

**Studied by:**



**Estb: 1988**

**Studied for:**



**Hydro-Geosurvey Consultants Private Limited  
C-103, Shastri Nagar, Jodhpur- 342003**

**Phone: - 0291-2431754**

**Web: [www.hydrogeosurvey.com](http://www.hydrogeosurvey.com), E-mail: - [hydro.geosurvey@yahoo.com](mailto:hydro.geosurvey@yahoo.com)**

**March, 2018**



HDPE laying in tailing dam





**SEWAGE TREATMENT PLANT AT COLONY.**



**STP (300KLD & 425 KLD)**



Annexure XVIII

उद्योग का नाम व पता		रामपुरा अगुचा खान हिन्दुस्तान जिंक लिमिटेड अगुचा 31129, जिला भीलवाड़ा ( राज.)	
हार्डवेयर वेस्ट एवं प्रदूषण नियंत्रण उपायों को प्रदर्शित हेतु जिम्मेदार व्यक्ति का नाम		पर्यावरण प्रमुख	
हार्डवेयर रसायनों के हैंडलिंग का वर्णन			
नाम	मात्रा भण्डारण / हैंडलिंग	विषैला / ज्वलनशील प्रकृति/ क्रियाशील / विस्फोटक:	
सोडियम सायनाइड	75 MT	विषैला	
वेस्ट पानी का विवरण :			
प्रदूषी घातु/ शारीरिक	मात्रा	उत्पत्ति/ उपभोग/ जलसंचयन नदी	इलेक्ट्रिक/ तापी/ शक्ति/ शक्ति
सैलोनिक	Nil	आवृत्त/ नहीं	शून्य/ शक्ति
निर्देशित मानक	आवृत्त/ नहीं	प्रदूषण नियंत्रण के उपाय किये गये/ नहीं किये गये/ आवश्यकता नहीं	आवृत्त/ नहीं
33 मी	एस पी एस 150 mg/Nm3	प्रदान किया गया	पूर्णतः पालन
39 मी	एस पी एस 150 mg/Nm3	प्रदान किया गया	पूर्णतः पालन
34 मी	एस पी एस 150 mg/Nm3	प्रदान किया गया	पूर्णतः पालन
हार्डवेयर वेस्ट का विवरण			
हार्डवेयर वेस्ट के प्रकार	हार्डवेयर वेस्ट श्रेणी	उत्पादित मात्रा	भण्डारण क्षमता
उपयुक्त/स्पेंट ऑयल	5.1, Sch. 1	700 KLA	विक्रय
सोडियम सायनाइड डिस्फाइड कन्टेनर	33.3 Sch. 1	7000 nos per annum	CTDF में निस्तारण
स्थानिक सूचना			
खनन पट्टे का क्षेत्रफल ( हे.)	1200 Ha		
खनन विधि	Mechanical Open Cast & Underground Mining		
उत्पादन क्षमता	6.15 Million tones per annum of Lead - Zinc Ore production (EC)		
खनन पट्टे की वैधता	20 Yrs validity upto 13-03-2020		
कार्य प्रारम्भ की तिथि	25 March 1991		
वायु प्रवाह			
स्त्रोत	चिमनी की ऊँचाई	निर्देशित मानक	एस पी एस
Primary Crusher Stack (w)	33 m	एस पी एस 150 mg/Nm3	25.81
Sec/Tert. Crusher Stack	39 m	एस पी एस 150 mg/Nm3	24.79
PCH (New)	34 m	एस पी एस 150 mg/Nm3	22.04

Name of Industry & Address		Rampura Agucha Mine Hindustan Zinc Ltd. Agucha-311029, Distt. Bhilwara (Ra.)	
Name of person responsible for handling Hazardous Waste & Pollution Control System		Head (Environment)	
Details of Hazardous Chemicals Handled			
Name	Quantity Stored/Handled	Nature Toxic/Inflammable/Reactive-Explosive	
Sodium Cyanide	75 MT	Toxic	
Waste Water Details			
Nature Domestic/Industrial	Quantity (KLD)	Treatment Provided/Not Provided/Not Required	Inland Surface Water/Irrigation/Sewer
Industrial	Nil	Not Required	Zero discharge
Air Emissions			
Source	Stack height	Standard Prescribed	SPM (mg/Nm3)
Primary Crusher Stack (w)	33 m	SPM : 150 mg/Nm3	25.81
Sec/Tert. Crusher Stack	39 m	SPM : 150 mg/Nm3	24.79
PCH (New)	34 m	SPM : 150 mg/Nm3	22.04
Hazardous Waste Details			
Type of hazardous Waste	Category of hazardous Waste	Quantity generated per month	Quantity stored up to previous month
Used oil	5.1, Sch. 1	700 KLA	700 KLA
Decontaminated empty sodium cyanide drums	33.3 Sch. 1	7000 nos per annum	7000 nos per annum
STATIC INFORMATION			
Mining lease Area (in Ha)	1200 Ha		
Method of Mining	Mechanical Open Cast & Underground Mining		
Production Capacity	6.15 Million tones per annum of Lead - Zinc Ore production (EC)		
Lease Duration	20 Yrs validity upto 13-03-2020		
Date of commencement of work	25 March 1991		
MONITORING OF ENVIRONMENTAL PARAMETERS			
Location	AMBIENT AIR MONITORING (µg/m <sup>3</sup> )		
Main Gate	PM <sub>10</sub>	PM <sub>2.5</sub>	SO <sub>2</sub> CO
Mine Site	PM <sub>10</sub>	PM <sub>2.5</sub>	SO <sub>2</sub> CO
Mine Tow	PM <sub>10</sub>	PM <sub>2.5</sub>	SO <sub>2</sub> CO
Blast Vibration (mm/Sec)			
Year	Nos. of Plants		Area Covered (ha)
2019-20	2		2 to 20

Display board at Main gate





Oil trap photo





HZL/RAM/Env/2019-20/1428

September 14, 2019

Member secretary  
Raj. Pollution Control Board  
4, Institutional Area  
Jhalan Doongri  
JAIPUR

Sub : Environmental Statement of Rampura Agucha Mine for year 2018-19.

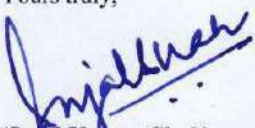
Ref: CTO granted vide order No 2019-2020/Mines/9959 dated 25/06/2019.  
CTO granted vide order No 2015-2016/Mines/6781 dated 24/09/2015 (Renewal  
application for beneficiation submitted vide letter no. HZL/RAM/ENV/2017-18/1636  
dated 31/10/2017. [EC:J-11015/267/2008-IA. II (m) dtd. 11.12.2009])

Madam,

Please find enclosed herewith the environmental statement for financial year ending on 31<sup>st</sup> March 2019.

Thanking you

Yours truly,

  
(Sujal Kumar Shah)  
Director (SBU)  
RA Mine

Director, Agucha SBU  
Hindustan Zinc Limited  
Rampura Agucha Mine  
P.O. Agucha  
Dist. - Bhilwara (Raj.)

cc to: Regional Officer : for kind information please.  
Raj. State Pollution Control Board  
18, Azad Nagar, Pannadhay Circle,  
Mining Engineer Office Road (Near Telephone Exchange)  
Bhilwara (Raj.)

The Director,  
Ministry of Environment and Forests,  
5<sup>th</sup> Floor, Kendriya Bhawan  
Lucknow

*Olc Environment*

**Hindustan Zinc Limited**

Rampura Agucha Mines, P.O. Agucha, Dist. Bhilwara (Rajasthan) - 311 022  
M +91-9001294956-57, F +91-1483 229012 www.hzindia.com

Registered Office : Yashad Bhawan, Udaipur (Rajasthan) 313 004  
CIN No. L27204RJ1966PLC001208



## QUARTERLY PROGRESS REPORT

**SUBMITTED TO: HINDUSTAN ZINC -VEDANTA**

**SUBMITTED BY: HEALTH TEAM, SMILE FOUNDATION**

**(April 2019 – June 2019)**

### BACKGROUND:

Since, last 10 years a substantial amount of effort has been made in India in the field of healthcare reforms. This transition has encouraged an assortment of governments and international agencies to invest resources in the healthcare industry. Delivering affordable health care to India's billion plus people presents enormous challenges and opportunities for the medical community. One of the challenges is increasing accessibility and affordability for those Village areas. The rural outreach and urban slums in the country still have severe difficulties in accessing even the most basic medical services, because of the accessibility of medical facilities, lack of awareness, poor economical condition; etc.

As per report published by Ministry of Health & Family Welfare, nearly 70 per cent of the country's population lives in rural areas. Of the 121 Crore Indians, 83.3 Crore live in rural areas while 37.7 Crore stay in urban areas, said the Census of India's 2011 Provisional Population Totals of Rural-Urban Distribution in the country<sup>1</sup>.(census of India survey 2011)

<sup>1</sup> As per census of India survey 2011

With this motive, Smile Foundation along with HINDUSTAN ZINC- VEDANTA planned to arbitrate in the lives of these underprivileged people by addressing their primary health needs through the mobile medical unit called **Smile on Wheels (SoW)**.

To fill the gap between community and government health institutional initiatives, Smile Foundation with the support of HINDUSTAN ZINC- VEDANTA has spear headed to provide primary healthcare services and awareness activities and successfully executed the planned activities.



## ACTIVITIES DONE IN THE REPORTING PERIOD

### Mobile Health clinics / OPD sessions

Every individual needs medical care at some point of time. Out Patients Department (OPD) is the essential part of the SoW design for beneficiaries to meet with the qualified doctor near their vicinity. A pre set roster is in place since the inception of the project and is strictly followed. The purpose of this roster is to render health services at an equal span of time in all the targeted villages & urban slums. Based on this plan the Smile on Wheels visits the pre destined locations. During the reporting period **142 OPDs** were done in the stated reporting period.

These OPDs have been successful in providing curative health care services which included health checkups, distribution of medicines and pathological tests.

In the context of women's health a sustainable wellbeing can be aimed if strategic interventions are made. In such prevailing conditions Smile on Wheels with its focus to provide doorstep health facilities reached the most vulnerable strata of society **i.e. women and children**. It is evident from the table and chart the project has been successful in achieving its goal. **52% of the beneficiaries were**



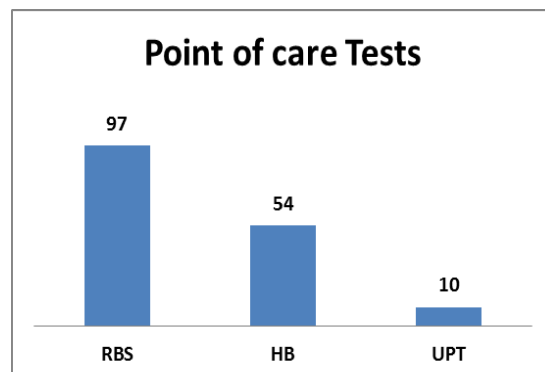


**women and children while the rest 48 % were Males.** However, the OPDs are aimed to sensitize these vulnerable sections of the society through promotive and preventive approach to raise health seeking behavior amongst the group.

S. No	Project	OPD's	Male	Female	Children	Total
1	Sow –Rampura , Agucha Mines	142	1777	1387	517	3681

### POINT OF CARE TESTS -

Point of care test is the major part of the health care services provided to the community and the patients residing there. It is used in the diagnosis, treatment and management of an increasing range of clinical disorder. Component of the primary healthcare services in SoW. Thus SoW breaks the barrier of high charges and time investment for point of care test of the underprivileged communities in the slums. It also helps to spread

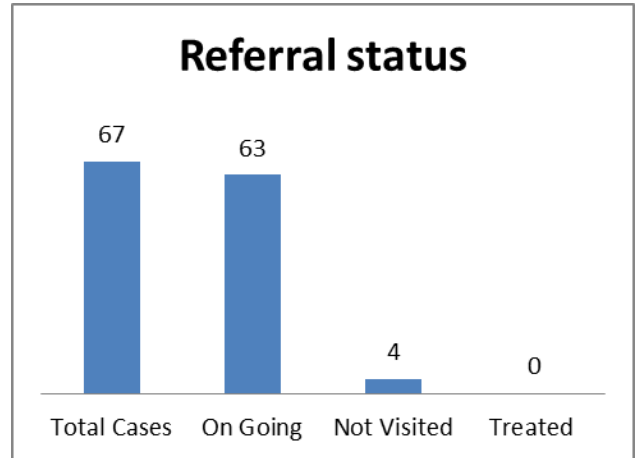


the word amongst the community dwellers about the efficacy of the SoW in their slums. Point of care test not only helps the underprivileged but also the SoW operation, as if observed and identified the increased number in any specific test. This directly shows the lack and need to address the health issue. For e.g. below chart reflects that the highest number of the beneficiaries came for RBS test (**97**) which indicates the need to address the same through necessary means, to decrease the lack.

### REFERRALS

**Referrals:** This is a process whereby a patient or the patient's family is introduced to additional health

Facilities in the community or in helping a patient find an appropriate health service from other Institutions such as a Government Hospital or Doctor. In connection the SoW-Mobile Medical Unit not only provides curative services but also acts as a bridge between the community and Government Health Services. This service provides the patients with contacts of hospitals when an advanced

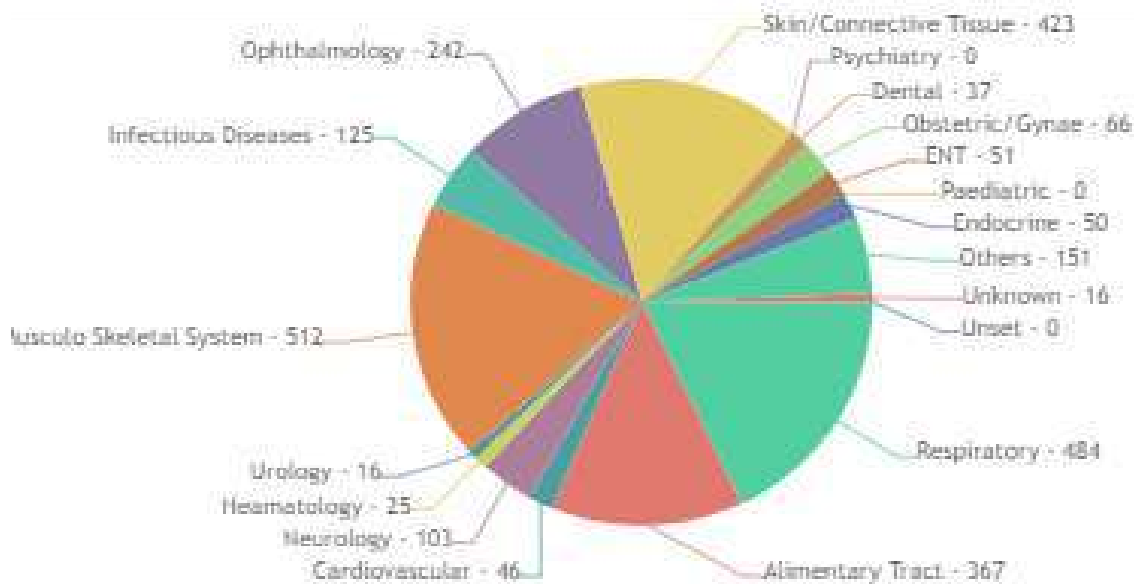


treatment is provided. Smile on Wheels tries to link the patients with government hospitals/private hospitals but preferably with a Government Hospital which can provide specialized care to the beneficiaries.

Therefore, in such cases, considering the need 67 patients were referred for advance treatment to different Government & Private hospitals. Smile on Wheels has developed linkages with Government Hospitals which can provide specialized care at affordable prices to the beneficiaries.

### Disease pattern

Disease pattern is very much needed for understanding, evaluating & analyzing the communities disease prominence and thus helpful in addressing the ailment through activity planning, keeping a check & tracking the need of specific medicines or Pathological test for the targeted communities. This increases



the overall



## IEC activities

The Purpose of the IEC activity is to create awareness in the community regarding the various health issues, diseases and the preventive measures. The focus of IEC activity is to disseminate maximum information to the community people to make them understand the need of prevention as well as the curative measure. During the reporting period we have conducted 3 IEC activities on the topic of Health & Hygiene, Cleanliness Drive, and Open Defection etc. Also organized 9 informal health talk sessions.



Session on Cleanliness Drive



Session on Health & Hygiene

Below table shows the number of IEC conducted and the number of participants attended the same. During this session we initiated pre and post session questionnaire to analyze the quality measure of our activities and to strengthen our programme in more effective way. During the period we have conducted 3 IEC activities and 9 community health talks on different topics.

No. of IEC activity conducted	No. of participants	Topic covered
1	60	Skin Infection
1	60	Cleanliness Drive
1	67	Health & Hygiene
9	271	Community Health Talks
<b>12</b>	<b>458</b>	<b>Total</b>

A total of 458 beneficiaries attended in overall IEC activities, out of which 187 were women and children which is approx. 40% of the total participants.

## MOTHER AND CHILD CARE

Good care during pregnancy is important for the health of the mother and the development of the fetus. Pregnancy is a crucial time to promote healthy behaviors and parenting skills. Good ANC links the woman and her family with the formal health system increases the chance of using a skilled attendant at birth and contributes to good health through the life cycle. Inadequate care during this time breaks a critical link in the continuum of care, and affects both mother and child. During the reporting period .to ensure the safe birth of the child and also regular check-up (Blood pressure, Hemoglobin test, weight etc.) of pregnant women.

This facility also provides women and their families with appropriate information and advice on healthy pregnancy, safe birth, and postnatal recovery, including care of the newborn, exclusive breastfeeding, and assistance with deciding on future pregnancies in order to improve pregnancy outcomes.

This is another important service which is provided to the pregnant women of the targeted areas. Keeping in mind that the health & safety of both the mother and her unborn child at the highest level.

During the reporting period 28 ANCs have been done to ensure the safe birth of the child and also regular check-up (Blood pressure, Hemoglobin test, weight etc.) of pregnant women.

### ANC /PNC CASES STATUS IN DIFFERENT LOCATION

LOCATION	ANC CASES REGISTERED	INSTITUTIONAL DELEIVEREY REPORTED	HOME DELEIVERY REPORTED	ON GOING ANC CASES
SOW-Agucha	28	7	0	21

## Health cannot wait- A case study

**Name:** Naru Ji Bheel.

**Father's Name:** Kanha ji Bheel

**Age:** 70 years.

**Problem reported:** Burn

**Location:** Bhojras, Bhilwara, Rajasthan

**Contact No.:** 7568652584



Before treatment

Naru Ji Bheel, a resident of Bhojras village, Hurda, Rajasthan. His left leg was burned in cooking oil and he needed frequent medical check-up. But there was no functional health institution in his village (as there is no doctor available in primary health center of Bhojras since last one year). So, when we organized our regular OPD checkup in his village, the guy came to Smile on Wheels and got checked-up by the medical professionals. We provided him necessary medicines and necessary medical care.



After treatment

Mr. Naru ji Bheel is under our treatment since last three weeks. And now he is pretty happy as the burn area in his leg is almost cured now! He is still under our follow up. And we feel proud to create a successful impact to him by our regular services. As like Naru Ji Bheel, there are thousands of needy people who deserve primary health right in their own community, which is being fulfilled by the initiative of Smile Foundation with the potential support of Vedanta, Hindustan Zinc (CSR).



# Glimpses:



**BLOOD LEAD LEVEL ANALYSIS IN NEAR BY COMMUNITY****KHEDAPALOLA (MAY 2019)**

SR.NO.	NAME OF PATIENT	FATHER/HUSBAND NAME	AGE IN YRS.	SEX	B.Pb level (microgram/dl)
1	RAMLAL	NANDRAM	60	M	2.50
2	CHOTI DEVI	PAPPUJI	54	F	2.19
3	LADI DEVI	BHERU LAL	70	F	2.81
4	NATHI DEVI	RAMLAL	45	F	2.81
5	SHANTI DEVI	LALAJI	40	F	2.19
6	PACHULAL	HARDEVJI	46	M	1.88
7	GISHI DEVI	SHREE RAM	50	F	2.19
8	SHREERAM	HARDEV JI	40	M	2.50
9	MANBHAR DEVI	MITHUJI	40	F	2.19
10	MADHU DEVI	JEEVRAJ	30	F	1.88

**CSR CAMP FOR BLOOD LEAD LEVEL ANALYSIS****BHERUKHEDA (JUNE 2019)**

SR.NO.	NAME OF PATIENT	FATHER/HUSBAND NAME	AGE IN YRS.	SEX	B.Pb level (microgram/dl)
1	RAMESHWAR GURJAR	HARJI GURJAR	23	M	2.81
2	RAM LAL	MADHUJI	55	M	2.19
3	RAM KUMAR	UDAI LAL	32	M	1.88
4	RUGMI DEVI	MAHADEV	55	F	2.50
5	SEETA DEVI	RAMESHWAR LAL	35	F	2.19
6	RAMU DEVI	RAMSUKH JI	58	F	1.88
7	POOJA DEVI	LADU LAL JI	75	F	1.88
8	LADI DEVI	HARJI	50	F	2.19
9	HARJI	GEESHA JI	65	M	1.88





## QUARTERLY PROGRESS REPORT

**Reporting Period: 25<sup>th</sup> Jun. 2019 to 25<sup>th</sup> Sept. 2019**

**SUBMITTED TO: HINDUSTAN ZINC -VEDANTA**

**SUBMITTED BY: SMILE FOUNDATION**

### BACKGROUND:

Since, last 10 years a substantial amount of effort has been made in India in the field of healthcare reforms. This transition has encouraged an assortment of governments and international agencies to invest resources in the healthcare industry. Delivering affordable health care to India's billion plus people presents enormous challenges and opportunities for the medical community. One of the challenges is increasing accessibility and affordability for those in rural or remote areas. The rural outreach and urban slums in the country still have severe difficulties in accessing even the most basic medical services, because of the accessibility of medical facilities, lack of awareness, poor economical condition; etc.

As per report published by Ministry of Health & Family Welfare, nearly 70 per cent of the country's population lives in rural areas. Of the 121 Crore Indians, 83.3 Crore live in rural areas while 37.7 Crore stay in urban areas, said the Census of India's 2011 Provisional Population Totals of Rural-Urban Distribution in the country<sup>1</sup>.**(census of India survey 2011)**

<sup>1</sup> As per census of India survey 2011

With this motive, Smile Foundation along with HINDUSTAN ZINC- VEDANTA planned to arbitrate in the lives of these underprivileged people by addressing their primary health needs through the mobile medical unit called **Smile on Wheels (SoW)**.

## Project Intervention

### Mobile Health Clinics / OPD sessions

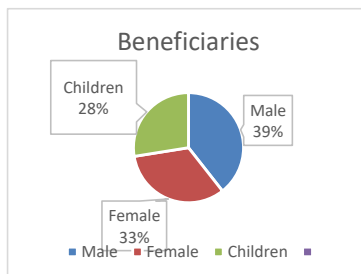
Every individual needs medical care at some point of time. The project ensures availability of qualified doctor at the door step of beneficiaries. A pre set roster is in place since the inception of the project and is strictly followed. The purpose of this roster is to render health services at an equal span of time in all the targeted villages. During the reporting period **144 OPDs** were done



These OPDs included health checkups, distribution of medicines and point of care tests.

### The details of OPDs and beneficiaries covered are as follows:-

Gender is one of the main social determinants of health that play a major role in the health outcomes of women and children in India. This is predominantly the existing gender inequality in India which negatively impacts the health of women and children. Differential access to healthcare occurs because women typically are entitled to a lower share of household resources and thus utilize healthcare resources to a lesser degree than men. In the context of women's health a sustainable well being can be aimed if strategic interventions are made. In such prevailing conditions Smile on Wheels with its focus to provide doorstep health facilities reached the most vulnerable strata of society i.e. **women and children**. It is evident from the table and chart that **61% of the beneficiaries were women and children while the rest 39 % were males**. However, the



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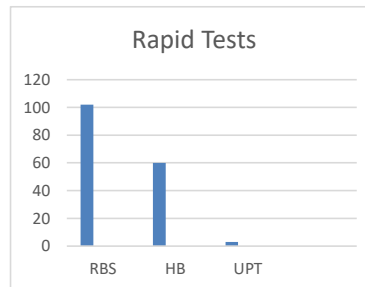
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OPDs are aimed to sensitize these vulnerable sections of the society through promotive and preventive approach to raise health seeking behaviour amongst the group.

S. No	Project	OPD's	Male	Female	Children	Total
1	Sow –Rampura , Agucha Mines	144	2040	1712	1425	5177

## RAPID TESTS

Rapid test is the major part of the health care services provided to the community. It is used in the diagnosis, treatment and management of an increasing range of clinical disorder. Thus SoW breaks the barrier of high charges and time investment for such tests for the underprivileged communities. It also helps to spread the word amongst the community dwellers about the efficacy of the Sow. This directly shows the lack and need to address the health issue. For e.g. the chart reflects that the highest number of the beneficiaries came for Random Blood Sugar test (102) which indicates the need to address the same .



RBS Test of a beneficiary

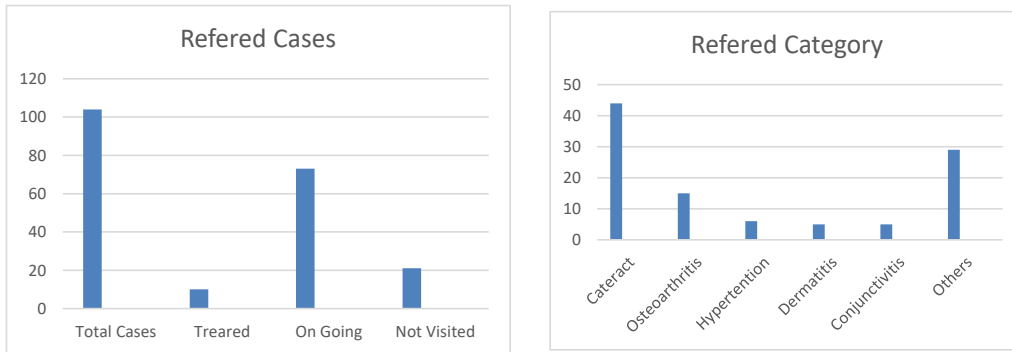


Hemoglobin Test of a beneficiary

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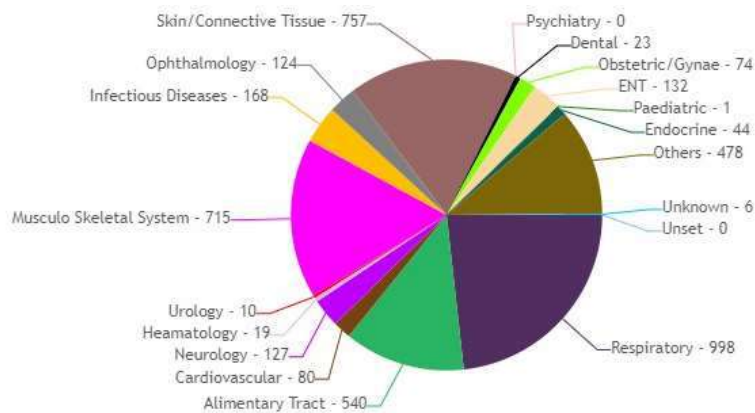
## REFERRALS

This is a process whereby a patient or the patient's family is linked with the advanced healthcare facilities. In connection the Sow not only provides curative services but also acts as a bridge between the community and Government Health Services. Therefore, in such cases, considering the need **104** patients were referred for advance treatment to different Government & Private hospitals.



## Disease pattern

Disease pattern is very much needed for understanding, evaluating & analyzing the community diseases. This helps in addressing the ailment through activity planning, & tracking the need of specific medicines or tests for the targeted communities. This increases the overall efficiency of the project operations. The below analysis shows that the prevalent disease reported is related to Respiratory, Skin, Muscular Skeletal System, Alimentary Tract, Infectious Disease, Ophthalmology etc.



## IEC activities

The Purpose of the IEC activity is to create awareness in the community regarding the various health issues, diseases and the preventive measures. The focus of IEC activity is to disseminate maximum information to the community people to make them understand the need of prevention as well as the curative measure. During the reporting period we have conducted 8 IEC activities on the topic of Women's Health, Communicable Disease, Nutrition etc. Also organized 6 informal health talk sessions.



Session on Anaemia & Women's Health



Session on Nutrition Week 2019

Below table shows the number of IEC conducted and the number of participants attended the same. During this session we initiated pre and post session questionnaire to analyze the quality measure of our activities and to strengthen our programme in more effective way. During the period we have conducted 8 IEC activities and 6 community health talks on different topics.

No. of IEC activity conducted	No. of participants	Topic covered
1	130	Communicable Disease
1	60	Anaemia & Women's health
5	1200	Nutrition
6	114	Community Health Talks
<b>13</b>	<b>1504</b>	<b>Total</b>

A total of 1504 beneficiaries attended in overall IEC activities, in which all participants were women and children.

## MOTHER AND CHILD CARE

Good care during pregnancy is important for the health of the mother and the development of the fetus.

Good ANC links the woman and her family with the formal health system increases the chance of using a skilled attendant at birth and contributes to good health through the life cycle. Inadequate care during this time breaks a critical link in the continuum of care, and affects both mother and child.

This is another important service which is provided to the pregnant women of the targeted areas. Keeping in mind that the health & safety of both the mother and her child at the highest level.

During the reporting period 39 ANCs have been reported to ensure the safe birth of the child and also regular check-up (Blood pressure, Hemoglobin test, weight etc) are conducted of pregnant women, out of which 35 deliveries are institutional.

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### ANC /PNC CASES STATUS IN DIFFERENT LOCATION

LOCATION	ANC CASES REGISTERED	INSTITUTIONAL DELEIVERYEY REPORTED	HOME DELEIVERY REPORTED	ON GOING ANC CASES
SOW-Agucha	31	13	0	18



### Case Study: September 2019

**Name:** Payel Jat

**Father:** Ramlal Jat

**Mother:** Kali Devi

**Age:** 1.5 years

**Current Weight:** 5.5 K.G.

**Current Height:** 1.6 Feet

**Case:** Malnourishment

**Duration:** Since Birth

**Location:** Hurda, Bhilwara, Rajasthan



Payel Jat, a baby girl of one and half years. She is suffering from malnourishment since infancy period. Through conducting camp under our promotive health care in collaboration with ICDS center we have identified this girl 3 months ago. This child is registered under Hurda ICDS center. When we identified this child she was in weight of 4.9 K.G. and was observed as too inactive in general movement. The ICDS Worker, Ms. Puspa Devi briefed her case history to our Medical officer and we had a complete checkup of this girl child that time. We provided her some required medicine as (Multi Vitamin Syrup) for improvement of her health status and later on our representative visited her house twice to meet her parents and delivering counselling & guidance for further improvement. We made aware the mother of the child about breastfeeding and recommended about some nutritious food consumables during this age.

Today, after our continuous follow up since three months, we observed a slight changes in her body weight (around 600 grams). The child is still under our regular observation. We are conducting frequent home visit to her. Her mother Mrs. Kali Devi, is very happy to receive the guidance from us and also following our advices about regular immunization in this period.





## Glimpses of the Reporting period: -



National Nutrition Week Celebration



School Health Checkup Program



Letter of Appreciation from Block



News on IEC on cleanliness

Thank you so much for your Support



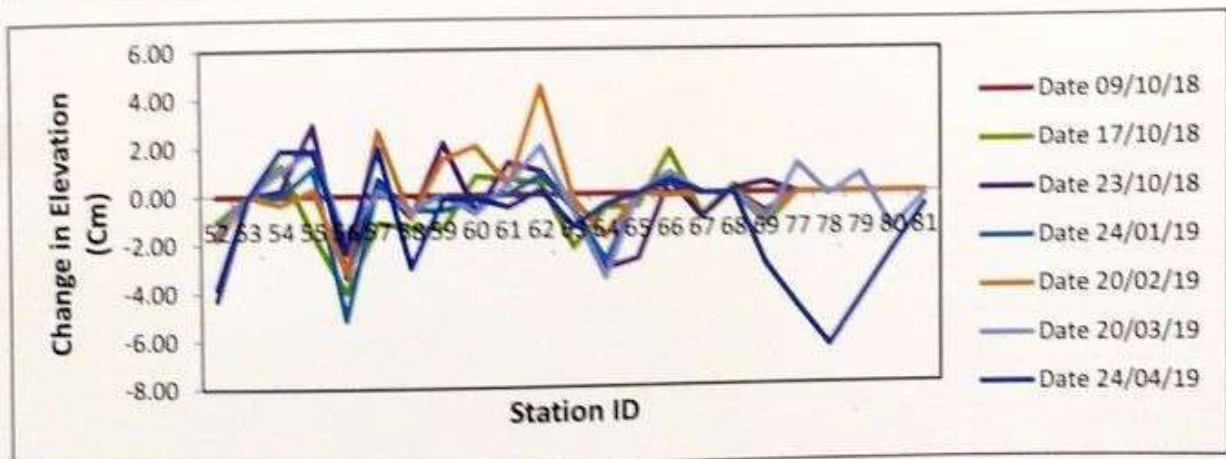


# FINAL REPORT

Project No: SSP/N/293/2018-19

## EVALUATION OF WASTE DUMP STABILITY THROUGH SLOPE MONITORING AT RAMPURA-AGUCHA OPENCAST MINE

For: M/S HINDUSTHAN ZINC LIMITED (VEDANTA), UDAIPUR



**CSIR-CENTRAL INSTITUTE OF MINING & FUEL RESEARCH**  
 (Council of Scientific & Industrial Research)  
 Regional Centre, 17/C, Telenkhedi Area, Civil Lines, Nagpur - 440 001

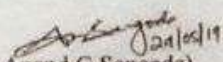
June, 2019

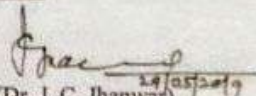
*Final Report*  
*On*  
**Evaluation of Waste Dump Stability through Slope Monitoring at  
Rampura-Agucha Opencast Mine.**

Project No. SSP/N/293/2018-19

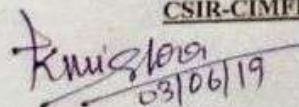
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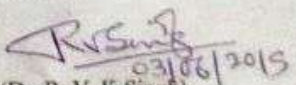
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Project Leader

  
(Dr. J. C. Jhanwar)  
Chief Scientist & HOS  
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Business Development & Industrial Liaison





## EXECUTIVE SUMMARY

CSIR - Central Institute of Mining and Fuel Research, Nagpur Research Centre (Mining Technology) conducted a Geotechnical study for evaluation of waste dump stability at the Rampura-Agucha mine following a work order from M/s Hindustan Zinc Ltd. (Vedanta Resources). The main objective of this study is Assessment of the stability of waste dump at Rampura- Agucha mine through slope monitoring & Recommendation of the appropriate waste dumps stabilization measures.

The Rampura-Agucha Mine (RAM) is located 15 km southeast of Gulabpura in Bhilwara District, Rajasthan. It forms a part of pre-Aravalli Banded Gneissic Complex consisting of gneisses, schists and intrusives of acidic and basic igneous rocks, which occupy predominantly the south-eastern plain of Ajmer and Bhilwara. It can be located in the Survey of India topo-sheet no. 45 K/9 & 45 K/13 and is bounded by Latitude: N 25° 50' 00" & Longitude: E 74° 44' 15". The mine is accessible by road from Bhilwara, which is the nearest major town on National Highway (NH) No. 79 approximately 70 km of the mine.

The waste dump at RAM consists of the waste rocks excavated from the RAM and mainly consists of Garnet-Biotite sillimanite-Gneiss (GBSG), Pegmatite and Amphibolite. It is situated on the base rocks of GBSG. The mine has only external waste dump, which is very big in size spreading in an area of around 300 Ha. The maximum height of waste dump is 140 m with 7 benches each of 20 m height. There is no major drainage course cutting across the area. The RAM exists in a semi-arid desert and the annual rainfall does not exceed 400 mm.

The stability of waste dump was monitored with the help of Total Station. The survey team of RAM conducted the monitoring in the presence of CIMFR scientist on a quarterly basis during 21-22 June, 2018 & 22-23 October, 2018, 24 January, 2019 & 24 April, 2019. For this purpose, reflector prisms were installed on alternate benches at an interval of around 200 m in the south, west & north-west sides of the waste dump. The monitoring observations were analysed on quarterly basis & also on collective basis at the end of fourth quarter. The horizontal distance and elevation of each monitoring station/target was compared with the base/first observations of the respective stations to derive amount of change in the horizontal distance of the particular monitoring station from the instrument/reference station & the change in its elevation.

The changes in horizontal distance & elevation across all monitoring stations located on different sides/benches of the waste dump have varied up to a maximum of 2.29 cm & 6.42 cm respectively as indicated from the analysis of movement observations. The analysis of movement observations & visual observations of the waste dump made during the course of this study does not indicate any significant instability in different sides of the waste dump. The waste dump currently appears to be stable from on an overall stability basis. However, the following recommendations/suggestions are made to further improve the stability and to ensure the waste dump stability in future.





It is suggested that systematic slope monitoring be implemented for all the sides of waste dump and accordingly, monitoring stations at an interval of around 200-300 m be installed on alternate benches on a staggered pattern on East, North-East & SE sides, which are still uncovered from systematic monitoring.

The application of Geotextiles or any other means be implemented to establish vegetation cover on waste dump bench slope surfaces to protect dump slopes against erosion due to wind & water and to improve its stability.

Water should not be allowed to accumulate on the bench floors & on top of the dump. Appropriate drainage measures be put in place in the form of drains on every bench connecting to main garland drain at the bottom level. It is essential that these drains should be kept clear of silt and debris.

At some place, gullies are formed due to water induced erosion, which may lead to further deterioration, it is therefore suggested that such gullies/voids be repaired through proper dozing of waste material. Additional heap of waste material should not be left on the benches. It should be cleaned and the gradient of the bench should be maintained so as to ensure smooth flow of rain water to lower level in a planned way.

The systematic monitoring of waste dump stability should be continued and the movement observations be scientifically analyzed to evaluate any potential signs of instability & to implement appropriate corrective measures. In addition to the total station based monitoring, the waste dump should be thoroughly inspected on a regular basis especially during the monsoon & post monsoon period to identify any indications of instability including the development of tension cracks anywhere on the waste dump surface. In the case of tension crack, it must be properly filled with waste material and should be monitoring for its further progression.





**TABLE OF CONTENT**

SR. NO.	Subject	Page No
	<b>EXECUTIVE SUMMARY</b>	i
	<b>TABLE OF CONTENTS</b>	iii
	<b>LIST OF FIGURES</b>	iv
	<b>LIST OF TABLES</b>	v
<b>1.0</b>	<b>INTRODUCTION</b>	1
1.1	Background	1
1.2	Objective & Scope of Work	1
<b>2.0</b>	<b>GEO-MINING DETAILS OF THE MINE</b>	1
<b>3.0</b>	<b>GEOLOGY</b>	2
<b>4.0</b>	<b>EVALUATION OF THE WASTE DUMP STABILITY AT RAM</b>	3
4.1	The Objective & Importance of Dump Slope Monitoring	3
4.2	General Details of the Waste Dump	3
4.3	Monitoring of Waste Dump Stability	7
<b>5.0</b>	<b>CONCLUSIONS AND RECOMMENDATIONS</b>	32
<b>6.0</b>	<b>ACKNOWLEDGEMENTS</b>	33
<b>7.0</b>	<b>REFERENCES</b>	34
	<b>ANNEXURE-I</b>	35
	<b>ANNEXURE-II</b>	37
	<b>ANNEXURE-III</b>	40
	<b>PROJECT PARTICULARS</b>	44



**LIST OF FIGURES**

No.	Caption	Page No
1	A satellite view of the Rampura Agucha mine (Source: Google map)	2
2a	South - side benches	4
2b	West side benches	5
2c	North - West side benches	5
2	A typical view of the benches in Waste Dump of Rampura-Agucha mine	5
3	Cross - sections of waste dump (E-200, 550, 1800, 1000)	6
4	A surface plan of the waste dump plan indicating monitoring stations	7
5	Change in elevation of different monitoring stations on the south side	25
6	Change in horizontal distance of different monitoring stations on the south side	25
7	Change in elevation of different monitoring stations on the west side	27
8	Change in horizontal distance of different monitoring stations on the west side	27
9	Change in elevation of different monitoring stations on the north/north-west side	30
10	Change in horizontal distance of different monitoring stations on the north/NW side	30
11	Monitoring observations with Total Station & Optech Polaris Laser Scanner	31
12	Processed images in 3D Laser Scanner	31
13	An output of the change detection by laser scanner in the south side of waste dump	32





### LIST OF TABLES

No	Caption	Page No
1	Monitoring observations of the south side of waste dump dated 09/10/2018	9
2	Monitoring observations on the south side of waste dump dated 17/10/2018	10
3	Monitoring observations on the south side of waste dump dated 22/10/2018	11
4	Monitoring observations on the south side of waste dump dated 24/01/2019	12
5	Monitoring observations on the south side of waste dump dated 20/02/2019	13
6	Monitoring observations on the south side of waste dump dated 20/03/2019	14
7	Monitoring observations on the south side of waste dump dated 24/04/2019	15
8	Monitoring observations on the west side of waste dump dated 25/08/2018	16
9	Monitoring observations on the west side of waste dump dated 22/10/2018	16
10	Monitoring observations on the west side of waste dump dated 24/01/2019	17
11	Monitoring observations on the west side of waste dump dated 20/02/2019	17
12	Monitoring observations on the west side of waste dump dated 20/03/2019	18
13	Monitoring observations on the west side of waste dump dated 24/04/2019	18
14	Monitoring observations on the North/NW side of waste dump dated 24/01/19	19
15	Monitoring observations on the North/NW side of waste dump dated 20/02/19	20
16	Monitoring observations on the North/NW side of waste dump dated 20/03/19	21
17	Monitoring observations on the North/NW side of waste dump dated 24/04/19	22
18	Change in elevation of different monitoring stations on the south side	23
19	Change in the horizontal distance of different monitoring stations on the south	24
20	Change in elevation of different monitoring stations on the west side	26
21	Change in the horizontal distance of different monitoring stations on the West	26
22	Change in the elevation of different monitoring stations on the North/NW side	28
23	Change in horizontal distance of monitoring stations on the North/NW side	29





## 1.0 INTRODUCTION

### 1.1 Background

CSIR-Central Institute of Mining and Fuel Research Centre, Nagpur (Mining Technology) conducted a Geotechnical study for evaluation of waste dump stability at the Rampura-Agucha mine following a work order (No.: 2000048401/5100022527 Dated: 07.03.2018) from M/s Hindustan Zinc Ltd. (Vedanta Resources).

### 1.2 The Objective & Scope of Work

The main objective of this study is Assessment of the stability of waste dump at Rampura- Agucha mine & Recommendation of the appropriate waste dumps stabilization measures. The scope of work of this study is limited to the external waste dump and broadly consists of the following work elements.

- i. Reconnaissance of the waste dump, collection and study of relevant geo-mining detail.
- ii. Monitoring of waste dump stability with the help of Total station by the survey team of RAM on a quarterly basis.
- iii. Assessment of waste dump stability through analysis & interpretation of monitoring observations provided by the RAM geotechnical team.
- iv. Documentation of results and preparation of study report.

## 2.0 GEOMINING DETAILS OF THE MINE

The Rampura-Agucha Mine (RAM) is located 15 km southeast of Gulabpura in Bhilwara District, Rajasthan. It forms a part of pre-Aravalli Banded Gneissic Complex consisting of gneisses, schists and intrusives of acidic and basic igneous rocks, which occupy predominantly the south-eastern plain of Ajmer and Bhilwara. It can be located in the Survey of India topo-sheet no. 45 K/9 & 45 K/13 and is bounded by Latitude: N 25° 50' 00" & Longitude: E 74° 44' 15". The mine is accessible by road from Bhilwara, which is the nearest major town on National Highway (NH) No. 79 approximately 70 km of the mine. A satellite view of the RAM is shown in Fig. 1. The mine has only external waste dump, which is very big in size spreading in an area of around 300 Ha. The maximum height of waste dump is 140 m with 7 benches each of 20 m height. Typical view of the waste dump is shown in Fig. 2.





Fig. 1 - A Satellite view of the Rampura-Agucha mine (Source: Google Map)

### 3.0 GEOLOGY

The rocks of Rampura-Agucha mine constitute a part of Pre-Cambrian Banded Gneissic Complex (BCG) group of rocks, which occupy an extensive tract in Central Rajasthan Pen plain. The general strike of litho units is NNE-SSW to NE-SW, with moderate to steep south-easterly dip. The orebody has been proved for a strike length of 1.55 km. The host rocks in the central part are graphite-mica-sillimanite gneiss/schist, with calc-silicate enveloping the main orebody. Long bands of amphibolite with pegmatite bodies are present. The main rock type is Garnet-Biotite sillimanite-Gneiss (GBSG). It is locally more weathered towards the southern part of the footwall side. The waste rocks at RAM mine are mainly GBSG, Pegmatite and Amphibolite. There is no major drainage course cutting across the area. Rampura-Agucha mine exists in a semi-arid desert and the annual rainfall does not exceed 400 mm. The high permeability of dumped material would make the geo-mining condition of the dumps to drained condition for all practical purposes after implementing an effective drainage system. The source of water is rainwater only.





#### 4.0 EVALUATION OF THE WASTE DUMP STABILITY AT RAM

##### 4.1 The Objective & Importance of Dump Slope Monitoring

The main objective of waste dump slope monitoring study is to detect any instability well in advance so that any damage to men and machineries can be avoided. If the failure is unavoidable then it can be brought down in a predictable manner. If any instability is detected in the early stage then it can be stabilized by applying the suitable remedial measures. If the instability is detected at a later stage then it may be very difficult to control it against further increase. The waste dump slope failures hardly occur suddenly. The actual slope failures are invariably preceded by manifestations of some indications in the form of tension cracks or other signs. It is therefore very crucial to observe & appropriately deal with the different indications of slope movement indicating impending slope instabilities. The first obvious sign of instability is exhibited by the formation of tension cracks on the crest of the waste dump slope. It must be treated as warning of instability [Barton, 1971]. It should be noted that the order of movement near failure are large, of the order of meters, and not millimeter [Kennedy, 1971]. The real hazard is not only the detection of movement in the waste dump slope, but it is the accelerated rate movement, which causes failure.

As soon as any movement is detected generally a question is asked regarding the rate of movement at which men and machinery should be removed. Actually the rate of movement near failure will depend on many factors including rock soil types, water pressure behind the slope, type of discontinuity along which failure is occurring etc. For each specific condition an empirical norm has to be established and then only it is possible to have an exact idea of rate of movement during failure which is not say easy. So, it is only the rate of acceleration of the movement, which can clearly tell the time to remove the men and machinery [Brawner, 1970]. Brawner [1970] from studies on over 200 slides in soil and rock concluded that complete failure has not occurred in less than 24 hours when the rate of movement was less than 25mm per day with the exception of slides triggered by earthquake.





#### 4.2 General Details of the Waste Dump

The waste dump consists of the waste rocks excavated from the RAM and mainly consists of Garnet-Biotite sillimanite-Gneiss (GBSG), Pegmatite and Amphibolite. It is situated on the base rocks of GBSG. The Bulk density, Cohesion and the Angle of internal friction of the waste dump spoil material are  $19.4 \text{ KN/m}^3$ ,  $53 \text{ KPa}$  and  $23^\circ$  respectively (Ref. CIMFR Report, 2017). The mine has only external waste dump, which is very big in size spreading in an area of around 300 Ha. The maximum height of waste dump is 140 m with 7 benches each of 20 m height. Typical view of the waste dump is shown in Fig. 2. The different cross-sections & a surface plan of the waste dump indicating various monitoring stations/prisms & are shown in Fig. 3 & 4 respectively.



2a - South - side benches



2b - West side benches



2c - North - West side benches

Fig. 2 (a to c) - A typical view of the benches in Waste Dump of Rampura-Agucha mine



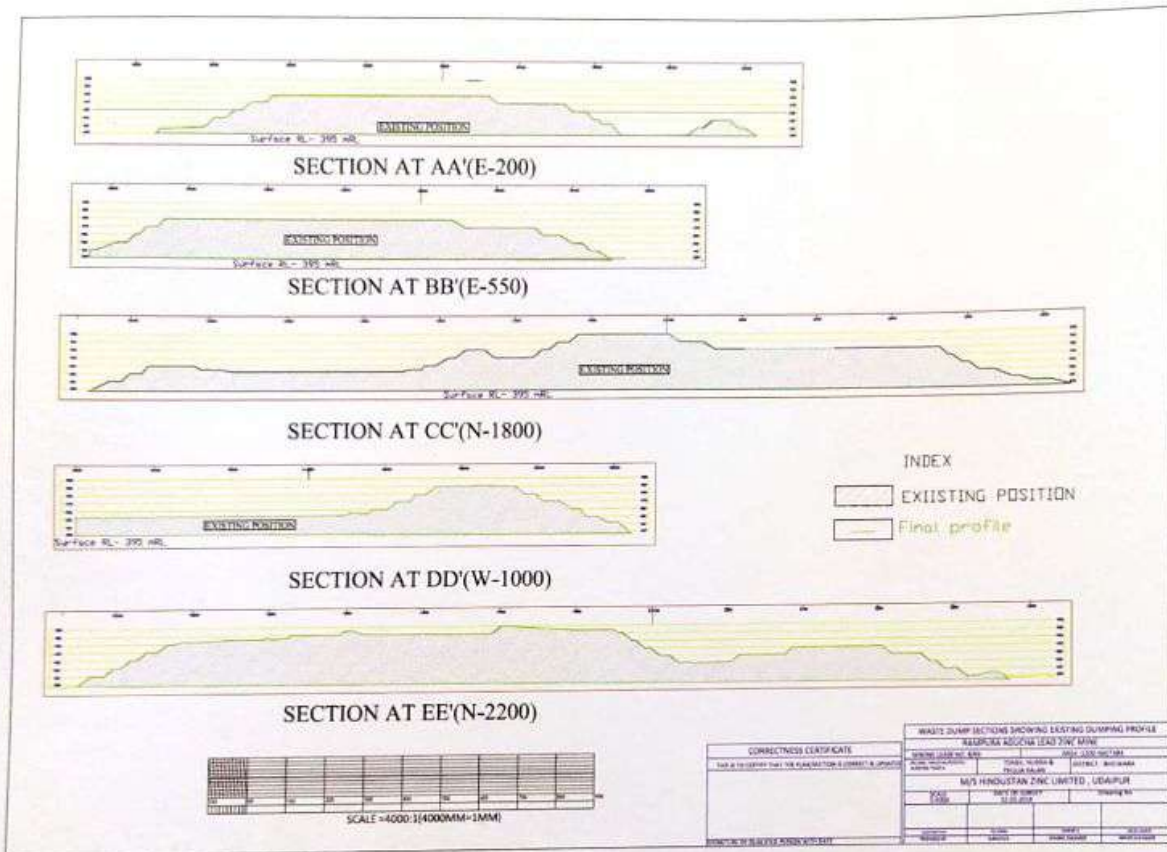


Fig. 3 - Cross - sections of waste dump (E-200, 550, 1800, 1000)



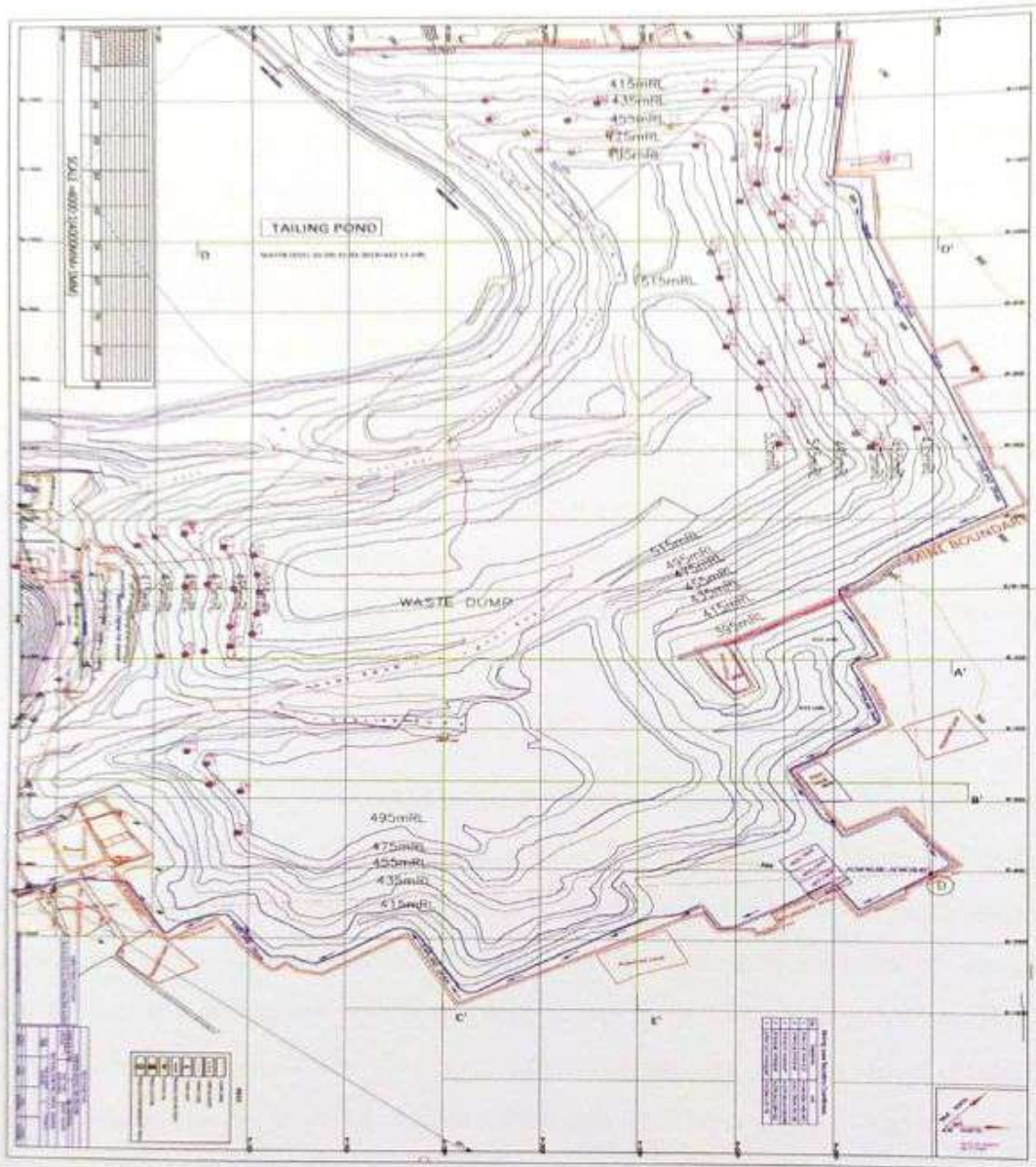


Fig. 4 - A surface plan of the waste dump plan indicating monitoring stations

### 4.3 Monitoring of Waste Dump Stability

#### 4.3.1 Total Station Based Monitoring

The stability of waste dump was monitored with the help of Total Station. The survey team of RAM conducted the monitoring in the presence of CIMFR scientist on quarterly basis during 21-22 June, 2018 & 22-23 October, 2018, 24 January, 2019 & 24 April, 2019. However, the RAM survey team have taken some more monitoring observations and have provided 3 such observations for analysis & inclusion in thre report. For this purpose, reflector prisms were





installed on alternate benches at an interval of around 200 m in the south, west & north-west sides of the waste dump. Initially, the monitoring stations were located in south side only but later on more monitoring stations were added on other sides as well as mentioned above. One instrument station was located on the hang-wall side of the pit to monitor the south side and two instrument stations were later installed on the North & North-West side of the waste dump to monitor the other sides of waste dump. The instrument station on the hang wall side of pit was shifted to another location on Hag wall side, hence the first monitoring observations taken on 2 June, 2018 were not included in the analysis since the remaining observations were taken from taken from different instrument location. At the end of quarterly visit by CIMFR Scientist, a brief report on waste dump stability was submitted as given in Annexure I. However, the fourth and last quarter visit report is not submitted separately and its observations are included in this final report. The monitoring observations taken during these visits on the South, West & North/N-W sides of waste dump are shown in Tables 1 to 7, 8 to 13 & 14 to 17 respectively.

#### **4.4 Analysis of Slope Monitoring Observations**

The monitoring observations as reported in the preceding section (Section: 4.3) were analysed on quarterly basis & also on collective basis at the end of fourth quarter. The horizontal distance and elevation of each monitoring station/target was compared with the base/first observations of the respective stations to derive amount of change in the horizontal distance of the particular monitoring station from the instrument/reference station & the change in elevation. The changes in horizontal distance & elevation of different monitoring stations as observed on different points of time during the year are shown in Tables 18 through 23. The changes in horizontal distance & elevation of different monitoring stations over a period is depicted in Figs. 5 through 10. The analysis observations/results are mentioned below:

The changes in horizontal distance & elevation across all monitoring stations located on different sides/benches of the waste dump have mostly varied up to a maximum of 2.29 cm & 6.42 cm respectively as shown in the above referred Tables & Figures. The analysis of movement observations & visual observations of the waste dump made during the course of this study does not indicate any significant instability in different sides of the waste dump but indicate an overall stability of the waste dump.





Table 1 - Monitoring observations of the south side of waste dump dated: 09/10/2018

Station No./ID	Station Location	Northing	Easting	Elevation	Horizontal Distance (m)	Slope Distance (m)
51	Check point BS	-65.4947	907.4098	400.7609	1368.6273	1368.7175
52	515 mRL E-130	129.7425	1403.4214	515.1566	1668.4610	1673.5321
53	515 mRL E-70	0.0000	0.0000	0.0000	0.0000	0.0000
54	515 mRL E-10	9.8217	1418.0756	515.7109	1737.6996	1742.6121
55	515 mRL W-40	-40.9013	1413.7663	516.4093	1759.6535	1764.5573
56	515 mRL W-100	-96.8961	1405.2969	515.5839	1782.1416	1786.9236
57	495 mRL W-120	-120.5743	1342.8584	497.2308	1743.3470	1746.9588
58	495 mRL E-110	108.0527	1357.1123	495.1414	1637.0558	1640.7580
59	495 mRL E-165	165.1600	1357.3677	495.2703	1611.5184	1615.2876
60	455 mRL E-190	188.1497	1264.4192	456.2291	1518.0000	1519.6697
61	475 mRL W-15	-13.3215	1309.3357	473.7877	1656.2953	1658.6746
62	475 mRL W-160	-159.3042	1260.2404	473.5897	1699.1653	1701.4750
63	455 mRL W-150	-151.2069	1198.6290	452.8541	1645.5164	1646.9156
64	455 mRL W-10	-7.9269	1263.3957	454.8047	1614.6718	1616.1805
65	435 mRL E-200	200.7900	1210.1065	437.6520	1463.8500	1464.7957
66	455 mRL E-188	188.1692	1264.4283	456.2434	1517.9993	1519.6697
67	435 mRL E-200	200.7965	1210.1097	437.6466	1463.8499	1464.7954
68	435 mRL E-20	22.1191	1214.8987	436.7986	1557.6331	1558.4941
69	435 mRL W-125	-126.1035	1160.6613	435.3372	1600.1687	1600.9605
73	Check points	-65.4705	907.4325	400.7423	1368.6273	1368.7173
77	475 mRL E-465	0.0000	0.0000	0.0000	0.0000	0.0000
78	475 mRL E-560	0.0000	0.0000	0.0000	0.0000	0.0000
79	475 mRL E-700	0.0000	0.0000	0.0000	0.0000	0.0000
80	495 mRL E-500	0.0000	0.0000	0.0000	0.0000	0.0000
81	495 mRL E-600	0.0000	0.0000	0.0000	0.0000	0.0000





Table 2 - Monitoring observations on the south side of waste dump dated 17/10/2018

Station No./ID	Northing	Easting	Elevation	Horizontal Distance (m)	Slope Distance (m)
51	-65.4937	907.4093	400.7764	1368.6262	1368.7157
52	129.7290	1403.4179	515.1463	1668.4638	1673.5281
53	0.0000	0.0000	0.0000	0.0000	0.0000
54	9.8092	1418.0692	515.7238	1737.7002	1742.6078
55	-40.8899	1413.7763	516.3934	1759.6561	1764.5529
56	-96.8941	1405.3031	515.5440	1782.1457	1786.9191
57	-120.5878	1342.8513	497.2196	1743.3488	1746.9549
58	108.0559	1357.1167	495.1283	1637.0582	1640.7543
59	165.1664	1357.3736	495.2567	1611.5209	1615.2838
60	188.1463	1264.4185	456.2369	1518.0009	1519.6673
61	-13.3126	1309.3433	473.7942	1656.2970	1658.6725
62	-159.3185	1260.2304	473.5946	1699.1660	1701.4719
63	-151.1968	1198.6373	452.8321	1645.5167	1646.9118
64	-7.9100	1263.4087	454.7991	1614.6735	1616.1786
65	200.7744	1210.0996	437.6468	1463.8510	1464.7937
66	188.1737	1264.4304	456.2611	1517.9992	1519.6668
67	200.8010	1210.1132	437.6372	1463.8509	1464.7933
68	22.1237	1214.9033	436.8016	1557.6345	1558.4930
69	-126.1060	1160.6614	435.3235	1600.1703	1600.9592
73	-65.4681	907.4340	400.7453	1368.6268	1368.7159
77	0.0000	0.0000	0.0000	0.0000	0.0000
78	0.0000	0.0000	0.0000	0.0000	0.0000
79	0.0000	0.0000	0.0000	0.0000	0.0000
80	0.0000	0.0000	0.0000	0.0000	0.0000
81	0.0000	0.0000	0.0000	0.0000	0.0000





Table 3 - Monitoring observations on the south side of waste dump dated 22/10/2018

Station No./ID	Northing	Easting	Elevation	Horizontal Distance (m)	Slope Distance (m)
51	-65.5053	907.4122	400.7619	1368.6273	1368.7176
52	129.7286	1403.4326	515.1139	1668.4682	1673.5309
53	0.0000	0.0000	0.0000	0.0000	0.0000
54	9.8065	1418.0810	515.7132	1737.7028	1742.6106
55	-40.8948	1413.7831	516.4386	1759.6555	1764.5566
56	-96.9030	1405.3107	515.5505	1782.1480	1786.9228
57	-120.5897	1342.8629	497.2376	1743.3505	1746.9587
58	108.0587	1357.1298	495.1323	1637.0595	1640.7568
59	165.1487	1357.3740	495.2921	1611.5200	1615.2863
60	188.1434	1264.4291	456.2220	1518.0027	1519.6694
61	-13.3232	1309.3487	473.8011	1656.2982	1658.6750
62	-159.3088	1260.2508	473.5993	1699.1674	1701.4745
63	-151.2031	1198.6442	452.8476	1645.5170	1646.9137
64	-7.9186	1263.4160	454.7738	1614.6753	1616.1803
65	200.7702	1210.1090	437.6251	1463.8522	1464.7952
66	188.1677	1264.4396	456.2490	1518.0011	1519.6691
67	200.7844	1210.1167	437.6364	1463.8526	1464.7960
68	22.1277	1214.9191	436.8002	1557.6365	1558.4960
69	-126.1110	1160.6711	435.3416	1600.1720	1600.9625
73	-65.4743	907.4413	400.7505	1368.6273	1368.7175
77	0.0000	0.0000	0.0000	0.0000	0.0000
78	0.0000	0.0000	0.0000	0.0000	0.0000
79	0.0000	0.0000	0.0000	0.0000	0.0000
80	0.0000	0.0000	0.0000	0.0000	0.0000
81	0.0000	0.0000	0.0000	0.0000	0.0000





Table 4 - Monitoring observations on the south side of waste dump dated 24/01/2019

Station No./ID	Northing	Easting	Elevation	Horizontal Distance (m)	Slope Distance (m)
51	-65.5053	907.4122	400.7619	1368.6273	1368.7176
52	129.7287	1403.4337	515.1389	1668.4781	1673.52851
53	0.0000	0.0000	0.0000	0.0000	0.00000
54	9.8104	1418.0885	515.7106	1737.7164	1742.61025
55	-40.9149	1413.7785	516.4208	1759.6710	1764.55704
56	-96.9088	1405.3118	515.5327	1782.1611	1786.92107
57	-120.5982	1342.8605	497.2359	1743.3623	1746.9585
58	108.0565	1357.1312	495.1353	1637.0707	1640.7558
59	165.1494	1357.3784	495.2642	1611.5327	1615.2844
60	188.1412	1264.4299	456.2272	1518.0133	1519.6713
61	-13.3344	1309.3435	473.7882	1656.3088	1658.6748
62	-159.3230	1260.2430	473.5978	1699.1788	1701.4759
63	-151.2169	1198.6320	452.8483	1645.5249	1646.9137
64	-7.9159	1263.4180	454.7769	1614.6844	1616.1812
65	0.0000	0.0000	0.0000	0.0000	0.0000
66	188.1675	1264.4418	456.2477	1518.0121	1519.6711
67	0.0000	0.0000	0.0000	0.0000	0.0000
68	0.0000	0.0000	0.0000	0.0000	0.0000
69	-126.1014	1160.6791	435.3293	1600.1813	1600.9651
73	-65.4981	907.4140	400.7609	1368.6327	1368.7201
77	0.0000	0.0000	0.0000	0.0000	0.0000
78	0.0000	0.0000	0.0000	0.0000	0.0000
79	0.0000	0.0000	0.0000	0.0000	0.0000
80	0.0000	0.0000	0.0000	0.0000	0.0000
81	0.0000	0.0000	0.0000	0.0000	0.0000





Table 5 - Monitoring observations on the south side of waste dump dated 20/02/2019

Station No./ID	Northing	Easting	Elevation	Horizontal Distance (m)	Slope Distance (m)
51	-65.486	907.409	400.761	1368.620	1368.708
52	129.751	1403.428	515.139	1668.463	1673.514
53	71.852	1412.738	515.544	1703.147	1708.126
54	9.809	1418.071	515.707	1737.702	1742.596
55	-40.901	1413.771	516.412	1759.657	1764.543
56	-96.886	1405.306	515.552	1782.144	1786.906
57	-120.579	1342.853	497.257	1743.345	1746.943
58	108.061	1357.117	495.133	1637.056	1640.741
59	165.160	1357.365	495.285	1611.516	1615.269
60	188.147	1264.416	456.249	1517.998	1519.657
61	-13.322	1309.334	473.792	1656.294	1658.660
62	-159.316	1260.227	473.634	1699.162	1701.461
63	-151.199	1198.627	452.852	1645.510	1646.899
64	-7.906	1263.407	454.787	1614.670	1616.167
65	0.000	0.000	0.000	0.000	0.000
66	0.000	0.000	0.000	0.000	1519.658
67	0.000	0.000	0.000	0.000	0.000
68	0.000	0.000	0.000	0.000	0.000
69	-126.092	1160.668	435.327	1600.167	1600.950
73	-65.4981	907.4140	400.7609	1368.6327	1368.7201
77	466.822	1269.944	471.844	1420.312	1422.948
78	562.493	1317.363	474.178	1442.506	1445.243
79	700.248	1376.747	473.263	1478.567	1481.183
80	503.053	1311.129	492.575	1450.280	1454.244
81	580.903	1381.917	494.943	1502.000	1505.999





Table 6 - Monitoring observations on the south side of waste dump dated 20/03/2019

Station No./ID	Northing	Easting	Elevation	Horizontal Distance (m)	Slope Distance (m)
51	-65.492	907.405	400.771	1368.622	1368.709
52	129.735	1403.423	515.142	1668.466	1673.517
53	71.847	1412.736	515.565	1703.148	1708.129
54	9.809	1418.074	515.721	1737.704	1742.599
55	-40.905	1413.772	516.428	1759.660	1764.546
56	-96.903	1405.299	515.567	1782.147	1786.909
57	-120.578	1342.859	497.233	1743.349	1746.945
58	108.062	1357.120	495.136	1637.059	1640.744
59	165.154	1357.366	495.270	1611.519	1615.272
60	188.154	1264.423	456.222	1518.001	1519.659
61	-13.320	1309.337	473.792	1656.296	1658.662
62	-159.311	1260.236	473.610	1699.166	1701.464
63	-151.201	1198.629	452.847	1645.513	1646.902
64	-7.924	1263.399	454.770	1614.673	1616.169
65	0.000	0.000	0.000	0.000	0.000
66	188.166	1264.427	456.252	1518.000	1519.659
67	0.000	0.000	0.000	0.000	0.000
68	0.000	0.000	0.000	0.000	0.000
69	-126.100	1160.665	435.324	1600.169	1600.953
73	-65.4981	907.4140	400.7609	1368.6327	1368.7201
77	466.824	1269.945	471.855	1420.313	1422.949
78	562.483	1317.360	474.177	1442.506	1445.242
79	700.244	1376.748	473.270	1478.569	1481.185
80	503.049	1311.130	492.559	1450.283	1454.246
81	580.907	1381.918	494.941	1502.000	1505.999





Table 7 - Monitoring observations on the south side of waste dump dated 24/04/2019

Station No./ID	Northing	Easting	Elevation	Horizontal Distance (m)	Slope Distance (m)
51	-65.483	907.392	400.773	1368.627	1368.717
52	129.755	1403.410	515.119	1668.467	1673.517
53	71.854	1412.715	515.560	1703.146	1708.129
54	9.821	1418.055	515.730	1737.703	1742.600
55	-40.895	1413.752	516.428	1759.659	1764.547
56	-96.886	1405.282	515.561	1782.145	1786.909
57	-120.573	1342.834	497.250	1743.347	1746.947
58	108.078	1357.106	495.112	1637.060	1640.745
59	165.170	1357.349	495.269	1611.518	1615.273
60	188.172	1264.410	456.228	1518.002	1519.663
61	-13.302	1309.321	473.783	1656.294	1658.662
62	-159.295	1260.222	473.592	1699.166	1701.465
63	-151.196	1198.607	452.840	1645.513	1646.904
64	-7.905	1263.385	454.800	1614.672	1616.172
65	0.000	0.000	0.000	0.000	0.000
66	188.181	1264.413	456.249	1518.001	1519.663
67	0.000	0.000	0.000	0.000	0.000
68	0.000	0.000	0.000	0.000	0.000
69	-126.085	1160.652	435.307	1600.171	1600.957
73	-65.483	907.392	400.773	1368.627	1368.717
77	466.741	1269.900	471.796	1420.314	1422.949
78	562.395	1317.314	474.114	1442.500	1445.236
79	700.154	1376.718	473.218	1478.570	1481.186
80	503.059	1311.108	492.550	1450.280	1454.244
81	580.910	1381.888	494.937	1501.991	1505.992





**Table 8 - Monitoring observations on the west side of waste dump dated 25/08/2018**

Station No./ID	Station Location	Northing	Easting	Elevation	Horizontal Distance (m)	Slope Distance (m)
1	Check point	-1765.6355	1969.9978	392.1091		
5	435 mRL N-1875	-1401.4750	1881.7911	432.6301	374.6909	376.8512
6	435 mRL N-2100	-1392.6896	2112.3658	435.6285	399.1958	401.5366
7	455 mRL N-2050	-1343.4378	2051.2440	456.9936	429.9440	434.7792
8	455 mRL N-1875	-1347.1201	1889.6296	455.4596	426.1621	430.8122
9	Check point	-1706.2479	1980.4420	389.1300	60.2990	60.3848
10	495 mRL N-2000	-1259.3173	1993.2075	496.4562	506.8499	517.4357
11	495 mRL N-2050	-1251.9648	2059.6044	497.8962	521.4278	532.0076
12	495 mRL N-2150	-1257.3732	2144.3409	496.4961	537.3324	547.3371
13	475 mRL N-2250	-1324.6003	2262.0823	473.7390	528.9853	535.2136
14	475 mRL N-2150	-1305.9162	2137.6263	474.5837	489.3273	496.1926
15	475 mRL N-1950	-1306.7680	1966.2910	475.2734	458.8824	466.3181
21	435 mRL N-2110	0.0000	0.0000	0.0000	0.0000	0.0000
22	435 mRL N-2335	0.0000	0.0000	0.0000	0.0000	0.0000
23	455 mRL N-2375	0.0000	0.0000	0.0000	0.0000	0.0000
24	495 mRL N-2315	0.0000	0.0000	0.0000	0.0000	0.0000

**Table 9 - Monitoring observations on the west side of waste dump dated 22/10/2018**

Station No./ID	Northing	Easting	Elevation	Horizontal Distance (m)	Slope Distance (m)
1	-1765.6355	1969.9978	392.1091		
5	-1401.4803	1881.7897	432.6340	374.6861	376.8469
6	-1392.6990	2112.3624	435.6347	399.1858	401.5274
7	-1343.4474	2051.2425	457.0091	429.9342	434.7718
8	-1347.1257	1889.6286	455.4726	426.1569	430.8089
9	-1706.2429	1980.4433	389.1302	60.3041	60.3899
10	-1259.3376	1993.1760	496.4555	506.8282	517.4143
11	-1251.9771	2059.5754	497.9387	521.4107	531.9993
12	-1257.3733	2144.2970	496.5210	537.3180	547.3277
13	-1324.6071	2262.0706	473.7621	528.9731	535.2051
14	-1305.9178	2137.5883	474.6130	489.3127	496.1831
15	-1306.7833	1966.2518	475.3183	458.8675	466.3114
21	0.0000	0.0000	0.0000	0.0000	0.0000
22	0.0000	0.0000	0.0000	0.0000	0.0000
23	0.0000	0.0000	0.0000	0.0000	0.0000
24	0.0000	0.0000	0.0000	0.0000	0.0000





Table 10 - Monitoring observations on the west side of waste dump dated 24/01/2019

Station No./ID	Northing	Easting	Elevation	Horizontal Distance (m)	Slope Distance (m)
1	-1765.636	1969.9978	392.109		
5	-1401.4749	1881.7915	432.6372	374.6909	376.8521
6	-1392.6898	2112.3628	435.6374	399.1945	401.5363
7	-1343.4389	2051.2415	457.0114	429.9424	434.7802
8	-1347.1173	1889.6284	455.4777	426.1652	430.8179
9	-1706.2316	1980.4445	389.1292	60.3155	60.4013
10	-1259.3406	1993.1736	496.4595	506.8251	517.4121
11	-1251.9691	2059.5740	497.9362	521.4183	532.0063
12	-1257.3661	2144.2959	496.5235	537.3245	547.3346
13	-1324.6005	2262.0732	473.7651	528.9801	535.2125
14	-1305.9122	2137.5943	474.6074	489.3200	496.1894
15	-1306.7751	1966.2474	475.3182	458.8757	466.3195
21	-1392.6878	2112.3518	435.6536	399.1925	401.5361
22	-1427.5083	2335.3813	434.8736	497.8304	499.6451
23	-1376.4750	2375.3488	454.8391	561.9211	565.3881
24	-1271.1754	2314.7264	497.2293	602.7674	611.8291

Table 11 - Monitoring observations on the west side of waste dump dated 20/02/2019

Station No./ID	Northing	Easting	Elevation	Horizontal Distance (m)	Slope Distance (m)
1	-1765.636	1969.9978	392.109		
5	-1401.478	1881.791	432.637	374.688	376.849
6	-1392.694	2112.365	435.638	399.191	401.533
7	-1343.443	2051.245	457.003	429.939	434.776
8	-1347.120	1889.628	455.473	426.162	430.814
9	-1706.239	1980.443	389.130	60.308	60.394
10	-1259.346	1993.171	496.457	506.820	517.406
11	-1251.975	2059.581	497.935	521.413	532.001
12	-1257.372	2144.295	496.526	537.319	547.329
13	-1324.605	2262.073	473.765	528.976	535.208
14	-1305.917	2137.592	474.616	489.314	496.185
15	-1306.780	1966.248	475.320	458.871	466.315
21	-1392.696	2112.363	435.652	399.189	401.532
22	-1427.511	2335.379	434.876	497.827	499.642
23	-1376.476	2375.344	454.834	561.918	565.384
24	-1271.182	2314.725	497.224	602.761	611.822





Table 12 - Monitoring observations on the west side of waste dump dated 20/03/2019

Station No./ID	Northing	Easting	Elevation	Horizontal Distance (m)	Slope Distance (m)
1	-1765.636	1969.9978	392.109		
5	-1401.481	1881.793	432.638	374.685	376.846
6	-1392.698	2112.363	435.641	399.187	401.530
7	-1343.444	2051.241	457.008	429.937	434.774
8	-1347.122	1889.633	455.472	426.160	430.812
9	-1706.239	1980.443	389.130	60.308	60.394
10	-1259.351	1993.174	496.458	506.814	517.401
11	-1251.978	2059.579	497.937	521.410	531.998
12	-1257.324	2144.314	496.540	537.370	547.383
13	-1324.608	2262.073	473.755	528.974	535.204
14	-1305.919	2137.590	474.608	489.312	496.181
15	-1306.782	1966.250	475.316	458.869	466.312
21	-1392.688	2112.339	435.647	399.188	401.530
22	-1427.516	2335.378	434.877	497.823	499.638
23	-1376.479	2375.341	454.837	561.913	565.380
24	-1271.188	2314.723	497.218	602.755	611.815

Table 13 - Monitoring observations on the west side of waste dump dated 24/04/2019)

Station No./ID	Northing	Easting	Elevation	Horizontal Distance (m)	Slope Distance (m)
1	-1765.636	1969.9978	392.109		60.382
5	-1401.480	1881.791	432.645	374.686	376.848
6	-1392.697	2112.364	435.652	399.189	401.532
7	-1343.444	2051.240	457.019	429.937	434.776
8	-1347.122	1889.631	455.489	426.160	430.815
9	-1706.243	1980.435	389.245	60.303	60.383
10	0.000	0.000	0.000	0.000	0.000
11	0.000	0.000	0.000	0.000	0.000
12	0.000	0.000	0.000	0.000	0.000
13	0.000	0.000	0.000	0.000	0.000
14	0.000	0.000	0.000	0.000	0.000
15	0.000	0.000	0.000	0.000	0.000
21	-1392.691	2112.346	435.661	399.188	401.532
22	-1427.513	2335.377	434.893	497.824	499.640
23	-1376.477	2375.340	454.863	561.913	565.383
24	-1271.193	2314.724	497.242	602.752	611.816





Table 14 - Monitoring observations on the North/NW side of waste dump dated 24/01/2019

Station No./ID	Station Location	Northing	Easting	Elevation	Horizontal Distance (m)	Slope Distance (m)
102	455 mRL W-1275	-1272.3473	2442.6355	453.8944	297.9449	304.7670
103	455 mRL W-1150	-1159.6767	2442.2284	454.5462	295.1965	302.2197
104	455 mRL W-1075	-1076.2948	2471.7884	454.3076	292.8497	299.8764
105	475 mRL W-1225	-1232.7488	2394.4308	472.3537	339.9794	349.8660
106	435 mRL W-1375	-1379.4853	2501.6102	433.9680	288.5629	291.9279
107	435 mRL W-1200	0.0000	0.0000	0.0000	0.0000	0.0000
108	435 mRL W-1050	-1045.4616	2557.9215	430.6164	239.0677	242.5314
109	475 mRL W-1100	-1110.9930	2405.6214	474.0500	341.8389	352.0754
110	475 mRL W-1200	-831.9606	2490.1706	477.8858	447.6640	456.2552
111	BS SIDE NW	-1210.3964	2689.5827	388.4768	43.9865	44.0058
112	BS SIDENM	-622.3925	2882.3264	390.0359	18.5485	18.6159
113	475 mRL W-700	-707.1925	2534.2544	477.0727	364.0427	373.9401
114	435 mRL W-675	-671.5582	2665.3263	437.4748	228.2672	232.8283
115	475 mRL W-600	-580.0466	2581.0949	478.0348	303.1698	315.2473
116	475 mRL W-450	-445.3947	2643.5190	472.1307	287.4416	298.5059
117	435 mRL W-500	0.0000	0.0000	0.0000	0.0000	0.0000
118	435 mRL W-300	0.0000	0.0000	0.0000	0.0000	0.0000
119	BS SIDENM	-622.3925	2882.3264	390.0358	18.5485	18.6159
120	BS SIDENM	-622.3924	2882.3264	390.0358	18.5484	18.6158
121	535 mRL W-400	-418.0616	2487.7458	536.5147	437.0466	460.4441
122	520 mRL W-500	-499.3568	2511.9402	520.3416	385.8127	406.7234
123	535 mRL W-600	-577.3242	2446.9290	534.6469	437.2048	460.0100
124	535 mRL W-700	-696.1091	2378.8994	535.5119	512.7915	532.6033
125	520 mRL W-650	-650.5110	2449.9489	519.9829	435.8807	454.3931
126	520 mRL W-800	-797.2445	2387.0135	519.1913	532.6542	547.7234
127	520 mRL W-900	-893.1528	2365.3120	519.1252	593.3158	606.8677
128	520 mRL W-950	-965.4610	2346.7120	517.8224	647.0727	659.2713
129	BS SIDENM	-622.3926	2882.3260	390.0374	18.5486	18.6159





Table 15 - Monitoring observations on the North/NW side of waste dump dated 20/02/2019

Station No./ID	Northing	Easting	Elevation	Horizontal Distance (m)	Slope Distance (m)
102	0	0	0	0	0
103	0	0	0	0	0
104	0	0	0	0	0
105	-1232.753	2394.434	472.348	339.977	349.862
106	-1379.483	2501.613	433.970	288.559	291.924
107	0	0	0	0	0
108	0	0	0	0	0
109					
110	-831.964	2490.176	477.881	447.658	456.249
111	0	0	0	0	0
112	-622.392	2882.326	390.044	18.548	18.615
113	0	0	0	0	0
114	0	0	0	0	0
115	0	0	0	0	0
116	0	0	0	0	0
117	0	0	0	0	0
118	-297.780	2824.976	433.118	311.604	314.356
119	-622.392	2882.327	390.044	18.548	18.615
120	-622.392	2882.327	390.044	18.548	18.615
121	-418.043	2487.768	536.509	437.034	460.430
122	-499.333	2511.954	520.334	385.806	406.715
123	-577.297	2446.935	534.622	437.200	459.998
124	-696.075	2378.903	535.504	512.782	532.591
125	-650.507	2449.960	519.982	435.869	454.382
126	-797.238	2387.020	519.194	532.646	547.716
127	-893.152	2365.321	519.127	593.308	606.860
128	-965.460	2346.719	517.820	647.066	659.264
129	-622.392	2882.326	390.038	18.548	18.615
151	-1258.333	2483.540	433.242	255.020	259.042
152	-1193.360	2705.139	387.637	31.781	31.782
153	-1119.652	2498.610	433.132	250.848	254.916





Table 16 - Monitoring observations on the North/NW side of waste dump dated 20/03/2019

Station No./ID	Northing	Easting	Elevation	Horizontal Distance (m)	Slope Distance (m)
102	-1272.336	2442.634	453.893	297.944	304.766
103	-1159.662	2442.232	454.543	295.195	302.217
104	-1076.284	2471.795	454.303	292.849	299.875
105	-1232.734	2394.431	472.352	339.978	349.864
106	-1379.471	2501.602	433.967	288.561	291.926
107	0.000	0.000	0.000	0.000	0.000
108	0.000	0.000	0.000	0.000	0.000
109	0.000	0.000	0.000	0.000	0.000
110	0.000	0.000	0.000	0.000	0.000
111	0.000	0.000	0.000	0.000	0.000
112	-622.394	2882.328	390.042	18.550	18.617
113	0.000	0.000	0.000	0.000	0.000
114	-671.574	2665.334	437.479	228.265	232.827
115	-580.068	2581.097	478.037	303.166	315.244
116	-445.414	2643.509	472.132	287.439	298.504
118	-297.785	2824.933	433.118	311.606	314.358
119	-622.394	2882.328	390.042	18.550	18.617
120	-622.394	2882.328	390.042	18.550	18.617
121	-418.100	2487.734	536.511	437.041	460.437
122	-499.391	2511.934	520.339	385.809	406.720
123	-577.363	2446.932	534.643	437.200	460.004
124	-696.155	2378.911	535.507	512.788	532.598
125	-650.506	2449.953	519.983	435.876	454.388
126	-797.245	2387.016	519.194	532.652	547.722
127	-893.153	2365.313	519.121	593.315	606.866
128	-965.458	2346.711	517.818	647.072	659.270
129	-622.393	2882.326	390.038	18.549	18.617
151	-1258.333	2483.540	433.242	255.020	259.042
152	-1193.360	2705.139	387.637	31.781	31.782
153	-1119.6518	2498.6102	433.1319	250.8480	254.9159





Table 17 - Monitoring observations on the North/NW side of waste dump dated 24/04/2019

Station No./ID	Northing	Easting	Elevation	Horizontal Distance (m)	Slope Distance (m)	Remark
109	-1111.155	2401.724	472.953	345.533	355.878	first reading
110	--	--	--	--	--	
111	--	--	--	--	--	
112	-622.392	2882.327	390.029	18.548	18.616	
119	-622.392	2882.332	390.030	18.548	18.616	
120	-622.392	2882.332	390.030	18.548	18.616	
121	-418.184	2487.712	536.487	437.025	460.415	
122	-499.485	2511.916	520.317	385.801	406.704	
123	-577.469	2446.937	534.612	437.188	459.983	
124	-696.273	2378.946	535.485	512.776	532.581	
125	-650.507	2449.971	519.975	435.858	454.369	
126	-797.236	2387.022	519.178	532.643	547.709	
127	-893.151	2365.325	519.120	593.304	606.855	
128	0.000	0.000	0.000	0.000	0.000	
129	-622.393	2882.326	390.037	18.549	18.617	
130	-1258.314	2483.535	433.358	255.021	259.063	
131	-1193.362	2705.143	387.637	31.777	31.778	
132	-1119.629	2498.615	433.254	250.852	254.941	first reading
154	-1300.354	2440.592	453.441	307.194	314.135	first reading
155	-1160.233	2439.222	453.401	298.074	305.214	first reading
156	-1039.043	2491.465	453.554	295.007	302.253	first reading
157	-873.101	2589.371	435.050	364.340	367.395	first reading
158	-1380.468	2497.777	432.974	292.232	295.707	first reading
159	-769.990	2619.130	439.458	312.083	316.038	first reading
160	-590.294	2697.841	433.269	185.982	191.036	first reading
161	-458.900	2767.190	429.238	185.754	189.932	first reading
162	-640.936	2573.250	476.843	312.285	324.239	first reading
163	-406.103	2673.873	470.660	288.068	299.252	first reading





Table 18 - Change in elevation of different monitoring stations on the south side

Station No./ID	Elevation (m) June 2018	Base/Initial Reading	Change in elevation at different points of time (cm)					
		Elevation (m) 09/10/18	17/10/18	22/10/18	24/01/19	20/02/2019	20/03/19	24/04/19
52	515.2107	515.1566	-1.03	-4.27	-1.77	-1.78	-1.44	-3.78
53	515.6988	0.0000	0.00	0.00	0.00	0.00	0.00	0.00
54	515.9689	515.7109	1.29	0.24	-0.03	-0.35	1.03	1.87
55	515.462	516.4093	-1.59	2.93	1.15	0.26	1.90	1.87
56	515.5984	515.5839	-3.99	-3.34	-5.12	-3.18	-1.72	-2.34
57	497.3308	497.2308	-1.12	0.68	0.50	2.66	0.19	1.96
58	496.3372	495.1414	-1.31	-0.91	-0.61	-0.89	-0.58	-2.99
59	495.6048	495.2703	-1.36	2.17	-0.61	1.49	0.01	-0.14
60	452.7482	456.2291	0.77	-0.71	-0.19	2.02	-0.76	-0.14
61	475.3971	473.7877	0.65	1.33	0.05	0.39	0.47	-0.51
62	473.8391	473.5897	0.48	0.96	0.81	4.45	1.99	0.20
63	454.9129	452.8541	-2.19	-0.65	-0.58	-0.21	-0.72	-1.36
64	456.3345	454.8047	-0.56	-3.10	-2.79	-1.77	-3.47	-0.43
65	437.4976	437.6520	-0.51	-2.69	0.00	0.00	0.00	0.00
66	436.8263	456.2434	1.77	0.56	0.43	-0.11	0.85	0.55
67	435.4439	437.6466	-0.94	-1.02	0.00	0.00	0.00	0.00
68	-	436.7986	0.30	0.16	0.00	0.00	0.00	0.00
69	-	435.3372	-1.37	0.44	-0.78	-1.04	-1.32	-2.99
77	-	471.844	-	-	-	-	1.18	-4.77
78	-	474.178	-	-	-	-	-0.12	-6.42
79	-	473.263	-	-	-	-	0.74	-4.43
80	-	492.575	-	-	-	-	-1.56	-2.44
81	-	494.943	-	-	-	-	-0.17	-0.58





Table 19 - Change in the horizontal distance of different monitoring stations on the south

Station No./ID	Horizontal Distance (m) June 18	Base/Initial Reading	Change in Horizontal Distance, Hd (cm)					
		Hd (m) 09/10/18	17/10/18	22/10/18	24/01/19	20/02/19	20/03/19	24/04/19
52	1705.4881	1668.4610	0.29	0.72	1.72	0.25	0.56	0.56
53	1734.1790	0.0000	0.00	0.00	0.00	0.00	0.00	0.00
54	1762.2829	1737.6996	0.06	0.32	1.69	0.24	0.36	0.36
55	1778.673	1759.6535	0.26	0.20	1.74	0.36	0.52	0.52
56	1794.9259	1782.1416	0.41	0.64	1.94	0.24	0.36	0.36
57	1749.9753	1743.3470	0.18	0.35	1.53	-0.15	0.04	0.04
58	1742.0106	1637.0558	0.24	0.37	1.49	0.06	0.38	0.38
59	1717.3099	1611.5184	0.25	0.16	1.42	-0.22	-0.01	-0.01
60	1639.3627	1518.0000	0.09	0.27	1.33	-0.16	0.23	0.23
61	1596.9947	1656.2953	0.17	0.29	1.35	-0.15	-0.15	-0.15
62	1672.2866	1699.1653	0.07	0.21	1.34	-0.31	0.05	0.05
63	1628.4419	1645.5164	0.03	0.06	0.86	-0.63	-0.31	-0.31
64	1555.0247	1614.6718	0.17	0.35	1.27	-0.19	0.02	0.02
65	1499.6067	1463.8500	0.10	0.23	0.00	0.00	0.00	0.00
66	1571.7536	1517.9993	-0.01	0.18	1.28	-0.03	0.21	0.21
67	1593.8235	1463.8499	0.10	0.28	0.00	0.00	0.00	0.00
68	-	1557.6331	0.14	0.34	0.00	0.00	0.00	0.00
69	-	1600.1687	0.16	0.33	1.26	-0.22	0.22	0.22
77	-	-	-	-	-	-	0.18	0.18
78	-	-	-	-	-	-	-0.59	-0.59
79	-	-	-	-	-	-	0.34	0.34
80	-	-	-	-	-	-	-0.01	-0.01
81	-	-	-	-	-	-	-0.93	-0.93



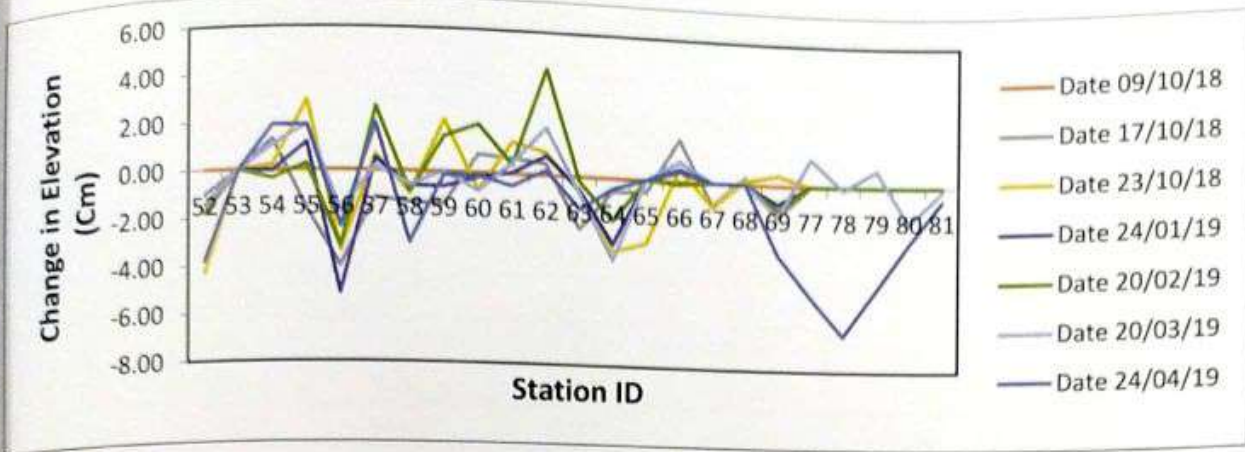


Fig 5 - Change in elevation of different monitoring stations on the south side

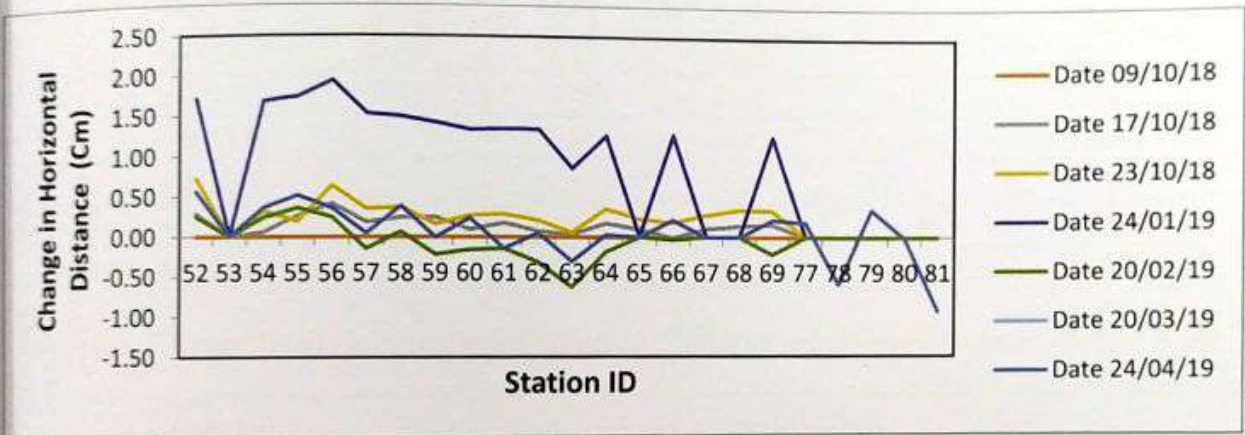


Fig. 6 - Change in horizontal distance of different monitoring stations on the south side





**Table 20 - Change in elevation of different monitoring stations on the west side**

Station No./ID	Base/Initial Reading	Change in Elevation (cm)				
	Elevation(m) 25/08/2018	23/10/18	24/01/19	20/02/19	20/03/19	24/04/19
5	432.6301	0.39	0.70	0.69	0.78	1.46
6	435.6285	0.62	0.90	0.96	1.27	2.36
7	456.9936	1.55	1.78	0.96	1.42	2.53
8	455.4596	1.30	1.81	1.34	1.20	2.92
10	496.4562	-0.07	0.33	0.05	0.22	0.00
11	497.8962	4.25	4.00	3.83	4.10	0.00
12	496.4961	2.49	2.74	2.96	4.39	0.00
13	473.7390	2.32	2.61	2.56	1.61	0.00
14	474.5837	2.94	2.37	3.20	2.46	0.00
15	475.2734	4.49	4.49	4.71	4.22	0.00
21	435.6536	--	--	-0.11	-0.65	0.69
22	434.8736	--	--	0.27	0.35	1.95
23	454.8391	--	--	-0.56	-0.20	2.42
24	497.2293	--	--	-0.57	-1.16	1.23

**Table 21 - Change in the horizontal distance of different monitoring stations on the West**

Station No./ID	Base/Initial Reading	Change in Horizontal Distance (cm)				
	Horizontal Distance (m) 25/08/2018	23/10/18	24/01/19	20/02/19	20/03/19	24/04/19
5	374.6909	-0.47	0.01	-0.28	-0.58	-0.49
6	399.1958	-0.99	-0.13	-0.47	-0.83	-0.71
7	429.9440	-0.98	-0.16	-0.45	-0.72	-0.72
8	426.1621	-0.53	0.30	0.03	-0.19	-0.17
10	506.8499	-2.17	-2.48	-3.01	-3.56	0.00
11	521.4278	-1.71	-0.94	-1.45	3.79	0.00
12	537.3324	-1.44	-0.79	-1.35	-1.17	0.00
13	528.9853	-1.22	-0.52	-0.96	-1.56	0.00
14	489.3273	-1.46	-0.73	-1.28	-1.36	0.00
15	458.8824	-1.49	-0.67	-1.13	-0.49	-0.49
21	399.1925	0.00	0.00	-0.37	-0.74	-0.65
22	497.8304	0.00	0.00	-0.35	-0.82	-0.76
23	561.9211	0.00	0.00	-0.36	-1.20	-1.57
24	602.7674	0.00	0.00	-0.63		



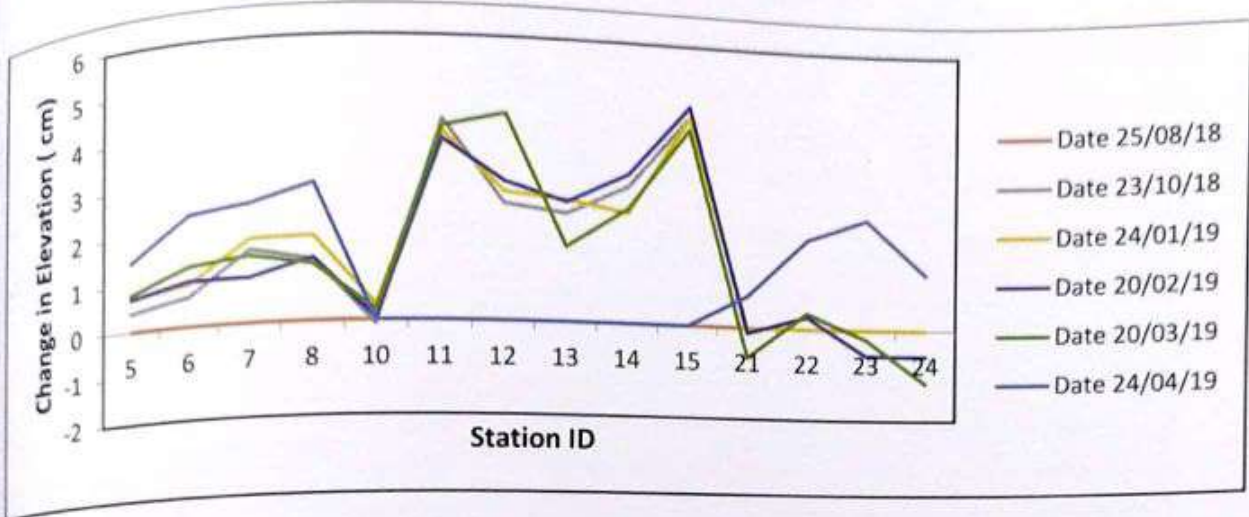


Fig. 7 - Change in elevation of different monitoring stations on the west side

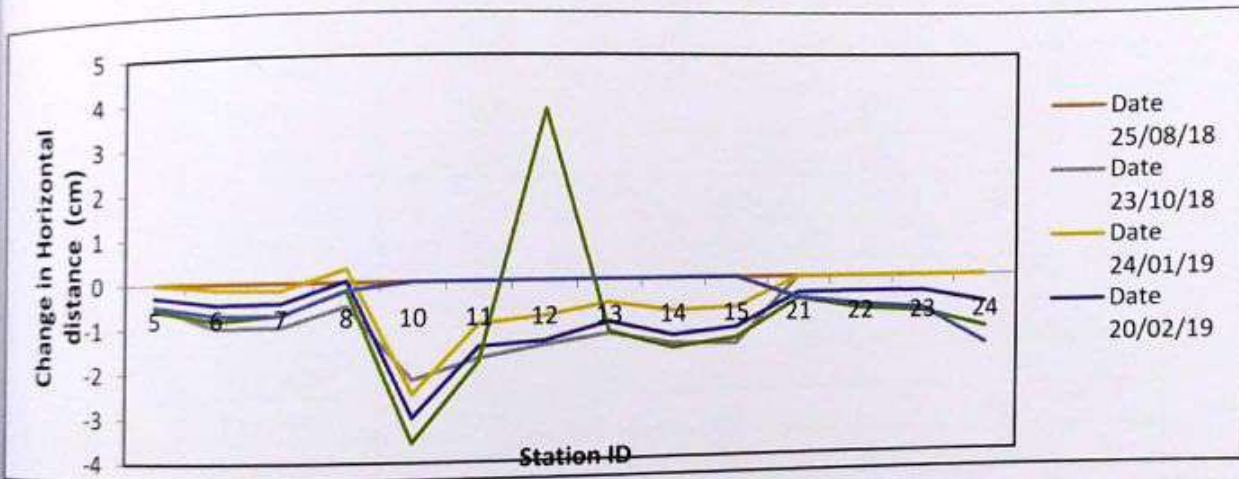


Fig. 8 - Change in horizontal distance of different monitoring stations on the west side



Table 22 - Change in the elevation of different monitoring stations on the North/NW side

Station No./ID	Base/Initial Reading	Change in Elevation (cm)		
	Elevation(m) 24/01/2019	20/02/2019	20/03/2019	24/04/2019
102	453.8944	0.0	-0.2	0.0
103	454.5462	0.0	-0.3	0.0
104	454.3076	0.0	-0.4	0.0
105	472.3537	-0.5	-0.2	0.0
106	433.9680	0.2	-0.1	0.0
107	0.0000	0.0	0.0	0.0
110	477.8858	-0.5	0.0	0.0
113	477.0727	0.0	0.0	0.0
114	437.4748	0.0	0.4	0.0
115	478.0348	0.0	0.3	0.0
116	472.1307	0.0	0.1	0.0
118	0.0000	0.0	0.0	-0.6
121	536.5147	-0.5	-0.3	-2.5
122	520.3416	-0.8	-0.2	-3.5
123	534.6469	-2.5	-0.4	-2.7
124	535.5119	-0.8	-0.5	-0.8
125	519.9829	0.0	0.0	-1.4
126	519.1913	0.3	0.3	-0.5
127	519.1252	0.2	-0.4	--
128	517.8224	-0.2	-0.4	--





**Table 23 - Change in horizontal distance of monitoring stations on the North/NW side**

Station No./ID	Base/Initial Reading	Change in Horizontal Distance(cm)		
	Horizontal Distance(m) 24/01/2019	20/02/2019	20/03/2019	24/04/2019
102	297.9449	0.00	-0.09	0.00
103	295.1965	0.00	-0.16	0.00
104	292.8497	0.00	-0.07	0.00
105	339.9794	-0.28	-0.17	0.00
106	288.5629	-0.41	-0.15	0.00
107	0.0000	0.00	0.00	0.00
110	447.6640	-0.57	0.00	0.00
113	364.0427	0.00	0.00	0.00
114	228.2672	0.00	-0.26	0.00
115	303.1698	0.00	-0.42	0.00
116	287.4416	0.00	-0.28	0.00
118	0.0000	0.00	0.00	0.00
121	437.0466	-1.27	-0.60	-2.14
122	385.8127	-0.66	-0.33	-1.17
123	437.2048	-0.47	-0.51	-1.69
124	512.7915	-0.99	-0.35	-1.59
125	435.8807	-1.14	-0.48	-2.29
126	532.6542	-0.80	-0.24	-1.11
127	593.3158	-0.82	-0.08	-1.20
128	647.0727	-0.67	-0.07	0.00

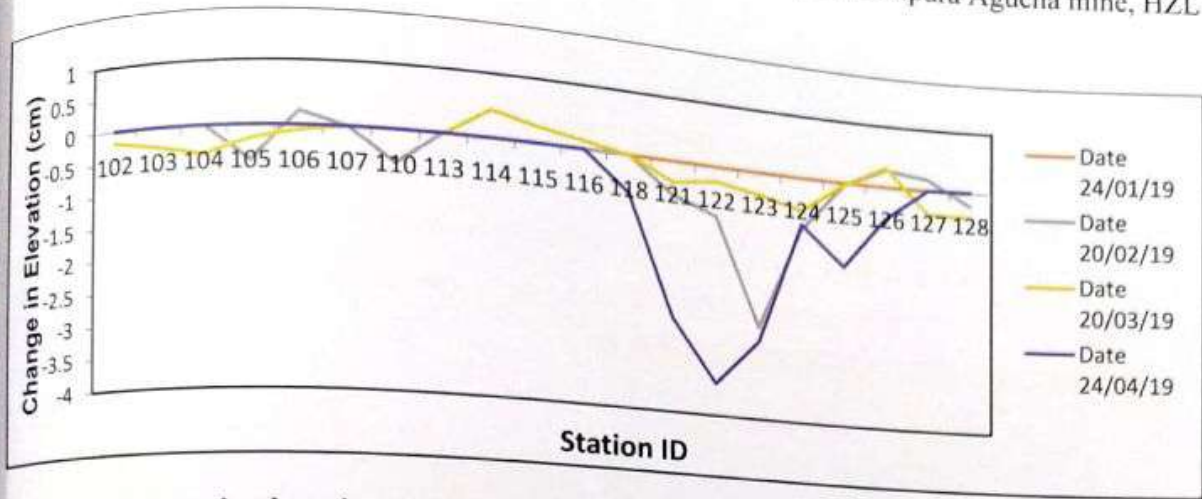


Fig. 9 - Change in elevation of different monitoring stations on the north/north-west side

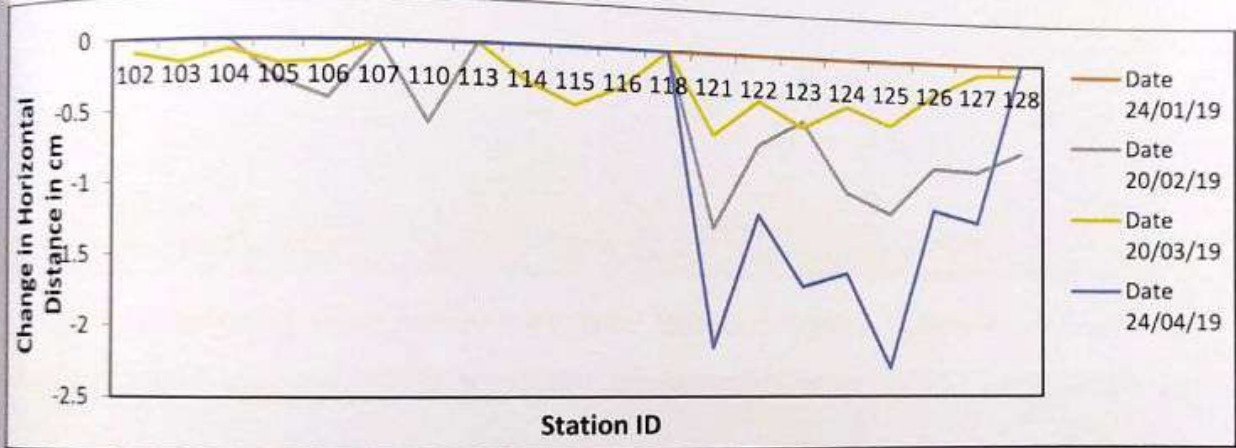


Fig. 10 - Change in horizontal distance of different monitoring stations on the north/NW side





### 4.3.2 3D Laser Scanner Based Monitoring

The south/pit side of the waste dump was scanned with the help of a 3D laser scanner (Model: Polaris TLS 1600) (Figs. 11 & 12). Two scans were made one each in the month of June & October, 2018. The two scans were compared for change detection, if any. The scan results have not shown any significant change in the surface on this side of the waste dump (Fig. 13).



Fig. 11 - Monitoring observations with Total Station & Optech Polaris Laser Scanner

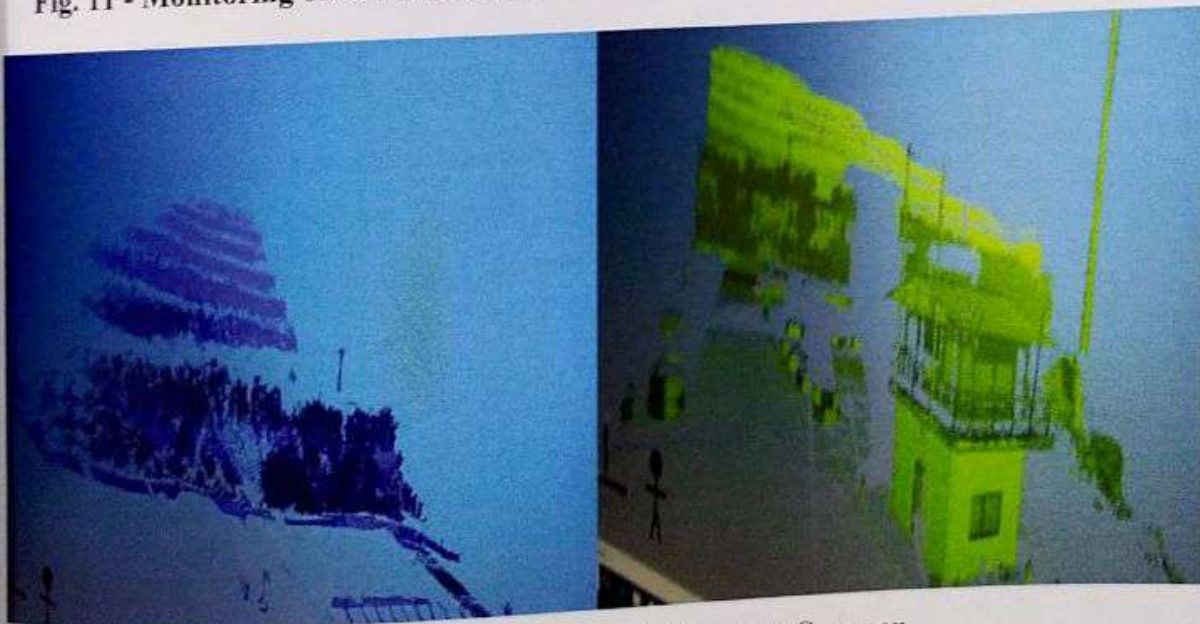


Fig 12 - Processed images in 3D Laser Scanner



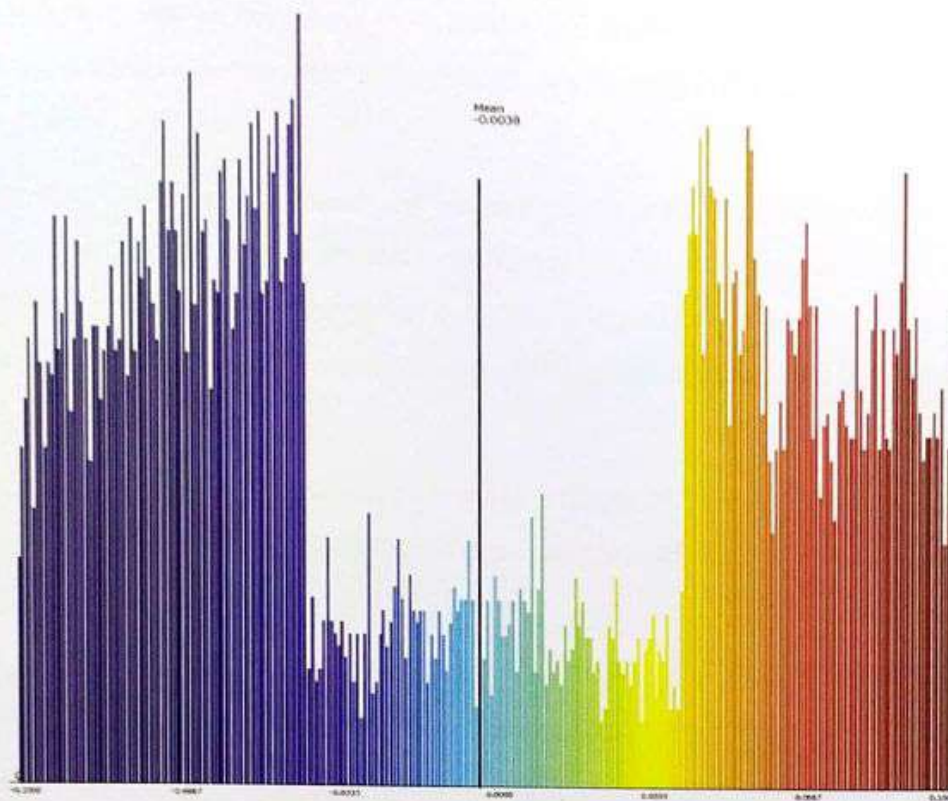


Fig. 13 - An output of the change detection by laser scanner in the south side of waste dump

## 5.0 CONCLUSIONS AND RECOMMENDATIONS

The changes in horizontal distance & elevation across all monitoring stations located on different sides/benches of the waste dump have varied up to a maximum of 2.29 cm & 6.42 cm respectively as indicated from the analysis of movement observations.

The analysis of movement observations & visual observations of the waste dump made during the course of this study does not indicate any significant instability in different sides of the waste dump. The waste dump currently appears to be stable from on an overall stability basis. However, the following recommendations/suggestions are made to further improve the stability and to ensure the waste dump stability in future.

It is suggested that systematic slope monitoring be implemented for all the sides of waste dump and accordingly, monitoring stations at an interval of around 200-300 m be installed on alternate benches on a staggered pattern on East, North-East & SE sides, which are still uncovered from systematic monitoring.





The application of Geotextiles or any other means be implemented to establish vegetation cover on waste dump bench slope surfaces to protect dump slopes against erosion due to wind & water and to improve its stability.

Water should not be allowed to accumulate on the bench floors & on top of the dump. Appropriate drainage measures be put in place in the form of drains on every bench connecting to main garland drain at the bottom level. It is essential that these drains should be kept clear of silt and debris. The benches should have toe drains. These drains should be again interconnected to drain out rainwater away from the dump area.

At some place, gullies are formed due to water induced erosion, which may lead to further deterioration, it is therefore suggested that such gullies/voids be repaired through proper dozing of waste material.

Additional of heap of waste material should not be left on the benches. It should be cleaned and the gradient of the bench should be maintained so as to ensure smooth flow of rain water to lower level in a planned way.

The systematic monitoring of waste dump stability should be continued and the movement observations be scientifically analyzed to evaluate any potential signs of instability & to implement appropriate corrective measures. In addition to the total station based monitoring, the waste dump should be thoroughly inspected on a regular basis especially during the monsoon & post monsoon period to identify any indications of instability including the development of tension cracks anywhere on the waste dump surface. In the case of tension crack, it must be properly filled with waste material and should be monitoring for its further progression.

## 6.0 ACKNOWLEDGEMENTS

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## 7.0 REFERENCES

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- (ii) CIMFR PIT & DUMP SLOPE MONITORING REPORT 2017-18
- (iii) CIMFR Report 140 meters waste dump
- (iv) User's Manual, Polarix TLS 3D Laser Scanner
- (v) Mining Plan & Section, Rampura Agucha Mine, HZL.



Annexure I

THE FIRST VISIT REPORT OF CIMFR ON WASTE DUMP STABILITY AT RAMPURA-AGUCHA MINE, HZL

The first visit of CIMFR team consisting of Dr. J. C. Jhanwar (Chief Scientist) & Mr. A. G. Sangode (Sr. Technical Officer) with regard to slope stability assessment/slope monitoring of waste dump at Rampura-Agucha mine was made during 20-22 June, 2018. From the RAM, Mr. Subhadip Adak, Mr. Avijit Bhunia & Mr. T R Chaudhary were associated in the field study/visit. During this period, the team undertook a comprehensive reconnaissance of waste dump to make a practical assessment of the overall stability of waste dump. The slope monitoring measurements/readings were taken by the Survey team of RAM using Total Station in the presence of CIMFR scientists (Table 1). A total of 19 numbers of monitoring stations/prisms were installed on various dump benches/locations. The Instrument/Reference station was located in the H/W side of open pit. In addition to above, a Terrestrial 3D laser scanner was used by CIMFR team to scan the waste dump side facing the open pit from a permanent station near the tower. A surface plan & sections of waste dump and soft copies of relevant reports were collected during this visit.

The following observations are made on this subject:

- i. The waste dump has a maximum height of 140 m with 07 benches each of 20 m height. The visual observations & previous slope monitoring records indicate overall stability of waste dump.
- ii. Monitoring stations are currently located only on the south side of waste dump facing the open pit and the other sides are devoid of any monitoring stations. It is suggested that systematic slope monitoring be implemented for all the slope sides and accordingly, monitoring stations on different benches at an interval of around 200-300 m be installed on other sides as well covering the North & North-West sides of waste dump, especially where the lease-hold boundary is within 50 m of the dump toe. Similarly, Instrument stations will be required at appropriate locations to monitor above proposed monitoring stations.
- iii. The application of Geotextiles be continued to establish vegetation cover on waste dump bench slope surfaces to protect dump slopes against erosion due to wind & water and to improve its stability.





- iv. Water should not be allowed to accumulate on the bench floors & on top of the dump. Appropriate drainage measures be put in place in the form of drains on every bench connecting to main garland drain at the bottom level.

**Table 1 - Slope monitoring observations of waste dump at RAM using Total station**

POINT ID	ID	Survey date	X	Y	Z	H. DIST. from sta-1	SLOPE DIST. from sta 1
st-1	station1	21-Jun-18	693.8075	206.1604	342.2642		
st-2	Station2	21-Jun-18	-131.6695	125.9116	333.1709	889.7663	889.8122
1	435 mRL	21-Jun-18	200.8117	1210.0971	437.4976	1499.6067	1502.6238
2	435 mRL	21-Jun-18	22.0424	1214.8045	436.8263	1571.7536	1574.5930
3	435 mRL	21-Jun-18	-126.2539	1160.5044	435.4439	1593.8235	1596.5427
4	455mRL	21-Jun-18	-151.1734	1198.6636	452.7482	1639.3627	1643.0798
5	455mRL	21-Jun-18	-8.0819	1263.2525	454.9129	1628.4419	1632.3314
6	455mRL	21-Jun-18	188.0673	1264.3255	456.3345	1555.0247	1559.1994
7	475 mRL	21-Jun-18	179.6128	1305.7906	475.3971	1596.9947	1602.5312
8	475mRL	21-Jun-18	-13.4747	1309.1925	473.8391	1672.2866	1677.4533
10	475 mRL	21-Jun-18	-159.4251	1260.0893	473.6994	1696.4357	1701.5187
11	495 mRL	21-Jun-18	-120.7734	1342.6687	497.3308	1749.9753	1756.8323
12	495mRL	21-Jun-18	-52.0626	1368.0945	496.3372	1742.0106	1748.8108
13	495 mRL	21-Jun-18	10.1119	1369.1851	495.6048	1717.3099	1724.1416
14	495mRL	21-Jun-18	107.9366	1356.9892	495.2187	1669.3357	1676.3265
15	496 mRL	21-Jun-18	165.0931	1357.2609	495.4266	1650.4015	1657.4910
16	515mRL	21-Jun-18	129.6990	1403.3336	515.2107	1705.4881	1714.2335
17	515 mRL	21-Jun-18	71.7101	1412.5958	515.6988	1734.1790	1742.8298
18	515mRL	21-Jun-18	9.6261	1417.8892	515.9689	1762.2829	1770.8236
19	516 mRL	21-Jun-18	-41.1108	1413.5842	516.4620	1778.6730	1787.1838
20	515mRL	21-Jun-18	-97.0591	1405.1400	515.5984	1794.9259	1803.2772
21	station1		-65.5573	907.3070	400.8290	1347.7554	1349.0230
22	Station2	20-Jun-18	-131.6608	125.9311	333.1613	889.7655	889.8115





ANNEXURE II

**THE SECOND VISIT REPORT OF CIMFR ON WASTE DUMP STABILITY AT RAMPURA-AGUCHA MINE, HZL**

The second visit of CIMFR team consisting of Dr. J. C. Jhanwar (Chief Scientist) & Mr. A. G. Sangode (Sr. Technical Officer) with regard to slope stability assessment/slope monitoring of waste dump at Rampura-Agucha mine was made during 22-24 October, 2018. From the RAM side, Mr. Subhadip Adak, Mr. Avijit Bhunia & Mr. T R Chaudhary were associated in the field study. During this field visit, the team undertook a reconnaissance of waste dump to make a practical assessment of the overall stability of waste dump. The slope monitoring measurements/readings were taken by the Survey team of RAM using Total Station (Table 1&2). A total of 30 numbers of monitoring stations/prisms were installed on various dump benches/locations. The measurements were from a new Instrument/Reference station, which was located on the top in the H/W side. In addition to above, a Terrestrial 3D laser scanner was used by CIMFR team to scan the North & South sides of waste dump. An updated surface plan of waste dump indicating monitoring stations was collected during this visit. The slope monitoring observations of 23.10.2018 along with the changes in horizontal distance & in elevation for south & west sides are shown in Tables 1 & 2 respectively.

The following observations are made:

- i. The visual observations & slope monitoring record indicate overall stability of waste dump. The comparison of current monitoring observations with the 1<sup>st</sup> observation (taken on 09.10.2018) on the south side doesn't indicate any significant displacement. However, in case of point no. 1 & 4 (Table 1), the horizontal displacement is found in the range of 6 - 7 mm. Similarly, in the western side the difference is found in the range of 4.7 mm - 2.17 cm & therefore needs attention. The indicated change could be due to the instrument accuracy/error or atmospheric corrections. In view of this, It is suggested that all such monitoring points showing change more than 5 mm (Table 1 & 2) & surrounding areas be visually inspected on a daily/weekly basis for identifying any significant signs of instability & for taking corrective actions, if required. Further, it is suggested that monitoring observations be taken on a weekly/fortnightly basis & the readings be sent to the undersigned by email for analysis & assessment of waste dump stability.





- ii. Monitoring stations are currently located on the south & west sides of waste dump facing. It is suggested that systematic slope monitoring be implemented for other remaining slope sides and accordingly, monitoring stations on different benches at an interval of around 200-300 m be installed on other sides as well covering the North & South-East sides of waste dump. Similarly, Instrument stations will be required at appropriate locations to monitor above proposed monitoring stations.
- iii. The application of Geotextiles be continued to establish vegetation cover on waste dump bench slope surfaces on all sides to protect dump slopes against erosion due to wind & water and to improve its stability.
- iv. The waste dump bench floors & dump top surface should be maintained in such a way that water is not accumulated anywhere on these surfaces. Appropriate drainage measures be put in place in the form of drains on every bench connecting to main garland drain at the bottom level. At some place, gullies are formed due to water induced erosion, which may lead to further deterioration, it is therefore suggested that such gullies/voids be repaired through proper dozing of waste material.

**Table 1 - Slope monitoring observation on the southern/pit side of waste dump**

Monitoring Point No.	Monitoring Prism/Point Location ID	X	Y	Z	Horizontal Distance (m)	Change in HD (m)	Change in Elevation (m)
	<b>Station Point</b>	<b>-65.5053</b>	<b>907.4122</b>	<b>400.7619</b>	<b>1368.6273</b>		
1	515 mRL E-130	129.7286	1403.4326	515.1139	1668.4682	0.0072	-0.0427
2	515 mRL E-10	9.8065	1418.0810	515.7132	1737.7028	0.0032	0.0024
3	515 mRL W-40	-40.8948	1413.7831	516.4386	1759.6555	0.0020	0.0293
4	515 mRL W-100	-96.9030	1405.3107	515.5505	1782.1480	0.0064	-0.0334
5	495 mRL W-120	120.5897	1342.8629	497.2376	1743.3505	0.0035	0.0068
6	495 mRL E-110	108.0587	1357.1298	495.1323	1637.0595	0.0037	-0.0091
7	495 mRL E-165	165.1487	1357.3740	495.2921	1611.5200	0.0016	0.0217
8	455 mRL E-190	188.1434	1264.4291	456.2220	1518.0027	0.0027	-0.0071
9	475 mRL W-15	-13.3232	1309.3487	473.8011	1656.2982	0.0029	0.0133
10	475 mRL W-160	159.3088	1260.2508	473.5993	1699.1674	0.0021	0.0096
11	455 mRL W-150	151.2031	1198.6442	452.8476	1645.5170	0.0006	-0.0065





12	455 mRL W-10	-7.9186	1263.4160	454.7738	1614.6753	0.0035	-0.0310
13	435 mRL E-200	200.7702	1210.1090	437.6251	1463.8522	0.0023	-0.0269
14	455 mRL E-188	188.1677	1264.4396	456.2490	1518.0011	0.0018	0.0056
15	435 mRL E-200	200.7844	1210.1167	437.6364	1463.8526	0.0028	-0.0102
16	435 mRL E-20	22.1277	1214.9191	436.8002	1557.6365	0.0034	0.0016
17	435 mRL W-125	126.1110	1160.6711	435.3416	1600.1720	0.0033	0.0044
18	455mRLTD N-985	433.1145	986.4475	454.5103	1691.1246	0.0005	0.0013
19	455mRLTD N-875	440.7588	873.5551	453.1589	1627.6054	0.0012	-0.0094
20	455mRLTD N-780	438.7406	779.6080	452.3528	1572.0050	-0.0012	0.0070

Table 2 - Slope monitoring observation on the western side of waste dump

Monitoring Point No.	Monitoring Prism/Point Location ID	X	Y	Z	Horizontal Distance (m)	Change in HD (m)	Change in Elevation (m)
	<b>Station point</b>	-					
		<b>1765.6355</b>	<b>1969.9978</b>	<b>392.1091</b>			
1	435 mRL N-1875	1401.4803	1881.7897	432.6340	374.6861	0.0047	0.0039
2	435 mRL N-2100	1392.6990	2112.3624	435.6347	399.1858	0.0099	0.0062
3	455 mRL N-2050	1343.4474	2051.2425	457.0091	429.9342	0.0098	0.0155
4	455 mRL N-1875	1347.1257	1889.6286	455.4726	426.1569	0.0053	0.0130
5	495 mRL N-2000	1259.3376	1993.1760	496.4555	506.8282	0.0217	-0.0007
6	495 mRL N-2050	1251.9771	2059.5754	497.9387	521.4107	0.0171	0.0425
7	495 mRL N-2150	1257.3733	2144.2970	496.5210	537.3180	0.0144	0.0249
8	475 mRL N-2250	1324.6071	2262.0706	473.7621	528.9731	0.0122	0.0232
9	475 mRL N-2150	1305.9178	2137.5883	474.6130	489.3127	0.0146	0.0294
10	475 mRL N-1950	1306.7833	1966.2518	475.3183	458.8675	0.0149	0.0449





THE THIRD VISIT REPORT OF CIMFR ON WASTE DUMP STABILITY AT RAMPURA-AGUCHA MINE, HZL

The third visit of CIMFR scientist with regard to slope stability assessment/slope monitoring of waste dump at Rampura-Agucha mine was made by Dr. J. C. Jhanwar (Chief Scientist) during 23-24 January, 2019. From the RAM side, Mr. Subhadip Adak & Mr. T R Chaudhary were associated in the field study. They visited the waste dump comprehensively to make a practical assessment of the overall stability of waste dump & relevant issues. The slope monitoring measurements/readings were taken by the Survey team of RAM using Total Station (Tables 1 & 2). The measurements were taken from Instrument/stations, which were located in the H/W side and in the West and North sides of the waste dump. An updated surface plan of waste dump indicating monitoring stations was collected during this visit. The slope monitoring observations of 24.01.2019 along with the changes in horizontal distance (HD) & Slope distance (SD) & in elevation for south & west sides are shown in Tables 1 & 2 respectively. New monitoring stations have been added in the south and north sides of the waste dump as shown in the Tables 1 & 2.

The following observations are made:

- i. The visual observations during site visit has indicated overall stability of waste dump. The comparison of current monitoring observations with the 1<sup>st</sup> observation (taken on 09.10.2018) on the south side indicate change in horizontal displacement (HD) in the range of 1.2 - 1.9 cm. However, the change in slope distance is in not significant as shown in Table 1. The indicated change could also be due to the instrument accuracy/error or atmospheric corrections. In view of this, It is suggested that all such monitoring points showing change more than 5 mm (Tables 1 & 2) & surrounding areas be visually inspected on a daily/weekly basis for identifying any significant signs of instability & for taking corrective actions, if required. Further, it is suggested that monitoring observations be taken on a weekly/fortnightly basis & the readings be sent to the undersigned by email for analysis & for further advice in this regard, if any.
- ii. Suitable vegetation cover should be established on the bench slopes of waste dump on all sides with the help of geotextile/other method to protect the dump slopes against erosion due to wind & water and to improve its stability.





- iii. The waste dump bench floors & dump top surface should be maintained in such a way that water is not accumulated anywhere on these surfaces. Appropriate drainage measures be put in place in the form of drains on every bench connecting to main garland drain at the bottom level. At some place, gullies are formed especially on the 3/4<sup>th</sup> bench on North side due to water induced erosion, which may lead to further deterioration, it is therefore suggested that such gullies/voids be repaired through proper dozing of waste material.
- iv. Monitoring stations should be appropriately installed on the benches of the east side of the waste dump also so as to cover all the dump sides under systematic monitoring.

**Table 1 - Slope monitoring observation on the southern/pit side of west dump**

Monitoring Point No.	Monitoring Prism/Point Location ID	X	Y	Z	HD (m)	Change in HD (m)	Change in SD (m)	Change in Elevation (m)
	<b>Station Point</b>	<b>-65.5053</b>	<b>907.4122</b>	<b>400.762</b>	<b>1368.6273</b>			
1	515 mRL E-130	129.7287	1403.4337	515.1389	1668.4781	0.0172	0.0036	0.0177
2	515 mRL E-10	9.8104	1418.0885	515.7106	1737.7164	0.0169	0.0019	0.0003
3	515 mRL W-40	-40.9149	1413.7785	516.4208	1759.6710	0.0174	0.0003	0.0115
4	515 mRL W-100	-96.9088	1405.3118	515.5327	1782.1611	0.0194	0.0025	0.0512
5	495 mRL W-120	-120.5982	1342.8605	497.2359	1743.3623	0.0153	0.0003	0.0050
6	495 mRL E-110	108.0565	1357.1312	495.1353	1637.0707	0.0149	0.0022	0.0061
7	495 mRL E-165	165.1494	1357.3784	495.2642	1611.5327	0.0142	0.0032	0.0061
8	455 mRL E-190	188.1412	1264.4299	456.2272	1518.0133	0.0133	0.0016	0.0019
9	475 mRL W-15	-13.3344	1309.3435	473.7882	1656.3088	0.0135	0.0002	0.0005
10	475 mRL W-160	-159.3230	1260.2430	473.5978	1699.1788	0.0134	0.0009	0.0081
11	455 mRL W-150	-151.2169	1198.6320	452.8483	1645.5249	0.0086	0.0019	0.0058
12	455 mRL W-10	-7.9159	1263.4180	454.7769	1614.6844	0.0127	0.0007	0.0279
13	455 mRL E-188	188.1675	1264.4418	456.2477	1518.0121	0.0128	0.0014	0.0043





14	435 mRL W-125	-126.1014	1160.6791	435.3293	1600.1813	0.0126	0.0045	0.0078
15	475 mRL E-465	466.7836	1269.9484	471.8472	1420.3277	NEW PT	-	-
16	475 mRL E-560	562.4531	1317.3708	474.1970	1442.5228	NEW PT	-	-
17	475 mRL E-700	700.2130	1376.7569	473.2665	1478.5811	NEW PT	-	-
18	495 mRL E-500	503.0470	1311.1437	492.5769	1450.2964	NEW PT	-	-
19	495 mRL E-600	580.8932	1381.9344	494.9575	1502.0189	NEW PT	-	-

Table 2 - Slope monitoring observation on the western & north sides of west dump

Station point	Monitoring Prism/Point Location ID	X	Y	Z	Horizontal Distance (m)	Change in HD (m)	Change in SD (m)	Change in elevation(m)
	Station point	-1765.636	1969.9978	392.109				
1	435 mRL N-1875	-1401.4749	1881.7915	432.6372	374.6909	0.0000	0.0008	0.0070
2	435 mRL N-2100	-1392.6898	2112.3628	435.6374	399.1945	0.0013	0.0003	0.0090
3	455 mRL N-2050	-1343.4389	2051.2415	457.0114	429.9424	0.0016	0.0010	0.0178
4	455 mRL N-1875	-1347.1173	1889.6284	455.4777	426.1652	0.0031	0.0057	0.0181
5	495 mRL N-2000	-1259.3406	1993.1736	496.4595	506.8251	0.0248	0.0237	0.0033
6	495 mRL N-2050	-1251.9691	2059.5740	497.9362	521.4183	0.0095	0.0013	0.0400
7	495 mRL N-2150	-1257.3661	2144.2959	496.5235	537.3245	0.0079	0.0025	0.0274
8	475 mRL N-2250	-1324.6005	2262.0732	473.7651	528.9801	0.0052	0.0011	0.0261
9	475 mRL N-2150	-1305.9122	2137.5943	474.6074	489.3200	0.0073	0.0033	0.0237
10	475 mRL N-1950	-1306.7751	1966.2474	475.3182	458.8757	0.0067	0.0014	0.0449
11	435 mRL N-2110	-1392.6878	2112.3518	435.6536	399.1925	NEW PT	-	-
12	435 mRL N-2335	-1427.5083	2335.3813	434.8736	497.8304	NEW PT	-	-
13	455 mRL N-2375	-1376.4750	2375.3488	454.8391	561.9211	NEW PT	-	-
14	495 mRL N-2315	-1271.1754	2314.7264	497.2293	602.7674	NEW PT	-	-
15	BS SIDE NW	-1210.3964	2689.5827	388.4768	43.9865	-	-	-
16	455 mRL W-1275	-1272.3473	2442.6355	453.8944	297.9449	NEW PT	-	-
17	455 mRL W-1150	-1159.6767	2442.2284	454.5462	295.1965	NEW PT	-	-
18	455 mRL W-1075	-1076.2948	2471.7884	454.3076	292.8497	NEW PT	-	-
19	475 mRL W-1225	-1232.7488	2394.4308	472.3537	339.9794	NEW PT	-	-
20	435 mRL W-1375	-1379.4853	2501.6102	433.9680	288.5629	NEW PT	-	-
21	435 mRL W-1050	-1045.4616	2557.9215	430.6164	239.0677	NEW PT	-	-





22	475 mRL W-1100	-1110.9930	2405.6214	474.0500	341.8389	NEW PT	-	-
23	475 mRL W-1200	-831.9606	2490.1706	477.8858	447.6640	NEW PT	-	-
24	BS SIDE NW	-1210.3964	2689.5827	388.4768	43.9865	-	-	-
25	BS SIDENM	-622.3925	2882.3264	390.0358	18.5485	NEW PT	-	-
26	535 mRL W-400	-418.0616	2487.7458	536.5147	437.0466	NEW PT	-	-
27	520 mRL W-500	-499.3568	2511.9402	520.3416	385.8127	NEW PT	-	-
28	535 mRL W-600	-577.3242	2446.9290	534.6469	437.2048	NEW PT	-	-
29	535 mRL W-700	-696.1091	2378.8994	535.5119	512.7915	NEW PT	-	-
30	520 mRL W-650	-650.5110	2449.9489	519.9829	435.8807	NEW PT	-	-
31	520 mRL W-800	-797.2445	2387.0135	519.1913	532.6542	NEW PT	-	-
32	520 mRL W-900	-893.1528	2365.3120	519.1252	593.3158	NEW PT	-	-
33	520 mRL W-950	-965.4610	2346.7120	517.8224	647.0727	NEW PT	-	-
34	475 mRL W-700	-707.1925	2534.2544	477.0727	364.0427	NEW PT	-	-
35	435 mRL W-675	-671.5582	2665.3263	437.4748	228.2672	NEW PT	-	-
36	475 mRL W-600	-580.0466	2581.0949	478.0348	303.1698	NEW PT	-	-
37	475 mRL W-450	-445.3947	2643.5190	472.1307	287.4416	NEW PT	-	-





## PROJECT PARTICULARS

**Project Title:** Evaluation of Waste Dump Stability Through Slope Monitoring at Rampura-Agucha Opencast Mine.

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