**Investigating for Dry Stack Tailings Facility Closure: Multidisciplinary Evaluation at the Pogo Mine, Alaska**

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**Summary**  
Sumitomo Metal Mining Pogo LLC (Pogo) is the operator of the Pogo underground gold mine, located near Delta Junction, Alaska. The mine has been in operation since 2006 and produces between 380,000 and 400,000 ounces of gold annually. Fractured tailings from the footwall circuit and waste rock from the mine are placed in the dry stack tailings facility (DSTF). Expansion of the DSTF from 2011 to 2013 involved a significant increase in the volume of materials placed in the DSTF closure plan. Geotechnical field and laboratory testing indicates that effective friction angles and dry densities of in situ DSTF materials are consistent with previous slope stability analyses. Geotechnical investigation, thermal monitoring, and analysis indicate the presence of permafrost within the DSTF. Positive pore pressures and shallow observations indicate a perched water surface near the base of the DSTF. This study narrows the focus of data collection for future closure planning and provides an example of physical and chemical conditions within a dry stack tailings facility in a continental, subarctic climate. These findings are pertinent for planning, design, permitting, operation, and closure of dry stacks in similar climates.

**Pogo Dry Stack Tailings Facility (DSTF)**  
Pogo Mine is an underground gold mine operated by Sumitomo Metal Mining Pogo LLC (Pogo), located approximately 60 km northeast of Delta Junction, Alaska.

**DSTF History**  
- Pogo Mine is an underground gold mine operated by Sumitomo Metal Mining Pogo LLC (Pogo), located approximately 60 km northeast of Delta Junction, Alaska.
- Ground temperature and pore pressure measurements, and estimated freezing characteristics of DSTF materials in the stack.
-occurrence of permafrost within the DSTF
-Positive pore pressures and shallow observations indicate a perched water surface near the base of the DSTF.

**Subsurface Investigation**  
Subsurface investigation to evaluate DSTF geotechnical, thermal, hydrogeological, and geochemical characteristics.

**Dry Stack Tailings and Waste Rock**  
- S8 scale tailings were described in the field to be moist, with most intervals unconfined ground water.
- Sand and gravel waste rock were described in the field to be dry.
- Effective friction angles of tailings ranged from 34°-36°.

**Ground Temperature and Pore Pressure**  
- Ground temperatures thermally equilibrated over a two- to three-month period following initialization.
- Shallow ground temperatures ranged from 1.9°C to 2.0°C in response to surface heating and cooling (VWP Sensor RR-1 Shallow).
- Deep ground temperatures below the depth of seasonal variation ranged from -0.6°C to -0.8°C.
- Permeability, as thermally defined, is present within the DSTF.
- VWP recorded both positive and negative pore pressures.
- Positive pore pressures recorded at the site may be caused by a perched water surface above the sensor.
- Negative pressures may be caused by either soil matric suction in unsaturated materials or cryosuction under freezing conditions.

**Tailings Freezing Characteristics**  
- Positive pore water in the DSTF affects physical stability, surface water runoff characteristics, permafrost, and geotechnical stability.
- Estimated unfrozen water content curves for DSTF tailings indicate liquid pore water is present at subfreezing temperatures.
- The unfrozen water content at -1°C is estimated to range between 7 and 11% of the dry mass.
- Acid-generating potential of DSTF materials affected water quality associated with the facility.
- Aqueous pH values were less than pH 9.0.
- Evaluation of the long-term metals-leaching potential of DSTF materials through laboratory testing, comparison to operational monitoring data, and water quality modeling may inform selection and design of a closure cover system.

**Acid-generating Potential**  
- Geochronological, chemical and physical characteristics of DSTF materials indicate potential for acid production.
- Geochemical analyses of DSTF materials show that acidic drainage from the stack is unlikely.
- Estimated unfrozen water content curves for DSTF tailings indicate liquid pore water is present at subfreezing temperatures.
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- Acid-generating potential of DSTF materials affected water quality associated with the facility.
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- Evaluation of the long-term metals-leaching potential of DSTF materials through laboratory testing, comparison to operational monitoring data, and water quality modeling may inform selection and design of a closure cover system.

**Key Findings and Implications for DSTF Closure**  
This study contributes to further understanding of the geotechnical, thermal, hydrologic, and geochronological conditions of the Pogo Mine DSTF in support of closure planning. Specifically, this study confirms specific aspects of the DSTF operational construction and closure plans while narrowing the focus of data collection for future closure planning.

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