

May 18, 2018

To: Kevin Lee, Minnesota Center for Environmental Advocacy

From: Jim Kuipers P.E., Kuipers & Associates

Re: **PolyMet NorthMet Mine Economic Analysis
Form NI 43-101F1 Technical Report
Performed by M3 March 26, 2018**

At your request I have reviewed above referenced Form NI 43-101F1 Technical Report which provides the most recent economic analysis for the proposed PolyMet Northmet project. The following comments compare and discuss the results of this recent report with PolyMet's previous 2006 NI 43-101 Technical Report. They also consider the rationale for PolyMet choosing to have the report include expanded production scenarios for the project.

General

For clarification, the designation "F1" in the title means "information concerning mineral deposits contained in this Report may not be comparable to similar information made by public U.S. companies subject to the reporting and disclosure requirements under the United States federal securities laws and the rules and regulations thereunder" referring to SEC Industry Guide 7 defined reserves.

Comparison of 2006 and 2018 Technical Reports

Table 1 provides a summary comparison of the 2006 Technical Report (TR) and 2018 TR. The summarized results in all cases are for the combined Phase I and Phase II development scenarios.

Mining Operations

The 2006 TR resulted in 227 MT (million tons) of ore being mined together with 336 MT of waste material for a total of 563 MT material mined over a life of 20 years.

The 2018 TR 32,000 STPD case resulted in 225 MT of ore being mined together with 349 MT of waste material for a total of 574 MT material mined over a life of 20 years, resulting in a slight decrease in the ore tons mined and a slight increase in the waste material mined as compared to the 2006 TR.

The 2018 TR 59,000 STPD case resulted in 293 MT of ore being mined together with 431 MT of waste material for a total of 724 MT material mined over a life of 15 years. The 2018 TR 118,000 STPD case resulted in 730 MT of ore being mined together with 1,636 MT of waste material for a total of 2,366 MT

Table 1 – Summary Comparison of 2006 Technical Report and 2018 Technical Report

Description	2006 Technical Report		2018 Technical Report		
	Base Case	Market Case	32,000 STPD	59,000 STPD	118,000 STPD
Mining Operations					
Ore Mined (kt)	226,706	226,706	225,000	293,000	730,000
Waste Mined (kt)	336,370	336,370	349,000	431,000	1,636,000
Total Material Mined (kt)	563,076	563,076	574,000	724,000	2,366,000
Mine Life (years)	20	20	20	15	19
Process Plant Operations					
Ore Grade					
Copper (%)	0.30%	0.30%	0.30%	0.29%	0.27%
Nickel (%)	0.09%	0.09%	0.09%	0.08%	0.08%
Cobalt ppm	74	74	75	74	70
Palladium ppb	276	276	269	264	247
Platinum ppb	79	79	79	79	73
Gold ppb	39	39	39	39	37
Metals Prices					
Copper (k\$)	\$1.50	\$2.25	\$3.22	\$3.22	\$3.22
Nickel (k\$)	\$6.50	\$7.80	\$7.95	\$7.95	\$7.95
Cobalt (k\$)	\$15.25	\$16.34	\$20.68	\$20.68	\$20.68
Palladium (k\$)	\$225.00	\$274.00	\$973.00	\$973.00	\$973.00
Platinum (k\$)	\$900.00	\$1,040.00	\$1,128.00	\$1,128.00	\$1,128.00
Gold (k\$)	\$450.00	\$540.00	\$1,308.00	\$1,308.00	\$1,308.00
Expenditures					
Capital Expenditures					
Initial Capital (k\$)	\$379,640	\$379,640	\$1,204,000	\$1,354,000	\$1,872,000
Sustaining Capital (k\$)	\$71,787	\$71,787	\$221,000	\$249,000	\$900,000
Total Capital Expenditures (k\$)	\$451,427	\$451,427	\$1,425,000	\$1,603,000	\$2,772,000
Total Operating Cost (\$/ton milled)	\$11.32	\$11.32	\$13.16	\$10.88	\$9.98
Reclamation Closure/Financial Assurance	Not Identified				
Economic Indicators (Pre-Tax)					
NPV @ 7.5% (2006), 7% (2018)	\$298,807	\$910,978	\$322,000	\$963,000	\$2,243,000
Internal Rate of Return (IRR)	17.4%	34.2%	10.9%	18.5%	23.6%
Payback (years)	4.1	4.1	7.5	4.8	4.1

material mined over a life of 19 years. The 59,000 STPD case would result in an additional 26% mined material, while the 118,000 STPD case would result in an additional 300% mined material. It is possible that the additional material for the 59,000 STPD case could be mined without resulting in significant (>10%) additional disturbance as only the pit size might change slightly, whereas the 118,000 STPD case would likely result in a significant additional disturbance.

Process Plant Operations

The ore grade for the 2006 TR and the 2018 TR 32,000 STPD case are consistent although a slight change in the cobalt grade (from 74 ppm to 75 ppm) and palladium grade (from 276 ppm to 269 ppm) was made in the interim. The 2018 TR 59,000 STPD and 118,000 STPD cases show only a slight decrease in copper and nickel grades. As noted in the 2018 TR, the assignment of grades to these cases is speculative.

The use of significantly different metals prices is one of the key aspect of the 2018 TR as compared to the 2016 TR. The use of \$3.22 per pound for copper given its significance in the project economics as compared to \$1.50-\$2.25 per pound in the 2006 TR, together with higher prices for all the other metals produced, would be expected to have a significant benefit in the overall project economics.

Expenditures

The 2006 TR estimated total capital expenditures of \$451M together with operating costs of \$11.32 per ton milled. The 2018 TR 32,000 STPD case estimates capital expenditures of \$1,425 M together with operating costs of \$13.16 per ton milled. While some increase in capital expenditures would be expected to occur due to inflation during the 12-year period from 2006-2018, at most that might account for a 20-30% increase, similar to the increase noted for operating costs. The increase in capital costs by more than 200% suggests that the previous costs were grossly underestimated. It should be noted that the underestimation of capital costs has been widely recognized by the mining industry as exemplified by the revised capital costs provided for this project.

Like the 2006 TR, the 2018 TR contains no specific information pertaining to reclamation and closure costs and/or financial assurance costs. According to the 2018 TR "These costs have been accounted for in the overall project economics." The 2018 TR also states that "For purposes of this Study, PolyMet has assumed that the Minnesota water quality standards governing sulfate in wild rice water will be revised, as required by law, after the Project is in operations." The approach taken does not appear to reflect the current reclamation and closure costs or the financial assurance costs provided for the project and also assumes favorable changes to water quality standards. This at least leaves the impression that they have not adequately realized or accounted for the potential environmental liabilities associated with this project in the 2018 TR.

Rationale for Expanded Production Scenarios in 2018 TR

The 2018 TR provides the following explanation for the expanded production scenarios in the 2018 TR:

"PolyMet has considered opportunities to improve annual operating costs and LOM strategies using the existing block resource model tons and grades as a basis for alternate economic scenarios. The scenarios presented in this section should not be misconstrued as proposals or detailed plans or strategies. PolyMet would need to prepare preliminary and definitive feasibility studies, as well as conduct an analysis of the environmental impact and alternatives

and budget and cost decisions prior to any decision to apply for permits to pursue these opportunities. Any such opportunities would be subject to various regulatory requirements and would require significant capital investment. Because the steps in this process have not been undertaken by PolyMet, the results presented in this section should be considered speculative. In addition, any future project proposal would be subject to additional environmental review and permitting requirements and or public notice and comment, and approval by appropriate Federal and State Agencies. The NorthMet FEIS evaluates the reasonably foreseeable environmental effects of the NorthMet Project (as described in Sections 2 through 23), based in part on a mine plan that identified an average production rate of 32,000 STPD (approximately 225 million short tons over the 20-year life of the mine). PolyMet's focus and intention is to put into operation the 32,000 STPD plan detailed in this Technical Report as soon as possible."

Given the potential implications of suggesting an expanded project, from both a public relations and permitting standpoint, PolyMet had to be motivated to produce these scenarios based on the relatively poor results from the 2018 TR indicating a 10.9% IRR and 7.5 year payback resulting in a NPV (7%) of \$322M. The highly volatile nature of the metal mining business generally requires a higher return on investment. While there is no standard, other than the higher the IRR the better, it is common for major mining firms to require a 30% or even 40% IRR before giving approval to a new mining project in particular. Given the high level of economic sensitivity involved with any metals mining project this result cannot be viewed favorably, particularly as compared to previous project forecasts. Taken to an extreme, the result could be viewed as suggesting the project is no longer economic based on the realization of the capital costs in particular for the proposed project resulting in low return.

While PolyMet has stated its intention is to put the 32,000 STPD plan into operation, the economic analysis contained in the 2018 TR suggests that their ultimate strategy will be to develop the expanded options. If it was not their intention to do so it is unlikely the 2018 TR would have included the expanded options as the scope of a TR is driven by the owner/operator and not the consultants performing the study. However, given the nature of the permitting process as well as site-specifics that make expansion relatively feasible, it is likely that the project as presently planned will at least continue to be suggested through completion of permitting. Depending on metals market considerations, plans for expansion would be likely to follow soon after permitting of the 32,000 STPD plan. Expanded production could at least initially be accommodated within the existing proposed disturbance area and other aspects covered by the permitting for the original plan, so expanded production at least initially (e.g. first ten years) could occur without triggering additional permitting requirements other than minor revisions.