

Waste Management

WASTE MANAGEMENT

PURPOSE OF THE DOCUMENT

This position statement sets out HZL's approach to managing waste. It is vital that the industry mines responsibly and seeks to ensure that resources used in the extraction and processing of minerals and metals are used efficiently and sustainably.

In a resource constrained world, site design and operational efficiencies that ensure energy recovery, waste minimisation and reuse, and optimised metals extraction and refinement processes are at the heart of all mining and smelting operations.

The high value of many metals and minerals also incentivises the recovery of such materials at the end of a product's life cycle, and hence there are many methods in place to facilitate their re-use and recycling. Circular approach as well as considering the environmental and societal impact of our operations is at the heart of our Sustainability Strategy. We take steps to minimise negative effects, share best practice and reduce waste.

OUR IMPACT

With production of various minerals increasing substantially in the present scenario, large quantities of waste materials are generated every year because of mining activity. If not handled properly, generated waste could pose serious threat to environment in the form of air, water or soil pollution and many other hazardous effects on the human life as well.

HZL is involved in the business of mineral extraction and processing with Lead, Zinc and Silver being our final products that are used as a raw material for many other industries. We convert these extracted minerals into ingot and supply to our consumers without any packaging. Even though our products do not include any plastic waste, e-waste, or major hazardous waste, we have a robust governance system that ensures management of all kinds of waste generated during our manufacturing processes.

We define waste into two main categories: mineral and non-mineral waste. These are each further divided into several subcategories:

Mineral Waste: Based on volume, mineral waste is the most significant type of waste generated by HZL. We characterize mineral waste as waste rock, coarse mineral refuse, fine mineral refuse from processing ore, and tailings. We use internal and external subject matter experts to design our mineral waste storage facilities, based on site-specific conditions and industry good practices.

- **Waste Rock:** Waste rock, which is material that is removed to access ores, typically contains trace amounts of naturally occurring metals and other constituents.

The bulk of waste rock from our operations is placed in areas that are specifically designed to contain the rock. The remainder of the rock is placed within tailings storage facilities or used to backfill underground mines. Long-term storage of waste rock is conducted in accordance with mine closure plans.

- **Tailings:** 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. These materials are typically stored in tailings storage facilities. See [Our Approach to Tailings Management](#).

Non-Mineral Waste: Non-mineral waste includes waste generated from overall activities such as construction, maintenance and office activities, but excludes mineral waste, which is further categorized as non-hazardous and hazardous waste. Our strategic intent is to eliminate or reduce the generation of non-mineral waste, to explore long-term viable alternatives, and to divert waste from disposal through reuse and recycling whenever possible.

- **Hazardous waste:** At HZL, primary industrial hazardous wastes produced at our operations include waste oil, ETP sludge, salt, anode mud, dross, and solvents. We collect and store hazardous waste in accordance with regulatory requirements in a responsible manner, and licensed third-party recyclers.
- **Non-hazardous waste:** The most significant types of non-hazardous waste streams include jarosite, fly ash, slags, scrap metal, glass, tires, cardboard and paper.

PARTNERSHIPS & COMMITMENT

We commit to optimizing extraction and manufacturing processes, using resources and energy efficiently, and reducing waste. Reducing our environmental footprint is the right thing to do and makes good economic sense too. We commit to effective materials stewardship which encompasses process and product stewardship. While we undertake activities to ensure that our processes to explore, extract and refine minerals and metals are done in a way that minimise environmental impacts and health and safety risks. HZL is committed to continually improving our waste management practices so that we can avoid waste at source wherever possible, minimize waste by adopting best operational practices and circularity measures, and ensure responsible disposal. A key component to how we manage waste at each operation is ensuring compliance with applicable standards, regulations and permits for treating and recycling waste.

We work with various industry associations to support responsible materials production and waste management.

- ✓ Our lab is equipped with state-of-the-art instruments like FESEM, XRD, and XRF, which allow us to conduct detailed analysis and characterization of materials.
- ✓ Besides, R&D is also equipped with well-equipped laboratory scale facility of hydrometallurgical and high-temperature material processing.
- ✓ **International collaborations:** Metso – Outotech/ Jarofix, Future elements/mine tailings, SGS – Recovery improvement etc
- ✓ **Indian collaborations:** IMMT Bhubaneshwar – Hematite production from Jarosite NML Jamshedpur – Metal recovery from Jarosite IMMT Bhubaneshwar – Silver recovery from mill tailings and Jarofix
- ✓ Bench/semi pilot scale trials for effective utilization of Jarosite/ Jarofix by using VeXL technology for accessing the technological performance and economic feasibility of a (new) process.

PATENTS AWARDED

Total of 8 national & 3 International patents are awarded to HZL.. Additionally, 6 projects have been applied for patents and are under process.

GOVERNANCE

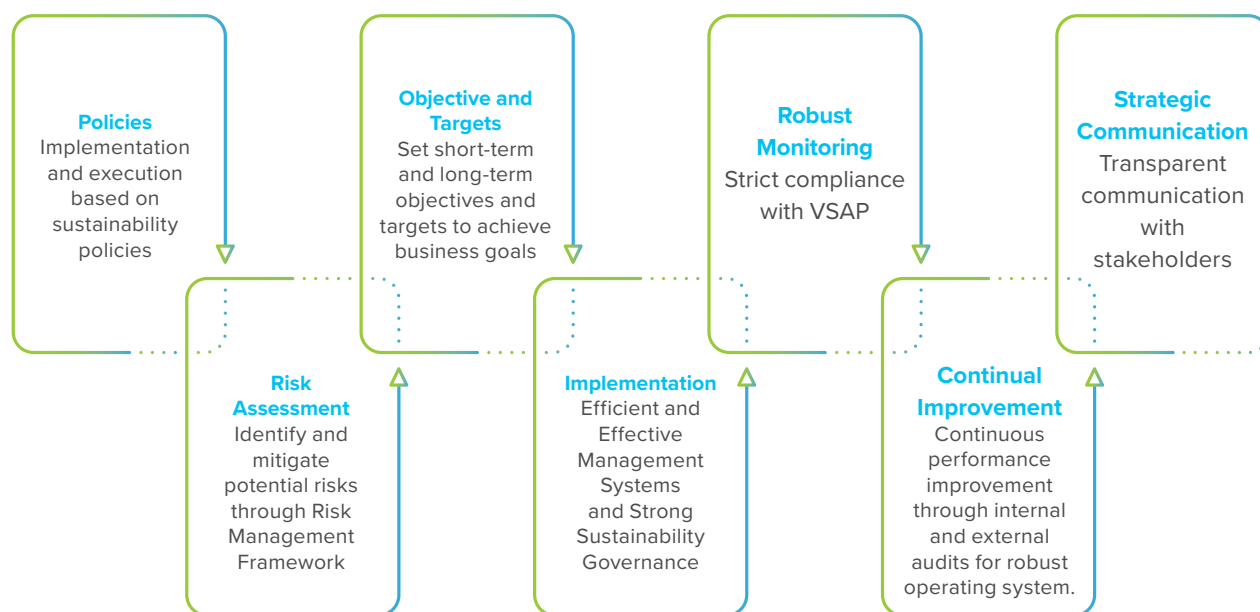
The Board Level Sustainability and ESG Committee is aligned with our Waste Management commitment and facilitates our efforts towards the accomplishment of our 2025 goals and Environmental, Social and Governance priorities.

The committee is led by an independent director as the chairperson of the committee. The role of the Sustainability and ESG Committee is to assist the Board in meeting its responsibilities in ESG matters and to ensure a strong governance on sustainability matters. It is also responsible for providing oversight on sustainability strategy, setting long-term goals & targets, ensuring continual improvement of our sustainability related performance as well as implementation of appropriate processes and policies across the Company. It also plays a key strategic role in eliminating potential damage to the environment.

- The Board Committee is supported by the Executive Sustainability Committee at the corporate level, chaired by CEO and includes senior executives to oversee delivery of the programs. The Executive Committee is responsible for sustainability, health and safety, environment, community, and Indigenous affairs, including waste management. The Committee is also meant to oversee the resolution of all grievances in a timely manner. The ESC consists of multi-functional representation of senior leaders.
- The Waste to Wealth Community is responsible for monitoring the waste disposal, use and reuse.

SUSTAINABILITY MANAGEMENT FRAMEWORK

Our Sustainability Management Framework is aligned with both, the Vedanta Sustainability Framework (VSF) and the Integrated Management System (IMS).



Waste to Wealth Community: Responsibilities

- Oversee the gainful utilization of waste and provide guidance to ensure continual improvement in waste minimization, utilization, and recycling by implementing appropriate processes and policies. For instance, it is continually working on optimization of the use of raw materials and exploring ways to reuse/recycle the waste products created during the manufacturing process.
- Identify and track the wastes generated throughout the mine life cycle along with their characterisation and classification. This helps in selecting the most efficient management practices.
- Find innovative ways and methods to utilize the residue waste
- Undertake R&D, outline initiatives, and develop strategies to minimize waste

POLICIES & STANDARDS

Our **Environmental Policy** gives general guidance on materials stewardship and mine waste management. HZL's Environment Technical Standard provides guidance to manage our impacts to the environment through effective management systems and processes and that work towards improving our environmental performance. This Standard supports HZL's Environmental Policy. HZL's HSE Performance Standards, are based on ISO management standard ISO 14001:2015.

Waste Management Performance Standard establishes a set of standardized waste management protocols for HZL. This standard applies to all owned and managed facilities over the life cycle of the asset and should be reviewed in conjunction with the **Waste management guidance note (GN14)**

We have a **Resource Use and Waste Management Technical Standard** in place along with supporting guidance notes to mitigate any environmental impacts of our products and process, going beyond mere compliance.

RISK MANAGEMENT

As part of our risk management, we have identified the following risks associated with waste management are working to address these risks effectively:

1. **Environmental and health risks:** Ineffective waste

management can result in environmental damages in the form of air, water, or soil pollution. This negatively impacts the biodiversity, vegetation, and human lives.

2. **Regulatory risks:** Complying with increasingly stricter regulations related to waste management is crucial in ensuring the company is able to continue its operations without any disruptions and delays in granting of permits. Otherwise, it can even affect company's social license to operate.
3. **Financial risks:** Adopting and implementing new infrastructure and technologies for improved waste management performance would demand considerable monetary investment.
4. **Community unrest:** If the company poorly manages its waste and negatively impact the local communities and their resources, there are chances for conflicts and protests that will result in bad reputation of the company.

Strategy

At HZL, we believe in Zero Waste to landfill and have designed a comprehensive approach in managing the waste generated. We have aligned our waste management practices to '**4R**' strategy – **Reduce, Reuse, Recycle and Reclaim**. With the commitment to continuously monitor and reduce our waste generation, we are moving steadily



We diligently follow this 4R framework at all our operations, using clearly defined risk-based procedures and processes. This ensures that all waste is systematically collected, stored, transported, reused, and recycled, thus helping in our efforts to transition to a circular economy. We continuously explore new initiatives for reducing, recycling, and reusing waste i.e., by extracting valuable residual metals and minerals, optimizing mining process by using new chemicals, minimizing wastage through leaching process and significantly enhancing recoveries. At the same time, we are using technology and innovation to restore natural systems, including land rehabilitation through top-soil cultivation and water reuse. Our in-house R&D center is involved in creating technologies with an aim of creating value from waste that can be utilized not just within HZL's operations but also to support local entrepreneurs and communities.

Leading the way in waste management, we are committed to:

- Oversee the gainful utilization of waste and guidance to ensure continual improvement in waste minimization, utilization, and recycling by implementing appropriate processes and quantified targets.
- Identify and track the wastes generated throughout the mine life cycle along with their characterisation and classification.
- Find innovative ways and methods to utilize the residue waste
- We have integrated reprocessing our waste by setting up Fumer at one of our hydro zinc smelter to eliminate jarosite waste generated hence reducing the waste to landfill.
- Undertake R&D, outline initiatives, and develop strategies to minimize waste
- Monitoring and Reporting Compliance and Continuous Improvement in waste management
- We are in continuous performance improvement through internal and external audits for robust operating system. Audits help us identify opportunities for improving waste performance and management.

Awareness & training:

- I. We annually conduct awareness and training sessions for all employees focused on waste management and reduction.
- II. This year we have also conducted a "Workshop on Circular Economy" as part of its efforts to transition to a circular economy, on 'Extended Producers Responsibility & Waste Management". Important stakeholders from waste management team came together to understand the implications of EPR rules and how to efficiently handle waste.

These initiatives aim to cultivate a culture of waste reduction within our workforce, fostering a collective effort to manage waste.

MANGEMENT OF WASTE

At HZL, we are taking various initiatives and have adopted state of the art technologies to reduce the waste generation, reuse of waste, recovery, recycling of metal from waste and disposal of remaining waste in environmentally sound manner.

Principle	Strategic Initiatives
1. REDUCE	• Switching from open cast to underground mine resulted in reduction in waste generation. Among the two major types of mining methods – opencast and underground mining – the former generates 8-10 times more quantity of waste than the later. • Commissioning of Fumer plant will be resulting in 100% elimination of Jarosite waste at one of the Hydro Zinc Smelter and production of usable clean slag. In addition, this eliminates the recurring demand for land to store Jarofix. • Adopting technologies to enhance ore extraction efficiency.
2. REUSE	• Replacing conventional hydraulic filling with Paste Fill/Hydro fill technology to reuse tailings generated from ore beneficiation process • Utilization of Jarosite waste (produced in the hydrometallurgy process of zinc extraction) for road/highway construction or embankment and cement industry. • Reuse of Fly ash and bottom ash (i.e., the 2 major wastes generated from our captive power plants) by selling to cement manufactures and brick manufactures, respectively. • Using tailings and waste rock as backfill to stabilize underground mining operations. • Using waste rock as construction material for roads, pavements, etc.
3. RECYCLE	• Ancillary plant for treatment of residues produced during smelting process leading to in-house production of few key consumables and by-products, in collaboration with the Company's central R&D team. For example: production of copper sulphate and zinc sulphate from Purification waste cake, potassium antimony tartrate from antimony dust, etc. • Recycling municipal solid waste (plastic, paper, etc.)
4. RECOVER	• Ongoing research for metal recovery (Zn, Pb & Ag) from tailings • Plant to recover sodium sulphate crystal from RO Reject commissioned at Dariba Zinc Smelter



The disposal/management practices that we adopt for mineral waste, solid waste as well as hazardous waste are as follows:

1. MINERAL WASTE

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

2. NON-HAZARDOUS WASTE

Waste	Source of Generation	Disposal/Management Practice
Slag	Smelting process	Utilisation in cement manufacturing and road construction
Fly Ash	Power generation	100 % Fly ash is reprocessed by cement manufacturers and brick manufacturers
Jarosite/ Jarofix	Hydro smelting process	Stabilisation with lime & cement as Jarofix using patented Jarofix Technology (M/s Canadian Electrolytic Zinc), followed by disposal in Jarofix yard/Utilisation in cement industry/road construction

3. HAZARDOUS WASTE

Waste	Source of Generation	Disposal/Management Practice
Used oil	Maintenance	Sale to authorised recyclers
Cooler cake	Cell house	Disposal in SLF/TSDF after stabilisation with cement
Purification cake	Purification	Recycle/ sale to authorised recyclers
ETP sludge	Effluent treatment plant	Disposal in SLF/TSDF after stabilisation with cement
Anode mud	Cell house	Reuse/recycle/ sale to authorised recyclers, surplus disposal in SLF/TSDF, if any
MEE/MVR salt	Recovery of Glauber's salt	Recovery of Sodium Sulphate and Disposal in SLF
Copper dross	Lead smelting	Recycle/ sale to registered recyclers
Zinc dross	Zinc smelting	Recycle
Lead dross	Lead smelting	Recycle
Bio-medical waste	Health services	Handed over to authorised treatment facilities
Used acid – lead battery	Maintenance	Sale to authorised recyclers

KEY METRICS MONITORED

- Waste generation by categories-Non-Hazardous, Hazardous, Plastic
- Waste generation by Source categorised by Waste type
- Waste disposed by Disposal Method categorised by Waste type
- Waste recycled
- Waste recycled used in production process

We monitor each of these KPIs on a monthly basis using our digital tool Enablon. Further, these indicators undergo third-party assurance during our ESG Assurance process.