

Technical Memorandum

To: Kristie Elickson, Minnesota Pollution Control Agency
From: Nadine Czoschke, Pat Sheehy, and Todd Fasking, Barr Engineering Company
Subject: Summary of updated Mine Site AERA related risk value estimates in 2017
Date: November 15, 2017
Project: 23690862.09
c: Suzanne Baumann, Minnesota Pollution Control Agency; Kevin Pylka, PolyMet

PolyMet has submitted Air Emissions Risk Analysis (AERA) evaluations for both the Mine and Plant components of the Project with the Air Permit Application (Aug 2016). Since this submittal, additional evaluations have been completed and the results are summarized in this memo. The supplemental evaluations that have been completed since the initial submission are listed below and address:

- corrections to code flaws in the EPA approved model (AERMOD) and incorporating the Waste Water Treatment System (WWTS) modifications, inhalation risk (May 2017),
- acute risk estimates at the NAAQs effective fenceline, inhalation risk only (June 2017)
- emissions true-up, inhalation risk (August 2017), and
- updated pit elevations in the open pit algorithm in AERMOD for the Mine Site, inhalation and multimedia risk (Oct 2017)

All evaluations and submittals have demonstrated that the Project continues to meet risk guidance criteria. The tables in this memo summarize and compare the results from the AERA evaluations conducted in support of the permitting for the Mine Site. A separate memo from August 17, 2017 includes a summary of both the Plant Site and Mine Site results. The updates to the open pit algorithm (the last bulleted item above) did not affect the Plant Site. Therefore, no updates to the Plant Site results from the summary information in the August 17, 2017 memo are included here.

Consistent with the updated Class II modeling methodology, the AERA modeling for the Mine Site, has been updated to change the open pit source elevations to the elevation of the out-of-pit haul roads. The risk results presented here as "open pit source updates" reflect the results from this modeling change.

AERA Updates

The following tables compare the evaluations described above for the different mine years for the full AERA receptor grid evaluations.

aq5-35j

Tables 1a and 1b Mine Site Acute Hazard Summary

Year 8	Acute 2016	Acute 2017 - AERMOD bug fix	Acute 2017 - Aug Emissions True-Up	Open-Pit Source updates Oct 2107
Arsenic	0.029	0.029	0.029	0.042
Copper	0.0012	0.0023	0.0023	0.0025
Nickel	0.011	0.008	0.008	0.011
Nitrogen oxide	0.25	0.26	0.26	0.30
Sulfur dioxide	0.0023	0.0014	0.0014	0.0015
Total	0.3	0.3	0.3	0.4
Guideline Value	1	1	1	1
Project comparison to guideline	OK	OK	OK	OK

Year 13	Acute 2016	Acute 2017 - AERMOD bug fix	Acute 2017 – August Emissions True-Up*	Open-Pit Source updates Oct 2107
Arsenic	0.036	0.035	0.035	0.050
Copper	0.0023	0.0025	0.0025	0.0029
Nickel	0.010	0.010	0.010	0.013
Nitrogen oxide	0.31	0.31	0.31	0.35
Sulfur dioxide	0.0015	0.0015	0.0015	0.0016
Total	0.4	0.4	0.4	0.4
Guideline Value	1	1	1	1
Project comparison to guideline	OK	OK	OK	OK

*Note: there were no emissions changes in the true-up for Mine Year 13. Estimates are equal to those from the AERMOD bug fix

Table 2a and 2b Mine Site Chronic Inhalation Non-Cancer Hazard Summary

Year 8	Chronic Noncancer 2016	Chronic Noncancer 2017 - AERMOD bug fix	Chronic Noncancer 2017 - Aug Emissions True-Up	Open-Pit Source updates Oct 2107
Arsenic	0.0074	0.0087	0.0087	0.017
Cobalt	0.077	0.080	0.080	0.15
Diesel exhaust particulate	0.016	0.019	0.02	0.022
Manganese	0.053	0.061	0.061	0.12
Nickel	0.23	0.22	0.22	0.39
Crystalline silica	0.025	0.026	0.026	0.049
TCDD Equivalents	0.0000062	0.0000076	0.0000076	0.000015
Total	0.4	0.4	0.4	0.7
Guideline Value	1	1	1	1
Project comparison to guideline	OK	OK	OK	OK

Year 13	Chronic Noncancer 2016	Chronic Noncancer 2017 - AERMOD bug fix	Chronic Noncancer 2017 – Aug Emissions True-Up*	Open-Pit Source updates Oct 2107
Arsenic	0.0074	0.0076	0.0076	0.014
Cobalt	0.077	0.065	0.065	0.13
Diesel exhaust particulate	0.016	0.019	0.019	0.023
Manganese	0.053	0.051	0.051	0.099
Nickel	0.23	0.21	0.21	0.35
Crystalline silica	0.025	0.020	0.020	0.042
TCDD Equivalents	0.0000062	0.0000070	0.0000070	0.000015
Total	0.4	0.4	0.4	0.7
Guideline Value	1	1	1	1
Project comparison to guideline	OK	OK	OK	OK

*Note: there were no emissions changes in the true-up for Mine Year 13. Estimates are equal to those from the AERMOD bug fix

Table 3a and 3b Mine Site Cancer Inhalation Risk Estimate Summary

Year 8	Cancer 2016	Cancer 2017 - AERMOD bug fix	Cancer 2017 - Aug Emissions True-Up	Open-Pit Source updates Oct 2107
Arsenic	4.8E-07	5.6E-07	5.6E-07	1.1E-06
Cobalt	4.1E-06	4.3E-06	4.3E-06	8.2E-06
Dibenz[a,h]anthracene	4.6E-10	5.7E-10	5.7E-10	1.0E-09
Indeno(1,2,3-cd)pyrene	1.9E-11	2.4E-11	2.4E-11	4.3E-11
Nickel	1.6E-06	1.5E-06	1.5E-06	2.6E-06
TCDD Equivalents	1.0E-07	1.2E-07	1.2E-07	2.4E-07
Total	6E-06	7E-06	6E-06	1E-05
Guideline Value	1E-05	1E-05	1E-05	1E-05
Project comparison to guideline	OK	OK	OK	OK

Year 13	Cancer 2016	Cancer 2017 - AERMOD bug fix	Cancer 2017 – Aug Emissions True-Up*	Open-Pit Source updates Oct 2107
Arsenic	4.8E-07	5.6E-07	5.6E-07	9.0E-07
Cobalt	4.1E-06	4.3E-06	4.3E-06	7.2E-06
Dibenz[a,h]anthracene	4.6E-10	5.7E-10	5.7E-10	8.6E-10
Indeno(1,2,3-cd)pyrene	1.9E-11	2.4E-11	2.4E-11	3.6E-11
Nickel	1.6E-06	1.5E-06	1.5E-06	2.3E-6
TCDD Equivalents	1.0E-07	1.2E-07	1.2E-07	2.0E-07
Total	6E-06	7E-06	7E-06	1E-05
Guideline Value	1E-05	1E-05	1E-05	1E-05
Project comparison to guideline	OK	OK	OK	OK

*Note: there were no emissions changes in the true-up for Mine Year 13. Estimates are equal to those from the AERMOD bug fix

Table 4a and 4b Mine Site Chronic Multimedia Non-Cancer Hazard Summary

Year 8	Chronic Noncancer Farmer HI 2016	Farmer HI Open-Pit Source updates Oct 2107	Chronic Noncancer Resident HI 2016	Resident HI Open-Pit Source updates Oct 2107
Arsenic	0.0017	0.0031	0.0015	0.0027
Cobalt	0.012	0.018	0.012	0.018
Diesel exhaust particulate	0.0019	0.0035	0.0019	0.0035
Manganese	0.0092	0.017	0.0092	0.017
Nickel	0.0033	0.050	0.0033	0.050
Crystalline silica	0.0038	0.0059	0.0038	0.0059
TCDD Equivalents	0.0037	0.0084	0.000067	0.00015
Total	0.06	0.1	0.06	0.1
Guideline Value	1	1	1	1
Project comparison to guideline	OK	OK	OK	OK

Year 13	Chronic Noncancer Farmer HI 2016	Farmer HI Open-Pit Source updates Oct 2107	Chronic Noncancer Resident HI 2016	Resident HI Open-Pit Source updates Oct 2107
Arsenic	0.0018	0.0041	0.0015	0.0035
Cobalt	0.013	0.026	0.013	0.026
Diesel exhaust particulate	0.0018	0.0040	0.0018	0.0040
Manganese	0.0097	0.022	0.0097	0.022
Nickel	0.034	0.069	0.034	0.069
Crystalline silica	0.0040	0.0083	0.0040	0.0083
TCDD Equivalents	0.0037	0.011	0.000065	0.00019
Total	0.07	0.1	0.06	0.1
Guideline Value	1	1	1	1
Project comparison to guideline	OK	OK	OK	OK

Table 5a and 5b Mine Site Cancer Inhalation Risk Estimate Summary

Year 8	Farmer Cancer Risk 2016	Farmer Cancer Risk Open-Pit Source updates Oct 2107	Resident Cancer Risk 2016	Resident Cancer Risk Open-Pit Source updates Oct 2107
Arsenic	8.7E-08	1.6E-07	8.6E-08	1.6E-07
Cobalt	6.3E-07	1.0E-06	6.3E-07	1.0E-06
Dibenz[a,h]anthracene	7.4E-07	1.6E-06	1.8E-09	3.9E-09
Indeno(1,2,3-cd)pyrene	4.0E-11	8.5E-11	4.1E-12	8.8E-12
Nickel	2.2E-07	3.4E-07	2.2E-07	3.4E-07
TCDD Equivalents	3.5E-06	7.9E-06	7.0E-08	1.6E-07
Total	5E-06	1E-05	1E-06	2E-06
Guideline Value	1E-05	1E-05	1E-05	1E-05
Project comparison to guideline	OK	OK	OK	OK

Year 13	Farmer Cancer Risk 2016	Farmer Cancer Risk Open-Pit Source updates Oct 2107	Resident Cancer Risk 2016	Resident Cancer Risk Open-Pit Source updates Oct 2107
Arsenic	9.1E-08	2.1E-07	8.9E-08	2.1E-07
Cobalt	7.2E-07	1.4E-06	7.2E-07	1.4E-06
Dibenz[a,h]anthracene	7.6E-07	2.0E-06	1.9E-09	4.8E-09
Indeno(1,2,3-cd)pyrene	4.1E-11	1.1E-10	4.2E-12	1.1E-11
Nickel	2.3E-07	4.6E-07	2.3E-07	4.6E-07
TCDD Equivalents	3.4E-06	1.0E-05	6.9E-08	2.0E-07
Total	5E-06	1E-05	1E-06	2E-06
Guideline Value	1E-05	1E-05	1E-05	1E-05
Project comparison to guideline	OK	OK	OK	OK

Summary

Using updated modeling methods and emission inputs, AERA evaluation results continue to be at or below MPCA guidance values protective of human health and the environment.

Attachments (provided on portable electronic media):

RASS files:

- Mine Site Inhalation Risk, Stockpile storage: 2017_RASS Mine Site Inhalation_year 8.xlsm
- Mine Site Inhalation Risk, In-Pit disposal: 2017_RASS Mine Site Inhalation_year 13.xlsm
- Mine Site Multimedia Risk, Stockpile storage: 2017_RASS Mine Site_multipathway_year 8.xlsm
- Mine Site Multimedia Risk, In-Pit disposal: 2017_RASS Mine Site_multipathway_year 13.xlsm

Modeled air concentrations:

- Mine Site hourly concentrations, Stockpile storage: Y8_1Hr_Results.xlsx
- Mine Site annual concentrations, Stockpile storage: Y8_AnnualMAX_Results.xlsx
- Mine Site hourly concentrations, In-Pit disposal: Y13_1Hr_Results.xlsx
- Mine Site annual concentrations, In-Pit disposal: Y13_AnnualMAX_Results.xlsx



Purpose: This form serves as a checklist for submitting all necessary AERA materials. Consult the Minnesota Pollution Control Agency (MPCA) AERA guidance found on the MPCA AERA website at http://www.pca.state.mn.us/mvrifb5 for instructions.

Contents:

- Facility Information
What the AERA Supports
Required AERA Forms
Required Permit Forms
Risk Tools
Additional Information

Instructions: Check appropriate boxes below by clicking on them. Response areas may be expanded as needed. All AERA documents must be submitted electronically. Spreadsheets should not be in pdf format. The AERA will be deemed incomplete if all requested forms and support documents are not included.

Facility Information

- 1. AQ Facility ID No.: 13700345
2. SIC Code: 1021
3. Date(s) of pre-application submittal: 7/1/2016
4. Date(s) of permit application submittal: 08/24/2016
5. Facility name: Poly Met Mining, Inc.
6. Facility location
Street address: 6500 County Road 666
City: Hoyt Lakes State: MN Zip code: 55750 County: St Louis
7. Proposer: Kevin Pylka; Poly Met Mining Inc. Phone: 218-471-2162 E-mail: kpylka@polymetmining.com
8. AERA Preparer: Patrick Sheehy; Barr Engineering Phone: 952-832-2790 E-mail: psheehy@barr.com

What the AERA Supports (Mark all that apply)

This AERA is submitted as a part of the following (may select more than one):

- [X] An air permit application.
[] Existing permit requirement.
[X] Mandatory Environmental Impact Statement (EIS), required by Minn. R. 4410.4400. Indicate which subpart is met:
AERA originally conducted to support mandatory EIS under Subpart 8b; although AERA not required per MPCA guidance.
[] Voluntary or discretionary EIS. If the AERA was requested by the MPCA, indicate the request date (mm/dd/yyyy):
[] Mandatory Environmental Assessment Worksheet (EAW), required by Minn. R. 4410.4300 subpart 15 (air emissions trigger) or subpart 5 (fuel conversion trigger).
[] Mandatory Environmental Assessment Worksheet (EAW) required by a subpart of Minn. R. 4410.4300 other than 15 or 5. Indicate which subpart is met:
If the AERA was requested by the MPCA indicate the request date (mm/dd/yyyy):
[] A voluntary or discretionary EAW. If the AERA was requested by the MPCA, indicate the request date (mm/dd/yyyy):
[] Pre-authorized change to a facility with a "flexible air permit", where a project proposer is seeking to increase toxic emissions, which may be allowed to be changed without additional permitting.
[] Other:

Required AERA Forms

AERA forms are located at <http://www.pca.state.mn.us/gp0r42f>

Submitted		Submittal date(s) (mm/dd/yyyy)	
<input checked="" type="checkbox"/>	<input type="checkbox"/> NA	11/15/2017	AERA-01 Deliverable Checklist (this form)
<input type="checkbox"/>	<input checked="" type="checkbox"/> NA		AERA-02 Qualitative Information Checklist for:
<input checked="" type="checkbox"/>	<input type="checkbox"/> NA	10/13/2016	<ul style="list-style-type: none"> • Protocol/workplan • Completed AERA
<input type="checkbox"/>	<input checked="" type="checkbox"/> NA		AERA-03 Air Dispersion Modeling Analysis Form for:
<input checked="" type="checkbox"/>	<input type="checkbox"/> NA	10/13/2016	<ul style="list-style-type: none"> • Protocol/workplan • Completed AERA
<input checked="" type="checkbox"/>	<input type="checkbox"/> NA	10/13/2016	AERA-04 Emergency Internal Combustion Engine Certification (if applicable)
<input type="checkbox"/>	<input checked="" type="checkbox"/> NA		AERA-05 Emissions Form for:
<input type="checkbox"/>	<input checked="" type="checkbox"/> NA		<ul style="list-style-type: none"> • Protocol/workplan • Completed AERA
<input type="checkbox"/>	<input checked="" type="checkbox"/> NA		AERA-13 Determination Checklist for Proposed Ethanol Facilities (if applicable)
<input type="checkbox"/>	<input checked="" type="checkbox"/> NA		AERA-19 Cumulative Air Emissions Risk Analysis Form (Required if environmental review is being done) for:
<input checked="" type="checkbox"/>	<input type="checkbox"/> NA	10/13/2016	<ul style="list-style-type: none"> • Protocol/workplan • Completed AERA
<input checked="" type="checkbox"/>	<input type="checkbox"/> NA	10/13/2016	AERA-24 AERA Certification
<input type="checkbox"/>	<input checked="" type="checkbox"/> NA		AERA-26 Refined HHRAP-based Analysis Form (if applicable) for:
<input type="checkbox"/>	<input checked="" type="checkbox"/> NA		<ul style="list-style-type: none"> • Protocol/workplan • Completed AERA
<input type="checkbox"/>	<input checked="" type="checkbox"/> NA		AERA 27 MPCA Mercury Risk Estimation Method (MMREM) Form (if applicable) for:
<input type="checkbox"/>	<input checked="" type="checkbox"/> NA		<ul style="list-style-type: none"> • Protocol/workplan
<input type="checkbox"/>	<input checked="" type="checkbox"/> NA		<ul style="list-style-type: none"> • Completed AERA

Electronic submittals are required. Hard copies are optional.

Required Permit Forms

Permit forms are located at <http://www.pca.state.mn.us/nwqh472>

The MPCA AERA reviewer will also review the following MPCA Air Permitting Forms. The AERA reviewer will obtain these forms from the MPCA air permit engineer; however, it is acceptable for a proposer to submit duplicate forms.

Submitted		Submittal date(s) (mm/dd/yyyy)	
<input type="checkbox"/>		8/24/2016	GI-02: Process Flow Diagram – note this form will be updated with conforming application
<input type="checkbox"/>		8/24/2016	GI-03: Facility and Stack/Vent Diagram – note this form will be updated with conforming application
<input checked="" type="checkbox"/>	<input type="checkbox"/> NA	8/24/2016	HG-01: Mercury Releases to Ambient Air (NA if Hg PTE is less than 1 lb/year) – note this form will be updated with conforming application

Risk Tool(s) Used

RASS and Q/CHI spreadsheets are at <http://www.pca.state.mn.us/bkzqe6d>

Submitted	Submittal date(s) (mm/dd/yyyy)	RASS spreadsheet(s) including all emitted chemicals	Existing Facility	Entire Facility as Proposed
☒	08/24/2016 and 11/15/2017	RASS spreadsheet(s) including all emitted chemicals		<p>All RASSes include chemicals for evaluation using screening process identified in Work Plans and Appendix X of the air permit application Sections X1-4.0 and X2-4.0</p> <p>Seven RASSes submitted Aug 2016:</p> <p>Mine Site Inhalation Risk, Stockpile storage scenario: RASS Mine Site Inhalation_year 8.xlsm</p> <p>Mine Site Inhalation Risk, In-Pit disposal scenario: RASS Mine Site Inhalation_year 13.xlsm</p> <p>Mine Site Multimedia Risk, Stockpile storage scenario: RASS Mine Site Multimedia_year 8.xlsm</p> <p>Mine Site Multimedia Risk: In-Pit disposal scenario: RASS Mine Site Multimedia_year 13.xlsm</p> <p>Plant Site Inhalation NonCancer Risk: RASS Plant Site Inhalation RME Non Cancer.xlsm</p> <p>Plant Site Inhalation Cancer Risk: RASS Plant Site Inhalation RME Cancer.xlsm</p> <p>Plant Site Multimedia Risk: RASS Plant Site Multimedia.xlsm</p> <p>Four RASSes submitted Nov 2017:</p> <p>Mine Site Inhalation Risk, Stockpile storage scenario: 2017_RASS Mine Site Inhalation_year 8.xlsm</p> <p>Mine Site Inhalation Risk, In-Pit disposal scenario: 2017_RASS Mine Site Inhalation_year 13.xlsm</p> <p>Mine Site Multimedia Risk, Stockpile storage scenario: 2017_RASS Mine Site_multipathway_year 8.xlsm</p> <p>Mine Site Multimedia</p>
☐	NA			

					Risk, In-Pit disposal scenario: 2017_RASS Mine Site_multipathway_year 13.xlsm
<input type="checkbox"/>	<input checked="" type="checkbox"/> NA		Q/CHI spreadsheet including all emitted chemicals		
<input type="checkbox"/>	<input checked="" type="checkbox"/> NA		HHRAP-based analysis files that include all emitted chemicals		
<input type="checkbox"/>	<input checked="" type="checkbox"/> NA		Q/CHI spreadsheet with select chemicals and a RASS that includes chemicals screened out		
<input type="checkbox"/>	<input checked="" type="checkbox"/> NA		HHRAP-based analysis files with select chemicals and a RASS that includes chemicals screened out		
<input checked="" type="checkbox"/>	<input type="checkbox"/> NA	3/25/2013	MPCA Mercury Risk Estimation Method (MMREM) spreadsheet		
<input type="checkbox"/>	<input checked="" type="checkbox"/> NA		U.S. Environmental Protection Agency (EPA) Integrated Exposure Uptake Biokinetic (IEUBK) model results (found on EPA's website at http://www.epa.gov/superfund/lead/products.htm)		

Additional Information In the table below, describe any additional attachments

Attachment reference number (or other identifier)	Submittal date(s) (mm/dd/yyyy)	Title	Purpose/Description