



## Overview

Lundin Mining employs a comprehensive approach to tailings management. This provides us with confidence that potential environmental and social impacts can be reliably identified and minimized.



Candelaria tailings facility at Candelaria, Chile

Efficient mining and mineral processing, along with disposal underground where practicable, allow our operations to minimize the quantities of tailings stored on surface. Our operations aim to minimize associated risk with a clear understanding of the tailings characteristics, the facility construction materials, and the final settings in which they are placed.

## Lundin Mining's Tailings Facilities

Lundin Mining operates four mines with five active tailings facilities and uses two widely accepted methods of tailings disposal:

(1) underground disposal involves mixing tailings with products, such as sand or cement, followed by

**5** Active tailings facilities

**5** Inactive tailings facilities

**36 tailings dam structures across all sites**

disposal as a paste backfill or hydraulic backfill in previously mined areas of underground mines; and

(2) surface disposal involves placement in engineered surface impoundments or, in the case of Eagle, in a previously mined open pit.

Of the four Lundin Mining operations, Eagle Mine is the only operation that does not have a constructed tailings impoundment with dams.

The five active tailings facilities use various construction techniques for the main and secondary or perimeter dams, but none use upstream construction. Lundin Mining also maintains and monitors five inactive tailings facilities, one of which

is a rockfill combination centerline and downstream design followed by rockfill upstream raises and buttresses (Enemossen tailings facility at Zinkgruvan).

A full list of tailings facilities that Lundin Mining manages, including information on construction method, maximum height and volume, can be found in the table on page 3.

## Tailings Management at Lundin Mining

Surface tailings impoundments can represent one of the more significant environmental risks for the mining industry. Lundin Mining takes considerable care to ensure our tailings facilities are well-designed, built in accordance with leading industry practices and standards, well-maintained, inspected, independently reviewed, and carefully monitored.

### Policies and Standards

Lundin Mining's Responsible Mining Policy includes a specific tailings management technical standard. All Lundin Mining's operations manage their tailings in accordance with this technical standard, developed in 2015, and currently under update. This technical standard requires that all tailings facilities, including major water retention dams, are planned, designed, constructed, operated, and, in the case of inactive or closed facilities, decommissioned and closed in such a manner that:

- all structures are stable; and
- all aspects comply with regulatory requirements and conform to Company standards, accepted international practice and any commitments to local stakeholders.



Cerro do Lobo tailings facility at Neves-Corvo, Portugal

### Monitoring and Surveillance

A requirement of the Tailings Management Technical Standard is for all sites to conduct regular geotechnical, hydrogeological and environmental



monitoring to meet regulatory requirements and prevent the uncontrolled release of tailings and/or water to the environment.

All sites employ monitoring and surveillance systems which may include surface prisms, piezometers, inclinometers, remote sensing and other technologies to monitor tailings dams and water levels. Trigger action response plans (TARPs) provide clear guidance on how to respond to pre-determined trigger levels for surveillance activities.



Enemossen tailings facility at Zinkgruvan, Sweden

## Responsible Person

Sites are required to identify a Responsible Person (RP) to ensure ownership and proper management of the tailings facility. The RP guarantees procedures for each facility, including an Operating, Maintenance, and Surveillance (OMS) Manual and Emergency Preparedness and Response Plan, are regularly documented and made available to site personnel.

The RP is an appropriately qualified, experienced and site-dedicated individual employed directly by the site. This person typically has an environmental or engineering background.

## Staff Inspections

Tailings dams are regularly inspected by trained operators and technical staff, sometimes as frequently as several times daily, with formal documented staff inspections at least quarterly.

## Engineer of Record

Each active and inactive tailings facility has an appropriately qualified, licensed and experienced third-party geotechnical engineer to act as an external Engineer of Record or Design Engineer in the relative jurisdiction.

## Dam Safety Inspections

Formal dam safety inspections are conducted at least annually by the external Engineer of Record, and reports are issued to the Responsible Person for action on recommendations.

## Risk Assessment

Tailings and water dam safety focused risk assessments are reviewed and updated at least annually and include input from site and corporate staff, the Engineer of Record and independent reviewers.

## Independent Reviews

A component of the Tailings Management Technical Standard is the requirement for regular independent third-party tailings reviews, which are recognized as a leading practice for effective tailings and water dam stewardship. The reviews are focused on impoundment stability and integrity.

### Independent Third-Party Tailings Reviews

- Requires annual reviews by independent qualified engineering specialists for all active and inactive facilities.
- Reviews are to provide an expert, independent opinion as to whether the tailings facility design and performance meet accepted international practice from a geotechnical and hydrogeological perspective.
- Includes all tailings facilities and water retention structures at each site.
- Program performance is reported quarterly to the Board-appointed HSEC Committee.

In 2018, independent third-party tailings reviews were completed at all Lundin Mining operations with qualifying dam structures (according to the definition provided in the Canadian Dam Association's dam safety guidelines). No critical dam safety issues were identified during the third-party reviews.

Results from the third-party reviews are carefully tracked, and progress updates are sent to the Board-appointed HSEC Committee each quarter.



Humboldt tailings facility at Eagle, USA



## Lundin Mining Tailings Facility Inventory

Mine Site	Tailings Facility	Location	Construction Method	Status	Current Storage Volume, Max Height	Current Number of Tailings Dam Structures	Most Recent Dam Safety Inspection	Most Recent Independent Expert Review
<b>Candelaria</b>	Candelaria Tailings Facility	Latitude: 27°30'21.90"S Longitude: 70°18'41.96"W	Downstream	Active	Volume - 310 Mm <sup>3</sup> Max Height - 170 m	One main dam and three perimeter dams	2018	November 2018
	Los Diques Tailings Facility	Latitude: 27°32'13.74"S Longitude: 70°19'8.37"W	Downstream	Active	Volume - 8 Mm <sup>3</sup> Max Height - 80 to 90 m	One main dam and one perimeter dam	2018	November 2018
	San Esteban Tailings Facility	Latitude: 27°29'7.11"S Longitude: 70°17'29.97"W	Centerline	Inactive - undergoing closure works construction	Volume - 2.1 Mm <sup>3</sup> Max Height - 45 m	One main dam and one secondary dam	Inspected as part of operational activities	November 2018
	Ojos del Salado Tailings Facility - North	Latitude: 27°29'25.18"S Longitude: 70°15'43.60"W	Centerline	Closed	Volume - less than 1 Mm <sup>3</sup> Max Height - 22 m	Two rehabilitated legacy dams	Inspected as part of operational activities	November 2018
	Ojos del Salado Tailings Facility - Central	Latitude: 27°29'40.43"S Longitude: 70°15'41.26"W	Centerline	Closed	Volume - less than 1 Mm <sup>3</sup> Max Height - 20 m	One rehabilitated legacy dam	Inspected as part of operational activities	November 2018
	Ojos del Salado Tailings Facility - South	Latitude: 27°29'45.59"S Longitude: 70°15'36.44"W	Centerline	Closed	Volume - less than 1 Mm <sup>3</sup> Max Height - 34 m	Three rehabilitated legacy dams	Inspected as part of operational activities	November 2018
<b>Neves-Corvo</b>	Cerro do Lobo Tailings Facility	Latitude: 37°33'36.99"N Longitude: 7°56'6.43"W	Downstream <sup>(1)</sup>	Active	Volume - 31 Mm <sup>3</sup> Max Height - 42 m	One main dam, seven perimeter dams, and four internal berms	2018	June 2018
<b>Zinkgruvan</b>	Enemossen East Tailings Facility	Latitude: 58°46'38.28"N Longitude: 15°6'24.23"E	Centerline	Active	Volume - less than 1 Mm <sup>3</sup> Max Height - 8 m	Two main dams	2018	June 2018
	Enemossen Tailings Facility	Latitude: 58°46'41.76"N Longitude: 15°5'48.58"E	Centerline & Downstream / Upstream	Inactive	Volume - 12 Mm <sup>3</sup> Max Height - 35 m	Two main dams and six perimeter dams	2018	June 2018
<b>Eagle</b>	Humboldt Tailings Facility	Latitude: 46°29'26.57"N Longitude: 87°54'8.70"W	N/A	Active	Volume - 1 to 2 Mm <sup>3</sup>	Zero dams, tailings stored sub-aqueously in an old open pit	N/A	January 2019

Note: (1) Includes internal upstream thickened tailings discharge rockfill berms

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