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VIA HAND DELIVERY (HARD COPY AND ELECTRONIC VERSION)

May 16, 2017

Jason Boyle
State Dam Safety Engineer
Minnesota Department of Natural Resources
500 Lafayette Road
St. Paul, MN 55155-3864

RE: Poly Met Mining, Inc.'s Updated Dam Safety Permit Application for the NorthMet Project

Dear Mr. Boyle:

Please find enclosed Poly Met Mining, Inc.'s (PolyMet) updated application to the Minnesota Department of Natural Resources (MDNR) for a Dam Safety Permit Application (Application) for its NorthMet Project's Flotation Tailings Basin (FTB). The updated Application is being submitted because it includes revisions associated with agency review and third party review.

By copy of this letter, and pursuant to Minnesota Statutes Section 103G.301, subd. 6, PolyMet is also providing copies of this updated Application to the local governmental units (the City of Hoyt Lakes and the North St. Louis Soil and Water Conservation District) in with the FTB will be located. This updated Application contains the five primary permit application content sections required by Minnesota Rules, part 6115.0410:

- General Permit Application
- Preliminary Design Report
- Final Design Report
- Plans and Specifications
- Permit Standards

Attached to this letter is a table that summarizes the DNR's third party review of the Application. The table provides the third party reviewers' comments and recommendations, as well as the location in the permit application documents where the comments have been addressed. Three of the main permit-related documents (Contingency Action Plan, Instrumentation and Monitoring Plan, and Template for Pilot/Field Testing of Bentonite Amendment for Tailings) that were updated or drafted based on the third party reviewers' comments are being submitted as separate documents to the MDNR for ease of local government review of the Application. These documents are also part of the Application.

Based on PolyMet's review of the applicable laws and content of this Application, PolyMet believes that this Application is complete and satisfies all federal and state requirements relating

to the content of a dam safety permit application. PolyMet recognizes that MDNR may request additional information during the course of its review.

Thank you in advance for your efforts to review PolyMet's Application. If any questions or concerns arise during MDNR's review of the Application, please do not hesitate to contact me at 651-389-4108 or jsaran@polymetmining.com.

Sincerely,

Jennifer Saran
Director of Environmental Permitting and Compliance

cc: Mark Skelton, City of Hoyt Lakes
Charles Bainter, North St Louis Soil and Water Conservation District

Review of PolyMet's Tailings Basin Permit Application: Tailings Basin Dam

Reviewers: Dirk Van Zyl, Steve Gale/Nate Lichty - Gale Tec Engineering, Inc. and Stu Grubb/Cecilio Olivier - Emmons Olivier Resources, Inc.

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1	Geotech Report-page 123 Mgmt. Plan - page 5 Mgmt. Plan - page 34	Section 9 - Operat. & Mainten. Section 2.1-Flotation Tailings Charact. Section 6.3 - Adaptive Mgmt.	The Management Plan calls for the design and/or the operation to be modified based on operational experience using the Observational Method. We recommend that this approach be defined in the Permit similar to that included in a paper "Liquefaction of Tailings Dams" by Solseng, P.B. - Barr Engineering Company presented/published for a "Liquefaction of Mining Tailings" symposium in Cleveland, Ohio - 1997. The Barr paper details that the Observational Method concept design should include: 1) Predict behavior with detailed calculations, 2) design with contingencies, 3) construct with monitoring and 4) compare measurements with predictions and redesign if necessary. The Geotechnical Report Section 2.1-page 5 states that this method is used for all MDNR-Permitted Tailings Basins. If the Observational Method is to be permitted, we recommend that the plan include a design at the time of permitting and identify what instrumentation will be installed, where the instrumentation will be installed and what the instrumentation will monitor (e.g. excess pore water pressures and tailings dam deformations). If the Observational Method is permitted, we recommend that the permit require stability evaluations be submitted at least yearly with the annual Dam Safety Report. If a significant design change is required, we recommend that the company apply for a permit amendment.	Further clarification on the details of the Observational Methods were requested.	The Observational Method (Peck, R.B., Geotechnique, No. 2, 1969) is based on assessing potential geotechnical failure modes that may result during/post construction as well as conditions and events that could instigate instability. An example condition could be a previously undiscovered layer of soft soil beneath the dike alignment. An example event may be a large rainfall that causes increased seepage and slope toe erosion. After this assessment is complete and critical failure modes and conditions/events are identified and analyzed, contingency plans should be developed for each critical failure mode. We recommend this analysis be performed prior to construction. With the analysis results in mind, a monitoring system (geotechnical instrumentation, site reviews, etc.) should be developed and implemented during construction to monitor dike performance. The monitoring system would be used to confirm assumptions made during original design or to change operations/design if field observations and adverse measurements are recorded. We recommend that to adequately use this method for dike construction, that a geotechnical instrumentation and monitoring plan should be developed based on the results of the dike stability analysis that considers conditions/events that could result in localized or complete dike instability. Contingency plans should be developed for each critical condition. The instrumentation and monitoring plan should include 1) a list of geotechnical instruments that will be installed, where they will be installed and what they will be measuring, 2) how often the instrumentation readings be taken, 3) who will review the instrumentation readings, 4) what the typical values will be and what the thresholds will be that indicate "adverse conditions" that will require a change in operation or design. The contingency plan should include a list of potential adverse conditions that may occur and what would be observed if that condition occurred. The plan should include different operational/design options to address the adverse conditions.	X	X		The importance of a well defined Observational Method is paramount. It is the preference of the reviewers that this key issue be addressed as part of the permit application. Either as a pre-permit or as a condition of the permit, the following items need to be incorporated: 1) Adverse conditions/events that could lead to localized/global dike instability. 2) An instrumentation and monitoring plan that includes those items presented in "Final Comment" section. 3) A contingency plan that includes those items presented in "Final Comment" section.	1) The Contingency Action Plan has been updated to clearly correlate (tabulate) adverse conditions that could occur, the instrumentation required to monitor for these adverse conditions, and the recommended adverse condition response actions. 2) The updated Instrumentation and Monitoring Plan parallels and supports the Contingency Action Plan. The updated plan confirms: a) the list of geotechnical instruments that will be installed, where they will be installed and what they will be measuring, b) how often the instrumentation readings will be taken, c) who will review the instrumentation readings, and d) what the typical values will be and what the thresholds will be that indicate "adverse conditions" that will require a change in operation or design (this item to be completed after instrument installation and baseline data gathering). 3) Instrumentation installation, calibration, and associated data gathering and analysis to confirm data previously utilized in geotechnical analysis is described in the Instrumentation and Monitoring Plan and Geotechnical Data Package - Vol. 1.

Review of PolyMet's Tailings Basin Permit Application: Tailings Basin Dam

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2	Mgmt. Plan - page 10 Geotech Report - page 75, Mgmt. Plan - page 10	Section 2.2.4 - Dam Construct. Section 6.3.2.4 - Cement Deep Soil Mixing Zone	Cement deep soil mixing (CDSM) shear walls are shown to be needed to satisfy stability of the north tailings dam as a result of liquefaction of buried slimes. The Geotechnical Report text states that a Construction Quality Assurance Plan will be developed. Since this CDSM structural feature is such a critical aspect of the plan, we recommend that the permit require bench-scale testing, test columns and field validation using such techniques as coring and wet sampling and geophysical testing (e.g. Ps logging and/or electromagnetic testing methods). The Federal Highway Administration (FHWA) has a design manual for Deep Mixing for Embankment and Foundation Support - October, 2013. This manual includes guidance for CDSM installation and integrity testing.	Post-permitting & pre-construct. bench scale testing and in-field validation testing is already incorporated in the construction specifications (FTMP, Attach. G, Section 313200). A Dec. 30, 2016 memo suggested that the CDSM be eliminated.	The Barr specifications included in the Basin Management Plan contain reasonable QA/QC procedures for CDSM construction.				This issue can be closed if a larger buttress will replace the CDSM.	Permit documents are amended to remove the CDSM zone and replace it with a modified buttress.
3	Geotech Report - page 8 Geotech Report - page 41	Section 3.2 - Tailings Basin Develop. Section 5.2.3 - Shear Strength of LTVSMC Tailings and Table 5-10	The Report describes various peat layer thicknesses and various slime layer thicknesses beneath the Cell2E North perimeter dam. Sitka Corporation identified typical standard penetration resistance value (blow/foot) for the slimes was 5 or less and for the fine tailings was in the range of 15-20. We recommend that the layer thicknesses and the continuity of the layers be further investigated and a sensitivity analysis be performed based on the thickness, continuity and the liquefied shear strength values. A USSR liq=0.10 is included in Table 5-10 (page 41) for the LTVSMC fine tailings/slimes and further alludes to this value being a minimum to be used for design by the Engineering and Design Manual - Coal Refuse Disposal Facilities published by U.S. Department of Labor - MSHA. Further documentation should be provided for this value: and a sensitivity analysis should be performed in conjunction with the previously described parameters. Sitka Corporation found remolded vane shear strength values of the slimes to be in the range of 100 - 300 pounds per square foot. These low remolded vane shear strength values could indicate a USSR liq. less than 0.10. These lower values could result in a factor of safety of less than 1.1.	Slope stability sensitivity analyses to evaluate variation in material strength has been performed and reported in GDP Vol 1, Sections 6.6 and 7.3.8. Affirmation of selected strength parameters will be performed following acquisition of additional strength data during post-permit installation of instrumentation.	The additional subsurface exploration and instrumentation & monitoring plan should be developed based on the results of the analysis performed as part of the Observational Method process Part 1. The plan should include what instrument type is required, its location, depth and expected range of values that will be obtained during basin construction. This plan should be incorporated into the submittal discussed as part of Comment 1.	X	X		The additional subsurface exploration, performed post permit, and development of the Instrumentation and Monitoring Plan should be based on the analysis of critical failure modes as associated with Comment 1	See comment 1 above. Further; per Geotechnical Data Package - Vol. 1; analyses will be updated in conjunction with future data gathering activities.

Review of PolyMet's Tailings Basin Permit Application: Tailings Basin Dam

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4	Geotech Report - page 8	Section 3.2 - Tailings Basin Develop.	The Report describes a layer of peat over a deposit of glacial till beneath the Cell 2E North perimeter dam. During the retreat of the glaciers approx. 10,000 years ago, depressions were formed in which lacustrine clay and peat were deposited. The Geotech. Report, however, does not reference any lacustrine clay layers, only peat over glacial till. Table 5-24 (page 64) identifies peat with a USSR yield = 0.23. This value may be appropriate for a fibrous peat but not for a decomposed amorphous peat or a high plasticity lacustrine clay. The soil types should be further investigated and sensitivity analysis performed for a range of shear strengths. Geotech. Report - page 49, Section 5.4.2.2, states that previous testing by Sitka resulted in higher permeability values for peat than that obtained from samples during the most recent 2014 investigation. This may indicate a different type of peat at various locations.	Same as Recommendation for Comment 3	The additional subsurface exploration and instrumentation & monitoring plan should be based on the results of the analysis performed as part of the Observational Method process Part 1. The results of this analysis should be used to develop the basin's instrumentation and monitoring plan. The plan should include what instrument type is required, its location, depth and expected range of values that will be obtained during basin's construction. This plan should be incorporated into the submittal discussed as part of Comment 1.	X	X		The additional subsurface exploration and instrumentation plan should be developed based on the analysis of critical failure modes as associated with Comment 1	See comment 1 above. Further; the instrumentation will be installed to monitor pore water pressure around the slip surface at select points along cross-sections of the dams, and therefore the peat interface will be targeted for investigation and monitoring.
5	Mgmt. Plan - page 22-24	Section 4.2 - Transport and Deposit. Plan	It appears that the stability analysis was based on maintaining a beach length of 625 feet between the inside crest of the dam and the edge of the water within the tailing basin. The water pocket could, at sometime during the operation, be closer to the dam than the 625 feet. Stability and exit seepage should be evaluated considering the water pocket closer or in contact with the tailings dam.	Addressed - have reviewed high pond conditions as shown in GDP Vol 1, Section 7.3.3.2 and supporting Sections	The analysis included a four foot head increase to the tailings basin water level while moving the water pond interface with the perimeter dike from 625 feet away to 150 feet away. Consistent with the Observational Method approach, a Contingency Plan should be prepared for instances when the water pocket is closer than 150 feet away from the inside crest of the dike. The April, 2017 Contingency Action Plan submitted by PolyMet/Barr should be updated to address this concern.	X	X		A Contingency Plan should be prepared as part of the Observational Method approach for circumstances when the water pocket is closer than 150 feet away from the inside crest of the dike	The Contingency Action Plan has been updated accordingly. The PMP models (discussed in Geotechnical Data Package - Vol. 1 Section 7.3.3.2) assume a 4-foot pond bounce, which shrinks the beach length from 625 feet (at normal pond) to approximately 150 feet. The data package text has been updated to include the PMP beach length associated with the pond bounce.
6	Mgmt. Plan - page 34	Section 7.3 - Structure Removals	The Management Plan is vague regarding abandonment of existing structures within the tailings basin and assumes that the previous owner properly abandoned all pipes within the basin which could be a conduit for water which could create erosion conditions which could then act as a trigger for liquefaction and induce a flow failure. Specifically, the 9 foot diameter drop inlet decant structure constructed in Basin 2W and the approximate 2000 lineal feet of 40 inch diameter spiral pipe extending into Basin 1E should be addressed.	This will be addressed post-permitting; prior to reactivation of the basin	If not investigated pre-permit, we recommend that the dam safety permit include language that requires all existing pipes/structures to be investigated and properly abandoned to ensure dike stability is maintained.			X		The recommended evaluation will be performed but will be a post-permit, pre-construction activity.
7	Geotech Report - page 90	Section 6.6.1 - Range and Distrib. of Shear Strength Values	The Report identifies that sensitivity analyses were performed for the USSR properties for most of the soils using either a normal or log-normal distribution. However, a sensitivity analysis was apparently not performed for liquefied shear strength ratio (USSR) for the slimes. The Report identifies that based on previous geotechnical workshops, a single estimate of that particular strength was chosen. Apparently, the chosen ratio is 0.10. Using this ratio, 40 feet of overburden would result in a liquefied shear strength of 600 pounds per square foot. Residual vane shear testing has shown slime values as low as 100 - 300 pounds per square foot, which would result in a ratio of less than 0.10. We recommend that this issue be further explored.	Affirmation of selected strength parameters will be performed following acquisition of additional strength data during post-permit installation of instrumentation.	The additional subsurface exploration and instrumentation & monitoring plan should be based on the results of the analysis performed as part of the Observational Method process Part 1. The results of this analysis should be used to develop the basin instrumentation and monitoring plan. The plan should include what instrument type is required, its location, depth and expected range of values that will be obtained during basin construction. This plan should be incorporated into the submittal discussed as part of Comment 1.	X	X		The additional subsurface exploration and monitoring plan should be included and analyzed as part of the Observational Method and be as part of the submittal associated with Comment 1	See comment 1 above.

Review of PolyMet's Tailings Basin Permit Application: Tailings Basin Dam

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8	Mgmt. Plan - page 37	Section 7.2 - Final Reclamat.	The Plan identifies approximately 3% bentonite by dry weight to be added to the fine tailings beach to a depth of 18 inches and then overlain by 30 additional inches of tailings and then vegetated. The 3% by dry weight addition should be further investigated based on field trials, not laboratory testing in which very controlled conditions exist. Closure of the pond bottom refers the Geotechnical Report reader to the Adaptive Water Management Plan - Version 7. The effectiveness of injecting bentonite through the pond water is subject to concern with regard to reliability of the infiltration reduction.	Pilot testing/field tests are already incorporated in closure construction specifications (FTMP, Attachment G, Section 03100)	A plan should be developed that requires test sections be constructed on both the pond bottom and tailings dike side slope to evaluate the chosen means for bentonite inclusion. The test section evaluation should consider: onsite water chemistry, potential for ice scour along the shoreline, oxidation of sulfide bearing rock within side slopes, and other concepts which may impact the permeability of the bentonite amended tailings. The Adaptive Water Management Plan, Section 5, states 3 methods on how the Tailing Pond bottom could be amended at the time of closure: 1) broadcasting granulated or pelletized bentonite on the pond surface and allowing it to settle to the pond bottom, 2) direct injection of bentonite into the pond bottom or 3) placing a GCL on the pond bottom. We understand that the PolyMet tailings are not available as yet for lab or field trials. But, if bentonite/tailing mixing (methods 1 or 2) is the preferred method of application, a preliminary material and installation specification should be developed and a protocol should be prepared for both a laboratory and a field pilot study as part of the permit application. The protocol (including the design calculations for 1 or 2) should include a degree of variability on which the acceptance criteria is based. The specification should also address how durability to ice heave on the side slopes and freeze-thaw degradation will be addressed.	X	X		Perform test sections for each bentonite application technology prior to tailings dike closure. A report should be submitted with test results and a QA/QC program demonstrating that the bentonite-tailings mixture has adequate permeability.	PolyMet has prepared a "Template for Pilot/Field-Testing of Bentonite Amendment of Tailings" for inclusion with the permit application documents.
9	Geotech Data Package, Vol. 1, Attach. C, page 19	Section 3.0 - Drained Shear Strength Paramet.	The shear strength data for the different materials was evaluated by considering laboratory shear strength data plus interpreted field shear strength data from various tests as appropriate. The 33rd percentile of the resulting data was then selected for the stability analyses. In the case of the drained shear strength of the LTVSMC coarse tailings, the shear strength ranges are: laboratory testing 28 to 47 degrees, SPT testing 26 to 50 degrees and CPT testing 39 to 46 degrees (outliers below 39 degrees, to as low as 32 degrees were excluded, Figure A-3). The resulting value selected for stability analysis from the statistical analysis is 38.5 degrees. This value seems on the high side as lab testing and SPT testing values in the high 20's are included in the evaluation while lower values of the CPT testing were excluded. Furthermore, the drained shear strength selected for the coarse tailings is higher than that selected for glacial till - typically a well graded material that is very dense. The angularity of the coarse tailings particles might have played a role in the selection of this higher value. It is recommended that the stability analysis should also be done with a lower shear strength value, say 36 degrees, for the coarse tailings as part of a sensitivity analysis. It is recognized that this may not change the outcome very much, however this sensitivity analysis is an important aspect of developing further confidence in the effective strength stability results.	A sensitivity analysis will be performed to review the effect of the lower friction angles on dike stability. Strength data will also be further investigated during instrumentation installation.	The Dec. 30, 2016 Barr Memorandum identified no substantial reduction in the tailings dike global factor of safety by lowering the coarse tailings friction angle from 38.5 deg. to 36 deg. We question why some of the data was excluded from the statistical analysis and recommend that the coarse tailings friction angle be considered as a variable condition in the Observation Method process. At cross sections where lower friction angles result in lower factors of safety, the Observational Method would suggest enhanced instrumentation and monitoring at these locations. This analysis should be incorporated into the submittal discussed as part of Comment 1.	X	X		The apparent variability of the coarse tailings friction angle should be analyzed as part of the Observational Method and be a part of the submittal associated with Comment 1	The analysis recommended by the agency review team; utilizing a reduced coarse tailings friction angle of 36 degrees has been completed and previously submitted, with an outcome of acceptable slope stability factor of safety. Further, contingency mitigations have been identified for implementation in the event that future data gathering, monitoring and analysis predict lower slope stability factors of safety than specified in the absence of proactive mitigation. See comment 1 above.

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10		Section 7.2 - Final Reclamat.	PolyMet is proposing a 20 year mine life and "wet closure" for the tailings basin. The proposed design is permittable and if permitted, would need to be managed in compliance with all rules and regulations including financial assurance. If permitted, the DNR should also require PolyMet to continually review the current state-of-the-practice for design techniques prior to starting any tailings basin closure activities. Information should be reviewed so that the decision on the best closure design option, accounts for current technologies, for environmental protections and considers the long term cost of operation. Continued study of tailings basin closure designs should also be considered as a permit condition. If a closure design change is required in the future, it must meet all environmental review and permitting standards.	Polymet will continue to evaluate potential project improvements during operations and at closure, one of which may be revisiting the tailings closure approach.	The review team is not ready to commit to a dry closure requirement. Wet closure will be more difficult and costly to manage for the long-term and it must be determined if this commitment is acceptable.			X		PolyMet has previously committed to evaluating alternate/new closure technologies that may become available between project initiation and tailings basin closure
11		Barr Memo Dec. 30, 2016 on Tailings Basin Cell 2E Buttress Design as Alternate to CDSM	The modified buttress design includes increasing the buttress height by 35 ft. to a total height of 84 ft above the surrounding grade. This increased height will require the buttress slope toe to extend approx. 100 ft more into the wetland than what was previously proposed (200-250 ft total). The stability analyses presented are limited to global failure planes through the entire tailings dike. The stability analyses indicate that the peat will be removed from beneath the buttress. Localized stability of the buttress toe with a failure plane extending out into the virgin peat soils does not seem to have been evaluated. This localized failure could be significant in that it could result in a progressive failure into the buttress. The results of the stability analysis should be used to determine the buttress toe design. Potential adverse environmental effects associated with the buttress fill (e.g. wetland fill and geochemistry of the Area 5 material) will also need to be addressed.			X				It was not envisioned that soft, peat soils would remain below the buttress. Rather, soft peat soils would be removed or displaced to the extent practicable prior to placement of the buttress. Slope stability analysis previously performed (ref. Geotechnical Data Package - Vol. 1 Sections 6.3.1 and 7.3 for "Buttress Slough" factor of safety outcomes) indicate that toe failures will not occur.