



HINDUSTAN ZINC  
Zinc & Silver of India

# Sustainability Framework

## TAILING DAM STANDARD

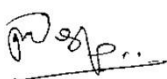
### Tailing Management Facility (TMF) Standard

Hindustan Zinc Limited



<b>Standard Title:</b>	<b>Site Closure</b>	<b>Date of Issue:</b>	<b>16/08/2025</b>
<b>Standard:</b>	HZL/CORP/SUST/TDS 1	<b>Revision:</b>	V.1

Document Issue and Revision History		
DATE	REVISION NUMBER	CHANGE SUMMARY
16/08/2025	v.1	Initial issue

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### Purpose

This document defines Tailing Management Facility (TMF) performance standard for the HZL of companies towards:

- a) Siting of TMF to minimise adverse impact and risk from facility. Riverine or sub-marine tailings disposal options would be completely avoided.
- b) Planning, designing and construction of TMF with the objective mitigate the impact and risks towards structural failure, environment, social and stakeholder.
- c) Operating the TMF with the objective no significant impact on environment and communities and ensuring protection of health & safety of the workers.
- d) Assuring safety and responsible management of TMF with the objective of zero fatalities & being able to initiate appropriate emergency management and mitigation measures in case of catastrophic failure;
- e) Enabling community engagement to ensure that communities have an understanding of the risks from adjacent TMFs and how those risks are being managed, including emergency preparedness and post incident recovery measures.
- f) Formulating a programme for periodic audit and review of tailing safety including provisions for independent review.
- g) Develop operation, maintenance and surveillance manual (OMS) for day-to-day implementation of the TMS and engineering practices for safe tailings management.

This PS is applicable.to all existing and future tailing facilities in HZL's mining operations (hereafter known as TMFs).

### Project Conception:

Project Conception would involve analysis of various alternatives- like location of a new tailings facility, technologies to be applied. Based on this study preferred alternative has been considered for designing of the facilities. The Project Conception shall be developed based on the following:

1. Conduct feasible site alternative studies for new tailing management facility- as per Good International Industry practices (GIIP) prescribed in Annexure 1.
2. Facility shall collect a wide range of information about the characteristics of each alternative being evaluated, and relevant to the planning decision to be made, such as:
  - i. Technical considerations (e.g. geotechnical, geochemical, mine operations).
  - ii. Environmental considerations (e.g. potential impacts on terrestrial and aquatic ecosystems).
  - iii. Socio-economic consideration (e.g. potential impacts on communities and others)
  - iv. Project economics (e.g. short- and long-term capital and operating costs).
3. Conduct site characterization and risk assessment to identify the potential alternatives for conceptual designing of tailing facility.



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4. Identify the alternatives of preliminary designs, and multi-criteria alternatives analysis to select the preferred alternative with the objective of to minimise the structural environmental and socioeconomic impacts & risks.
5. Assess country specific and local regulatory requirements pertaining to tailing management and for TMF.
6. Define the performance objectives and design criteria for the TMF.

**Designing Tailing Management facility:** The Tailing management facility designing shall be developed based on the following:

1. Integrated tailing management facility designing with mine plan; which includes:
  - i. The life of the mine reserve and resource and generation of tailings to determine the capacity of TM facility;
  - ii. Ore processing approaches and anticipated ore variability and tailing generation;
  - iii. Characterization of tailing to be determined to establish the potential short and long term liabilities and environmental impacts during final disposal;
  - iv. Characterization of mining waste including tailing to establish potential acid mine drainage.
  - v. Tailing technology (production rate, material property, climate water balance and closure objectives) of the mine to determine the capacity of the final tailing facility
2. Undertake detailed site characterization (geotechnical, geologic, hydro-geologic, seismic, climate) during Project Conception period to identify the critical elements that need to be considered for designing of the TMF. These should include:
  - vi. Geotechnical study- Undertake comprehensive site survey, geotechnical foundation investigation, analyses of tailings, soil borrow and liner material as per recommendation of designer/consultant requirement and ensure that geotechnical investigation values are used in design by the consultant/designer. Typical content of a report consist of site survey, geotechnical investigation and analysis, and TMF design is prescribed in the Annexure 2.
  - vii. Hydrological studies to understand the catchment characteristics (drainage, water flow, erosion potentiality, water quality) and incorporate inputs in facility design in such a way as to minimize the impact on hydrology. Based on hydrology study, assess the potential impact on drainage and if required prepare drainage diversion/management plan.
  - viii. Hydrogeological studies to understand groundwater regime, quality to be undertaken in order to delineate appropriate measures to protect ground water resources.
  - ix. Natural hazards like flood, earthquake to be factored into the design criteria, so that during extreme natural hazard events, the facility will not be impacted and have related adverse environmental impacts.
- b. Design TMF based on best available technology that will subject business to minimum environment, social, and economic risk at an optimal total cost of ownership (TCO) over life cycle of the operation.
3. Design the liner system of the TMF based on the tailing characteristics and hydro-geological condition of the Site and regulatory requirement.
4. Designing the tailing management facility to minimise the risk and uncertainty.
  - i. Develop a risk management plan to limit the impact of residual risks.
  - ii. Develop a surveillance plan to sufficiently inform implementation of the risk management plan.



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- iii. Conduct dam break analysis based on advice of the designer/consultant to quantify the TMF related business risk in the case the TMF is located upstream, in proximity of community or sensitive environmental receptors.
  - iv. Design freeboard, decant, and return water system to manage worst case flood scenario.
  - v. Design decant pool away from the TMF embankments
5. Design the TMF to reduce adverse environmental impacts, ensuring:
- i. Fugitive dust control measures from the TMF
  - ii. Leachate collection and treatment facility;
  - iii. Recycle and reuse arrangements for decanted water to mining and mineral processing units;
6. Engage a competent designer/engineering firm in managing the TMF over the life cycle of the facility to the extent possible. The activities of engagement will include but not limited to TMF siting, geotechnical investigations, planning, designing, periodical site visits and Tailing management performance evaluation.
7. Design TMFs meeting permit requirements, based on recognized national and/or international standards for dam or TMF design with best possible factors of safety based on risk classification of the site.
8. Include “stage storage” curve for the normal production in the design document and update the same in whenever production changes.
9. Design a robust surveillance and monitoring programme for seepage and contamination assessment of soil and ground water.
10. Engage one designer/engineering firm to act as “Engineer-of-Record” to the extent possible. Typical Role and Responsibility of the EOR is given in Annexure 3.

### Construction of TMF:

Every unit will appoint qualified 3rd Party consultant for supervision and quality assurance of TMF construction, and obtain construction report toward completion of the work. Typical content of Construction report is given in the **Annexure 4**.

**TMF Operation and Management:** The TMF shall consider following matters during construction of the facility:

1. Tailing management committee with defined roles and responsibility lead by the process or ash department.
2. Develop, operate, monitor and manage TMF in line with “Tailings Management Plan (TMP)”. Typical TMP content is presented in **Annexure 5**.
3. Conduct periodical TMF risk assessment and develop mitigation plan to minimize public health and safety, environment, social and economic risk to the business. Discuss and escalate the risk in line with HZL risk management framework.
4. Develop emergency response plan and test effectiveness of the same through desktop evaluation and mock drill annually.
5. Conduct / facilitate TMF audits against the requirements set in this performance standard. Typical aspects covered in internal audit are given in the **Annexure 6**.
  - i. Internal audit - Bi-annually.
  - ii. Designer / engineering firm audit – annually.

- iii. Third party expert audit – once in 3 years.

### Operation of TMF

The full range of concepts, principles and practices for tailings management are to be deployed during the Operations phase to ensure safe, responsible tailings management. Each facility shall follow the following operating practices:

1. Evaluate the TMF implementation:
  - i. Evaluating Performance is ongoing.
  - ii. Identify the actions to improve performance
  - iii. Action plans are developed and implemented to address
2. Risk management plan is implemented and is reviewed and updated regularly.
3. Tailings transportation and deposition plan is implemented, reviewed and updated regularly.
4. Construction activities continue to increase the capacity of a tailing's facility as per approved design criteria.
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6. Constructed conditions are accurately documented, including deviations from the design intent and design basis.
7. A programme for reviewing tailings safety is implemented
8. Community engagement continues
9. Conduct periodical monitoring programme and reporting to stakeholder and regulators
10. All updates and operational changes are assessed through the change management system.
11. Conduct the periodic internal and external audit and review of TMF as per monitoring framework.

### Closure & Post-closure

1. Risk assessment should be updated for closure, and the risk management plan updated accordingly.
2. Construction activities are carried out as per the closure plan, with adherence to design specifications and quality management requirements.
3. Independent Review continues with a focus both on implementation of the closure plan and preparations for the Post-Closure phase.
4. Community engagement continues.
5. EPRP is updated to reflect closure conditions, including a potential change in the role of the Operator and third parties in responding to an emergency as the Operator's on-site resources change.
6. Continue to conduct independent audit review and documentation.
7. Formulate post closure monitoring framework for to determine whether specific pre-set criteria are being met.



### Documentation:

1. Risk assessment and mitigation plan.
2. Tailing Management plan.
3. Emergency response program and effectiveness evaluation report.
4. Investigation, design, construction reports over life of the asset.
5. Internal and external audit reports and corrective action plans