



centerra**GOLD**



Kemess South TSF, British Columbia

## CENTERRA GOLD'S COMMITMENT TO TAILINGS SAFETY

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### Centerra Gold's Tailings Storage Facilities

Tailings are liquid and solid materials, commonly deposited as slurry, that remain after the extraction of metals and minerals from crushed, ground and processed ore. Tailings are a waste by-product of extraction and are stored in specially designed impoundments that retain solid materials and water. Typically, the water is recovered and recycled back to the mill or is treated for release into the environment.

Centerra Gold (Centerra) actively manages six tailings storage facilities (TSFs). Two facilities are currently active, two are on care and maintenance, one is entering the closure phase and the final one is in the early stages of the closure phase. A disclosure table on Centerra's TSFs can be found in Appendix A.

Centerra's TSFs are actively managed to maintain structural performance and ensure worker, environmental and public safety. Centerra's TSFs are designed in accordance with all applicable dam safety regulations and requirements. In addition, operation of the TSFs is informed by, and routinely checked against, guidance from the Canadian Dam Association and the International Commission on Large Dams.

# Centerra has four types of TSFs: downstream, centreline, modified centreline and upstream.

## 1. Downstream

A downstream tailings design starts with the construction of a starter dam. Tailings are discharged behind the dam and as the embankment is raised, each new wall is constructed and supported on top of the downstream slope of the previous section and on new ground. This method does not use the tailings as any part of the foundation, as the dam crest moves downstream of the starter dam with each additional dam raise.

Centerra has one downstream TSF located at its Kumtor gold mine in the Kyrgyz Republic. At the Kumtor TSF, a shear key has been incorporated into the design which is on average constructed to a depth of 10m below ground to remove an ice-rich fluvial material for added dam stability.



Fig. 1: Downstream TSF



Fig. 2: Downstream TSF at the Kumtor gold mine

## 2. Centreline

A centreline tailings design begins with the construction of a starter dam. The dam is raised in vertical lifts from the starter dam which keeps the dam crest fixed relative to both the downstream and upstream directions. This construction methodology has little reliance on the formation of the tailings beach; however, it requires engineered drainage features that intercept seepage to avoid saturation and a breakout of the phreatic surface on the downstream slope. Centerra has two centreline TSFs located at its Thompson Creek mine in Idaho, USA, and its Mount Milligan mine in British Columbia, Canada.



Fig. 3: Centreline TSF

## 3. Modified Centreline

The modified centreline design combines construction aspects from both the upstream and centreline methods and is used to reduce the volume of construction material placed on the downstream shell of the embankment. The angle of the upstream crest advance is calculated during the design phase using stability and seepage analyses. Typically, rockfill is used rather than the coarse tailings fraction to gain a higher angle, and increase the stability of the dam.

As the red angle line, shown in Figure 4, rotates counterclockwise this method basically transitions from a centreline to an upstream method. Therefore, it is important that the extent of the step-out on the tailings is not excessive to ensure that the tailings have the strength required to support the nose of each dam raise.

Centerra has one modified centreline TSF located at its Kemess South mine in British Columbia, Canada. At the Kemess South facility, a supporting buttress and spillway (a structure used to provide the controlled release of flows from the dam into a downstream area) has been constructed to support closure activities.

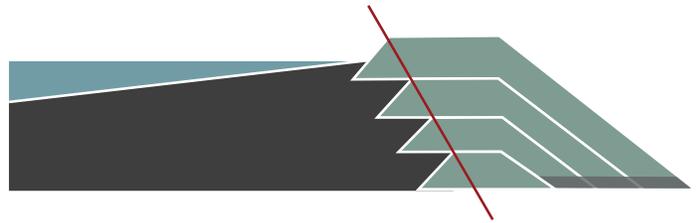


Fig. 4: Modified Centreline TSF

## 4. Upstream

An upstream tailings design begins with the construction of a starter dam. Tailings are discharged behind the dam and form a tailings beach as water drains, allowing the tailings to harden and form a foundation for the next lift. Construction progresses such that the crest of the dam moves upstream to the starter dam using a portion of the hardened tailings as a foundation.

Centerra has two upstream TSFs located at its Endako mine in British Columbia, Canada. At these facilities, Centerra actively manages the pond water to maintain the required beach width and prevent the pool from flooding the beach during operations and extreme precipitation events.

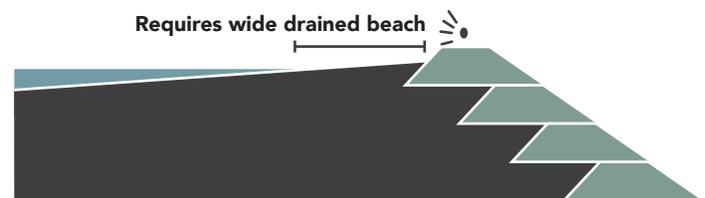


Fig. 5: Upstream TSF

## Centerra's Risk Management Process

Centerra's TSFs have all been designed by professional engineers and are constructed, operated and monitored under the guidance of an external engineer of record (EoR). Each site has an Operations, Maintenance and Surveillance Manual that sets-out clear expectations for the maintenance and ongoing management of the TSFs to ensure they remain safe and perform as designed.

All of Centerra's mine sites follow the Canadian Dam Association's Consequence Classification which assigns a consequence ranking from low to extreme based upon the environmental, safety and economic effects of a potential dam incident. This system does not assign a risk associated with a

given TSF; instead, it is intended to evaluate the consequences in the unlikely event of a dam breach. Formal inundation studies have also been completed for each of Centerra's sites to identify potential community and environmental impacts, including impacts on nearby bodies of water in the event of a tailings incident. Used together, Centerra's sites can evaluate potential risks, evaluate design and mitigation strategies and develop appropriate emergency planning and response systems.

Centerra has developed a 5-step risk mitigation process that is applied and monitored at each site. These systems and procedures are part of Centerra's proactive approach to tailings management.

### STEP 1

#### Site Monitoring Systems

Centerra's on-site teams use monitoring programs that may include but are not limited to piezometers, inclinometers, pressure gauges, monitoring prisms, seepage wells, thermistors and settlement plates to monitor the performance of the tailings dams, abutments, natural slopes and water levels. In addition, the on-site teams rely on seepage flow rate measurement, impoundment pool monitoring and routine visual observation.

### STEP 2

#### Operational Staff Inspections

Trained site personnel and technical staff perform daily inspections on each active TSF. The operations and on-site teams perform monthly inspections and review systems data to monitor the tailings facilities for cracking or other signs of potential instability. More frequent inspections are conducted following significant precipitation, wind, fire or seismic events.

### STEP 3

#### Annual Engineer of Record Inspections

Annual safety inspections are completed by an external EoR. The EoR reviews the performance of the facility against the design criteria and submits reports to the site with prioritized action items for review as well as proposes a timeline to complete any required actions items.

### STEP 4

#### Independent Third-Party Dam Safety Reports

In all jurisdictions except Idaho, USA, a qualified independent tailings reviewer (different from the EoR and not a member of the ITRB or equivalent externally appointed expert) periodically conducts an assessment of the tailings dam and issues a report that evaluates the performance of the tailings facilities to the EoR and Centerra.

In Idaho, an independent review of the Thompson Creek tailings dam is carried out periodically by a panel comprised of regulatory agencies.

### STEP 5

#### Independent Tailings Review Boards

Each site, regardless of its facilities life cycle, has an Independent Tailings Review Board (ITRB) or an equivalent externally appointed expert. An ITRB comprises independent experts who work with Centerra and the EoR by conducting reviews of the design, operation, monitoring data, and maintenance practices to evaluate the performance of the tailings facilities against the design criteria and to provide guidance and recommendations regarding these practices.

## Emergency Response and Preparedness Plan

In addition to the comprehensive risk mitigation process, Centerra has an emergency response plan (ERP) in place at each site. During the permitting and environmental assessment phases, the ERP is communicated to key stakeholders. Centerra's ERP also sets-out notification protocol to communities and the Ministry of Environment, or equivalent local and regional authorities, in the event of an incident. During visits to operational sites, local community members and authorities may request information about the emergency preparedness actions and procedures in order to become familiar with the company's operations and understand the measures that the company applies to minimize its environmental impact.

## Continuous Improvement

Centerra is firmly committed to ensuring that its TSFs remain safe and continue to perform as designed, especially in light of recent global TSF breaches. As part of this process, Centerra evaluates its risk mitigation strategy against international best practices and external factors, like increased precipitation events, and identifies areas for improvement. For example, in 2019, each site completed an initial climate change impact assessment to understand the risks associated with extreme weather events and what design strategies may be implemented to mitigate any dam incident risks.

### For more information

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**This disclosure is certified by Scott G. Perry,  
President and Chief Executive Officer of Centerra Gold.**



Scott G. Perry  
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Information contained in this document which is not a statement of historical fact may be "forward-looking information" for the purposes of Canadian securities laws. Such forward-looking information involves assumptions, risks, uncertainties and other factors that could cause actual results, performance, prospects and opportunities to differ materially from those expressed or implied by such forward looking information. The words "believe", "expect", "anticipate", "contemplate", "plan", "intends", "continue", "budget", "estimate", "may", "will", "schedule", "understand" and similar expressions identify forward-looking information. These forward-looking statements relate to, among other things: the Company's plans and strategies for overseeing risks related to its tailings storage facilities.

Forward-looking information is necessarily based upon a number of estimates and assumptions that, while considered reasonable by Centerra, are inherently subject to significant political, business, economic and competitive uncertainties and contingencies. Known and unknown factors could cause actual results to differ materially from those projected in the forward-looking information. Factors that could cause actual results or events to differ materially from current expectations are set out in Centerra's annual information form.

Centerra assumes no obligation to update or revise forward looking information to reflect changes in assumptions, changes in circumstances or any other events affecting such forward-looking information, except as required by applicable law.

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TSX: CG

## APPENDIX A: MINE TAILINGS DISCLOSURE TABLE

1. "Tailings Dam" Name/identifier	2. Location	3. Ownership	4. Status	5. Date of initial operation	6. Is the Dam currently operated or closed as per currently approved design?	7. Raising method
<b>Kumtor TSF</b>	42° N 78° E	Owned and Operated	Active	1997	Yes	Downstream
<b>Mount Milligan TSF</b>	UTM NAD83 (435,073E, 6,110,636N) to (438,178E, 6,107,238N)	Owned and Operated	Active	2013	Yes	Centreline
<b>Kemess South TSF</b>	57°01' 18" N 126° 40' 11" W	Owned and Operated	Transition to Closure	1998	Yes	Modified Centreline
<b>Thompson Creek Mine Bruno Creek TSF</b>	Northing 294.542813 Easting 110.772088	Owned and Operated	Inactive Care & Maintenance	1983	Yes	Centreline
<b>Endako Tailings Ponds #1 &amp; #3</b>	Northing 125.091929 Easting 54.051582	Joint Venture: Centerra (75%, Operator), Sojitz (25%)	Inactive Care & Maintenance	1965	Yes	Upstream
<b>Endako Tailings Pond #2</b>	Northing 125.11678 Easting 54.021438	Joint Venture: Centerra (75%, Operator), Sojitz (25%)	Inactive Care & Maintenance (End of life)	1967	Yes	Upstream



	<b>8. Current Maximum Height</b> (m=metres) *The information below is the current actual height of the TSF.	<b>9. Current Tailings Storage Impoundment Volume</b> (M <sup>3</sup> =million cubic metres)	<b>10. Planned Tailings Storage Impoundment Volume in 5 years time</b> (M <sup>3</sup> =million cubic metres)	<b>11. Most recent Independent Expert Review</b> (i.e. Dam Safety Inspection)	<b>12. Do you have full and complete relevant engineering records including design, construction, operation, maintenance and/or closure?</b>	<b>13. What is your hazard categorisation of this facility, based on consequence of failure?</b>	<b>14. What guideline do you follow for the classification system?</b>
<b>Kumtor TSF</b>	40.5m	90M <sup>3</sup>	106.5M <sup>3</sup>	Oct 2018	Yes	Very High	Canadian Dam Association (CDA) 2013
<b>Mount Milligan TSF</b>	100m	86M <sup>3</sup>	111.1M <sup>3</sup>	Oct 2018	Yes	Very High	Canadian Dam Association (CDA) 2013
<b>Kemess South TSF</b>	180m	141M <sup>3</sup>	141M <sup>3</sup>	Oct 2018	Yes	Very High	Canadian Dam Association (CDA) 2013
<b>Thompson Creek Mine Bruno Creek TSF</b>	230m	150M <sup>3</sup>	150M <sup>3</sup>	Oct 2018	Yes	Very High	Canadian Dam Association (CDA) 2013
<b>Endako Tailings Ponds #1 &amp; #3</b>	96m	216M <sup>3</sup>	216M <sup>3</sup>	Jul 2018	Yes	Pond 1: High Pond 3: Significant	Canadian Dam Association (CDA) 2013
<b>Endako Tailings Pond #2</b>	147m	107M <sup>3</sup>	107M <sup>3</sup>	Jul 2018	Yes	High	Canadian Dam Association (CDA) 2013



	15. Has this facility, at any point in its history, failed to be confirmed or certified as stable, or experienced notable stability concerns, as identified by an independent engineer (even if later certified as stable by the same or a different firm).	16. Do you have internal/in house engineering specialist oversight of this facility? Or do you have external engineering support for this purpose?	17. Has a formal analysis of the downstream impact on communities, ecosystems and critical infrastructure in the event of catastrophic failure been undertaken and to reflect final conditions? If so, when did this assessment take place?	18. Is there a) a closure plan in place for this dam, and b) does it include long term monitoring?	19. Have you, or do you plan to assess your tailings facilities against the impact of more regular extreme weather events as a result of climate change, e.g. over the next two years?
<b>Kumtor TSF</b>	Yes	Both	Yes - May 2015	Yes and Yes	Yes
<b>Mount Milligan TSF</b>	No	Both	Yes - Jun 2015	Yes and Yes	Yes
<b>Kemess South TSF</b>	No	External	Yes - Jul 2005	Yes and Yes	Yes
<b>Thompson Creek Mine Bruno Creek TSF</b>	No	External	Yes - Aug 2015	Yes and Yes	Yes
<b>Endako Tailings Ponds #1 &amp; #3</b>	No	External	Yes - May 2013	Yes and Yes	Yes
<b>Endako Tailings Pond #2</b>	No	External	Yes - May 2013	Yes and Yes	Yes



**20. Any other relevant information and supporting documentation.**  
 Please state if you have omitted any other exposure to tailings facilities through any joint ventures you may have.

<p><b>Kumtor TSF</b></p>	<p>Further to question 15, a shear key has been incorporated into the designs that removes an ice-rich permafrost from the foundation.                  More information on Centerra's TSFs can be found in the company's technical reports and annual filings on <a href="http://www.sedar.com">www.sedar.com</a> and <a href="http://www.centerragold.com">www.centerragold.com</a></p>
<p><b>Mount Milligan TSF</b></p>	<p>More information on Centerra's TSFs can be found in the company's technical reports and annual filings on <a href="http://www.sedar.com">www.sedar.com</a> and <a href="http://www.centerragold.com">www.centerragold.com</a></p>
<p><b>Kemess South TSF</b></p>	<p>More information on Centerra's TSFs can be found in the company's technical reports and annual filings on <a href="http://www.sedar.com">www.sedar.com</a> and <a href="http://www.centerragold.com">www.centerragold.com</a></p>
<p><b>Thompson Creek Mine Bruno Creek TSF</b></p>	<p>More information on Centerra's TSFs can be found in the company's technical reports and annual filings on <a href="http://www.sedar.com">www.sedar.com</a>. Technical reports are filed under the Thompson Creek Metals Company Inc. issuer profile.</p>
<p><b>Endako Tailings Ponds #1 &amp; #3</b></p>	<p>For Pond #3, the starter dam has been constructed as a downstream design; however, when operations resume, this dam will be raised according to an upstream design.</p>
<p><b>Endako Tailings Pond #2</b></p>	<p>More information on Centerra's TSFs can be found in the company's technical reports and annual filings on <a href="http://www.sedar.com">www.sedar.com</a>. Technical reports are filed under the Thompson Creek Metals Company Inc. issuer profile.</p>

\* Information regarding management of the historic tailings at the Hardrock Project, a 50/50 joint ownership between Centerra Gold and Premier Gold Mines Limited, will be addressed in a subsequent disclosure.