Tailings and Mine Waste Management

Why was Tailings and Waste Management a Material Topic in 2015?

Global Context: As the global population grows and demand for products and services increases, wastes and by-products from consumer and business activities increase in tandem. Both hazardous and non-hazardous wastes have the potential to significantly impact the environment and human health. To mitigate those impacts, proper waste and material management is critical to ensuring human health and the environment are protected. Responsible corporations are taking greater ownership for their role in managing waste across the life cycle of their products.

Industry Context

Mining involves the management of large quantities of material to produce an end product. This process generates non-economic materials consisting of rock and overburden from mining and tailings from processing. These combined materials have traditionally been termed mine wastes, but are not to be confused with industrial wastes. If not responsibly managed, the environment, health and safety impacts associated with mine wastes have the potential to directly affect communities of interest (COIs) and the ongoing operations of mines.

Tailings management is especially critical for the mining industry. While very rare, recent tailings facility incidents in Canada and Brazil at other companies served as a reminder of just how critical. In response to these events, the industry is working collaboratively to review and improve standards and critical controls for tailings management. For example, in November 2015, an independent task force commissioned by the Mining Association of Canada (MAC) submitted its review of tailings management requirements and guidance under MAC's Towards Sustainable Mining (TSM) initiative. Another response was initiated in December 2015 when the International Council on Mining and Metals (ICMM) announced a global review, supported by external experts and member company representatives including Teck, of tailings storage facility standards and critical controls.

Teck Context

Teck operates seven mines with active tailings storage facilities (TSFs)[13] and we take extensive measures to ensure the safety of these facilities. Tailings storage facilities at all of our operations meet or exceed regulatory requirements and we are continually improving the management of our facilities by developing and incorporating best practice. Teck has played, and will continue to play, an active role in promoting best practices for tailings facility management, both in our own operations and across the mining industry. For example, our Vice President, Environment was a member of the aforementioned tailings management task force established by MAC. We believe that our ongoing efforts help us build trust in our communities, minimize legal and regulatory challenges, and keep local ecosystems safe and healthy for decades to come.

What is in this Topic?

Management approach and performance related to waste management, including the construction, operation, and ongoing monitoring of the various health, safety, and environmental risks and impacts associated with tailings storage (TSFs) and waste rock facilities.

Performance Highlights

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The number of tailings review boards in place, which covers 100% of our major active tailings facilities as detailed on page 95.

Learn More

Towards Sustainable Mining Tailings Management Protocol — Mining Association of Canada

Pictured left: Garry Luini, Environmental Officer, at Line Creek Operations
Pictured above: Reclamation activities are ongoing at Highland Valley Copper's Highmont Tailings Pond

[13] For purposes of reporting, "active tailings storage facilities" denotes a constructed impoundment involving one or more tailings dams in which tailings are currently being deposited. The seven operations with active TSFs include: Carmen de Andacollo, Elkview, Fording River, Greenhills, Highland Valley Copper, Pend Oreille and Red Dog.

How Does Teck Manage Tailings and Mine Waste?

Our Targets and Commitments

We continually review our facilities and procedures, and are committed to maintaining the highest standard of safety and environmental protection at our operations.

Mining at Teck generates mineral waste materials consisting of tailings and fine coal refuse, coarse coal refuse and waste rock, as well as much smaller amounts of non-mineral wastes, including hazardous and non-hazardous materials. Responsible tailings and waste management practices are a critical part of environmental management and operational integrity at Teck.

Table 21: **Mining Waste Categories**

Tailings and Fine Coal Refuse	Tailings and fine coal refuse are the finer fractions of the processed material that have no economically recoverable mineral or coal content. Tailings and fine coal refuse are typically stored in tailings storage facilities (TSFs).
Coarse Coal Refuse	Coarse coal refuse (CCR) is a coarse fraction of raw coal that is separated during processing; it is not currently an economic product. CCR is placed in designated engineered facilities or, if determined to not be susceptible to leaching, may be used as a construction material including for creating dams to store fine coal refuse.
Waste Rock and Overburden	The rock that is removed to access ores and coal, which typically contains trace amounts of naturally occurring metals and other constituents, is commonly called waste rock. Waste rock must be properly managed to ensure geotechnically and geochemically sound storage to create stable landscapes that minimize effects on local waterbodies.
Hazardous Waste	Hazardous wastes produced at our operations include such items as waste oil, solvents, antifreeze, paint, batteries and fluorescent tubes. This waste is recycled or transported off-site by licensed contractors to appropriately designated and regulated facilities.
Non-hazardous Waste	Non-hazardous waste (e.g., scrap metal, wood waste, glass, tires, cardboard and paper) is recycled whenever possible.

Tailings Management

We take extensive measures to safeguard the tailings storage facilities at each of our operations. We are committed to the safe and environmentally responsible development, operation and management of tailings storage facilities. Planning, design, construction, operation, decommissioning and closure are carried out in a manner such that:

- Structures are stable
- Solids and water are managed within designated areas
- Facilities comply with regulatory requirements
- Facilities conform to applicable standards, internal policies, industry best practices and the technical guidelines of the jurisdictions in which we operate

The effective planning, design, construction, monitoring and maintenance of our tailings facilities is built on good corporate governance, technology, systems and procedures, inspections and reviews, community of interest (COI) engagement, and reporting. We have multiple layers of system protection, as identified in our internal policies and guidelines.

We have comprehensive systems and procedures in place for the safe operation and monitoring of tailing facilities that

follow best practices, organized around six levels of protection:

- **Surveillance Technology:** Our sites employ various systems such as GPS hubs, piezometers, inclinometers, pressure gauges, remote sensing and other technologies to monitor tailings dams, abutments, natural slopes and water levels.
- **Staff Inspections:** Tailings dams are inspected by trained operators and expert technical staff as frequently as several times daily, with formal staff inspections at least once per month.
- **Annual External Inspections:** Formal dam safety inspections are conducted at least annually by an external Engineer of Record. Independent qualified engineers also do periodic reviews, with timing dependent upon the consequence classification of the facility. For all facilities, the annual inspection reports are provided to the appropriate authority in each jurisdiction.
- **Internal Audits:** On a rotation basis of approximately once every three years, our HSEC management team audits operations and legacy properties with tailings storage facilities that could create an off-site impact. These facilities are audited against Teck's Tailings and Water Retaining Structures guidance requirements. This guidance document was developed under our Tailings and Water Retaining Structures Policy, and adheres to Teck's HSEC Standards, MAC TSM Tailings Management Protocol and associated guides, and several other relevant national and international guidance documents.
- **Detailed Third-Party Reviews:** Comprehensive third-party dam safety reviews are conducted by an independent tailings reviewer(s) every five to 10 years for active and inactive facilities. The frequency of inspection is based upon the consequence classification for each facility.
- **Independent Review Boards:** Our operations and projects with existing or planned major tailing storage facilities have Tailings Review Boards comprising independent experts from relevant fields such as geotechnical, hydrogeological, hydro-technical and geochemical. These boards meet from once to several times per year, depending upon the nature of the facility and issues being considered by the board, to conduct a third-party review of design, operation, surveillance and maintenance of our storage facilities.

Our facilities also have detailed Operations, Maintenance and Surveillance (OMS) manuals and Emergency Preparedness and Response Plans, both of which are regularly updated. We maintain site-specific Tailings Management Systems that conform to or exceed industry standards of practice, that demonstrate responsibility and leadership through the commitment and actions of our employees, and that are developed through consultation with COIs. We continually review our facilities and procedures and are committed to maintaining the highest standard of safety at our operations.

In addition to internal assessments of performance against our own guidelines and practices noted as one of our six levels of protection, we assess our tailings management practices under the MAC TSM Tailings Management Protocol. Achieving a minimum of a "Level A" under TSM is a requirement of our HSEC Management Standards. A "Level A" indicates that tailings management practices that meet industry best practice, as defined by the MAC Tailings Guidelines, have been developed and implemented. In addition to our minimum requirements, several of our facilities reach Level AAA, which indicates that excellence and leadership in tailings management are demonstrated through validation by an external, independent evaluation.

As the need for updating the TSM indicators is being evaluated and the call for industry to re-evaluate its practices is being heeded, we provided substantial support and input to the MAC; the Mining Association of BC; the Canadian Institute of Mining, Metallurgy and Petroleum; and the ICMM in related discussions throughout 2015.

Update From Our Subject Matter Experts

"At Teck, we have comprehensive systems and procedures in place for the safe operation, maintenance and monitoring of our tailing facilities which we consider to be industry best practices. At the same time, we recognize the value of continued improvement in tailings management both for Teck and the industry. For example, I represented Teck in 2015 on an independent task force to review Mining Association of Canada's (MAC) Towards Sustainable Mining (TSM) tailings management requirements. The task force made 29 recommendations to support the mining industry in ensuring zero failures, which have been accepted by MAC's membership and will be integrated into TSM during 2016."

Michael Davies,
Vice President, Environment

How Does Teck Manage Tailings and Mine Waste?

Snapshot

Learning from the Mount Polley Tailings Pond Breach

In light of tailings storage facilities failures at the Mount Polley mine and Samarco mine, we recognize the need for the mining sector as a whole to improve its performance and provide greater assurance to the public of the measures taken to ensure the integrity of tailings facilities.

While we have confidence in our policies and procedures relating to tailings management, following the Mount Polley incident we undertook a comprehensive review of our tailings management systems. In addition to conducting specific reviews of our facilities to ensure safety and stability following the Mount Polley failure, we also reviewed our dam consequence classification scoring system to ensure tailings dams are classified based on risk. Our tailings storage facilities scores were also reviewed, as well as potential inundation impacts, and surveillance and monitoring practices. The review concluded that our practices were appropriate. A company-wide tailings database, which contains key information for our facilities, was updated and will be reviewed annually. We have also increased COI engagement activities, to better inform COIs about our tailings management practices and about our emergency response and evacuation procedures.

Coarse Coal Refuse Management

Coarse coal refuse is mixed with dewatered fine coal refuse within engineered structures at several of our operations for storage efficiency and optimal geotechnical performance. Long-term storage of coarse coal refuse is conducted in accordance with approved closure plans involving contouring, covering and revegetation to achieve established land use objectives.

Waste Rock Management

The bulk of waste rock from our operations is placed in areas that are specifically designed to contain the rock, or it is used to backfill open pits and underground workings. Waste rock that is not susceptible to oxidation processes, which can lead to metal leaching, is also used for reclamation activities and to construct dams and roads. Long-term storage of waste rock is conducted in accordance with closure plans approved by regulatory authorities. These plans can include contouring, covering and revegetation to achieve established land use objectives.

Hazardous Waste and Non-Hazardous Waste Management

Although a small volume relative to our tailings and waste rock, we treat our other waste management responsibilities with equal focus. Hazardous and non-hazardous wastes are segregated and disposed of in accordance with waste management plans and regulatory requirements. The primary hazardous wastes produced at our operations include waste oil, solvents, antifreeze, paint, batteries and fluorescent tubes. This waste is recycled or disposed of off-site by licensed contractors. Non-hazardous waste (e.g., scrap metal, wood waste, glass, tires, cardboard and paper) is recycled whenever possible. We have systems in place to responsibly manage all of our waste materials.

What was Our Performance in Tailings and Mine Waste Management in 2015?

In this section, we report on tailings management and waste management performance.

Tailings Management Performance

Well before the incidents at Mount Polley and Samarco operations, Teck had in place a tailings management policy and guidance document and employed industry best practices such as review boards. However, as a result of these recent tailings incidents, we have further intensified our focus on reviewing our tailings management practices and facilities to ensure they meet evolving best practice. We continue to assess and improve our operating, inspection, monitoring and maintenance practices. Table 22 below outlines the internal and external review mechanisms that are in place.

Table 22: **Summary of Management At Active Tailings Storage Facilities at Teck[1,2]**

Operation	Type	Staff Inspection	Annual External Inspection	Detailed Third-Party Reviews (Frequency)	Tailings Review Board
Carmen de Andacollo	Tailings Impoundment	Yes	Yes	N/A[1]	Yes
Elkview	Tailings Impoundment	Yes	Yes	Every 5 years	Yes
Fording River	Tailings Impoundment	Yes	Yes	Every 7 years	Yes
Greenhills	Tailings Impoundment	Yes	Yes	Every 7 years	Yes
Highland Valley Copper	Tailings Impoundment	Yes	Yes	Every 5 years	Yes
Pend Oreille	Tailings Impoundment	Yes	Yes	Every 5 years	N/A[2]
Red Dog	Tailings Impoundment	Yes	Yes	Every 5 years	Yes

(1) This type of review not mandated in Chile — Teck utilizes the Tailings Review Board for this function.
(2) Pend Oreille Operations is not a major facility with a credible failure mode, so a tailings review board has not been struck.

Waste Management Performance

In 2015, our operations generated approximately 822 million tonnes of mineral waste, with the vast majority being waste rock from the extraction of ore and coal. In 2015, we generated approximately:

- 69 million tonnes of tailings and fine coal refuse from processing ore and raw coal in 2015 (73 million tonnes in 2014)
- 9 million tonnes of coarse coal refuse (11 million tonnes in 2014)
- 744 million tonnes of waste rock (829 million tonnes in 2014)

We don't currently track office and construction waste, which are managed by external waste service providers. Hazardous and non-hazardous waste numbers can be found on www.teck.com.

Emerging Risk — Tailings Management Technologies

Societal concern on how tailings are managed has increased in the wake of tailings dam failures in 2014 and 2015. There are growing COI expectations that mining companies will implement alternatives to water-covered tailings storage facilities for new mine developments. This may result in changes to regulatory requirements, increased mine construction costs and community opposition if preferred tailings alternatives are not employed. At the same time, this focus has the potential to drive new advancements in tailings technologies over the longer term.

Outlook for Tailings and Mine Waste Management

As the mining industry reviews and improves best practices for tailings management, Teck will continue to play an active role in collaborating with industry partners. In 2016, Teck will participate in the ICMM global tailings management review, the review of Towards Sustainable Mining (TSM) Tailings Management Protocol and other industry forums. At our operations, we will continue to review our facilities and procedures to maintain the highest standard of safety while meeting all environmental management objectives.