Responsible Tailings Management



RESPONSIBLE TAILINGS MANAGEMENT

PURPOSE OF THE DOCUMENT

This position statement sets out HZL's approach to the governance of tailings storage facilities (TSFs) to minimise the risk of catastrophic failure of tailings facilities. Tailings are a common by-product of the mining process which are generated as waste during the process of separating out the valuable mineral from mined ore. Responsible tailings management constitutes one of the material risks of mining industry, owing to its multidisciplinary and complex nature. In case of failures of any kind, the consequences would be catastrophic to human life as well as the environment.

With climate change resulting in increasing number of extreme weather conditions and changes in average rainfall, the risk of tailings facility failure is more if not constructed, operated, and maintained to meet the best global practices. In this context, the Global Industry Standard on Tailings Management (GISTM) jointly released by International Council on Mining and Metals (ICMM), United Nations Environment Program (UNEP) and Principles for Responsible Investment (PRI) in August 2020, is a significant development in the international mining sector. This document provides guidance on managing tailings storage facilities (TSFs) throughout its life including design, operation, closure, and post-closure.

At HZL, we are committed to manage our TSFs in a safe and environmentally responsible way, without compromising on the health and well-being of our employees as well as communities. We regularly undertake consultations with local communities and other stakeholders of interest to incorporate and address their concerns regarding tailings management

IMPACT

A tailings incident has the potential to have a devastating impact on communities and the surrounding environment. Tailing management plans are an essential prerequisite for sound storage practice, as most failures of tailing storages around the world result from inadequate management of the storages. Effective implementation of a management plan not only results in a safer tailing storage facility (TSF) but will frequently reduce overall costs associated with operation and closure of the facility. The main focus of management of tailings facilities is on ensuring failures do not occur. HZL currently manages 3 tailings facilities and 3 are in active use.

HZL has set up Dry Tailing Plant which is based on separating water from tailings slurry generated in the beneficiation process. Company repurposes tailings materials and waste rock as backfill to stabilise our underground mining operations, while the remaining tailings are then placed in a specially designed tailings storage to minimise the environmental, social, and economic risks. Key benefits of the dry tailing technology include recirculation of more than 80% of the process water present in tailings, a faster rehabilitation and restoration of storage site at mine closure and ensuring re-availability of water for further use. Hindustan Zinc has implemented global leading practices in tailing dam management, and we are associating with renowned global experts to provide long-term monitoring and advice on the design, construction, and operation of our three tailing storage facilities. Overall good construction quality, along with upgradation of tailing slurry transport and discharge lines through installation of piezometers (and inclinometer) with automated data collection and web-based monitoring, are indeed indicative of a world-class approach to tailings management.

Further, the pH of the dams is regularly monitored to check for Acid Drainage. To prevent contamination of surface water and soil erosion, garland drains are constructed around the waste dump to collect the run-off water from the dump so that it may be utilized after proper treatment.

GOVERNANCE

There is Tailing storage facility committee at corporate level and at all the three mining sites which is comprising of representatives of various functions. By strengthening our governance model and clarifying the chain of accountability, HZL has TSF Manager who is responsible for:

- Creating Awareness on tailing management policy, standard, plan and best practices
- Ensuring adherence of Operations, Maintenance and Surveillance (OMS) Manual
- Ensuring effectiveness of reclaim water system
- Ensuring effectiveness of Emergency Planning and Response
- Ensure the availability of all required resources
- Ensure Continuous monitoring and reporting

POLICY & STANDARD

HZL has established a Tailings Management Facility Standard (TMFS) to assess and manage the impacts of Tailings Storage Facilities (TSFs) on human health and ecosystems, applying uniformly across all mining practices and Environment and CSR staff are active participants in the monthly TSF Committee meetings.

HZL have robust TMF Policy and Standard and are updated every two years or as needed as benchmarking, new guidelines and legal compliances. This has been developed based on ICMM guidelines as well as Vedanta's Tailing Management Facility (TMF) Standard. We aim to be fully compliant with the Global Industry Standards on Tailings Management (GISTM) by 2025





Six Key Elements of TSF Governance Framework as per ICMM



1. Risk Assessment and Management:

HZL carried out Regular and periodic risk assessments to identify potential hazards and impacts related to tailings dams. This includes evaluating the structural integrity of the dam, the potential for tailings leakage, and the effects on surrounding ecosystems.

Safety Reviews , Risk Assessments, failure Modes Analysis and Dam Break assessment carried by external expert - Golder Associates in 2019 and ATC Williams in 2023 to address all potential failure modes of the structure, its foundation, abutments, reservoir (tailings deposit and pond), reservoir rim and appurtenant structures to minimize risk to ALARP(as low as reasonably practicable) using a methodology that considers credible failure modes, site conditions, and the properties of the slurry. Risk assessments must be used to inform the design.

Every year, an internal expert conducted an evaluation of internal risks for the whole TSF. The risk assessment included the following categories: Risks, Hazards Mitigation Plan, Responsibility, Status and Target Date.

The Internal Technical Review Board (ITRB) is an essential component in the management of tailings facilities, particularly under frameworks like the Global Industry Standard on Tailings Management (GISTM)

An ITRB is a committee or group or third party responsible for reviewing the technical aspects of tailings dam projects, including design, construction, and monitoring practices. This board would ensure that best practices and regulatory requirements are followed.

Now HZL under progress to hire an independent agency to act as ITRB for HZL.

2. Monitoring and Surveillance:

Environmental Monitoring: Routine Environmental Monitoring for the TSF carried out like Ground water monitoring for the TSF, Seepage Monitoring and Dust control, water quality, air quality, and other environmental parameters around the tailings dam. This helps detect any deviations from acceptable standards and allows for prompt corrective actions.

Dam Surveillance by Using advanced technologies such as remote sensing and automated sensors to monitor the condition of the tailings dam and detect any signs of distress or failure.

Installation of embankment vibrating wire piezometers and inclinometer on the embankment all of which are connected to an automatic web-based monitoring system to trigger the levels i.e., the water level in the piezometers that indicate that the embankment is becoming unstable and according to data base a response escalation plan can be developed to respond.

HZL Develop, implement and maintain a water balance model and associated water management plans for the tailings facility, taking into account the knowledge base including climate change, upstream and downstream hydrological and hydrogeological basins, the mine site, mine planning and overall operations and the integrity of the tailings facility throughout its lifecycle. The water management programme must be designed to protect against unintentional releases.

For existing tailings facilities, the HZL shall periodically review and refine the tailings technologies and design, and management strategies to minimize risk and improve environmental outcomes. An exception applies to facilities that are demonstrated to be in a state of safe closure.

3. Design and Maintenance:

HZL developed plan and design criteria for tailing facility to minimize risk for all phases of its lifecycle including closure and post closure.

HZL shifted to wet to dry stacking tailing system by appropriate engineering assessment to ensure the safe operation of the facility and to reduce degree of





geochemical risk and minimizes risks to people and the environment throughout the tailings facility lifecycle and (ii) minimize the volume of tailings and water placed in external tailings facilities.

Implement a rigorous maintenance program to address any wear and tear on the tailings dam infrastructure and ensure its continued safety like arresting a seepage identification

Timely Stability Analysis of tailing dams done by external expert like School of infrastructure Indian institute of technology, Bhubaneswar, done stability analysis in Mar-24 for existing TSF and dry stacking TSF.

4. Emergency Preparedness and Response:

- HZL has developed detailed emergency response and crisis plans for potential tailings dam failures or incidents. This includes evacuation procedures, communication plans, and coordination with local authorities.
- Mock Drills and Training: Conduct regular drills every 6 months and training exercises to ensure readiness for emergency situations. This involves practicing response scenarios and updating plans based on lessons learned. A record of all such drills shall be maintained. The lapses in the mock drill shall be circulated so that all short coming can be improved and help in designing a better system. All the rescue and fire-fighting teams must be properly trained to carry out their duties in an Emergency.

5. Regulatory Compliance and Standards:

- Adherence to Standards: Ensure compliance with relevant regulations and industry standards, including those set by ICMM, GISTM, and local regulatory authorities.
- Certification and Audits: Pursue third-party certification where applicable and undergo regular audits to verify adherence to tailings management standards and practices.

STRATEGY

Our strategy on responsible tailings management broadly includes following aspects from both technical and governance perspective:

- Tailing Management Policy & Tailing Management
 Plan
- Tailing Storage Design
- Incorporating Best Practices
- Surveillance of Tailing Dams
- Internal / External Review
- Emergency Planning and Response

HZL'S ACTIVE TSFS



TAILING DAM MANAGEMENT

All the Company's tailings facilities are designed and constructed to the highest engineering standards and bestin-class benchmarked practices

- External and internal inspection and monitoring of the TSFs to review the integrity/stability of our TSF structures and their associated management practices
- Effectiveness of reclaim water system
- Collection and recycling of supernatant water
- Conducting periodic TSF risk assessments and developing mitigation plans to minimize associated risks
- Surveillance of tailings storage facility
- Effectiveness of emergency planning and response
- Utilization of tailings in backfilling
- Replacement of wet tailing disposal system with dry tailing disposal
- Dam break analysis and Emergency preparedness
- Company introduced a novel, satellite based Interferometric Synthetic Aperture Radar (InSAR) monitoring technique to provide early warning of surface ground movements
- Framework for closure & post-closure activities as per s Vedanta's Tailing Management Facility (TMF) Standard.

TAILING STORAGE DESIGN

We recognize the uniqueness of our mining locations and accordingly consider factors such as local topography and climate, the geotechnical, geological, and seismic activity, its proximity to people and infrastructure, land rehabilitation, and future land use while designing our storage facilities.





Downstream design continues the construction of the embankment wall on the external side of the compound with the batter extending on to what we call natural surface (or land that previously has not been disturbed), by depositing more support rock and bunding against the previously built tailings wall, thereby expanding the footprint, width and height of the initial embankment wall.



Center line design involves the continuation of the embankment construction on the external side of the compound however, does rely on the deposited tailings adjacent to the top of the initial embankment wall to support the raises.



Upstream design allows the embankment wall to be constructed on the inner side of the compound and relies on the strength of the deposited tailings to support the structural material for each lift of the embankment. This method allows for smaller quantities of earth and rock fill to be built on top of the tailings and therefore does not expand the footprint of the facility.



Based on the above said factors, we choose the best method from among the three main tailings construction methods, i.e., downstream, centreline, and upstream design.

TECHNOLOGY INTERVENTION

HZL is committed to integrating new and innovative technologies as part of our overall tailings management process. We make use of established and emerging dewatering approaches for applicable locations, as well as enhanced surveillance to add to our already extensive monitoring and response program across all of our facilities. By leveraging modern technology and maintaining high construction standards, HZL can effectively manage risks and ensure the safety and sustainability of their tailings facilities.

INCORPORATING BEST PRACTICES

The following are few best practices developed and incorporated at our three TSFs with an objective of continuously improving our tailings management:

- Clear policy on tailings management, and strong management commitment for safe and responsible
- Management of Tailings Storage Facility (TSF)
- TSF Committee in-house experts to strengthen compliance to Vedanta TMF standard
- Reputable engineering and design firms selected for the design of these facilities
- Periodic TSF risk assessment conducted, and mitigation plan developed to minimize associated risks
- Tailings utilization in back filling through Paste fill/ Hydro fill. At SKM, we have commissioned +100 meters incline hole (+75 meters vertical) for backfilling the SK area to employ more tailings in the mine instead of sending the same to the tailing dam. This cost effective and environment-positive initiative is a milestone in the mine's sustainable growth journey.
- Replacement of wet tailings disposal system with dry tailings disposal
- Supernatant water collected and recycled in process
- Garland Drains around tailings dam, Zero Liquid Discharge maintained from tailings dam
- HZL introduced a novel, satellite-based Interferometric Synthetic Aperture Radar (InSAR) monitoring technique to provide early warning of surface ground movements.







Supernatant Water Collection Pond



Garland Drains Around Tailing Dam



Dry Tailing plant

SURVEILLANCE OF TAILING DAMS

Surveillance involves inspection and monitoring of the operation, structural integrity, and safety of a facility. It consists of both qualitative and quantitative comparison of actual to expected behaviour. Regular review of surveillance information can provide an early indication of performance trends that, although within specification, warrant further evaluation or action.

1. Visual Monitoring and Inspection

 Weekly/Monthly and annual monitoring of the impoundment, dam safety instrumentation monitoring, and environmental monitoring by TSF committee

2. Geotech Monitoring on Tailing Dam

- Pillar-prism-total station data for measurement of Slope displacement
- Piezometer for measurement of pore water pressure
- Inclinometer for measurement of Sub-surface deformation
- Cameras are placed for security purpose monitoring

INTERNAL/EXTERNAL REVIEW

Internal Review	External Review		
 Comprehensive internal audits/ inspection by cross-functional teams Hazard identification & risk assessment conducted 	 Engagement of world class consultants Indian Institute of Science (IISc) Bangalore, IIT Guwahati, Hatch etc. for design and stability of existing TSF 		
and reviewed periodically	 Independent assessment by global experts Golder Associates to review the integrity/ stability of our dam structures and their associated management practices 		
	 Independent assessment by global experts ATC Williams to review compliance against GISTM guidelines and principles 		







EMERGENCY PLANNING & RESPONSE

Emergency Preparedness and Response Plan is available at all the three mines and is enabling us to identify emergency and hazardous conditions threatening the TSF, expedite effective response actions to prevent failure, and reduce loss of life and property damage. These systems, which demonstrate leadership and commitment to responsible tailings management practices, were developed through consultation with communities. We continually review our facilities and procedures and are committed to maintaining the highest standard of safety at our operations. See Our Performance Standard on **Emergency Planning and Preparedness** for further information.

Key features of Emergency Planning and Response are as follows:

- Identify emergency and hazardous conditions
 threatening the TSF
- Assessing, mapping, and mitigating the potential impacts from a hypothetical failure scenario
- Training and awareness to operations personnel in responding to emergency conditions
- Testing of effectiveness through validation drills
- Process of reporting on TSFs' failures

High Risk Potential Tailing Sites

METRICS & PERFORMANCE

Goals

Complete transition from wet tailing to dry tailing disposal by 2025

Performance

- Zero incidents associated with existing tailings facilities
- During the year, a third-party audit was conducted to identify any deficiencies against Global Industry Standard on Tailings Management (GISTM) requirements, as per the Group's business target to fully implement all the GISTM principles by FY 2024-25.
- 100% of active tailings facilities have undergone independent third-party reviews in the last three years
- Additionally, we have also conducted the detailed analysis/assessment of Acid Rock Drainage Assessment completed by ERM. The study identified none of our mines and locations as geochemically reactive and no acid generation is happening in the current time.
- No issues indicating potential risk identified in site tailings internal/ external review

Waste	Source of Generation	Disposal/Management Practice	% of waste recycled/reused
Waste Rock	Mining	Utilised in mine backfilling and tailing dam height raising/embankment, the remaining is safely disposed of in a dedicated overburden dump yard as per mine plan	17.44%
Tailing	Ore beneficiation process	Utilised in mine backfilling through Hydro fill or Paste fill technology, while the remaining is safely disposed of in Tailings Storage Facilities (TSF)	32.54%

TAILING DAM INVENTORY

S NO.	DESCRIPTION	RAMPURA AGUCHA	DARIBA	ZAWAR	DEBARI
1	Tailing facility Name	HZL - RDM complex RDC Tailing dam	RA Mines Tailing dam	Zawar Tailing storage facility	Jarosite Pond III
2	Location (Latitude / longitude coordinates)	24°57'58.7"N 74°08'51.0"E	25°50'53.5"N 74°44'25.7"E	24°20'32.34" N 73°42'45.58" E	24°35'40.9"N 73°49'24.1"E
3	Ownerships (Owned and operated, subsidiary, JV)	Operated 65% owned	Operated 65% owned	Operated 65% owned	Operated 65% owned
4	Status (Active, Inactive)	Active	Active	Active	Inactive
5	Date of initial operation	1982	1991	1982	2002
6	Is the dam currently operated or closed as per approved dam design	Yes	Yes	Yes. Dry stack method in process	Disposal Stopped Since Jul 2019.Yet to be closed as per approved design





S NO.	DESCRIPTION	RAMPURA AGUCHA	DARIBA	ZAWAR	DEBARI
7	Raising method (Upstream, centre line, modified centre line, downstream, landform etc.	Phase 1 to Phase 9 – Downstream and partially U/S in most of the phase	Phase 1 to Phase 7 – Fully Downstream, Phase 8 – Complete downstream except in a stretch of 600 m raised with upstream Phase 9-combination of downstream & centreline method	TSF-2: Phase 1 to 5 with Downstream and phase 6 to 8 with Upstream followed by Dry stacking. TSF-1: Dry stacking	Upstream & Downstream
8	Current maximum height (m	32m	60m	TSF-2: 60 m through wet disposal mode followed by 40m dry stacking (434 mRL to 474 mRL) in progress. TSF- 1: Dry stacking in progress (383mRL to 423mRL) present avg.level 393mRL(10 m)	17m
9	Current Tailing Storage impoundment volume (Million m3)	20 Million m3	59.7 million m3 (Filled) & 4.2 Million m3 free space available	TSF-2: 28.38 TSF-1: 7.47	No storage allowed; capping is planned(Capex Mancom asked to explore for emptying the Jarosite Pond instead of capping)
10	Planned Tailing Storage impoundment volume (Million m3) in 5 years (January 2024)	12	8	12.65 Million m3 (FY25 to FY30)	0
11	Most recent independent expert review	Dec-22	Dec-22	Apr-22	Sep-21
12	Do you have full and complete relevant engineering records including design, construction, operation, maintenance, and/ or closure	Yes	Yes	Yes	Yes
13	What is your hazard categorization of this facility, based on the consequence of failure	Category A	Category A (EXTREME)	Extreme	Yet to be classified
14	What guideline do you follow for the classification system	ICOLD	ICOLD	Canadian Dam Association	HW rules 2016





S NO.	DESCRIPTION	RAMPURA AGUCHA	DARIBA	ZAWAR	DEBARI
15	Has this facility, at any point in its history, failed to be confirmed or certified as stable, or experienced notable stability concerns, as identified by an independent engineer (even if later certified as stable by the same or different firm)	No	No	No	No
16	Do you have internal / in house engineering specialist oversight of this facility? Or you have external engineering support for this purpose?	External	External	External	External
17	Has formal analysis of the downstream impact on communities, ecosystem and critical instruction in the event of catastrophic failure been undertaken and to reflect final conditions? If so, when did this assessment take place?	Yes, 2018	Yes, 2017	Yes, 2019	No
18	Is there (a) a closure plan in place for this dam (b) does it include long term monitoring	Yes	Yes	Yes	Yes
19	Have you, or do you plan to, assess your tailings facilities against the impact of more regular extreme weather events as a result of climate change, e.g. over the next two years?	Yes	Yes	Yes	Yes
20	Any other relevant information and supporting documentation	Tailings volume reduced through consumption in underground mine paste fil	Tailings volume reduced through consumption in underground mine paste fill	Presently dry stack is being done for tailing storage. Also, started backfilling in mines through hydro fill and paste fill plant	Disposal Stopped since July 2019. External inspection carried out and capping is planned

