

## Tailings Dam Terms and FAQ

### **What is a tailings storage facility (TSF)?**

- A tailings storage facility (TSF) is a structure (one or more dams) built for the purposes of storing the uneconomical ore (ground up rock, sand and silt) and water from the milling process.

### **Are tailings storage facilities/dams the same as conventional water dams?**

- Tailings storage facilities are similar to conventional dams and they are subject to similar technical guidelines but serve different purposes. They are also regulated by different government agencies and under separate pieces of legislation.

### **How many tailings dams are there in B.C.?**

- There are 98 tailings dams at 60 mine sites in B.C.
- By comparison, there are almost 1500 water dams and 79 hydroelectric dams in BC.

### **What is contained in a tailings storage facility?**

- Tailings, ground up rock (uneconomical ore after processing) plus water, are contained in the TSF. The composition of the tailings will vary depending on the composition of the rock in the surrounding environment and the process of mineral extraction used at each mine.

### **How are tailings storage facilities regulated in B.C.?**

- TSFs are regulated in BC by the Ministry of Energy & Mines under the Mines Act and the Health, Safety and Reclamation Code for Mines in British Columbia (HSRC). The HSRC includes the requirement to use the Canadian Dam Association Dam Safety Guidelines.
- The CDA guidelines are comprehensive design guidelines that include a Consequence of Failure classification. Dams are rated according to the potential effect of failure and dams are assigned risk ratings of Low, Significant, High, Very High or Extreme. Design guidelines vary by the risk rating.

### **How is the safety of tailings dams maintained?**

- The provincial government through the Health, Safety and Reclamation Code for Mines in British Columbia (HSRC), requires that:
  - Tailings dams are inspected annually, and a Dam Safety Inspection (DSI) report is submitted to and reviewed by the Chief Inspector of Mines.
  - Dam Safety Reviews are required every five to ten years for dams with a significant, high, very high or extreme classification. These reviews are more comprehensive than the annual DSI and follow the Association of Profession Engineers of BC (APEG BC) Guidelines and the Canadian Dam Association (CDA) Guidelines.

- All TSFs are required to have an Operational, Maintenance and Surveillance (OMS) Manual that prescribes the responsibilities of all parties associated with the tailings dam and documents dam safety procedures for monitoring and response to monitoring.

### **What are Dam Safety Inspection Reports?**

- Annual Inspections of tailings impoundments at mines and associated facilities are required to evaluate the current and past performance of the facility and to observe potential deficiencies in its condition, performance and/or operation.
- All mining companies must complete and submit to the Chief Inspector of Mines an annual Dam Safety Inspection report on the operation, maintenance and surveillance of the tailings impoundments and water management facilities for each structure.
- In addition to the annual Dam Safety Inspection Report, the Ministry of Energy and Mines conducts its own inspections regularly at mines throughout the province, the owner is required to complete a Dam Safety Review every 5 to 10 years which is a more comprehensive analysis of the state of the dam.

### **Who conducts the annual Dam Safety Inspection?**

- A qualified geotechnical engineer is responsible for conducting each dam safety inspection.
- The engineer must be qualified to conduct safety evaluations and be familiar with the designs and other site-specific conditions and requirements pertaining to operations of the impoundment and associated facilities.
- The dam safety inspection is based on detailed observations made by the engineer on site and relevant information on the tailings storage facilities operations collected by site personnel (including observations and instrumentation results).
- In addition, the August 2014 Chief Inspector Mines order a review by an independent qualified third party professional engineer from a firm not associated with the tailings facility. This third party review must also include a review of the dam consequence classification.

### **What do the engineers look at when they conduct an annual Dam Safety Inspection?**

- The geotechnical engineer doing the report will meet with operations staff at the facility, review records and physically walk sections of the dam in order to evaluate the safety of the tailings storage facility and report on the following:
  - The classification of a dam based on the consequences of its failure (i.e. it is not based on the condition of the dam)
  - Records of the instrumentation readings and visual surveillance carried out since the last dam safety inspection.

- Changes to surface water control, including records of surface water levels based on gauging
- Updates to the Operation, Maintenance and Surveillance Manual prepared for each dam
- Current plan views and representative cross sections, comparing the current state of the dam versus the design and identifying any non-conformances or changes to the plan.
- The past year's construction (if any) on the dam
- Site photographs
- Available Freeboard (the distance between the top of the water level surface and the lowest point of the crest of the dam)
- Volumes and quality of water discharged from the tailings storage facility as measured by instrumentation and laboratory test results.
- Locations of seepage on the slopes, at the base and around the perimeter of the dam, including locations beyond the base of the dam,
- Areas of surface erosion which may require additional protection

**What is meant by “plan and representative cross sections”?**

- Design drawings are required to be provided in plain view (from above), and cross sections (across the dam) at representative points. As most tailings dams are built over a number of years, regular reviews of plan and representative cross sections allows the engineer to assess whether the dam is being constructed according to the design plan for the facility.

**What is included in the engineers Dam Safety Inspection Report?**

- The report includes information on the areas inspected by the engineer as outlined above.
- In addition, the report will include the engineer's conclusions on the status of the tailings storage facility, recommendations if necessary, and an indication of the mine's completion of recommendations from previous inspections.

**What does the mining company have to do in response to the reports?**

- The mine must prepare and execute an appropriate action plan to ensure that all recommendations made in the annual inspection report are followed.

**What is a dam's classification based upon?**

- A dam's classification (also referred to as a dam consequence classification) is based on potential impacts of failure (i.e. consequences) on the safety of the population, the environment, cultural values, property and infrastructure.

- The classification is not reflective of the current condition of the dam.
- The classification is set as Low, Significant, High, Very High or Extreme according to guidelines set by the Canadian Dam Association Dam Safety Guidelines.
- The classification is used to establish design criteria (i.e. the higher the consequence the more robust the design), as well as to set the frequency of inspection and the requirements for the preparation of an emergency preparedness plan.
- Dam classification is based on the extent of a hypothetical failure (inundation).

**What is a dam break inundation study and why don't all mines with tailings storage facilities have to prepare them?**

- A dam break inundation study is completed to model where the water and tailing materials retained by the dam would flow if a failure were to occur.
- Not every mine with a tailings impoundment is required to complete a dam break inundation study. The Health, Safety and Reclamation Code for Mines in British Columbia requires Emergency Preparedness and Response Plans for dams with a consequence classification of high, very high or extreme.

**What does the mining company do when it comes to the “surveillance” of the tailings storage facility?**

- The level of surveillance and monitoring on tailings impoundments depends on the size/scale of the facility and the dam consequence classification. Some examples of what this includes are:
  - Visual observation (e.g. signs of slope movements, loss of freeboard, increased seepage, excessive vegetation growth, etc.)
  - Instrumentation in the dam to monitor pore water pressures and movement.
  - Compaction testing and material specifications during construction activities
  - Monitoring of operations (e.g. water balance)

**Who is the Canadian Dam Association (CDA) and what role do they play in dam safety?**

- CDA is a group of dam owners, operators, regulators, engineers and others who share the goal of advancing knowledge and practices related to dams, consistent with social and environmental values. Their members are involved with all types of dams, including those used for irrigation, hydroelectric power, municipal water supply and mining operations.
- The Canadian Dam Safety Association (CDSA) was founded in 1989 to advance the implementation of practice to ensure the safe operation of dams in Canada. In 1997, the CDSA amalgamated with the Canadian National Committee on Large Dams (CANCOLD) to form the

Canadian Dam Association (CDA). CDA now serves as the Canadian national committee of the International Commission on Large Dams (ICOLD).

- CDA has developed Dam Safety Guidelines and related technical bulletins that have become primary references for dam owners, operators and regulators. The CDA Mining Dams Committee has developed additional guidance on dam safety for tailing dams and other mining dams.
- CDA publishes guidance on the design, construction and safe operation of all dams including tailings dams. In Canada, the licensing and regulation of dams is generally under provincial or territorial jurisdiction, although the Canadian Nuclear Safety Commission is responsible for the regulation of tailings dams associated with uranium mining.