TECHNICAL MEMORANDUM

DATE April 18, 2017

PROJECT No. 1408383 (3300/3301)

TO Sandra Pouliot
Canadian Malartic Corporation

DOC. No. 012 (Rev 2)

CC Adam Auckland and Ken De Vos

FROM Sean Capstick and Natalie Jones

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REVISED EMISSION RATE ASSUMPTIONS AND DISPERSION MODELLING RESULTS – HAMMOND REEF GOLD PROJECT

Introduction

Golder has revised the emissions inventory to include less conservative assumptions and annual average production rates in response to comments received from the Government Review Team (GRT) in January 2016, specifically comments T(3)-01, MOE-AIR-2, EMRB-2 and EMRB-8. The revised assumptions were outlined in a technical memorandum to the GRT in March of 2016 and GRT comments on the revised assumptions memorandum were acknowledged and responded to in a follow-up technical memorandum to the GRT in April of 2016. The GRT communicated that the revised assumptions and responses to their comments had addressed their expectations for the updated dispersion modelling with only minor additional requests which have been addressed in this document. The Federal reviewers provided this communication by letter dated April 29, 2016 and the Provincial reviewers by email correspondence on May 2, 2016. All precedent memoranda and relevant communications are included in Appendix A. Responses to comments received from the MOECC on the results of the revised emission and dispersion modelling and the BMPP for control of Fugitive Dust (submitted separately) are provided in Appendix E.

The original Environmental Impact Statement/Environment Assessment (EIS/EA) emissions inventory was created to support an Ontario Regulation 419/05 assessment of emissions and included maximum operating parameters and conservative modelling inputs which are necessary when applying for an Environmental Compliance Approval in Ontario as opposed to using average operating parameters and assessing against ambient air criteria. This approach was accepted by the GRT during pre-consultation in 2012 prior to the development of the Atmospheric Environment Technical Supporting Document (TSD) in support of the EIS/EA. The assumptions that formed the basis of the original inventory can be found in Section 3.0 of Appendix 3.1 of the Atmospheric Environment TSD. The original predictions using the maximum operating parameters as assumptions were passed onto the Human Health and Ecological Risk Assessment (HHERA) team and no significant HHERA impacts were predicted.

This technical memorandum summarizes the results of the updated dispersion modelling assessment which is based on the revised emissions inventory.

These results are more representative of actual expected conditions, while maintaining a sufficient level of conservatism to ensure that the maximum potential emissions are adequately captured. The revised predicted air concentrations were added to the baseline concentrations, where available, and the resulting ambient air concentrations were compared to the National Ambient Air Quality Objectives (NAAQO), Canadian Ambient Air

Quality Standards (CAAQS), and Ontario's Ambient Air Quality Criteria (AAQC) within the LSA, RSA and beyond the RSA and were reviewed by the HHERA team for potential impacts at sensitive receptor locations. The memorandum includes frequency above criteria (FAC) information including isopleths, Figures 1-5, for any compound with predicted concentrations above the applicable criteria in the LSA.

Revised Emission Rate Assumptions

Based on the GRT comments, the primary focus of the concerns relate to the particulate emissions from the Project. Therefore, the proposed revisions impact primarily the fugitive particulate emission sources. The previous assumptions used the maximum daily emission rate during the life of mine for all sources. The revised assumptions use the average daily emission rates for ore and waste rock extraction and haulage, which are the most significant contributors to the particulate emissions, during the maximum waste rock extraction year (Year 5) during the life of mine. The year with the highest waste rock extraction rate was selected because the haulage of waste rock to the waste rock storage area produces higher emissions than the haulage of ore to the Mill and/or low grade ore stockpile due to the length of the roadways. The revised emissions predicted using Year 5 are expected to be higher than the actual emissions for all other years of production. Table 1 summarizes the revised assumptions that are based on Year 5 of the mine plan and provides rationale for each.

Table 1: Revisions to Assumptions based on Year 5 of Mine Plan

Parameter	Previous Assumption	Revised Assumption	Rationale
Ore extraction and haulage rate to the Mill	65,000 tpd	47,000 tpd	The maximum daily tonnage has been reduced to an average daily tonnage based on Year 5 of the mine plan (see Table 5-2 of the EIS/EA) which has the highest average daily waste rock extraction rate during the life of mine.
Waste rock extraction and haulage rate	100,000 tpd	77,000 tpd	The maximum daily tonnage has been reduced to an average daily tonnage based on Year 5 of the mine plan (see Table 5-2 of the EIS/EA) which has the highest average daily waste rock extraction rate during the life of mine.
Ore haulage from the low grade ore stockpile to the Mill	27,400 tpd	13,000 tpd	Based on the Year 5 ore extraction rate, 13,000 tpd would be hauled from the stockpile in order to keep the Mill operating at 60,000 tpd.
Ore crushing and screening	65,000 tpd	60,000 tpd	The maximum daily processing rate has been reduced to an average daily processing rate for the Mill as recommended by the GRT.

The reduced tonnages for ore and waste rock extraction not only impact the emissions from blasting and material handling but also directly impact the amount of fugitive dust created due to hauling the materials to the storage areas and/or to the Mill.

Table 2 summarizes the revised assumptions that are not related to the mine plan.

Table 2: Revisions to Other Modelling Assumptions

Parameter	Previous Assumption	Revised Assumption	Rationale
Silt content on unpaved roads	9.18%	5%	The 5% silt content will be managed through the Best Management Practices Plan (BMPP). Road dust sampling will be carried out and road maintenance will be conducted to maintain the silt content to at or below 5%.
Control factor on the unpaved roads due to the BMPP	80%	75%	In response to GRT comments, the control factor has been modified to 75% which is the control factor for Level 2 watering (>2 L/m²) from the NPI emission factor document for Mining. This level of watering is prescribed in the BMPP.
Bulldozing and grading within the pits	Emissions were quantified based on moisture content and silt loading	Emissions are insignificant	Due to the high moisture content of the ore after blasting, emissions due to bulldozing and grading within the pit will be insignificant.
Bulldozing and grading at the low grade ore stockpile and waste rock storage area	Emissions were quantified based on moisture content and silt loading	Emissions are less than a source already accounted for in the inventory	The inventory includes emissions associated with material handling which results in a higher g/s emission rate than bulldozing and grading. The same material will not be handled and bulldozed at the same time. Therefore, only material handling is included in the inventory.

Any parameters not referenced in the tables above remain the same as stated in the Atmospheric Environment TSD. All other conservative modelling assumptions remain the same as stated in the Atmospheric Environment TSD. Appendix B includes a sample calculation of fugitive dust emissions from unpaved roadways using the revised assumptions. As per comment T(3)-01 item #3, Appendix C is a source summary table showing the daily emission rates for TSP, PM_{10} and $PM_{2.5}$ based on the revised assumptions. These revised emissions together with the conservative modelling input parameters are unlikely to underestimate the impacts from the Project.

Revised Dispersion Modelling Results

Table 3 summarizes the revised maximum predicted air concentrations due to the Project emissions within the study areas and compares them to the ambient air criteria. Maximum concentrations are also presented for "LSA + 500 buffer," which is the area between the LSA and the property boundary plus 500 m. The locations of the maximum concentration for each compound are presented on Figure 6. For the purpose of this assessment, SO_2 was modelled with and without contributions from the emergency generators. As per comment R(2)-09 from the federal review team, the new CAAQS for $PM_{2.5}$ which will come into effect in 2020 are shown. As per comment MOE-AIR-2, the AAQCs for SO_2 and 24-hour acrolein are included. The modelled concentrations due to the Project emissions alone are all below the ambient air criteria within the RSA.

Table 3: Summary of Maximum Predicted Air Concentrations as a Result of the Project

Indicator		NAAQO/CAAQS/ AAQC (µg/m³)	Maximum Predicted Air Concentration (µg/m³)			
Compound	Averaging Period		LSA[a]	LSA + 500 Buffer[b]	RSA[c]	Beyond RSA[d]
$PM_{2.5}$	24-hour	28	***47***	***38***	9	8
		27[e]	***47***	***38***	9	8
	Annual	10	9	5	1	0
		8.8[e]	***9***	5	1	0
PM_{10}	24-hour	50 (interim)	***230***	***164***	40	32
TSP	24-hour	120	***631***	***464***	97	79
	Annual	60	***129***	***70***	7	6
NO_2	1-hour	400	333	316	164	142
	24-hour	200	113	106	64	52
	Annual	100	55	31	4	3
CO	1-hour	35,000	2,077	1,958	765	629
	8-hour	15,000	1,160	1,094	427	351
SO_2	1-hour	690	***868***	***795***	198	153
	24-hour	275	26	27	11	8
	Annual	55	2	1.25	1	1
SO_2[f]	1-hour	690	207	189	95	81
	24-hour	275	24	25	11	8
	Annual	55	2	1	1	1
Acrolein	24-hour	0.4	***1.58***	***1.23***	0.29	0.24

Notes:
Bold italicized values are greater than the ambient air criteria.
a) Represents the maximum predicted air concentration outside of the property boundary but within the LSA.
b) Represents the maximum predicted air concentration outside the property boundary plus 500 m but within the LSA.
c) Represents the maximum predicted air concentration outside the LSA but within the RSA.
d) Represents the maximum predicted air concentration outside the RSA.
e) New standard effective in 2020.
f) Maximum predicted SO_2 concentration excluding contributions from the emergency generators.

The revised maximum predicted ambient air concentrations due to the Project emissions were added to the baseline concentrations and compared to the ambient air criteria. The results of this comparison are shown in Table 4. When the background concentrations are added to the maximum concentrations generated by the Project, the predicted concentration of PM_{10} in the RSA is greater than the respective ambient air criteria. However, this is predicted to occur only one day per year or less and is not considered to be significant for the following reasons:

- The background concentrations used in the assessment likely overestimate the actual background concentrations in the study area;
- The use of 5 years of meteorological data;
- The predicted frequency of the maximum predicted concentrations; and
- The model will over predict the actual concentrations because deposition was not included in the modelling assumptions.

These considerations are further explained below Table 4.

Table 4: Summary of the Maximum Ambient Air Concentrations

Indicator		NAAQO/CAAQS/ AAQC (µg/m³)	Baseline Concentration (µg/m³)(g)	Maximum Ambient Air Concentration (µg/m³)			
Compound	Averaging Period			LSA(a)	LSA + 500 Buffer(b)	RSA(c)	Beyond RSA(d)
$PM_{2.5}$	24-hour	28	4.9	***52***	*42*	14	12
		27(e)		***52***	*42*	14	12
	Annual	10	—	9	5	1	0
		8.8(e)		***9***	5	1	0
PM_{10}	24-hour	50 (interim)	17.8	***248***	***182***	***57***	49
TSP	24-hour	120	—	***631***	***464***	97	79
	Annual	60	—	***129***	***70***	7	6
NO_2	1-hour	400	2.32	335	318	166	144
	24-hour	200	2.32	116	109	67	54
	Annual	100	—	55	31	4	3
CO	1-hour	35,000	1150	3,227	3,108	1,915	1,779
	8-hour	15,000	1160	2,320	2,254	1,587	1,511
SO_2	1-hour	690	2.6	***871***	***798***	200	155
	24-hour	275	1.77	27	29	13	10
	Annual	55	—	2	1.25	1	1
SO_2 (f)	1-hour	690	2.6	210	192	97	83
	24-hour	275	1.8	26	27	13	10
	Annual	55	—	2	1	1	1
Acrolein	24-hour	0.4	—	***1.58***	***1.23***	0.29	0.24

Notes:
Bold italicized values are greater than the ambient air criteria.
a) Represents the maximum ambient air concentration outside of the property boundary but within the LSA.
b) Represents the maximum ambient air concentration outside the property boundary plus 500 m but within the LSA.
c) Represents the maximum ambient air concentration outside the LSA but within the RSA.
d) Represents the maximum ambient air concentration outside the RSA.
e) New standard effective in 2020.
f) Maximum predicted SO_2 concentration excluding contributions from the emergency generators.
g) Values used in the HHERA.

Background Concentration

Baseline estimates of PM_{10} in the RSA were based on the 90th percentile of data collected at the Fort Liard station. Data at the Ford Liard station were used because there were no baseline ambient air concentrations measured at the Project site, and are likely an overestimate of the concentrations in the RSA. The Fort Liard station is operated by the Northwest Territories Air Quality Monitoring Network and is located at an airport in southern Northwest Territories. This station is used to establish baseline community air quality. However, there are a number of oil and gas developments in the region that could contribute to the existing air quality. In addition, because the station at Fort Liard is located at the airport, the baseline air quality may also be influenced by aircraft.

As the baseline concentration of PM_{10} accounts for over one third of the interim criteria, it is important to recognize this potential conservatism when considering the resulting maximum ambient air concentration that is greater than the criteria in the RSA.

Meteorological Conditions

The emission estimates were modelled using a 5 year time series of meteorological data and the PM_{10} exceedance outside the RSA occurred during the worst meteorological day within the record. The peak emissions year (based on Year 5 of the mine plan) and the elevated baseline concentrations (90^{th} percentile) were assumed to occur continuously during these 5 years. The probability of peak emissions, elevated baseline concentrations and worst-case meteorological conditions occurring simultaneously is relatively low.

Predicted Frequency of Exceedance

The AERMOD dispersion model (version 11103) was used to model frequency above ambient air criteria (FAAAC) for each compound that had a maximum predicted air concentration due to the Project greater than criteria in the LSA. The five year meteorological data set and receptor grid for the LSA and RSA, as described in the Atmospheric Environment TSD, were used. A receptor grid with 500 m spacing was created within the Mine Study Area (MSA). Output files were post processed and the FAAAC was calculated at each receptor over the 5-year period. Meteorological anomalies were not removed during post processing. The maximum FAAAC for each compound in each study area is shown in Table 5.

Table 5: Maximum Frequency above Ambient Air Criteria

Indicator		NAAQO/CAAQS/AAQC (µg/m³)	Maximum Frequency Above Ambient Air Criteria (%)			
Compound	Averaging Period		LSA[(a)]	LSA + 500 buffer[(b)]	RSA[(c)]	Beyond RSA[(d)]
$PM_{2.5}$	24-hour	28	7	1	—	—
		27 (effective in 2020)	7	1	—	—
PM_{10}	24-hour	50 (interim AAQO)	44	26	0.2	—
TSP	24-hour	120 (AAQO)	38	19	—	—
SO_2	1-hour	690 (OAAQC)	0.3	0.1	—	—
Acrolein	24-hour	0.4 (OAAQC)	24	7.8	—	—

a) Represents the maximum FAAAC outside of the property boundary but within the LSA.
b) Represents the maximum FAAAC outside the property boundary plus 500 m but within the LSA.
c) Represents the maximum FAAAC outside the LSA but within the RSA.
d) Represents the maximum FAAAC outside the RSA.

Concentrations above criteria at each receptor that occurred more than one day per year (≥ 0.25%) [or one hour per year (≥0.01%) for SO2] were used to create isopleth figures (Figures 1 to 5). Concentrations above ambient air criteria that occur only one day per year or less are likely a result of the conservative assumptions (e.g., the worst meteorological conditions, maximum daily emission rates in Year 5, and baseline concentrations at or above the 90th percentile) all occurring simultaneously which in reality, is unlikely to occur.

However, as shown in Figure 2, the PM_{10} concentration is above criteria in the RSA only one day or less per year and this occurs likely as a result of the conservative assumptions. As shown in Table 2, the predicted PM_{10} concentration due the Project alone is below the criteria in the RSA.

Deposition

The dispersion modelling was completed conservatively without taking into account particle deposition. The addition of particle deposition would likely reduce the predicted PM_{10} concentration due to the Project by over 70%, which in turn would bring the ambient concentration in the RSA to a value well below the criteria.

Summary

Therefore, due to the elevated baseline concentration for PM_{10}, the very low predicted frequency (i.e., one day per year or less) above ambient air criteria in the RSA and the conservative dispersion modelling without deposition, the impacts due to the Project are likely not significant for PM_{10} despite the predicted maximum ambient air concentration in the RSA. The maximum ambient air concentrations are less than the ambient air criteria within the RSA for all other compounds assessed indicating there are likely no significant impacts from these compounds.

Human Health and Ecological Risk Assessment

The concentrations relied upon in the HHERA TSD were compared to the revised air quality predictions at select human health receptor locations off-site and within the LSA (i.e., Receptors 20, 24, 25, 29, 32, and 49) to identify the new assumptions' impact on health risks. Health risks were not significant as described in the HHERA TSD, so where the revised predictions are the same or lower than those used in the HHERA (or lower than ambient air criteria), health risks would be expected to be similarly negligible. This comparison is provided in (Table 6).

Table 6: Comparison of Revised Air Quality Concentrations to Those Relied Upon in the HHERA TSD

Indicator		NAAQO/CAAQS/AAQC (µg/m³)	Concentration Relied Upon in the HHERA TSD[a]	Revised Air Quality Concentrations[b]
Compound	**Averaging Period**			
$PM_{2.5}$	24-hour	28	10	14
		27[c]	10	14
	Annual	10	4.2	2.3
		8.8[c]	4.2	2.3
PM_{10}	24-hour	50 (interim)	***146***	***59***
DPM	Annual	5 (non-cancer)	0.24	0.24
		0.003 (cancer)	***0.24***	***0.24***
NO_2	1-hour	400	180	170
	24-hour	200	104	93
	Annual	100	49	28
CO	1-hour	35,000	899	803
	8-hour	15,000	502	448
SO_2	1-hour	690	14	282
	24-hour	275	14	13
	Annual	55	0.52	0.6
SO_2 [d]	1-hour	690	-	132
	24-hour	275	-	13
	Annual	55	-	0.6
Acrolein	24-hour	0.4	***0.41***	***0.42***

Notes:

Bold italicized values are greater than the ambient air criteria.

a) Concentrations used in the HHERA (2014).

b) Represents the maximum ambient air concentration at Receptors 20, 24, 25, 29, 32, and 49.

c) New standard effective in 2020.

d) Maximum predicted SO_2 concentration excluding contributions from the emergency generators.

With the exception of 24-hour acrolein, all of the revised air quality concentrations at the select receptor locations were either the same or lower than the concentrations relied upon in the HHERA TSD or lower than the ambient air criteria; therefore, acute and chronic health risks are considered to be negligible. For acrolein, the revised predicted air concentration at Receptor 32, a trapper cabin, was 0.42 µg/m^3, which is slightly greater than the maximum concentration used at this receptor location in the HHERA. As a result, the potential risks associated with this slight increase in concentration were re-calculated for the trapper receptor.

Using the receptor characteristics for the trapper as presented in Table 4-8 of the HHERA and the exposure equation presented in Section 4.4.3.3 of the HHERA, the exposure dose for the trapper at Receptor location 32 is 9.4x10^{-6} mg/kg-day. Using the methods described in Section 4.4.4 of the HHERA, the estimated hazard quotient for the trapper was 0.12, which is less than the target HQ of 1. Therefore, chronic health risks due to acrolein are considered to be negligible.

Given that the compounds listed above are expected to be primarily present in air and not be deposited onto soil, other exposure routes such as dermal contact with surface soils, dust deposition onto soil, plants, and waterbodies, uptake by terrestrial and aquatic species, and subsequent consumption of these foods by humans were not relevant (please refer to Section 4.7.1.2 of the HHERA).

Conclusion

The results of revised emissions modelling and human health and ecological risk assessment presented in this memorandum support the following conclusions:

- With the exception of PM10, the maximum ambient air concentrations are predicted to be less than the ambient air criteria within the RSA for all compounds assessed indicating there are likely no significant impacts.
- PM10 is predicted to exceed the ambient air criteria within the RSA for one day per year or less. However, this is not considered to be significant, based on the reasons described above (i.e., 90th percentile baseline concentrations, worst meteorological day, very low frequency of occurrence, no particle deposition assumption).
- With the exception of 24-hour acrolein, all of the revised air quality concentrations at the select receptor locations were either the same or lower than the concentrations relied upon in the HHERA TSD or lower than the ambient air criteria; therefore, acute and chronic health risks are considered to be negligible.
- For acrolein, the revised predicted air concentration at Receptor 32, a trapper cabin, was slightly greater than the maximum concentration used at this receptor location in the HHERA. The potential health risks due to acrolein at this Receptor were re-examined and risks were determined to be negligible.

FIGURES

607000 612000 617000 622000

5427000 5422000 5417000 5412000

29

20

32

LEGEND

Mine Site Study Area

Local Study Area

Receptor Types

Tourism Establishment

Trapper Cabin

% Above Criteria

0.25% - 0.5%

0.5% - 0.75%

0.75% - 1.0%

1.0% - 1.5%

1.5% - 2.0%

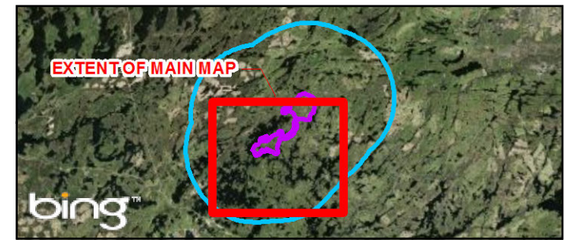
2.0% - 4.0%

4.0% - 6.0%

6.0% - 10.0%

10.0% - >20.0%

AAQC: 28 µg/m^3
Baseline: 5 µg/m^3



NOTES

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING GOLDER ASSOCIATES LTD. REPORT NO. 1408383/3300

REFERENCE

BING IMAGERY SUPPLIED BY MICROSOFT® VIRTUAL EARTH BING MAP™ LICENSE UNDER ESRI INC. ©2010 MICROSOFT CORPORATION AND ITS DATA SUPPLIERS.(ACCURACY UNKNOWN)
PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83
COORDINATE SYSTEM: UTM ZONE 15 VERTICAL DATUM: CGVD28

0 625 1,250 2,500
METRES

SCALE 1:65,000

CLIENT
CANADIAN MALARTIC

PROJECT
HAMMOND REEF GOLD PROJECT
ATIKOKAN, ONTARIO, CANADA

TITLE
24-HR PM 2.5
FREQUENCY ABOVE CRITERIA

CONSULTANT

Golder Associates

YYYY-MM-DD	2016-07-25
PREPARED	RRD
DESIGN	--
REVIEW	JT
APPROVED	NCJ

PROJECT No.	PHASE	Rev.	FIGURE
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24 25 29 20 28 32 30 31 2

LEGEND

Mine Site Study Area
Local Study Area

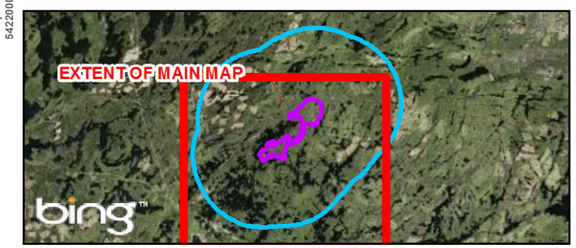
Receptor Types

- Tourism Establishment
- Trapper Cabin

% Above Criteria

- 0.25% - 0.5%
- 0.5% - 0.75%
- 0.75% - 1.0%
- 1.0% - 1.5
- 1.5% - 2.0%
- 2.0% - 4.0%
- 4.0% - 6.0%
- 6.0% - 10.0%
- 10.0% - 20.0%
- 20.0% - 30.0%
- 30.0% - >40.0%

AAQC: 50 µg/m^3
Baseline: 17 µg/m^3



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COORDINATE SYSTEM: UTM ZONE 15 VERTICAL DATUM: CGVD28

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METRES

SCALE 1:100,000

CLIENT
CANADIAN MALARTIC

PROJECT
HAMMOND REEF GOLD PROJECT
ATIKOKAN, ONTARIO, CANADA

TITLE
24-HR PM 10
FREQUENCY ABOVE CRITERIA

CONSULTANT

Golder Associates

YYYY-MM-DD	2016-07-25
PREPARED	RRD
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REVIEW	JT
APPROVED	NCJ

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29 20 32

LEGEND

Mine Site Study Area
Local Study Area

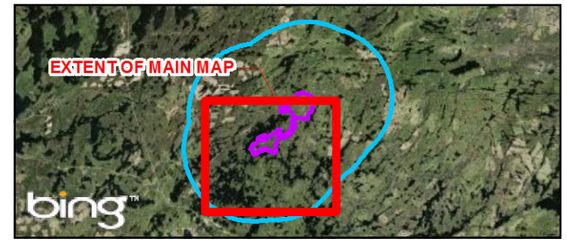
Receptor Types

Tourism Establishment
Trapper Cabin

% Above Criteria

0.25% - 0.5%
0.5% - 0.75%
0.75% - 1.0%
1.0% - 1.5
1.5% - 2.0%
2.0% - 4.0%
4.0% - 6.0%
6.0% - 10.0%
10.0% - 20.0%
20.0% - 30.0%
30.0% - >40.0%

AAQC: 120 µg/m^3
Baseline: ---



NOTES

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COORDINATE SYSTEM: UTM ZONE 15 VERTICAL DATUM: CGVD28

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METRES

SCALE 1:65,000

CLIENT
CANADIAN MALARTIC

PROJECT
HAMMOND REEF GOLD PROJECT
ATIKOKAN, ONTARIO, CANADA

TITLE
24-HR TSP
FREQUENCY ABOVE CRITERIA

CONSULTANT

Golder Associates

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PREPARED	RRD
DESIGN	--
REVIEW	JT
APPROVED	NCJ

PROJECT No.	PHASE	Rev.	FIGURE
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5427000 5422000 5417000 5412000

29 20 32

LEGEND

Mine Site Study Area
Local Study Area

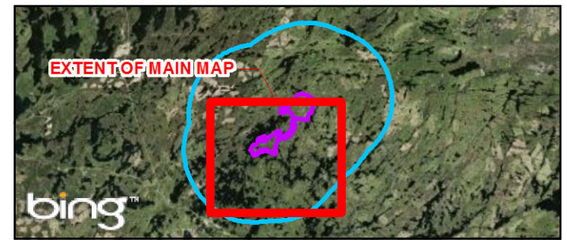
Receptor Types

Tourism Establishment
Trapper Cabin

% Above Criteria

0.01% - 0.5%
0.5% - 1.0%
1.0% - 1.5%
1.5% - 2.0%
2.0% - 2.5%
2.5% - 3.0%
3.0% - 3.5%
3.5% - 4.0%
4.0% - 4.5%

AAQC: 690 µg/m^3
Baseline: 3 µg/m^3



NOTES

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING GOLDER ASSOCIATES LTD. REPORT NO. 1408383/3300

REFERENCE

BING IMAGERY SUPPLIED BY MICROSOFT® VIRTUAL EARTH BING MAP™ LICENSE UNDER ESRI INC. ©2010 MICROSOFT CORPORATION AND ITS DATA SUPPLIERS.(ACCURACY UNKNOWN)
PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83
COORDINATE SYSTEM: UTM ZONE 15 VERTICAL DATUM: CGVD28

0 625 1,250 2,500
METRES

SCALE 1:65,000

CLIENT
CANADIAN MALARTIC

PROJECT
HAMMOND REEF GOLD PROJECT
ATIKOKAN, ONTARIO, CANADA

TITLE
1-HR SO_2
FREQUENCY ABOVE CRITERIA

CONSULTANT

Golder Associates

YYYY-MM-DD	2016-07-25
PREPARED	RRD
DESIGN	--
REVIEW	JT
APPROVED	NCJ

PROJECT No.	PHASE	Rev.	FIGURE
1408383	3300	A	**4**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: 25mm 0

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607000 612000 617000 622000

5427000 5422000 5417000 5412000

29 20 32

LEGEND

Mine Site Study Area
Local Study Area

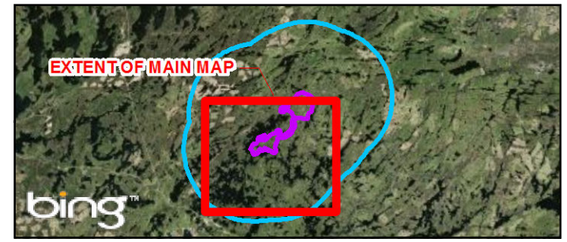
Receptor Types

Tourism Establishment
Trapper Cabin

% Above Criteria

0.25% - 0.5%
0.5% - 0.75%
0.75% - 1.0%
1.0% - 1.5
1.5% - 2.0%
2.0% - 4.0%
4.0% - 6.0%
6.0% - 10.0%
10.0% - 20.0%
20.0% - 30.0%
30.0% - >40.0%

AAQC: 0.4 µg/m^3
Baseline: ---



NOTES

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING GOLDER ASSOCIATES LTD. REPORT NO. 1408383/3300

REFERENCE

BING IMAGERY SUPPLIED BY MICROSOFT® VIRTUAL EARTH BING MAP™ LICENSE UNDER ESRI INC. ©2010 MICROSOFT CORPORATION AND ITS DATA SUPPLIERS.(ACCURACY UNKNOWN)
PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83
COORDINATE SYSTEM: UTM ZONE 15 VERTICAL DATUM: CGVD28

0 625 1,250 2,500
METRES
SCALE 1:65,000

CLIENT
CANADIAN MALARTIC

PROJECT
HAMMOND REEF GOLD PROJECT
ATIKOKAN, ONTARIO, CANADA

TITLE
24-HR ACROLEIN
FREQUENCY ABOVE CRITERIA

CONSULTANT
Golder Associates

YYYY-MM-DD	2016-07-27
PREPARED	RRD
DESIGN	--
REVIEW	JT
APPROVED	NCJ

PROJECT No.	PHASE	Rev.	FIGURE
1408383	3300	A	5

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: 25mm 0

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602000 607000 612000 617000 622000 627000

5432000 5427000 5422000 5417000 5412000

24 25 29 20 28 32 30 31 2

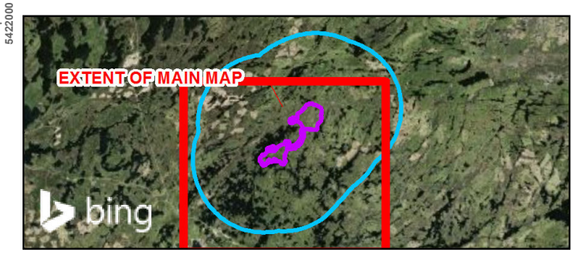
24-hour SO_2
1-hour SO_2
Annual SO_2
1-hr NO_2
24-hr NO_2
Annual NO_2
24-hour $PM_{2.5}$
24-hour TSP
24-hour Acrolein
24-hour PM_{10}
Annual $PM_{2.5}$
1-hour CO
8-hour CO

LEGEND

- Maximum Concentration
- Mine Site Study Area
- Local Study Area

Receptor Types

- Tourism Establishment
- Trapper Cabin



NOTES

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING GOLDER ASSOCIATES LTD. REPORT NO. 1408383/3300

REFERENCE

BING IMAGERY SUPPLIED BY MICROSOFT® VIRTUAL EARTH BING MAP™ LICENSE UNDER ESRI INC. ©2010 MICROSOFT CORPORATION AND ITS DATA SUPPLIERS.(ACCURACY UNKNOWN)
PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83
COORDINATE SYSTEM: UTM ZONE 15 VERTICAL DATUM: CGVD28

0 1,000 2,000 4,000
METRES

SCALE 1:100,000

CLIENT
CANADIAN MALARTIC

PROJECT
HAMMOND REEF GOLD PROJECT
ATIKOKAN, ONTARIO, CANADA

TITLE
MAXIMUM CONCENTRATIONS

CONSULTANT
Golder Associates

YYYY-MM-DD	2017-04-17
PREPARED	RRD
DESIGN	–
REVIEW	JT
APPROVED	NCJ

PROJECT No.	PHASE	Rev.	FIGURE
1408383	3300	A	**6**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

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APPENDIX A

Precedent Memoranda and Relevant Communications

TECHNICAL MEMORANDUM

DATE March 18, 2016 **PROJECT No.** 1408383 (DOC009_Rev 0)

TO Sandra Pouliot
Canadian Malartic Hammond Reef Gold Project

CC Adam Auckland

FROM Sean Capstick
Natalie Jones

EMAIL scapstick@golder.com
njones@golder.com

CANADIAN MALARTIC HRG PROJECT – REVISED EMISSION RATE ASSUMPTIONS

Golder is proposing to revise the emissions inventory to include less conservative assumptions and annual average production rates in response to comments from the Government Review Team (GRT) received in January 2016.

The original inventory was created to support an Ontario Regulation 419/05 assessment of the emissions and included maximum operating parameters and conservative modelling inputs which are necessary when applying for an Environmental Compliance Approval in Ontario as opposed to using average operating parameters and assessing against ambient air criteria. This approach was accepted by the regulators during pre-consultation in 2012 prior to the Atmospheric Environment Technical Supporting Document (TSD) being prepared in support of the Environmental Impact Statement/Environment Assessment (EIS/EA). The assumptions that formed the basis of the original inventory can be found in Section 3.0 of Appendix 3.1 of the Atmospheric Environment TSD. The original predictions using the maximum operating parameters as assumptions were passed onto the Human Health and Ecological Risk (HHER) team and no significant HHER impacts were predicted.

This memo summarizes the assumptions that can be revised and used to update the emissions inventory in order to predict maximum concentrations that are more representative of actual expected conditions. The dispersion modelling assessment will also be revised using the new emission rates once the new assumptions are accepted by the GRT. All other conservative modelling input parameters will remain the same. The revised predicted air concentrations will be compared to the National Ambient Air Quality Objectives within the LSA, RSA and beyond the RSA as well as reviewed by the HHER team for potential impacts at sensitive receptor locations. A memo will be prepared to summarize and discuss the results. The memo will include concentration isopleths for any compound with predicted concentrations above the applicable criteria within the LSA. Frequency above applicable criteria analysis data in tabular form will also be presented for any compound with predicted concentrations above applicable criteria.

Revised Assumptions

Based on the GRT comments, the primary focus of the concerns relate to the particulate emissions from the Project. Therefore the proposed revisions impact primarily the fugitive particulate emission sources. The previous assumptions used the maximum daily emission rate day during the life of mine for all sources. The revised assumptions use the average daily emission rates for ore and waste rock extraction and haulage, which are the most significant contributors to the particulate emissions, during the maximum waste rock extraction year during the life of mine (Year 5 as per Table 5-2 of the EIS/EA). The year with the highest waste rock extraction rate was selected because the haulage of waste rock to the waste rock storage area produces higher emissions than the haulage of ore to the Mill and/or low grade ore stockpile due to the length of the roadways. As a result of the longer waste rock haul distance, the emissions generated during Year 5 are expected to be higher than the emissions generated during any other year of the mine plan.

Table 1 summarizes the revised assumptions that are related to Year 5 of the mine plan and provides rationale for each revision.

Table 1: Proposed Revisions to Assumptions related to Year 5 Mine Plan

Parameter	Previous Assumption	Revised Assumption	Rationale
Ore extraction and haulage rate to the Mill	65,000 tpd	47,000 tpd	The maximum daily tonnage has been reduced to an average daily tonnage based on Year 5 of the mine plan (see Table 5-2 of the EIS/EA) which has the highest waste rock extraction rate during the life of mine.
Waste rock extraction and haulage rate	100,000 tpd	77,000 tpd	The maximum daily tonnage has been reduced to an average daily tonnage based on Year 5 of the mine plan (see Table 5-2 of the EIS/EA) which has the highest waste rock extraction rate during the life of mine.
Ore haulage from the low grade ore stockpile to the Mill	27,400 tpd	13,000 tpd	Based on the Year 5 ore extraction rate, 13,000 tpd would be hauled from the low grade stockpile in order to keep the Mill operating at 60,000 tpd.
Ore crushing and screening	65,000 tpd	60,000 tpd	The maximum daily processing rate has been reduced to an average daily processing rate for the Mill as recommended by the GRT.

The reduced tonnages for ore and waste rock extraction not only impact the emissions from blasting and material handling but also directly impact the amount of fugitive dust created due to hauling the materials to the Mill.

Table 2 summarizes the revised assumptions that are not specifically related to the Year 5 waste rock and ore hauling and processing rates, including the rationale for each revision.

Table 2: Proposed Revisions to Other Modelling Assumptions

Parameter	Previous Assumption	Revised Assumption	Rationale
Silt content on unpaved roads	9.18%	5%	The 5% silt content will be managed through the Best Management Practices Plan (BMPP). Road dust sampling will be carried out and road maintenance will be conducted to maintain the silt content to at or below 5%.
Control factor on the unpaved roads due to the BMPP	80%	75%	In response to GRT comments, the control factor has been modified to 75% which is the control factor for Level 2 watering (>2 L/m²) from the NPI emission factor document for Mining. This level of watering will be prescribed in the BMPP.
Bulldozing and grading within the pits	Emissions were quantified based on moisture content and silt loading	Emissions are insignificant	Due to the high moisture content of the ore after blasting, emissions due to bulldozing and grading within the pit will be insignificant.
Bulldozing and grading at the low grade ore stockpile and waste rock storage area	Emissions were quantified based on moisture content and silt loading	Emissions are less than a source already accounted for in the inventory	The inventory includes emissions associated with material handling which results is a higher g/s emission rate than bulldozing and grading. The same material will not be handled and bulldozed at the same time. Therefore only material handling is included in the inventory.

Any parameters not referenced in the tables above will remain the same as stated in the Atmospheric Environment TSD. All other conservative modelling assumptions will remain the same as stated in the Atmospheric Environment TSD. These revised emissions together with the conservative modelling input parameters will not likely underestimate the impacts from the Project.

If you have any questions please do not hesitate to contact Natalie Jones or Sean Capstick.

NCJ/SC/AA/sk

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Canadian Environmental Assessment Agency
Agence canadienne d'évaluation environnementale

55 St. Clair Avenue East
Suite 907
Toronto, Ontario
M4T 1M2

55, avenue St-Clair Est
Bureau 907
Toronto (Ontario)
M4T 1M2

March 24, 2016

ELECTRONIC MAIL

Ms. Sandra Pouliot, ing.
Environnement project manager
Canadian Malartic Corporation
100, chemin du Lac Mourier
Malartic, QC J0Y 1Z0

SUBJECT: Federal Comments on the Revised Air Quality Modeling Assumptions for the Hammond Reef Gold Project

Dear Ms. Pouliot:

The Canadian Environmental Assessment Agency (the Agency), along with federal expert departments, have completed the review of Canadian Malartic Corporation's (CMC's) March 18, 2016 technical memorandum on the revised air quality modeling assumptions.

The Agency recognizes the work done by CMC to produce a memorandum in response to expectations for the scope of work recommended by T(3)-01 of Information Request #3 and related discussions held during the teleconference of March 2, 2016. Some assumptions described in the memorandum require clarification as described in the attached table. To support expectations being met, the Agency would appreciate receiving from CMC an addendum to the memorandum that addresses these comments.

Feel free to contact me directly at 416-952-1574 or HammondReef@ceaa-acee.gc.ca, if there are questions about the contents of this letter, including the table of comments.

Sincerely,
<Original signed by>

Loraine Cox
Project Manager

Attachment:

- Table of Federal Comments on the Revised Air Quality Modeling Assumptions

cc. Sheelagh Hysenaj, Environment and Climate Change Canada
Lance Richardson-Prager, Health Canada
Antonia Testa, Ministry of the Environment and Climate Change

Table of Federal Comments on the Revised Air Quality Modeling Assumptions

Item #	*Comment*
1	In the second paragraph on page 1 of the memorandum, it is stated "The original inventory was created to support an Ontario Regulation 419/05 assessment of the emissions and included maximum operating parameters and conservative modeling inputs, which are necessary when applying for an Environmental Compliance Approval..." Please explain what is meant by "maximum operating parameters and conservative modeling inputs", in a manner that describes the operating scenario represented by the previous assumptions used for the *Ontario Regulation 419/05* assessment of emissions.
2	In the last paragraph of page 1, it is stated that "The revised predicted air concentrations will be compared to the National Ambient Air Quality Objectives [NAAQO] within the LSA, RSA, and beyond the RSA...". Please confirm that the concentrations will be compared with all relevant standards/guidelines/objectives, where applicable (e.g., NAAQO, the *Canadian Ambient Air Quality Standards* (CAAQS), Ontario's *Ambient Air Quality Objectives*, *Ontario Regulation 419/05* standards). Also, it is recommended that the expectations described in comment R(2)-09 from Information Request #2 be considered.
3	How do ore haulage rates to the mill impact the average daily processing rate of the mill? In Table 1 on page 2 of the memorandum, the revised assumption for low grade ore haulage is more than 50% lower than the previous assumption (that is, 13 000 tpd versus 27 400 tpd, respectively), whereas the ore crushing and screening assumption has been revised downwards from 65 000 tpd to only 60 000 tpd. Please explain how a greater than 50% reduction in low grade ore haulage to the mill does not similarly impact the ore crushing and screening assumption by the same magnitude. It would seem that there should not be such a large decrease in the assumption for the ore haulage parameter.
4	Please confirm if the previous assumptions identified in Tables 1 and 2 are those that were used to predict air concentrations presented in the updated Table MOE Air-2-1, dated October 2015.
5	In Table 2 on page 3, the silt content was previously assumed to be 9.18%, which represents the mean silt content on unpaved roads from a large sampling of mine sites in Ontario. It is recommended that the silt content assumption not be revised as proposed (i.e., 5%), because the rationale provided in support of this revision is not adequately substantiated. Alternatively, please further substantiate the 5% assumption. It should also be noted that 9.18% is incorrect in the memorandum; the mean is 9.14%.
6	In Table 2 on page 3, it is stated that the emissions for bulldozing and grading are assumed to be "insignificant"; however, these activities represent sources of emissions, and therefore, should still be included in the air quality assessment.

Ministry of the Environment and Climate Change
125 Resources Road
West Wing
Toronto ON M9P 3V6

Environmental Monitoring and Reporting Branch
Tel. (416) 235- 6300
Fax (416) 235- 6235

Ontario

Memorandum

22 March 2016

To: Antonia Testa, Special Project Officer – Environmental Approvals Branch

From: Abby Salb, P.Eng., Air Dispersion Modelling Engineer, EMRB
Guowang Qiu, Air Quality Analyst – Northern Region

Re: Review of Revised AQA Assumptions – "Typical/Average Production" for CMC Hammond Reef Gold Project

Cc: Yvonne Hall, Supervisor – Air Modelling & Emissions Unit, EMRB

EMRB and NR reviewed the memo Canadian Malarctic HRG Project – Revised Emission Rates, dated March 18, 2016, and have the following comments.

1. The proponent has chosen Year 5 to calculate the average daily emissions, which seems reasonable based on the rationale provided in the technical memo (i.e. highest waste rock extraction rate and longest waste rock haul distance).

2. The revised assumption indicates that emissions from bulldozing and grading within pits are insignificant. The emissions from bulldozing and grading within the pits account for about 5% of **total** PM emissions based on the information provided in the Table 6-10 of the Effects Assessment. *The proponent is requested to provide the moisture content of the ore/waste rock after blasting, and confirm that the dozing/grading would occur prior to the material drying out.*

3. The revised control factor on the unpaved roads due to the BMPP decreased from 80% to 75%, which is reasonable, as based on the calculation methodology provided the response to Provincial Regulators (EMRB-2), this would represent control only through watering (i.e. it would not include natural mitigation).

4. The noted 5 % silt content is on the low end of silt ranges for mining sources. It is unclear what measures will be undertaken to manage the roadway silt content in the Best Management Practices Plan (BMPP). *The proponent is requested to provide further details*

on the specific actions that will be undertaken in BMPP for maintaining a low silt content for unpaved roads (i.e. ~5%), in addition to the commitment of periodic road dust sampling to verify the silt content on an ongoing basis. This is required to demonstrate whether there is any need for further actions to control the silt content.

5. The MOECC expects that revised predicted air concentrations including cumulative impacts (modelled plus background) should be compared to AAQC and/or NAAQO. The concentrations and frequency above applicable criteria should also be presented in Tabular form as well as isopleth showing the concentrations and frequency of exceedance.

TECHNICAL MEMORANDUM

DATE April 7, 2016 **PROJECT No.** 1408383 (DOC010_Rev 0)

TO Sandra Pouliot
Canadian Malartic Hammond Reef Gold Project

FROM Sean Capstick
Natalie Jones

EMAIL scapstick@golder.com
njones@golder.com

CANADIAN MALARTIC HRG PROJECT – REVISED EMISSION RATE ASSUMPTIONS RESPONSES TO GRT COMMENTS

Golder is proposing to revise the emissions inventory to include less conservative assumptions and annual average production rates in response to comments from the Government Review Team (GRT) received in January 2016. Golder summarized their proposed revised assumptions in a technical memorandum dated March 18, 2016 which was distributed to the GRT for review and comment. The GRT commented on the proposed revised assumptions in letters to Canadian Malartic dated March 22, 2016 from the Ontario Ministry of Environment and Climate Change (MOECC) and March 24, 2016 from the Canadian Environmental Assessment Agency (CEAA).

This memo summarizes Golder's responses to the GRT comments. Not all of the MOECC comments required a follow up response and these comments (Item's #1 and #3) have been acknowledged.

Operating Scenario for Previous Assumptions

Item # 1 - Federal

In the second paragraph on page 1of the memorandum, it is stated "The original inventory was created to support an Ontario Regulation 419/05 assessment of the emissions and included maximum operating parameters and conservative modeling inputs, which are necessary when applying for an Environmental Compliance Approval..." Please explain what is meant by "maximum operating parameters and conservative modeling inputs", in a manner that describes the operating scenario represented by the previous assumptions used for the Ontario Regulation 419/05 assessment of emissions.

Response

O.Reg.419/05 requires that the maximum operating parameters be assessed, meaning that if the standard is a 24-hr standard, the maximum emissions possible within a 24-hr period must be considered if these emissions are possible to occur for one day in a given year. For this reason, many of the previous assumptions were made so that the maximum possible short term emissions were being assessed. Using the previous assumptions, the Project was capable of demonstrating compliance with the O.Reg.419/05 standards. It is important to note that under O.Reg.419/05, tailpipe emissions from mobile vehicles and, if the site implements a Best Management Practices Plan (BMPP), fugitive particulate emissions are not considered. For this reason an assessment using O.Reg.419/05 standards and an assessment using the NAAQO/CAAQS cannot be directly compared.

The revised assumptions are based on annual average emissions therefore they represent less conservative more realistic longer term emissions, representative of normal operating conditions. They account for the variation in emissions over the course of an entire year. The emission inventory based on the revised assumptions is more suitable for comparison with the NAAQO/CAAQS.

Relevant Criteria

Item # 2 – Federal

In the last paragraph of page 1, it is stated that "The revised predicted air concentrations will be compared to the National Ambient Air Quality Objectives [NAAQO] within the LSA, RSA, and beyond the RSA". Please confirm that the concentrations will be compared with all relevant standards/guidelines/objectives, where applicable {e.g., NAAQO}, the Canadian Ambient Air Quality Standards {CAAQS}, Ontario's Ambient Air Quality Objectives, Ontario Regulation 419/05 standards). Also, it is recommended that the expectations described in comment R(2)-09 from Information Request #2 be considered.

Item # 5 – Provincial

The MOECC expects that revised predicted air concentrations including cumulative impacts (modelled plus background) should be compared to AAQC and/or NAAQO. The concentrations and frequency above applicable criteria should also be presented in Tabular form as well as isopleth showing the concentrations and frequency of exceedance.

Response

The revised predictions will be compared to the following criteria which is consistent with the criteria used in the previous assessment in response to MOE-Air 2-2. The revised maximum concentrations within the LSA, LSA + 500m, RSA and beyond the RSA will be added to the background concentrations and compared with the criteria in the table below. As per R(2)-09, the new CAAQS for PM2.5 which will be coming into effect in 2020 have been included.

Indicator		**NAAQO/CAAQS (µg/m³)**
Compound	**Averaging Period**	
$PM_{2.5}$	24-hour	28
	24-hour	27 (effective in 2020)
	Annual	10
	Annual	8.8 (effective in 2020)
PM_{10}	24-hour	50 (interim AAQO)
TSP	24-hour	120 (AAQO)
NO_2	1-hour	400
	24-hour	200
	Annual	100

Indicator		NAAQO/CAAQS (µg/m³)
Compound	**Averaging Period**	
SO_2	1-hour	900
	24-hour	300
	Annual	60
CO	1-hour	35,000
	8-hour	15,000

The CEAA comment made reference to Ontario Regulation 419/05 standards. An assessment using O.Reg.419/05 was previously completed as part of the Atmospheric TSD, see Section 3.2.3, using the original emissions estimates and the Project was able to demonstrate compliance with the O.Reg.419/05 standards. Given that the revised emission estimates are lower than the previous estimates, a subsequent O.Reg.419/05 assessment should not be required.

Ore Haulage Rates

Item # 1 – Provincial

The proponent has chosen Year 5 to calculate the average daily emissions, which seems reasonable based on the rationale provided in the technical memo (i.e. highest waste rock extraction rate and longest waste rock haul distance).

Item # 3 – Federal

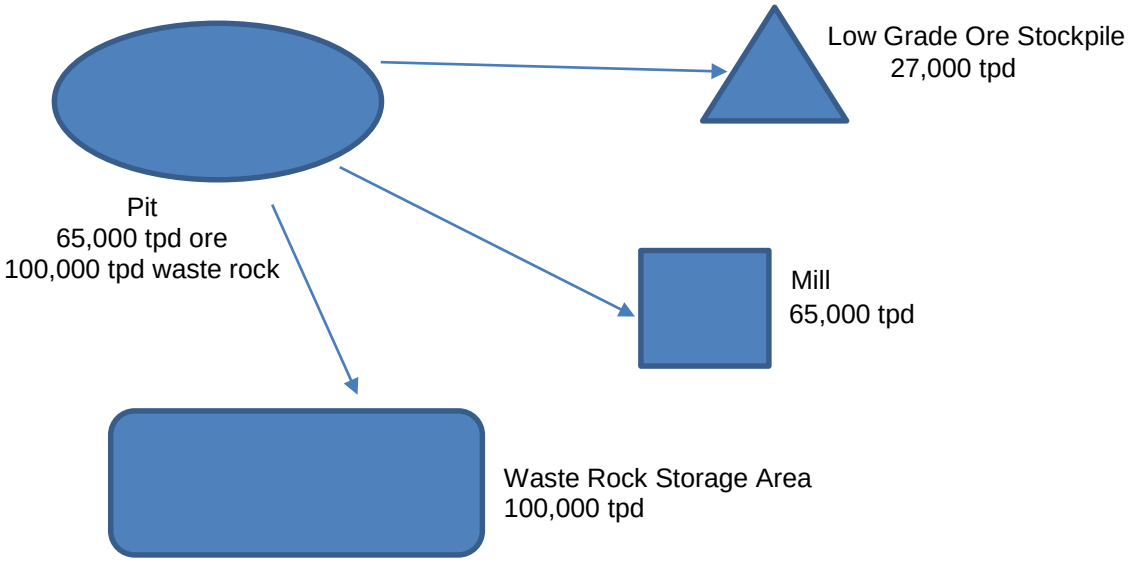
How do ore haulage rates to the mill impact the average daily processing rate of the mill? In Table 1on page 2 of the memorandum, the revised assumption for low grade ore haulage is more than 50% lower than the previous assumption {that is, 13 000 tpd versus 27 400 tpd, respectively), whereas the ore crushing and screening assumption has been revised downwards from 65 000 tpd to only 60 000 tpd. Please explain how a greater than 50% reduction in low grade ore haulage to the mill does not similarly impact the ore crushing and screening assumption by the same magnitude. It would seem that there should not be such a large decrease in the assumption for the ore haulage parameter.

Response

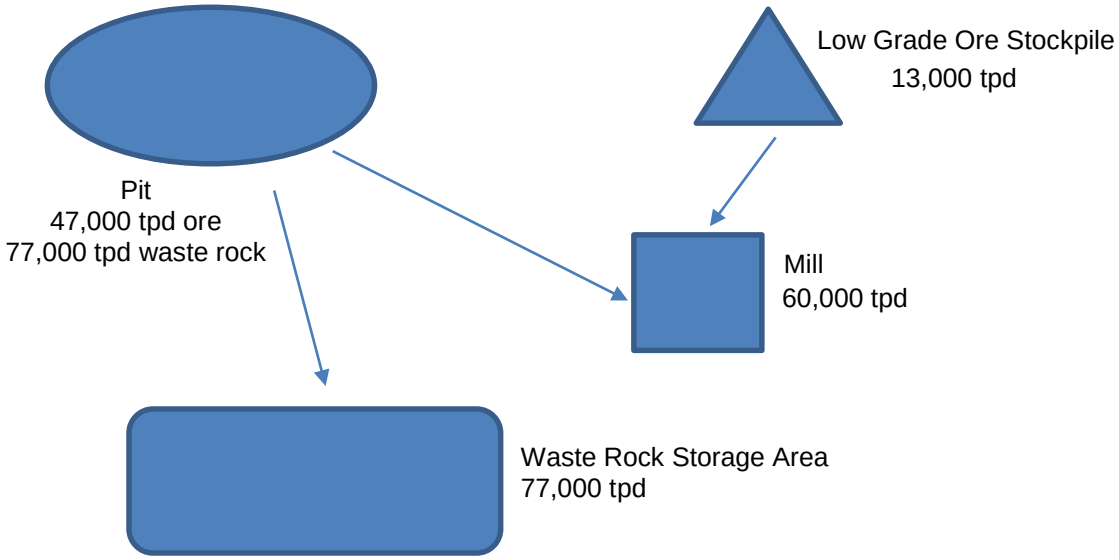
Using the previous assumptions, the extraction rate in the pit, handling at the low grade stockpile and the mill processing rate are independent. This was done in order to capture the maximum operating scenario, which is required under O.Reg.419/05. Although these assumptions are very conservative, the Project was able to demonstrate compliance with O.Reg.419/05 therefore refinements were not necessary.

The revised assumptions are based on an actual production year, Year 5, therefore the extraction, haulage and material handling rates are linked with the mill processing rate. Year 5 was selected because in this year, the combined total waste rock, ore and low grade ore haul distance was the largest and would therefore generate the largest emission. Prior to Year 5, total ore extraction from the pit exceeds the mill capacity which results in the creation of the low grade ore stockpile. The following process flow diagrams represent the two scenarios. In Year 5, a haulage of 13,000 tpd from the low grade ore stockpile is required to meet the mill ore demand of 60,000 tpd.

Previous Assumptions (Very Conservative – Maximum Daily Haul Rates; Not based on Mine Plan)



Revised Assumptions (Actual Mine Plan Year 5 – Maximum Material Haulage Year)



Previous Assumptions and Table MOE Air 2-1

Item # 4 – Federal

Please confirm if the previous assumptions identified in Tables 1 and 2 are those that were used to predict air concentrations presented in the updated Table MOE Air-2-1, dated October 2015.

Response

Yes, the previous assumptions from Tables 1 and 2 were used to predict the air concentrations in the updated Table MOE Air 2-1. As stated in the previous section with respect to the maximum operating scenario, the previous assumptions overestimate the average daily emissions from the Project.

Silt Content on Unpaved Roads

Item # 4 - Provincial

The noted 5 % silt content is on the low end of silt ranges for mining sources. It is unclear what measures will be undertaken to manage the roadway silt content in the Best Management Practices Plan (BMPP). The proponent is requested to provide further details on the specific actions that will be undertaken in BMPP for maintaining a low silt content for unpaved roads (i.e. ~5%), in addition to the commitment of periodic road dust sampling to verify the silt content on an ongoing basis. This is required to demonstrate whether there is any need for further actions to control the silt content.

Item # 5 - Federal

In Table 2 on page 3, the silt content was previously assumed to be 9.18%, which represents the mean silt content on unpaved roads from a large sampling of mine sites in Ontario. It is recommended that the silt content assumption not be revised as proposed (i.e.5%), because the rationale provided in support of this revision is not adequately substantiated. Alternatively, please further substantiate the 5% assumption. It should also be noted that 9.18% is incorrect in the memorandum; the mean is 9.14%.

Response

The silt content that was used in the original inventory was based on the mean silt content on unpaved roads from a large sampling of mines however this sampling was conducted prior to the implementation of a formal Best Management Practices (BMP) program at the mines in which the sampling occurred. The intent of the data analysis was to provide a baseline for a mining operation to gauge the effectiveness of BMP programs once they are fully implemented. In our experience, the silt content on unpaved roads at a mining operation that has a fully implemented BMP program can be reduced below 5%. There is not any published data available at this time that can be used as reference. However, Canadian Malartic is committed to confirmatory road dust sampling and this will form a significant component of the BMP Plan for the Project which will be provided to the GRT with the revised modelling predictions.

Bulldozing and Grading within the Pits

Item # 6 - Federal

In Table 2 on page 3, it is stated that the emissions for bulldozing and grading are assumed to be "insignificant"; however, these activities represent sources of emissions, and therefore, should still be included in the air quality assessment.

Item # 2 - Provincial

The revised assumption indicates that emissions from bulldozing and grading within pits are insignificant. The emissions from bulldozing and grading within the pits account for about 5% of total PM emissions based on the information provided in the Table 6-10 of the Effects Assessment. The proponent is requested to provide the moisture content of the ore/waste rock after blasting, and confirm that the dozing/grading would occur prior to the material drying out.

Response

Upon further review of site specific details for the Project and discussions with Canadian Malartic, these activities are unlikely to create emissions due to the high moisture content of the material within the pits. During open pit mining, groundwater is constantly seeping into the pit since the activities are occurring below the water table. This results in the need for dewatering of the pit throughout the life of mine. The handling of material after blasting is referred to as “mucking” which speaks to the nature of the material. Once the material is blasted, it will be loaded into trucks and hauled out of the pit. . The moisture content of the material handled within the pit will be managed as part of the BMPP for the Project.

Closure

If you have any further questions please do not hesitate to contact Natalie Jones or Sean Capstick.

NCJ/SC/AA/sk

n:\active\2014\1188\1408383-cm -hammond reef ea follow-up\3300 - air quality\3301 - ir3 support\memo_response to grt comments on aq assumtions\rev 0\1408383_doc010_rev 0_response to regulator comments_7apr2016.docx

Canadian Environmental Assessment Agency
Ontario Regional Office
55 St. Clair Avenue East,
Room 907
Toronto, ON M4T 1M2

Agence canadienne d'évaluation environnementale
Bureau régional de l'Ontario
55, avenue St-Clair est,
bureau 907
Toronto (Ontario) M4T 1M2

April 29, 2016

Ms. Sandra Pouliot, ing.
Project Manager, Environment
Canadian Malartic Corporation
100, chemin du Lac Mourier
Malartic, QC J0Y 1Z0

ELECTRONIC MAIL

SUBJECT: Federal Comments on the April 7, 2016 Technical Memorandum on the Revised Emission Rate Assumptions for the Federal Environmental Assessment of the Hammond Reef Gold Project

Dear Ms. Pouliot:

The Canadian Environmental Assessment Agency, along with Environment and Climate Change Canada and Health Canada, completed the review of Canadian Malartic Corporation's April 7, 2016 technical memorandum on the revised emission rate assumptions of the air quality modeling scenario for the proposed Hammond Reef Gold Project.

Upon review, the revised modeling assumptions as described in the original March 1, 2016 memorandum and clarified by the April 7, 2016 memorandum addendum appear to address the expectations for responding to T(3)-01, with the addition of the following:

1. In line with part 2 of T(3)-01, provide a detailed sample calculation for unpaved roads ($PM_{2.5}$, PM_{10}, TSP), and include the modelling assumptions and references used to calculate emissions.

.../2

2. In line with part 7 of T(3)-01, compare the updated air quality modelling results with the values used in the human health risk assessment, the air quality technical supporting document, and Tables MOE Air-2-1 and MOE Air-2-2 and provide a summary table of the comparisons. If the human health risk assessment is not revised, provide a detailed health-science based rationale.

Please feel free to contact me at 416-952-1574 or HammondReef@ceaa-acee.gc.ca, if there are questions about the content of this letter.

Sincerely,
<Original signed by>

Loraine Cox
Project Manager

cc. Sheelagh Hysenaj, Environment and Climate Change Canada
Allison Denning, Health Canada
Antonia Testa, Ontario Ministry of the Environment and Climate Change

From: Testa, Antonia (MOECC) <Antonia.Testa@ontario.ca>
Sent: Monday, May 02, 2016 7:32 AM
To: Sandra Pouliot
Cc: Auckland, Adam; Hammond Reef Mine / Mine Hammond Reef (CEAA/ACEE); Cox,Loraine [CEAA]
Subject: RE: Revised Air Quality Response Memorandum

Hi Sandra,

My reviewers have completed the review of the Revised Air Quality Response Memorandum sent to us in your email below. MOECC is satisfied with the responses except for the response to MOECC's comment #5. The following is MOECC's response to CMC's response to comment #5:

"As mentioned in the comment #5, predicted cumulative air concentrations should be compared to all applicable provincial and federal criteria (i.e. AAQC and/or NAAQO/CAAQS). The 1-hour, 24-hour, and annual AAQCs for SO2 are stricter compared to NAAQO. The revised SO2 prediction should be compared to AAQCs."

Please provide response/acknowledgement of this comment. Feel free to contact me if you have any questions.

Cheers,
Antonia

Antonia Testa | Special Project Officer
Environmental Assessment Services | Environmental Approvals Branch
Ministry of the Environment and Climate Change | 135 St. Clair Ave. W, 1st Floor, Toronto ON M4V 1P5
T: 416.325.5500 | F: 416.314.8452 | E: antonia.testa@ontario.ca

From: Sandra Pouliot [mailto:spouliot@canadianmalartic.com]
Sent: April-11-16 2:37 PM
To: Sen,Amy [CEAA]; Testa, Antonia (MOECC); Hammond Reef Mine / Mine Hammond Reef (CEAA/ACEE); Cox,Loraine [CEAA]
Cc: Auckland, Adam; Pascal Lavoie
Subject: Revised Air Quality Response Memorandum

Good afternoon ladies,

Please find attached the revised air quality response memo, as previously agreed upon.

Do not hesitate to contact me for any questions

Best regards,

Sandra Pouliot, ing.
Chargée de projet Environnement
100, chemin du Lac Mourier, Malartic, Québec, J0Y 1Z0
Tél. : 819.757.2225 #2297 | Téléc. 819.757.2351
spouliot@canadianmalartic.com | www.canadianmalartic.com

APPENDIX B

Sample Calculation: Vehicles – Unpaved Road Fugitive Dust

The following sample calculation is provided in response to Comment # 1 of the CEAA Letter (April 29, 2016):

> *CEAA Comment #1 (April 29, 2016 Letter):*
>
> *In line with part 2 of (T3)-01, provide a detailed sample calculation for unpaved roads (PM2.5, PM10, TSP), and include the modelling assumptions and references used to calculated emissions.*

Sample Calculation: Vehicles – Unpaved Fugitive Road Dust

The predictive equation in U.S. EPA AP-42 Chapter 13.2.2 "*Unpaved Roads*" (November 2006) was used to calculate the fugitive dust emissions from the unpaved roadways. The equation is as follows:

$$EF = k\left(\frac{s}{12}\right)^{a} \times \left(\frac{W}{3}\right)^{b} \times 281.9 \times (1 - 75\%)$$

where: EF = particulate emission factor (g/VKT),
k = empirical constant for particle size range (pounds per vehicle mile travelled) (Table 4-1),
s = road surface silt content (%),
W = average weight (tons) of the vehicles traveling the road,
a= empirical constant for particle size range (dimensionless) (Table 4-1),
b= empirical constant for particle size range (dimensionless) (Table 4-1),
281.9 = conversion from pounds per vehicle miles travelled to grams per vehicle kilometres travelled,
75% = reduction of fugitive dust emissions due to best management practices to control fugitive dust.

Table 1 shows the constants used for the unpaved roadways fugitive dust emissions.

Table 1: Particle Size Constants for Unpaved Road Dust – Industrial Roads

Size Range	k (lb/VMT)	a	b
$PM_{2.5}$	0.15	0.9	0.45
PM_{10}	1.5	0.9	0.45
TSP	4.9	0.7	0.45

Unpaved road dust emissions were conservatively calculated without an adjustment for natural mitigation.

The following is a sample calculation for the TSP emission factor using the following values for the section of roadway from the east pit to the gyratory crusher (Activity ID - ORE-1):

Silt content (%)	5
Average weight of vehicles (tons)[(a)]	304.9
Length of road segment (km)	2.95
Number of one-way vehicle passes per day	58

a) Average weight assumes a full truck weighs 390 tonnes and an empty truck weighs 163 tonnes and the truck drives there and back in one trip.

$$EF = 4.9\left(\frac{5}{12}\right)^{0.7} \times \left(\frac{304.9}{3}\right)^{0.45} \times 281.9$$

$$EF = 5988.2\ g/VKT$$

The following is a sample calculation for the TSP emission rate:

$$ER = EF \times Daily\ Vehicle\ Kilometres\ Travelled \times (1 - Control\ Efficiency) \times \frac{1\ day}{24\ hr} \times \frac{1\ hr}{3600\ s}$$

$$ER = \frac{5988.2\ g}{km} \times \frac{\left(2.95\ \frac{\text{km}}{\text{trip}}\ (\text{one way}) \times 2\ (\text{return}) \times 58\ \text{trips}\right)\text{km}}{1\ \text{day}} \times (1 - 75\%) \times \frac{1\ \text{day}}{24\ hr} \times \frac{1\ hr}{3600\ s}$$

$$ER = 5.9\ g/s$$

The emissions of PM_{10} and $PM_{2.5}$ were calculated in a similar manner.

The metals in the fugitive road dust were calculated based on the conservative assumption that 10% of the surface road silt is ore. Therefore 10% of the emissions were then speciated using an assay to represent typical ore found at the site. The emission rate for each metal was derived from the following equation.

$$ER = ER\ on\ the\ road\ segment \times 10\% \times concentration\ of\ the\ metal\ in\ the\ ore$$

The following is a calculation for manganese on the roadway from the East pit to the gyratory crusher using the ore assay provided in the TSD.

$$ER = \frac{5.9\ g}{s} \times 10\% \times 0.04\%$$

$$ER = 0.0002\ g/s$$

APPENDIX C
Source Summary Table

Project Component	Activity	Daily Emission Rate (g/s)		
		TSP	PM10	PM2.5
Open Pit Extraction	Blasting	0.571	0.297	0.017
	Material Handling	7.176	2.870	1.148
	Vehicle – Exhaust	0.779	0.779	0.755
	Vehicles – Unpaved Road Dust	43.027	11.056	1.106
Low Grade Ore Stockpile	Material Handling	0.752	0.301	0.120
Waste Rock Stockpile	Material Handling	4.456	1.782	0.713
Surface Roads	Vehicle – Exhaust	0.713	0.713	0.691
	Vehicles – Unpaved Road Dust	53.968	13.867	1.387
Ore Crushing and Screening	Material Handling	0.903	0.361	0.106
	Ore Crushing	0.486	0.181	0.334
	Ore Screening	0.043	0.015	0.002
Ore Processing and Refining	Carbon Regeneration	0.104	0.104	0.104
	Smelting Furnace	0.199	0.199	0.199
Emergency Power Generators	Stationary Diesel Combustion	0.033	0.015	—
Comfort Heating	Propane Combustion	0.166	0.166	0.166

APPENDIX D

Cumulative Air Quality Concentration at Receptor Locations for the 24-hr Averaging Period

Receptor	Easting [km]	Northing [km]	Cumulative Air Quality Concentration					
			TSP	PM_{10}	$PM_{2.5}$	SO_2	NO_2	Acrolein
Receptor 1	634.729	5,435.560	39.83	32.90	8.29	4.95	25.95	0.11
Receptor 2	621.329	5,407.827	44.96	36.39	9.25	5.56	32.64	0.14
Receptor 3	599.103	5,407.955	18.56	26.04	6.88	5.03	16.08	0.06
Receptor 4	601.019	5,401.373	35.37	33.22	8.55	5.84	28.05	0.12
Receptor 5	602.252	5,433.101	34.11	31.87	8.25	6.60	24.93	0.10
Receptor 6	606.970	5,415.292	61.34	43.55	11.11	12.04	45.21	0.19
Receptor 7	606.970	5,413.525	74.51	48.77	12.15	7.40	53.83	0.23
Receptor 8	607.976	5,417.527	95.05	60.12	15.04	12.66	74.52	0.33
Receptor 9	612.400	5,439.064	26.36	28.57	7.46	7.83	19.97	0.08
Receptor 12	610.866	5,413.196	124.02	66.94	16.36	8.75	81.76	0.35
Receptor 13	621.419	5,418.271	135.33	68.07	16.71	8.72	74.98	0.33
Receptor 14	619.206	5,411.765	76.38	47.11	11.58	6.34	47.08	0.20
Receptor 15	615.718	5,433.437	39.02	33.52	8.62	10.96	28.50	0.11
Receptor 16	606.511	5,435.326	37.75	32.03	8.15	7.12	24.92	0.10
Receptor 18	601.534	5,416.647	41.57	35.00	9.04	9.11	30.02	0.12
Receptor 20	623.275	5,422.826	87.74	51.90	12.97	11.06	52.83	0.23
Receptor 21	620.559	5,439.329	28.28	27.82	7.14	5.93	17.61	0.07
Receptor 22	606.019	5,436.032	31.20	30.09	7.76	7.09	22.14	0.09
Receptor 24	606.925	5,428.702	81.31	48.17	11.74	10.11	49.61	0.21
Receptor 25	622.015	5,428.871	67.05	45.92	11.57	7.91	49.68	0.21
Receptor 26	618.758	5,435.290	27.51	28.51	7.48	8.19	20.04	0.08
Receptor 27	621.600	5,432.857	59.63	39.63	9.65	9.92	36.54	0.15
Receptor 28	626.980	5,419.176	72.82	46.54	11.73	7.69	45.53	0.20
Receptor 29	617.283	5,426.253	135.07	68.50	17.01	13.75	80.31	0.33
Receptor 30	602.629	5,412.109	32.41	31.73	8.23	7.70	25.09	0.10
Receptor 31	613.059	5,410.973	106.87	59.15	14.34	7.51	66.21	0.29
Receptor 32	617.518	5,415.904	157.23	77.00	18.80	6.97	90.28	0.42
Receptor 33	606.883	5,432.877	36.25	32.44	8.19	9.08	26.11	0.11
Receptor 34	629.368	5,420.150	52.42	39.46	10.09	9.89	35.52	0.15
Receptor 35	616.320	5,434.785	30.57	30.18	7.90	10.01	22.69	0.09
Receptor 38	618.108	5,416.927	184.68	87.52	21.39	7.99	92.06	0.47
Receptor 39	599.386	5,413.575	24.70	28.60	7.50	7.78	20.15	0.08
Receptor 40	622.090	5,412.726	91.20	53.23	13.50	6.92	56.37	0.24
Receptor 41	616.407	5,426.925	106.65	62.54	16.53	15.93	90.54	0.32
Receptor 42	616.317	5,426.799	110.34	62.85	16.05	16.12	80.71	0.33
Receptor 43	616.460	5,426.912	107.95	63.79	17.31	16.17	98.85	0.32
Receptor 44	616.479	5,426.917	110.90	66.41	21.63	16.22	101.97	0.32
Receptor 45	616.499	5,426.921	111.19	66.38	24.27	16.24	106.46	0.32
Receptor 46	616.445	5,427.011	106.85	63.44	18.24	15.66	98.17	0.31
Receptor 47	616.464	5,427.013	108.45	66.14	20.82	15.74	99.50	0.31
Receptor 48	616.484	5,427.016	107.67	66.32	22.68	15.81	104.27	0.31
Receptor 49	616.444	5,427.115	103.29	60.28	17.54	14.97	95.38	0.30
Receptor 50	616.463	5,427.110	104.07	61.61	19.37	15.13	96.59	0.30
Receptor 51	616.482	5,427.105	103.71	62.13	21.94	15.27	100.42	0.30

APPENDIX E

Responses to Provincial Comments related to the Revised Emissions and Dispersion Modelling

Sandra Pouliot
Canadian Malartic Corporation

Responses to Provincial Comments related to the Revised Emissions and Dispersion Modelling

Submitter	Topic	Reference to EIS/EA Report	Summary of Comment	CMC's Previous Response	Status	CMC Response
MOECC #1	Air Quality		The proponent has chosen Year 5 to calculate the average daily emissions, which seems reasonable based on the rationale provided in the technical memo (i.e. highest waste rock extraction rate and longest waste rock haul distance).	Acknowledged	No further response is required.	Acknowledged
MOECC #2	Air Quality		The revised assumption indicates that emissions from bulldozing and grading within pits are insignificant. The emissions from bulldozing and grading within the pits account for about 5% of total PM emissions based on the information provided in the Table 6-10 of the Effects Assessment. The proponent is requested to provide the moisture content of the ore/waste rock after blasting, and confirm that the dozing/grading would occur prior to the material drying out.	Upon further review of site specific details for the Project and discussions with Canadian Malartic, these activities are unlikely to create emissions due to the high moisture content of the material within the pits. During the open pit mining, groundwater is constantly seeping into the pit since the activities are occurring below the water table. This results in the need for dewatering of the pit throughout the life of mine. The handling of material after blasting is referred to as "mucking" which speaks to the nature of the material. Once the material is blasted, it will be loaded into trucks and hauled out of the pit. The moisture content of the material handled within the pit will be managed as part of the BMPP for the Project.	No further response is required.	Acknowledged
MOECC #3	Air Quality		The revised control factor on the unpaved roads due to the BMPP decreased from 80% to 75%, which is reasonable, as based on the calculation methodology provided the response to Provincial Regulators (EMRB-2), this would represent control only through watering (i.e. it would not include natural mitigation).	Acknowledged	No further response is required.	Acknowledged

Sandra Pouliot
Canadian Malartic Corporation

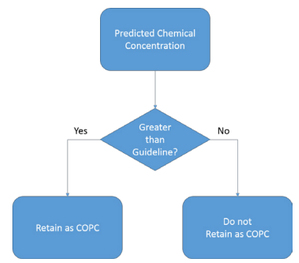
Responses to Provincial Comments related to the Revised Emissions and Dispersion Modelling

Submitter	Topic	Reference to EIS/EA Report	Summary of Comment	CMC's Previous Response	Status	CMC Response
MOECC #4	Air Quality	Best Management Practices Plan for the Control of Fugitive Dust	The noted 5 % silt content is on the low end of silt ranges for mining sources. It is unclear what measures will be undertaken to manage the roadway silt content in the Best Management Practices Plan (BMPP). The proponent is requested to provide further details on the specific actions that will be undertaken in BMPP for maintaining a low silt content for unpaved roads (i.e. ~5%), in addition to the commitment of periodic road dust sampling to verify the silt content on an ongoing basis. This is required to demonstrate whether there is any need for further actions to control the silt content.	The silt content that was used in the original inventory was based on the mean silt content on unpaved roads from a large sampling of mines however this sampling was conducted prior to the implementation of a formal Best Management Practices (BMP) program at the mines in which the sampling occurred. The intent of the data analysis was to provide a baseline for a mining operation to gauge the effectiveness of BMP programs once they are fully implemented. In our experience, the silt content on unpaved roads at a mining operation that has a fully implemented BMP program can be reduced below 5%. There is not any published data available at this time that can be used as reference. However, Canadian Malartic is committed to confirmatory road dust sampling and this will form a significant component of the BMP plan for the Project which will be provided to the GRT with the revised modelling predictions.	The BMPP is not clear on what actions will be taken if the confirmatory road dust sampling shows that the (a) the silt content is greater than 5%, and (b) the measured concentrations (presumably collected as part of the AAMP) exceed AAQCs or are higher than the model predicted values (which would indicate that the control methods are not achieving the assumed level of 75%). The BMPP should include specific actions that are "triggered" if these measurements indicate that dust levels are unacceptable. These could include measures such as increased frequency of watering, reduction or cessation of operations, etc. Also note that the BMPP indicates that site roadways will be inspected weekly (when roads are in use during not winter conditions). Worst case dust concentrations can often occur during winter months when water isn't applied if roads are not appropriately maintained. The ACT portion of the BMPP indicates that the Plan *should be monitored and updated – when there are visible dust emissions occurring more frequently and/or at a higher rate (excluding seasonal conditions).* Please clarify the benchmarks to be used for comparison (i.e. more frequently than or higher rate than what?) Lastly, the site appears to have a tailings area that was not included in the BMPP. Tailings can be a significant source of fugitive, windblown dust if not appropriately managed. Please provide additional details on the management of tailings, and if not already included in a separate plan, please include this in the BMPP for fugitive dust.	The BMPP has been revised to include trigger levels and corrective actions (see section 4.4 of the attached revised BMPP) and inspection of roads during winter conditions. The tailings will thickened and deposited to the Tailings Management Facility as a slurry at a rate of 60,000 tonnes per day. The tailings deposition will be conical with a central discharge location. Fugitive dust will be managed primarily through operations and strategic slurry deposition to maintain a layer of fresh tailings over as large an area as possible. Should areas of tailings be exposed to drying conditions and during shutdown periods, the tailings will be monitored daily and mitigation such as watering, irrigation and/or application of polymer will be implemented, as required, to reduce the potential for dust emissions from the tailings deposit. This commitment has been included in the revised BMPP. **Attachment**: Best Management Practices Plan for the Control of Fugitive Dust. Hammond Reef Gold Project. Version 2.0.

Responses to Provincial Comments related to the Revised Emissions and Dispersion Modelling

Submitter	Topic	Reference to EIS/EA Report	Summary of Comment	CMC's Previous Response	Status	CMC Response
MOECC #5	Air Quality		The MOECC expects that revised predicted air concentrations including cumulative impacts (modelled plus background) should be compared to AAQC and/or NAAQO. The concentrations and frequency above applicable criteria should also be presented in Tabular form as well as isopleth showing the concentrations and frequency of exceedance.	The revised predictions will be compared to the following criteria which is consistent with criteria used in the previous assessment in response to MOE-Air 2-2. The revised maximum concentrations within the LSA, LSA+500m, RSA and beyond the RSA will be added to the background concentrations and compared with the criteria in the table below.	Ontario has an annual AAQC for total suspended particulate matter (TSP), 60 µg/m^3. The revised maximum annual TSP concentrations were not presented. Also the revised maximum concentrations for LSA+500m, and at sensitive receptors were not included. Update Table 3, Table 4 and Table MOE Air-2-4 to include annual TSP AAQC, revised modelled maximum annual TSP concentration, revised maximum concentrations for LSA+500m, and for sensitive receptors if above applicable criteria are expected. In addition, a summary of frequency above applicable criteria analysis should also be presented in a table, similar as Table MOE Air-2-3. The proponent has made a commitment for air quality monitoring for the construction and operation phases. The monitoring program should include all the compounds that may have potential exceedances of AAQC. For particulate matter monitoring, in addition to the high-volume TSP, it is recommended that real-time PM monitoring be considered, given that the frequency above PM criteria is high. The real-time PM monitoring will allow site operators to take mitigation measures to control fugitive dust emissions if required.	The Technical Memorandum: Revised Emission Rate Assumptions and Dispersion Modelling Results – Hammond Reef Gold Project has been revised to include the maximum annual TSP concentration, maximum concentrations for LSA+500m, a new table (Table 5) which provides the predicted maximum frequency above ambient air criteria for all parameters that are predicted to have concentrations above ambient air criteria (i.e., an updated Table MOE Air-2-3) and an new appendix (Appendix D) which provides the cumulative air quality concentration at receptor locations (i.e., an updated Table MOE Air-2-4). A revised version on the technical memorandum is attached. Although the emissions predictions have been revised to be more representative of average operating conditions, the modelling is still considered to be very conservative because it assumes maximum daily emission rates in Year 5, baseline concentrations at or above the 90th percentile and does not account for particle deposition. CMC will carry out monitoring as indicated in the BMPP and in Section 8.2.2 of the EIS/EA including source testing to confirm and updated, as required, the emissions assumptions used in the EIS/EA. Source testing will include all compounds that are predicted to be above ambient air quality criteria. In addition, CMC will comply with the monitoring requirements of all applicable Acts and approvals, including but not limited to, Environmental Compliance Approvals and Ontario Regulation 419/05 which requires that an emission summary and dispersion modeling report be updated annually to assess compliance.

Responses to Provincial Comments related to the Revised Emissions and Dispersion Modelling

Submitter	Topic	Reference to EIS/EA Report	Summary of Comment	CMC's Previous Response	Status	CMC Response
						CMC is willing to consider implementation of real-time PM monitoring as a contingency measure should the monitoring program that is presently proposed indicate that PM concentrations may indeed be above AAQC outside the mine study area on a frequent basis (i.e. during non-upset conditions). **Attachment**: Technical Memorandum: Revised Emission Rate Assumptions and Dispersion Modelling Results. (Rev. 1) – Hammond Reef Gold Project
MOECC #6	Air Quality				The Conclusions of the Technical Memorandum dated August 5, 2016 states "With the exception of 24-hour acrolein, all of the revised air quality concentrations at the select receptor locations were either the same or lower than the concentrations relied upon in the HHERA TSD or lower than the ambient air criteria; therefore, acute and chronic health risks are considered to be negligible." This doesn't appear to be true for 1-hour SO2 concentrations, which the table shows increased from 14 ug/m3 to 282 ug/m3, and 24-hour PM2.5 concentrations which increased from 10 ug/m3 to 14 ug/m3. Please confirm these concentrations, and the potential effect on the HHERA.	In order for Chemicals of Potential Concern (COPCs) to be retained for quantitative assessment in the HHERA TSD, the predicted chemical concentrations were required to be greater than a health-based air quality standard. The chemical screening process is shown using a flow logic diagram below.  It is agreed that the concentrations of 1-hour SO2 and 24-hour PM2.5 increased relative to the concentrations used in the HHERA TSD; however, because the predicted concentrations were lower than health-based air quality standards as shown in Table 6 of the attached memo, these parameters were not identified as COPCs requiring quantitative assessment. **Attachment**: Technical Memorandum: Revised Emission Rate Assumptions and Dispersion Modelling Results. (Rev. 1) – Hammond Reef Gold Project

Responses to Provincial Comments related to the Revised Emissions and Dispersion Modelling

Submitter	Topic	Reference to EIS/EA Report	Summary of Comment	CMC's Previous Response	Status	CMC Response
MOECC #7	Air Quality				The revised concentrations and isopleths illustrate that TSP, PM10 and acrolein appear to exceed their respective criteria up to 40% of the time in the vicinity of the mine. Have these frequencies of exceedance been considered in the assessment of potential effects?	The HHERA TSD, the human health risk assessment section of the attached technical memorandum and the assessment of recreational receptors at the locations of maximum concentration (see response to comment T(3)-01) considered that all of the time a human health receptor spends at the assessment location, the concentrations of air quality parameters are at their maximum concentration for that location 100% of the time. Therefore, the assessment does not require consideration of frequency of above criteria and is considered to be conservative such that potential effects are overestimated. Locations within the Mine Study Area are not considered as human health receptors requiring assessment in the EIS/EA because access to the mine site will be restricted to the general public for safety reasons. Worker health and safety will be regulated by the Ministry of Labour and adherence to occupational health and safety standards.