

**PolyMet Mining Inc.**  
**Proposed Risk Assessment Verification for the NorthMet Mine Site and Plant Site**  
February 22, 2017

**Background**

The Mine Site and Plant Site AERAs for the NorthMet Project (“Project”) submitted in August 2016 as part of the Air Permit application for PolyMet Mining Inc. provided risk estimates and hazard indices (HIs) using estimated air concentrations of chemicals modeled with the EPA issued air dispersion model, AERMOD. This modeling used AERMOD version 15181 and AERMET version 15181 as the meteorological data processing program. The  $u^*$  function of AERMET version 15181 contained a calculation bug and EPA no longer supports its use. As such, MPCA has requested verification of the risk estimates and HIs presented in the August 2016 Air Permit Application to ensure that the conclusions presented in the Mine Site and Plant Site AERAs are still valid.

**Nature of Discrepancies from AERMET Bug**

The AERMET  $u^*$  calculation bug impacts Class II modeling in addition to the AERA modeling. A comparison of Class II model results using AERMET version 15181 and the updated AERMET version 16216, which is being accepted by the EPA, has indicated the following:

1. The effect of the bug is most pronounced for ground level area and volume sources. For the Project, the sources expected to be most affected are fugitive dust sources and tailpipe emissions from construction and mining equipment.
2. Effects are greater at receptors close to the emission source. Thus, receptors at the ownership boundary are expected to show a greater impact using the corrected AERMET version compared to receptors at a distance.
3. Greater discrepancies are observed for shorter averaging periods. Thus, risk estimates, which use 1-hour air concentrations, are expected to be impacted more than chronic risk estimates that use annual air concentrations.
4. The calculation bug impacts the magnitude of air concentrations but not the location of the maximum modeled concentration. Therefore, the location of receptors indicating maximum air concentrations should remain unchanged.

**Risk Estimates and HIs in Air Permit Application**

Several exposure scenarios were assessed in the 2016 Mine Site and Plant Site AERAs. When considering if a change to these estimates could change any conclusions in the AERA, the magnitude of the risk estimates and the magnitude relative to the guideline values are both important factors. For example, if the impact of correcting the AERMET  $u^*$  bug changes a modeled air concentration by a very small percentage, conclusions regarding risk estimates that are well below the guideline values are expected to be the same. Conversely, if the  $u^*$  bug has a larger impact or the original risk estimate is approximately equal to the guideline value, an updated risk estimate could be greater than the guideline value. Ideally, to support the conclusions presented in the 2016 Mine Site and Plant Site AERA, verification results would be modeled for risk estimates at receptors most impacted by the AERMET bug and exposure scenarios with risks closest to the guideline values.

## 2016 AERA Estimates and Expected Impact of u\* Bug

Table 1 and Table 2 below show the exposure scenarios evaluated in the 2016 Mine and Plant Site AERAs and the associated risk estimates as a percent of the guideline values. The expected impact of the AERMET u\* correction on the receptors evaluated for each scenario is also presented. Receptors close to fugitive sources and scenarios using 1-hour air concentrations are expected to be more highly impacted and receptors at a distance from fugitive sources and scenarios using annual air concentrations are expected to be minimally impacted. As seen in Table 1 and Table 2, the exposure scenarios closest to the guideline values are also the scenarios evaluated at receptors expected to be most impacted by the AERMET u\* correction. If verification of these scenarios indicates the conclusions in the 2016 Mine Site and Plant Site AERAs are still valid, then the conclusions regarding all other exposure scenarios would also still be valid.

*Table 1. Risk Estimate and Receptor Summary for Plant Site AERA*

<b>Exposure Scenario</b>	<b>Receptor Location of Maximum Risk Estimate</b>	<b>% of Guideline Value</b>	<b>Expected impact of u* Bug on air concentration</b>
Acute	Property Boundary	~100%	High
Offsite worker Chronic noncancer - inhalation	Property Boundary	~100%	Medium
Offsite worker Cancer - inhalation	Property Boundary	~100%	Medium
Resident noncancer	Former LTVSMC Boundary	~50%	Low
Resident cancer	Former LTVSMC Boundary	~60%	Low
Farmer noncancer	Former LTVSMC Boundary	~50%	Low
Farmer cancer	Former LTVSMC Boundary	~80%	Low

*Table 2. Risk Estimate and Receptor Summary for Mine Site AERA*

<b>Exposure Scenario</b>	<b>Receptor Location</b>	<b>% of Guideline Value</b>	<b>Expected impact of u* Bug on air concentration</b>
Acute	Property Boundary	~30%	High
Chronic noncancer - inhalation	Property Boundary	~40%	Medium to high
Cancer - inhalation	Property Boundary	~60%	Medium to high
Resident noncancer	Mineral Mining/Industrial District Boundary	~6%	Low
Resident cancer	Mineral Mining/Industrial District Boundary	~10%	Low
Farmer noncancer	Mineral Mining/Industrial District Boundary	~6%	Low
Farmer cancer	Mineral Mining/Industrial District Boundary	~50%	Low

## Proposed Receptors and Exposure Scenarios for Verification

Based on the 2016 Mine Site and Plant Site risk estimates and expected impact of the  $u^*$  correction on those estimates, the following exposure scenarios are proposed for modeling and verification risk estimates. The 2016 AERA modeling showed the maximum concentrations for all pollutants and averaging periods evaluated at and beyond the property line were at receptors located along the property line. Therefore, receptors can be limited to those on the property line for the proposed modeling. Large Figure A shows the receptors to be modeled in separate Mine Site and Plant Site verification runs for these updated estimates.

- Mine Site
  - acute HI at the PolyMet property boundary
  - MEI inhalation cancer risk at the PolyMet property boundary
  - MEI chronic inhalation non cancer HI at the PolyMet property boundary
- Plant Site
  - acute inhalation HI at the PolyMet property boundary
  - offsite worker (OSW) inhalation cancer risk at the PolyMet property boundary
  - OSW chronic inhalation non cancer HI at the PolyMet property boundary

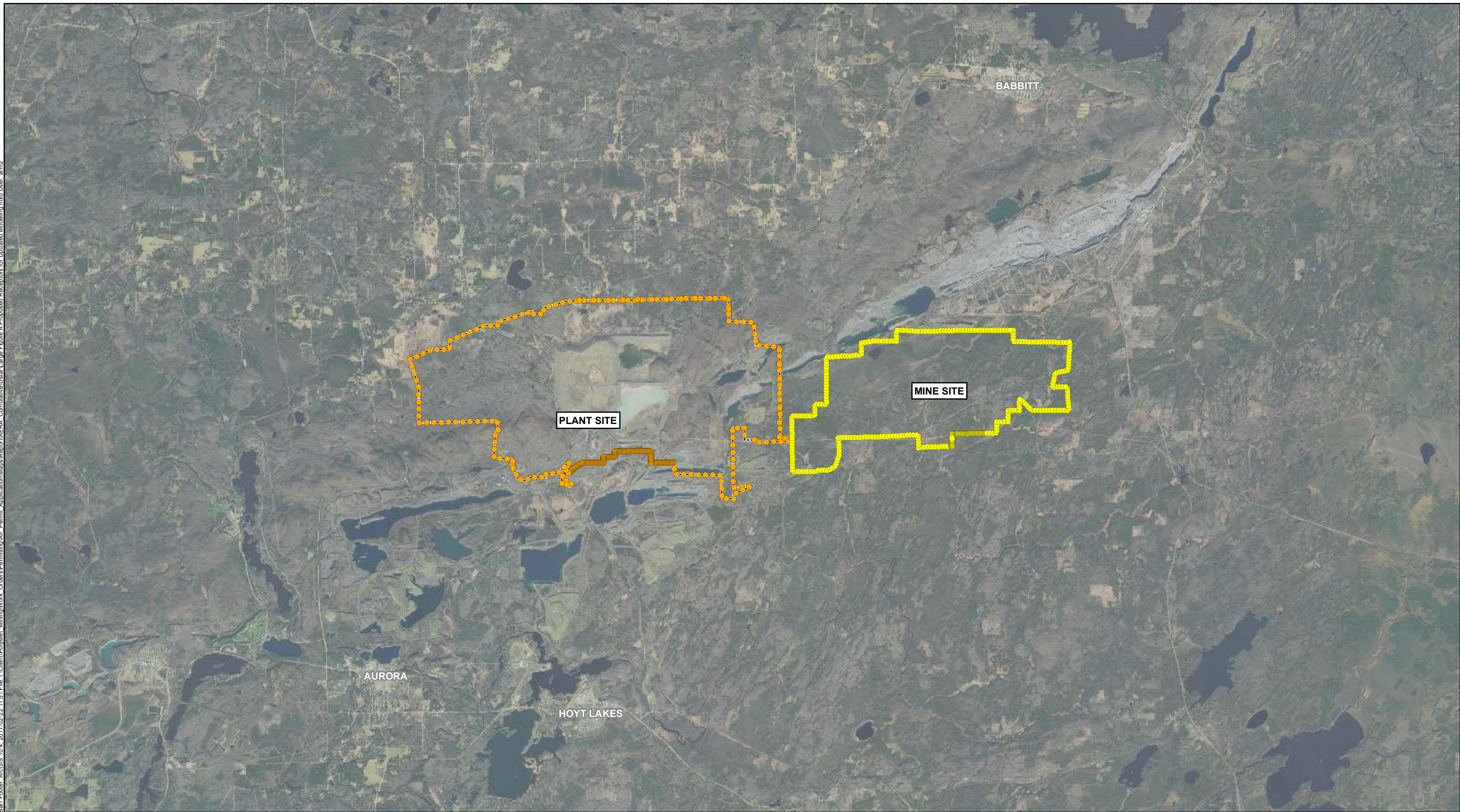
If the risk estimates for the exposure scenarios above continue to meet guideline values and support the conclusions presented in the 2016 Mine Site and Plant Site AERA, it can be concluded that other risk estimates for all other exposure scenarios will also meet guideline values and support the conclusions in the 2016 Mine Site and Plant Site AERA. As such, the following exposure scenarios will not be modeled for verification for risk estimates.

- Mine Site
  - multimedia cancer risk at the mineral mining/industrial district boundary
  - multimedia chronic non cancer HI at the mineral mining/industrial district boundary
- Plant Site
  - multimedia cancer risk at the former LTVSMC boundary
  - multimedia chronic non cancer HI at the former LTVSMC boundary
- Cumulative AERA

## Reporting

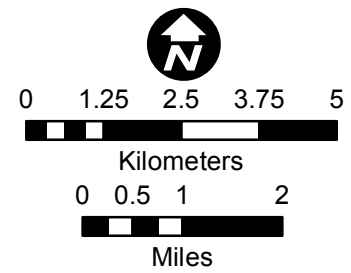
The results of the verification runs will be provided to MPCA in the form of results tables and MPCA RASS spreadsheets. Any MPCA AERA Reporting Forms and figures requiring updating as a result of the verification modeling will also be provided to MPCA. Model input files will also be provided if changes have been made relative to the previously submitted input files.

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Receptors by Exposure Scenario

- Plant Site Offsite Worker which is Reasonable Maximum Exposure for chronic inhalation)
- Inhalation only (maximum exposed individual (MEI) for acute and chronic inhalation)



Large Figure A  
PROPOSED RECEPTORS FOR  
UPDATED MODELING  
NorthMet Project  
Poly Met Mining, Inc.