POLYMET
MINING

100 King Street West, Suite 5700, Toronto, Ontario, Canada, M5X 1C7
Tel: +1 (416) 915-4149

444 Cedar Street, St. Paul, MN 55101, Tel: +1 (651) 389-4100

6500 County Road 666, Hoyt Lakes, MN 55750-0475
Tel: +1 (218) 471-2150

www.polymetmining.com

January 9, 2015

This letter is to inform the co-lead agencies of PolyMetôs plan to incoporate cement deep soil mixing (CDSM) into the existing tailings basin. The CDSM will enhance the shear strength of the existing LTVSMC fine tailings/slimes and peat layers.

CDSM is an additional engineering measure that has been added to the Flotation Tailings Basin (FTB) design in order to achieve the required slope stability factors of safety under one possibleð but unlikelyð geotechnical modeling scenario. This particular modeling scenario involves an unknown trigger causing tailings to liquefy, with significant loss in strength. In such a worst-case modeling scenario, LTVSMC fine tailings/slimes and the Flotation Tailings are assumed to liquefy, whether or not liquefaction is shown to trigger in these materials. The precise likelihood of an unknown trigger occurring is, by definition, unknown. But with the addition of CDSM, modeling shows that the FTB design achieves required slope stability factors of safety for the worst-case modeling scenario. Probabilistic analysis that takes into account the uncertainty in material strengths shows that the combined probability of incurring an unknown trigger that causes liquefaction, and dropping below the minimum slope stability safety factor of 1.0 (thereby causing slope failure), is on the order of 1 in 1,000,000.

CDSM is a well-established in-situ soil stabilization method that mixes soil with cement or other suitable stabilizing agent. The resulting mix improves engineering properties of materials in terms of strength and stiffness and reduces the permeability and compressibility of the treated tailings. For over 40 years, national and international practitioners and researchers have documented projects where this technique has been successfully implemented to improve slope stability.

Shear walls will be created using CDSM by augering multiple, overlapping, 3-foot diameter columns. The tailings and peat encountered within the auger path will be mixed with cement to create the overlapping columns (shear walls). The tailings and peat plus the cement have improved strength. The augers used are hollow-stem; cement or water-cement slurry is injected from the auger blades, mixing the cement with the tailings and peat as the augers rotate and advance. To provide anchorage and to ensure CDSM shear walls will not move with the soil mass in a potential liquefaction triggering event, the shear walls will be partially drilled into the competent till layer that underlies the peat.

The properties of the CDSM zone depend on the width, height, thickness, spacing, area replacement ratio (the percent of a unit quantity of tailings or peat that undergoes CDSM), and location of the shear walls. Optimal location and geometry of the CDSM shear walls are determined in an iterative design process during geotechnical modeling. For more specific details on the modeling and design, see the Geotechnical Data Package, Volume 1. In summary, the shear walls will be 5 to 50 feet long, 55 feet tall, 3 feet thick (the column diameter), and oriented perpendicular to the dam axis, with spacing of 10 feet.

Construction of the CDSM will take place during the Project construction phase. Engineering controls such as enclosed material storage and transfer equipment, handling of wet material and/or dust collection equipment will be used as needed to prevent particulate matter from becoming airborned as required by Minnesota Rules 7011.0150. Cement will be delivered by rail or truck and pneumatically conveyed to silos. After mixing in a portable cement plant, the cement will be conveyed to two cement deep soil mixing machines mounted on backhoe loaders. Up to two front-end loaders and trucks for hauling material will also be operated. The portable cement plant will require electrical power. The deep soil mixing process is expected to take about 8 to 10 weeks, plus time for setup and demobilization.

An estimate of greenhouse gas emissions for this process assumes that a cement plant with an integrated diesel generator would be used. The estimated GHG emissions (CO2-e) for this process are minor: they are 0.2% of the total construction phase GHG emissions, and 0.0013% of the total project GHG emissions.

The addition of the CDSM to the FTB is not expected to have a significant impact on the hydrology in the basin. While the addition of cement during the CDSM process will reduce the hydraulic conductivity of the fine tailings/slimes and peat layers, the hydraulic conductivity after mixing will be about 70% of its original valueð a decrease that is in the range of the natural variability of the materials. Also, the shear walls will be narrow and oriented parallel to the direction of groundwater flow. For these two reasons, the shear walls were not simulated in the groundwater model and are not expected to have a significant impact on the key model predictions. (From Water Modeling Data Package Volume 2 ï Plant Site, Attachment A).

The addition of the CDSM to the FTB is not expected to have a significant impact on the geochemistry of the water in the basin. Cement will be added to build the shear walls. Hydrated Portland cement is composed of calcium silicate hydrates, portlandite, hydrated aluminates, ferrites, and sulfate minerals. It may contain minor sodium and potassium dissolved in pore fluid. Therefore, it could theoretically be a source of calcium, aluminum, iron, magnesium, sulfate, sodium, potassium, and alkalinity to seepage. However, the cement component of the CDSM zones will not contribute appreciable constituent load for several reasons: 1) the mass of the cement comprises only a minor amount, approximately 0.1% by volume and approximately 0.01% by mass, of the LTVSMC tailings in which it will be emplaced; 2) the

constituents present in Portland cement are controlled by solubility relationships and observed concentration caps in the seepage from the Tailings Basin and are, therefore, insensitive to release rates; and 3) during the CDSM mix design process, a cement composition will be selected that is relatively non-reactive in the presence of tailings basin seepage. For these reasons, the shear walls were not simulated in the water modeling and are not expected to have a significant impact on the key model predictions. (From Water Modeling Data Package Volume 2 ï Plant Site).

PolyMet is happy to answer any questions you have about the CDSM, or any other aspect of the NorthMet project.

Sincerely,

Jennifer Saran

Jennifer Saran
Director of Environmental Permitting and Compliance