APPENDIX J

AIR QUALITY STUDY

J-1 RWDI Memorandum
J-2 Environmental Air Quality Assessment
J-3 Emissions Summary and Dispersion Modelling Report
J-4 Best Management Practices Plan for Dust

NOTE TO READER
APPENDIX J

In April 2015, Treasury Metals submitted an Environmental Impact Statement (EIS) for the proposed Goliath Gold Project (the Project) to the Canadian Environmental Assessment Agency (the Agency) for consideration under the Canadian Environmental Assessment Act (CEAA), 2012. The Agency reviewed the submission and informed Treasury Metals that the requirements of the EIS Guidelines for the Project were met and that the Agency would begin its technical review of the submission. In June 2015, the Agency issued a series of information requests to Treasury Metals regarding the EIS and supporting appendices (referred to herein as the Round 1 information requests). The Round 1 information requests included questions from the Agency, other federal and provincial reviewers, First Nations and other Aboriginal peoples, as well as interested stakeholders. As part of the Round 1 information request process, the Agency requested that Treasury Metals consolidate the responses to the information requests into a revised EIS for the Project.

Appendix J to the revised EIS (Air Quality Study) includes information related to the effects of the Project on air quality. The appendix includes the following four components:

- J-1: A memorandum from RWDI Air, dated May 5, 2017, providing an opinion of the implications of refinements to the Project layout on the air quality predictions presented as part of the original EIS. The expected changes should be relatively minor, resulting in slightly higher predicted levels for those receptors located along East Thunder Lake Road and slightly lower predictions at the closest receptors, located to the south of the Project near Tree Nursery Road.
- J-2: Environmental Air Quality Assessment: This study provides a full evaluation of the potential effects of the Project on air quality. In addition to providing predicted levels of air quality, the report includes information describing the baseline air quality used in the assessment, the approach used in calculating Project emissions, and information on the air dispersion modelling used. The information presented in this report is the primary source of information used for describing the effects of the Project on air quality (Section 6.6 of the revised EIS).
- J-3: Emissions Summary and Dispersion Modelling (ESDM) Report: This study demonstrates that the Project will be able to achieve compliance with provincial permitting requirements. The information contained in this report was not relied upon in the revised EIS. The provincial permitting to obtain an ECA for air quality is a separate process that will require Treasury Metals submit an updated ESDM Report with final design specifications for the Project.
- J-4: Best Management Practices Plan for Dust: This report represents a preliminary management plan detailing fugitive dust sources and mitigation measures that would be used to control dust from the Project. This plan would be required as part of the provincial permitting process. Key elements of the plan are summarized Section 12.7 of the revised EIS.

No changes have been made to the portions of this appendix presented in the original EIS issued in April 2015 (i.e., J-2, J-3 and J-4). To aid the reader, bookmarks for each component are provided in the electronic copy of this appendix.

As part of the process to revise the EIS, Treasury Metals has undertaken a review of the status for the various appendices. The status of each appendix to the revised EIS has been classified as one of the following:

- **Unchanged**: The appendix remains unchanged from the original EIS, and has been re-issued as part revised EIS.
- **Modified**: The appendix remains relatively unchanged from the original EIS, and has been re-issued with relevant clarification.
- **Re-written**: The appendix has been substantially changed from the original EIS. A re-written appendix has been issued as part of the revised EIS.
- **Discarded**: The appendix is no longer required to support the EIS. The information in the original appendix has been replaced by information provided in a new appendix prepared to support the revised EIS.
- **New**: This is a new appendix prepared to support the revised EIS.

The following table provides a listing of the appendices to the revised EIS, along with a listing of the status of each appendix and their description.

List of Appendices to the Revised EIS		
Appendix	Status	Description
Appendix A	Modified	Table of Concordance
Appendix B	Unchanged	Optimization Study
Appendix C	Unchanged	Mining Study
Appendix D	Re-written	Tailings Storage Facility
Appendix E	Unchanged	Traffic Study
Appendix F	Re-written	Water Management Plan
Appendix G	Discarded	Environmental Baseline
Appendix H	Unchanged	Acoustic Environment Study
Appendix I	Unchanged	Light Environment Study
Appendix J	Unchanged	Air Quality Study
Appendix K	Unchanged	Geochemistry
Appendix L	Discarded	Geochemical Modelling
Appendix M	Unchanged	Hydrogeology
Appendix N	Unchanged	Surface Hydrology
Appendix O	Discarded	Hydrologic Modeling
Appendix P	Unchanged	Aquatics DST

List of Appendices to the Revised EIS		
Appendix	Status	Description
Appendix Q	Re-written	Fisheries and Habitat
Appendix R	Re-written	Terrestrial
Appendix S	Re-written	Wetlands
Appendix T	Unchanged	Socio-Economic
Appendix U	Unchanged	Heritage Resources
Appendix V	Unchanged	Public Engagement
Appendix W	Unchanged	Screening Level Risk Assessment
Appendix X	Re-written	Alternatives Assessment Matrix
Appendix Y	Unchanged	EIS Guidelines
Appendix Z	Unchanged	TML Corporate Policies
Appendix AA	Modified	List of Mineral Claims
Appendix BB	Unchanged	Preliminary Economic Assessment
Appendix CC	Unchanged	Mining, Dynamic And Dependable For Ontario's Future
Appendix DD	Re-written	Aboriginal Engagement Report
Appendix EE	Unchanged	Country Foods Assessment
Appendix FF	Unchanged	Photo Record Of The Goliath Gold Project
Appendix GG	Modified	TSF Failure Modelling
Appendix HH	Unchanged	Failure Modes And Effects Analysis
Appendix II	Unchanged	Draft Fisheries Compensation Strategy and Plans
Appendix JJ	New	Water Report

APPENDIX J-1

RWDI MEMORANDUM

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Canada

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MEMORANDUM

DATE:	2017-05-05	**RWDI REFERENCE #:** 1602163
TO:	Mark Wheeler	**EMAIL:** mark@treasurymetals.com
FROM:	John DeYoe	**Email:** john.deyoe@rwdi.com
RE:	**Air Quality and Noise Impact Changes Related to Proposed Mill Location Treasury Metals**	

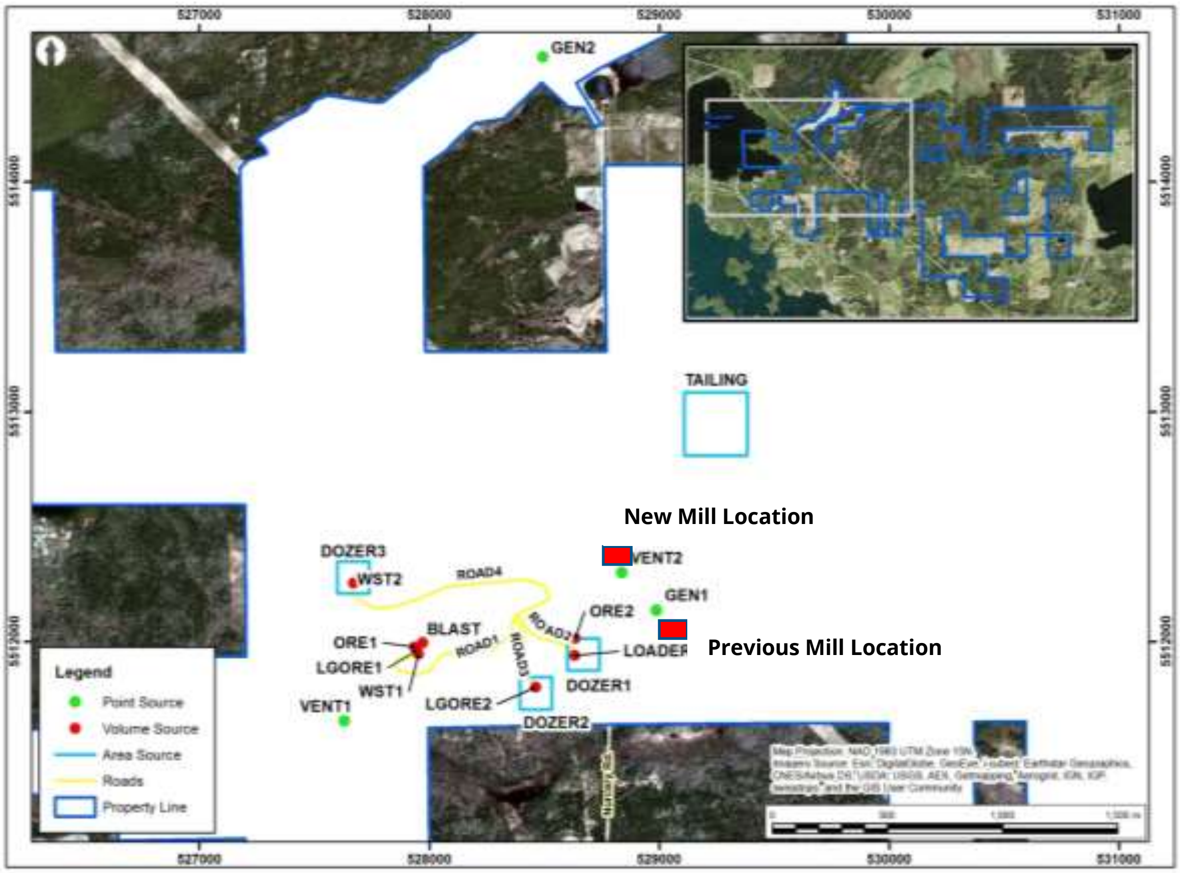
RWDI has previously completed an Air Quality[i] and Noise[ii] assessment for the Environmental Impact Statement (Federal) as well as an Air Quality[iii] and Noise[iv] assessment for the Environmental Compliance Assessment (Provincial). There were numerous air quality and noise sources examined for the project and their impact was assessed at receptors around the site.

Treasury Metals has asked RWDI to review the impact of moving the mine mill and associated activities to a location roughly 500 metres the northwest of the previously proposed location as shown in Figure 1, attached. Relatively few of the air quality and noise sources are associated with the mill. Generally speaking, this move would be an improvement or neutral in terms of air quality and noise. The mill activities are now farther from the closest receptors to the site and will improve. The receptors to the west, near Thunder Lake, are all over two kilometers away from the mill activity and will now be approximately 250 metres closer to the mill activities and will be neutrally affected. The following sections examine the air quality and noise impacts related to the proposed relocation of the mill.

AIR QUALITY

Air Quality Sources

The locations of the sources used in the air quality modelling are shown in the figure following. The red rectangles indicate the approximate positions of the previously proposed position of the mill and the newly proposed location of the mill.



The following sources associated with the mill were evaluated in the EIS and/or ECA assessments:

Source	**Label**	**Percentage Emissions**
Road to ore stock pile (shorter)	ROAD2	2% of Airborne metals
Unloading from ore trucks	ORE2	< 1% of particulate
Loader feeding ore crusher	LOADER	< 1% of particulate
Dozer on ore pile	DOZER1	3% of particulate

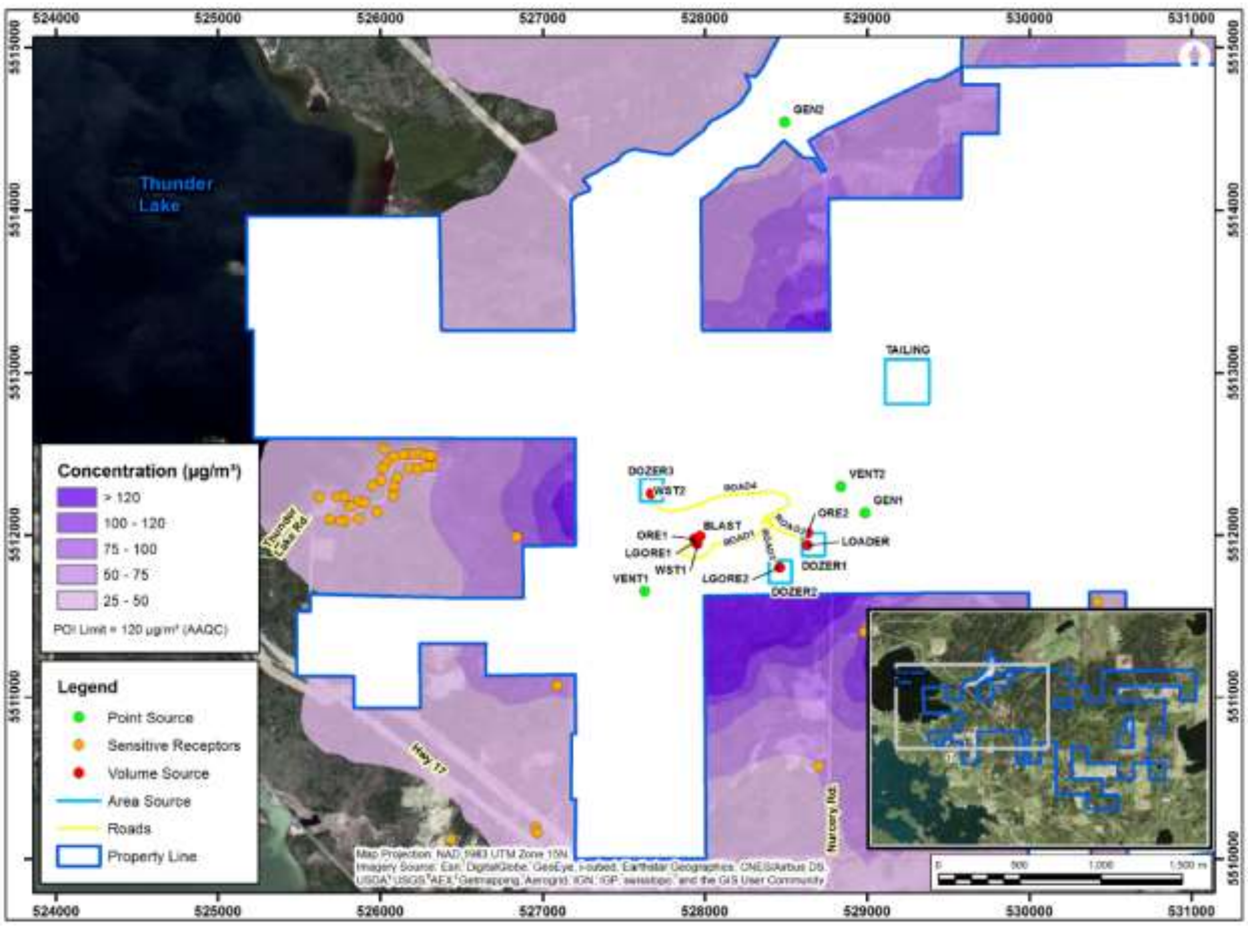
Insignificant Sources

500 KW Emergency generator	Gen1
150 kW Emergency Generator	Gen2
Baghouse emissions -ore crusher	BAGHOUSE
Kiln Burner	KILN
Elution Heater	ELUTION
Carbon Leach Tanks	MILL

The insignificant sources listed above will continue to be insignificant if the location of the mill is changed. For a further discussion of the significance of the sources we would direct the reader to the Air Quality Environment Compliance Assessment[iii]. The only significant emission from the mill area that were assessed are related to particulate emissions.

Air Quality Receptors

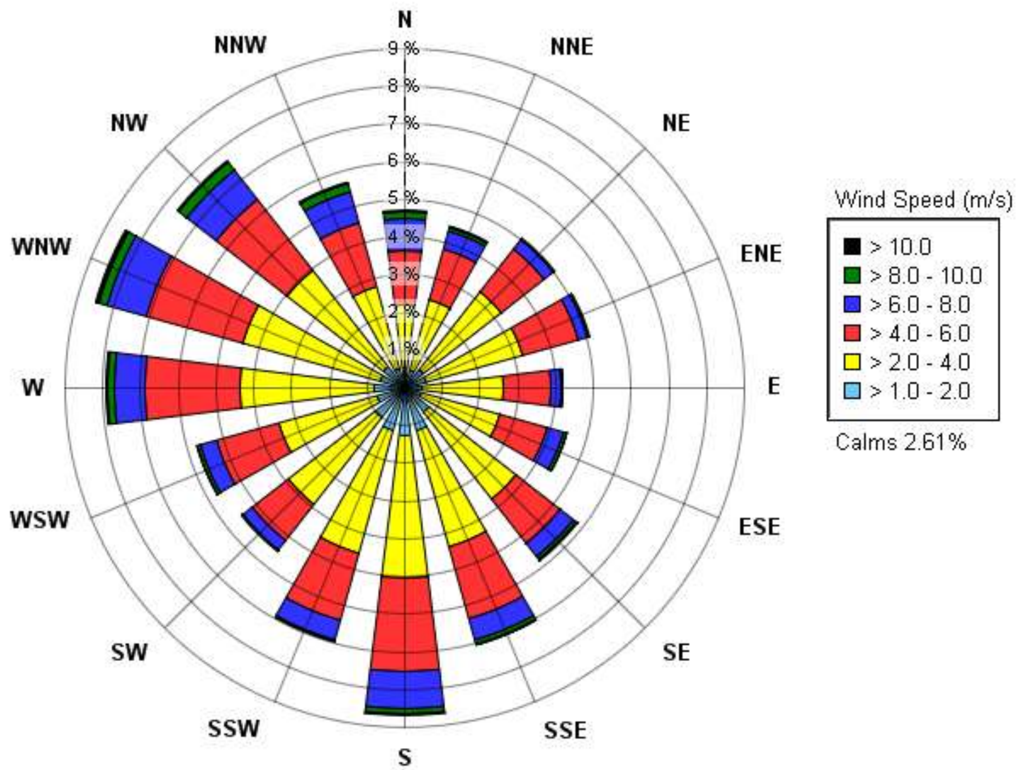
The only receptors that could possibly be negatively affected by moving the mill are the receptors to the west of the mine site, towards Thunder Lake. The receptor locations are shown in the figure below which also shows the worst case 24-hour total suspended particulate (TSP) emissions:



The closest residential receptors are roughly 2500 metres from the initially proposed location of the mill. The newly proposed mill location will be approximately 300 metres closer to the western receptors.

Air Quality Impact Frequency

The receptors located to the west of the site are also only infrequently impacted by emissions from the mill. The figure below shows the distribution of wind angles for the area:



As can be seen from the wind rose above the western receptors will be downwind of the mill area less than 10 % of the time.

Air Quality Discussion

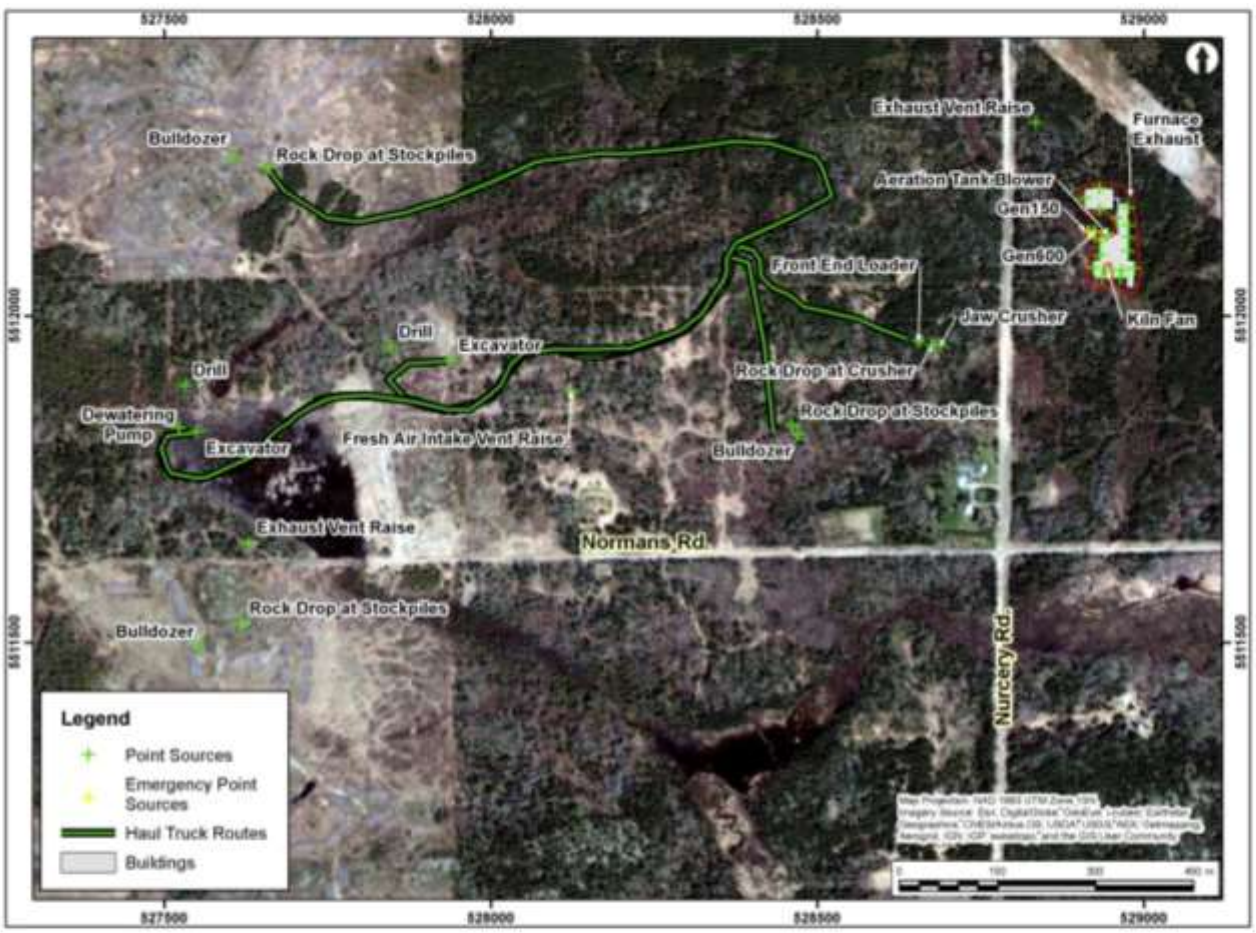
The mill site will be roughly 12% closer to the closest residential receptors to the west of the site. The receptors are well past the point of maximum ground level concentrations for the mill emissions. Numerical modelling of the mill emission would show concentrations at these points would increase less than 12%. Since mill area emissions only represent 7% of the total emissions, even if the predicted concentrations related to the emissions from the mill area doubled, they would only represent a 7% increase in the predicted concentration of particulate. The most critical air quality impacts modelled for the western receptors are related to the 24-hour TSP concentrations. Under worst-case conditions, at the closest residential receptor, the changed mill location would translate to roughly 3 micrograms per cubic metre of TSP. Any increase in concentrations related to the newly proposed mill location would occur less than 10% of the time.

The worst case receptor locations were to the south of the mine property. These locations will experience lower concentrations as a result of the new proposed mill location. The same is true for any receptors to the east of the site. There are no nearby receptors to the north of the site.

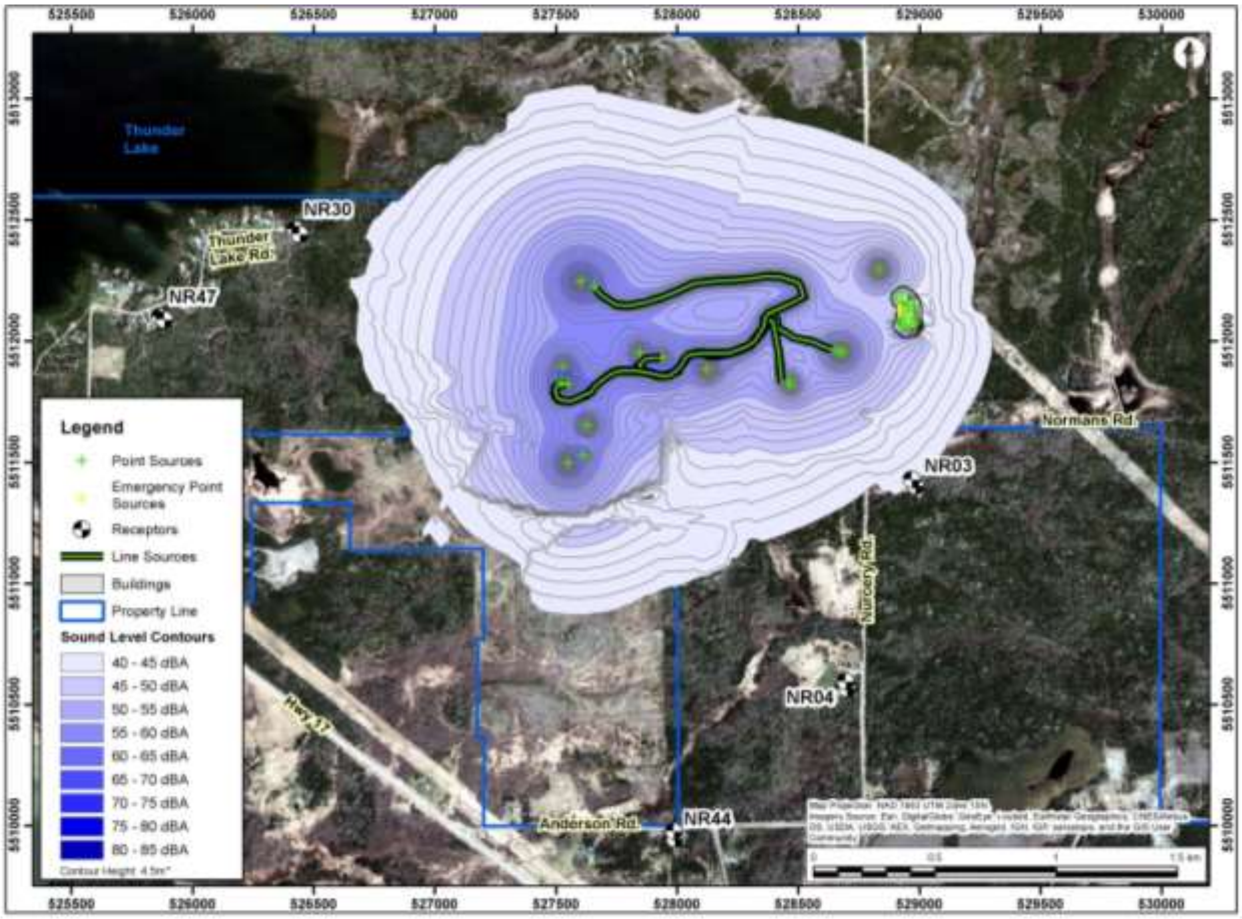
In conclusion, the receptors to the west of the mine site would experience very small increases in particulate emissions that would occur infrequently and would still be below air quality criteria. Air quality will be improved at all other receptors as a result of the new mill location.

NOISE

The locations of the noise sources are shown in the figure following.



The next figure shows the noise modelling results with mill located in the previously proposed location as well as a number of critical receptors.



The receptor that will be most negatively affected by moving the mill related noise sources 500 metres to the northwest will be NR30. The mill will be roughly 300 metres closer to NR30. The table following shows the impact of all the mill related noise sources at NR30.

The impact of all the mill related sources at NR30 is 17 and 28 decibels for regular and emergency operations respectively. The new proposed mill location is roughly 300 metres closer to NR30. The average distance of the mill related sources is 2515 metres from the previously proposed mill location. The simple noise to distance attenuation is calculated by the formula:

20 log (R2/R1)

Where: R1 is the distance to the first receptor from the source
R2 is the distance to the second receptor from the source

Thus:

20 log (2515/2215)
= 1.1 dBA

The approximate impact at NR30 from the sources related to the new mill location is 29 dBA. The modelled noise impact from all sources at NR30 was 34 dBA with the mill in the new location the impact from all sources will be below 35 dBA which is still well below the provincial nighttime guideline of 40 dBA.

Please note that the 1.1 dBA increase is only related to the mill sources. The impacts at NR30 are still dominated by other sources so the cumulative increase is much less than 1.1 dBA.

The previously modelled impact at NR3, which is the closest receptor to the site, was 40 dBA. The old mill location was within one kilometer to NR3 and the new location will be roughly 1200 metres away. The noise impact will likely be below 40 dBA at this location now.

In conclusion, the proposed new mill location will not cause any of the critical receptors to be above noise criteria values and may improve conditions at the worst-case receptor.

CLOSING

In general, the new proposed mill location will have benefits in terms of air quality and noise at the most greatly impacted receptors.

Those receptors that will now be closer to the mill will have imperceptible changes in noise impacts. All receptors will be below noise criteria.

In terms of Air Quality (particulate) impacts, the receptors to the west will infrequently experience very small increases in particulate levels over what was predicted with the old mill location. The predicted levels will still be well below Air Quality criteria.

Yours very truly,

<Original signed by>

John DeYoe, B.A., d.E.T.
Senior Consultant / Air Quality Specialist / Principal

JD/klm

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[i] Goliath Gold Project, Wabigoon, Ontario, Final Report, Environmental Air Quality Assessment, RWDI #1401701
October 16, 2014.
[ii] Treasury Metals Inc. – Goliath Gold Project, Wabigoon, Ontario, Final Report, Environmental Noise Assessment, RWDI #1401701, October 16, 2014.
[iii] Treasury Metals Incorporated, Goliath Gold Project, Wabigoon, Ontario, **Final Report** Emission Summary and Dispersion Modelling Report, RWDI #1401701, October 16, 2014.
[iv] Treasury Metals Incorporated, Goliath Gold Project, Wabigoon, Ontario, Final Report, Acoustic Assessment Report, RWDI #1401701, October 16, 2014.

GOLIATH GOLD PROJECT **DRYDEN, ON, CANADA**	SCALE:7500 ***TREASURY METALS INC.***		**Figure 1**
RWDI GA Changes	*DESIGN: MP 26 JAN. 2017* *GIS: MP 26 JAN. 2017* *CHECK: MW 26 JAN. 2017* *REVIEW: DB 26 JAN. 2017*	***REFERENCE AND NOTES*** *Data by Treasury Metals Inc.* *Projection: NAD83 UTM Zone 15N* *Note: Project details are subject to change during final engineering design*	
FIGURE: TBD REV.00			

APPENDIX J-2

ENVIRONMENTAL AIR QUALITY ASSESSMENT

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Guelph, Ontario, Canada
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CONSULTING ENGINEERS & SCIENTISTS

Goliath Gold Project

Wabigoon, Ontario

Final Report

Environmental Air Quality Assessment

RWDI #1401701
October 16, 2014

SUBMITTED TO:

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EXECUTIVE SUMMARY

Treasury Metals Inc. retained RWDI AIR Inc. (RWDI) to complete an air quality assessment in support of the Goliath Gold Project (the Project). The Project is a proposed gold mine near Wabigoon, Ontario. This report assesses anticipated air emissions from the mine against the applicable criteria.

Gaseous and particulate emissions were estimated from all activities related to the mine construction and site preparation phase, mine operation phase, and the closure of the mine phase. Emissions from the mine operation phase were assessed using US EPA's AERMOD dispersion model based on the Ministry of Environment and Climate Change's (MOECC) Air Dispersion Modelling Guideline and. The predicted impact of the mine operations were assessed against relevant Canadian Ambient Air Quality Criteria (CAAQS), National Ambient Air Quality Objectives (NAAQOs), Ontario Ambient Air Quality Criteria (AAQCs), and Ontario Jurisdictional Screening Level (JSL).

The concentrations of all contaminants at sensitive receptors were predicted to be below their respective criteria and the Goliath Gold Projects is expected to be in compliance with the Canadian Environmental Assessment Agency and the Ministry of Environment and Climate Change guidelines.

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Appendices

1. INTRODUCTION

1.1 Overview

Treasury Metals Inc. (Treasury) has been exploring and developing the Thunder Lake Gold deposit known as the Goliath Gold Project (the Project), located near Wabigoon, Ontario. The Project involves the construction, operation, closure, and reclamation of a 4.5 million tonne-per-annum (Mt/a) open pit and underground mine that will operate for 12 years. This report focuses on the environmental air quality over the life of the project, and is intended to support the federal Environmental Assessment process.

1.2 Air Quality Considerations

The Project is located in a rural area of Northern Ontario and is at least 10 km from any existing sources of significant air emissions. There are several aggregate operations on the east side of Airport Road in Dryden. The town of Dryden, located approximately 15 km to the west, is home to a Kraft pulp mill operated by Domtar, which would contribute to the background air quality in the area, primarily due to emissions from the natural gas and wood-waste fired boilers, recovery boiler and lime kiln. Due to the distance between sources at the Domtar pulp mill, the aggregate operations and the project site, significant interaction between these sources are expected to be minimal.

The Goliath Gold Project will add new sources of air emissions to the area, which may pose potential health, visibility, vegetative and dust impacts to the surrounding area. This assessment addresses the impacts using applicable Ontario and Canadian ambient air quality criteria, and provides a quantitative evaluation of air quality impacts.

This report identifies the existing air quality environment in the project area and describes the potential impacts of the Project.

1.3 Regional Setting

The Project is located in northwestern Ontario, approximately 15 km east of the City of Dryden and 325 km northwest of the City of Thunder Bay. The total area of the Project is 4,991 hectares (50 km^2) covering portions of Hartman and Zealand townships east of the city of Dryden, Ontario. The Project is located approximately 3 km north of the Trans-Canada Highway, and is accessible by road. Figure 1 below illustrates the general project location relative to the cities of Dryden and Thunder Bay.

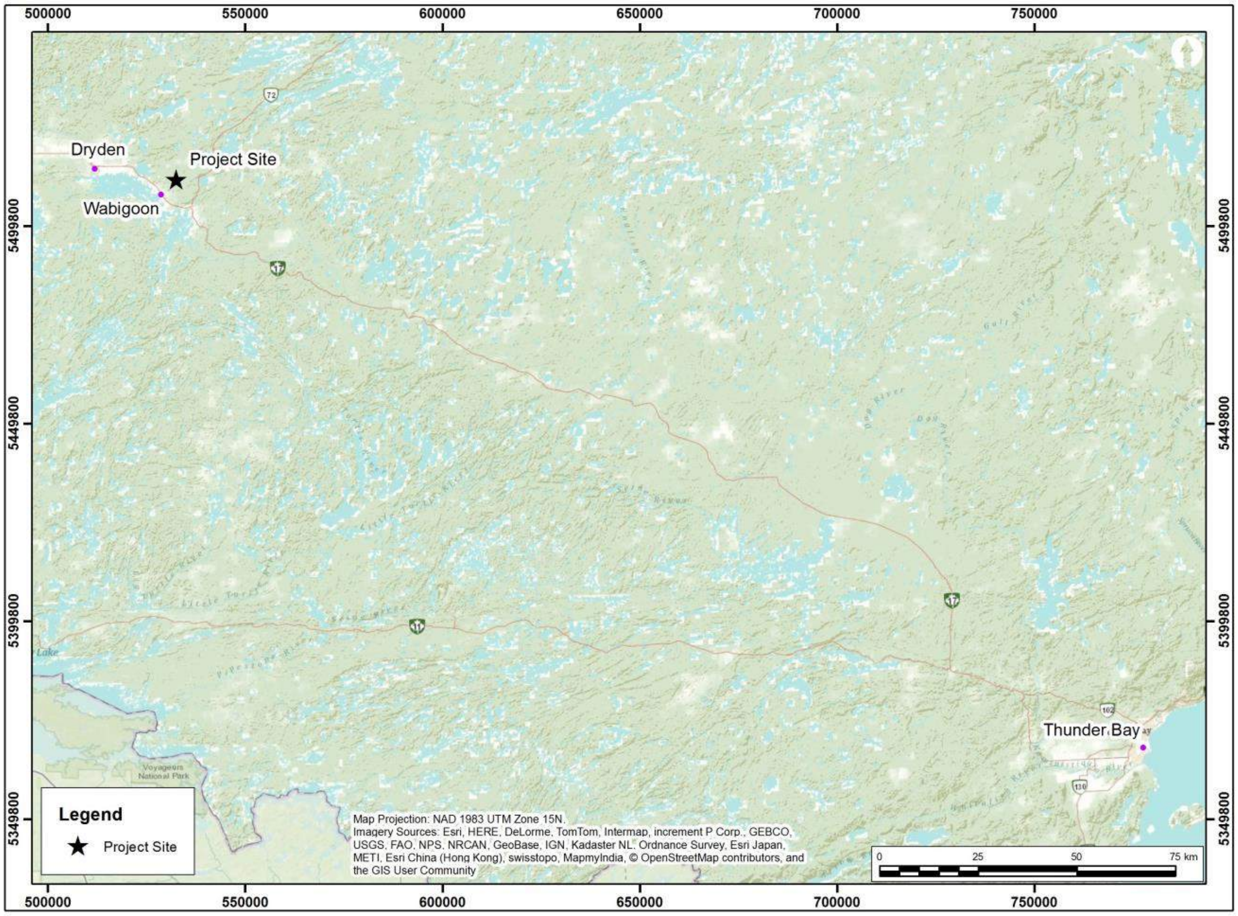

Figure 1: General Project Location

1.4 Local Study area

The Local Study Area was selected to represent areas where air quality impacts associated with the project are likely to occur. In practice, air quality impacts from a project of this magnitude are anticipated to be indistinguishable from background levels at distances 10 km and greater from the nearest active project area. The study therefore focuses on areas within a 20 km by 20 km area, which includes the main features of the mine; namely the underground and open pit mine, mill, vent raises, stockpiles, and haul truck routes. Figure 2 illustrates the location of the facility.

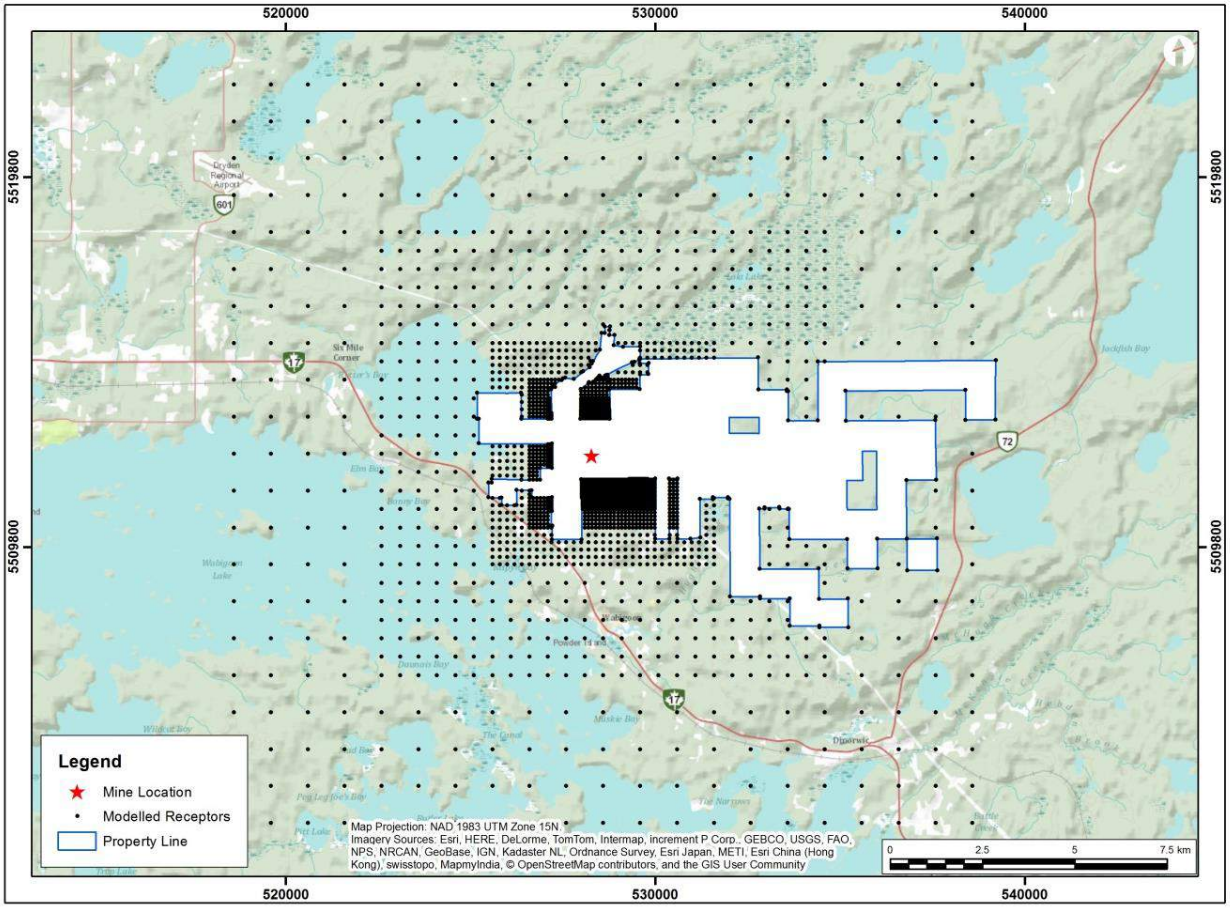

Figure 2: Local Study Area

2. VALUE COMPONENTS

2.1 Selected Valued Components and Indicators

Two Valued Components (VCs) have been established for the Goliath Gold Mine project. The focus of the air quality assessment is on air contaminants commonly associated with mine projects of the size and scope of the Goliath Gold Mine project. These contaminants can be broadly grouped as gaseous or particulate emissions. Both gaseous and particulate emissions can result in air contaminants (i.e., TSP, PM_{10}, $PM_{2.5}$, metals, SO_2, NO_2 CO, VOCs, NH_3, and O_3) which can be measured as concentrations on a mass per volume of air basis (µg/m³), or deposition of TSP measured as mass per area per time basis (g/m²/30 days). The VC associated with these contaminants is air quality.

2.1.1 Gaseous Emissions

Gaseous emissions result from products of combustion sources that include mine fleet exhausts, power generator stacks and heater stacks. The main fuel for the mine fleet and the mill is diesel (a hydrocarbon) and the associated primary exhaust and stack emissions are water vapour (H_2O), carbon dioxide (CO_2)

and nitrogen (N_2). The combustion process also produces trace gases such as nitrogen dioxide (NO_2), sulphur dioxide (SO_2) and carbon monoxide (CO) and trace amounts of fine particulate matter (PM) in the $PM_{2.5}$ size range.

Although Ozone (O_3) can be photochemically formed downwind from large urban areas that are sources of precursor NO_x and VOC emissions, the magnitude of these emissions due to the project is viewed as negligible. While the production of O_3 is not addressed as an air quality issue in this report, an understanding of regional ozone values is important with respect to the prediction of ambient NO_2 concentrations.

2.1.2 Particulate Emissions

The operation of the mine, the haul roads and the mill will release trace amounts of particulate matter to the atmosphere. The larger particles, referred to as dust and/or Total Suspended Particulates (TSP) are emitted from mining operations. Fine particulate matter can be grouped as PM_{10} with aerodynamic diameters less than 10 microns (i.e., PM_{10} or inhalable PM) and as $PM_{2.5}$ with aerodynamic diameters less than 2.5 microns (i.e., $PM_{2.5}$ or respirable PM). PM_{10} and $PM_{2.5}$ are better correlated to adverse pulmonary effects than TSP. Metals are present in trace amounts in the particulate matter generated at the facility. Metals are also present due to the nature of the material being processed, handled, or disturbed, which includes fugitive particulate matter generated by the movement of vehicles. Metal assay data from the site (for ore and waste rock) was used to evaluate the potential emissions of metals from the project site.

2.1.3 Deposition or Dustfall

Due to gravitational settling and other influences, the particulate air quality contaminants can be deposited to the earth's surface and potentially accumulate in terrestrial and aquatic systems. Here the contaminant is measured as deposition on a mass per area per time basis ($g/m^2/30$ days). Depending on the composition of the TSP (i.e., if the TSP contains any toxic materials), this deposition can range from being a nuisance to an environmental concern. Because the Goliath Gold Mine Project is a mining operation, contamination from metals is considered.

2.1.4 Air Quality Metrics

Air quality impacts are normally assessed using a concentration in air for each contaminant, over varying lengths of time. The normal metric used for air quality studies is the micrograms of contaminant per cubic metre of air ($\mu g/m^3$). Certain contaminants pose very short term, even transient impacts, especially where odour is concerned. These contaminants are typically compared to 10-minute average concentrations. Many contaminants pose more long-term impacts, and will be assessed on the basis of a 24-hour average, or possibly a monthly or annual basis. Lastly, some contaminants pose acute health impacts, and will be assessed on a 1-hour average basis.

Air emissions are normally assessed using a mass emission rate, again with a varying time basis. The normal metric for emissions is grams of contaminant per second (g/s). This emission rate must also be paired with the averaging period on which it was based to be meaningful. Most often, the emission rate will be based on an hourly production rate, traffic volume or fuel consumption rating, and therefore the emission rate will take into account short term fluctuations during that hour, and reflects an average value. This is similar to driving in a vehicle along a stretch of highway, where the speed at any given time will vary, but over the course of an hour will have a speed corresponding to the average for the entire period. In some cases, shorter or longer averaging periods may be considered, but the most common is the one hour basis.

2.1.5 Duration and Reversibility

Air emissions are temporary in nature and stop when the source ceases to exist. Certain air emissions do pose long-term health and environmental effects. These can persist after the source ceases to exist. These effects are due both to uptake of the contaminant through inhalation, absorption, ingestion, and deposition of contaminants onto surfaces. The contaminants can then persist in the environment or be present for future uptake.

2.1.6 Direction

The impacts of air emissions are dependent on meteorological conditions at the time when they are emitted. Impacts occur downwind of the emission sources, at a distance typically determined by the speed of the winds during which the emissions occurred. A minimum of 5 years of meteorological data is normally included in assessments to ensure that worst-case possible meteorological conditions are captured.

2.1.7 Frequency and Timing

Air emissions will occur throughout the life of the project, when any activities take place. Air quality impacts are therefore considered to be frequent, and continuous.

3. STUDY METHODOLOGY

3.1 Contaminants and Ambient Air Quality Standards

As discussed in Section 2.1, the focus of the air quality assessment is on air contaminants commonly associated with mine projects of the size and scope of the Goliath Gold Mine project. These contaminants can be broadly grouped as gaseous or particulate emissions. Both gaseous and particulate emissions can result in air contaminants (i.e., TSP, PM_{10}, $PM_{2.5}$, metals, SO_2, NO_2 CO, VOCs, NH_3, and O_3) which can be measured as concentrations on a mass per volume of air basis (µg/m³) or dustfall of TSP measured in mass per area per time (g/m²/30 days). As noted in Section 2.1.1, O_3 is not directly assessed, but is used to facilitate the assessment of NO_2.

As noted in Section 2.1.2, metals are present in trace amounts in the particulate matter generated at the facility, due to the nature of the material being processed. The list of metals included in the assessment was obtained using the metal assay data from the site.

Some of the metals were screened out of the detailed assessment using established methods from the Ontario Ministry of the Environment and Climate Change (MOECC) in their Guideline A10: Procedure for Preparing an Emission Summary and Dispersion Modelling Report (MOECC, 2009). This method uses a screening tool to remove contaminants with emissions that are very low compared to their relevant criteria. This allows the analysis to focus on those contaminants that pose the highest potential impacts. This assessment is provided in Appendix B.

3.2 Baseline Ambient Air Quality

The proposed Treasury Metals' Goliath Gold mine site is located in an area that is predominantly forested. Although it would be ideal to estimate future background air quality conditions in the area by examining historical monitoring data from similar areas, there were no suitable monitoring stations located in such an area. Therefore, the most recent available monitoring data from the closest MOE operated monitoring station was used to estimate background air quality conditions.

Data was obtained for the years 2007 to 2011 from MOE Station No. 63203, located at 421 James Street South, in Thunder Bay and for the years 1999 to 2003 from MOE Station No. 63064 and 63264 located at Montreal Street, Thunder Bay (MOECC, 1999 to 2013). As the monitoring stations are located in a more urbanized area compared to the study area, they are likely to capture higher concentrations of the contaminants of concern. The ambient monitoring data collected from these stations are therefore likely to be conservative estimates of the future background conditions experienced in the study area. Monitoring station locations are shown in Figure 3, along with the location of the meteorological tower which data were extracted from for the dispersion modelling assessment, all in relation to the project site.

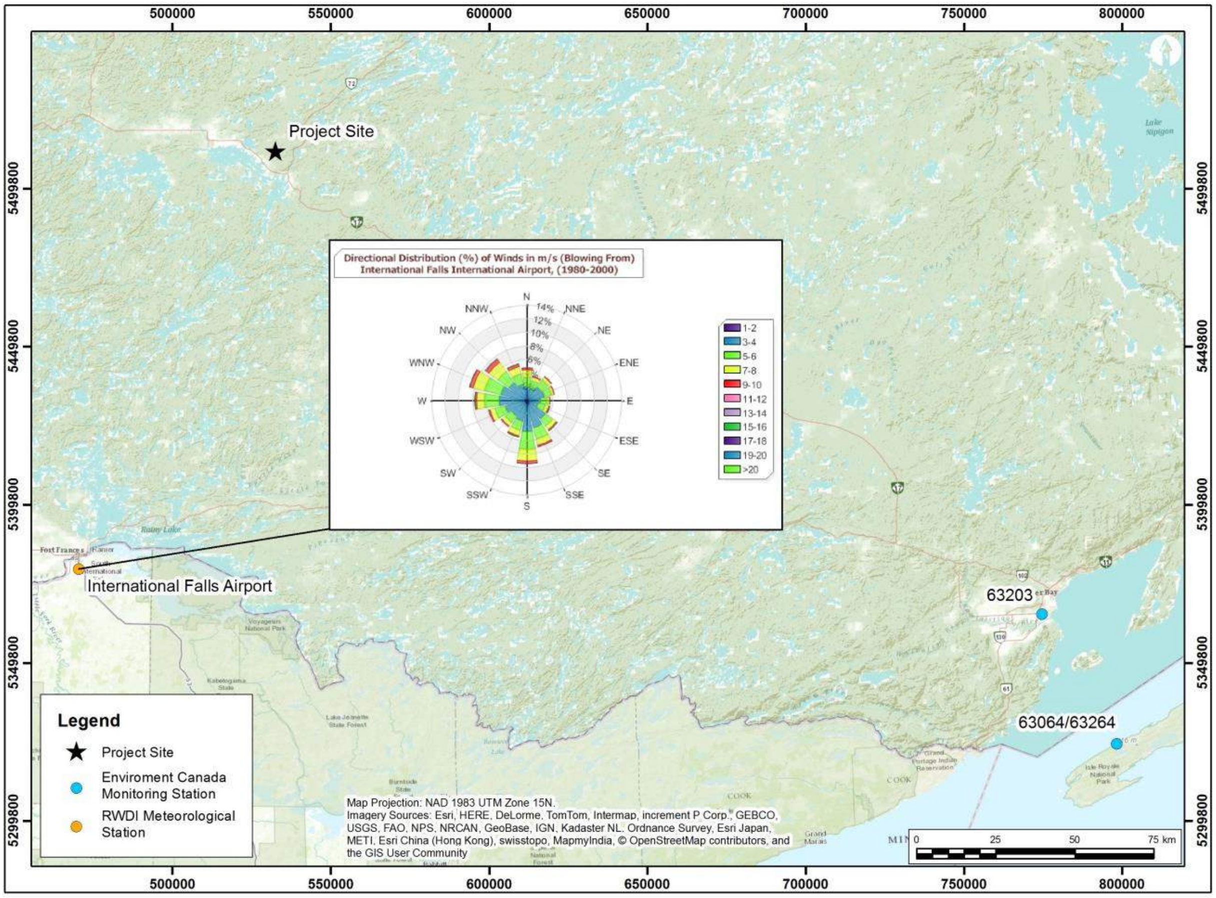

Figure 3: Ambient Monitoring Station & Meteorological Tower Locations

In addition, ambient monitoring data for other contaminants, such as metals, was not available from the monitoring stations examined. As there are no other significant sources of such compounds in the area, ambient concentrations of these compounds would result only from ubiquitous sources such as vehicle traffic on local roads and the Trans-Canada Highway to the south. The contribution of these ubiquitous sources to these contaminants would be negligible, especially in comparison to the contaminants of concern such as TSP, PM_{10}, $PM_{2.5}$ and NO_X. Given the location of the project site, the nature of the surrounding area, and the fact that contaminants such as metals would normally be present only in trace amounts for ubiquitous sources, no background measurements are included in the assessment.

Table 1 provides a summary of the monitored data from the monitoring stations. The maximum values are representative of peak events which occur occasionally, while the 90^{th} percentile concentrations are those that are exceeded only 10% of the time. The 90^{th} percentile values are more representative of the maximum background conditions likely to coincide with maximum contributions from the project related emissions.

CONSULTING ENGINEERS & SCIENTISTS

Table 1: Summary of Ambient Air Measurements (µg/m³) [1]

Contaminant	Monitoring Period	Averaging Period	Statistic	Average Concentration (Over All Years and Stations)
CO [2]	2000 - 2003	1 hr	90th Percentile	1,248
			Maximum	6,630
	2000 - 2003	8 hr	90th Percentile	1,248
			Maximum	3,493
SO_2	1999 - 2003	1 hr	90th Percentile	4
			Maximum	162
	1999 - 2003	24 hr	90th Percentile	4
			Maximum	31
	1999 - 2003	Annual	Annual Mean	1
			Maximum Annual	2
NO_2	2007 - 2011	1 hr	90th Percentile	33
			Maximum	103
	2007 - 2011	24 hr	90th Percentile	33
			Maximum	64
$PM_{2.5}$ [3]	2007 - 2011	24 hr	90th Percentile	10
			Maximum	52
	2007 - 2011	Annual	Annual Mean	4.275
			Maximum Annual	4.8
PM_{10} [4]	2007 - 2011	24 hr	90th Percentile	15
			Maximum	96
TSP [5]	2007 - 2011	24 hr	90th Percentile	33
			Maximum	173
	2007 - 2011	Annual	Annual Mean	14
			Maximum Annual	16
Ozone	2007 - 2011	1 hr	90th Percentile	79
			Maximum	145
	2007 - 2011	24 hr	90th Percentile	79
			Maximum	110

Notes:
[1] For each contaminant, the 5 most recent available years of data were reviewed and the average annual 90th percentile from among the 5 years was chosen for the 1-hour and 24-hour averaging periods. The worst-case annual mean was chosen for the annual averaging period.
[2] 90th percentile of 8-hour data assumed to be the same as that for hourly data, as this statistic was not readily available for 8-hour data.
[3] 90th percentile of 24-hour data assumed to be the same as that for hourly data, as this statistic was not readily available for 24-hour data.
[4] PM_{10} data were calculated from $PM_{2.5}$ data by using the equation $PM_{10} = PM_{2.5}/0.54$.
[5] TSP data were calculated from $PM_{2.5}$ data by using the equation $TSP = PM_{2.5}/0.30$.

TSP and PM_{10} are no longer routinely monitored in Ontario by government agencies. The background values shown in the table were estimated from observed $PM_{2.5}$ levels, using published data on the ratio of TSP and PM_{10} to $PM_{2.5}$. Studies in the U.S. have found that the $PM_{2.5}$ / TSP ratio is normally distributed with a mean of 0.30 (±14), while the $PM_{2.5}$ / PM_{10} ratio is normally distributed with a mean of 0.54 (±14) (Lall, 2004). This result was based on an analysis of a large amount of data and stations. Therefore, 90th percentile background TSP and PM_{10} concentrations were calculated using the mean ratios.

Ozone is included in the above table, because although it is not emitted directly from any of the sources at the site, it is used in predicting the formation of NO_2 from NO_X emissions.

3.3 Emissions

Emissions from mining activities at the Goliath Gold mine site are generated from: blasting, material handling, bulldozing, hauling of materials on unpaved roads, and combustion of diesel by the various equipment operating at the mine site. Emissions are also generated by wind erosion of the dry, un-vegetated tailings area.

This section of the report describes the methodology used to estimate emissions from activities at the project site based on predicted mine processing and handling rates. These methods apply to all of the scenarios examined in the assessment. Emission calculations are provided for all sources and phases in Appendix B.

3.3.1 Material Handling

Fugitive emissions of TSP, PM_{10} and $PM_{2.5}$ were estimated for material handling activities such as loading of haul trucks by shovels, dumping of material from trucks at ore and low grade ore stockpiles or at waste rock areas, and handling of material by loaders at the crusher. The fugitive emissions were based on emission factors obtained from Chapter 13.2.4 of the U.S. EPA Compilation of Air Pollutant Emission Factors (AP-42), as shown below:

$$E = k * (0.0016) * \frac{(\frac{U}{2.2})^{1.3}}{(\frac{M}{2})^{1.4}} * CE$$

Where:

E = Emission Factor in kg/tonne of Material Handled
k = Particle Size Multiplier, depending on the size fraction of dust
U = Mean Wind Speed (m/s)
M = Material Moisture Content (%)
CE = Control Efficiency (%)

The particulate emission rate is calculated as:

$$Q = E * MH * conversion\ factor$$

Where:

Q = emission Rate (g/s)
E = Emission Factor (kg/tonne)
MH = Material Handled (tonnes/hour)

The particle size multipliers given in Section 13.2.4 of AP-42 were applied in the TSP, PM_{10}, and $PM_{2.5}$ emission estimates. Moisture content of 10% and material handling rates were used to estimate fugitive dust emissions from the material handling sources. The emission estimates for material handling are dependent on wind speed. Hourly wind speeds from the dispersion modelling meteorological data set described in Section 3.5.3 of this report were used for this purpose. This results in an hourly-varying emission file that was used in the dispersion modelling to account for changing meteorological conditions and, hence, changing magnitudes in fugitive dust emissions. It was assumed that the fugitive dust emissions from the handling sources were not mitigated.

3.3.2 Road Dust from Unpaved Roads

Particulate matter emissions from unpaved roads within the Treasury Metals facility, due to the movement of haul trucks on haul roads were estimated using the method described in the Chapter 13.2.2 of AP-42 as shown below:

$$E = 281.9\, k * (\frac{s}{12})^{a} * (\frac{W}{3})^{b}$$

Where:

E = Emission Factor (g/VKT);
k, a, and b are empirical constants with values depending on the size of particulate matter;
s = surface material silt content (%); and
W = mean vehicle weight

The particulate emission rate is calculated as:

$$Q = E * P * D * CE$$

Where:

Q = emission Rate (g/s)
E = Emission Factor (g/VKT)
P = Number of vehicle passes
D = Distance travelled by vehicle (Km)
CE = Control Efficiency (%)

The surface silt content for the unpaved roads was assumed to be 5.8%. This value is the mean surface silt content for “taconite mining and processing haul road to/from pit” as per Table 13.2.2-1 in AP-42. Table 13.2.2-1 of AP-42 does not provide values specifically for gold ore mining.

The hourly traffic passes on the haul roads were provided by Treasury Metals. Particulate matter emissions were estimated by dividing the roads into separate segments. A length of haul road is treated as a separate segment whenever one or more parameters (e.g. number of hourly passes, silt content, etc.) change.

Water and chemical suppressants will be used for dust control on the haul roads at the mine site, when temperatures are above freezing. The watering program requires dedicated watering equipment, and enough water must be available and applied to off-set evaporation and maintain a wetted road surface. This program would also be supplemented with applications of an approved dust suppressant as required to minimize fugitive dust emissions. The control efficiency for each road segment was conservatively assumed to be 75%, based on this requirement.

3.3.3 Wind Erosion of Tailings

The total area of the tailings pond at the mine is expected to cover 750,000 m² of which 90% is expected to be either vegetated or wet. Therefore wind erosion of particulate matter from tailings at the mine site was estimated for 75,000 m² of dry, un-vegetated tailings (10% of the tailings area). The emissions of wind eroded particulate matter were calculated as per equation 15 of the 1989 paper from W. G. Nickling and J. A. Gilles "Emissions of Fine Grained Particulates from Desert Soils" (Nickling). The emission factor is given as:

$$F = 1.59 * 10^{-12} * U^{*2.93}$$

Where:

F = Emission Factor (g/cm² s);
U^* = Friction velocity at tailing surface (cm/s)

This equation is based on two tests of tailings disposal areas in Arizona. Wind erosion of the tailings takes place only when the friction velocity at the surface is above a certain threshold velocity. For this study, the friction velocity was assumed to be 0.2 m/s, which is the average of the threshold velocities for the two tailing sites in Nickling (Nickling, 1989).

The friction velocity at tailing surface can be calculated from Prandtl's equation as follows:

$$U^* = \frac{k * U_{10}}{\ln\left(\frac{z}{z_o}\right)} * conversion\ factors$$

Where:

k Von Karman constant, 0.4;
U_{10} = Velocity at length z. 10 m in this case;
z = 10 m above ground level;
z_o = Roughness length of the tailing surface.

The roughness length of the tailing surface was assumed to be 0.016cm, which is the average roughness length of the two tailing sites in Nickling (Nickling, 1989).

The particulate emission rate is calculated as:

$$Q = F * A * k * conversion\ factors$$

Where,

Q = emission Rate (g/s);
F = Emission Factor (g/cm² s);
A = Area of dry, un-vegetated tailings (56 ha);
k = Particle size multiplier.

The particle size multiplier (to estimate emissions of TSP, PM_{10}, and $PM_{2.5}$) were derived from particle size analysis conducted for the two tailings site study areas in Nickling (Nickling, 1989).

The emission estimates for wind erosion are dependent on hourly wind speeds at the mine site. This results in a variable emission file that was used in the dispersion modelling to account for changing meteorological conditions and, hence, changing magnitudes in fugitive dust emissions. It was assumed that no wind erosion of the tailings took place when there was precipitation or snow cover on the ground. Snow cover for the region was obtained from the Climate Normals for Dryden (Environment Canada, 2012), where snow cover has been recorded from October to April. Hourly precipitation data was obtained from International Falls, which is approximately 145 km away from the mine site.

The tailing area was modeled as a square source with an area equal to 75,000 m^2.

3.3.4 Tailpipe Emissions

Emissions of products of combustion (particulate matter, NO_X and CO) were calculated for diesel fuelled non-road equipment such as bulldozers, haul trucks, loaders and shovels based on equipment horsepower, load factor, and emissions factors of the contaminants as follows:

$$Q = LF * P * EF * conversion\ factors$$

Where,

Q = emission Rate (g/s);
LF = Load Factor (%);
P = Gross Power Rating (hp); and,
EF = Emission Factor (g/hp - h).

Each piece of equipment was assumed to be manufactured in 2010 and was expected to comply with the phase in periods for emission standards. Load factors and the emissions factors for vehicles of different emission standard tiers were obtained from the US EPA report NR-009d “Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling – Compression Ignition” (U.S. EPA 2010).

Emissions of SO_2 were estimated using the brake specific fuel consumption for the different vehicles (U.S. EPA 2010), and the sulphur content in diesel fuel as follows:

$$Q = BSFC * S * P * conversion\ factors$$

Where,

Q = emission Rate (g/s);
BSFC = Brake Specific Fuel Consumption (lb/hp - h);
S = Sulphur Content in Diesel (%); and,
P = Gross Power Rating (hp).

The sulphur content in diesel fuel was expected to comply with the sulphur content in diesel fuel limit in Canada for off-road engines (0.0015%). It was assumed that all the sulphur was converted to SO_2 during combustion.

3.3.5 Bulldozing

At the Goliath Gold mine bulldozing operations take place at the ore dump, low grade ore stockpile and at waste rock stockpile. Fugitive emissions generated from the bulldozing at the mine site were estimated based on emission factors for bulldozing of overburden, obtained from Chapter 11.9 of AP-42 as follows:

$$EF\ (for\ TSP) = 2.6(s)^{1.2}/(M)^{1.3}$$
$$EF\ (for\ PM_{10}) = 0.75 * 0.45(s)^{1.5}/(M)^{1.4}$$
$$EF\ (for\ PM_{2.5}) = 0.105 * EF\ (for\ TSP)$$

Where:

EF = Emission Factor (kg/h);
s = Silt content (%)
M = Moisture content (%)

The particulate emission rate is calculated as:

$$Q = EF * conversion\ factors$$

Where,

Q = emission Rate (g/s);
EF = Emission Factor (kg/h);

The average silt content was assumed to be approximately the same as that occurring on truck haul roads within the site, which was estimated to be 5.8% as per Table 13.2.2-1 in AP-42. The moisture content of waste rocks and ore was estimated by Treasury Metals to be 10%.

The emission factor for bulldozing was developed for coal mining, but is applicable here since bulldozing of overburden at a coal mine is analogous to bulldozing at Goliath Gold.

3.3.6 Generator Emissions

Emissions from emergency power generators present on site to provide back-up power in case of a power failure were estimated using emission factors obtained from Chapter 11.9 of AP-42 as follows:

$$Q = EF * P * conversion\ factors$$

Where,

Q = emission Rate (g/s);
EF = Emission Factor (lb/hp - h); and,
P = Power Output of Generator Engine (hp).

3.3.7 Vent Emissions

Emissions from underground mining activities are released to the atmosphere through two vent raises. Emission factors from underground activities released to atmosphere are obtained from the Bovar Environmental report titled Report on Mine Vent Exhaust Testing (Bovar), Falconbridge Limited, Falconbridge, Ontario, BE Project 541-6254, dated February 1996 are used to estimate emissions from the underground vent raises.

3.4 Selection of Modelling Scenario

Annual emissions for each phase of the operations were estimated using the methodology presented in Section 3.3. In general, these estimates were developed assuming continuous operations, which provides a conservative estimate. The tabulated emissions are presented in the section describing each Phase.

The indicator compounds for this assessment were TSP, PM_{10}, $PM_{2.5}$ and NO_x. Metals are directly proportional to the level of TSP, so are therefore implicitly included. NO_x is used as a surrogate for other combustion related emissions as it is normally the most significant with respect to the relative criteria than any other combustion related emission. RWDI has previously conducted detailed studies on a variety of stationary and mobile combustion sources that supports this conclusion.

A comparison of the total annual emissions indicates that all phases of the Project will have annual emissions that are within the same order of magnitude. The Operational phase however will pose the longest term potential air quality impact, as this phase will last significantly longer than the other two phases. This phase was selected for the dispersion modelling portion of the assessment. In addition, the increased emissions from the haul road shown in the Construction and Site Preparation Phase and the Closure, Decommissioning and Restoration Phase are due to the trucks moving along a longer stretch of haul road, from the waste rock pile to the open mine pit. As a result the emissions are actually further from the receptors of interest than during the Operations Phase.

3.5 Dispersion Modelling

3.5.1 Dispersion Model Selection

Dispersion modelling was conducted using the estimated emission rates discussed in the preceding section in conjunction with the U.S. EPA's AERMOD dispersion model to predict concentrations of all contaminants at all off-site receptor locations. The AERMOD model is the most advanced of the models currently approved for use in regulatory dispersion modelling assessments in Ontario, and has been used extensively to study potential impacts from mining operations in Ontario.

All dispersion models have inherent inaccuracies, but due to the wide-scale use of the AERMOD model for many years, in a wide variety of applications, these inaccuracies are now well-understood. The U.S. EPA reviewed various studies of dispersion model accuracy and the overall findings are consistent with RWDI's experience in Ontario and elsewhere with comparison between models and field measurements. The models are more reliable at predicting longer time-averaged concentrations (e.g., annual averages) than short-term concentrations (e.g., 1-hour and 24-hour periods) at specific locations. With respect to the short-term concentrations, however, the models are reasonably reliable in estimating the magnitude of highest concentrations occurring sometime, somewhere within an area. Typical accuracy in highest estimated concentrations is in the range of ±10% to ±40% (U.S. EPA, 2003).

3.5.2 Dispersion Model of Deposition (Dustfall)

Particulate matter plumes differ from gaseous plumes in that the particles can settle out due to gravity. Heavier particles will tend to settle out quickly, reducing the particulate concentration in the plume as it moves farther from the source. The AERMOD model allows the user to account for this settling through the use of deposition and plume depletion algorithms. The deposition results that are produced by the model represent the deposition flux rate, in mass per area (g/m^2/30 days). With the deposition algorithm, the model does not reduce the plume size by the deposition flux rate; it merely predicts the amount of deposition that could occurs from the plume at any receptor point. In order to decrease the plume by the deposited amount, the plume depletion algorithm must also be activated. For the purposes of this assessment, only the effects of dry deposition and dry plume depletion were considered.

Since deposition rates depend on the mass of the particles contained within the plume, particle size ranges were included in the AERMOD model. These size ranges were based on the average mass of particles for each size category for each type of source. The particle size ranges were based on generic information from U.S. EPA's AP-42. Particle size ranges were used for all on-site sources included in the AERMOD model.

3.5.3 Source Data

Fugitive sources were modelled as a series of volume and line sources with parameters based on information obtained from Treasury Metals and typical dimensions of processing equipment and vehicles used at other facilities of this nature. The modelled source parameters are consistent with guidance from the National Stone, Sand & Gravel Association (NSSGA, 2004). Internal haul roads were modelled as adjacent volume sources, also in accordance with guidance from the NSSGA and the U.S. EPA (U.S. EPA, 2012). Point sources were modelled with parameters based on information obtained from Treasury Metals. Figure 4 shows the location of modelled property boundary as well as all modelled sources at the facility.

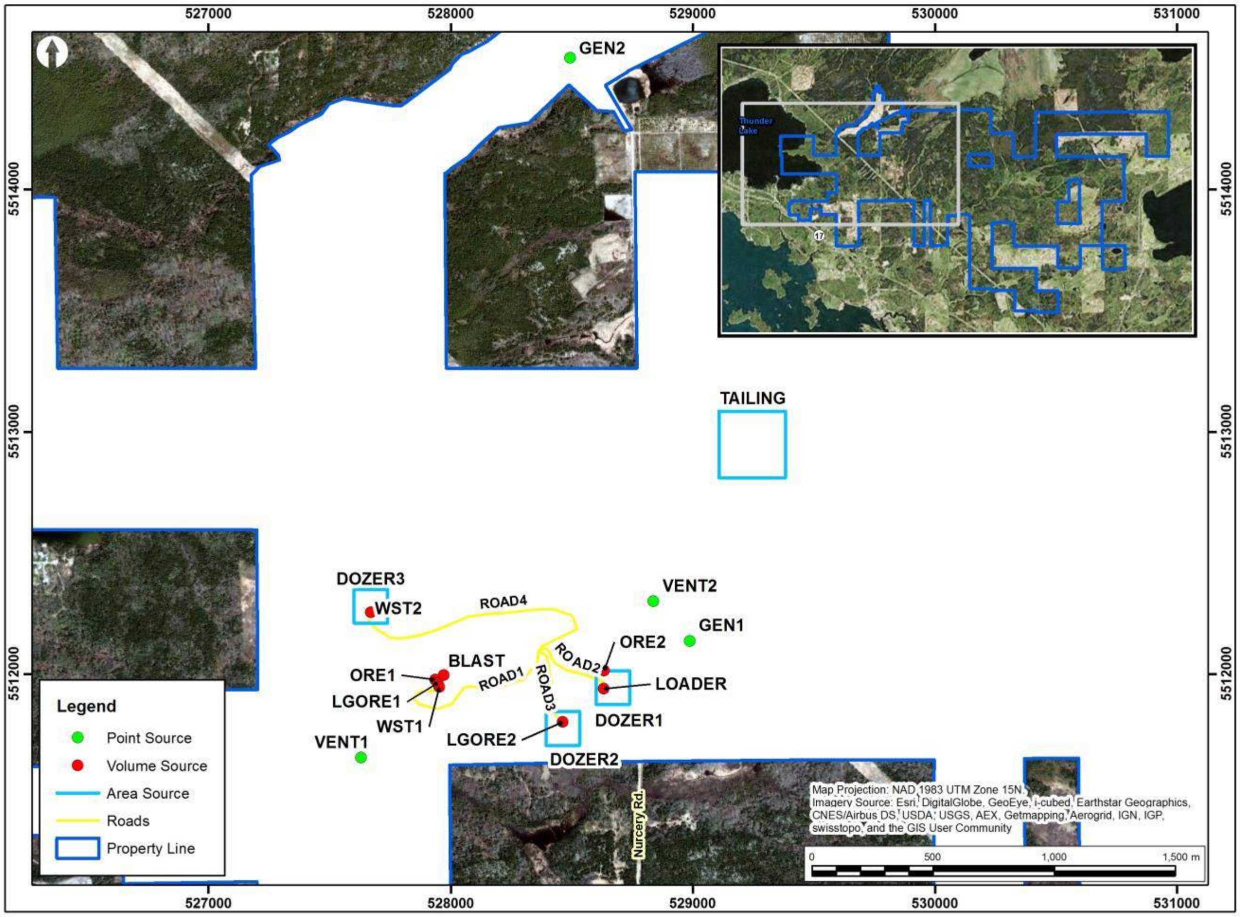

Figure 4: Facility Property Boundary and Source Locations

3.5.4 Meteorological Data

Under O. Reg. 419/05 the MOE provides a series of pre-processed meteorological data sets for use in dispersion modelling assessments in Ontario. These data sets use surface observations and upper air data from airports that represent major geographical areas of Ontario. Given the lack of meteorological data available in this area, the use of the MOE pre-processed data sets is considered to be an acceptable approach.

The site is located near Dryden, therefore the Northern Region (Thunder Bay, Kenora) meteorological data set (MOE, 2007) is recommended by the MOE for use at this site. This includes both surface data and upper air data from International Falls, Minnesota. Within each region, the MOE provides alternative data sets with the choice of data set depending on the character of the terrain at the study site. The area surrounding the site is typically forested, with some areas of open water and clear-cuts. The default data set for “forest” was used based on the land use patterns surrounding the site. Figure 5 shows the wind rose for the pre-processed meteorological data used for this study.

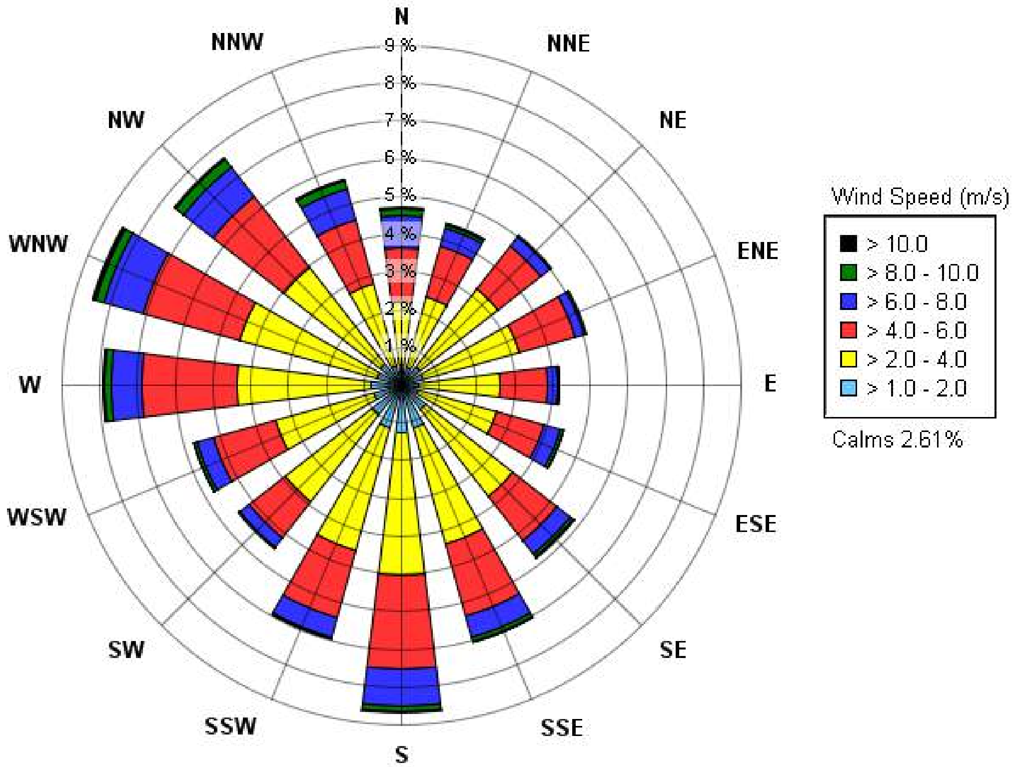

Figure 5: Wind Rose

3.5.5 Area of Modelling Coverage and Sensitive Receptor Locations

The area of modelling coverage was designed to meet the requirements outlined in O. Reg. 419/05, section 14, which provides suitable receptor coverage for this assessment. A multi-tiered receptor grid was developed with reference to Section 7.2 of the MOE Guideline A11: Air Dispersion Modelling Guideline for Ontario, Version 2.0, March, 2009 (MOE, 2009); therefore, interval spacing was dependent on the receptor distance from on-site sources. This gird covers the Local Study Area, as described in Section 1.4, and includes an area approximately 20 km by 20 km.

Forty-four receptors of interest were identified within the local study area. Where the surface mining rights have been secured by Treasury Metals, land use was assumed to be non-sensitive and no receptors were identified. All other vacant lands in the vicinity of the Project that were found to be inaccessible (except by a rough cut-in through the forest) were not considered as receptors. Forty-two of the receptors were identified as houses. One was identified as the campground at Aaron Provincial Park. One receptor is a trailer located on otherwise vacant land. There are no receptors identified within the local study area to the north east, because Treasury Metals has surface rights to all land in that direction. All receptors fall within the receptor grid modelled by RWDI. These receptors are illustrated on Figures 6 through 17, in Section 7.2.

3.5.6 Terrain Data

Terrain information for the area surrounding the facility was obtained from the MOE Ontario Digital Elevation Model Data web site. The terrain data is based on the North American Datum 1983 (NAD83) horizontal reference datum. These data were run through the AERMAP terrain pre-processor to estimate base elevations for receptors and to help the model account for changes in elevation of the surrounding terrain.

3.6 Evaluation of Impacts

The effects of the Project are ultimately evaluated by comparing modelled results to the applicable criteria. In this study, the following comparisons will be made:

- Canadian Ambient Air Quality Criteria (CAAQS);
- National Ambient Air Quality Objectives (NAAQOs);
- Ontario Ambient Air Quality Criteria (AAQCs); and
- Ontario Jurisdictional Screening Level (JSL).

4. ASSESSMENT CRITERIA

Regulatory agencies have identified ambient air quality criteria for the identified indicator contaminants, specifying maximum concentration levels in the atmosphere. These criteria are based on the lowest-observed-level-of-effect and incorporate a safety factor. For the purposes of this assessment, these criteria have been used to define thresholds for the indicator contaminants that, if exceeded, would be considered to be of potential concern. National Ambient Air Quality Objectives and Ontario Ambient Air Quality Criteria have been selected as the thresholds for the Goliath Gold Mine project.

4.1 Canadian Ambient Air Quality Standards

On May 25, 2013, new air CAAQS for $PM_{2.5}$ and O_3 were established by the federal government using the authority of the Canadian Environmental Protection Act, 1999. These CAAQSs come into force in 2015, and are therefore most suitable for this assessment. The CAAQS for $PM_{2.5}$ will be altered in 2020, and therefore this value is used, since the expected project life will extend beyond this time. As noted in Section 2.1.1, O_3 was not directly assessed in this analysis, and is therefore not included in the list of criteria used in this assessment.

4.2 National Ambient Air Quality Objectives

The NAAQOs were developed to provide air quality objectives for all of Canada. These values were first published in the 1970s, and later reviewed in the 1980s and 1990s. In 1999, the Canadian Council of the Ministers of the Environment (CCME) published another review of the NAAQO system in 1989 (CCME, 1999), which identified the need for a new system, which then led to the development of the CAAQSs. The NAAQOs are eventually being phased out and replaced by CAAQS, but for the time being, serve as a benchmark against which the impact of proposed activities can be compared. Three levels are defined under the NAAQO system (CCME, 1989):

- "**Maximum desirable level** is the long-term goal for air quality and provides a basis for an anti-degradation policy for the unpolluted parts of the country, and for continuing development of control technology."
- "**Maximum acceptable level** is intended to provide adequate protection against effects on soil, water, vegetation, materials, visibility, personal comfort and well-being."
- **Maximum tolerable level** denotes time-based concentrations of air contaminants beyond which, due to a diminishing margin of safety, appropriate action is required without delay to protect the health of the general public."

Although the NAAQOs will eventually be replaced by CAAQS, they are used as criteria for compounds for which CAAQSs have not yet been developed.

4.3 Ontario Ministry of the Environment and Climate Change

The MOECC sets AAQCs as a desirable concentration of a contaminant in the air. The AAQCs are developed to provide protection against adverse effects, including health, odour, vegetation, soiling, visibility, corrosion or other suitable end-points. The AAQCs are set with averaging times that are appropriate for the effect that they are intended to protect against, with 10-minute, 30-minute, 1-hour, 8-hour, 24 hour, monthly and annual values being used. The AAQCs are reviewed periodically to ensure that they reflect current science.

The AAQCs apply to environmental assessments such as this, as well as other specialized studies.

A contaminant with multiple AAQCs, for different effects and / or averaging times, have been assessed against all AAQCs.

For contaminants without AAQCs, the MOECC also publishes a list of Jurisdictional Screening Levels (JSLs) that identify whether a contaminant requires further assessment by the MOECC Standards Development Branch (SDB). Contaminants with a predicted concentration exceeding these levels are forwarded to the SDB for further assessment, and a site-specific limit may be assigned, if the SDB deems it necessary. These values are therefore used in this assessment as criteria where no other criteria exist.

4.4 Criteria Used in the Assessment

Table 2 identifies and compares the federal and provincial criteria. The criteria refer to different averaging periods to account for potential short-term acute exposures and long-term chronic exposures. On the basis of the precautionary principle, the most stringent criteria were selected as the threshold for each contaminant indicator. Given that O_3 formation due to the project is not being assessed, no indicator threshold for O_3 has been identified.

Table 2 also identifies dust deposition (dustfall) criteria for Ontario. The basis for these criteria is based on nuisance considerations. All dust deposition criteria are used to assess the project.

Table 2: Air Quality Indicator Thresholds (in µg/m³) – Except Where Noted

Air Quality Indicator	Averaging Time	Federal Air Quality Objectives			Canadian Ambient Air Quality Standards	Ontario Ambient Air Quality Criteria	Indicator Threshold
		Desirable	Acceptable	Tolerable			
TSP	24 hr	-	120	400	-	120	120
	Annual	60	70	-	-	60	60
PM_{10}	24 hr	-	-	-	-	50	50
$PM_{2.5}$	24 hr	-	-	-	28 (27 after 2020)	-	27
	Annual	-	-	-	10 (8.8 after 2020)	-	8.8
Dustfall [1]	30 day	-	-	-	-	7	7
	Annual	-	-	-	-	4.6	4.6
SO_2	1 hr	450	900	-	-	690	450
	24 hr	150	300	800	-	275	150
	Annual	30	60	-	-	55	30
NO_2	1 hr	-	400	1,000	-	400	400
	24 hr	-	200	300	-	200	200
	Annual	60	100	-	-	-	60
CO	1 hr	15,000	35,000	-	-	36,200	15,000
	8 hr	6,000	15,000	20,000	-	15,700	6,000
Gold	24-hr	-	-	-	-	-	N/A
Silver	24-hr	-	-	-	-	50	50
Copper	24-hr	-	-	-	-	4	4
Iron	24-hr	-	-	-	-	25	25
Lead	24-hr	-	-	-	-	0.5	0.5
Zinc	24-hr	-	-	-	-	120	120
Aluminium	24-hr	-	-	-	-	4.8 (JSL)	4.8
Arsenic	24-hr	-	-	-	-	0.3	0.3
Barium	24-hr	-	-	-	-	10	10
Beryllium	24-hr	-	-	-	-	0.1	0.1
Bismuth	24-hr	-	-	-	-	-	N/A
Calcium	24-hr	-	-	-	-	-	N/A
Cadmium	24-hr	-	-	-	-	0.025	0.025
Cobalt	24-hr	-	-	-	-	0.1	0.1
Chromium	24-hr	-	-	-	-	0.5	0.5

Air Quality Indicator	Averaging Time	Federal Air Quality Objectives			Canadian Ambient Air Quality Standards	Ontario Ambient Air Quality Criteria	Indicator Threshold
		Desirable	Acceptable	Tolerable			
Potassium	24-hr	-	-	-	-	28	28
Lithium	24-hr	-	-	-	-	20	20
Magnesium	24-hr	-	-	-	-	120	120
Manganese	24-hr	-	-	-	-	0.4	0.4
Molybdenum	24-hr	-	-	-	-	120	120
Nickel	Annual	-	-	-	-	0.04	0.04
Phosphorous	24-hr	-	-	-	-	0.35 (JSL)	0.35
Antimony	24-hr	-	-	-	-	25	25
Selenium	24-hr	-	-	-	-	10	10
Tin	24-hr	-	-	-	-	10	10
Strontium	24-hr	-	-	-	-	120	120
Titanium	24-hr	-	-	-	-	120	120
Thallium	24-hr	-	-	-	-	0.24	0.24
Vanadium	24-hr	-	-	-	-	2	2
Tungsten	24-hr	-	-	-	-	4 (JSL)	4
Yttrium	24-hr	-	-	-	-	2.4 (JSL)	2.4
Sulphur	24-hr	-	-	-	-	20 (JSL)	20
Uranium	Annual	-	-	-	-	0.03	0.03
Gallium	24-hr	-	-	-	-	-	N/A
Lanthanum	24-hr	-	-	-	-	-	N/A
Scandium	24-hr	-	-	-	-	-	N/A
Thorium	24-hr	-	-	-	-	-	N/A
Platinum	24-hr	-	-	-	-	0.2	0.2
Palladium	24-hr	-	-	-	-	10	10
Rhodium	24-hr	-	-	-	-	0.4 (JSL)	0.4
Sodium	24-hr	-	-	-	-	10	10

Notes: [1] The threshold for dustfall is given in g/m²/30 days. The annual dustfall threshold is 4.6 g/m²/ 30 days for an averaging period of 1 year.

5. BASELINE STUDIES

5.1 Air Quality Environment

Section 3.2 provides a detailed assessment and summary of the local background air quality environment for the site.

5.2 Baseline Monitoring Locations

No baseline monitoring was conducted in the baseline study. Ambient air quality data was obtained for the years 2007 to 2011 from MOE Station No. 63203, located at 421 James Street South, in Thunder Bay and for the years 1999 to 2003 from MOE Station No. 63064 located at Montreal Street, Thunder Bay.

5.3 Temporal variation

The air quality in Northwestern Ontario has been improving for more than the last decade. A reduction in the emissions from heavy industry through better pollution control, and lower emissions due to better vehicle technology have all played a part in this. In addition, economic factors in Northwestern Ontario have played a role in improving air quality, as the region has seen a reduction in traditional industries including forestry, sawmilling and pulp and paper. Long term trends available from both Environment Canada and the Ontario MOECC show similar trends throughout the region and on a larger scale. The 2011 Air Quality in Ontario Report (MOECC, 2013), which is the most recent report available, states that:

"Overall, air quality has improved significantly over the past 10 years, especially for nitrogen dioxide (NO_2), carbon monoxide (CO) and sulphur dioxide (SO_2) - pollutants emitted by vehicles and industry, as well as fine particulate matter ($PM_{2.5}$), which may be emitted directly or from other emissions such as SO2."

5.4 Applicability

The levels identified in Section 3.2 will be used as background concentration for cumulative assessment impacts. As noted in Section 3.2, the monitoring stations used are located in a more urbanized area compared to the study area, and they are likely to capture higher concentrations of the contaminants of concern. The ambient monitoring data collected from these stations are therefore likely to be conservative estimates of the future background conditions experienced in the study area.

6. CONSTRUCTION AND SITE PREPARATION

6.1 Description of Continuous Operations

Construction and Site Preparation phases will include tree clearing, grubbing, stripping of overburden, crushing of aggregate for road construction, blasting, and construction of project facilities. Many of these activities have the potential for local air quality impacts, but these are expected to be lower than during the full operational phase. The duration of the Site Preparation and the Construction phase is estimated to be 3 years. It is conservatively assumed in the assessment of Construction and Site Preparation that these activities would take place 24-hours per day, with no change in the nature of the operations during daytime, evening, or nighttime.

Blasting during the Construction and Site Preparation phase is expected to take place once per day in the area of the open pit mine. At the time of the assessment, limited details regarding the expected blast area and charge size were available. It was therefore assumed that the blasts would be approximately 25%

of those occurring during the operational phase, as these blasts would be for clearing activities, and not for production purposes.

6.2 Air Quality Source Summary

The primary air quality sources include stripping of overburden, blasting, material handling, crushing of aggregate for road construction, and movement of material by truck. The expected equipment will include 1 rock drill, 1 excavator, 6 haul trucks, 2 dozers 1 front-end loader and 1 portable crushing plant. Expected emissions are summarized in Table 3, below.

Table 3: Annual Emissions from Construction and Site Preparation Phase

Emission Source	Annual Emission Rate (Mg/y)			
	TSP	PM_{10}	$PM_{2.5}$	NO_X
Haul Roads (Including Tailpipe Emissions from Trucks)	551.61	148.49	17.89	56.32
Dozers (Including Tailpipe Emissions)	19.42	3.90	2.60	10.42
Loader (Including Tailpipe Emissions)	0.93	0.69	0.52	15.08
Material Handling (Loading and Unloading Waste Rock)	4.94	2.33	0.35	-
Excavator (Tailpipe Emissions)	0.12	0.12	0.12	1.99
Crusher	4.73	2.10	0.32	-
Blasting	2.51	1.30	0.08	0.02

6.3 Mitigation

Treasury metals will ensure that best practices are followed during the Construction and Site Preparation phase to ensure that sound levels are minimized. These best practices will include:

- Conduct heavy construction activity between the hours of 07:00 and 22:00 if possible;
- Blasting will be conducted in a phased manner that optimizes the amount of explosives needed for a given area to be blasted, and that minimizes the area being blasted;
- Material will be loaded into haul trucks in a manner that minimizes the drop height from the loader or excavator bucket to the bed of the truck (or equivalent bed height as material is loaded into the truck);
- Ensure that all internal combustion engines are properly maintained and all emission control systems (e.g., diesel particulate filters) are in good working order.
- Water and chemical suppressants will be used for dust control on the haul roads is used at the mine site, when temperatures are above freezing. The watering program requires dedicated watering equipment, and enough water must be available and applied to off-set evaporation and maintain a wetted road surface. This program would also be supplemented with applications of an approved dust suppressant as required to minimize fugitive dust emissions.
- A best management practices plan for dust will be implemented on the site to provide specific directions for operators.

6.4 Residual Effects

Residual effects are those that remain when all mitigation options have been incorporated into the project design and operation. As all air quality levels are expected to comply with the applicable criteria, it is not anticipated that there will be residual effects for this site.

6.5 Conclusions

Predicted air quality levels are expected to be below the applicable criteria at each of the receptors for the Construction and Site Preparation phase.

7. OPERATIONAL PHASE

7.1 Description of Continuous Operations

The operational phases will include both underground and open face mining activities. The open face mining activities include drilling, blasting, dozing, excavating and the transportation of rock material on-site. The underground activities include the operation of intake and exhaust vent raises and the transportation of rock material to the surface. Emergency power generation occurs on site and testing of emergency generators occurs only during the daytime hours. Many of these activities have the potential for local air quality impacts. The duration of the operations phase is estimated to be 10 years. It is conservatively assumed, in the assessment of operations, that these activities would take place 24-hours per day, with no change in the nature of the operations during daytime, evening or nighttime, other than the generator testing.

7.2 Air Quality Source Summary

The primary air quality sources include extraction of ore and waste rock from the open pit and the handling and movement of that material to the mill and waste rock pile respectively. Underground operations will contribute emissions from the vent raises, as well as movement of ore and waste rock to the mill and waste rock pile respectively. Natural gas-fired heating equipment and testing of the emergency generators will also contribute to local air quality impacts, but these are expected to be minor in comparison to the other activities at the site.

The expected above-ground mobile equipment will include 1 rock drill, 2 excavators, 14 haul trucks, 3 dozers and 1 front-end loader. Other equipment assessed included the jaw crusher, vent raises, and combustion equipment including natural gas-fired heaters and the emergency generators. Expected emissions are summarized in Table 4, below.

Table 4: Annual Emissions from the Mine Operational Phase

Emission Source	Annual Emission Rate (Mg/y)			
	TSP	PM_{10}	$PM_{2.5}$	NO_X
Haul Roads (Including Tailpipe Emissions from Trucks)	221.41	60.68	8.60	46.93
Dozers (Including Tailpipe Emissions)	29.85	6.55	4.58	26.94
Loader (Including Tailpipe Emissions)	0.07	0.08	0.07	2.28
Material Handling (Loading and Unloading Waste Rock)	6.41	3.03	0.46	0.00
Excavator (Tailpipe Emissions)	0.02	0.02	0.02	0.30
Wind Erosion of Tailings	22.32	17.66	10.26	0.00
Crusher [1]	0.18	0.18	0.18	0.00
Blasting	10.04	5.22	0.30	0.07
Vent Raises [1]	18.94	18.94	18.94	86.79
Heaters [1]	0.10	0.10	0.10	1.35
Generators [2]	0.02	0.02	0.02	0.58

Notes: [1] Annual emissions for bag-house, vent raises, and heaters based on 24/7 operations.
[2] Annual emissions for generators based on weekly testing for one hour for each generator.

7.3 Anticipated Impacts

Figures 6 through 19 provide concentration contour plots for each of the contaminants modelled, with the exception of the metals. The metal concentrations and dustfall are scaled directly from the TSP results, and therefore the contours will generally be similar in shape, but with much lower values, as can be inferred the results provided on Table 5 and Table 6.

Table 5: Predicted Impacts of the Mine Operations at Property Line (µg/m³)

Contaminant	Averaging Period	Maximum Predicted Concentration	Background Concentration [1]	Cumulative Concentration	Threshold	Source of Threshold Value	% of Threshold
TSP	24 hr	3.51E+02	3.3E+01	3.84E+02	120	AAQC	320%
	Annual	5.74E+01	1.4E+01	7.14E+01	60	AAQC	119%
PM_{10}	24 hr	9.65E+01	1.5E+01	1.11E+02	50	AAQC	223%
$PM_{2.5}$	24 hr	1.09E+01	1.0E+01	2.09E+01	27	CAAQS	77%
	Annual	2.76E+00	4.28E+00	7.04E+00	8.8	CAAQS	80%
Dustfall [2]	30 day	5.50E+00	-	5.50E+00	7	AAQC	79%
	Annual	4.45E+00	-	4.45E+00	4.6	AAQC	97%
CO	1 hr	1.99E+02	1.248E+03	1.45E+03	36,200	AAQC	4%
	8 hr [3]	1.11E+02	1.248 E+03	1.36E+03	15,700	AAQC	9%
NO_2	1 hr	1.86E+02	3.3E+01	2.19E+02	400	AAQC	55%
	24 hr	1.08E+02	3.3E+01	1.41E+02	200	AAQC	70%
SO_2	1 hr	8.02E+00	4.0E+00	1.20E+01	690	AAQC	2%
	24 hr	3.09E+00	4.0E+00	7.09E+00	275	AAQC	3%
	Annual	6.80E-01	1.0E+00	1.68E+00	55	AAQC	3%
Gold	24 hr	2.63E-03	-	2.63E-03	N/A	N/A	N/A
Lead	24 hr	1.66E-01	-	1.66E-01	0.5	AAQC	33%
Arsenic	24 hr	2.17E-02	-	2.17E-02	0.3	AAQC	7%
Barium	24 hr	2.50E-01	-	2.50E-01	10	AAQC	3%
Beryllium	24-hr	1.27E-03	-	1.27E-03	0.1	AAQC	1%
Bismuth	24 hr	5.59E-03	-	5.59E-03	N/A	N/A	N/A
Cadmium	24 hr	2.32E-03	-	2.32E-03	0.025	AAQC	9%

Contaminant	Averaging Period	Maximum Predicted Concentration	Background Concentration [1]	Cumulative Concentration	Threshold	Source of Threshold Value	% of Threshold
Cobalt	24 hr	6.07E-03	-	6.07E-03	0.1	AAQC	6%
Chromium	24 hr	7.74E-02	-	7.74E-02	1	AAQC	15%
Manganese	24 hr	2.86E-01	-	2.86E-01	0.4	AAQC	72%
Nickel	24 hr	2.57E-03	-	2.57E-03	0.04	AAQC	6%
Phosphorous	24 hr	2.63E-01	-	2.63E-01	0.35	JSL	75%
Titanium	24 hr	9.18E-01	-	9.18E-01	120	AAQC	1%
Thallium	24 hr	8.56E-03	-	8.56E-03	0.24	JSL	4%
Vanadium	24 hr	2.42E-02	-	2.42E-02	2	AAQC	1%
Uranium	24 hr	6.73E-04	-	6.73E-04	0.03	AAQC	2%
Gallium	24 hr	1.05E-02	-	1.05E-02	N/A	N/A	N/A
Lanthanum	24 hr	8.77E-03	-	8.77E-03	N/A	N/A	N/A
Scandium	24 hr	2.94E-03	-	2.94E-03	N/A	N/A	N/A
Thorium	24 hr	1.07E-02	-	1.07E-02	N/A	N/A	N/A
Platinum	24 hr	1.00E-02	-	1.00E-02	0.2	AAQC	5%
Rhodium	24 hr	3.27E-03	-	3.27E-03	0.4	JSL	1%

Notes: [1] 1-hr, ½-hour, and 24-hour background concentrations were based on 90th percentile values. Annual background values were based on the maximum annual mean value over the most recent available 5-year period.
[2] Predicted impacts and thresholds of dustfall are in g/m²/30 days
[3] 8-hr predicted CO concentration is calculated from 1-hr predicted concentration using a published conversion factor (Ontario Regulation 419/05, 17(2)).

Table 6: Predicted Deposition of Metals Due to Mine Operations at Property Line (g/m²/30 days)

Contaminant	Deposition (g/m²/30 days)	
	30 Day	Annual
Gold	4.94E-06	4.00E-06
Lead	6.12E-04	4.95E-04
Arsenic	1.75E-04	1.42E-04
Barium	2.58E-03	2.09E-03
Beryllium	1.29E-05	1.05E-05
Bismuth	5.86E-05	4.74E-05
Cadmium	1.86E-05	1.50E-05
Cobalt	6.53E-05	5.28E-05
Chromium	7.90E-04	6.40E-04
Manganese	3.09E-03	2.50E-03
Nickel	2.11E-04	1.71E-04
Phosphorous	2.79E-03	2.25E-03
Titanium	9.96E-03	8.05E-03
Thallium	9.29E-05	7.52E-05
Vanadium	2.64E-04	2.13E-04
Uranium	5.50E-05	4.45E-05
Gallium	1.09E-04	8.83E-05
Lanthanum	8.98E-05	7.27E-05
Scandium	2.87E-05	2.32E-05
Thorium	1.10E-04	8.90E-05
Platinum	1.11E-04	8.96E-05
Rhodium	3.29E-05	2.66E-05

Notes: [1] The deposition of metals is scaled directly from the deposition of TSP results based on the metals content in waste rock.

Federal EA requirements prescribe that impacts be assessed at the nearest receptors, and not specifically at the property boundary. As such, the particulate levels in Table 7 below reflect the predicted impacts at the nearest receptors. These are the concentration values that are applicable to the criteria as per Federal EA requirements.

Table 7: Predicted Impacts of the Mine Operations at Most-Impacted Receptor Location

Contaminant	Averaging Period	Maximum Predicted Concentration	Background Concentration [1]	Cumulative Concentration	Threshold	Source of Threshold Value	% of Threshold
TSP [2]	24 hr	6.66E+01	3.3E+01	9.96E+01	120	AAQC	83%
	Annual	1.34E+01	1.4E+01	2.74E+01	60	AAQC	46%
PM_{10}	24 hr	2.58E+01	1.5E+01	4.08E+02	50	AAQC	82%

Notes: [1] 1-hr, ½-hour, and 24-hour background concentrations were based on 90th percentile values. Annual background values were based on the maximum annual mean value over the most recent available 5-year period.
[2] Maximum 24-hour predicted concentrations of TSP reflect the 98th percentile value at the nearest residential receptor, as this criteria is based on visibility, and is not a health-related criteria.

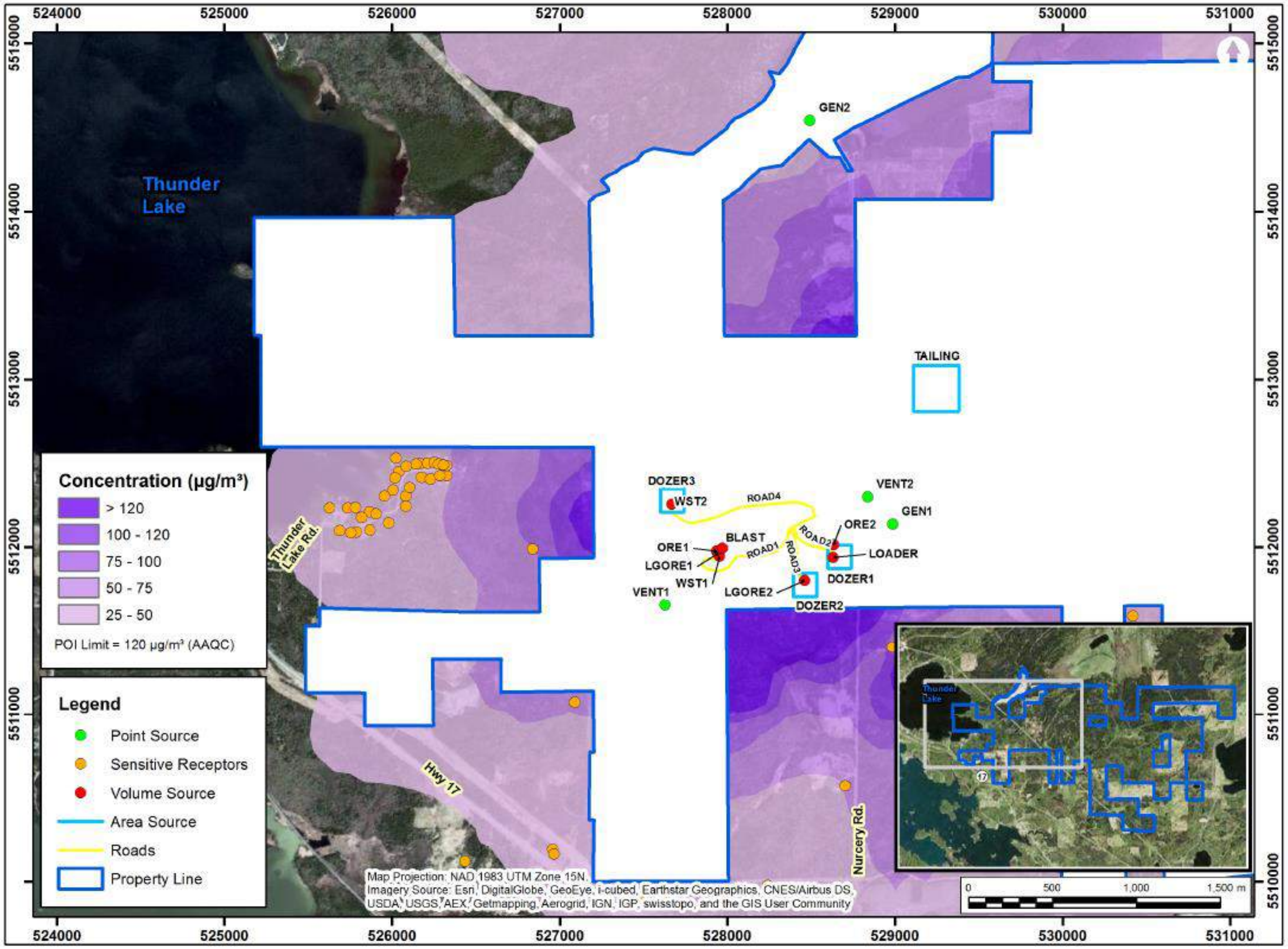

Figure 6: TSP 24hr Contour Plot (criteria: 120 µg/m³)

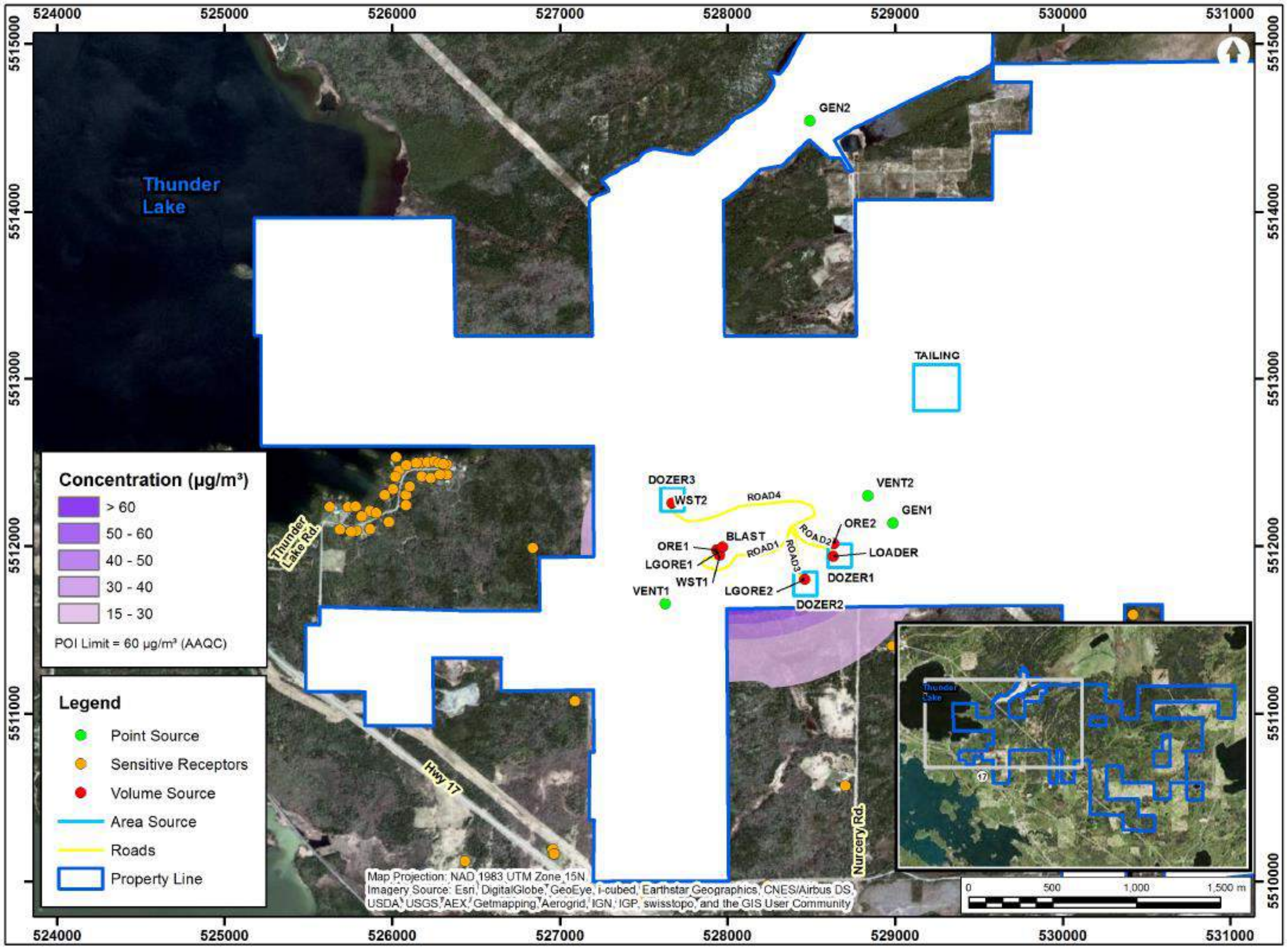

Figure 7: TSP Annual Contour Plot (criteria: 60 µg/m³)

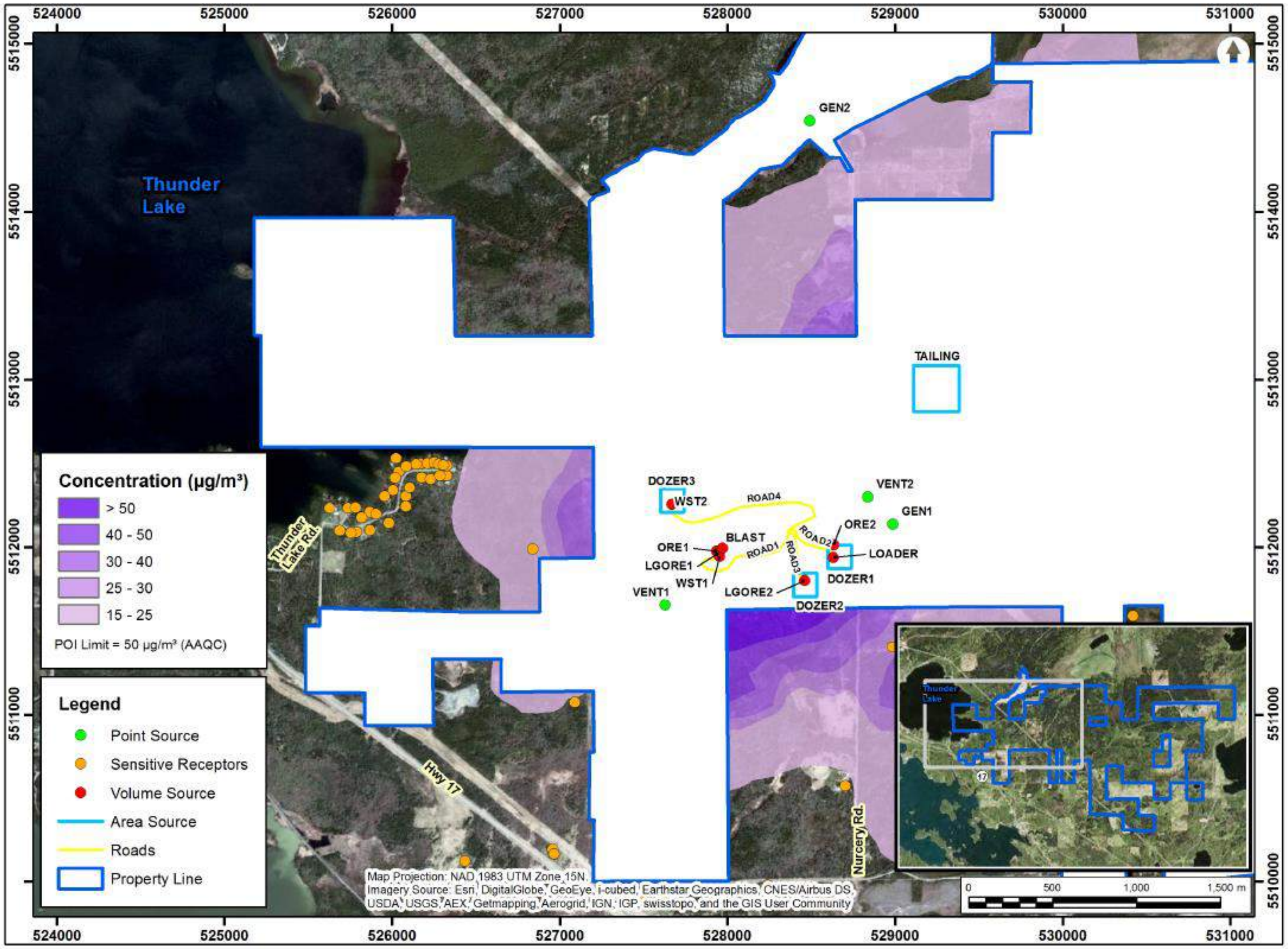

Figure 8: PM_{10} 24hr Contour Plot (criteria: 50 µg/m³)

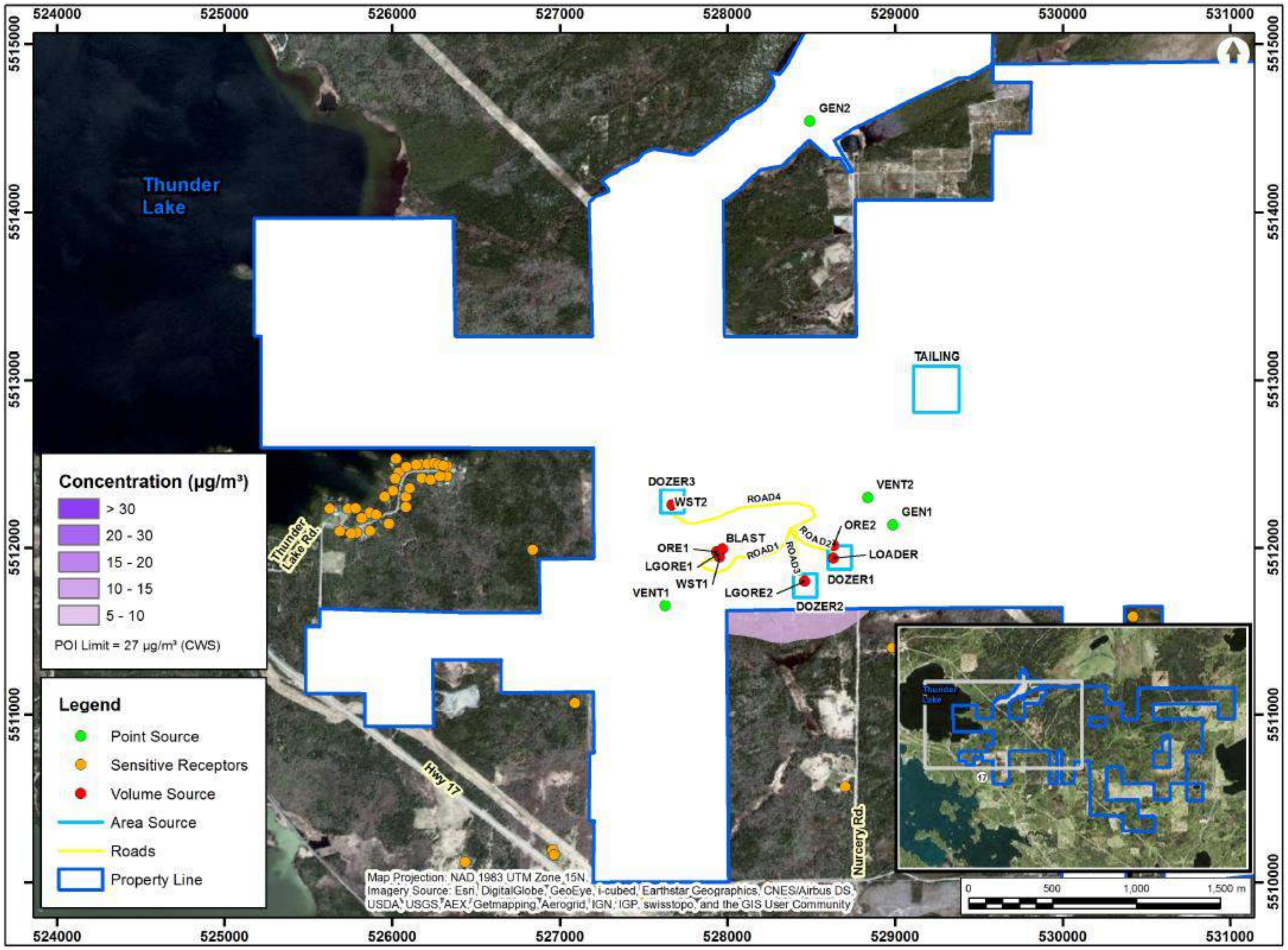

Figure 9: $PM_{2.5}$ 24hr Contour Plot (criteria: 27 µg/m³)

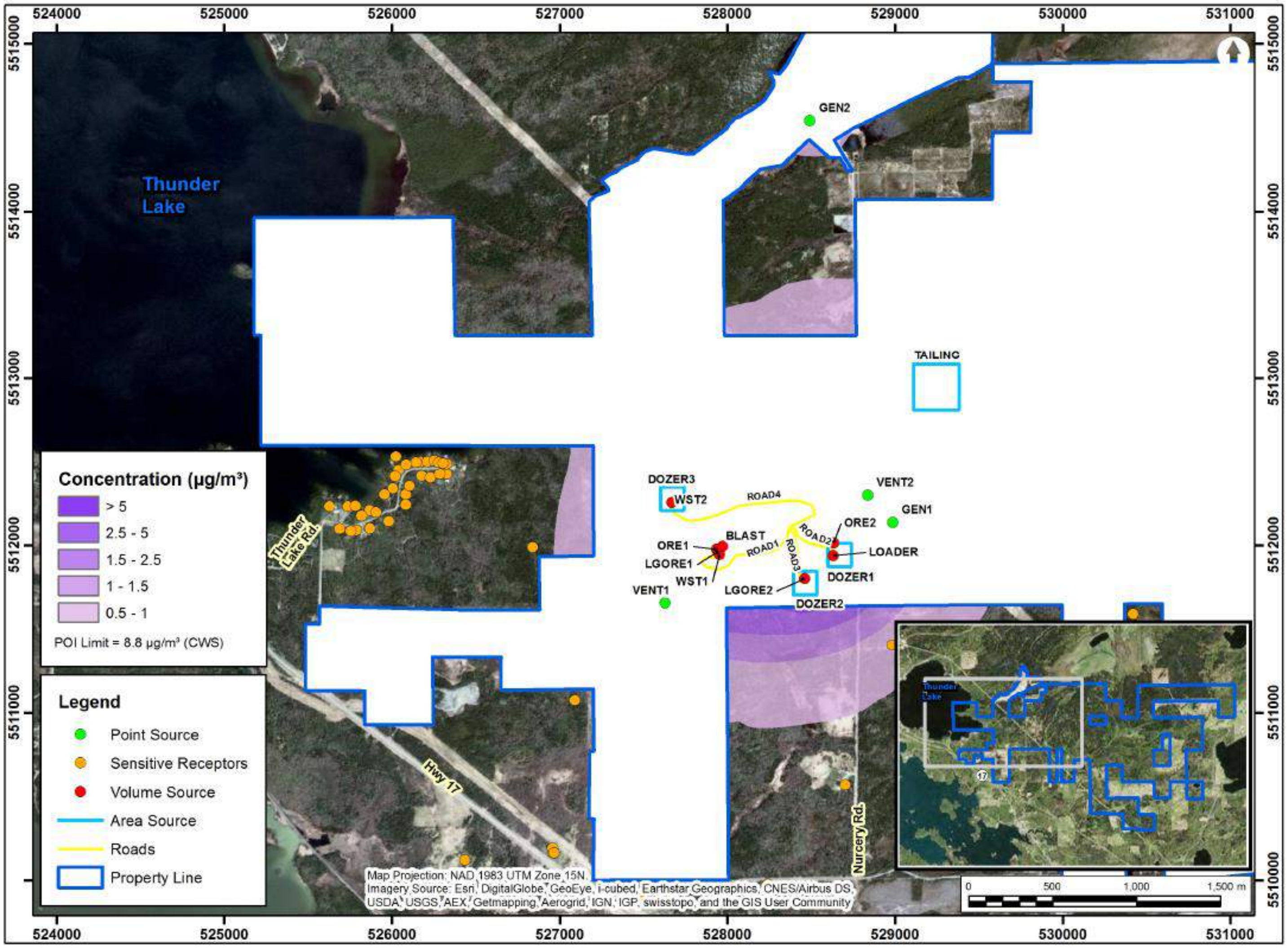

Figure 10: $PM_{2.5}$ Annual Contour Plot (criteria: 8.8 µg/m³)

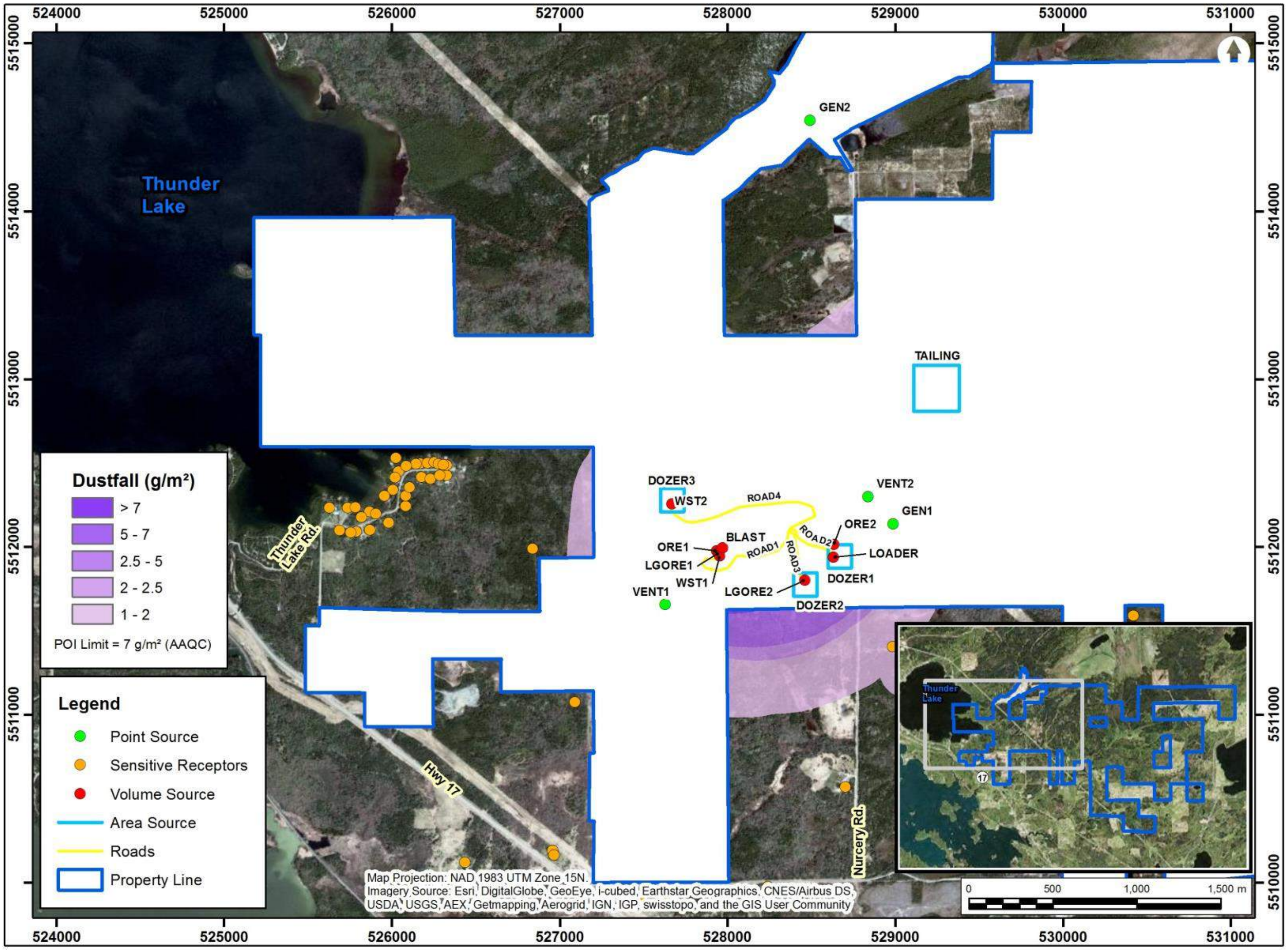

Figure 11: Dustfall 30 day Contour Plot (criteria: 7 g/m²/30 days)

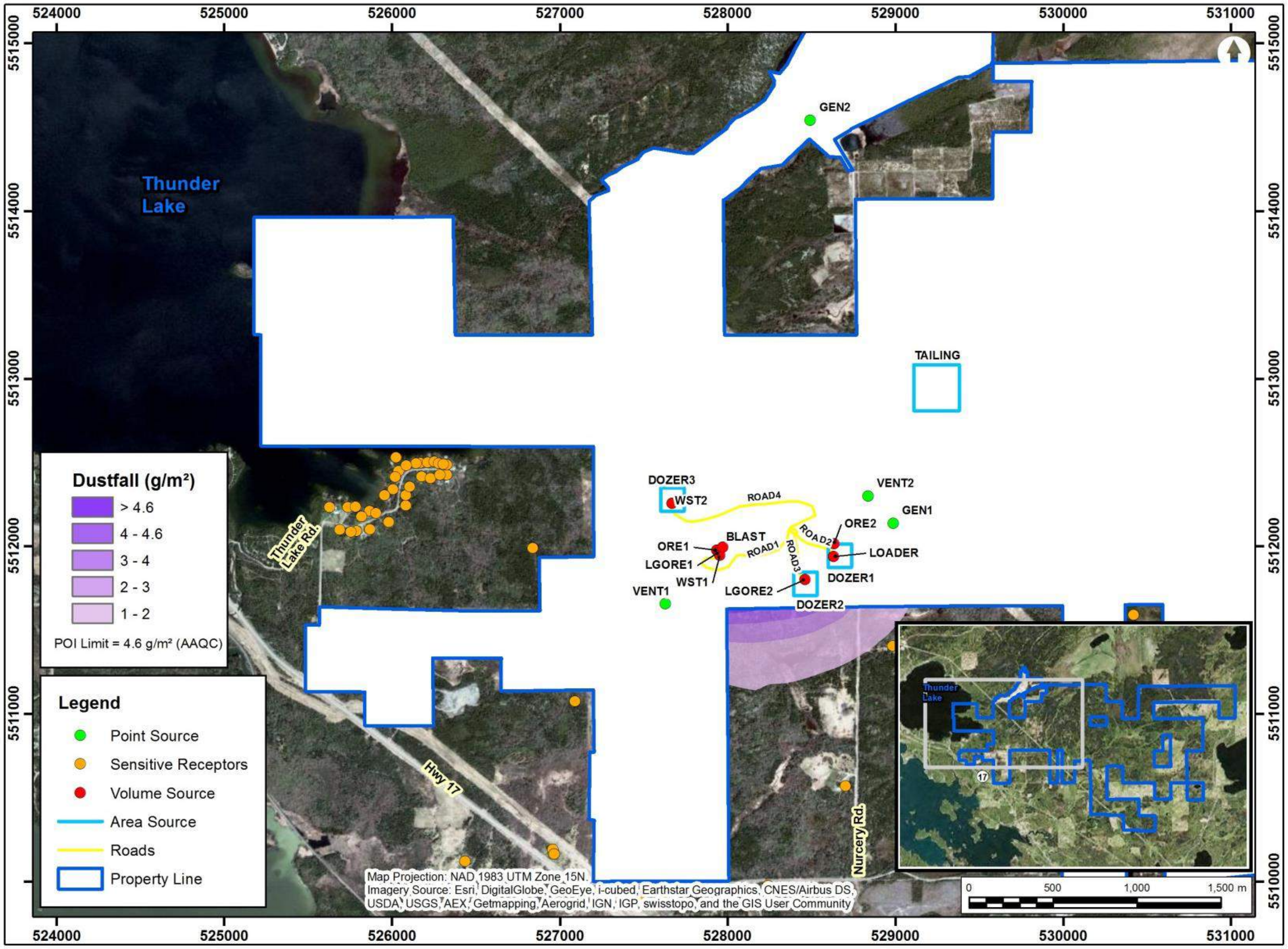

Figure 12: Dustfall Annual Contour Plot (criteria: 4.6 g/m²/30 days)

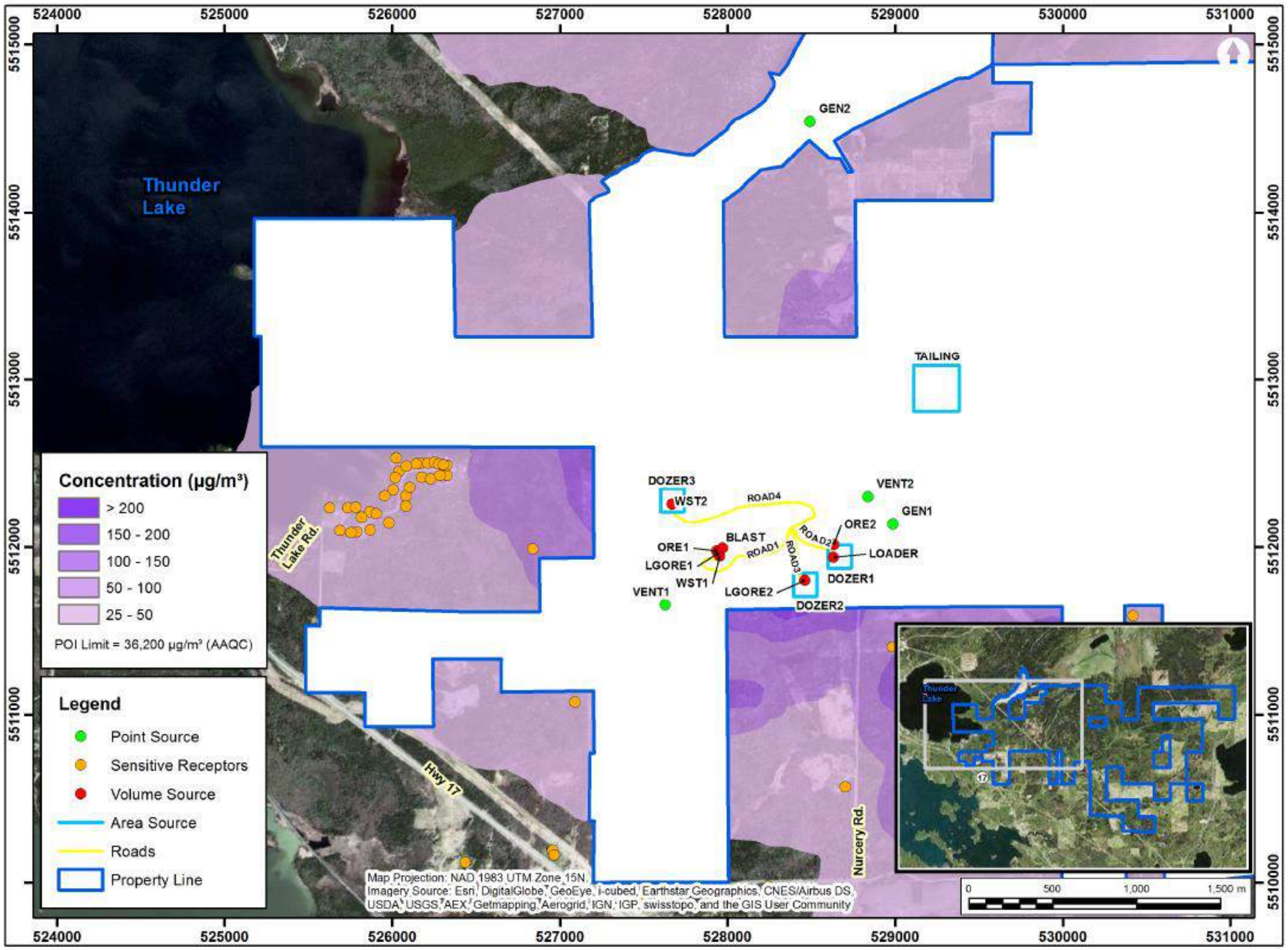

Figure 13: CO 1hr Contour Plot (criteria: 36,200 µg/m³)

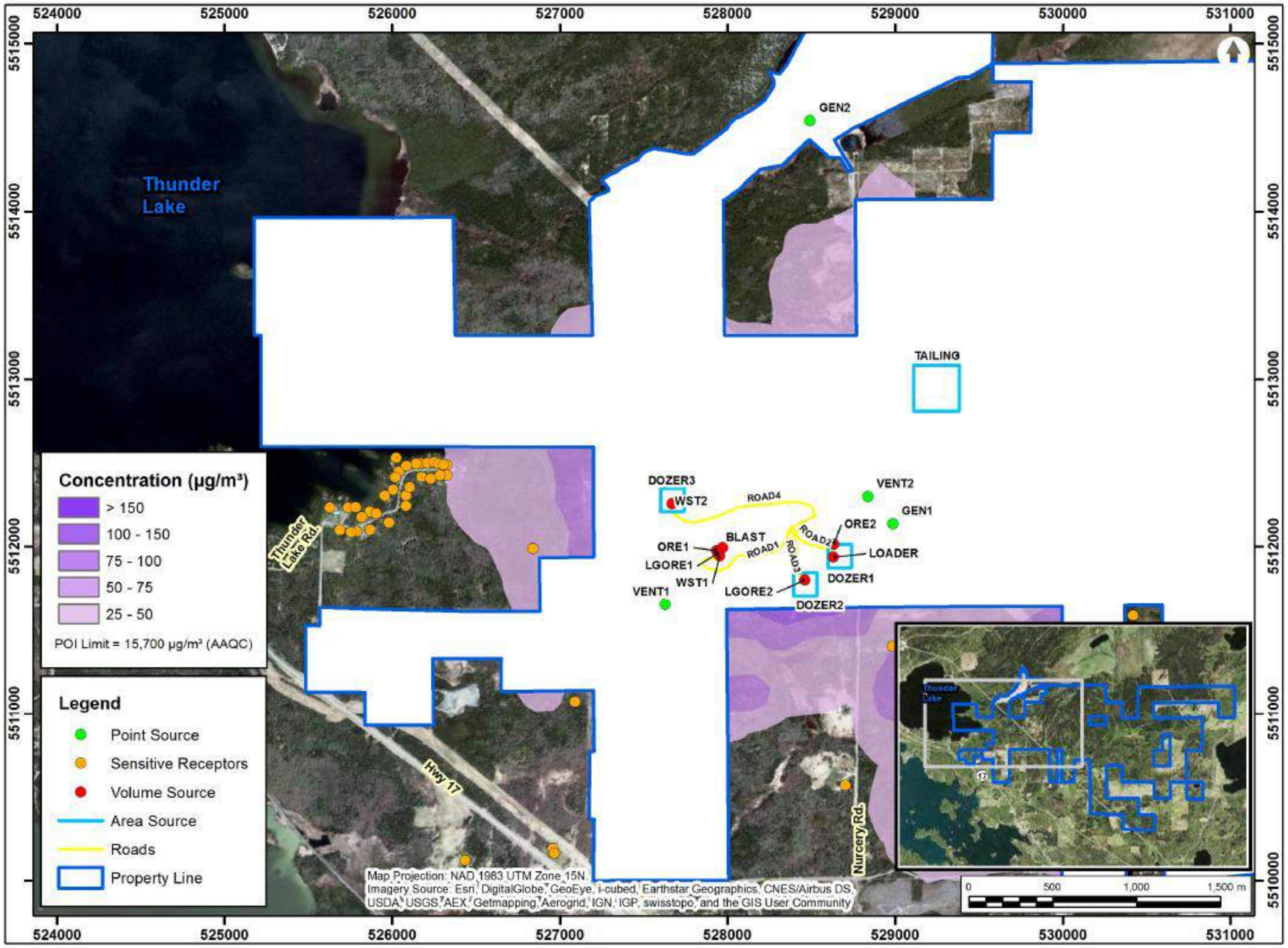

Figure 14: CO 8hr Contour Plot (criteria: 15,700 µg/m³)

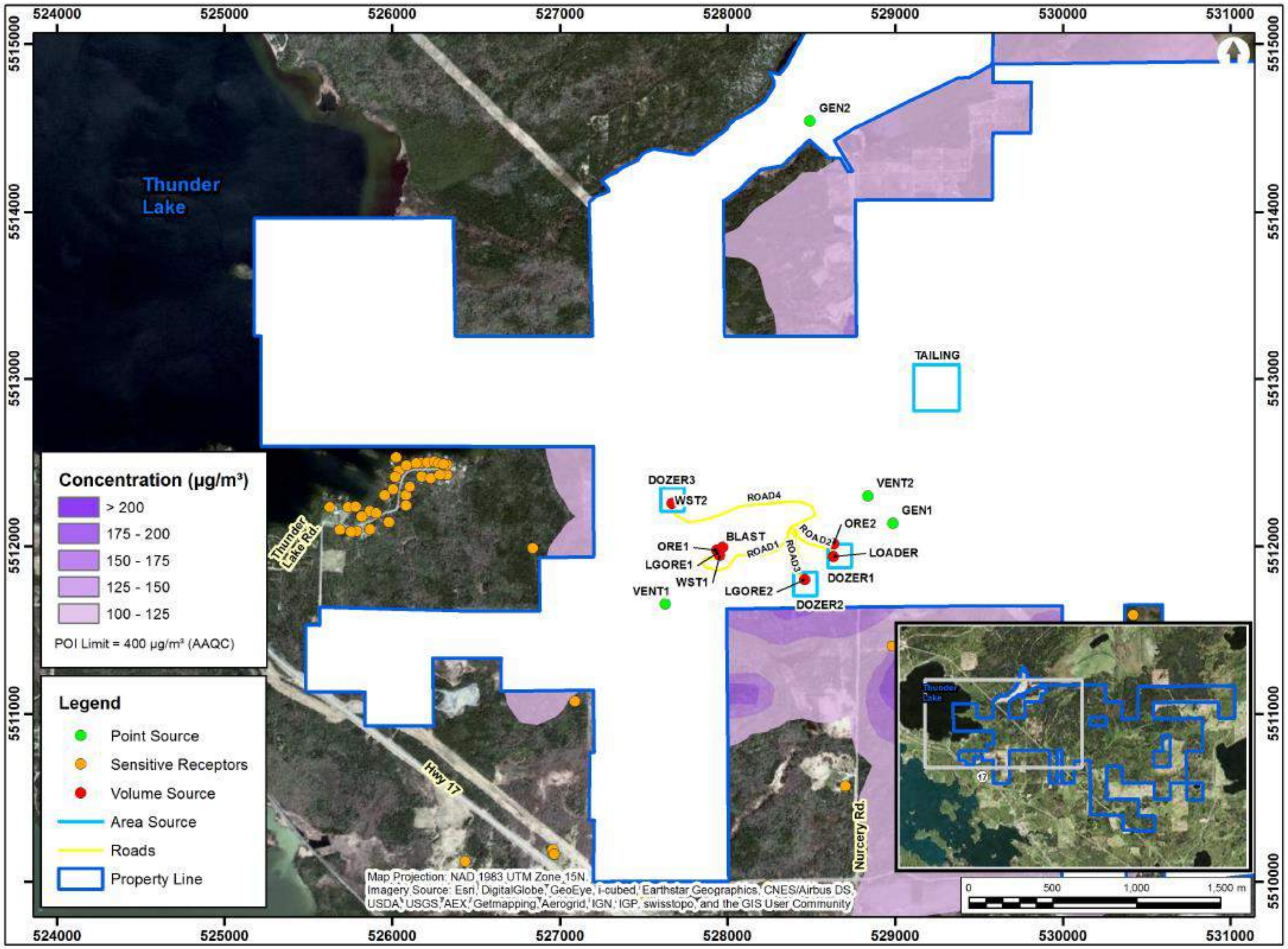

Figure 15: NO_2 1hr Contour Plot (criteria: 400 µg/m³)

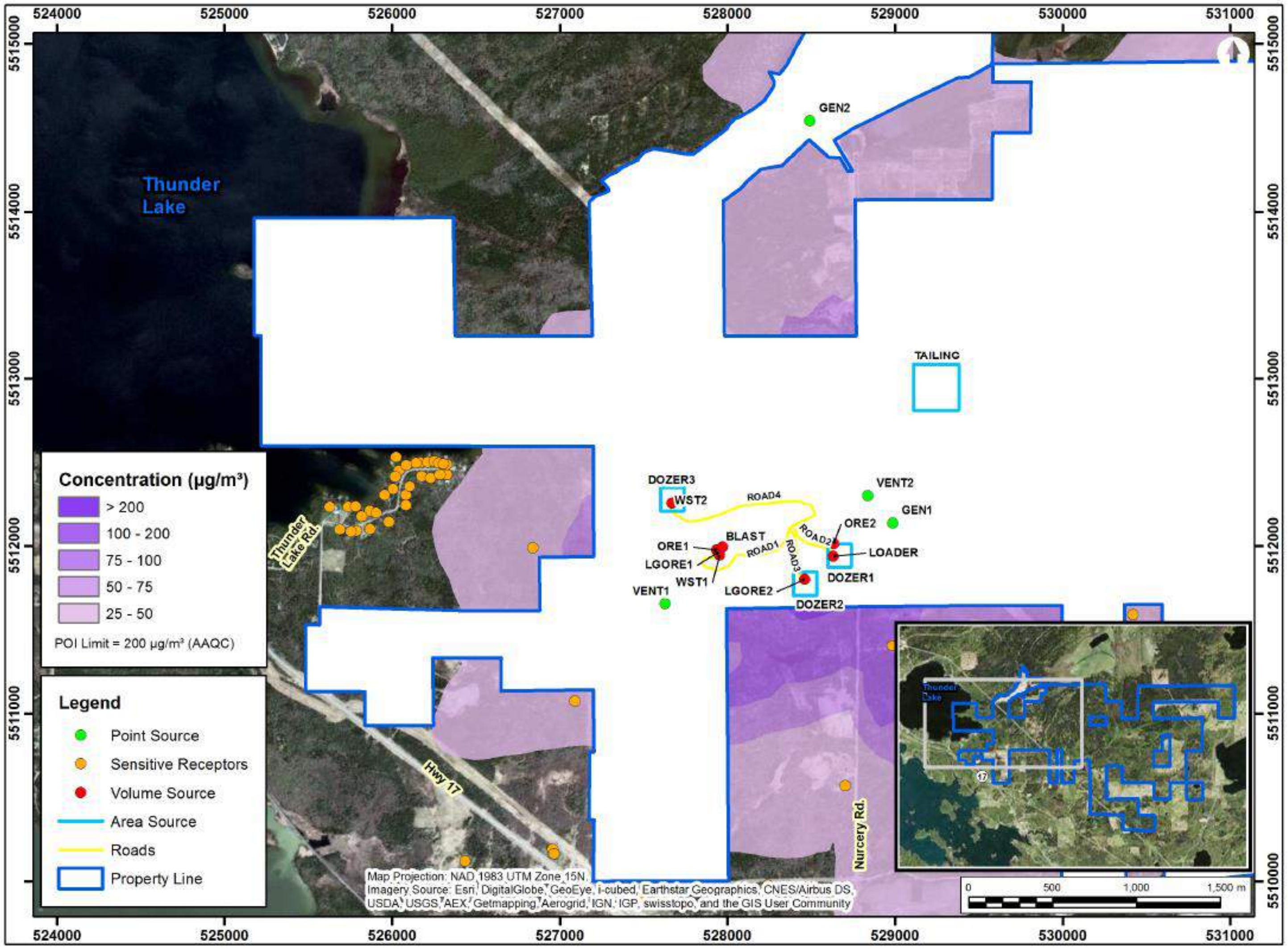

Figure 16: NO_2 24hr Contour Plot (criteria: 200 µg/m³)

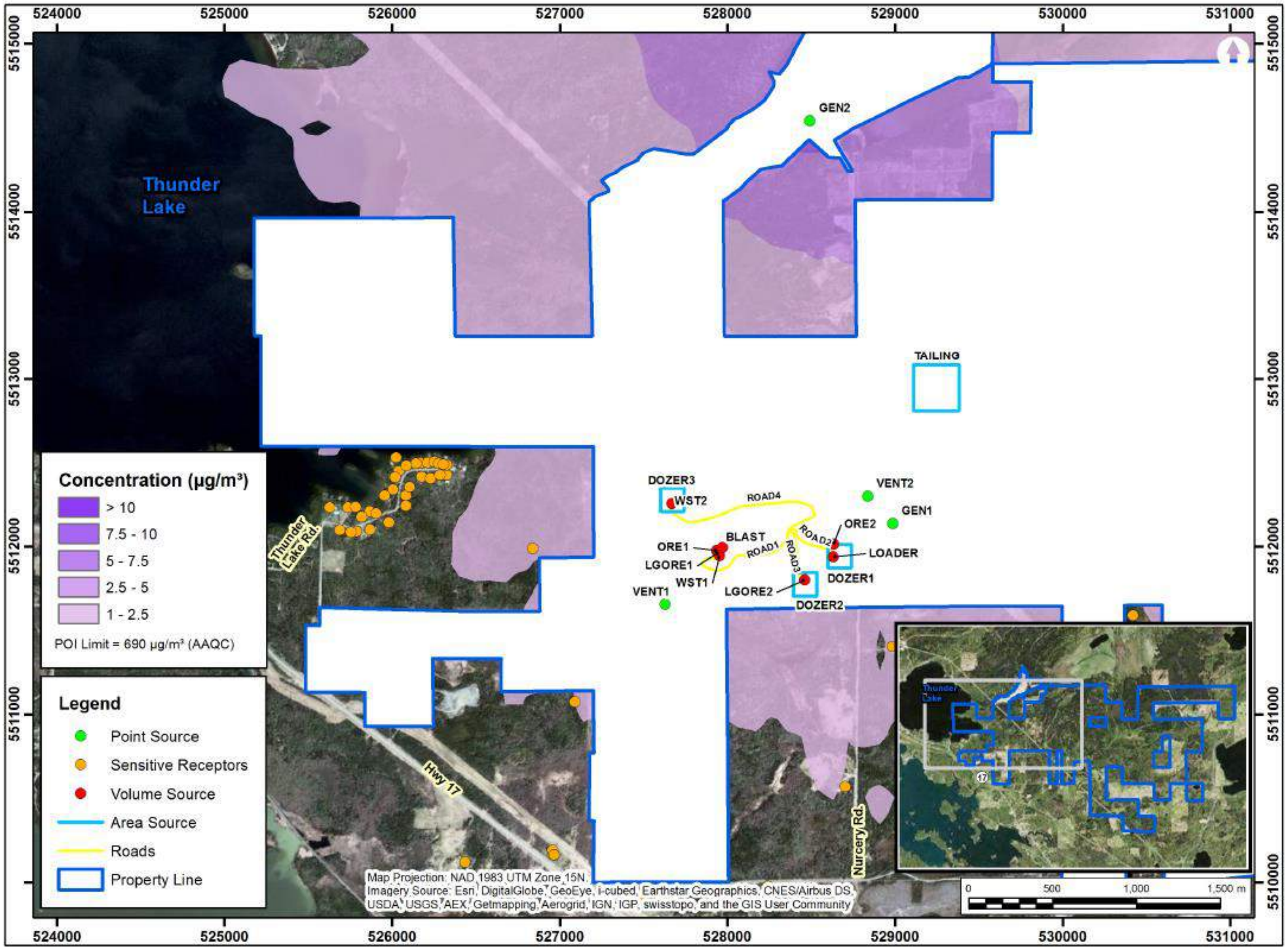

Figure 17: SO_2 1hr Contour Plot (criteria: 690 µg/m³)

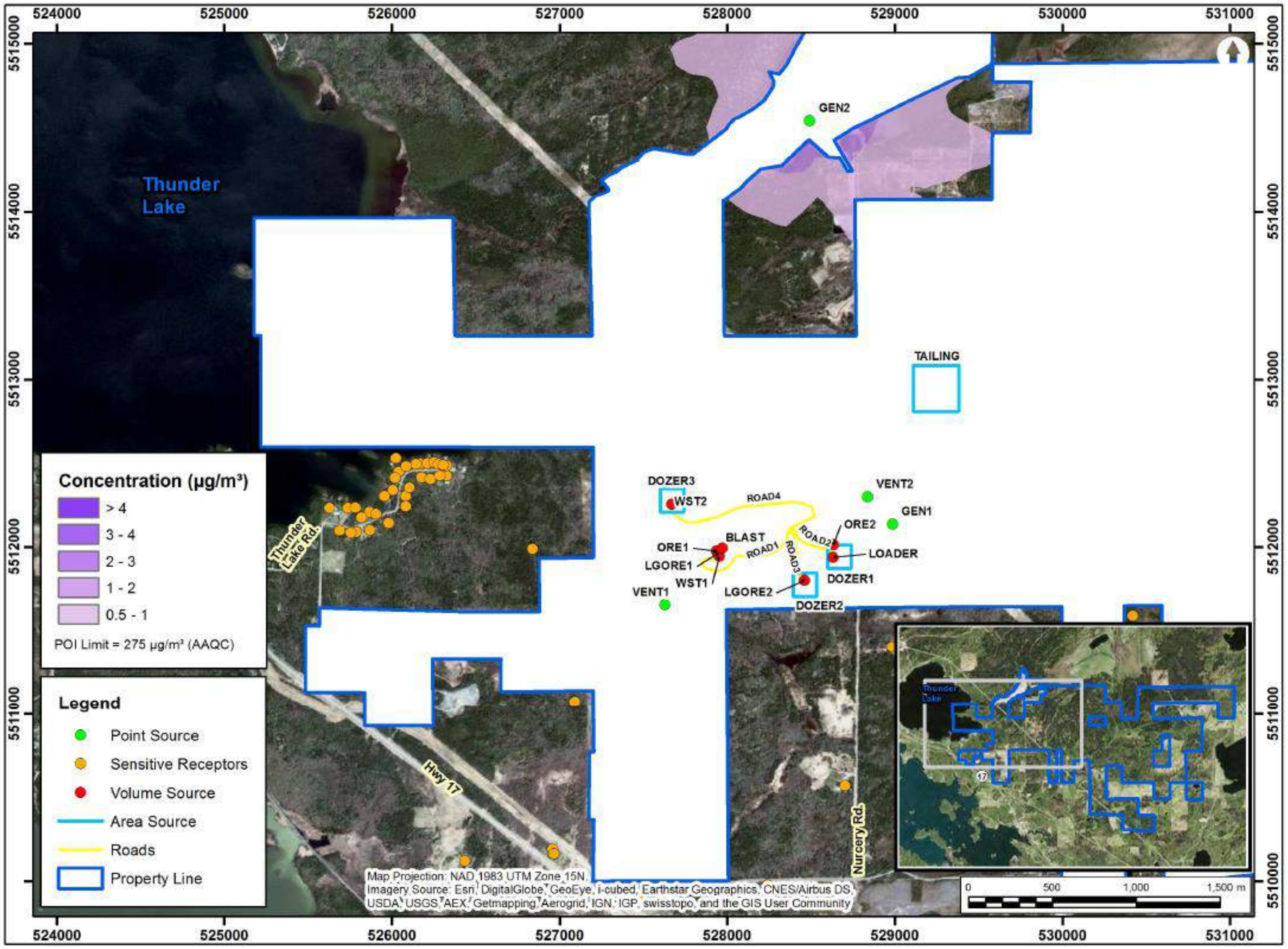

Figure 18: SO_2 24hr Contour Plot (criteria: 275 µg/m³)

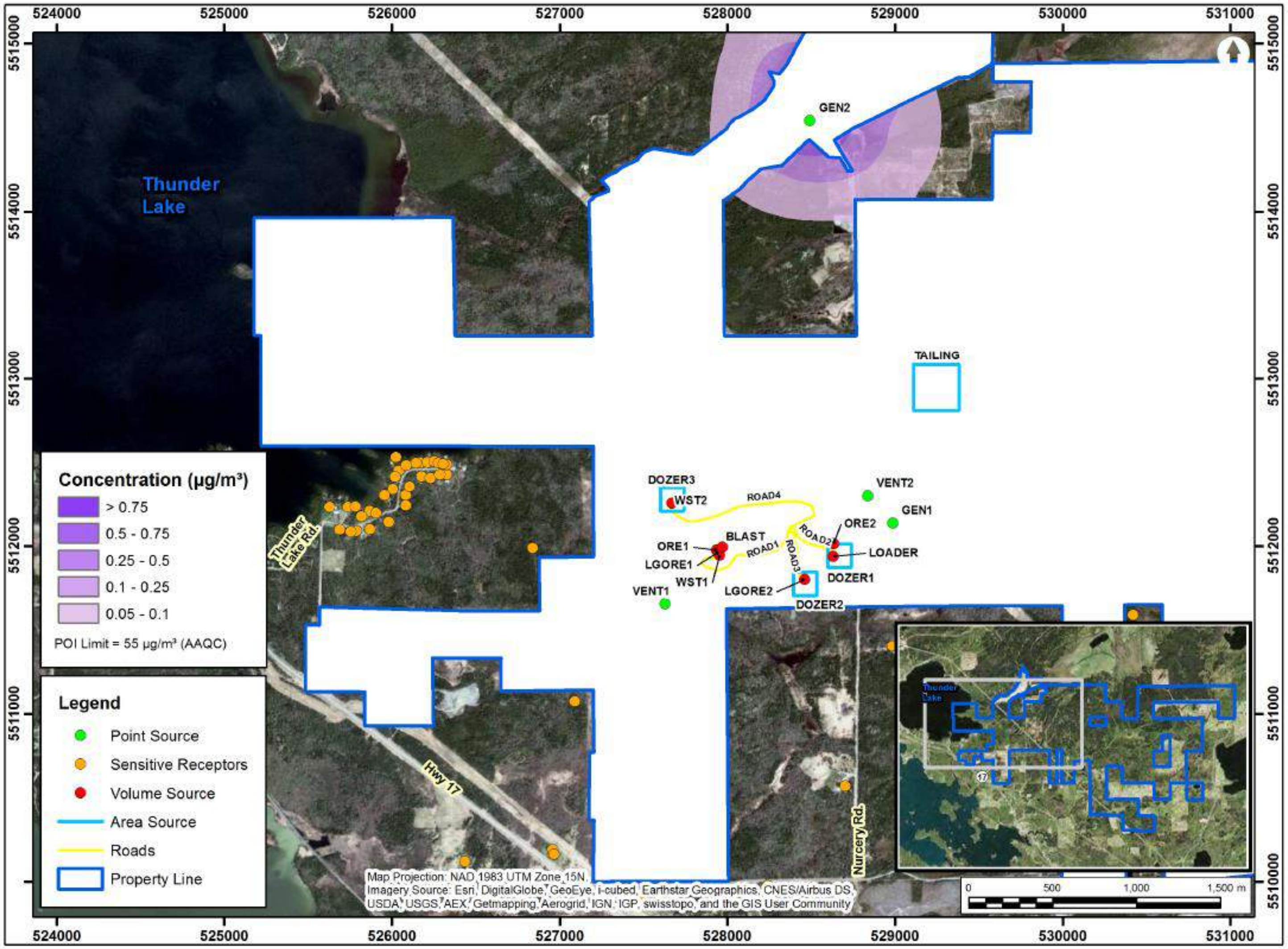

Figure 19: SO_2 Ann Contour Plot (criteria: 55 µg/m³)

7.4 Mitigation

Treasury metals will ensure that best practices are followed during the Operational phase to ensure that air emissions are minimized. These best practices will include:

- Surface drilling will be performed with drilling rigs equipped with dust suppression equipment, such as wet suppression or dry filtration systems;
- Blasting will be conducted in a phased manner that optimizes the amount of explosives needed for a given area to be blasted, and that minimizes the area being blasted;
- Material will be loaded into haul trucks in a manner that minimizes the drop height from the loader or excavator bucket to the bed of the truck (or equivalent bed height as material is loaded into the truck);
- Ensure that all internal combustion engines are properly maintained and all emission control systems (e.g., diesel particulate filters) are in good working order.
- Water and chemical suppressants will be used for dust control on the haul roads is used at the mine site, when temperatures are above freezing. The watering program requires dedicated watering equipment, and enough water must be available and applied to off-set evaporation and maintain a wetted road surface. This program would also be supplemented with applications of an approved dust suppressant as required to minimize fugitive dust emissions.
- The crusher will be located inside a structure that is equipped with a bag-house dust collector to minimize dust from processing.
- A best management practices plan for dust will be implemented on the site to provide specific directions for operations.

7.5 Residual Effects

Residual effects are those that remain when all mitigation options have been incorporated into the project design and operation. As all air quality levels are expected to comply with the applicable criteria, it is not anticipated that there will be residual effects for this site.

7.6 Conclusions

Predicted air quality levels are expected to be below the applicable criteria at each of the receptors for the Operational phase.

8. CLOSURE, DECOMMISSIONING AND RESTORATION

8.1 Description of Continuous Operations

Closure, Decommissioning and Restoration phases will include backfilling and flooding of the open pits and underground mine area, disassembling of infrastructure and equipment as well as overall site maintenance. Many of these activities have the potential for local air quality impacts. The duration of the

Closure, Decommissioning and Restoration phase is estimated to be 2 years. It is conservatively assumed in the assessment of Closure, Decommissioning and Restoration that these activities would take place 24-hours per day, with no change in the nature of the operations during daytime, evening, and nighttime. No blasting would take place during this phase.

8.2 Air Quality Source Summary

The primary air quality sources include movement of waste rock from the waste rock piles to the final rehabilitation area, and placement of that material to achieve the requirements of the closure plan. Material will be loaded onto trucks at the rock pile by excavators, and the trucks will move throughout the site as required. Waste rock will be dumped near the final placement location, where front end loader and dozers will move the material into final position. The expected equipment will include 2 excavators, 6 haul trucks, 2 dozers and 1 front-end loader. Expected emissions are summarized in Table 8, below.

Table 8: Annual Emissions from Closure, Decommissioning and Restoration Phase

Emission Source	Annual Emission Rate (Mg/y)			
	TSP	PM_{10}	$PM_{2.5}$	NO_X
Haul Roads (Including Tailpipe Emissions from Trucks)	551.61	148.49	17.89	56.32
Dozers (Including Tailpipe Emissions)	19.42	3.90	2.60	10.42
Loader (Including Tailpipe Emissions)	0.93	0.69	0.52	15.08
Material Handling (Loading and Unloading Waste Rock)	4.94	2.33	0.35	0.00
Excavator (Tailpipe Emissions)	0.24	0.24	0.24	3.97

8.3 Mitigation

Treasury metals will ensure that best practices are followed during the Closure, Decommissioning and Restoration phase to ensure that sound levels are minimized. These best practices will include:

- Conduct heavy construction activity between the hours of 07:00 and 22:00 if possible;
- Material will be loaded into haul trucks in a manner that minimizes the drop height from the loader or excavator bucket to the bed of the truck (or equivalent bed height as material is loaded into the truck);
- Ensure that all internal combustion engines are properly maintained and all emission control systems (e.g., diesel particulate filters) are in good working order.
- Water and chemical suppressants will be used for dust control on the haul roads is used at the mine site, when temperatures are above freezing. The watering program requires dedicated watering equipment, and enough water must be available and applied to off-set evaporation and maintain a wetted road surface. This program would also be supplemented with applications of an approved dust suppressant as required to minimize fugitive dust emissions.

- A best management practices plan for dust will be implemented on the site to provide specific directions for operations.

8.4 Residual Effects

Residual effects are those that remain when all mitigation options have been incorporated into the project design and operation. As all air quality levels are expected to comply with the applicable criteria, it is not anticipated that there will be residual effects for this site.

8.5 Conclusions

Predicted air quality levels are expected to be below the applicable criteria at each of the receptors for the Closure, Decommissioning and Restoration phase.

9. SUMMARY AND CONCLUSIONS

A systematic approach was adopted to identify potential air emission sources and quantify the emissions due to Project activities at the Goliath Gold site. Best-available data regarding future construction, operations, and decommissioning were collected from Treasury Metals, and used to predict potential air quality impacts due to the Project.

This assessment concentrates on comparisons with published criteria provided by the Canadian and Ontario governments. These criteria are intended to against adverse effect including health, odour, vegetation, soiling, visibility, corrosion or other suitable end-points.

The air quality assessment for the Project indicates that project emissions and the resulting predicted impacts are within the relevant criteria. The contaminant with the highest predicted concentration relative to the criteria was dustfall, which was at 97% of the annual criteria. The reason that there is such a small difference between the monthly maximum deposition and the annual average deposition is that where the maximums occur the dominant source is roadway emissions which are not greatly affected by seasonable variability.

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APPENDIX A

1. GLOSSARY OF TERMS

Ambient Air Quality

State of outdoor air quality from an environmental perspective, usually measured based on concentrations of contaminants in the air.

Air Quality Criteria

Criteria, expressed as objectives and standards, developed by environmental and health authorities to provide guidance for environmental protection decisions. These criteria may be based on the effects of the contaminant on human health, wildlife, vegetation, and aesthetic qualities such as odour or visibility.

Ambient Concentration

Measure of the level of a contaminant in the atmosphere, typically at ground level, expressed as a mass per volume of air (e.g., micrograms per cubic metre) or volume of contaminant per volume of air (e.g., parts per billion).

Area Source

Stationary source of air pollutants that is too small and too numerous to require an authorization under Ministry of Environment laws. In emission inventories, this is a diffuse source of air contaminant emissions or a grouping of sources (e.g., home heating in a residential area). In dispersion modelling, it is treated as a two-dimensional source (or grouping of sources) of diffuse air contaminant emissions that emanates from a broad area (e.g., amalgamated emissions from mobile equipment and/or general activities in an open pit, fugitive dust from stockpiles).

Atmospheric Stability

Measure of resistance to vertical motion in the air.

Background

A single value representing the representative background concentration of a criteria air contaminant.

Baseline

Air quality conditions, in terms of emissions or ambient concentrations, associated with existing sources in the study area including all human-caused and natural sources.

Climate Normals

The arithmetic mean of climatological elements over 30 years used to describe the average climate conditions at a location.

Criteria Air Contaminant

Air contaminants for which Ontario or Canada have ambient air quality criteria (objectives or standards). Criteria air contaminants include total suspended particulates (TSP), particulate matter with a diameter less than 10 microns (PM_{10}), particulate matter with a diameter less than 2.5 microns ($PM_{2.5}$), nitrogen dioxide (NO_2), sulphur dioxide (SO_2) and carbon monoxide (CO).

Deposition

Deposition is the settling of particles or gases onto a surface. Wet and dry deposition refer to the settling with or without precipitation. Typical units for dustfall deposition are milligrams per metre squared per day.

Dispersion

Process by which contaminants emitted from a source mix with ambient air and are transported downwind and thereby decrease in concentration the further they are measured from the source.

Dispersion Modelling

Mathematical simulation of contaminant dispersion in the atmosphere used to predict downwind concentrations of contaminants.

Dustfall

The amount of particulate matter of all size classes that deposit onto a collection surface in a given amount of time.

Emission Inventory

Summary of emission rates of air contaminants from all point, area and mobile sources in a defined area, which could be the property of an industrial facility or a geopolitical boundary.

Emission Rate

The rate at which contaminants are released into the atmosphere from a source such as a stack. Typically expressed as a mass per unit time (e.g. grams per second or tonnes per year).

Emission Factor

Measure of the amount of contaminant discharged into the atmosphere, expressed as a quantity of contaminant released per unit activity associated with the release (e.g., kilograms per tonne of material handled, grams per vehicle kilometres travelled).

Fugitive Dust

Dust released into the atmosphere as a result of the mechanical disturbance of granular material exposed to air.

Heavy-Duty Vehicle

Following the US Environmental Protection Agency's vehicle weight classification, a vehicle with a gross vehicle weight rating exceeding 8,500 lbs.

Light-Duty Vehicle

Following the US Environmental Protection Agency's vehicle weight classification, a vehicle with a gross vehicle weight rating of up to 8,500 lbs.

Maximum Acceptable Objective

Federal air quality objective. This level is intended to provide adequate protection against effects on soil, water, vegetation, materials, visibility, personal comfort and well-being.

Maximum Desirable Objective

Federal air quality objective. This level is the long-term goal for air quality and provides a basis for an anti-degradation policy for the unpolluted parts of the country, and for continuing development of control technology.

Maximum Tolerable Objective

Federal air quality objective. This level denotes time-based concentrations of air contaminants beyond which, due to a diminishing margin of safety, appropriate action is required without delay to protect the health of the general public.

Meteorological Conditions

Prevailing environmental conditions as they influence the prediction of dispersion.

Meteorological Monitoring Data

Monitoring data of various meteorological elements including wind speed, wind direction, temperature, precipitation.

Mixing Height

The height above ground in which the lower atmosphere will undergo mechanical or turbulent mixing, producing a nearly homogenous air mass.

Mobile Source

A non-stationary source of air emissions such as a vehicle, backhoe, tractor, ship, train or airplane; typically associated with transportation, construction or agriculture

Off-Road Transportation

Vehicle movements that do not take place on roads, rail, water, or in the air, for example operation of most on-site construction equipment, snowmobiles, recreational trail quads, and agricultural vehicles. Also classified as 'other mobile sources'.

Oxides of Nitrogen

In the context of the and air quality assessment, the term 'oxides of nitrogen' is used interchangeably with 'nitrogen oxides' (NO_x), referring to nitric oxide (NO) and nitrogen dioxide (NO_2).

Particulate Matter

Complex mixture of extremely small particles and liquid droplets suspended in the Earth's atmosphere.

Percentile

The n^{th} percentile is defined as the value that is greater than or equal to the n% lowest values and equal or less than the (100-n)% highest values. For example, 1% of all data are less than or equal to the 1st percentile. The median is the value that separates the lower and the upper half of all values and therefore is equal to the 50th percentile.

Point Source

In emission inventories, an industrial facility operating under an air quality permit or reporting emissions to a regulatory authority. In dispersion modelling, any single identifiable source of pollution from which contaminants are discharged (e.g., a stack).

Receptor

A discrete point at which ambient concentrations and/or depositions are predicted in a dispersion model. Receptors can be specified as a grid of discrete points over an area or as individual points representing residences and other sensitive receptors.

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Sulphur Oxides (SO_x)

Refers to any of the following classes of sulphur and oxygen containing compounds: lower sulphur oxides (S_nO, S_7O_2, S_6O_2), sulphur monoxide (SO), sulphur dioxide (SO_2), sulphur trioxide (SO_3), and higher sulphur oxides (SO_y, $3<y\leq4$).

Surface Roughness Length

A characteristic length of individual roughness elements that disturb air flow over the Earth's surface. It depends on the characteristics of individual roughness elements (e.g. size, geometry, permeability, and flexibility) and their arrangement relative to the mean wind.

Surface Station

A meteorological monitoring station that measures meteorological elements representative of ground-layer weather conditions, below an inversion.

Topography

Surface shape and features of the Earth.

Total Suspended Particulate

Particles less than approximately 100 microns (µm) in diameter that typically remain suspended in the air for some time.

Volume Source

A three-dimensional source (or grouping of sources) of diffuse air contaminant emissions that emanates from a point (e.g. fugitive dust from an isolated activity, emissions from a specific vent or window).

Wind Rose

A bar chart in polar format used to depict the frequency of occurrence of various wind speed classes and wind directions.

APPENDIX B

Appendix B1: On-Site Mobile Equipment Emissions Spreadsheet - Fugitive Dust for the Mine Construction Phase

Project #1401701

Treasury Metals

UNPAVED ROAD SECTIONS - AP-42 Section 13.2.2
PAVED ROAD SECTIONS - AP-42 Section 13.2.1

Paved Roads: $E = k\,(sL)^{0.91}\,(W)^{1.02}$
Unpaved Roads - Industrial: $E = 281.9\,k\,(s / 12)^{a}\,(W / 3)^{b}$
Unpaved Roads - Public: $E = 281.9\,k\,(s / 12)^{a}\,(S / 30)^{d} / (M / 0.5)^{c} - C$

E particulate emission factor (g/VKT)
k particle size multiplier (see below)
sL road surface silt loading (g/m^2)
W average weight of the vehicles traveling the road (US short tons)
s surface material silt content (%)
C emission factor for 1980's vehicle fleet exhaust, brake wear and tire wear
M surface material moisture content (%)
S mean vehicle speed (mph)
a,b,c,d constants (see below)

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Route ID [1]	Route Description	Traffic Passes [2] Hourly (#/h)	Daily (#/d)	Annual (#/a)	Segment Length [2] (m)	Road Surface [3]	Roadway Type [4]	Mean Vehicle Speed (km/h)	(mph)	Average Vehicle Weight [5] (tons)	Surface Material Moisture Content [6] (%)	Surface Silt Content [7] (%)	Road Surface Silt Loading [8] (g/m^2)	Base AP-42 Emission Factor TSP (g/VKT)	PM_{10} (g/VKT)	$PM_{2.5}$ (g/VKT)	Base Emission Rate TSP (g/s)	PM_{10} (g/s)	$PM_{2.5}$ (g/s)	Additional Control Efficiency Applied (%)	Final Controlled Emission Rate TSP (g/s)	Data Quality Rating	PM_{10} (g/s)	Data Quality Rating	$PM_{2.5}$ (g/s)	Data Quality Rating
ROUTE1	Road from center of mine pit to waste rock stockpile	28			1886	Unpaved	Industrial	25	16	144		5.8%		4.7E+03	1.3E+03	1.3E+02	7.0E+01	1.8E+01	1.8E+00	75%	1.7E+01		4.6E+00		4.6E-01	

Constants for Mobile Emission Equations

Roadway Type	Contaminant	k	a	b	c	d	Quality
Paved Roads:	**$PM_{2.5}$**	0.15	-	-	-	-	-
	PM_{10}	0.62	-	-	-	-	-
	TSP	3.23	-	-	-	-	-
Unpaved Roads - Industrial:	**$PM_{2.5}$**	0.15	0.9	0.45	-	-	C
	PM_{10}	1.5	0.9	0.45	-	-	B
	TSP	4.9	0.7	0.45	-	-	B
Unpaved Roads - Public:	**$PM_{2.5}$**	0.18	1	-	0.2	0.5	C
	PM_{10}	1.8	1	-	0.2	0.5	B
	TSP	6	1	-	0.3	0.3	B

[1] Route ID numbers provided on site plan.
[2] Length of a specific road segment. A separate segment should be used whenever one or more parameters change.
[3] Paved surfaces include asphalt, concrete, and recycled asphalt (if it forms a relatively consistent surface).
[4] Publicly accessible and dominated by light vehicles, or industrial, and dominated by heavy vehicles.
[5] The average vehicle weight reflects the average of the empty and loaded vehicle weight, for travel in both directions.
[6] Required only for publicly accessible unpaved roads.
[7] Required only for unpaved roads (public and industrial).
[8] Required only for industrial paved roads.

Sample calculation for uncontrolled TSP emission factor for Source ROUTE1: Road from center of mine pit to waste rock stockpile

EF = 281.9 x (4.9) x [(5.8% / 12)]^(0.7) x [(144 tons) / 3]^(0.45) = 4740 g TSP / vehicle kilometer travelled (vkt)

Sample calculation for TSP emission rate for Source ROUTE1: Road from center of mine pit to waste rock stockpile

$$\frac{28\ \text{vehicles}}{1\ \text{h}} \times 1886\ \text{m} \times \frac{1\ \text{km}}{1000\ \text{m}} \times \frac{4740\ g_{TSP}}{1\ \text{vehicle km}} \times \frac{1\ \text{h}}{3600\ \text{s}} \times \frac{0.25\ g_{TSP\ uncontrolled}}{1\ g_{TSP}} = 1.7E+01\ g_{TSP} / s$$

Comments
Hourly traffic passes is assuemd to be the same as the mine operation phase for with information was provided by Treasury Metals.

Appendix B2: Summary of Combustion Exhaust Emissions (Mobile and Stationary Sources) for the Mine Construction Phase

Project #1401701

Treasury Metals

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Source ID	Description	Gross Power Rating	Traffic Passes [2]			Segment Length [3]	Mean Vehicle Speed	Load Factor [4]	Tailpipe Emission Factor [5]								Tailpipe Emission Rate				Tailpipe + Fugitive Emission Rate			
			Hourly	Daily	Annual				TSP		PM10		PM2.5		NOx		TSP	PM10	PM2.5	NOx	TSP	PM10	PM2.5	NOx
		(hp)	(#/h)	(#/d)	(#/a)	(m)	(km/h)	(%)	(g/vkt)	(g/hp-h)	(g/vkt)	(g/hp-h)	(g/vkt)	(g/hp-h)	(g/vkt)	(g/hp-h)	(g/s)	(g/s)	(g/s)	(g/s)	(g/s)	(g/s)	(g/s)	(g/s)
On-Site Mobile Equipment																								
ROUTE1	Road from center of mine pit to wast	739	28			1886	25	58%	--	0.15	--	0.15	--	0.15	--	2.5	1.1E-01	1.1E-01	1.1E-01	1.8E+00	1.7E+01	4.7E+00	5.7E-01	1.8E+00
DOZER1	Dozer 1	410						58%	--	0.15	--	0.15	--	0.15	--	2.5	9.9E-03	9.9E-03	9.9E-03	1.7E-01	3.1E-01	6.2E-02	4.1E-02	1.7E-01
DOZER2	Dozer 2	410						58%	--	0.15	--	0.15	--	0.15	--	2.5	9.9E-03	9.9E-03	9.9E-03	1.7E-01	3.1E-01	6.2E-02	4.1E-02	1.7E-01
LOADER	Loader	2000						21%	--	0.1316	--	0.1316	--	0.1316	--	4.1	1.5E-02	1.5E-02	1.5E-02	4.8E-01	[6]	[6]	[6]	4.8E-01
EXCAVATOR	Excavator	432						21%	--	0.15	--	0.15	--	0.15	--	2.5	3.8E-03	3.8E-03	3.8E-03	6.3E-02	3.8E-03	3.8E-03	3.8E-03	6.3E-02

[1] ID should reflect Source ID or Route ID, as approprite.
[2] Where applicable, this value reflects travel in both directions (e.g., 1 round-trip = 2 passes)
[3] Length of a specific road segment. A separate segment should be used whenever one or more parameters change.
[4] Load Factors from "Median Life, Annual Activity, and Load Factor Values for Nonroad Engine Emissions Modeling", EPA-420-R-10-016, NR-005d, July 2010
[5] Emissions are input on either a vehicle distance or power rating basis. Load factor applies only to emissions based on power ratings.
[6] Please see Appendix B3 for fugitive emissions from loader operations.

Comments
All vehicles are assumed to be year 2010 models.
Mine trucks assumed to be Komatsu HD465-7 with 55 tonne payload and meeting Tier 3 emission standards
CAT D9 Dozers are assumed to meet Tier 3 emission standards
Loader assumed to be LeTourneau L-1850 and meeting Tier 2 emission standards
Excavator is CAT 349E L hydraulic excavator meeting Tier 3 emission standards
PM10 and PM2.5 tailpipe emissions assumed to be same as TSP emissions

<u>Sample Calculations</u>

Pit Loader Exhaust TSP Emissions:

410 kW	0.15 g	58% Load	1 h		
	1 kW h		3600 s	=	1.0E-02 g_{TSP} / s

Highway Truck Exhaust TSP Emissions:
(10 Rd East)

28 Vehicles	1886 m	-- g	1 km	1 h		
1 h		1 Veh. Km	1000 m	3600 s	=	#VALUE! g_{TSP} / s

Appendix B3: Bulk Material Handling Emissions Spreadsheet for the Mine Construction Phase

Project #1401701

Treasury Metals

AGGREGATE HANDLING AND STORAGE PILES - AP-42 Section 13.2.4

Average recorded hourly wind speed (m/s): 4.1
(used for sample calculations & factor validation)

Material handling emissions: $E = 0.0016\ k\ (U / 2.2)^{1.3} / (M / 2)^{1.4}$

E emission factor
k particle size multiplier (0.74, 0.35 and 0.053 for TSP, PM_{10} and $PM_{2.5}$)
U mean wind speed, meters per second (m/s)
M material moisture content (%)

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Source ID [1]	Description	Processing Rate			Site Data				Base AP-42 Emission Factor			Base Emission Rate			Additional Control Efficiency Applied	Final Controlled Emission Rate at 4.1 m/s					
		Hourly (Mg/h)	Daily (Mg/d)	Annual (Mg/y)	Site Specific Data? (y/n)	Silt Content (%)	Moisture Content (%)	Source Conditions Valid [2]	TSP (kg/Mg)	PM_{10} (kg/Mg)	$PM_{2.5}$ (kg/Mg)	TSP (g/s)	PM_{10} (g/s)	$PM_{2.5}$ (g/s)	(%)	TSP (g/s)	Data Quality Rating	PM_{10} (g/s)	Data Quality Rating	$PM_{2.5}$ (g/s)	Data Quality Rating
WST1	Loading truckswith waste rock	1111			y		10.0%	silt too low	2.8E-04	1.3E-04	2.0E-05	8.6E-02	4.1E-02	6.2E-03		8.6E-02	B	4.1E-02	B	6.2E-03	B
WST2	unloading waste rock from trucks	1111			y		10.0%	silt too low	2.8E-04	1.3E-04	2.0E-05	8.6E-02	4.1E-02	6.2E-03		8.6E-02	B	4.1E-02	B	6.2E-03	B
LOADER	front end loader	200			y		10.0%	silt too low	2.8E-04	1.3E-04	2.0E-05	1.6E-02	7.3E-03	1.1E-03		1.6E-02	B	7.3E-03	B	1.1E-03	B

[1] ID corresponds to process flow diagram for facility and / or material
[2] Relates to AP-42 Section 13.2.4-4

Comments
Moisture content provided by Treasury Metals. Hourly processing rates assumed to be the same as the mine operation phase.

Sample calculation for uncontrolled TSP emission factor for Source WST1: Loading truckswith waste rock, at a sample wind speed of 4.1 m/s

EF = 0.0016 x (0.74) x ((4.1 m/s) / 2.2)^1.3 / ((10%) / 2)^1.4 = 2.8E-04 kg TSP / Mg handled

Sample calculation for TSP emission rate for Source WST1: Loading truckswith waste rock, at a sample wind speed of 5 m/s

$$\frac{1111\ Mg_{handled}}{1\ h} \times \frac{2.8E\text{-}04\ kg_{TSP}}{1\ Mg_{handled}} \times \frac{1\ h}{3600\ s} \times \frac{1000\ g_{TSP}}{1\ kg_{TSP}} \times \frac{1\ g_{TSP\ uncontrolled}}{1\ g_{TSP}} = 8.6E\text{-}02\ g_{TSP} / s$$

Appendix B4: Blasting Operations Emission Spreadsheet for the Mine Construction Phase

Project #1401701

Treasury Metals

WESTERN SURFACE COAL MINING - AP-42 Section 11.9
EXPLOSIVES DETONATION - AP-42 Section 13.3

Blasting operation particulate emissions: $E = 0.00022\ k * A^{1.5}$

E emission factor
k particle size multiplier (1, 0.52 and 0.03 for TSP, PM_{10} and $PM_{2.5}$)
A blast surface area (m^2)

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Soource ID	Source Description	Total Blast Area (m^2)	Shot Size (Charge) (Mg)	Explosive Type	Number of Blasts			Base AP-42 Emission Factor				Base Emission Rate				Additional Control Efficiency Applied (%)	Final Controlled Emission Rate							
					Hourly	Daily	Annual	TSP (kg/blast)	PM_{10} (kg/blast)	$PM_{2.5}$ (kg/blast)	NOx [1] (kg/Mg_{expl})	TSP (g/s)	PM_{10} (g/s)	$PM_{2.5}$ (g/s)	NOx (g/s)		TSP (g/s)	Data Quality Rating	PM_{10} (g/s)	Data Quality Rating	$PM_{2.5}$ (g/s)	Data Quality Rating	NOx (g/s)	Data Quality Rating
BLAST	Blasting once a day at 1 pm	2500	0.025	ANFO	1	1	1	2.8E+01	1.4E+01	8.3E-01	8.0E+00	7.6E+00	4.0E+00	2.3E-01	5.6E-02	75%	1.9E+00	C	9.9E-01	C	5.7E-02	C	5.6E-02	D

[1] NOx emission factor taken directly from AP-42 Chapter 13.3, based on type of explosive used. Provided in kg of NOx per Mg of explosive charge used.

<u>Sample calculation for uncontrolled TSP emission factor for Source BLAST: Blasting once a day at 1 pm.</u>

EF = 0.00022 x (1) x (2500 m)^1.5 = 2.8E+01 kg TSP / blast

<u>Sample calculation for TSP emission rate for Source BLAST: Blasting once a day at 1 pm.</u>

$$\frac{1\ \text{blast}}{1\ \text{h}} \times \frac{2.8E+01\ kg_{TSP}}{1\ \text{blast}} \times \frac{1\ \text{h}}{3600\ \text{s}} \times \frac{1000\ g_{TSP}}{1\ kg_{TSP}} \times \frac{0.25\ g_{TSP\ uncontrolled}}{1\ g_{TSP}} = 1.9E+00\ g_{TSP} / s$$

<u>Sample calculation for NOx uncontrolled emission factor for Source BLAST: Blasting once a day at 1 pm.</u>

$$\frac{0.025\ Mg_{explosive}}{1\ \text{blast}} \times \frac{1\ \text{blast}}{1\ \text{h}} \times \frac{8.0E+00\ kg_{NOx}}{1\ Mg_{explosive}} \times \frac{1\ \text{h}}{3600\ \text{s}} \times \frac{1000\ g_{NOx}}{1\ kg_{NOx}} = 5.6E-02\ g_{NOx} / s$$

Comments

It is assumed that blasting during the mine construction phase will be undertaken at a ratio of 25% of the mine operation phase. The blasting emissions for the mine construction phase was calculated by applying a 75% control efficiency emissions using the parameters provided for the mine operation phase.

Appendix B5: Bulldozing Emissions Spreadsheet for the Mine Construction Phase

Project #1401701

Treasury Metals

WESTERN SURFACE COAL MINING - AP-42 Section 11.9

Emission Factors for Overburden Bulldozing:

$TSP = 2.6(s)^{1.2}/(M)^{1.3}$ kg/h

$PM10 = 0.75 * 0.45(s)^{1.5}/(M)^{1.4}$ kg/h

$PM2.5 = 0.105 * TSP$

s silt content (%) **M** moisture content (%)

It has been assumed that overburden bulldozing emission factors from AP-42 Section 11.9, Western Surface Coal Mining applies to bulldozing of both waste rock and ore at Goliath Gold Mine

Description	Value	Unit	Comments
Number of dozers	2		2 dozers clearing overburden
Annual operating hrs per unit	8,760	h	Dozers operate 24/7
Silt content	5.8	%	Mean haul road silt content for Taconite mining and processing Table 13.2.2-1 US EPA AP 42 Chapter 13.2.2 Unpaved Roads
Moisture content	10	%	Provided by Tresury Metals

Summary of Bulldozing Emissions

Emissions	TSP	PM10	PM2.5
Annual Emissions (t/y)	19	3	2
Max Hourly Emission Rate (g/s)	0.60	0.10	0.06
Max Hourly Emission Rate per Dozer (g/s)	0.30	0.05	0.03

Appendix B6: On-Site Mobile Equipment Emissions Spreadsheet - Fugitive Dust for the Mine Operation Phase

Project #1401701

Treasury Metals

UNPAVED ROAD SECTIONS - AP-42 Section 13.2.2
PAVED ROAD SECTIONS - AP-42 Section 13.2.1

Paved Roads: $E = k\ (sL)^{0.91}\ (W)^{1.02}$
Unpaved Roads - Industrial: $E = 281.9\ k\ (s / 12)^{a}\ (W / 3)^{b}$
Unpaved Roads - Public: $E = 281.9\ k\ (s / 12)^{a}\ (S / 30)^{d} / (M / 0.5)^{c} - C$

E particulate emission factor (g/VKT)
k particle size multiplier (see below)
sL road surface silt loading (g/m^2)
W average weight of the vehicles traveling the road (US short tons)
s surface material silt content (%)
C emission factor for 1980's vehicle fleet exhaust, brake wear and tire wear
M surface material moisture content (%)
S mean vehicle speed (mph)
a,b,c,d constants (see below)

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Route ID [1]	Route Description	Traffic Passes [2] Hourly (#/h)	Daily (#/d)	Annual (#/a)	Segment Length [2] (m)	Road Surface [3]	Roadway Type [4]	Mean Vehicle Speed (km/h)	(mph)	Average Vehicle Weight [5] (tons)	Surface Material Moisture Content [6] (%)	Surface Silt Content [7] (%)	Road Surface Silt Loading [8] (g/m^2)	Base AP-42 Emission Factor TSP (g/VKT)	PM_{10} (g/VKT)	$PM_{2.5}$ (g/VKT)	Base Emission Rate TSP (g/s)	PM_{10} (g/s)	$PM_{2.5}$ (g/s)	Additional Control Efficiency Applied (%)	Final Controlled Emission Rate TSP (g/s)	Data Quality Rating	PM_{10} (g/s)	Data Quality Rating	$PM_{2.5}$ (g/s)	Data Quality Rating
ROAD1	Road from mine pit	28			752	Unpaved	Industrial	25	16	144		5.8%		4.7E+03	1.3E+03	1.3E+02	2.8E+01	7.3E+00	7.3E-01	75%	6.9E+00		1.8E+00		1.8E-01	
ROAD2	Road to Crusher	4			313	Unpaved	Industrial	25	16	144		5.8%		4.7E+03	1.3E+03	1.3E+02	1.6E+00	4.4E-01	4.4E-02	75%	4.1E-01		1.1E-01		1.1E-02	
ROAD3	Road to Low Grade Stockpile	4			297	Unpaved	Industrial	25	16	144		5.8%		4.7E+03	1.3E+03	1.3E+02	1.6E+00	4.1E-01	4.1E-02	75%	3.9E-01		1.0E-01		1.0E-02	
ROAD4	Road to Waste Rock Stockpile	20			1134	Unpaved	Industrial	25	16	144		5.8%		4.7E+03	1.3E+03	1.3E+02	3.0E+01	7.9E+00	7.9E-01	75%	7.5E+00		2.0E+00		2.0E-01	

Constants for Mobile Emission Equations

Roadway Type	Contaminant	k	a	b	c	d	Quality
Paved Roads:	$PM_{2.5}$	0.15	-	-	-	-	-
	PM_{10}	0.62	-	-	-	-	-
	TSP	3.23	-	-	-	-	-
Unpaved Roads - Industrial:	$PM_{2.5}$	0.15	0.9	0.45	-	-	C
	PM_{10}	1.5	0.9	0.45	-	-	B
	TSP	4.9	0.7	0.45	-	-	B
Unpaved Roads - Public:	$PM_{2.5}$	0.18	1	-	0.2	0.5	C
	PM_{10}	1.8	1	-	0.2	0.5	B
	TSP	6	1	-	0.3	0.3	B

[1] Route ID numbers provided on site plan.
[2] Length of a specific road segment. A separate segment should be used whenever one or more parameters change.
[3] Paved surfaces include asphalt, concrete, and recycled asphalt (if it forms a relatively consistent surface).
[4] Publicly accessible and dominated by light vehicles, or industrial, and dominated by heavy vehicles.
[5] The average vehicle weight reflects the average of the empty and loaded vehicle weight, for travel in both directions.
[6] Required only for publicly accessible unpaved roads.
[7] Required only for unpaved roads (public and industrial).
[8] Required only for industrial paved roads.

Sample calculation for uncontrolled TSP emission factor for Source ROAD1: Road from mine pit

EF = 281.9 x (4.9) x [(5.8% / 12)]^(0.7) x [(144 tons) / 3]^(0.45) = 4740 g TSP / vehicle kilometer travelled (vkt)

Sample calculation for TSP emission rate for Source ROAD1: Road from mine pit

$$\frac{28\text{ vehicles}}{1\text{ h}} \times 752\text{ m} \times \frac{1\text{ km}}{1000\text{ m}} \times \frac{4740\ g_{TSP}}{1\text{ vehicle km}} \times \frac{1\text{ h}}{3600\text{ s}} \times \frac{0.25\ g_{TSP\ uncontrolled}}{1\ g_{TSP}} = 6.9E+00\ g_{TSP} / s$$

Comments

Hourly passes, weight of truck and payload received from Treasury Metals. Surface silt content taken from AP-42 Table 13.2.2-1 - Mean silt content for Taconite mining and processing haul road to/from pit

Appendix B7: Summary of Combustion Exhaust Emissions (Mobile Sources) for the Mine Operation Phase

Project #1401701

Treasury Metals

Input Required
Calculated Value / Do Not Edit
Comment required
Table Heading (do not edit)

Source ID	Description	Gross Power Rating (hp)	Traffic Passes [2] Hourly (#/h)	Daily (#/d)	Annual (#/a)	Segment Length [3] (m)	Mean Vehicle Speed (km/h)	Load Factor [4] (%)	BSFC [5] (lb/hp - hr)	Tailpipe Emission Factor [6] [7] TSP (g/vkt)	TSP (g/hp-h)	PM10 (g/vkt)	PM10 (g/hp-h)	PM2.5 (g/vkt)	PM2.5 (g/hp-h)	NOx (g/vkt)	NOx (g/hp-h)	CO (g/vkt)	CO (g/hp-h)	SO2 (g/hp-h)	Tailpipe Emission Rate TSP (g/s)	PM10 (g/s)	PM2.5 (g/s)	NOx (g/s)	CO (g/s)	SO2 (g/s)
On-Site Mobile Equipment																										
ROAD	All mine trucks on haul roads	739	28			752	25	58%	0.367	--	0.15	--	0.15	--	0.15	--	2.5	--	1.3	0.002	8.9E-02	8.9E-02	8.9E-02	1.5E+00	7.9E-01	5.1E-04
DOZER1	Dozer at ore dump	410						58%	0.367	--	0.15	--	0.15	--	0.15	--	2.5	--	0.8	0.002	9.9E-03	9.9E-03	9.9E-03	1.7E-01	5.6E-02	2.8E-04
DOZER2	Dozer at low grade stockpile	410						58%	0.367	--	0.15	--	0.15	--	0.15	--	2.5	--	0.8	0.002	9.9E-03	9.9E-03	9.9E-03	1.7E-01	5.6E-02	2.8E-04
DOZER3	Dozer at waste rock stockpile	410						58%	0.367	--	0.15	--	0.15	--	0.15	--	2.5	--	0.8	0.002	9.9E-03	9.9E-03	9.9E-03	1.7E-01	5.6E-02	2.8E-04
LOADER	Loader at ore crusher	2000						21%	0.367	--	0.1316	--	0.1316	--	0.1316	--	4.1	--	0.7642	0.002	1.5E-02	1.5E-02	1.5E-02	4.8E-01	8.9E-02	1.4E-03
EXCAVATOR	Excavator to load trucks in mine pit	432						21%	0.367	--	0.15	--	0.15	--	0.15	--	2.5	--	0.8	0.002	3.8E-03	3.8E-03	3.8E-03	6.3E-02	2.1E-02	3.0E-04

[1] ID should reflect Source ID or Route ID, as approprite.
[2] Where applicable, this value reflects travel in both directions (e.g., 1 round-trip = 2 passes)
[3] Length of a specific road segment. A separate segment should be used whenever one or more parameters change.
[4] Load Factors from "Median Life, Annual Activity, and Load Factor Values for Nonroad Engine Emissions Modeling", EPA-420-R-10-016, NR-005d, July 2010
[5] Brake Specific Fuel Consumption from Table A2 of "Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling - Compression Ignition", EPA420-P-04-009
[6] Emissions are input on either a vehicle distance or power rating basis. Load factor applies only to emissions based on power ratings.
[7] Emissions are input power rating basis. Emission factors from Table A2 of "Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling - Compression Ignition", EPA420-P-04-009
[8] SO2 emissions based on fuel consumption by each piece of equipment per hour, sulphur content in diesel fuel and assumption that all sulphur is converted to SO2.
[9] Sulphur content in diesel for off-road engines is 0.0015% as per https://www.ec.gc.ca/energie-energy/default.asp?lang=En&n=7A8F92ED-1

Comments

All vehicles are assumed to be year 2010 models.
Five trucks are assumed to be in operation at any given time
Mine trucks assumed to be Komatsu HD465-7 with 55 tonne payload and meeting Tier 3 emission standards
CAT D9 Dozers are assumed to meet Tier 3 emission standards
Loader assumed to be LeTourneau L-1850 and meeting Tier 2 emission standards
Shovel is CAT 349E L hydraulic excavator meeting Tier 3 emission standards
PM10 and PM2.5 emissions assumed to be same as TSP emissions
Sulphur content in diesel = 0.0015%

<u>Sample Calculations</u>

Mine truck TSP Emissions (per vehicle):

$$\frac{739\ \text{kW}}{} \times \frac{0.15\ \text{g}}{1\ \text{kW h}} \times \frac{58\%\ \text{Load}}{} \times \frac{1\ \text{h}}{3600\ \text{s}} = 1.8\text{E-02}\ g_{TSP}\ /\ \text{s}$$

Mine truck TSP Emissions (for all 5 vehicles):

$$\frac{1.8\text{E-02}\ g_{TSP}}{\text{s}} \times 5\ \text{Trucks} = 9.0\text{E-02}$$

Appendix B8: Bulk Material Handling Emissions Spreadsheet for the Mine Operation phase

Project #1401701

Treasury Metals

AGGREGATE HANDLING AND STORAGE PILES - AP-42 Section 13.2.4

Average recorded hourly wind speed (m/s): 4.1
(used for sample calculations & factor validation)

Material handling emissions: $E = 0.0016\ k\ (U / 2.2)^{1.3} / (M / 2)^{1.4}$

E emission factor
k particle size multiplier (0.74, 0.35 and 0.053 for TSP, PM_{10} and $PM_{2.5}$)
U mean wind speed, meters per second (m/s)
M material moisture content (%)

Input Required
Calculated Value / Do Not Edit
Comment required
Table Heading (do not edit)

Source ID [1]	Description	Processing Rate: Hourly (Mg/h)	Processing Rate: Daily (Mg/d)	Processing Rate: Annual (Mg/y)	Site Data: Site Specific Data? (y/n)	Site Data: Silt Content (%)	Site Data: Moisture Content (%)	Site Data: Source Conditions Valid [2]	Base AP-42 Emission Factor: TSP (kg/Mg)	Base AP-42 Emission Factor: PM_{10} (kg/Mg)	Base AP-42 Emission Factor: $PM_{2.5}$ (kg/Mg)	Base Emission Rate: TSP (g/s)	Base Emission Rate: PM_{10} (g/s)	Base Emission Rate: $PM_{2.5}$ (g/s)	Additional Control Efficiency Applied (%)	Final Controlled Emission Rate at 4.1 m/s: TSP (g/s)	Data Quality Rating	PM_{10} (g/s)	Data Quality Rating	$PM_{2.5}$ (g/s)	Data Quality Rating
ORE1	Loading trucks with ore	113			y		10.0%	silt too low	2.8E-04	1.3E-04	2.0E-05	8.8E-03	4.1E-03	6.3E-04		8.8E-03	B	4.1E-03	B	6.3E-04	B
LGORE1	Loading trucks with low grade ore	113			y		10.0%	silt too low	2.8E-04	1.3E-04	2.0E-05	8.8E-03	4.1E-03	6.3E-04		8.8E-03	B	4.1E-03	B	6.3E-04	B
WST1	Loading trucks with waste rock	1111			y		10.0%	silt too low	2.8E-04	1.3E-04	2.0E-05	8.6E-02	4.1E-02	6.2E-03		8.6E-02	B	4.1E-02	B	6.2E-03	B
ORE2	Unloading ore at crusher	113			y		10.0%	silt too low	2.8E-04	1.3E-04	2.0E-05	8.8E-03	4.1E-03	6.3E-04		8.8E-03	B	4.1E-03	B	6.3E-04	B
LGORE2	Unloading low grade ore at low grade stock	113			y		10.0%	silt too low	2.8E-04	1.3E-04	2.0E-05	8.8E-03	4.1E-03	6.3E-04		8.8E-03	B	4.1E-03	B	6.3E-04	B
WST2	Unloading waste rock	1111			y		10.0%	silt too low	2.8E-04	1.3E-04	2.0E-05	8.6E-02	4.1E-02	6.2E-03		8.6E-02	B	4.1E-02	B	6.2E-03	B
LOADER	Front end loader at crusher	135			y		10.0%	silt too low	2.8E-04	1.3E-04	2.0E-05	1.0E-02	5.0E-03	7.5E-04		1.0E-02	B	5.0E-03	B	7.5E-04	B

[1] ID corresponds to process flow diagram for facility and / or material
[2] Relates to AP-42 Section 13.2.4-4

Comments

Moisture content and hourly processing rates provided by Treasury Metals
Hourly emission file based on hourly wind data prepared for dispersion modelling

Sample calculation for uncontrolled TSP emission factor for Source ORE1: Loading trucks with ore, at a sample wind speed of 3.7 m/s

EF = 0.0016 x (0.74) x ((4.1 m/s) / 2.2)^1.3 / ((10%) / 2)^1.4 = 2.8E-04 kg TSP / Mg handled

Sample calculation for TSP emission rate for Source ORE1: Loading trucks with ore, at a sample wind speed of 5 m/s

$$\frac{113\ Mg_{handled}}{1\ h} \times \frac{2.8E\text{-}04\ kg_{TSP}}{1\ Mg_{handled}} \times \frac{1\ h}{3600\ s} \times \frac{1000\ g_{TSP}}{1\ kg_{TSP}} \times \frac{1\ g_{TSP\ uncontrolled}}{1\ g_{TSP}} = 8.8E\text{-}03\ g_{TSP} / s$$

Appendix B9: Blasting Operations Emission Spreadsheet for the Mine Operation Phase

Project #1401701

Treasury Metals

WESTERN SURFACE COAL MINING - AP-42 Section 11.9
EXPLOSIVES DETONATION - AP-42 Section 13.3

Blasting operation particulate emissions: $E = 0.00022\ k * A^{1.5}$

E emission factor
k particle size multiplier (1, 0.52 and 0.03 for TSP, PM_{10} and $PM_{2.5}$)
A blast surface area (m^2)

Input Required
Calculated Value / Do Not Edit
Comments
Table Heading (do not edit)

Soource ID	Source Description	Total Blast Area (m^2)	Shot Size (Charge) (Mg)	Explosive Type	Number of Blasts: Hourly	Daily	Annual	Base AP-42 Emission Factor: TSP (kg/blast)	PM_{10} (kg/blast)	$PM_{2.5}$ (kg/blast)	NOx [1] (kg/Mg_{expl})	Base Emission Rate: TSP (g/s)	PM_{10} (g/s)	$PM_{2.5}$ (g/s)	NOx (g/s)	Additional Control Efficiency Applied (%)	Final Controlled Emission Rate: TSP (g/s)	Data Quality Rating	PM_{10} (g/s)	Data Quality Rating	$PM_{2.5}$ (g/s)	Data Quality Rating	NOx (g/s)	Data Quality Rating
BLAST	Blasting once a day at 1 pm	2500	0.025	ANFO	1	1	1	2.8E+01	1.4E+01	8.3E-01	8.0E+00	7.6E+00	4.0E+00	2.3E-01	5.6E-02		7.6E+00	C	4.0E+00	C	2.3E-01	C	5.6E-02	D

[1] NOx emission factor taken directly from AP-42 Chapter 13.3, based on type of explosive used. Provided in kg of NOx per Mg of explosive charge used.

Sample calculation for uncontrolled TSP emission factor for Source BLAST: Blasting once a day at 1 pm.

EF = 0.00022 x (1) x (2500 m)^1.5 = 2.8E+01 kg TSP / blast

Sample calculation for TSP emission rate for Source BLAST: Blasting once a day at 1 pm.

$$\frac{1\ \text{blast}}{1\ \text{h}} \times \frac{2.8E{+}01\ kg_{TSP}}{1\ \text{blast}} \times \frac{1\ \text{h}}{3600\ \text{s}} \times \frac{1000\ g_{TSP}}{1\ kg_{TSP}} \times \frac{1\ g_{TSP\ uncontrolled}}{1\ g_{TSP}} = 7.6E{+}00\ g_{TSP} / s$$

Sample calculation for NOx uncontrolled emission factor for Source BLAST: Blasting once a day at 1 pm.

$$\frac{0.025\ Mg_{explosive}}{1\ \text{blast}} \times \frac{1\ \text{blast}}{1\ \text{h}} \times \frac{8.0E{+}00\ kg_{NOx}}{1\ Mg_{explosive}} \times \frac{1\ \text{h}}{3600\ \text{s}} \times \frac{1000\ g_{NOx}}{1\ kg_{NOx}} = 5.6E{-}02\ g_{NOx} / s$$

Comments
Total blast area, number of holes and charge per hole provide by Treasury Metals

Appendix B10: Bulldozing Emissions Spreadsheet for the Mine Operation Phase

Project #1401701

Treasury Metals

WESTERN SURFACE COAL MINING - AP-42 Section 11.9

Emission Factors for Overburden Bulldozing:

$TSP = 2.6(s)^{1.2}/(M)^{1.3}$ kg/h

$PM10 = 0.75 * 0.45(s)^{1.5}/(M)^{1.4}$ kg/h

$PM2.5 = 0.105 * TSP$

s silt content (%)　　**M** moisture content (%)

It has been assumed that overburden bulldozing emission factors from AP-42 Section 11.9, Western Surface Coal Mining applies to bulldozing of both waste rock and ore at Goliath Gold Mine

Description	Value	Unit	Comments
Number of dozers	3		1 dozer operating at dumps and sometimes in pit
Annual operating hrs per unit	8,760	h	Dozers operate 24/7
Silt content	5.8	%	Mean haul road silt content for Taconite mining and processing Table 13.2.2-1 US EPA AP 42 Chapter 13.2.2 Unpaved Roads
Moisture content	10	%	Provided by Tresury Metals

Summary of Bulldozing Emissions

Emissions	**TSP**	**PM10**	**PM2.5**
Annual Emissions (t/y)	28.2	4.9	3.0
Max Hourly Emission Rate (g/s)	0.90	0.16	0.09
Max Hourly Emission Rate per Dozer (g/s)	0.30	0.05	0.03

Appendix B11: Wind Erosion of Tailings Spreadsheet for the Mine Operation Phase

Project #1401701

Treasury Metals

Emission of Fine Grained Particulates from Desert Soils, W.G. Nickling and J. A. Gillies

Equation 15 - Mine Tailings

Erosion from Tailings: F = 1.59 * 10^-12 * U*^2.93 (g/cm² s)

F Soil flux in g/cm² s

U^* Friction velocity (cm/s)

Friction velocity at tailings can be calculated from Prandtls' equation as follows

$U^* = k * U_{10} / \ln(z/z_o)$

Where:

k = Von Karman Constant, 0.4

U_{10} = Velocity at length z

z = 10m above ground

z_o = Roughness length of the surface

U_{10} will be obtained from MOE meteorological data

z_o is assumed to be average of the roughness lengths of the two tailings sites in Emission of Fine Grained Particulates from Desert Soils, W.G. Nickling and J. A. Gillies

z_o = 0.016 cm

Wind erosion of tailings occurs when wind speed is above threshold velocity U^*_t

U^*_t is assumed to be average of the threshold velocities for the two tailings sites in Emission of Fine Grained Particulates from Desert Soils, W.G. Nickling and J. A. Gillies

U^*_t = 0.2 m/s

Sample Calculation: with an assumed velocity of 10 m/s at 10m above ground

Description	Value	Unit	Comments
Dry Unvegetated Tailings area at Goliath Gold Mine	75000	m²	Provided by Treasury Metals. Unvegetated area is 10% of total tailings area
Unvegetated dry tailings area at Goliath Gold Mine	750,000,000	cm²	
Friction velocity	0.36	m/s	Using Prandtl's equation
Soil flux	5.88E-08	g/cm² s	
Emission rate	44.08	g/s	Wind erosion emission rate from unvegetated tailings area

Note:

[1] Hourly emission file prepared based on hourly AERMET wind speeds

Appendix B12: Combustion Spreadsheet (Stationary Combustion)   RWDI Project #1401701

RWDI Project Name:	Treasury Metals
RWDI Project Number:	1401701
Manufacturer:	
Engine Model:	

Parameter	Units	Value
Engine Fuel		Diesel
Fuel Heating Value	(Btu/gal)	137000
Stroke Cycle		4-Stroke
Engine Loading	(%)	
Burn Style		Lean
NOx Controlled?		No

Rating (enter one set of units)	Units	Value
Electrical Power Output (kW)	(kW)	500
Generator Transfer Efficiency	(%)	90
Engine Combustion Efficiency	(%)	
Calculated Engine Output	(hp)	744
	(kW)	556
	(hp)	744.444
Calculated Engine Input	(hp)	

Manufacturer Emissions Data	Units	Factor
Oxides of Sulphur (SOx)	(g/hp-hr)	
Oxides of Nitrogen (NO_x)	(g/hp-hr)	
Carbon Monoxide (CO)	(g/hp-hr)	
PM	(g/hp-hr)	
Source:		

Fuel Sulphur Information	Units	Value
Natural Gas Sulphur Content	(%)	
Fuel Oil Sulphur Content	(%)	0.0015

Exhaust Temperature	Units	Value
Exhaust Temperature (ºC)	(ºC)	
Calculated Exit Temperature	(K)	273
Exhaust Flow Rate	cfm	
	m³/s	

Emission Factors	Emission Factor		Data	Source of Emission Factor	Emission Rate	
	Valule	Units	Quality		Valule	Units
Oxides of Sulphur (SOx)	1.2135E-05	(lb/hp-hr)	B	AP 42 (10/1996) Ch 3.4, Tables 3.4-1	1.14E-03	g/s
Oxides of Nitrogen (NOx)	0.024	(lb/hp-hr)	B	AP 42 (10/1996) Ch 3.4, Tables 3.4-1	2.25E+00	g/s
Carbon Monoxide (CO)	0.0055	(lb/hp-hr)	C	AP 42 (10/1996) Ch 3.4, Tables 3.4-1	5.16E-01	g/s
Total Particulate Matter (TSP)	0.0007	(lb/hp-hr)	B	AP 42 (10/1996) Ch 3.4, Tables 3.4-1	6.57E-02	g/s

Appendix B13: Combustion Spreadsheet (Stationary Combustion)

RWDI Project #1401701

RWDI Project Name:	Treasury Metals
RWDI Project Number:	1401701
Manufacturer:	
Engine Model:	

Parameter	Units	Value
Engine Fuel		Diesel
Fuel Heating Value	(Btu/gal)	137000
Stroke Cycle		4-Stroke
Engine Loading	(%)	
Burn Style		Lean
NOx Controlled?		No

Manufacturer Emissions Data	Units	Factor
Oxides of Sulphur (SOx)	(g/hp-hr)	
Oxides of Nitrogen (NO_x)	(g/hp-hr)	
Carbon Monoxide (CO)	(g/hp-hr)	
PM	(g/hp-hr)	
Source:		

Fuel Sulphur Information	Units	Value
Natural Gas Sulphur Content	(%)	
Fuel Oil Sulphur Content	(%)	0.0015

Rating (enter one set of units)	Units	Value
Electrical Power Output (kW)	(kW)	150
Generator Transfer Efficiency	(%)	90
Engine Combustion Efficiency	(%)	
Calculated Engine Output	(hp)	223
	(kW)	167
	(hp)	223.333
Calculated Engine Input	(hp)	

Exhaust Temperature	Units	Value
Exhaust Temperature (ºC)	(ºC)	
Calculated Exit Temperature	(K)	273
Exhaust Flow Rate	cfm	
	m³/s	

Emission Factors	Emission Factor Valule	Emission Factor Units	Data Quality	Source of Emission Factor	Emission Rate Valule	Emission Rate Units
Oxides of Sulphur (SOx)	0.00205	(lb/hp-hr)	B	AP 42 (10/1996) Ch 3.3, Tables 3.3-1	5.77E-02	g/s
Oxides of Nitrogen (NOx)	0.031	(lb/hp-hr)	B	AP 42 (10/1996) Ch 3.3, Tables 3.3-1	8.72E-01	g/s
Carbon Monoxide (CO)	0.00668	(lb/hp-hr)	C	AP 42 (10/1996) Ch 3.3, Tables 3.3-1	1.88E-01	g/s
Total Particulate Matter (TSP)	0.0022	(lb/hp-hr)	B	AP 42 (10/1996) Ch 3.3, Tables 3.3-1	6.19E-02	g/s

Appendix B14: Combustion Spreadsheet for Natural Gas-Fired Boilers

RWDI Project #1401701

RWDI Project Name:	Treasury Metals
RWDI Project Number:	1401701
Boiler Information for Unit:	115 kW heater

Denotes user specified value (read comments)

Parameter	Value	Units
Fuel Type	Natural Gas	
Fuel Heating Value	1020	(Btu/scf)
Fuel Density		(lb/gal)
Firing Configuration	Wall-fired	
Boiler Efficiency	80%	(%)
Excess Air	5%	(%)

Exhaust Information	Value	Units
Exhaust Temperature (ºC)	125	(ºC)
Calculated Exit Temperature	398	(K)

Fuel Sulphur Information	Value	Units
Natural Gas Sulphur Content	2000	(grains/10^6scf)
Fuel Oil Sulphur Content	0	(%)

Rating (enter one set of units)	Value	Units
Boiler Heat Input (kW)	115	(kW)
Calculated Heat Input	0.39	(MMBtu/hr)
Boiler Size Cut-off	<100	(MMBtu/hr)

Pollution Controls	Value	Units
NSPS	n/a	
Low-NOx Burners	no	
Flue-gas Recirculation	no	

Fuel & Air Parameters	Value	Units	Sample Calculation / Comment
Fuel Consumption	382	(scf/h)	= (0.39 MMBTU/h) x (1000000 BTU/MMBTU) / (1020 Btu/scf)
	10818	(L/h)	
Fuel Molar Flow Rate (NG Only)	458	(mol'h)	= (382 scf/h) x (28.32 L/scf) x (101.3 kPa) / (8.314 L·kPa/mol·K) / (288 K)
Fuel Mass Flow Rate	7	(kg/h)	= (458 mol/h) x (16.03 g/mol) / (1000 g/kg)
Stoichiometric Ratio (NG only)	10.996	ratio	= 1 CO2 + 2 H2O + 0.05 O2 + 2 x 3.76 x (1 + 0.05) N2 per mol CH4
Theoretical Moist Air (Oil Only)	not applicable		
Combustion Air	4578	(mol/h)	= (458 mol fuel / h) x (2 mol O2 / mol fuel) x (1 + (15% XS Air)) x (4.76 mol air / mol O2)
	132	(kg/h)	= (4578 mol air / h) x (28.8 g air / mol air) / (1000 g / kg)
	108	(m³/h) @ 60ºF	= (4578 mol/h) x (8.314 L·kPa/mol·K) x (288 K) / (101.3 kPa) / (1000 L/m³)
	64	(scfm)	= (108 m³/h) x (35.31 ft³/m³) / (60 min/h)

Exhaust Parameters	Value	Units	Sample Calculation
Exhaust Gas Molar Flow (NG only)	5036	(mol/h)	= (458 mol/h) x (10.996 mol exhaust / mol fuel)
Theoretical Flue Gas (Oil Only)	not applicable	(m^3_{air} / L_{fuel})	
Exhaust Gas Mass Flow Rate	133	(kg/h)	= (458 mol/h) x (10.996 mol exhaust / mol fuel)
Exhaust Gas Flow	165	(Am³/h)	= (5036 mol/h) x (8.314 L·kPa/mol·K) x (398 K) / (101.3 kPa) / (1000 L/m³)
	0.05	(Am³/s)	= (165 m³ / h) / (3600 s / h)
	119	(m³/h) @ 60ºF	= (165 m³/h) x (288K) / (398K)
	70	(scfm)	= (119 m³ / h) x (35.31 ft³ / m³) / (60 min / h)

Criteria Contaminants	Emission Factor		Emission Rate		Data Quality	Sample Calculation
	Value	Units	Value	Units		
Sulphur Dioxide	0.6	(lb/10^6scf)	2.89E-05	(g/s)	A	= (382 scf/h) x (0.6 lb / 10^6 scf) x (453.6 g / lb) / (3660 s / h)
Oxides of Nitrogen	100	(lb/10^6scf)	4.81E-03	(g/s)	B	= (382 scf/h) x (100 lb / 10^6 scf) x (453.6 g / lb) / (3660 s / h)
Carbon Monoxide	84	(lb/10^6scf)	4.04E-03	(g/s)	B	= (382 scf/h) x (84 lb / 10^6 scf) x (453.6 g / lb) / (3660 s / h)
Filterable Particulate	7.6	(lb/10^6scf)	3.66E-04	(g/s)	D	= (382 scf/h) x (7.6 lb / 10^6 scf) x (453.6 g / lb) / (3660 s / h)
Condensible Particulate	--		--			
Total Particulate	7.6	(lb/10^6scf)	3.66E-04	(g/s)	D	= (382 scf/h) x (7.6 lb / 10^6 scf) x (453.6 g / lb) / (3660 s / h)

Note: Total Particulate = Filterable + Condensible, if applicable. Lowest data quality rating of either filterable or condensible applied.

Revision Date:	2012-11-20
Prepared by:	
Checked by:	

Appendix B15: Combustion Spreadsheet for Natural Gas-Fired Boilers

RWDI Project #1401701

RWDI Project Name:	Treasury Metals
RWDI Project Number:	1401701
Boiler Information for Unit:	900 kW heater

Denotes user specified value (read comments)

Parameter	Value	Units
Fuel Type	Natural Gas	
Fuel Heating Value	1020	(Btu/scf)
Fuel Density		(lb/gal)
Firing Configuration	Wall-fired	
Boiler Efficiency	80%	(%)
Excess Air	5%	(%)

Exhaust Information	Value	Units
Exhaust Temperature (ºC)	125	(ºC)
Calculated Exit Temperature	398	(K)

Fuel Sulphur Information	Value	Units
Natural Gas Sulphur Content	2000	(grains/10^6scf)
Fuel Oil Sulphur Content	0	(%)

Rating (enter one set of units)	Value	Units
Boiler Heat Input (kW)	900	(kW)
Calculated Heat Input	3.07	(MMBtu/hr)
Boiler Size Cut-off	<100	(MMBtu/hr)

Pollution Controls	Value	Units
NSPS	n/a	
Low-NOx Burners	no	
Flue-gas Recirculation	no	

Fuel & Air Parameters	Value	Units	Sample Calculation / Comment
Fuel Consumption	3010	(scf/h)	= (3.07 MMBTU/h) x (1000000 BTU/MMBTU) / (1020 BTU/scf)
	85243	(L/h)	
Fuel Molar Flow Rate (NG Only)	3606	(mol'h)	= (3010 scf/h) x (28.32 L/scf) x (101.3 kPa) / (8.314 L·kPa/mol·K) / (288 K)
Fuel Mass Flow Rate	58	(kg/h)	= (3606 mol/h) x (16.03 g/mol) / (1000 g/kg)
Stoichiometric Ratio (NG only)	10.996	ratio	= 1 CO2 + 2 H2O + 0.05 O2 + 2 x 3.76 x (1 + 0.05) N2 per mol CH4
Theoretical Moist Air (Oil Only)	not applicable		
Combustion Air	36046	(mol/h)	= (3606 mol fuel / h) x (2 mol O2 / mol fuel) x (1 + (15% XS Air)) x (4.76 mol air / mol O2)
	1038	(kg/h)	= (36046 mol air / h) x (28.8 g air / mol air) / (1000 g / kg)
	852	(m³/h) @ 60ºF	= (36046 mol/h) x (8.314 L·kPa/mol·K) x (288 K) / (101.3 kPa) / (1000 L/m³)
	501	(scfm)	= (852 m³/h) x (35.31 ft³/m³) / (60 min/h)

Exhaust Parameters	Value	Units	Sample Calculation
Exhaust Gas Molar Flow (NG only)	39652	(mol/h)	= (3606 mol/h) x (10.996 mol exhaust / mol fuel)
Theoretical Flue Gas (Oil Only)	not applicable	(m^3_{air} / L_{fuel})	
Exhaust Gas Mass Flow Rate	1100	(kg/h)	= (3606 mol/h) x (10.996 mol exhaust / mol fuel)
Exhaust Gas Flow	1295	(Am³/h)	= (39652 mol/h) x (8.314 L·kPa/mol·K) x (398 K) / (101.3 kPa) / (1000 L/m³)
	0.36	(Am³/s)	= (1295 m³ / h) / (3600 s / h)
	937	(m³/h) @ 60ºF	= (1295 m³/h) x (288K) / (398K)
	551	(scfm)	= (937 m³ / h) x (35.31 ft³ / m³) / (60 min / h)

Criteria Contaminants	Emission Factor		Emission Rate		Data Quality	Sample Calculation
	Value	Units	Value	Units		
Sulphur Dioxide	0.6	(lb/10^6scf)	2.28E-04	(g/s)	A	= (3010 scf/h) x (0.6 lb / 10^6 scf) x (453.6 g / lb) / (3660 s / h)
Oxides of Nitrogen	100	(lb/10^6scf)	3.79E-02	(g/s)	B	= (3010 scf/h) x (100 lb / 10^6 scf) x (453.6 g / lb) / (3660 s / h)
Carbon Monoxide	84	(lb/10^6scf)	3.19E-02	(g/s)	B	= (3010 scf/h) x (84 lb / 10^6 scf) x (453.6 g / lb) / (3660 s / h)
Filterable Particulate	7.6	(lb/10^6scf)	2.88E-03	(g/s)	D	= (3010 scf/h) x (7.6 lb / 10^6 scf) x (453.6 g / lb) / (3660 s / h)
Condensible Particulate	--		--			
Total Particulate	7.6	(lb/10^6scf)	2.88E-03	(g/s)	D	= (3010 scf/h) x (7.6 lb / 10^6 scf) x (453.6 g / lb) / (3660 s / h)

Note: Total Particulate = Filterable + Condensible, if applicable. Lowest data quality rating of either filterable or condensible applied.

Revision Date:	2012-11-20
Prepared by:	
Checked by:	

Appendix B16: Vent Raises Emissions Spreadsheet for the Mine Operation Phase

Parameter	Source		Units	Comments
	V1	V2		
Flow	740,000	740,000	CFM	Provided by Treasury Metals
Flow	349.24	349.24	m^3/s	Calculation

Emission Factors

Contaminant	Emission Factor		Reference
	Value	Units	
TSP	0.86	mg/m³	Report on Mine Vent Exhaust Testing, Falconbridge Limited, Bovar Env. Project 541-6254, February 1996
Oil Mist	0.01574	mg/m³	Report on Mine Vent Exhaust Testing, Falconbridge Limited, Bovar Env. Project 541-6254, February 1996
NOx	3.94	mg/m³	Report on Mine Vent Exhaust Testing, Falconbridge Limited, Bovar Env. Project 541-6254, February 1996
CO	4.32	mg/m³	Report on Mine Vent Exhaust Testing, Falconbridge Limited, Bovar Env. Project 541-6254, February 1996

Calculated Emissions

Contaminant	Emission Rate		Rating
	V1 [g/s]	V2 [g/s]	
TSP	3.0E-01	3.0E-01	Above Average
Oil Mist	5.5E-03	5.5E-03	Above Average
NOx	1.4E+00	1.4E+00	Above Average
CO	1.5E+00	1.5E+00	Above Average

Appendix B17: On-Site Mobile Equipment Emissions Spreadsheet - Fugitive Dust for the Mine Closure Phase

Project #1401701

Treasury Metals

Input Required
Calculated Value / Do Not Edit
Comment required
Table Heading (do not edit)

UNPAVED ROAD SECTIONS - AP-42 Section 13.2.2
PAVED ROAD SECTIONS - AP-42 Section 13.2.1

Paved Roads: $E = k\,(sL)^{0.91}\,(W)^{1.02}$
Unpaved Roads - Industrial: $E = 281.9\,k\,(s / 12)^{a}\,(W / 3)^{b}$
Unpaved Roads - Public: $E = 281.9\,k\,(s / 12)^{a}\,(S / 30)^{d} / (M / 0.5)^{c} - C$

E particulate emission factor (g/VKT)
k particle size multiplier (see below)
sL road surface silt loading (g/m^2)
W average weight of the vehicles traveling the road (US short tons)
s surface material silt content (%)
C emission factor for 1980's vehicle fleet exhaust, brake wear and tire wear
M surface material moisture content (%)
S mean vehicle speed (mph)
a,b,c,d constants (see below)

Route ID [1]	Route Description	Traffic Passes [2] Hourly (#/h)	Daily (#/d)	Annual (#/a)	Segment Length [2] (m)	Road Surface [3]	Roadway Type [4]	Mean Vehicle Speed (km/h)	(mph)	Average Vehicle Weight [5] (tons)	Surface Material Moisture Content [6] (%)	Surface Silt Content [7] (%)	Road Surface Silt Loading [8] (g/m^2)	Base AP-42 Emission Factor TSP (g/VKT)	PM_{10} (g/VKT)	$PM_{2.5}$ (g/VKT)	Base Emission Rate TSP (g/s)	PM_{10} (g/s)	$PM_{2.5}$ (g/s)	Additional Control Efficiency Applied (%)	Final Controlled Emission Rate TSP (g/s)	Data Quality Rating	PM_{10} (g/s)	Data Quality Rating	$PM_{2.5}$ (g/s)	Data Quality Rating
ROUTE1	Road from center of mine pit to wast	28			1886	Unpaved	Industrial	25	16	144		5.8%		4.7E+03	1.3E+03	1.3E+02	7.0E+01	1.8E+01	1.8E+00	75%	1.7E+01		4.6E+00		4.6E-01	

Constants for Mobile Emission Equations

Roadway Type	Contaminant	k	a	b	c	d	Quality
Paved Roads:	$PM_{2.5}$	0.15	-	-	-	-	-
	PM_{10}	0.62	-	-	-	-	-
	TSP	3.23	-	-	-	-	-
Unpaved Roads - Industrial:	$PM_{2.5}$	0.15	0.9	0.45	-	-	C
	PM_{10}	1.5	0.9	0.45	-	-	B
	TSP	4.9	0.7	0.45	-	-	B
Unpaved Roads - Public:	$PM_{2.5}$	0.18	1	-	0.2	0.5	C
	PM_{10}	1.8	1	-	0.2	0.5	B
	TSP	6	1	-	0.3	0.3	B

[1] Route ID numbers provided on site plan.
[2] Length of a specific road segment. A separate segment should be used whenever one or more parameters change.
[3] Paved surfaces include asphalt, concrete, and recycled asphalt (if it forms a relatively consistent surface).
[4] Publicly accessible and dominated by light vehicles, or industrial, and dominated by heavy vehicles.
[5] The average vehicle weight reflects the average of the empty and loaded vehicle weight, for travel in both directions.
[6] Required only for publicly accessible unpaved roads.
[7] Required only for unpaved roads (public and industrial).
[8] Required only for industrial paved roads.

Sample calculation for uncontrolled TSP emission factor for Source ROUTE1: Road from center of mine pit to waste rock stockpile

EF = 281.9 x (4.9) x [(5.8% / 12)]^(0.7) x [(144 tons) / 3]^(0.45) = 4740 g TSP / vehicle kilometer travelled (vkt)

Sample calculation for TSP emission rate for Source ROUTE1: Road from center of mine pit to waste rock stockpile

28 vehicles	1886 m	1 km	4740 g_{TSP}	1 h	0.25 $g_{TSP\ uncontrolled}$		
1 h		1000 m	1 vehicle km	3600 s	1 g_{TSP}	=	1.7E+01 g_{TSP} / s

Comments

Hourly traffic passes is assuemd to be the same as the mine operation phase for with information was provided by Treasury Metals.

Appendix B18: Summary of Combustion Exhaust Emissions (Mobile Sources) for the Mine Closure Phase

Project #1401701

Treasury Metals

Input Required
Calculated Value / Do Not Edit
Comment required
Table Heading (do not edit)

Source ID	Description	Gross Power Rating (hp)	Traffic Passes [2]			Segment Length [3] (m)	Mean Vehicle Speed (km/h)	Load Factor [4] (%)	Tailpipe Emission Factor [5]								Tailpipe Emission Rate				Tailpipe + Fugitive Emission Rate [6]			
			Hourly	Daily	Annual				TSP		PM10		PM2.5		NOx		TSP	PM10	PM2.5	NOx	TSP	PM10	PM2.5	NOx
			(#/h)	(#/d)	(#/a)				(g/vkt)	(g/hp-h)	(g/vkt)	(g/hp-h)	(g/vkt)	(g/hp-h)	(g/vkt)	(g/hp-h)	(g/s)	(g/s)	(g/s)	(g/s)	(g/s)	(g/s)	(g/s)	(g/s)
On-Site Mobile Equipment																								
ROUTE1	Road from center of mine pit to wast	739	28			1886	25	58%	--	0.15	--	0.15	--	0.15	--	2.5	1.1E-01	1.1E-01	1.1E-01	1.8E+00	1.7E+01	4.7E+00	5.7E-01	1.8E+00
DOZER1	Dozer 1	410						58%	--	0.15	--	0.15	--	0.15	--	2.5	9.9E-03	9.9E-03	9.9E-03	1.7E-01	3.1E-01	6.2E-02	4.1E-02	1.7E-01
DOZER2	Dozer 2	410						58%	--	0.15	--	0.15	--	0.15	--	2.5	9.9E-03	9.9E-03	9.9E-03	1.7E-01	3.1E-01	6.2E-02	4.1E-02	1.7E-01
LOADER	Loader	2000						21%	--	0.1316	--	0.1316	--	0.1316	--	4.1	1.5E-02	1.5E-02	1.5E-02	4.8E-01	[6]	[6]	[6]	4.8E-01
EXCAVATOR	Excavator	432						21%	--	0.15	--	0.15	--	0.15	--	2.5	7.6E-03	7.6E-03	7.6E-03	1.3E-01	7.6E-03	7.6E-03	7.6E-03	1.3E-01

[1] ID should reflect Source ID or Route ID, as approprite.
[2] Where applicable, this value reflects travel in both directions (e.g., 1 round-trip = 2 passes)
[3] Length of a specific road segment. A separate segment should be used whenever one or more parameters change.
[4] Load Factors from "Median Life, Annual Activity, and Load Factor Values for Nonroad Engine Emissions Modeling", EPA-420-R-10-016, NR-005d, July 2010
[5] Emissions are input on either a vehicle distance or power rating basis. Load factor applies only to emissions based on power ratings.
[6] Please see Appendix B19 for fugitive emissions from loader operations.

Comments
All vehicles are assumed to be year 2010 models.
Mine trucks assumed to be Komatsu HD465-7 with 55 tonne payload and meeting Tier 3 emission standards
CAT D9 Dozers are assumed to meet Tier 3 emission standards
Loader assumed to be LeTourneau L-1850 and meeting Tier 2 emission standards
Excavator is CAT 349E L hydraulic excavator meeting Tier 3 emission standards
PM10 and PM2.5 tailpipe emissions assumed to be same as TSP emissions

Sample Calculations

Pit Loader Exhaust TSP Emissions:

410 kW	0.15 g	58% Load	1 h		
	1 kW h		3600 s	=	1.0E-02 g_{TSP} / s

Highway Truck Exhaust TSP Emissions:
(10 Rd East)

28 Vehicles	1886 m	-- g	1 km	1 h		
1 h		1 Veh. Km	1000 m	3600 s	=	#VALUE! g_{TSP} / s

Appendix B19: Bulk Material Handling Emissions Spreadsheet for the Mine Closure Phase

Project #1401701

Treasury Metals

AGGREGATE HANDLING AND STORAGE PILES - AP-42 Section 13.2.4

Average recorded hourly wind speed (m/s): 4.1
(used for sample calculations & factor validation)

Material handling emissions: $E = 0.0016\ k\ (U / 2.2)^{1.3} / (M / 2)^{1.4}$

- **E** emission factor
- **k** particle size multiplier (0.74, 0.35 and 0.053 for TSP, PM_{10} and $PM_{2.5}$)
- **U** mean wind speed, meters per second (m/s)
- **M** material moisture content (%)

Legend
Input Required
Calculated Value / Do Not Edit
Comment required
Table Heading (do not edit)

Source ID [1]	Description	Processing Rate			Site Data				Base AP-42 Emission Factor			Base Emission Rate			Additional	Final Controlled Emission Rate at 4.1 m/s					
		Hourly (Mg/h)	Daily (Mg/d)	Annual (Mg/y)	Site Specific Data? (y/n)	Silt Content (%)	Moisture Content (%)	Source Conditions Valid [2]	TSP (kg/Mg)	PM_{10} (kg/Mg)	$PM_{2.5}$ (kg/Mg)	TSP (g/s)	PM_{10} (g/s)	$PM_{2.5}$ (g/s)	Control Efficiency Applied (%)	TSP (g/s)	Data Quality Rating	PM_{10} (g/s)	Data Quality Rating	$PM_{2.5}$ (g/s)	Data Quality Rating
WST1	Loading truckswith waste rock	1111			y		10.0%	silt too low	2.8E-04	1.3E-04	2.0E-05	8.6E-02	4.1E-02	6.2E-03		8.6E-02	B	4.1E-02	B	6.2E-03	B
WST2	unloading waste rock from trucks	1111			y		10.0%	silt too low	2.8E-04	1.3E-04	2.0E-05	8.6E-02	4.1E-02	6.2E-03		8.6E-02	B	4.1E-02	B	6.2E-03	B
LOADER	front end loader	200			y		10.0%	silt too low	2.8E-04	1.3E-04	2.0E-05	1.6E-02	7.3E-03	1.1E-03		1.6E-02	B	7.3E-03	B	1.1E-03	B

[1] ID corresponds to process flow diagram for facility and / or material
[2] Relates to AP-42 Section 13.2.4-4

Comments

Moisture content provided by Treasury Metals.
Hourly processing rates assumed to be the same as the mine operation phase.

Sample calculation for uncontrolled TSP emission factor for Source WST1: Loading truckswith waste rock, at a sample wind speed of 3.7 m/s

EF = 0.0016 x (0.74) x ((4.1 m/s) / 2.2)^1.3 / ((10%) / 2)^1.4 = 2.8E-04 kg TSP / Mg handled

Sample calculation for TSP emission rate for Source WST1: Loading truckswith waste rock, at a sample wind speed of 5 m/s

1111 $Mg_{handled}$	2.8E-04 kg_{TSP}	1 h	1000 g_{TSP}	1 $g_{TSP\ uncontrolled}$		
1 h	1 $Mg_{handled}$	3600 s	1 kg_{TSP}	1 g_{TSP}	=	8.6E-02 g_{TSP} / s

Appendix B20: Bulldozing Emissions Spreadsheet for the Mine Closure Phase

Project #1401701

Treasury Metals

WESTERN SURFACE COAL MINING - AP-42 Section 11.9

Emission Factors for Overburden Bulldozing:

$TSP = 2.6(s)^{1.2}/(M)^{1.3}$ kg/h

$PM10 = 0.75 * 0.45(s)^{1.5}/(M)^{1.4}$ kg/h

$PM2.5 = 0.105 * TSP$

s silt content (%) **M** moisture content (%)

It has been assumed that overburden bulldozing emission factors from AP-42 Section 11.9, Western Surface Coal Mining applies to bulldozing of both waste rock and

Description	Value	Unit	Comments
Number of dozers	2		2 dozers moving waste rock
Annual operating hrs per unit	8,760	h	Dozers operate 24/7
Silt content	5.8	%	Mean haul road silt content for Taconite mining and processing Table 13.2.2-1 US EPA AP 42 Chapter 13.2.2 Unpaved Roads
Moisture content	10	%	Provided by Tresury Metals

Summary of Bulldozing Emissions

Emissions	TSP	PM10	PM2.5
Annual Emissions (t/y)	19	3	2
Max Hourly Emission Rate (g/s)	0.60	0.10	0.06
Max Hourly Emission Rate per Dozer (g/s)	0.30	0.05	0.03

ore at Goliath Gold Mine

Appendix B21: Supporting Information for Assessment of Negligibility

Contaminant Name	Contaminant CAS Number	Source ID	Source Description	Contaminant Emission Rate (by source) (g/s)	Distance to Property Line (m)	Criteria [1] 50% of Standard or de minimus ($\mu g/m^3$)	Regulation Schedule #	Criteria Averaging Time (hours)	Table B-1 1-hour Dispersion Factor for Shortest Distance to Property Line [2] ($\mu g/m^3$ / g/s)	Table B-1 Dispersion Factor Converted to Criteria Averaging Time ($\mu g/m^3$ / g/s)	Predicted Concentration ($\mu g/m^3$)	Contaminant Negligible?
TSP	N/A		All Sources	2.52E+01	20	60	3	24	10000	4107	1.04E+05	no
Gold	7440-57-5		All Sources	4.08E-05	20	0.05	De Minimis	24	10000	4107	1.67E-01	no
Silver	7440-22-4		All Sources	6.09E-05	20	0.5	3	24	10000	4107	2.50E-01	yes
Copper	7440-50-8		All Sources	1.03E-03	20	25	3	24	10000	4107	4.23E+00	yes
Iron	15438-31-0		All Sources	5.94E-05	20	2	3	24	10000	4107	2.44E-01	yes
	1309-37-1		All Sources	1.70E-04	20	12.5	3	24	10000	4107	6.98E-01	yes
Lead	7439-92-1		All Sources	4.27E-03	20	0.25	3	24	10000	4107	1.75E+01	no
Zinc	7440-66-6		All Sources	9.94E-03	20	60	3	24	10000	4107	4.08E+01	yes
Aluminium	7429-90-5		All Sources	1.49E-04	20	2.4	JSL	24	10000	4107	6.13E-01	yes
	1344-28-1		All Sources	2.82E-04	20	60	Guidelines	24	10000	4107	1.16E+00	yes
Arsenic	7440-38-2		All Sources	8.68E-04	20	0.15	Guidelines	24	10000	4107	3.57E+00	no
Barium	7440-39-3		All Sources	1.18E-02	20	5	Guidelines	24	10000	4107	4.86E+01	no
Beryllium	7440-41-7		All Sources	5.95E-05	20	0.05	3	24	10000	4107	2.44E-01	no
Bismuth	7440-69-9		All Sources	2.68E-04	20	0.05	De Minimis	24	10000	4107	1.10E+00	no
Calcium	7440-70-2		All Sources	6.05E-05	20	5	3	24	10000	4107	2.48E-01	yes
Cadmium	7440-43-9		All Sources	9.23E-05	20	0.0125	3	24	10000	4107	3.79E-01	no
Cobalt	7440-48-4		All Sources	2.96E-04	20	0.05	Guidelines	24	10000	4107	1.22E+00	no
Chromium	7440-47-3		All Sources	3.64E-03	20	0.25	3	24	10000	4107	1.49E+01	no
Potassium	7440-09-7		All Sources	4.01E-05	20	14	Guidelines	24	10000	4107	1.65E-01	yes
Lithium	7439-93-2		All Sources	4.99E-04	20	10	3	24	10000	4107	2.05E+00	yes
Magnesium	7439-95-4		All Sources	4.42E-05	20	60	Guidelines	24	10000	4107	1.82E-01	yes
Manganese	7439-96-5		All Sources	1.40E-02	20	0.2	3	24	10000	4107	5.75E+01	no
Molybdenum	7439-98-7		All Sources	1.89E-04	20	60	Guidelines	24	10000	4107	7.75E-01	yes
Nickel	7440-02-0		All Sources	9.65E-04	20	0.02	3	8760	10000	787	7.60E-01	no
Phosphorous	7723-14-0		All Sources	1.27E-02	20	0.175	JSL	24	10000	4107	5.21E+01	no
Antimony	7440-36-0		All Sources	1.63E-04	20	12.5	3	24	10000	4107	6.69E-01	yes
Selenium	7782-49-2		All Sources	2.28E-04	20	5	Guidelines	24	10000	4107	9.38E-01	yes
Tin	7440-31-5		All Sources	5.83E-04	20	5	3	24	10000	4107	2.39E+00	yes
Strontium	7440-24-6		All Sources	3.96E-03	20	60	Guidelines	24	10000	4107	1.63E+01	yes
Titanium	7440-32-6		All Sources	4.50E-02	20	60	3	24	10000	4107	1.85E+02	no
Thallium	7440-28-0		All Sources	4.20E-04	20	0.12	JSL	24	10000	4107	1.72E+00	no
Vanadium	7440-62-2		All Sources	1.19E-03	20	1	3	24	10000	4107	4.89E+00	no
Tungsten	7440-33-7		All Sources	2.89E-04	20	2	JSL	24	10000	4107	1.19E+00	yes
Yttrium	7440-65-5		All Sources	1.81E-04	20	1.2	JSL	24	10000	4107	7.42E-01	yes
Sulphur	7704-34-9		All Sources	6.97E-05	20	10	JSL	24	10000	4107	2.86E-01	yes
Uranium	7440-61-1		All Sources	2.52E-04	20	0.015	Guidelines	8760	10000	787	1.99E-01	no
Gallium	7440-55-3		All Sources	4.99E-04	20	0.05	De Minimis	24	10000	4107	2.05E+00	no
Lanthanum	7439-91-0		All Sources	4.13E-04	20	0.05	De Minimis	24	10000	4107	1.70E+00	no
Scandium	7440-20-2		All Sources	1.34E-04	20	0.05	De Minimis	24	10000	4107	5.50E-01	no
Thorium	7440-29-1		All Sources	5.05E-04	20	0.05	De Minimis	24	10000	4107	2.07E+00	no
Platinum	7440-06-4		All Sources	4.98E-04	20	0.1	Guidelines	24	10000	4107	2.05E+00	no
Palladium	7657-10-1		All Sources	2.89E-04	20	5	Guidelines	24	10000	4107	1.19E+00	yes
Rhodium	7440-16-6		All Sources	1.52E-04	20	0.2	JSL	24	10000	4107	6.23E-01	no
Sodium	7440-23-5		All Sources	3.45E-05	20	5	Guidelines	24	10000	4107	1.42E-01	yes
NOx	10102-44-0		All Sources	5.96E+00	20	200	3	24	10000	4107	2.45E+04	no
CO	630-08-0		All Sources	3.00E+00	20	6000	3	0.5	10000	12142	3.64E+04	no
Sodium cyanide	143339		All Sources	2.36E-04	20	60	Guidelines	24	10000	4107	9.70E-01	yes

APPENDIX J-3

EMISSIONS SUMMARY AND DISPERSION MODELLING REPORT

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Email: solutions@rwdi.com

Treasury Metals Incorporated
Goliath Gold Project
Wabigoon, Ontario

Final Report

Emission Summary and Dispersion Modelling Report

RWDI #1401701
October 16, 2014

SUBMITTED TO:

Mark Wheeler, P.Eng.
Senior Mining Engineer
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Ministry of the Environment | Ministère de l'Environnement

EMISSION SUMMARY AND DISPERSION MODELLING REPORT CHECKLIST

Company Name: Treasury Metals Incorporated

Company Address: 130 King Street West, Suite 3680
PO Box 99, The Exchange Tower, Toronto, ON M5X 1B1

Location of Facility: Hartman and Zealand Townships
Ontario

The attached Emission Summary and Dispersion Modeling Report was prepared in accordance with s.26 of O. Reg. 419/05 and the guidance in the MOE document "Procedure for Preparing an Emission Summary and Dispersion Modelling Report" dated March 2009 and "Air Dispersion Modelling Guideline for Ontario" dated March 2009 and the minimum required information identified in the check-list on the reverse of this sheet has been submitted.

Company Contact: ______

Name: Mark Wheeler

Title: Senior Mining Engineer

Phone Number: ______

Signature: ______

Date: ______

Technical Contact: ______

Name: Melissa Annett

Representing: RWDI AIR Inc.

Phone Number: (519) 823-1311 x 2372

Signature: ______

Date: ______

 * This checklist is taken from the document titled "Procedure for Preparing an Emission Summary and Dispersion Modelling Report" dated March 2009

EMISSION SUMMARY AND DISPERSION MODELLING REPORT CHECKLIST

	Required Information			
			Submitted	Explanation/Reference
	Executive Summary and Emission Summary Table			
	1.1	Overview of ESDM Report	☒ Yes	Executive Summary
	1.2	Emission Summary Table	☒ Yes	ESDM Report Table 7.1
1.0	**Introduction and Facility Description**			
	1.1	Purpose and Scope of ESDM Report (when report only represents a portion of facility)	☒ Yes	ESDM Report Section 1.1
	1.2	Description of Processes and NAICS code(s)	☒ Yes	ESDM Report Section 1.2
	1.3	Description of Products and Raw Materials	☒ Yes	ESDM Report Section 1.3
	1.4	Process Flow Diagram	☒ Yes	ESDM Figure 1.4
	1.5	Operating Schedule	☒ Yes	ESDM Report Section 1.5
2.0	**Initial Identification of Sources and Contaminants**			
	2.1	Sources and Contaminants Identification Table	☒ Yes	ESDM Report Section 2
3.0	**Assessment of the Significance of Contaminants and Sources**			
	3.1	Identification of Negligible Contaminants and Sources	☒ Yes	ESDM Section 3
	3.2	Rationale for Assessment	☒ Yes	ESDM Section 3
4.0	**Operating Conditions, Emission Rate Estimating and Data Quality**			
	4.1	Description of operating conditions, for each significant contaminant that results in the maximum POI concentration for that contaminant	☒ Yes	ESDM Report Section 4.1
	4.2	Explanation of Method used to calculate the emission rate for each contaminant	☒ Yes	ESDM Report Section 4.2
	4.3	Sample calculation for each method	☒ Yes	ESDM Report Section 4.3
	4.4	Assessment of Data Quality for each emission rate	☒ Yes	ESDM Report Section 4.4
5.0	**Source Summary Table and Property Plan**			
	5.1	Source Summary Table	☒ Yes	ESDM Report Table 5.1
	5.2	Site Plan (scalable)	☒ Yes	ESDM Report Figure 5.2
6.0	**Dispersion Modelling**			
	6.1	Dispersion Modelling Input Summary Table	☒ Yes	ESDM Report Table 6.1
	6.2	Land Use Zoning Designation Plan	☒ Yes	ESDM Report Figure 6.2
	6.3	Dispersion Modelling Input and Output Files	☒ Yes	Appendix A
7.0	**Emission Summary Table and Conclusions**			
	7.1	Emission Summary Table	☒ Yes	ESDM Report Table 7.1
	7.2	Assessment of Contaminants with no MOE POI Limits	☒ Yes	ESDM Report Section 7.2
	7.3	Conclusions	☒ Yes	ESDM Report Section 7.3
	Appendices (Provide supporting information or details such as…)			
	Appendix A: Dispersion Modelling Input & Output Files & Calculations		☒ Yes	
	Appendix B: Emission Calculations		☒ Yes	
	Appendix C: Negligibility Analysis		☒ Yes	
	Appendix D: Metals Impact Assessment		☒ Yes	
	Appendix E: Best Management Practise		☒ Yes	
			☐ Yes	

 * This checklist is taken from the document titled "Procedure for Preparing an Emission Summary and Dispersion Modelling Report" dated March 2009

EXECUTIVE SUMMARY

This Emission Summary and Dispersion Modelling (ESDM) report was prepared in support of an application for an Environmental Compliance Approval (ECA) with Limited Operational Flexibility for the applicant's facility located near Wabigoon, Ontario. This application is being submitted to achieve compliance of Treasury Metals Incorporated's Goliath Gold (Goliath Gold) Mine operations with the requirements of Section 9 of the Environmental Protection Act (EPA), R.S.O. 1990.

Sources and activities subject to the Environmental Activity and Sector Registry are included in this application for an ECA, in accordance with a request that will be made under s. 20.18 of the Environmental Protection Act.

This proposal is for an ECA with Limited Operation Flexibility which is a single ECA that that replaces existing ECA(s) and includes the addition of new or historically unapproved sources for all emissions from the Goliath Gold mine project which produces gold. This application includes all sources at the facility related to open pit mining, underground mining and milling operations, including fugitive emission sources, exhaust vent raises, emergency generators, baghouses, and natural gas-fired heating equipment.

The Goliath Gold mine project is being developed and involves the construction, operation and closure of an open-pit and underground mine. The mine is expected to be in operation for approximately 15 years. Goliath Gold will also conduct milling operations to purify the gold ore at the mine site with a maximum processing rate of 2700 tonnes per day of milled gold ore. The mining and milling operations will take place 24 hours a day, 365 days a year.

Under the North American Industry Classification System (NAICS) the facility is classified as 212221 (Gold Ore Mining). The Goliath Gold project is a Schedule 4 facility and as such is required to comply with Schedule 3 standards effective February 1, 2010.

A total of 45 contaminants were identified with respect to the facility, emitted from a total of 20 significant sources. Of the identified contaminants, 6 do not have existing Schedule 3 Limits under O. Reg. 419/05, and 20 were discharged in negligible amounts.

For the purposes of estimating emissions from the facility, a maximum operating scenario where both the open pit mine and underground mine in simultaneous operation was considered. The mining operations include drilling, blasting, and transportation of ore and waste rock to the various stockpiles. Emissions from the underground mining activities are exhausted to the atmosphere though exhaust vent raises. The underground mine will go into operation approximately 3 years after the open pit mine has been in operation, when the open pit mining activities are taking place below surface level. This scenario was used as the basis for the dispersion modelling, which was conducted for averaging periods of 30-minutes, 1-hour, 24-hours and 1 year. Emission rates were determined through the following estimation techniques; emission factors, and engineering calculations.

The facility covers portions of Hartman and Zealand townships, approximately 15 km east of the City of Dryden and 3 km north of Wabigoon, Ontario. It is surrounded by general use areas, provincial park areas and other private lands. The local terrain was taken into consideration in the dispersion modelling analysis.

Concentrations at points of impingement were predicted using the US EPA's AERMOD dispersion model. Modelling input and output files have been provided on a compact disc included in Appendix A. Predicted concentrations for all of the contaminants of significance were found to be less than their respective Standards or guidelines under O. Reg. 419/05 at all receptors in the area. The contaminant with the greatest percentage of the O. Reg. 419/05 Standard was predicted to be particulate matter with a value of 77%. Therefore, Treasury Metals Incorporated's Goliath Gold Mine is expected to be in compliance with the requirements of O. Reg. 419/05.

Emission Summary Table

RWDI Project 1401701

Receptor	Contaminant	CAS Number	Total Facility Emission Rate (g/s)	Air Dispersion Model Used	Maximum POI Concentration (µg/m³)	Averaging Period (hours)	MOE POI Limit [1] (µg/m³)	Limiting Effect	Regulation Schedule #	Percentage of MOE POI Limit (%)
MAXGLC	TSP	N/A	1.00E+01	AERMOD	9.21E+01	24	120	Visibility	3	77%
MAXGLC	Gold	7440-57-5	4.08E-05	AERMOD	2.63E-03	24	N/A	N/A	N/A	N/A
MAXGLC	Lead	7439-92-1	4.27E-03	AERMOD	1.66E-01	24	0.5	Health	3	33%
MAXGLC	Arsenic	7440-38-2	8.68E-04	AERMOD	2.17E-02	24	0.3	Health	Guidelines	7%
MAXGLC	Barium	7440-39-3	1.18E-02	AERMOD	2.50E-01	24	10	Health	Guidelines	3%
MAXGLC	Beryllium	7440-41-7	5.95E-05	AERMOD	1.27E-03	24	0.1	Health	3	1%
MAXGLC	Bismuth	7440-69-9	2.68E-04	AERMOD	5.59E-03	24	N/A	N/A	N/A	N/A
MAXGLC	Cadmium	7440-43-9	9.23E-05	AERMOD	2.32E-03	24	0.025	Health	3	9%
MAXGLC	Cobalt	7440-48-4	2.96E-04	AERMOD	6.07E-03	24	0.1	Health	Guidelines	6%
MAXGLC	Chromium	7440-47-3	3.64E-03	AERMOD	7.74E-02	24	0.5	Health	3	15%
MAXGLC	Manganese	7439-96-5	1.40E-02	AERMOD	2.86E-01	24	0.4	Health	3	72%
MAXGLC	Nickel	7440-02-0	9.65E-04	AERMOD	2.57E-03	Annual	0.04	Health	3	6%
MAXGLC	Phosphorous	7723-14-0	1.27E-02	AERMOD	2.63E-01	24	0.35	N/A	JSL	75%
MAXGLC	Titanium	7440-32-6	4.50E-02	AERMOD	9.18E-01	24	120	Particulate	3	1%
MAXGLC	Thallium	7440-28-0	4.20E-04	AERMOD	8.56E-03	24	0.24	N/A	JSL	4%
MAXGLC	Vanadium	7440-62-2	1.19E-03	AERMOD	2.42E-02	24	2	Health	3	1%
MAXGLC	Uranium	7440-61-1	2.52E-04	AERMOD	6.73E-04	Annual	0.03	Health	Guidelines	2%
MAXGLC	Gallium	7440-55-3	4.99E-04	AERMOD	1.05E-02	24	N/A	N/A	N/A	N/A
MAXGLC	Lanthanum	7439-91-0	4.13E-04	AERMOD	8.77E-03	24	N/A	N/A	N/A	N/A
MAXGLC	Scandium	7440-20-2	1.34E-04	AERMOD	2.94E-03	24	N/A	N/A	N/A	N/A
MAXGLC	Thorium	7440-29-1	5.05E-04	AERMOD	1.07E-02	24	N/A	N/A	N/A	N/A
MAXGLC	Platinum	7440-06-4	4.98E-04	AERMOD	1.00E-02	24	0.2	Health	Guidelines	5%
MAXGLC	Rhodium	7440-16-6	1.52E-04	AERMOD	3.27E-03	24	0.4	N/A	JSL	1%
MAXGLC	NOx	10102-44-0	5.96E+00	AERMOD	4.68E+01	24	200	Health	3	23%
MAXGLC				AERMOD	1.24E+02	1	400	Health	3	31%
MAXGLC	CO	630-08-0	3.00E+00	AERMOD	6.72E+01	0.5	6000	Health	3	1%

Notes:

[1] The term “MOE POI Limit” identified in Table D-4 refers to the following information (there may be more than one relevant MOE POI Limit for each contaminant):

- air quality standards in Schedules 2 and 3 of the Regulation;
- the guidelines for contaminants set out the MOE publication, “Summary of Standards and Guidelines to Support Ontario Regulation 419: Air Pollution – Local Air Quality"; or,
- an acceptable concentration for contaminants with no standards or guidelines.

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CONSULTING ENGINEERS & SCIENTISTS

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Appendices

1 INTRODUCTION AND FACILITY DESCRIPTION

1.1 Purpose and Scope of ESDM Report

This Emission Summary and Dispersion Modelling (ESDM) report was prepared in support of an application for an Environmental Compliance Approval (ECA) with Limited Operational Flexibility for the applicant's facility located near Wabigoon, Ontario. This application is being submitted to achieve compliance of Treasury Metals Incorporated's Goliath Gold (Goliath Gold) Mine operations with the requirements of Section 9 of the Environmental Protection Act (EPA), R.S.O. 1990.

Sources and activities subject to the Environmental Activity and Sector Registry are included in this application for an ECA, in accordance with a request made under s. 20.18 of the Environmental Protection Act.

1.2 Description of Process and NAICS Code(s)

The Goliath Gold mine project involves the construction, operation and closure of an open-pit and underground mine. The mine is expected to be in operation for approximately 15 years. Goliath Gold will also conduct milling operations to purify the gold ore at the mine site with a maximum processing rate of 2700 tonnes per day of gold ore. The mining and milling operations will take place 24 hours a day, 365 days a year.

Under the North American Industry Classification System (NAICS) the facility is classified as 212221 (Gold Ore Mining). The Goliath Gold project is a Schedule 4 facility and as such is required to comply with Schedule 3 standards effective February 1, 2010.

1.3 Description of Products and Raw Materials

This proposal is for an ECA with Limited Operation Flexibility which is a single ECA that that replaces existing ECA(s) and includes the addition of new or historically unapproved sources for all emissions from the Goliath Gold mine project which produces gold. This application includes all sources at the facility related to open pit mining, underground mining and milling operations, including fugitive emission sources, exhaust vent raises, emergency generators, baghouses, and natural gas-fired heating equipment.

The Goliath Gold mine project is being developed and involves the construction, operation and closure of an open-pit and underground mine. The raw materials at the mine can be considered to be gold ore and low grade gold ore which are processed by on-site milling operations. The milling operations at the Goliath Gold mine site will purify the gold ore with a maximum processing rate of 2700 tonnes per day of milled gold ore. The mining and milling operations will take place 24 hours a day, 365 days a year.

1.4 Process Flow Diagram

Figure 1.4 in the Figures Section provides the process flow diagram for the facility.

1.5 Operating Schedule

The facility will operate 24 hours per day, 7 days per week.

2 INITIAL IDENTIFICATION OF SOURCES AND CONTAMINANTS

Table 2.1 in the Tables Section provides the Source and Contaminants Identification Table. An overview of the sources included in this assessment is provided below:

2.1 Fugitive Emission Sources

- One (1) unpaved haul route (ROAD1), having a total length of approximately 750 m extending from the center of the open mine pit to the edge of the mine pit.
- One (1) unpaved haul route (ROAD2), used to transport ore, having a total length of approximately 320 m extending from the edge of the mine pit to the crusher.
- One (1) unpaved haul route (ROAD3), used to transport low grade ore, having a total length of approximately 290 m extending from the edge of the mine pit to the center of the low grade stockpile.
- One (1) unpaved haul route (ROAD4), used to transport waste rock, having a total length of approximately 1130 m extending from the edge of the mine pit to the center of the waste rock stockpile
- Loading of ore (ORE1), low grade ore (LGORE1) and waste rock (WST1) by a mechanical excavator into trucks at the working face of the open pit mine. Loading of waste rock will take place at approximately 1111 tonnes per hour and loading of ore and low grade ore will take place at approximately 113 tonnes per hour.
- Unloading of ore (ORE2), low grade ore (LGORE2) and waste rock (WST2) at the ore crusher, low grade stockpile and waste rock stockpile, respectively.
- Bulldozing operations at the ore dump near the crusher (DOZER1), low grade stockpile (DOZER2) and at the waste rock stockpile (DOZER3).
- Loading of ore at the crusher by a front end loader (LOADER) at a rate of 135 tonnes per hour.
- Blasting operations (BLAST) at the working face of the mine pit to separate ore and waste rock from the bedrock.
- One (1) tailings area (TAILING) that will cover a total area of 750,000 m^2. 90% of the tailings area is expected to be either vegetated or wet (under water), with wind erosion taking place over the remaining 10% (dry, un-vegetated) surface of the tailings area.
- Drilling (DRILLING) operations at the working face of the mine.

2.2 Point Sources Requiring Approval

- Two (2) underground mine exhaust vent raises (VENT1, VENT2), each exhausting into the atmosphere at a maximum volumetric flow rate of 349.24 cubic metres per second (740,000 cubic feet per minute).

2.3 Insignificant Point Sources Requiring Approval

- One (1) 500 kW diesel fired emergency generator (GEN1).
- One (1) 150 kW diesel fired emergency generator (GEN2).
- One (1) baghouse (BAGHOUSE) used to control the emissions from the crusher. The baghouse exhausts to the atmosphere at a maximum volumetric flow rate of 1,000 cubic metres per hour.
- One (1) 150 kW natural gas-fired kiln burner (KILN).
- One (1) 900 kW natural gas-fired heater (ELUTION) used in the elution circuit of the mill.
- Six (6) carbon in leach process tanks (MILL) with a total air flow rate of 760 cubic metres per hour.
- One (1) baghouse (BAGHOUSE2) used to control particulate matter emissions from the gold smelting kiln furnace.
- One maintenance welding station.

2.4 Sources Subject to the Environmental Activity and Sector Registry

- Natural gas-fired comfort heating equipment with a total heat input of less than 20 million kilojoules per hour.

3 SIGNIFICANCE OF SOURCES AND CONTAMINANTS

3.1 Identification of Negligible Sources

3.1.1 Insignificant Sources

The sources listed in Section 2.3 of this report were determined to be insignificant. Supporting information is provided in Appendices B and C

3.1.2 Rationale for Assessment

3.1.2.1 Emergency Generators

Sources that are generally found to emit contaminants in insignificant amounts are listed on Table B-3 in Appendix B.2 of the MOE Guideline A10: Procedure for Preparing an ESDM Report, Version 3.0, March 2009. Standby power generators firing liquid or gaseous fuels that are used for standby power only with periodic testing are listed on Table B-3 and are therefore considered to be insignificant.

3.1.2.2 Baghouses, Kiln Burner and Natural Gas-Fired Heater

Section 7.2.2 of MOE Guideline A10 states that “sources that, in combination, represent less than 5% of total property-wide emissions of a contaminant can, in many cases, be considered insignificant”. Combined emissions from the baghouses, kiln burner and heater represents less than 5% of the total property-wide emissions of TSP. Therefore, these sources are considered to be insignificant.

3.1.2.3 Carbon in Leach Tanks

As per MOE Guideline A10, aggregate facility-wide emissions of a contaminant may be compared to a calculated site-specific emission threshold to evaluate whether the contaminant is significant. The Emission Threshold is calculated using a conservative dispersion factor (µg/m³ per g/s emission) and the relevant standard or guideline under O. Reg. 419/05.

If the aggregate facility-wide emission rate of a contaminant multiplied by the appropriate dispersion factor from Appendix B.1 of the MOE Guideline A10 is less than 50% of the standard or guideline under O. Reg. 419/05, then the assessment for that contaminant is complete.

The only contaminant emitted by the carbon in leach tanks, hydrogen cyanide, was screened out using the emission threshold.

3.1.2.4 Drilling Operations

Drilling operations at the Goliath Gold mine will be performed with drilling rigs equipped with dust suppression equipment, such as wet suppression or dry filtration systems, and in combination with the baghouses represents less than 5% of the total property-wide emissions of TSP. Therefore, the drilling operations were considered to be insignificant sources of emissions.

3.1.2.5 Maintenance Welding Station

Sources that are generally found to emit contaminants in insignificant amounts are listed on Table B-3 in Appendix B.2 of the MOE Guideline A10. Maintenance welding stations are listed on Table B-3 and are therefore considered to be insignificant.

3.1.2.1 Natural Gas-Fired Comfort Heating Equipment

Sources that are generally found to emit contaminants in insignificant amounts are listed on Table B-3 in Appendix B.2 of the MOE Guideline A10. Natural gas-fired comfort heating equipment with a total heat input of less than 20 million kilojoules per hour is listed on Table B-3 and is therefore considered to be insignificant.

3.2 Identification of Insignificant Contaminants

3.2.1 Insignificant Contaminants

The following contaminants were determined to be insignificant:

- Fugitive emissions of total suspended particulate from the on-site roadways. Metals in the fugitive dust emissions from the on-site roadways were still considered significant and were included in the assessment;
- Fugitive emissions of certain metals in particulate matter were screened out using the emission threshold (see Appendix C for the complete list).
- Contaminants other than oxides of nitrogen from natural gas-fired combustion equipment.

3.2.2 Rationale for Assessment

3.2.2.1 Particulate Matter Dust Emissions from the On-Site Roadways

As per Section 7.4.1 of MOE Guideline A10, it is acceptable to deem fugitive dust emissions from on-site roadways insignificant if a best management practices plan is in place. Treasury Metals has a best management practices plan in place to mitigate dust emissions from on-site roadways at the Goliath Gold mine site. A copy of the facility's Management of Fugitive Dust Procedure is provided in Appendix E.

3.2.2.2 Contaminants Screened Out Using the Emission Threshold

As per MOE Guideline A10, aggregate facility-wide emissions of a contaminant may be compared to a calculated site-specific emission threshold to evaluate whether the contaminant is significant. The Emission Threshold is calculated using a conservative dispersion factor (µg/m³ per g/s emission) and the relevant standard or guideline under O. Reg. 419/05. For chemicals without standards or guidelines under O. Reg. 419/05, the MOE de minimus POI concentrations (24-hour average basis) presented on Table B-2A in Appendix B.1 of MOE Guideline A10 can be used (unless the chemical is listed on Table B-2B of MOE Guideline A10).

If the aggregate facility-wide emission rate of a contaminant multiplied by the appropriate dispersion factor from Appendix B.1 of the MOE Guideline A10 is less than 50% of the standard or guideline under O. Reg. 419/05, or is less than the appropriate de minimus value (or converted to a 24-hour average concentration in the case of 24-hour average standard or guideline under O. Reg. 419/05), then the assessment for that contaminant is complete.

Contaminants screened out using the emission threshold are listed in Appendix C.

3.2.2.3 Contaminants other than Oxides of Nitrogen from Natural Gas-Fired Combustion Equipment

As per guidance in MOE Guideline A10, the significant contaminant for the combustion of natural gas and propane may be oxides of nitrogen. Other contaminants for this type of source are generally emitted in negligible amounts.

4 OPERATING CONDITIONS, EMISSIONS ESTIMATING AND DATA QUALITY

Section 10 of O. Reg. 419/05 states that, for the purposes of an ESDM report, an acceptable operating scenario to consider is one that would result, for a given contaminant, in the highest concentration of that contaminant at Points of Impingement (POIs) that the facility is capable of causing. To satisfy this requirement, a maximum production scenario was developed in consultation with Treasury Metals Inc. This scenario examined the maximum processing rate that the facility could be expected to achieve. This consists of all equipment operating at the maximum production rates at the same time.

4.1 Description of Operating Conditions

At the Goliath Gold, Mining operations such as drilling, blasting, material handling and material haulage can take place either in the open pit mine or in the underground mine. The open pit mine is to be commissioned first, with mining progressively taking place at lower benches. The underground mine is expected to become operational approximately 3 years after the opening of the open pit mine at which time open pit mining will be taking place at a bench lower than surface level. However, for this study, it has been conservatively assumed that all open pit mining operations at surface level and the underground mining operations will take place simultaneously. All the processes at Goliath Gold operate 24 hours a day, except blasting, which is assumed to occur once a day at 1 p.m.

4.2 Explanation of Method Used to Calculate the Emission Rate

Emission rates of TSP were determined using emission factors and engineering calculations. The emissions of metals from were scaled from the emission rate of TSP based on the content of metal in ore dust and in waste rock dust. Information on metals content in dust was provided by Treasury Metals.

4.2.1 Fugitive Emissions from Unpaved Roadways

Emission factors from Chapter 13.2.2 of AP-42 were used to predict the emission rates from vehicle traffic on the unpaved internal haul roads. The silt loading values, 5.8%, were based on values provided Table 13.2.2-1 in AP-42 for “taconite mining and processing haul road to/from pit” as AP-42 does not provide silt loading values specifically for gold mines.

The hourly traffic passes on the haul roads were provided by Treasury Metals.

Water and chemical suppressants will be used for dust control on the haul roads at the mine site, when temperatures are above freezing. The watering program requires dedicated watering equipment, and enough water must be available and applied to off-set evaporation and maintain a wet road surface. This program would also be supplemented with applications of an approved dust suppressant as required to minimize fugitive dust emissions. The control efficiency for each road segment was conservatively assumed to be only 75%, based on this requirement. Detailed information on these sources is provided in Appendix B1.

4.2.2 Material Handling

Bulk material handling operations include the loading of trucks with ore, low grade ore and waste rock, unloading of trucks and loading of ore at the crusher. Emission factors from Chapter 13.2.4 of the U.S. EPA's AP-42, Aggregate Handling and Storage Piles, were used to predict the emission rates from the bulk material handling.

These emission factors are dependent on wind speed. To accurately reflect the change in emissions with changes in wind speed, hourly wind speeds from the meteorological data file were used in conjunction with the emission factor to develop a file of hourly emission rates for use in the dispersion modelling analysis.

Moisture content of 10% was used for the ore and waste rock, based on information provided by Treasury Metals, was used in the calculations. Detailed information on these sources is provided in Appendix B2.

4.2.3 Bulldozing Operations

Fugitive emissions generated from the bulldozing at the mine site were estimated based on emission factors for bulldozing of overburden, obtained from Chapter 11.9 of AP-42.

The average silt content was assumed to be the same as that occurring on the unpaved roadways within the site, which was estimated to be 5.8% as per Table 13.2.2-1 in AP-42. The moisture content of waste rocks and ore was estimated by Treasury Metals to be 10%.

The emission factor for bulldozing was developed for coal mining, but is applicable here since bulldozing of overburden at a coal mine is analogous to bulldozing at Goliath Gold. Detailed information on this source is provided in Appendix B3.

4.2.4 Blasting

Emissions from blasting at the working face of the mine were based on emission factors from Chapter 11.9 of the U.S. EPA's AP-42, Western Surface Coal Mining.

A maximum of one blast per day will occur at the Goliath Gold mine site, covering an area of 2400 m² per blast. The blasting is assumed to take place at 1 P.M. every day. Detailed information on this source is provided in Appendix B4.

4.2.5 Wind Erosion From Tailings Area

The total area of the tailings pond at the mine is expected to cover 750,000 m² of which 90% is expected to be either vegetated or wet. Therefore wind erosion of particulate matter from tailings at the mine site was estimated for 75,000 m² of dry, un-vegetated tailings (10% of the tailings area). The emissions of wind eroded particulate matter were calculated as per equation 15 of the 1989 paper from W. G. Nickling and J. A. Gilles “Emissions of Fine Grained Particulates from Desert Soils”[1].

These emission factors are dependent on wind speed. To accurately reflect the change in emissions with changes in wind speed, hourly wind speeds from the meteorological data file were used in conjunction with the emission factor to develop a file of hourly emission rates for use in the dispersion modelling analysis. Detailed information on this source is provided in Appendix B5.

4.2.6 Vent Raises

Emissions from underground activities released to the atmosphere through the vent raises are based on emission factors and the flow rate of the vent raises. Emission factors from underground activities released to atmosphere are based on the Bovar Environmental report titled “Report on Mine Vent Exhaust Testing”[2]. The emission factors published in this study have been previously accepted by the Ministry of the Environment for underground mining operations throughout Ontario. Detailed information on these sources is provided in Appendix B6.

4.2.7 Diesel Fired Emergency Generators

Emergency power generators are present on site to provide back-up power in case of a power failure. Emissions from the diesel-fired emergency generators were estimated based on emission factors from Chapter 3.4 and Chapter 3.3 of AP-42, for the 500 kW generator and the 150 kW generator, respectively. The generators are tested for approximately 30 minutes, once a week. However, in this study, the generators are conservatively assumed to be in constant operation. Detailed information on these sources is provided in Appendix B7 and B8.

4.2.8 Baghouse Emissions

Emissions from both the baghouses are calculated using the emission factor provided in Table C-1 of the MOE Procedure for Preparing an ESDM Report Version 3.0, March 2009. Detailed information on this source is provided in Appendix B9. Specific information about the gold smelting kiln furnace baghouse (BAGHOUSE2) was not available. Therefore, the source parameters were assumed to be the same as those of the crusher baghouse (BAGHOUSE).

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1 W. G. Nickling and J. A. Gilles, “Emissions of Fine Grained Particulates from Desert Soils”. Department of Geography, University of Guelph, 1989.

2 Bovar Environmental, Report on Mine Vent Exhaust Testing, Falconbridge Limited, Falconbridge, Ontario, BE Project 541-6254, February 1996.

4.2.9 Natural Gas-Fired Kiln Burner and Heater

Emission of NO_X from the natural gas-fired kiln burner and heater was estimated based on emission factors provided in Chapter 1.4 of AP-42. Detailed information on these sources is provided in Appendix B10 and B11.

4.2.10 Carbon in Leach Emissions

Emissions from the carbon in leach tanks are based on a conservative assumption that hydrogen cyanide will evolve at a concentration of 1 ppm from the tanks. This concentration is converted to an emission rate based on the molecular weight of hydrogen cyanide. Detailed information on this source is provided in Appendix B12.

4.2.11 Drilling Emissions

Emissions from the drilling operations at Goliath Gold were based on emission factors obtained from Chapter 11.19.2 of the US EPA's AP-42, Crushed Stone Processing and Pulverized Mineral Processing.

A maximum of 25 holes will be drilled in an hour with a total processing rate of 338 tonnes per hour. Detailed information on this source is provided in Appendix B13,

4.3 Sample Calculation for Each Method

Sample calculations for each method are provided in Appendix B of this report.

4.4 Assessment of Data Quality for each Emission Rate

The assessment of data quality for each emission rate is provided in the Source Summary Table.

The calculated emission rates for the unpaved roadways, bulk material handling sources and generators are based on AP-42 and had a data quality rating of B or "above average". Emissions from bulldozing operations are given a rating of C in AP-42 which corresponds to an "average" rating. The blasting emission of TSP has been assigned a rating of C and emission of NO_X has been assigned a rating of D which corresponds to a rating of "average" and "marginal", respectively. Emissions from the vents and wind erosion of the tailings area are based on emission factors published in papers and have been assigned a "marginal" rating in this study.

5 SOURCE SUMMARY TABLE AND PROPERTY PLAN

5.1 Source Summary Table

Table 5.1 in the Tables Section provides the Source Summary Table for the facility.

5.2 Site Plan

Figure 5.2 in the Figures Section provides the site plan for the facility. It should be noted that the locations of mining activities shown in the figures are representative locations since the location of these sources are subject to change as mining progresses.

6 DISPERSION MODELLING

6.1 Dispersion Modelling Input Summary Table

Table 6.1 in the Tables Section provides the Dispersion Modelling Input Summary Table for the facility. Additional information on specific elements of the modelling analysis is provided in the following sections. The dispersion modelling was performed using US EPA's AERMOD dispersion model. The model was used to predict maximum concentrations resulting from Goliath Gold's mining and mill operations.

The unpaved roadways and material handling sources were modelled as volume sources with typical dimensions of processing equipment and vehicles expected to be used at the site. The modelled source parameters are consistent with guidance from the National Stone Sand and Gravel Association (NSSGA), which provides detailed guidance on modelling fugitive dust sources[3].

The impact of the emission of metals from the mine site was assessed by completing a dispersion modelling run for TSP with a source group included for each source emitting metals. The predicted maximum TSP concentration for each source group was then scaled with metals content in the origin of dust emitted by that source (either ore or waste rock). The results for each source were then summed to obtain a worst-case maximum POI concentration, by contaminant (metal), for the overall facility. The resulting impacts are more conservative than modelling each contaminant with a separate model run, since the maximum impact for each source does not occur at the same receptor location. The results of this analysis are provided in Appendix D.

6.1.1 Meteorological Conditions

The site is located near Dryden, therefore the Northern Region (Thunder Bay, Kenora) meteorological data set is recommended by the MOE for use at this site. This includes both surface data and upper air data from International Falls, Minnesota. Within each region, the MOE provides alternative data sets with the choice of data set depending on the character of the terrain at the study site. The area surrounding the site is typically forested, with some areas of open water and clear-cuts. The default data set for "forest" was used based on the land use patterns surrounding the site.

6.1.2 Area of Modelling Coverage

The area of modelling coverage was designed to meet the requirements outlined in O. Reg. 419/05, section 14, which provides suitable receptor coverage for this assessment. A multi-tiered receptor grid was developed with reference to Section 7.2 of the MOE Guideline A11: Air Dispersion Modelling

[3] *Modelling Fugitive Dust Sources", National Stone, Sand & Gravel Association, Alexandria, VA., 2004*

Guideline for Ontario, Version 2.0, March, 2009; therefore, interval spacing was dependent on the receptor distance from on-site sources.

6.1.3 Stack Height for Certain New Sources of Contaminant

All stack heights are less than the allowable stack height obtained using the stack height formula defined under Section 15 of O. Reg. 419/05.

6.1.4 Terrain Data

Terrain information for the area surrounding the facility was obtained from the MOE Ontario Digital Elevation Model Data web site. The terrain data is based on the North American Datum 1983 (NAD83) horizontal reference datum. These data were run through the AERMAP terrain pre-processor to estimate base elevations for receptors and to help the model account for changes in elevation of the surrounding terrain.

6.1.5 Averaging Periods Used

½-hour, 1-hour, 24-hour and annual averaging times were used with the AERMOD model to compare to Schedule 3 Standards and other guidelines listed in the Ministry document "Summary of O. Reg. 419/05 Standards and Point Of Impingement Guidelines and Ambient Air Quality Criteria (AAQC's)" dated April 2012. ½-hour average values were calculated from the 1-hour predicted concentrations using a factor of 1.2, as given in Table 4.1 of the Ministry document "Guideline A11: Air Dispersion Modelling Guideline for Ontario" dated March 2009.

6.2 Land Use Designation Plan

Figure 6.2 in the Figures Section provides the land use information.

The facility covers portions of Hartman and Zealand townships, approximately 15 km east of the City of Dryden and 3 km north of Wabigoon, Ontario. It is surrounded by general use areas, provincial park areas and other private lands. It is surrounded by general use areas, provincial park areas and other private lands.

6.3 Dispersion Modelling Input and Output Files

Modelling input and output files have been provided on a compact disc included in Appendix A

7 EMISSION SUMMARY TABLE AND CONCLUSIONS

7.1 Emission Summary Table

Table 7.1 in the Tables Section provides the Emission Summary Table for the facility.

7.2 Contaminants without Standards or Guidelines under O. Reg. 419/05

The following contaminants do not have Standards or guidelines under O. Reg. 419/05, nor do they have relevant Jurisdictional Screening Levels. A Maximum Ground Level Concentration Acceptability Request for Compounds with No Ministry POI Limit has been prepared for these compounds.

- Gold (CAS# 7440-57-5)
- Bismuth (CAS# 7440-69-9)
- Gallium (CAS# 7440-55-3)
- Lanthanum (CAS# 7439-91-0)
- Scandium (CAS# 7440-20-2)
- Thorium (CAS# 7440-29-1)

7.3 Conclusions

Concentrations at points of impingement were predicted using the US EPA's AERMOD dispersion model. Modelling input and output files have been provided on a compact disc included in Appendix A. Predicted concentrations for all of the contaminants of significance were found to be less than their respective Standards or guidelines under O. Reg. 419/05 at all receptors in the area. The contaminant with the greatest percentage of the O. Reg. 419/05 Standard was predicted to be particulate matter with a value of 77%. Therefore, Treasury Metals Incorporated's Goliath Gold Mine is expected to be in compliance with the requirements of O. Reg. 419/05.

TABLES

2.1 Sources and Contaminant Identification Table

Source Information			Expected Contaminants	Included in Modelling?	Significant?	Reference
Source ID (optional)	Source Description or Title	General Location		(yes / no)	(yes / no)	(optional)
ROAD1	Unpaved road from center of mine pit to edge of mine pit	From center of mine pit to edge of mine pit	TSP	No	No	Section 3.2 of ESDM report
			Metals	Yes	Yes	
ROAD2	Unpaved edge of mine pit to ore dump	From edge of mine pit to ore dump	TSP	No	No	Section 3.2 of ESDM report
			Metals	Yes	Yes	
ROAD3	Unpaved edge of mine pit to center of low grade stockpile	From edge of mine pit to center of low grade stockpile	TSP	No	No	Section 3.2 of ESDM report
			Metals	Yes	Yes	
ROAD4	Unpaved edge of mine pit to center of waste rock stockpile	From edge of mine pit to center of waste rock stockpile	TSP	No	No	Section 3.2 of ESDM report
			Metals	Yes	Yes	
DOZER1	Bulldozer at ore dump	At the ore dump	TSP	Yes	Yes	
			Metals	Yes	Yes	
DOZER2	Bulldozer at low grade ore stockpile	At the low grade stockpile	TSP	Yes	Yes	
			Metals	Yes	Yes	
DOZER3	Bulldozer at waste rock stockpile	At the waste rock stockpile	TSP	Yes	Yes	
			Metals	Yes	Yes	
ORE1	Loading trucks with ore in the mine pit	In the center of the mine pit	TSP	Yes	Yes	
			Metals	Yes	Yes	
LGORE1	Loading trucks with low grade ore in the mine pit	In the center of the mine pit	TSP	Yes	Yes	
			Metals	Yes	Yes	
WST1	Loading trucks with waste rock in the mine pit	In the center of the mine pit	TSP	Yes	Yes	
			Metals	Yes	Yes	
ORE2	Unloading ore from trucks	At the ore dump	TSP	Yes	Yes	
			Metals	Yes	Yes	
LGORE2	Unloading low grade ore from trucks	At the low grade stockpile	TSP	Yes	Yes	
			Metals	Yes	Yes	
WST2	Unloading waste rock from trucks	At the waste rock stockpile	TSP	Yes	Yes	
			Metals	Yes	Yes	
LOADER	Loading ore in to crusher	East of open pit mine	TSP	Yes	Yes	
			Metals	Yes	Yes	
BLAST	Blasting at working face of mine	Working face of open pit mine	TSP	Yes	Yes	
			Metals	Yes	Yes	
			NO_X	Yes	Yes	
TAILING	Dry, unvegetated tailings area	Tailings area north east of mill building	TSP	Yes	Yes	
			Metals	Yes	Yes	
VENT1	Underground mine exhaust vent raise	South west of open pit mine	TSP	Yes	Yes	
			Metals	Yes	Yes	
			NO_X	Yes	Yes	
			CO	Yes	Yes	
VENT2	Underground mine exhaust vent raise	North east of open pit mine	TSP	Yes	Yes	
			Metals	Yes	Yes	
			NO_X	Yes	Yes	
			CO	Yes	Yes	
GEN1	500 kW diesel emergency generator	East of open pit mine	NO_X	No	No	Section 3.1 of ESDM report
			Other products of combustion	No	No	Section 3.1 of ESDM report
GEN2	150 kW diesel emergency generator	North of open pit mine	NO_X	No	No	Section 3.1 of ESDM report
			Other products of combustion	No	No	Section 3.1 of ESDM report
DRILLING	Drilling at mine pit work face	Center of open pit mine	TSP	No	No	Section 3.1 of ESDM report
BAGHOUSE	Crusher baghouse	East of open pit mine	TSP	No	No	Section 3.1 of ESDM report
BAGHOUSE2	Gold Smelting kiln furnace baghouse	East of open pit mine	TSP	No	No	Section 3.1 of ESDM report
MILL	Carbon in leach tanks	East of open pit mine	Hydrogen Cyanide	No	No	Section 3.1 of ESDM report
WELDING	Maintenance welding station	East of open pit mine	Products of welding	No	No	Section 3.1 of ESDM report
KILN	150 kW natural gas-fired kiln burner	East of open pit mine	NO_X	No	No	Section 3.1 of ESDM report
			Other products of combustion	No	No	Section 3.1 of ESDM report
ELUTION	900 kW natural gas-fired heater	East of open pit mine	NO_X	No	No	Section 3.1 of ESDM report
			Other products of combustion	No	No	Section 3.1 of ESDM report
	Natural gas-fired comfort heating equipment	East of open pit mine in mill building	NO_X	No	No	Section 3.1 of ESDM report
			Other products of combustion	No	No	Section 3.1 of ESDM report

5.1 Source Summary Table (by source)

Source ID [1]	Source Type [1]	Source Description	Source Data								Emission Data						
			Stack Volumetric Flow Rate (Am^3/s)	Stack Exit Gas Temp. (°C)	Stack Inner Diameter (m)	Stack Exit Velocity (m/s)	Stack Height Above Grade (m)	Stack Height Above Roof (m)	Source Coordinates X (m)	Source Coordinates Y (m)	Contaminant	CAS Number	Maximum Emission Rate (g/s)	Averaging Period (hours)	Emission Estimating Technique [2]	Emissions Data Quality [3]	% of Overall Emissions (%)
ROAD1	Volume	Unpaved road from center of mine pit to edge of mine pit	--	--	--	--	--	--	--	--	Gold	7440-57-5	6.20E-06	24	EF	Above-Average	15%
											Silver	7440-22-4	1.03E-05	24	EF	Above-Average	17%
											Copper	7440-50-8	2.30E-04	24	EF	Above-Average	22%
											Iron	15438-31-0	1.62E-05	24	EF	Above-Average	27%
											Lead	7439-92-1	7.68E-04	24	EF	Above-Average	18%
											Zinc	7440-66-6	1.85E-03	24	EF	Above-Average	19%
											Aluminium	7429-90-5	4.10E-05	24	EF	Above-Average	27%
											Arsenic	7440-38-2	2.20E-04	24	EF	Above-Average	25%
											Barium	7440-39-3	3.24E-03	24	EF	Above-Average	27%
											Beryllium	7440-41-7	1.62E-05	24	EF	Above-Average	27%
											Bismuth	7440-69-9	7.35E-05	24	EF	Above-Average	27%
											Calcium	7440-70-2	1.22E-05	24	EF	Above-Average	28%
											Cadmium	7440-43-9	2.33E-05	24	EF	Above-Average	25%
											Cobalt	7440-48-4	8.19E-05	24	EF	Above-Average	28%
											Chromium	7440-47-3	9.92E-04	24	EF	Above-Average	27%
											Potassium	7440-09-7	7.65E-06	24	EF	Above-Average	27%
											Lithium	7439-93-2	1.38E-04	24	EF	Above-Average	28%
											Magnesium	7439-95-4	7.41E-06	24	EF	Above-Average	28%
											Manganese	7439-96-5	3.88E-03	24	EF	Above-Average	28%
											Molybdenum	7439-98-7	5.08E-05	24	EF	Above-Average	27%
											Nickel	7440-02-0	2.64E-04	Annual	EF	Above-Average	27%
											Phosphorous	7723-14-0	3.49E-03	24	EF	Above-Average	28%
											Antimony	7440-36-0	3.73E-05	24	EF	Above-Average	23%
											Selenium	7782-49-2	6.21E-05	24	EF	Above-Average	27%
											Tin	7440-31-5	1.60E-04	24	EF	Above-Average	27%
											Strontium	7440-24-6	1.12E-03	24	EF	Above-Average	28%
											Titanium	7440-32-6	1.25E-02	24	EF	Above-Average	28%
											Thallium	7440-28-0	1.17E-04	24	EF	Above-Average	28%
											Vanadium	7440-62-2	3.31E-04	24	EF	Above-Average	28%
											Tungsten	7440-33-7	7.10E-05	24	EF	Above-Average	25%
											Yttrium	7440-65-5	5.01E-05	24	EF	Above-Average	28%
											Sulphur	7704-34-9	1.54E-05	24	EF	Above-Average	22%
											Uranium	7440-61-1	6.90E-05	Annual	EF	Above-Average	27%
											Gallium	7440-55-3	1.37E-04	24	EF	Above-Average	27%
											Lanthanum	7439-91-0	1.13E-04	24	EF	Above-Average	27%
											Scandium	7440-20-2	3.60E-05	24	EF	Above-Average	27%
											Thorium	7440-29-1	1.38E-04	24	EF	Above-Average	27%
											Platinum	7440-06-4	1.39E-04	24	EF	Above-Average	28%
											Palladium	7657-10-1	7.97E-05	24	EF	Above-Average	28%
											Rhodium	7440-16-6	4.12E-05	24	EF	Above-Average	27%
											Sodium	7440-23-5	5.66E-06	24	EF	Above-Average	29%
ROAD2	Volume	Unpaved edge of mine pit to ore dump	--	--	--	--	--	--	--	--	Gold	7440-57-5	3.68E-07	24	EF	Above-Average	<1%
											Silver	7440-22-4	6.12E-07	24	EF	Above-Average	1%
											Copper	7440-50-8	1.37E-05	24	EF	Above-Average	1%
											Iron	15438-31-0	9.62E-07	24	EF	Above-Average	2%
											Lead	7439-92-1	4.56E-05	24	EF	Above-Average	1%
											Zinc	7440-66-6	1.10E-04	24	EF	Above-Average	1%
											Aluminium	7429-90-5	2.43E-06	24	EF	Above-Average	2%
											Arsenic	7440-38-2	1.31E-05	24	EF	Above-Average	2%
											Barium	7440-39-3	1.92E-04	24	EF	Above-Average	2%
											Beryllium	7440-41-7	9.64E-07	24	EF	Above-Average	2%

Source ID [1]	Source Type [1]	Source Description	Source Data								Emission Data						
			Stack Volumetric Flow Rate (Am³/s)	Stack Exit Gas Temp. (ºC)	Stack Inner Diameter (m)	Stack Exit Velocity (m/s)	Stack Height Above Grade (m)	Stack Height Above Roof (m)	Source Coordinates X (m)	Source Coordinates Y (m)	Contaminant	CAS Number	Maximum Emission Rate (g/s)	Averaging Period (hours)	Emission Estimating Technique [2]	Emissions Data Quality [3]	% of Overall Emissions (%)
											Bismuth	7440-69-9	4.37E-06	24	EF	Above-Average	2%
											Calcium	7440-70-2	7.25E-07	24	EF	Above-Average	2%
											Cadmium	7440-43-9	1.39E-06	24	EF	Above-Average	2%
											Cobalt	7440-48-4	4.87E-06	24	EF	Above-Average	2%
											Chromium	7440-47-3	5.89E-05	24	EF	Above-Average	2%
											Potassium	7440-09-7	4.55E-07	24	EF	Above-Average	2%
											Lithium	7439-93-2	8.19E-06	24	EF	Above-Average	2%
											Magnesium	7439-95-4	4.40E-07	24	EF	Above-Average	2%
											Manganese	7439-96-5	2.31E-04	24	EF	Above-Average	2%
											Molybdenum	7439-98-7	3.02E-06	24	EF	Above-Average	2%
											Nickel	7440-02-0	1.57E-05	Annual	EF	Above-Average	2%
											Phosphorous	7723-14-0	2.08E-04	24	EF	Above-Average	2%
											Antimony	7440-36-0	2.22E-06	24	EF	Above-Average	1%
											Selenium	7782-49-2	3.69E-06	24	EF	Above-Average	2%
											Tin	7440-31-5	9.50E-06	24	EF	Above-Average	2%
											Strontium	7440-24-6	6.63E-05	24	EF	Above-Average	2%
											Titanium	7440-32-6	7.42E-04	24	EF	Above-Average	2%
											Thallium	7440-28-0	6.93E-06	24	EF	Above-Average	2%
											Vanadium	7440-62-2	1.97E-05	24	EF	Above-Average	2%
											Tungsten	7440-33-7	4.22E-06	24	EF	Above-Average	1%
											Yttrium	7440-65-5	2.98E-06	24	EF	Above-Average	2%
											Sulphur	7704-34-9	9.17E-07	24	EF	Above-Average	1%
											Uranium	7440-61-1	4.10E-06	Annual	EF	Above-Average	2%
											Gallium	7440-55-3	8.14E-06	24	EF	Above-Average	2%
											Lanthanum	7439-91-0	6.70E-06	24	EF	Above-Average	2%
											Scandium	7440-20-2	2.14E-06	24	EF	Above-Average	2%
											Thorium	7440-29-1	8.20E-06	24	EF	Above-Average	2%
											Platinum	7440-06-4	8.26E-06	24	EF	Above-Average	2%
											Palladium	7657-10-1	4.74E-06	24	EF	Above-Average	2%
											Rhodium	7440-16-6	2.45E-06	24	EF	Above-Average	2%
											Sodium	7440-23-5	3.37E-07	24	EF	Above-Average	2%
ROAD3	Volume	Unpaved edge of mine pit to center of low grade stockpile	--	--	--	--	--	--	--	--	Gold	7440-57-5	3.50E-07	24	EF	Above-Average	<1%
											Silver	7440-22-4	5.83E-07	24	EF	Above-Average	<1%
											Copper	7440-50-8	1.30E-05	24	EF	Above-Average	1%
											Iron	15438-31-0	9.15E-07	24	EF	Above-Average	2%
											Lead	7439-92-1	4.34E-05	24	EF	Above-Average	1%
											Zinc	7440-66-6	1.05E-04	24	EF	Above-Average	1%
											Aluminium	7429-90-5	2.32E-06	24	EF	Above-Average	2%
											Arsenic	7440-38-2	1.24E-05	24	EF	Above-Average	1%
											Barium	7440-39-3	1.83E-04	24	EF	Above-Average	2%
											Beryllium	7440-41-7	9.17E-07	24	EF	Above-Average	2%
											Bismuth	7440-69-9	4.16E-06	24	EF	Above-Average	2%
											Calcium	7440-70-2	6.89E-07	24	EF	Above-Average	2%
											Cadmium	7440-43-9	1.32E-06	24	EF	Above-Average	1%
											Cobalt	7440-48-4	4.63E-06	24	EF	Above-Average	2%
											Chromium	7440-47-3	5.60E-05	24	EF	Above-Average	2%
											Potassium	7440-09-7	4.32E-07	24	EF	Above-Average	2%
											Lithium	7439-93-2	7.79E-06	24	EF	Above-Average	2%
											Magnesium	7439-95-4	4.19E-07	24	EF	Above-Average	2%
											Manganese	7439-96-5	2.19E-04	24	EF	Above-Average	2%
											Molybdenum	7439-98-7	2.87E-06	24	EF	Above-Average	2%
											Nickel	7440-02-0	1.49E-05	Annual	EF	Above-Average	2%
											Phosphorous	7723-14-0	1.97E-04	24	EF	Above-Average	2%
											Antimony	7440-36-0	2.11E-06	24	EF	Above-Average	1%
											Selenium	7782-49-2	3.51E-06	24	EF	Above-Average	2%

Source ID [1]	Source Type [1]	Source Description	Source Data: Stack Volumetric Flow Rate (Am³/s)	Stack Exit Gas Temp. (°C)	Stack Inner Diameter (m)	Stack Exit Velocity (m/s)	Stack Height Above Grade (m)	Stack Height Above Roof (m)	Source Coordinates X (m)	Source Coordinates Y (m)	Emission Data: Contaminant	CAS Number	Maximum Emission Rate (g/s)	Averaging Period (hours)	Emission Estimating Technique [2]	Emissions Data Quality [3]	% of Overall Emissions (%)
											Tin	7440-31-5	9.04E-06	24	EF	Above-Average	2%
											Strontium	7440-24-6	6.30E-05	24	EF	Above-Average	2%
											Titanium	7440-32-6	7.06E-04	24	EF	Above-Average	2%
											Thallium	7440-28-0	6.59E-06	24	EF	Above-Average	2%
											Vanadium	7440-62-2	1.87E-05	24	EF	Above-Average	2%
											Tungsten	7440-33-7	4.01E-06	24	EF	Above-Average	1%
											Yttrium	7440-65-5	2.83E-06	24	EF	Above-Average	2%
											Sulphur	7704-34-9	8.73E-07	24	EF	Above-Average	1%
											Uranium	7440-61-1	3.90E-06	Annual	EF	Above-Average	2%
											Gallium	7440-55-3	7.74E-06	24	EF	Above-Average	2%
											Lanthanum	7439-91-0	6.37E-06	24	EF	Above-Average	2%
											Scandium	7440-20-2	2.04E-06	24	EF	Above-Average	2%
											Thorium	7440-29-1	7.80E-06	24	EF	Above-Average	2%
											Platinum	7440-06-4	7.86E-06	24	EF	Above-Average	2%
											Palladium	7657-10-1	4.51E-06	24	EF	Above-Average	2%
											Rhodium	7440-16-6	2.33E-06	24	EF	Above-Average	2%
											Sodium	7440-23-5	3.20E-07	24	EF	Above-Average	2%
ROAD4	Volume	Unpaved edge of mine pit to center of waste rock stockpile	--	--	--	--	--	--	--	--	Gold	7440-57-5	6.74E-06	24	EF	Above-Average	17%
											Silver	7440-22-4	1.12E-05	24	EF	Above-Average	18%
											Copper	7440-50-8	2.50E-04	24	EF	Above-Average	24%
											Iron	15438-31-0	1.76E-05	24	EF	Above-Average	30%
											Lead	7439-92-1	8.35E-04	24	EF	Above-Average	20%
											Zinc	7440-66-6	2.01E-03	24	EF	Above-Average	20%
											Aluminium	7429-90-5	4.45E-05	24	EF	Above-Average	30%
											Arsenic	7440-38-2	2.39E-04	24	EF	Above-Average	28%
											Barium	7440-39-3	3.52E-03	24	EF	Above-Average	30%
											Beryllium	7440-41-7	1.76E-05	24	EF	Above-Average	30%
											Bismuth	7440-69-9	7.99E-05	24	EF	Above-Average	30%
											Calcium	7440-70-2	1.33E-05	24	EF	Above-Average	31%
											Cadmium	7440-43-9	2.53E-05	24	EF	Above-Average	27%
											Cobalt	7440-48-4	8.90E-05	24	EF	Above-Average	30%
											Chromium	7440-47-3	1.08E-03	24	EF	Above-Average	30%
											Potassium	7440-09-7	8.32E-06	24	EF	Above-Average	30%
											Lithium	7439-93-2	1.50E-04	24	EF	Above-Average	30%
											Magnesium	7439-95-4	8.05E-06	24	EF	Above-Average	30%
											Manganese	7439-96-5	4.22E-03	24	EF	Above-Average	30%
											Molybdenum	7439-98-7	5.52E-05	24	EF	Above-Average	29%
											Nickel	7440-02-0	2.87E-04	Annual	EF	Above-Average	30%
											Phosphorous	7723-14-0	3.80E-03	24	EF	Above-Average	30%
											Antimony	7440-36-0	4.05E-05	24	EF	Above-Average	25%
											Selenium	7782-49-2	6.75E-05	24	EF	Above-Average	30%
											Tin	7440-31-5	1.74E-04	24	EF	Above-Average	30%
											Strontium	7440-24-6	1.21E-03	24	EF	Above-Average	31%
											Titanium	7440-32-6	1.36E-02	24	EF	Above-Average	30%
											Thallium	7440-28-0	1.27E-04	24	EF	Above-Average	30%
											Vanadium	7440-62-2	3.60E-04	24	EF	Above-Average	30%
											Tungsten	7440-33-7	7.72E-05	24	EF	Above-Average	27%
											Yttrium	7440-65-5	5.45E-05	24	EF	Above-Average	30%
											Sulphur	7704-34-9	1.68E-05	24	EF	Above-Average	24%
											Uranium	7440-61-1	7.50E-05	Annual	EF	Above-Average	30%
											Gallium	7440-55-3	1.49E-04	24	EF	Above-Average	30%
											Lanthanum	7439-91-0	1.22E-04	24	EF	Above-Average	30%
											Scandium	7440-20-2	3.92E-05	24	EF	Above-Average	29%
											Thorium	7440-29-1	1.50E-04	24	EF	Above-Average	30%
											Platinum	7440-06-4	1.51E-04	24	EF	Above-Average	30%

Source ID [1]	Source Type [1]	Source Description	Source Data								Emission Data						
			Stack Volumetric Flow Rate (Am³/s)	Stack Exit Gas Temp. (°C)	Stack Inner Diameter (m)	Stack Exit Velocity (m/s)	Stack Height Above Grade (m)	Stack Height Above Roof (m)	Source Coordinates X (m)	Source Coordinates Y (m)	Contaminant	CAS Number	Maximum Emission Rate (g/s)	Averaging Period (hours)	Emission Estimating Technique [2]	Emissions Data Quality [3]	% of Overall Emissions (%)
											Palladium	7657-10-1	8.66E-05	24	EF	Above-Average	30%
											Rhodium	7440-16-6	4.48E-05	24	EF	Above-Average	30%
											Sodium	7440-23-5	6.16E-06	24	EF	Above-Average	31%
DOZER1	Area	Bulldozer at ore dump	--	--	--	--	--	--	--	--	TSP	N/A	2.98E-01	24	EF	Average	3%
											Gold	7440-57-5	4.78E-06	24	EF	Average	12%
											Silver	7440-22-4	4.00E-06	24	EF	Average	7%
											Copper	7440-50-8	3.88E-05	24	EF	Average	4%
											Iron	15438-31-0	7.34E-07	24	EF	Average	1%
											Lead	7439-92-1	2.57E-04	24	EF	Average	6%
											Zinc	7440-66-6	5.66E-04	24	EF	Average	6%
											Aluminium	7429-90-5	1.67E-06	24	EF	Average	1%
											Arsenic	7440-38-2	1.93E-05	24	EF	Average	2%
											Barium	7440-39-3	1.40E-04	24	EF	Average	1%
											Beryllium	7440-41-7	7.21E-07	24	EF	Average	1%
											Bismuth	7440-69-9	2.96E-06	24	EF	Average	1%
											Calcium	7440-70-2	3.15E-07	24	EF	Average	<1%
											Cadmium	7440-43-9	2.09E-06	24	EF	Average	2%
											Cobalt	7440-48-4	2.98E-06	24	EF	Average	1%
											Chromium	7440-47-3	4.42E-05	24	EF	Average	1%
											Potassium	7440-09-7	3.23E-07	24	EF	Average	1%
											Lithium	7439-93-2	5.14E-06	24	EF	Average	1%
											Magnesium	7439-95-4	2.54E-07	24	EF	Average	<1%
											Manganese	7439-96-5	1.37E-04	24	EF	Average	<1%
											Molybdenum	7439-98-7	2.67E-06	24	EF	Average	1%
											Nickel	7440-02-0	1.11E-05	Annual	EF	Average	1%
											Phosphorous	7723-14-0	1.36E-04	24	EF	Average	1%
											Antimony	7440-36-0	5.67E-06	24	EF	Average	3%
											Selenium	7782-49-2	2.88E-06	24	EF	Average	1%
											Tin	7440-31-5	6.60E-06	24	EF	Average	1%
											Strontium	7440-24-6	2.97E-05	24	EF	Average	<1%
											Titanium	7440-32-6	4.37E-04	24	EF	Average	<1%
											Thallium	7440-28-0	4.07E-06	24	EF	Average	<1%
											Vanadium	7440-62-2	1.13E-05	24	EF	Average	<1%
											Tungsten	7440-33-7	7.60E-06	24	EF	Average	3%
											Yttrium	7440-65-5	1.78E-06	24	EF	Average	<1%
											Sulphur	7704-34-9	2.69E-06	24	EF	Average	4%
											Uranium	7440-61-1	2.98E-06	Annual	EF	Average	1%
											Gallium	7440-55-3	5.68E-06	24	EF	Average	1%
											Lanthanum	7439-91-0	4.97E-06	24	EF	Average	1%
											Scandium	7440-20-2	1.86E-06	24	EF	Average	1%
											Thorium	7440-29-1	5.97E-06	24	EF	Average	1%
											Platinum	7440-06-4	4.48E-06	24	EF	Average	<1%
											Palladium	7657-10-1	2.98E-06	24	EF	Average	1%
											Rhodium	7440-16-6	1.94E-06	24	EF	Average	1%
											Sodium	7440-23-5	1.11E-07	24	EF	Average	<1%
DOZER2	Area	Bulldozer at low grade ore stockpile	--	--	--	--	--	--	--	--	TSP	N/A	2.98E-01	24	EF	Average	3%
											Gold	7440-57-5	4.78E-06	24	EF	Average	12%
											Silver	7440-22-4	4.00E-06	24	EF	Average	7%
											Copper	7440-50-8	3.88E-05	24	EF	Average	4%
											Iron	15438-31-0	7.34E-07	24	EF	Average	1%
											Lead	7439-92-1	2.57E-04	24	EF	Average	6%
											Zinc	7440-66-6	5.66E-04	24	EF	Average	6%
											Aluminium	7429-90-5	1.67E-06	24	EF	Average	1%
											Arsenic	7440-38-2	1.93E-05	24	EF	Average	2%
											Barium	7440-39-3	1.40E-04	24	EF	Average	1%
											Beryllium	7440-41-7	7.21E-07	24	EF	Average	1%

Source ID [1]	Source Type [1]	Source Description	Source Data: Stack Volumetric Flow Rate (Am³/s)	Stack Exit Gas Temp. (°C)	Stack Inner Diameter (m)	Stack Exit Velocity (m/s)	Stack Height Above Grade (m)	Stack Height Above Roof (m)	Source Coordinates X (m)	Source Coordinates Y (m)	Emission Data: Contaminant	CAS Number	Maximum Emission Rate (g/s)	Averaging Period (hours)	Emission Estimating Technique [2]	Emissions Data Quality [3]	% of Overall Emissions (%)
											Bismuth	7440-69-9	2.96E-06	24	EF	Average	1%
											Calcium	7440-70-2	3.15E-07	24	EF	Average	<1%
											Cadmium	7440-43-9	2.09E-06	24	EF	Average	2%
											Cobalt	7440-48-4	2.98E-06	24	EF	Average	1%
											Chromium	7440-47-3	4.42E-05	24	EF	Average	1%
											Potassium	7440-09-7	3.23E-07	24	EF	Average	1%
											Lithium	7439-93-2	5.14E-06	24	EF	Average	1%
											Magnesium	7439-95-4	2.54E-07	24	EF	Average	<1%
											Manganese	7439-96-5	1.37E-04	24	EF	Average	<1%
											Molybdenum	7439-98-7	2.67E-06	24	EF	Average	1%
											Nickel	7440-02-0	1.11E-05	Annual	EF	Average	1%
											Phosphorous	7723-14-0	1.36E-04	24	EF	Average	1%
											Antimony	7440-36-0	5.67E-06	24	EF	Average	3%
											Selenium	7782-49-2	2.88E-06	24	EF	Average	1%
											Tin	7440-31-5	6.60E-06	24	EF	Average	1%
											Strontium	7440-24-6	2.97E-05	24	EF	Average	<1%
											Titanium	7440-32-6	4.37E-04	24	EF	Average	<1%
											Thallium	7440-28-0	4.07E-06	24	EF	Average	<1%
											Vanadium	7440-62-2	1.13E-05	24	EF	Average	<1%
											Tungsten	7440-33-7	7.60E-06	24	EF	Average	3%
											Yttrium	7440-65-5	1.78E-06	24	EF	Average	<1%
											Sulphur	7704-34-9	2.69E-06	24	EF	Average	4%
											Uranium	7440-61-1	2.98E-06	Annual	EF	Average	1%
											Gallium	7440-55-3	5.68E-06	24	EF	Average	1%
											Lanthanum	7439-91-0	4.97E-06	24	EF	Average	1%
											Scandium	7440-20-2	1.86E-06	24	EF	Average	1%
											Thorium	7440-29-1	5.97E-06	24	EF	Average	1%
											Platinum	7440-06-4	4.48E-06	24	EF	Average	<1%
											Palladium	7657-10-1	2.98E-06	24	EF	Average	1%
											Rhodium	7440-16-6	1.94E-06	24	EF	Average	1%
											Sodium	7440-23-5	1.11E-07	24	EF	Average	<1%
DOZER3	Area	Bulldozer at waste rock stockpile	--	--	--	--	--	--	--	--	TSP	N/A	2.98E-01	24	EF	Average	3%
											Gold	7440-57-5	2.68E-07	24	EF	Average	<1%
											Silver	7440-22-4	4.46E-07	24	EF	Average	<1%
											Copper	7440-50-8	9.95E-06	24	EF	Average	<1%
											Iron	15438-31-0	7.00E-07	24	EF	Average	1%
											Lead	7439-92-1	3.32E-05	24	EF	Average	<1%
											Zinc	7440-66-6	8.01E-05	24	EF	Average	<1%
											Aluminium	7429-90-5	1.77E-06	24	EF	Average	1%
											Arsenic	7440-38-2	9.51E-06	24	EF	Average	1%
											Barium	7440-39-3	1.40E-04	24	EF	Average	1%
											Beryllium	7440-41-7	7.02E-07	24	EF	Average	1%
											Bismuth	7440-69-9	3.18E-06	24	EF	Average	1%
											Calcium	7440-70-2	5.27E-07	24	EF	Average	1%
											Cadmium	7440-43-9	1.01E-06	24	EF	Average	1%
											Cobalt	7440-48-4	3.54E-06	24	EF	Average	1%
											Chromium	7440-47-3	4.29E-05	24	EF	Average	1%
											Potassium	7440-09-7	3.31E-07	24	EF	Average	1%
											Lithium	7439-93-2	5.96E-06	24	EF	Average	1%
											Magnesium	7439-95-4	3.20E-07	24	EF	Average	1%
											Manganese	7439-96-5	1.68E-04	24	EF	Average	1%
											Molybdenum	7439-98-7	2.20E-06	24	EF	Average	1%
											Nickel	7440-02-0	1.14E-05	Annual	EF	Average	1%
											Phosphorous	7723-14-0	1.51E-04	24	EF	Average	1%
											Antimony	7440-36-0	1.61E-06	24	EF	Average	<1%
											Selenium	7782-49-2	2.68E-06	24	EF	Average	1%

Source ID [1]	Source Type [1]	Source Description	Source Data: Stack Volumetric Flow Rate (Am³/s)	Stack Exit Gas Temp. (°C)	Stack Inner Diameter (m)	Stack Exit Velocity (m/s)	Stack Height Above Grade (m)	Stack Height Above Roof (m)	Source Coordinates X (m)	Source Coordinates Y (m)	Emission Data: Contaminant	CAS Number	Maximum Emission Rate (g/s)	Averaging Period (hours)	Emission Estimating Technique [2]	Emissions Data Quality [3]	% of Overall Emissions (%)
											Tin	7440-31-5	6.92E-06	24	EF	Average	1%
											Strontium	7440-24-6	4.82E-05	24	EF	Average	1%
											Titanium	7440-32-6	5.40E-04	24	EF	Average	1%
											Thallium	7440-28-0	5.04E-06	24	EF	Average	1%
											Vanadium	7440-62-2	1.43E-05	24	EF	Average	1%
											Tungsten	7440-33-7	3.07E-06	24	EF	Average	1%
											Yttrium	7440-65-5	2.17E-06	24	EF	Average	1%
											Sulphur	7704-34-9	6.68E-07	24	EF	Average	<1%
											Uranium	7440-61-1	2.98E-06	Annual	EF	Average	1%
											Gallium	7440-55-3	5.92E-06	24	EF	Average	1%
											Lanthanum	7439-91-0	4.87E-06	24	EF	Average	1%
											Scandium	7440-20-2	1.56E-06	24	EF	Average	1%
											Thorium	7440-29-1	5.97E-06	24	EF	Average	1%
											Platinum	7440-06-4	6.01E-06	24	EF	Average	1%
											Palladium	7657-10-1	3.45E-06	24	EF	Average	1%
											Rhodium	7440-16-6	1.78E-06	24	EF	Average	1%
											Sodium	7440-23-5	2.45E-07	24	EF	Average	1%
ORE1	Volume	Loading trucks with ore in the mine pit	--	--	--	--	--	--	--	--	TSP	N/A	7.95E-03	24	EF	Above-Average	<1%
											Gold	7440-57-5	1.27E-07	24	EF	Above-Average	<1%
											Silver	7440-22-4	1.07E-07	24	EF	Above-Average	<1%
											Copper	7440-50-8	1.03E-06	24	EF	Above-Average	<1%
											Iron	15438-31-0	1.96E-08	24	EF	Above-Average	<1%
											Lead	7439-92-1	6.84E-06	24	EF	Above-Average	<1%
											Zinc	7440-66-6	1.51E-05	24	EF	Above-Average	<1%
											Aluminium	7429-90-5	4.45E-08	24	EF	Above-Average	<1%
											Arsenic	7440-38-2	5.15E-07	24	EF	Above-Average	<1%
											Barium	7440-39-3	3.72E-06	24	EF	Above-Average	<1%
											Beryllium	7440-41-7	1.92E-08	24	EF	Above-Average	<1%
											Bismuth	7440-69-9	7.89E-08	24	EF	Above-Average	<1%
											Calcium	7440-70-2	8.39E-09	24	EF	Above-Average	<1%
											Cadmium	7440-43-9	5.56E-08	24	EF	Above-Average	<1%
											Cobalt	7440-48-4	7.93E-08	24	EF	Above-Average	<1%
											Chromium	7440-47-3	1.18E-06	24	EF	Above-Average	<1%
											Potassium	7440-09-7	8.62E-09	24	EF	Above-Average	<1%
											Lithium	7439-93-2	1.37E-07	24	EF	Above-Average	<1%
											Magnesium	7439-95-4	6.77E-09	24	EF	Above-Average	<1%
											Manganese	7439-96-5	3.66E-06	24	EF	Above-Average	<1%
											Molybdenum	7439-98-7	7.12E-08	24	EF	Above-Average	<1%
											Nickel	7440-02-0	2.97E-07	Annual	EF	Above-Average	<1%
											Phosphorous	7723-14-0	3.61E-06	24	EF	Above-Average	<1%
											Antimony	7440-36-0	1.51E-07	24	EF	Above-Average	<1%
											Selenium	7782-49-2	7.67E-08	24	EF	Above-Average	<1%
											Tin	7440-31-5	1.76E-07	24	EF	Above-Average	<1%
											Strontium	7440-24-6	7.91E-07	24	EF	Above-Average	<1%
											Titanium	7440-32-6	1.16E-05	24	EF	Above-Average	<1%
											Thallium	7440-28-0	1.08E-07	24	EF	Above-Average	<1%
											Vanadium	7440-62-2	3.00E-07	24	EF	Above-Average	<1%
											Tungsten	7440-33-7	2.02E-07	24	EF	Above-Average	<1%
											Yttrium	7440-65-5	4.74E-08	24	EF	Above-Average	<1%
											Sulphur	7704-34-9	7.17E-08	24	EF	Above-Average	<1%
											Uranium	7440-61-1	7.95E-08	Annual	EF	Above-Average	<1%
											Gallium	7440-55-3	1.51E-07	24	EF	Above-Average	<1%
											Lanthanum	7439-91-0	1.33E-07	24	EF	Above-Average	<1%
											Scandium	7440-20-2	4.96E-08	24	EF	Above-Average	<1%
											Thorium	7440-29-1	1.59E-07	24	EF	Above-Average	<1%
											Platinum	7440-06-4	1.19E-07	24	EF	Above-Average	<1%

Source ID [1]	Source Type [1]	Source Description	Source Data								Emission Data						
			Stack Volumetric Flow Rate (Am³/s)	Stack Exit Gas Temp. (°C)	Stack Inner Diameter (m)	Stack Exit Velocity (m/s)	Stack Height Above Grade (m)	Stack Height Above Roof (m)	Source Coordinates X (m)	Source Coordinates Y (m)	Contaminant	CAS Number	Maximum Emission Rate (g/s)	Averaging Period (hours)	Emission Estimating Technique [2]	Emissions Data Quality [3]	% of Overall Emissions (%)
											Palladium	7657-10-1	7.95E-08	24	EF	Above-Average	<1%
											Rhodium	7440-16-6	5.17E-08	24	EF	Above-Average	<1%
											Sodium	7440-23-5	2.95E-09	24	EF	Above-Average	<1%
LGORE1	Volume	Loading trucks with low grade ore in the mine pit	--	--	--	--	--	--	--	--	TSP	N/A	7.95E-03	24	EF	Above-Average	<1%
											Gold	7440-57-5	1.27E-07	24	EF	Above-Average	<1%
											Silver	7440-22-4	1.07E-07	24	EF	Above-Average	<1%
											Copper	7440-50-8	1.03E-06	24	EF	Above-Average	<1%
											Iron	15438-31-0	1.96E-08	24	EF	Above-Average	<1%
											Lead	7439-92-1	6.84E-06	24	EF	Above-Average	<1%
											Zinc	7440-66-6	1.51E-05	24	EF	Above-Average	<1%
											Aluminium	7429-90-5	4.45E-08	24	EF	Above-Average	<1%
											Arsenic	7440-38-2	5.15E-07	24	EF	Above-Average	<1%
											Barium	7440-39-3	3.72E-06	24	EF	Above-Average	<1%
											Beryllium	7440-41-7	1.92E-08	24	EF	Above-Average	<1%
											Bismuth	7440-69-9	7.89E-08	24	EF	Above-Average	<1%
											Calcium	7440-70-2	8.39E-09	24	EF	Above-Average	<1%
											Cadmium	7440-43-9	5.56E-08	24	EF	Above-Average	<1%
											Cobalt	7440-48-4	7.93E-08	24	EF	Above-Average	<1%
											Chromium	7440-47-3	1.18E-06	24	EF	Above-Average	<1%
											Potassium	7440-09-7	8.62E-09	24	EF	Above-Average	<1%
											Lithium	7439-93-2	1.37E-07	24	EF	Above-Average	<1%
											Magnesium	7439-95-4	6.77E-09	24	EF	Above-Average	<1%
											Manganese	7439-96-5	3.66E-06	24	EF	Above-Average	<1%
											Molybdenum	7439-98-7	7.12E-08	24	EF	Above-Average	<1%
											Nickel	7440-02-0	2.97E-07	Annual	EF	Above-Average	<1%
											Phosphorous	7723-14-0	3.61E-06	24	EF	Above-Average	<1%
											Antimony	7440-36-0	1.51E-07	24	EF	Above-Average	<1%
											Selenium	7782-49-2	7.67E-08	24	EF	Above-Average	<1%
											Tin	7440-31-5	1.76E-07	24	EF	Above-Average	<1%
											Strontium	7440-24-6	7.91E-07	24	EF	Above-Average	<1%
											Titanium	7440-32-6	1.16E-05	24	EF	Above-Average	<1%
											Thallium	7440-28-0	1.08E-07	24	EF	Above-Average	<1%
											Vanadium	7440-62-2	3.00E-07	24	EF	Above-Average	<1%
											Tungsten	7440-33-7	2.02E-07	24	EF	Above-Average	<1%
											Yttrium	7440-65-5	4.74E-08	24	EF	Above-Average	<1%
											Sulphur	7704-34-9	7.17E-08	24	EF	Above-Average	<1%
											Uranium	7440-61-1	7.95E-08	Annual	EF	Above-Average	<1%
											Gallium	7440-55-3	1.51E-07	24	EF	Above-Average	<1%
											Lanthanum	7439-91-0	1.33E-07	24	EF	Above-Average	<1%
											Scandium	7440-20-2	4.96E-08	24	EF	Above-Average	<1%
											Thorium	7440-29-1	1.59E-07	24	EF	Above-Average	<1%
											Platinum	7440-06-4	1.19E-07	24	EF	Above-Average	<1%
											Palladium	7657-10-1	7.95E-08	24	EF	Above-Average	<1%
											Rhodium	7440-16-6	5.17E-08	24	EF	Above-Average	<1%
											Sodium	7440-23-5	2.95E-09	24	EF	Above-Average	<1%
WST1	Volume	Loading trucks with waste rock in the mine pit	--	--	--	--	--	--	--	--	TSP	N/A	7.82E-02	24	EF	Above-Average	<1%
											Gold	7440-57-5	7.02E-08	24	EF	Above-Average	<1%
											Silver	7440-22-4	1.17E-07	24	EF	Above-Average	<1%
											Copper	7440-50-8	2.61E-06	24	EF	Above-Average	<1%
											Iron	15438-31-0	1.83E-07	24	EF	Above-Average	<1%
											Lead	7439-92-1	8.70E-06	24	EF	Above-Average	<1%
											Zinc	7440-66-6	2.10E-05	24	EF	Above-Average	<1%
											Aluminium	7429-90-5	4.64E-07	24	EF	Above-Average	<1%
											Arsenic	7440-38-2	2.49E-06	24	EF	Above-Average	<1%

Source ID [1]	Source Type [1]	Source Description	Source Data: Stack Volumetric Flow Rate (Am³/s)	Stack Exit Gas Temp. (°C)	Stack Inner Diameter (m)	Stack Exit Velocity (m/s)	Stack Height Above Grade (m)	Stack Height Above Roof (m)	Source Coordinates X (m)	Source Coordinates Y (m)	Emission Data: Contaminant	CAS Number	Maximum Emission Rate (g/s)	Averaging Period (hours)	Emission Estimating Technique [2]	Emissions Data Quality [3]	% of Overall Emissions (%)
											Barium	7440-39-3	3.67E-05	24	EF	Above-Average	<1%
											Beryllium	7440-41-7	1.84E-07	24	EF	Above-Average	<1%
											Bismuth	7440-69-9	8.33E-07	24	EF	Above-Average	<1%
											Calcium	7440-70-2	1.38E-07	24	EF	Above-Average	<1%
											Cadmium	7440-43-9	2.64E-07	24	EF	Above-Average	<1%
											Cobalt	7440-48-4	9.28E-07	24	EF	Above-Average	<1%
											Chromium	7440-47-3	1.12E-05	24	EF	Above-Average	<1%
											Potassium	7440-09-7	8.67E-08	24	EF	Above-Average	<1%
											Lithium	7439-93-2	1.56E-06	24	EF	Above-Average	<1%
											Magnesium	7439-95-4	8.39E-08	24	EF	Above-Average	<1%
											Manganese	7439-96-5	4.40E-05	24	EF	Above-Average	<1%
											Molybdenum	7439-98-7	5.75E-07	24	EF	Above-Average	<1%
											Nickel	7440-02-0	3.00E-06	Annual	EF	Above-Average	<1%
											Phosphorous	7723-14-0	3.96E-05	24	EF	Above-Average	<1%
											Antimony	7440-36-0	4.22E-07	24	EF	Above-Average	<1%
											Selenium	7782-49-2	7.03E-07	24	EF	Above-Average	<1%
											Tin	7440-31-5	1.81E-06	24	EF	Above-Average	<1%
											Strontium	7440-24-6	1.26E-05	24	EF	Above-Average	<1%
											Titanium	7440-32-6	1.41E-04	24	EF	Above-Average	<1%
											Thallium	7440-28-0	1.32E-06	24	EF	Above-Average	<1%
											Vanadium	7440-62-2	3.75E-06	24	EF	Above-Average	<1%
											Tungsten	7440-33-7	8.05E-07	24	EF	Above-Average	<1%
											Yttrium	7440-65-5	5.68E-07	24	EF	Above-Average	<1%
											Sulphur	7704-34-9	1.75E-07	24	EF	Above-Average	<1%
											Uranium	7440-61-1	7.82E-07	Annual	EF	Above-Average	<1%
											Gallium	7440-55-3	1.55E-06	24	EF	Above-Average	<1%
											Lanthanum	7439-91-0	1.28E-06	24	EF	Above-Average	<1%
											Scandium	7440-20-2	4.08E-07	24	EF	Above-Average	<1%
											Thorium	7440-29-1	1.56E-06	24	EF	Above-Average	<1%
											Platinum	7440-06-4	1.57E-06	24	EF	Above-Average	<1%
											Palladium	7657-10-1	9.03E-07	24	EF	Above-Average	<1%
											Rhodium	7440-16-6	4.67E-07	24	EF	Above-Average	<1%
											Sodium	7440-23-5	6.42E-08	24	EF	Above-Average	<1%
ORE2	Volume	Unloading ore from trucks	--	--	--	--	--	--	--	--	TSP	N/A	7.95E-03	24	EF	Above-Average	<1%
											Gold	7440-57-5	1.27E-07	24	EF	Above-Average	<1%
											Silver	7440-22-4	1.07E-07	24	EF	Above-Average	<1%
											Copper	7440-50-8	1.03E-06	24	EF	Above-Average	<1%
											Iron	15438-31-0	1.96E-08	24	EF	Above-Average	<1%
											Lead	7439-92-1	6.84E-06	24	EF	Above-Average	<1%
											Zinc	7440-66-6	1.51E-05	24	EF	Above-Average	<1%
											Aluminium	7429-90-5	4.45E-08	24	EF	Above-Average	<1%
											Arsenic	7440-38-2	5.15E-07	24	EF	Above-Average	<1%
											Barium	7440-39-3	3.72E-06	24	EF	Above-Average	<1%
											Beryllium	7440-41-7	1.92E-08	24	EF	Above-Average	<1%
											Bismuth	7440-69-9	7.89E-08	24	EF	Above-Average	<1%
											Calcium	7440-70-2	8.39E-09	24	EF	Above-Average	<1%
											Cadmium	7440-43-9	5.56E-08	24	EF	Above-Average	<1%
											Cobalt	7440-48-4	7.93E-08	24	EF	Above-Average	<1%
											Chromium	7440-47-3	1.18E-06	24	EF	Above-Average	<1%
											Potassium	7440-09-7	8.62E-09	24	EF	Above-Average	<1%
											Lithium	7439-93-2	1.37E-07	24	EF	Above-Average	<1%
											Magnesium	7439-95-4	6.77E-09	24	EF	Above-Average	<1%
											Manganese	7439-96-5	3.66E-06	24	EF	Above-Average	<1%
											Molybdenum	7439-98-7	7.12E-08	24	EF	Above-Average	<1%
											Nickel	7440-02-0	2.97E-07	Annual	EF	Above-Average	<1%
											Phosphorous	7723-14-0	3.61E-06	24	EF	Above-Average	<1%

Source ID [1]	Source Type [1]	Source Description	Source Data: Stack Volumetric Flow Rate (Am³/s)	Stack Exit Gas Temp. (ºC)	Stack Inner Diameter (m)	Stack Exit Velocity (m/s)	Stack Height Above Grade (m)	Stack Height Above Roof (m)	Source Coordinates X (m)	Source Coordinates Y (m)	Emission Data: Contaminant	CAS Number	Maximum Emission Rate (g/s)	Averaging Period (hours)	Emission Estimating Technique [2]	Emissions Data Quality [3]	% of Overall Emissions (%)
											Antimony	7440-36-0	1.51E-07	24	EF	Above-Average	<1%
											Selenium	7782-49-2	7.67E-08	24	EF	Above-Average	<1%
											Tin	7440-31-5	1.76E-07	24	EF	Above-Average	<1%
											Strontium	7440-24-6	7.91E-07	24	EF	Above-Average	<1%
											Titanium	7440-32-6	1.16E-05	24	EF	Above-Average	<1%
											Thallium	7440-28-0	1.08E-07	24	EF	Above-Average	<1%
											Vanadium	7440-62-2	3.00E-07	24	EF	Above-Average	<1%
											Tungsten	7440-33-7	2.02E-07	24	EF	Above-Average	<1%
											Yttrium	7440-65-5	4.74E-08	24	EF	Above-Average	<1%
											Sulphur	7704-34-9	7.17E-08	24	EF	Above-Average	<1%
											Uranium	7440-61-1	7.95E-08	Annual	EF	Above-Average	<1%
											Gallium	7440-55-3	1.51E-07	24	EF	Above-Average	<1%
											Lanthanum	7439-91-0	1.33E-07	24	EF	Above-Average	<1%
											Scandium	7440-20-2	4.96E-08	24	EF	Above-Average	<1%
											Thorium	7440-29-1	1.59E-07	24	EF	Above-Average	<1%
											Platinum	7440-06-4	1.19E-07	24	EF	Above-Average	<1%
											Palladium	7657-10-1	7.95E-08	24	EF	Above-Average	<1%
											Rhodium	7440-16-6	5.17E-08	24	EF	Above-Average	<1%
											Sodium	7440-23-5	2.95E-09	24	EF	Above-Average	<1%
LGORE2	Volume	Unloading low grade ore from trucks	--	--	--	--	--	--	--	--	TSP	N/A	7.95E-03	24	EF	Above-Average	<1%
											Gold	7440-57-5	1.27E-07	24	EF	Above-Average	<1%
											Silver	7440-22-4	1.07E-07	24	EF	Above-Average	<1%
											Copper	7440-50-8	1.03E-06	24	EF	Above-Average	<1%
											Iron	15438-31-0	1.96E-08	24	EF	Above-Average	<1%
											Lead	7439-92-1	6.84E-06	24	EF	Above-Average	<1%
											Zinc	7440-66-6	1.51E-05	24	EF	Above-Average	<1%
											Aluminium	7429-90-5	4.45E-08	24	EF	Above-Average	<1%
											Arsenic	7440-38-2	5.15E-07	24	EF	Above-Average	<1%
											Barium	7440-39-3	3.72E-06	24	EF	Above-Average	<1%
											Beryllium	7440-41-7	1.92E-08	24	EF	Above-Average	<1%
											Bismuth	7440-69-9	7.89E-08	24	EF	Above-Average	<1%
											Calcium	7440-70-2	8.39E-09	24	EF	Above-Average	<1%
											Cadmium	7440-43-9	5.56E-08	24	EF	Above-Average	<1%
											Cobalt	7440-48-4	7.93E-08	24	EF	Above-Average	<1%
											Chromium	7440-47-3	1.18E-06	24	EF	Above-Average	<1%
											Potassium	7440-09-7	8.62E-09	24	EF	Above-Average	<1%
											Lithium	7439-93-2	1.37E-07	24	EF	Above-Average	<1%
											Magnesium	7439-95-4	6.77E-09	24	EF	Above-Average	<1%
											Manganese	7439-96-5	3.66E-06	24	EF	Above-Average	<1%
											Molybdenum	7439-98-7	7.12E-08	24	EF	Above-Average	<1%
											Nickel	7440-02-0	2.97E-07	Annual	EF	Above-Average	<1%
											Phosphorous	7723-14-0	3.61E-06	24	EF	Above-Average	<1%
											Antimony	7440-36-0	1.51E-07	24	EF	Above-Average	<1%
											Selenium	7782-49-2	7.67E-08	24	EF	Above-Average	<1%
											Tin	7440-31-5	1.76E-07	24	EF	Above-Average	<1%
											Strontium	7440-24-6	7.91E-07	24	EF	Above-Average	<1%
											Titanium	7440-32-6	1.16E-05	24	EF	Above-Average	<1%
											Thallium	7440-28-0	1.08E-07	24	EF	Above-Average	<1%
											Vanadium	7440-62-2	3.00E-07	24	EF	Above-Average	<1%
											Tungsten	7440-33-7	2.02E-07	24	EF	Above-Average	<1%
											Yttrium	7440-65-5	4.74E-08	24	EF	Above-Average	<1%
											Sulphur	7704-34-9	7.17E-08	24	EF	Above-Average	<1%
											Uranium	7440-61-1	7.95E-08	Annual	EF	Above-Average	<1%
											Gallium	7440-55-3	1.51E-07	24	EF	Above-Average	<1%
											Lanthanum	7439-91-0	1.33E-07	24	EF	Above-Average	<1%
											Scandium	7440-20-2	4.96E-08	24	EF	Above-Average	<1%

Source ID [1]	Source Type [1]	Source Description	Source Data								Emission Data						
			Stack Volumetric Flow Rate (Am³/s)	Stack Exit Gas Temp. (ºC)	Stack Inner Diameter (m)	Stack Exit Velocity (m/s)	Stack Height Above Grade (m)	Stack Height Above Roof (m)	Source Coordinates X (m)	Source Coordinates Y (m)	Contaminant	CAS Number	Maximum Emission Rate (g/s)	Averaging Period (hours)	Emission Estimating Technique [2]	Emissions Data Quality [3]	% of Overall Emissions (%)
											Thorium	7440-29-1	1.59E-07	24	EF	Above-Average	<1%
											Platinum	7440-06-4	1.19E-07	24	EF	Above-Average	<1%
											Palladium	7657-10-1	7.95E-08	24	EF	Above-Average	<1%
											Rhodium	7440-16-6	5.17E-08	24	EF	Above-Average	<1%
											Sodium	7440-23-5	2.95E-09	24	EF	Above-Average	<1%
WST2	Volume	Unloading waste rock from trucks	--	--	--	--	--	--	--	--	TSP	N/A	7.82E-02	24	EF	Above-Average	<1%
											Gold	7440-57-5	7.02E-08	24	EF	Above-Average	<1%
											Silver	7440-22-4	1.17E-07	24	EF	Above-Average	<1%
											Copper	7440-50-8	2.61E-06	24	EF	Above-Average	<1%
											Iron	15438-31-0	1.83E-07	24	EF	Above-Average	<1%
											Lead	7439-92-1	8.70E-06	24	EF	Above-Average	<1%
											Zinc	7440-66-6	2.10E-05	24	EF	Above-Average	<1%
											Aluminium	7429-90-5	4.64E-07	24	EF	Above-Average	<1%
											Arsenic	7440-38-2	2.49E-06	24	EF	Above-Average	<1%
											Barium	7440-39-3	3.67E-05	24	EF	Above-Average	<1%
											Beryllium	7440-41-7	1.84E-07	24	EF	Above-Average	<1%
											Bismuth	7440-69-9	8.33E-07	24	EF	Above-Average	<1%
											Calcium	7440-70-2	1.38E-07	24	EF	Above-Average	<1%
											Cadmium	7440-43-9	2.64E-07	24	EF	Above-Average	<1%
											Cobalt	7440-48-4	9.28E-07	24	EF	Above-Average	<1%
											Chromium	7440-47-3	1.12E-05	24	EF	Above-Average	<1%
											Potassium	7440-09-7	8.67E-08	24	EF	Above-Average	<1%
											Lithium	7439-93-2	1.56E-06	24	EF	Above-Average	<1%
											Magnesium	7439-95-4	8.39E-08	24	EF	Above-Average	<1%
											Manganese	7439-96-5	4.40E-05	24	EF	Above-Average	<1%
											Molybdenum	7439-98-7	5.75E-07	24	EF	Above-Average	<1%
											Nickel	7440-02-0	3.00E-06	Annual	EF	Above-Average	<1%
											Phosphorous	7723-14-0	3.96E-05	24	EF	Above-Average	<1%
											Antimony	7440-36-0	4.22E-07	24	EF	Above-Average	<1%
											Selenium	7782-49-2	7.03E-07	24	EF	Above-Average	<1%
											Tin	7440-31-5	1.81E-06	24	EF	Above-Average	<1%
											Strontium	7440-24-6	1.26E-05	24	EF	Above-Average	<1%
											Titanium	7440-32-6	1.41E-04	24	EF	Above-Average	<1%
											Thallium	7440-28-0	1.32E-06	24	EF	Above-Average	<1%
											Vanadium	7440-62-2	3.75E-06	24	EF	Above-Average	<1%
											Tungsten	7440-33-7	8.05E-07	24	EF	Above-Average	<1%
											Yttrium	7440-65-5	5.68E-07	24	EF	Above-Average	<1%
											Sulphur	7704-34-9	1.75E-07	24	EF	Above-Average	<1%
											Uranium	7440-61-1	7.82E-07	Annual	EF	Above-Average	<1%
											Gallium	7440-55-3	1.55E-06	24	EF	Above-Average	<1%
											Lanthanum	7439-91-0	1.28E-06	24	EF	Above-Average	<1%
											Scandium	7440-20-2	4.08E-07	24	EF	Above-Average	<1%
											Thorium	7440-29-1	1.56E-06	24	EF	Above-Average	<1%
											Platinum	7440-06-4	1.57E-06	24	EF	Above-Average	<1%
											Palladium	7657-10-1	9.03E-07	24	EF	Above-Average	<1%
											Rhodium	7440-16-6	4.67E-07	24	EF	Above-Average	<1%
											Sodium	7440-23-5	6.42E-08	24	EF	Above-Average	<1%
LOADER	Volume	Loader at ore crusher	--	--	--	--	--	--	528631	5511938	TSP	N/A	9.50E-03	24	EF	Above-Average	<1%
											Gold	7440-57-5	1.52E-07	24	EF	Above-Average	<1%
											Silver	7440-22-4	1.27E-07	24	EF	Above-Average	<1%
											Copper	7440-50-8	1.24E-06	24	EF	Above-Average	<1%
											Iron	15438-31-0	2.34E-08	24	EF	Above-Average	<1%
											Lead	7439-92-1	8.18E-06	24	EF	Above-Average	<1%
											Zinc	7440-66-6	1.80E-05	24	EF	Above-Average	<1%
											Aluminium	7429-90-5	5.31E-08	24	EF	Above-Average	<1%
											Arsenic	7440-38-2	6.16E-07	24	EF	Above-Average	<1%

Source ID [1]	Source Type [1]	Source Description	Source Data: Stack Volumetric Flow Rate (Am³/s)	Stack Exit Gas Temp. (°C)	Stack Inner Diameter (m)	Stack Exit Velocity (m/s)	Stack Height Above Grade (m)	Stack Height Above Roof (m)	Source Coordinates X (m)	Source Coordinates Y (m)	Emission Data: Contaminant	CAS Number	Maximum Emission Rate (g/s)	Averaging Period (hours)	Emission Estimating Technique [2]	Emissions Data Quality [3]	% of Overall Emissions (%)
											Barium	7440-39-3	4.44E-06	24	EF	Above-Average	<1%
											Beryllium	7440-41-7	2.30E-08	24	EF	Above-Average	<1%
											Bismuth	7440-69-9	9.42E-08	24	EF	Above-Average	<1%
											Calcium	7440-70-2	1.00E-08	24	EF	Above-Average	<1%
											Cadmium	7440-43-9	6.65E-08	24	EF	Above-Average	<1%
											Cobalt	7440-48-4	9.47E-08	24	EF	Above-Average	<1%
											Chromium	7440-47-3	1.41E-06	24	EF	Above-Average	<1%
											Potassium	7440-09-7	1.03E-08	24	EF	Above-Average	<1%
											Lithium	7439-93-2	1.64E-07	24	EF	Above-Average	<1%
											Magnesium	7439-95-4	8.09E-09	24	EF	Above-Average	<1%
											Manganese	7439-96-5	4.37E-06	24	EF	Above-Average	<1%
											Molybdenum	7439-98-7	8.50E-08	24	EF	Above-Average	<1%
											Nickel	7440-02-0	3.54E-07	Annual	EF	Above-Average	<1%
											Phosphorous	7723-14-0	4.32E-06	24	EF	Above-Average	<1%
											Antimony	7440-36-0	1.80E-07	24	EF	Above-Average	<1%
											Selenium	7782-49-2	9.17E-08	24	EF	Above-Average	<1%
											Tin	7440-31-5	2.10E-07	24	EF	Above-Average	<1%
											Strontium	7440-24-6	9.45E-07	24	EF	Above-Average	<1%
											Titanium	7440-32-6	1.39E-05	24	EF	Above-Average	<1%
											Thallium	7440-28-0	1.30E-07	24	EF	Above-Average	<1%
											Vanadium	7440-62-2	3.59E-07	24	EF	Above-Average	<1%
											Tungsten	7440-33-7	2.42E-07	24	EF	Above-Average	<1%
											Yttrium	7440-65-5	5.66E-08	24	EF	Above-Average	<1%
											Sulphur	7704-34-9	8.56E-08	24	EF	Above-Average	<1%
											Uranium	7440-61-1	9.50E-08	Annual	EF	Above-Average	<1%
											Gallium	7440-55-3	1.81E-07	24	EF	Above-Average	<1%
											Lanthanum	7439-91-0	1.58E-07	24	EF	Above-Average	<1%
											Scandium	7440-20-2	5.93E-08	24	EF	Above-Average	<1%
											Thorium	7440-29-1	1.90E-07	24	EF	Above-Average	<1%
											Platinum	7440-06-4	1.42E-07	24	EF	Above-Average	<1%
											Palladium	7657-10-1	9.50E-08	24	EF	Above-Average	<1%
											Rhodium	7440-16-6	6.17E-08	24	EF	Above-Average	<1%
											Sodium	7440-23-5	3.52E-09	24	EF	Above-Average	<1%
BLAST	Volume	Blasting at working face of mine	--	--	--	--	--	--	--	--	TSP	N/A	7.64E+00	24	EF	Average	76%
											Gold	7440-57-5	6.87E-06	24	EF	Average	17%
											Silver	7440-22-4	1.14E-05	24	EF	Average	19%
											Copper	7440-50-8	2.55E-04	24	EF	Average	25%
											Iron	15438-31-0	1.79E-05	24	EF	Average	30%
											Lead	7439-92-1	8.50E-04	24	EF	Average	20%
											Zinc	7440-66-6	2.05E-03	24	EF	Average	21%
											Aluminium	7429-90-5	4.54E-05	24	EF	Average	30%
											Arsenic	7440-38-2	2.43E-04	24	EF	Average	28%
											Barium	7440-39-3	3.58E-03	24	EF	Average	30%
											Beryllium	7440-41-7	1.80E-05	24	EF	Average	30%
											Bismuth	7440-69-9	8.14E-05	24	EF	Average	30%
											Calcium	7440-70-2	1.35E-05	24	EF	Average	31%
											Cadmium	7440-43-9	2.58E-05	24	EF	Average	28%
											Cobalt	7440-48-4	9.07E-05	24	EF	Average	31%
											Chromium	7440-47-3	1.10E-03	24	EF	Average	30%
											Potassium	7440-09-7	8.47E-06	24	EF	Average	30%
											Lithium	7439-93-2	1.53E-04	24	EF	Average	31%
											Magnesium	7439-95-4	8.20E-06	24	EF	Average	31%
											Manganese	7439-96-5	4.30E-03	24	EF	Average	31%
											Molybdenum	7439-98-7	5.62E-05	24	EF	Average	30%
											Nickel	7440-02-0	2.93E-04	Annual	EF	Average	30%
											Phosphorous	7723-14-0	3.87E-03	24	EF	Average	31%

Source ID [1]	Source Type [1]	Source Description	Source Data: Stack Volumetric Flow Rate (Am^3/s)	Stack Exit Gas Temp. (°C)	Stack Inner Diameter (m)	Stack Exit Velocity (m/s)	Stack Height Above Grade (m)	Stack Height Above Roof (m)	Source Coordinates X (m)	Source Coordinates Y (m)	Emission Data: Contaminant	CAS Number	Maximum Emission Rate (g/s)	Averaging Period (hours)	Emission Estimating Technique [2]	Emissions Data Quality [3]	% of Overall Emissions (%)
											Antimony	7440-36-0	4.13E-05	24	EF	Average	25%
											Selenium	7782-49-2	6.87E-05	24	EF	Average	30%
											Tin	7440-31-5	1.77E-04	24	EF	Average	30%
											Strontium	7440-24-6	1.23E-03	24	EF	Average	31%
											Titanium	7440-32-6	1.38E-02	24	EF	Average	31%
											Thallium	7440-28-0	1.29E-04	24	EF	Average	31%
											Vanadium	7440-62-2	3.66E-04	24	EF	Average	31%
											Tungsten	7440-33-7	7.86E-05	24	EF	Average	27%
											Yttrium	7440-65-5	5.55E-05	24	EF	Average	31%
											Sulphur	7704-34-9	1.71E-05	24	EF	Average	25%
											Uranium	7440-61-1	7.64E-05	Annual	EF	Average	30%
											Gallium	7440-55-3	1.52E-04	24	EF	Average	30%
											Lanthanum	7439-91-0	1.25E-04	24	EF	Average	30%
											Scandium	7440-20-2	3.99E-05	24	EF	Average	30%
											Thorium	7440-29-1	1.53E-04	24	EF	Average	30%
											Platinum	7440-06-4	1.54E-04	24	EF	Average	31%
											Palladium	7657-10-1	8.83E-05	24	EF	Average	31%
											Rhodium	7440-16-6	4.56E-05	24	EF	Average	30%
											Sodium	7440-23-5	6.27E-06	24	EF	Average	32%
											NOx	10102-44-0	5.60E-02	24	EF	Marginal	<1%
TAILING	Area	Dry, unvegetated tailings area	--	--	--	--	--	--	--	--	TSP	N/A	7.07E-01	24	EF	Marginal	7%
											Silver	7440-22-4	9.47E-06	24	EF	Marginal	16%
											Copper	7440-50-8	9.19E-05	24	EF	Marginal	9%
											Iron	15438-31-0	1.74E-06	24	EF	Marginal	3%
											Lead	7439-92-1	6.09E-04	24	EF	Marginal	14%
											Zinc	7440-66-6	1.34E-03	24	EF	Marginal	13%
											Aluminium	7429-90-5	3.95E-06	24	EF	Marginal	3%
											Arsenic	7440-38-2	4.58E-05	24	EF	Marginal	5%
											Barium	7440-39-3	3.31E-04	24	EF	Marginal	3%
											Beryllium	7440-41-7	1.71E-06	24	EF	Marginal	3%
											Bismuth	7440-69-9	7.01E-06	24	EF	Marginal	3%
											Calcium	7440-70-2	7.46E-07	24	EF	Marginal	2%
											Cadmium	7440-43-9	4.95E-06	24	EF	Marginal	5%
											Cobalt	7440-48-4	7.05E-06	24	EF	Marginal	2%
											Chromium	7440-47-3	1.05E-04	24	EF	Marginal	3%
											Potassium	7440-09-7	7.66E-07	24	EF	Marginal	3%
											Lithium	7439-93-2	1.22E-05	24	EF	Marginal	2%
											Magnesium	7439-95-4	6.02E-07	24	EF	Marginal	2%
											Manganese	7439-96-5	3.25E-04	24	EF	Marginal	2%
											Molybdenum	7439-98-7	6.33E-06	24	EF	Marginal	3%
											Nickel	7440-02-0	2.64E-05	Annual	EF	Marginal	3%
											Phosphorous	7723-14-0	3.21E-04	24	EF	Marginal	3%
											Antimony	7440-36-0	1.34E-05	24	EF	Marginal	8%
											Selenium	7782-49-2	6.82E-06	24	EF	Marginal	3%
											Tin	7440-31-5	1.56E-05	24	EF	Marginal	3%
											Strontium	7440-24-6	7.04E-05	24	EF	Marginal	2%
											Titanium	7440-32-6	1.03E-03	24	EF	Marginal	2%
											Thallium	7440-28-0	9.64E-06	24	EF	Marginal	2%
											Vanadium	7440-62-2	2.67E-05	24	EF	Marginal	2%
											Tungsten	7440-33-7	1.80E-05	24	EF	Marginal	6%
											Yttrium	7440-65-5	4.22E-06	24	EF	Marginal	2%
											Sulphur	7704-34-9	6.37E-06	24	EF	Marginal	9%
											Uranium	7440-61-1	7.07E-06	Annual	EF	Marginal	3%
											Gallium	7440-55-3	1.35E-05	24	EF	Marginal	3%
											Lanthanum	7439-91-0	1.18E-05	24	EF	Marginal	3%
											Scandium	7440-20-2	4.41E-06	24	EF	Marginal	3%

Source ID [1]	Source Type [1]	Source Description	Source Data								Emission Data						
			Stack Volumetric Flow Rate (Am³/s)	Stack Exit Gas Temp. (ºC)	Stack Inner Diameter (m)	Stack Exit Velocity (m/s)	Stack Height Above Grade (m)	Stack Height Above Roof (m)	Source Coordinates X (m)	Y (m)	Contaminant	CAS Number	Maximum Emission Rate (g/s)	Averaging Period (hours)	Emission Estimating Technique [2]	Emissions Data Quality [3]	% of Overall Emissions (%)
											Thorium	7440-29-1	1.41E-05	24	EF	Marginal	3%
											Platinum	7440-06-4	1.06E-05	24	EF	Marginal	2%
											Palladium	7657-10-1	7.07E-06	24	EF	Marginal	2%
											Rhodium	7440-16-6	4.60E-06	24	EF	Marginal	3%
											Sodium	7440-23-5	2.62E-07	24	EF	Marginal	1%
VENT1	Point	Underground mine exhaust vent raise	349.24	25	5.1	17.1	3	-	527629	5511654	TSP	N/A	3.00E-01	24	EF	Marginal	3%
											NOx	10102-44-0	1.40E+00	24	EF	Marginal	23%
											CO	630-08-0	1.50E+00	0.5	EF	Marginal	50%
											Gold	7440-57-5	4.81E-06	24	EF	Marginal	12%
											Silver	7440-22-4	4.02E-06	24	EF	Marginal	7%
											Copper	7440-50-8	3.90E-05	24	EF	Marginal	4%
											Iron	15438-31-0	7.38E-07	24	EF	Marginal	1%
											Lead	7439-92-1	2.58E-04	24	EF	Marginal	6%
											Zinc	7440-66-6	5.69E-04	24	EF	Marginal	6%
											Aluminium	7429-90-5	1.68E-06	24	EF	Marginal	1%
											Arsenic	7440-38-2	1.95E-05	24	EF	Marginal	2%
											Barium	7440-39-3	1.40E-04	24	EF	Marginal	1%
											Beryllium	7440-41-7	7.25E-07	24	EF	Marginal	1%
											Bismuth	7440-69-9	2.98E-06	24	EF	Marginal	1%
											Calcium	7440-70-2	3.17E-07	24	EF	Marginal	<1%
											Cadmium	7440-43-9	2.10E-06	24	EF	Marginal	2%
											Cobalt	7440-48-4	2.99E-06	24	EF	Marginal	1%
											Chromium	7440-47-3	4.44E-05	24	EF	Marginal	1%
											Potassium	7440-09-7	3.25E-07	24	EF	Marginal	1%
											Lithium	7439-93-2	5.17E-06	24	EF	Marginal	1%
											Magnesium	7439-95-4	2.56E-07	24	EF	Marginal	<1%
											Manganese	7439-96-5	1.38E-04	24	EF	Marginal	<1%
											Molybdenum	7439-98-7	2.69E-06	24	EF	Marginal	1%
											Nickel	7440-02-0	1.12E-05	Annual	EF	Marginal	1%
											Phosphorous	7723-14-0	1.36E-04	24	EF	Marginal	1%
											Antimony	7440-36-0	5.70E-06	24	EF	Marginal	3%
											Selenium	7782-49-2	2.90E-06	24	EF	Marginal	1%
											Tin	7440-31-5	6.64E-06	24	EF	Marginal	1%
											Strontium	7440-24-6	2.99E-05	24	EF	Marginal	<1%
											Titanium	7440-32-6	4.39E-04	24	EF	Marginal	<1%
											Thallium	7440-28-0	4.09E-06	24	EF	Marginal	<1%
											Vanadium	7440-62-2	1.13E-05	24	EF	Marginal	<1%
											Tungsten	7440-33-7	7.64E-06	24	EF	Marginal	3%
											Yttrium	7440-65-5	1.79E-06	24	EF	Marginal	<1%
											Sulphur	7704-34-9	2.70E-06	24	EF	Marginal	4%
											Uranium	7440-61-1	3.00E-06	Annual	EF	Marginal	1%
											Gallium	7440-55-3	5.71E-06	24	EF	Marginal	1%
											Lanthanum	7439-91-0	5.00E-06	24	EF	Marginal	1%
											Scandium	7440-20-2	1.87E-06	24	EF	Marginal	1%
											Thorium	7440-29-1	6.00E-06	24	EF	Marginal	1%
											Platinum	7440-06-4	4.50E-06	24	EF	Marginal	<1%
											Palladium	7657-10-1	3.00E-06	24	EF	Marginal	1%
											Rhodium	7440-16-6	1.95E-06	24	EF	Marginal	1%
											Sodium	7440-23-5	1.11E-07	24	EF	Marginal	<1%
VENT2	Point	Underground mine exhaust vent raise	349.24	25	5.1	17.1	3	-	528838	5512299	TSP	N/A	3.00E-01	24	EF	Marginal	3%
											NOx	10102-44-0	1.40E+00	24	EF	Marginal	23%
											CO	630-08-0	1.50E+00	0.5	EF	Marginal	50%
											Gold	7440-57-5	4.81E-06	24	EF	Marginal	12%
											Silver	7440-22-4	4.02E-06	24	EF	Marginal	7%
											Copper	7440-50-8	3.90E-05	24	EF	Marginal	4%
											Iron	15438-31-0	7.38E-07	24	EF	Marginal	1%

Source ID [1]	Source Type [1]	Source Description	Source Data								Emission Data						
			Stack Volumetric Flow Rate (Am³/s)	Stack Exit Gas Temp. (°C)	Stack Inner Diameter (m)	Stack Exit Velocity (m/s)	Stack Height Above Grade (m)	Stack Height Above Roof (m)	Source Coordinates X (m)	Source Coordinates Y (m)	Contaminant	CAS Number	Maximum Emission Rate (g/s)	Averaging Period (hours)	Emission Estimating Technique [2]	Emissions Data Quality [3]	% of Overall Emissions (%)
											Lead	7439-92-1	2.58E-04	24	EF	Marginal	6%
											Zinc	7440-66-6	5.69E-04	24	EF	Marginal	6%
											Aluminium	7429-90-5	1.68E-06	24	EF	Marginal	1%
											Arsenic	7440-38-2	1.95E-05	24	EF	Marginal	2%
											Barium	7440-39-3	1.40E-04	24	EF	Marginal	1%
											Beryllium	7440-41-7	7.25E-07	24	EF	Marginal	1%
											Bismuth	7440-69-9	2.98E-06	24	EF	Marginal	1%
											Calcium	7440-70-2	3.17E-07	24	EF	Marginal	<1%
											Cadmium	7440-43-9	2.10E-06	24	EF	Marginal	2%
											Cobalt	7440-48-4	2.99E-06	24	EF	Marginal	1%
											Chromium	7440-47-3	4.44E-05	24	EF	Marginal	1%
											Potassium	7440-09-7	3.25E-07	24	EF	Marginal	1%
											Lithium	7439-93-2	5.17E-06	24	EF	Marginal	1%
											Magnesium	7439-95-4	2.56E-07	24	EF	Marginal	<1%
											Manganese	7439-96-5	1.38E-04	24	EF	Marginal	<1%
											Molybdenum	7439-98-7	2.69E-06	24	EF	Marginal	1%
											Nickel	7440-02-0	1.12E-05	Annual	EF	Marginal	1%
											Phosphorous	7723-14-0	1.36E-04	24	EF	Marginal	1%
											Antimony	7440-36-0	5.70E-06	24	EF	Marginal	3%
											Selenium	7782-49-2	2.90E-06	24	EF	Marginal	1%
											Tin	7440-31-5	6.64E-06	24	EF	Marginal	1%
											Strontium	7440-24-6	2.99E-05	24	EF	Marginal	<1%
											Titanium	7440-32-6	4.39E-04	24	EF	Marginal	<1%
											Thallium	7440-28-0	4.09E-06	24	EF	Marginal	<1%
											Vanadium	7440-62-2	1.13E-05	24	EF	Marginal	<1%
											Tungsten	7440-33-7	7.64E-06	24	EF	Marginal	3%
											Yttrium	7440-65-5	1.79E-06	24	EF	Marginal	<1%
											Sulphur	7704-34-9	2.70E-06	24	EF	Marginal	4%
											Uranium	7440-61-1	3.00E-06	Annual	EF	Marginal	1%
											Gallium	7440-55-3	5.71E-06	24	EF	Marginal	1%
											Lanthanum	7439-91-0	5.00E-06	24	EF	Marginal	1%
											Scandium	7440-20-2	1.87E-06	24	EF	Marginal	1%
											Thorium	7440-29-1	6.00E-06	24	EF	Marginal	1%
											Platinum	7440-06-4	4.50E-06	24	EF	Marginal	<1%
											Palladium	7657-10-1	3.00E-06	24	EF	Marginal	1%
											Rhodium	7440-16-6	1.95E-06	24	EF	Marginal	1%
											Sodium	7440-23-5	1.11E-07	24	EF	Marginal	<1%
MILL	Volume	Carbon in leach tanks	-	-	-	-	20	-	528899	5512140	Hydrogen Cyanide	74-90-8	3.95E-04	24	EC	Average	100%
BAGHOUSE	Point	Crusher baghouse	0.28	25	-	-	-	-	528676	5511949	TSP	N/A	1.00E-02	24	EF	Average	<1%
BAGHOUSE2	Point	Gold Smelting kiln furnace baghouse	0.28	25	-	-	-	-	528854	5512127	TSP	N/A	1.00E-02	24	EF	Average	<1%
GEN1	Point	500 kW diesel emergency generator	1.32	510	0.5	6.7	5	-	528987	5512136	NOx	10102-44-0	2.25E+00	24	EF	Above-Average	37%
GEN2	Point	150 kW diesel emergency generator	0.51	470	0.5	2.6	5	-	528493	5514542	NOx	10102-44-0	8.72E-01	24	EF	Above-Average	14%
DRILLING	Area	Drilling at mine pit work face	-	-	-	-	-	-	-	-	TSP	N/A	1.01E-02	24	EF	Marginal	<1%
KILN	Point	150 kW natural gas-fired kiln burner	0.05	250	0.3	0.7	6	-	528854	5512127	NOx	10102-44-0	4.81E-03	24	EF	Average	<1%
ELUTION	Point	900 kW natural gas-fired heater	0.36	250	0.3	5.1	6	-	528854	5512127	NOx	10102-44-0	3.79E-02	24	EF	Average	<1%
Total	n/a	Total of all listed sources									TSP	N/A	1.01E+01				100%
											Gold	7440-57-5	4.08E-05				100%
											Silver	7440-22-4	6.09E-05				100%
											Copper	7440-50-8	1.03E-03				100%
											Iron	15438-31-0	5.94E-05				100%
											Lead	7439-92-1	4.27E-03				100%
											Zinc	7440-66-6	9.94E-03				100%
											Aluminium	7429-90-5	1.49E-04				100%
											Arsenic	7440-38-2	8.68E-04				100%
											Barium	7440-39-3	1.18E-02				100%
											Beryllium	7440-41-7	5.95E-05				100%

Source ID [1]	Source Type [1]	Source Description	Source Data								Emission Data						
			Stack Volumetric Flow Rate (Am³/s)	Stack Exit Gas Temp. (°C)	Stack Inner Diameter (m)	Stack Exit Velocity (m/s)	Stack Height Above Grade (m)	Stack Height Above Roof (m)	Source Coordinates X (m)	Source Coordinates Y (m)	Contaminant	CAS Number	Maximum Emission Rate (g/s)	Averaging Period (hours)	Emission Estimating Technique [2]	Emissions Data Quality [3]	% of Overall Emissions (%)
											Bismuth	7440-69-9	2.68E-04				100%
											Calcium	7440-70-2	4.32E-05				100%
											Cadmium	7440-43-9	9.23E-05				100%
											Cobalt	7440-48-4	2.96E-04				100%
											Chromium	7440-47-3	3.64E-03				100%
											Potassium	7440-09-7	2.79E-05				100%
											Lithium	7439-93-2	4.99E-04				100%
											Magnesium	7439-95-4	2.67E-05				100%
											Manganese	7439-96-5	1.40E-02				100%
											Molybdenum	7439-98-7	1.89E-04				100%
											Nickel	7440-02-0	9.65E-04				100%
											Phosphorous	7723-14-0	1.27E-02				100%
											Antimony	7440-36-0	1.63E-04				100%
											Selenium	7782-49-2	2.28E-04				100%
											Tin	7440-31-5	5.83E-04				100%
											Strontium	7440-24-6	3.96E-03				100%
											Titanium	7440-32-6	4.50E-02				100%
											Thallium	7440-28-0	4.20E-04				100%
											Vanadium	7440-62-2	1.19E-03				100%
											Tungsten	7440-33-7	2.89E-04				100%
											Yttrium	7440-65-5	1.81E-04				100%
											Sulphur	7704-34-9	6.97E-05				100%
											Uranium	7440-61-1	2.52E-04				100%
											Gallium	7440-55-3	4.99E-04				100%
											Lanthanum	7439-91-0	4.13E-04				100%
											Scandium	7440-20-2	1.34E-04				100%
											Thorium	7440-29-1	5.05E-04				100%
											Platinum	7440-06-4	4.98E-04				100%
											Palladium	7657-10-1	2.89E-04				100%
											Rhodium	7440-16-6	1.52E-04				100%
											Sodium	7440-23-5	1.98E-05				100%
											NOx	10102-44-0	6.02E+00				100%
											CO	630-08-0	3.00E+00				100%
											Hydrogen Cyanide	74-90-8	3.95E-04				100%

Notes:

[1] Source ID, Source Type: should provide information on the modelling source type (e.g., Point, Area or Volume Source); the process source or sources within the modelling source (e.g., Process Line #1); and the stack or stacks within each process source.

[2] Emission Estimating Technique Short-Forms are V-ST (Validated Source Test), “ST” (Source Test), EF (Emission Factor), MB (Mass Balance), and EC (Engineering Calculation).

[3] Data Quality Categories: Highest; Above-Average; Average; and Marginal.

6.1 Dispersion Modelling Input Summary Table

RWDI Project 1401701

Relevant Section of the Regulation	Section Title	Description of How the Approved Dispersion Model was Used
Section 8	Negligible Sources	Please refer to Section 3.1 of the ESDM report "Identification of Negligible Sources". The baghouse, kiln burner, heater, carbon in leach tanks, drilling operations, maintenance welding operations and all natural gas-fired comfort heating equipment were considered to be negligible
Section 9	Same Structure Contamination	Same structure contamination was not considered in this assessment.
Section 10	Operating Conditions	Please refer to Section 4.1 of the ESDM report "Description of Operating Conditions" The maximum operating scenario consists of all the open pit operations at surface level and all the underground mining operations taking place simultaneously. All operations were assumed to be taking place continuously, except for blasting, which was assumed to take place once a day at 1 p.m.
Section 11	Source of Contaminant Emission Rates	Please refer to Section 4.0 of the ESDM report for a full explanation of the methods used to estimate contaminant emissions. The emission rates were determined through engineering calculations and emission factors.
Section 12	Combined Effect of Assumptions for Operating Conditions and Emission Rates	The operating conditions and emission rates (as described in the preceeding sections) were used in an approved dispersion model. The models predicted results that were less than the applicable POI Limits; therefore, no further refinements were made to either the operating conditions or emission rates.
Section 13	Meteorological Conditions	Please refer to Section 6.1.1 of the ESDM report. Default MOE meteorological data for the Northern Region set for forests was used in this study.
Section 14	Area of Modelling Coverage	Please refer to Section 6.1.2 of the ESDM report. The area of modelling coverage was designed to meet the requirements outlined in O. Reg. 419/05, section 14, which provides suitable receptor coverage for this assessment. A multi-tiered receptor grid was developed with reference to Section 7.2 of the MOE Guideline A11: Air Dispersion Modelling Guideline for Ontario, Version 2.0, March, 2009; therefore, interval spacing was dependent on the receptor distance from on-site sources.
Section 15	Stack Height for Certain New Sources of Contaminant	Please refer to Section 6.1.3 of the ESDM report. All stack heights are less than the allowable stack height obtained using the stack height formula defined under Section 15 of O. Reg. 419/05.
Section 16	Terrain Data	Please refer to Section 6.1.4 of the ESDM report. Terrain information for the area surrounding the facility was obtained from the MOE Ontario Digital Elevation Model Data web site.
Section 17	Averaging Periods	Please refer to Section 6.1.5 of the ESDM report. ½-hour, 1-hour, 24-hour and annual averaging times were used with the AERMOD model to compare to Schedule 3 Standards and other guidelines listed in the Ministry document "Summary of O. Reg. 419/05 Standards and Point Of Impingement Guidelines and Ambient Air Quality Criteria (AAQC's)" dated April 2012. ½-hour average values were calculated from the 1-hour predicted concentrations using a factor of 1.2, as given in Table 4.1 of the Ministry document “Guideline A11: Air Dispersion Modelling Guideline for Ontario” dated March 2009.

7.1 Emission Summary Table

RWDI Project 1401701

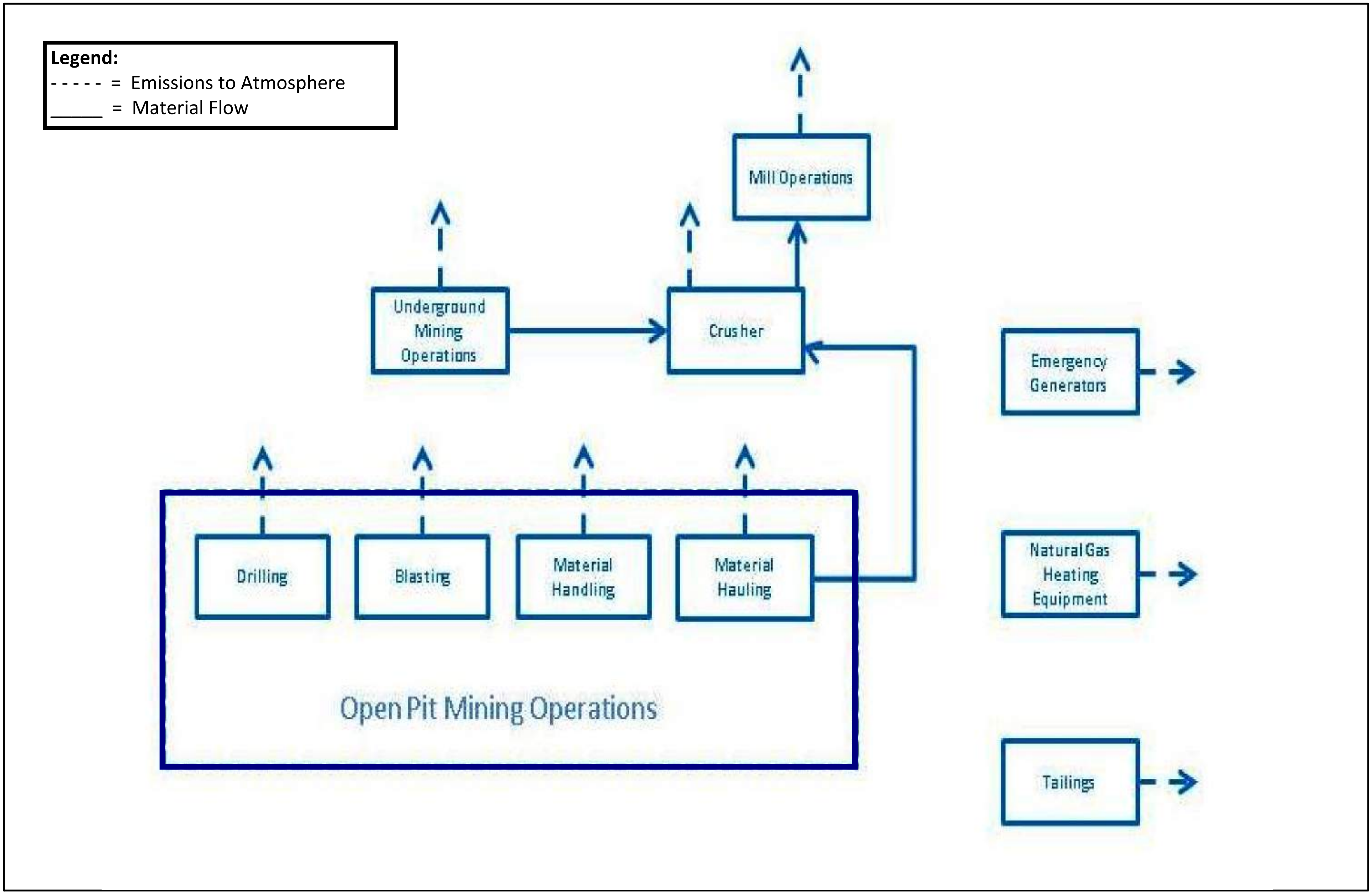
Receptor	Contaminant	CAS Number	Total Facility Emission Rate (g/s)	Air Dispersion Model Used	Maximum POI Concentration (µg/m³)	Averaging Period (hours)	MOE POI Limit [1] (µg/m³)	Limiting Effect	Regulation Schedule #	Percentage of MOE POI Limit (%)
MAXGLC	TSP	N/A	1.00E+01	AERMOD	9.21E+01	24	120	Visibility	3	77%
MAXGLC	Gold	7440-57-5	4.08E-05	AERMOD	2.63E-03	24	N/A	N/A	N/A	N/A
MAXGLC	Lead	7439-92-1	4.27E-03	AERMOD	1.66E-01	24	0.5	Health	3	33%
MAXGLC	Arsenic	7440-38-2	8.68E-04	AERMOD	2.17E-02	24	0.3	Health	Guidelines	7%
MAXGLC	Barium	7440-39-3	1.18E-02	AERMOD	2.50E-01	24	10	Health	Guidelines	3%
MAXGLC	Beryllium	7440-41-7	5.95E-05	AERMOD	1.27E-03	24	0.1	Health	3	1%
MAXGLC	Bismuth	7440-69-9	2.68E-04	AERMOD	5.59E-03	24	N/A	N/A	N/A	N/A
MAXGLC	Cadmium	7440-43-9	9.23E-05	AERMOD	2.32E-03	24	0.025	Health	3	9%
MAXGLC	Cobalt	7440-48-4	2.96E-04	AERMOD	6.07E-03	24	0.1	Health	Guidelines	6%
MAXGLC	Chromium	7440-47-3	3.64E-03	AERMOD	7.74E-02	24	0.5	Health	3	15%
MAXGLC	Manganese	7439-96-5	1.40E-02	AERMOD	2.86E-01	24	0.4	Health	3	72%
MAXGLC	Nickel	7440-02-0	9.65E-04	AERMOD	2.57E-03	Annual	0.04	Health	3	6%
MAXGLC	Phosphorous	7723-14-0	1.27E-02	AERMOD	2.63E-01	24	0.35	N/A	JSL	75%
MAXGLC	Titanium	7440-32-6	4.50E-02	AERMOD	9.18E-01	24	120	Particulate	3	1%
MAXGLC	Thallium	7440-28-0	4.20E-04	AERMOD	8.56E-03	24	0.24	N/A	JSL	4%
MAXGLC	Vanadium	7440-62-2	1.19E-03	AERMOD	2.42E-02	24	2	Health	3	1%
MAXGLC	Uranium	7440-61-1	2.52E-04	AERMOD	6.73E-04	Annual	0.03	Health	Guidelines	2%
MAXGLC	Gallium	7440-55-3	4.99E-04	AERMOD	1.05E-02	24	N/A	N/A	N/A	N/A
MAXGLC	Lanthanum	7439-91-0	4.13E-04	AERMOD	8.77E-03	24	N/A	N/A	N/A	N/A
MAXGLC	Scandium	7440-20-2	1.34E-04	AERMOD	2.94E-03	24	N/A	N/A	N/A	N/A
MAXGLC	Thorium	7440-29-1	5.05E-04	AERMOD	1.07E-02	24	N/A	N/A	N/A	N/A
MAXGLC	Platinum	7440-06-4	4.98E-04	AERMOD	1.00E-02	24	0.2	Health	Guidelines	5%
MAXGLC	Rhodium	7440-16-6	1.52E-04	AERMOD	3.27E-03	24	0.4	N/A	JSL	1%
MAXGLC	NOx	10102-44-0	5.96E+00	AERMOD	4.68E+01	24	200	Health	3	23%
MAXGLC				AERMOD	1.24E+02	1	400	Health	3	31%
MAXGLC	CO	630-08-0	3.00E+00	AERMOD	6.72E+01	0.5	6000	Health	3	1%

Notes:

[1] The term “MOE POI Limit” identified in Table D-4 refers to the following information (there may be more than one relevant MOE POI Limit for each contaminant):

- air quality standards in Schedules 2 and 3 of the Regulation;
- the guidelines for contaminants set out the MOE publication, “Summary of Standards and Guidelines to Support Ontario Regulation 419: Air Pollution – Local Air Quality"; or,
- an acceptable concentration for contaminants with no standards or guidelines.

FIGURES



Process Flow Diagram Goliath Gold Mine

Treasury Metals Inc. - Goliath Gold Project - Wabigoon, Ontario

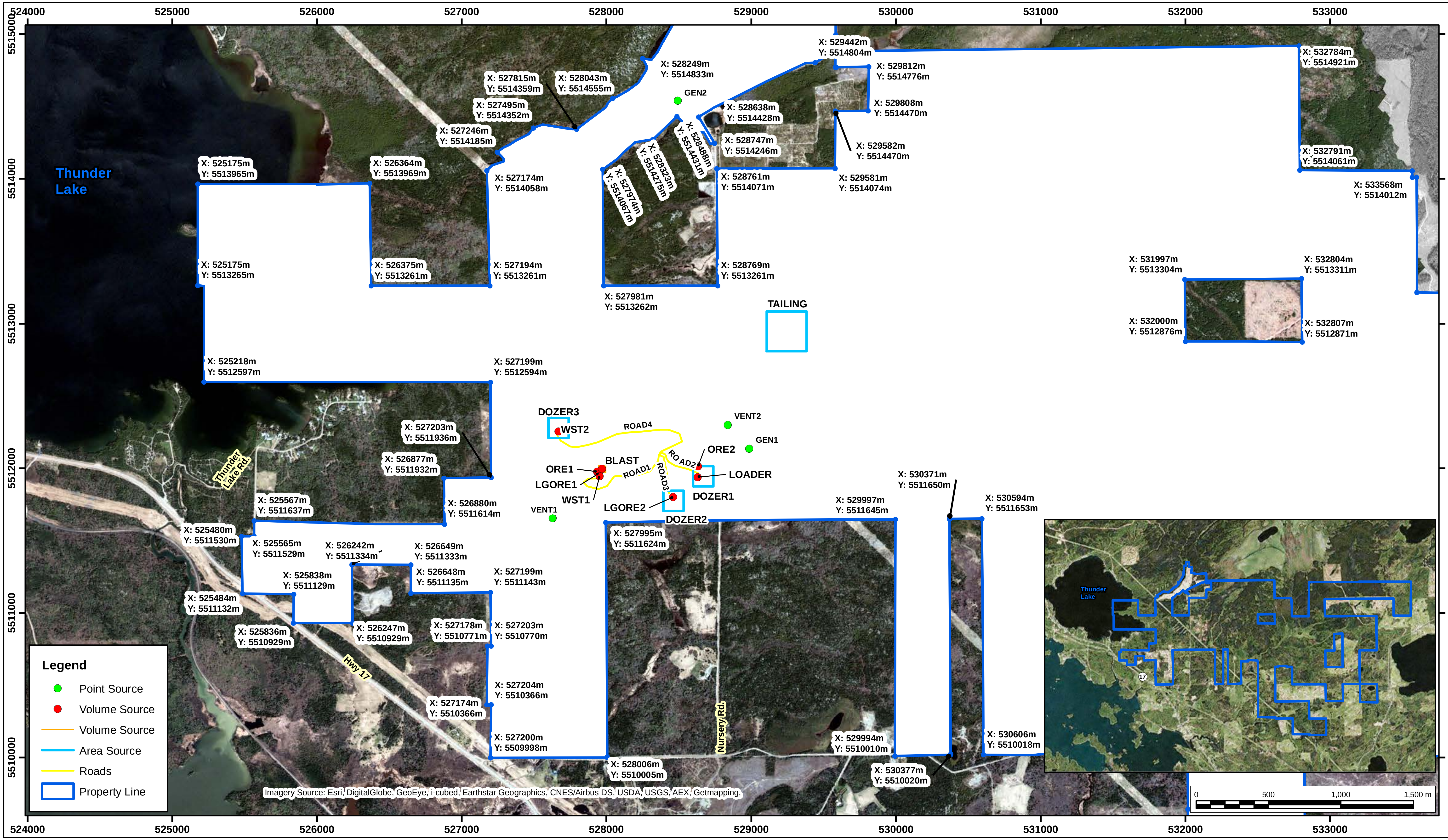
Project #1401701

Drawn by: NBN | Fig: 1.4

Approx. Scale: n/a

Date Revised: Aug. 19, 2014

RWDI



Site Plan Showing Location of Significant Sources, and Property Line

Map Projection: NAD 1983 UTM Zone 15N.

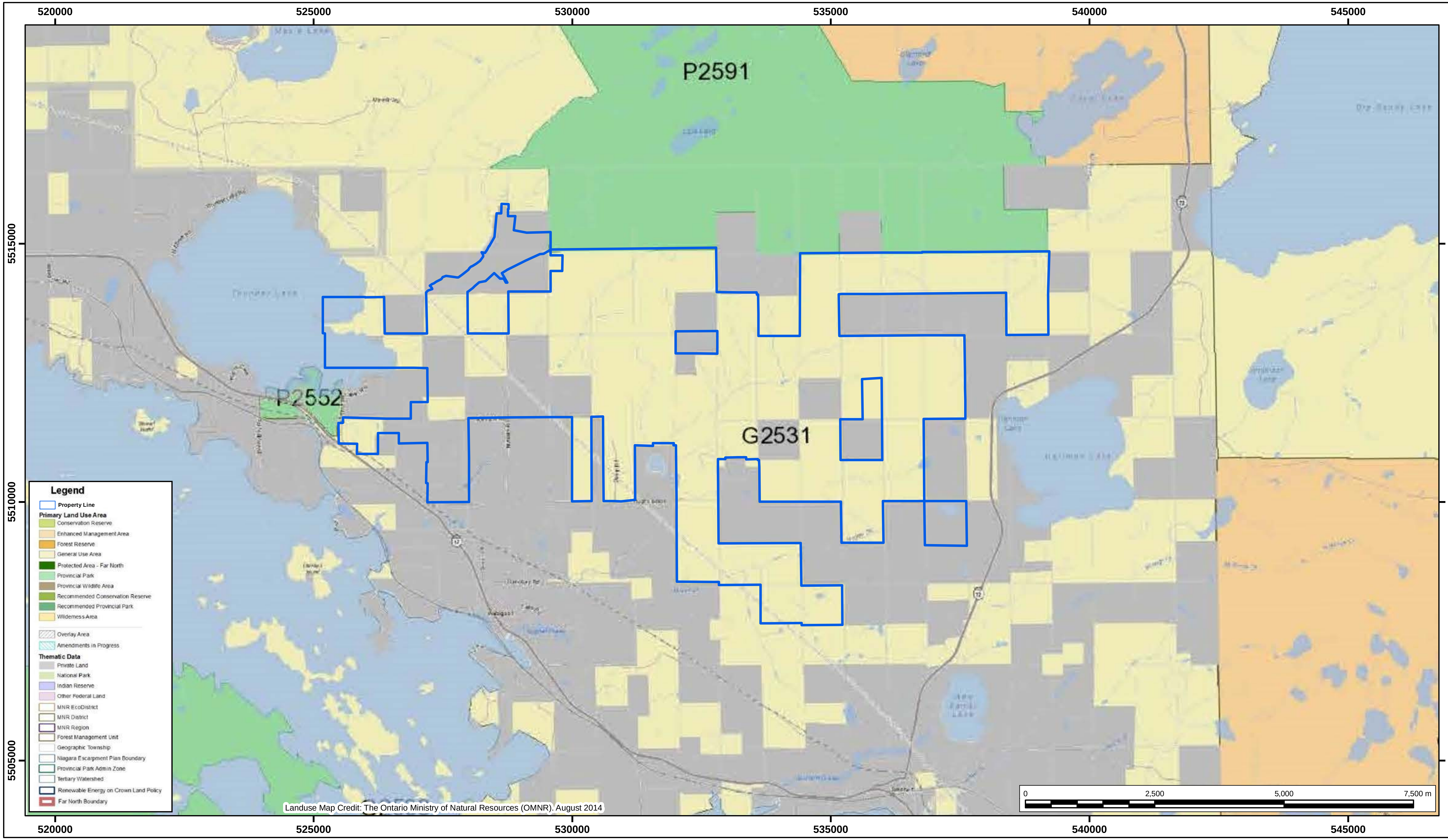
Treasury Metals Inc. - Goliath Gold Project - Wabigoon, Ontario

True North

Project #1401701

Drawn by:	NBN	Figure: 5.2
Approx. Scale:	1:25,000	
Date Revised:	Aug. 20, 2014	

RWDI



Land Use Zoning and Designation

Map Projection: NAD 1983 UTM Zone 15N.

Treasury Metals Inc. - Goliath Gold Project - Wabigoon, Ontario

True North

Project #1401701

Drawn by: NBN	Figure: 6.2
Approx. Scale:	1:70,000
Date Revised:	Aug. 20 2014

RWDI

APPENDIX A

Please See Attached CD

APPENDIX B

Appendix B1: On-Site Mobile Equipment Emissions Spreadsheet

Project #1401701

Treasury Metals

Input Required
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UNPAVED ROAD SECTIONS - AP-42 Section 13.2.2

PAVED ROAD SECTIONS - AP-42 Section 13.2.1

Paved Roads: $E = k\,(sL)^{0.91}\,(W)^{1.02}$

Unpaved Roads - Industrial: $E = 281.9\,k\,(s / 12)^{a}\,(W / 3)^{b}$

Unpaved Roads - Public: $E = 281.9\,k\,(s / 12)^{a}\,(S / 30)^{d} / (M / 0.5)^{c} - C$

E particulate emission factor (g/VKT)
k particle size multiplier (see below)
sL road surface silt loading (g/m^2)
W average weight of the vehicles traveling the road (US short tons)
s surface material silt content (%)
C emission factor for 1980's vehicle fleet exhaust, brake wear and tire wear
M surface material moisture content (%)
S mean vehicle speed (mph)
a,b,c,d constants (see below)

Route ID [1]	Route Description	Traffic Passes [2] Hourly (#/h)	Daily (#/d)	Annual (#/a)	Segment Length [2] (m)	Road Surface [3]	Roadway Type [4]	Mean Vehicle Speed (km/h)	(mph)	Average Vehicle Weight [5] (tons)	Surface Material Moisture Content [6] (%)	Surface Silt Content [7] (%)	Road Surface Silt Loading [8] (g/m^2)	Base AP-42 Emission Factor TSP (g/VKT)	PM_{10} (g/VKT)	$PM_{2.5}$ (g/VKT)	Base Emission Rate TSP (g/s)	PM_{10} (g/s)	$PM_{2.5}$ (g/s)	Additional Control Efficiency Applied (%)	Final Controlled Emission Rate TSP (g/s)	Data Quality Rating	PM_{10} (g/s)	Data Quality Rating	$PM_{2.5}$ (g/s)	Data Quality Rating
ROAD1	Road from mine pit	28			752	Unpaved	Industrial	25	16	144		5.8%		4.7E+03	1.3E+03	1.3E+02	2.8E+01	7.3E+00	7.3E-01	75%	6.9E+00		1.8E+00		1.8E-01	
ROAD2	Road to Crusher	4			313	Unpaved	Industrial	25	16	144		5.8%		4.7E+03	1.3E+03	1.3E+02	1.6E+00	4.4E-01	4.4E-02	75%	4.1E-01		1.1E-01		1.1E-02	
ROAD3	Road to Low Grade Stockpile	4			297	Unpaved	Industrial	25	16	144		5.8%		4.7E+03	1.3E+03	1.3E+02	1.6E+00	4.1E-01	4.1E-02	75%	3.9E-01		1.0E-01		1.0E-02	
ROAD4	Road to Waste Rock Stockpile	20			1134	Unpaved	Industrial	25	16	144		5.8%		4.7E+03	1.3E+03	1.3E+02	3.0E+01	7.9E+00	7.9E-01	75%	7.5E+00		2.0E+00		2.0E-01	

Constants for Mobile Emission Equations

Roadway Type	Contaminant	k	a	b	c	d	Quality
Paved Roads:	$PM_{2.5}$	0.15	-	-	-	-	-
	PM_{10}	0.62	-	-	-	-	-
	TSP	3.23	-	-	-	-	-
Unpaved Roads - Industrial:	$PM_{2.5}$	0.15	0.9	0.45	-	-	C
	PM_{10}	1.5	0.9	0.45	-	-	B
	TSP	4.9	0.7	0.45	-	-	B
Unpaved Roads - Public:	$PM_{2.5}$	0.18	1	-	0.2	0.5	C
	PM_{10}	1.8	1	-	0.2	0.5	B
	TSP	6	1	-	0.3	0.3	B

[1] Route ID numbers provided on site plan.
[2] Length of a specific road segment. A separate segment should be used whenever one or more parameters change.
[3] Paved surfaces include asphalt, concrete, and recycled asphalt (if it forms a relatively consistent surface).
[4] Publicly accessible and dominated by light vehicles, or industrial, and dominated by heavy vehicles.
[5] The average vehicle weight reflects the average of the empty and loaded vehicle weight, for travel in both directions.
[6] Required only for publicly accessible unpaved roads.
[7] Required only for unpaved roads (public and industrial).
[8] Required only for industrial paved roads.

Sample calculation for uncontrolled TSP emission factor for Source ROAD1: Road from mine pit

EF = 281.9 x (4.9) x [(5.8% / 12)]^(0.7) x [(144 tons) / 3]^(0.45) = 4740 g TSP / vehicle kilometer travelled (vkt)

Sample calculation for TSP emission rate for Source ROAD1: Road from mine pit

28 vehicles	752 m	1 km	4740 g_{TSP}	1 h	0.25 $g_{TSP\ uncontrolled}$		
1 h		1000 m	1 vehicle km	3600 s	1 g_{TSP}	=	6.9E+00 g_{TSP} / s

Comments

Hourly passes, weight of truck and payload received from Treasury Metals. Surface silt content taken from AP-42 Table 13.2.2-1 - Mean silt content for Taconite mining and processing haul road to/from pit

Appendix B2: Bulk Material Handling Emissions Spreadsheet

Project #1401701

Treasury Metals

AGGREGATE HANDLING AND STORAGE PILES - AP-42 Section 13.2.4

Average recorded hourly wind speed (m/s): 4.1
(used for sample calculations & factor validation)

Material handling emissions: $E = 0.0016\ k\ (U / 2.2)^{1.3} / (M / 2)^{1.4}$

- **E** emission factor
- **k** particle size multiplier (0.74, 0.35 and 0.053 for TSP, PM_{10} and $PM_{2.5}$)
- **U** mean wind speed, meters per second (m/s)
- **M** material moisture content (%)

Legend
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Calculated Value / Do Not Edit
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Source ID [1]	Description	Processing Rate			Site Data				Base AP-42 Emission Factor			Base Emission Rate			Additional Control Efficiency Applied	Final Controlled Emission Rate at 4.1 m/s					
		Hourly (Mg/h)	Daily (Mg/d)	Annual (Mg/y)	Site Specific Data? (y/n)	Silt Content (%)	Moisture Content (%)	Source Conditions Valid [2]	TSP (kg/Mg)	PM_{10} (kg/Mg)	$PM_{2.5}$ (kg/Mg)	TSP (g/s)	PM_{10} (g/s)	$PM_{2.5}$ (g/s)	(%)	TSP (g/s)	Data Quality Rating	PM_{10} (g/s)	Data Quality Rating	$PM_{2.5}$ (g/s)	Data Quality Rating
ORE1	Loading trucks with ore	113			y		10.0%	silt too low	2.8E-04	1.3E-04	2.0E-05	8.8E-03	4.1E-03	6.3E-04		8.8E-03	B	4.1E-03	B	6.3E-04	B
LGORE1	Loading trucks with low grade ore	113			y		10.0%	silt too low	2.8E-04	1.3E-04	2.0E-05	8.8E-03	4.1E-03	6.3E-04		8.8E-03	B	4.1E-03	B	6.3E-04	B
WST1	Loading trucks with waste rock	1111			y		10.0%	silt too low	2.8E-04	1.3E-04	2.0E-05	8.6E-02	4.1E-02	6.2E-03		8.6E-02	B	4.1E-02	B	6.2E-03	B
ORE2	Unloading ore at crusher	113			y		10.0%	silt too low	2.8E-04	1.3E-04	2.0E-05	8.8E-03	4.1E-03	6.3E-04		8.8E-03	B	4.1E-03	B	6.3E-04	B
LGORE2	Unloading low grade ore at low grade stock	113			y		10.0%	silt too low	2.8E-04	1.3E-04	2.0E-05	8.8E-03	4.1E-03	6.3E-04		8.8E-03	B	4.1E-03	B	6.3E-04	B
WST2	Unloading waste rock	1111			y		10.0%	silt too low	2.8E-04	1.3E-04	2.0E-05	8.6E-02	4.1E-02	6.2E-03		8.6E-02	B	4.1E-02	B	6.2E-03	B
LOADER	Front end loader at crusher	135			y		10.0%	silt too low	2.8E-04	1.3E-04	2.0E-05	1.0E-02	5.0E-03	7.5E-04		1.0E-02	B	5.0E-03	B	7.5E-04	B

[1] ID corresponds to process flow diagram for facility and / or material
[2] Relates to AP-42 Section 13.2.4-4

Sample calculation for uncontrolled TSP emission factor for Source ORE1: Loading trucks with ore, at a sample wind speed of 3.7 m/s

EF = 0.0016 x (0.74) x ((4.1 m/s) / 2.2)^1.3 / ((10%) / 2)^1.4 = 2.8E-04 kg TSP / Mg handled

Sample calculation for TSP emission rate for Source ORE1: Loading trucks with ore, at a sample wind speed of 5 m/s

$$\frac{113\ Mg_{handled}}{1\ h} \times \frac{2.8E\text{-}04\ kg_{TSP}}{1\ Mg_{handled}} \times \frac{1\ h}{3600\ s} \times \frac{1000\ g_{TSP}}{1\ kg_{TSP}} \times \frac{1\ g_{TSP\ uncontrolled}}{1\ g_{TSP}} = 8.8E\text{-}03\ g_{TSP} / s$$

Comments
Moisture content and hourly processing rates provided by Treasury Metals
Hourly emission file based on hourly wind data prepared for dispersion modelling

Appendix B3: Bulldozing Emissions Spreadsheet

Project #1401701

Treasury Metals

WESTERN SURFACE COAL MINING - AP-42 Section 11.9

Emission Factors for Overburden Bulldozing:
TSP = $2.6(s)^{1.2}/(M)^{1.3}$ kg/h
PM10 = $0.75 * 0.45(s)^{1.5}/(M)^{1.4}$ kg/h
PM2.5 = 0.105 * TSP

s silt content (%) **M** moisture content (%)

It has been assumed that overburden bulldozing emission factors from AP-42 Section 11.9, Western Surface Coal Mining applies to bulldozing of both waste rock and ore at Goliath Gol

Description	Value	Unit	Comments
Number of dozers	3		1 dozer operating at dumps and sometimes in pit
Annual operating hrs per unit	8,760	h	Dozers operate 24/7
Silt content	5.8	%	Mean haul road silt content for Taconite mining and processing Table 13.2.2-1 US EPA AP 42 Chapter 13.2.2 Unpaved Roads
Moisture content	10	%	Provided by Tresury Metals

Summary of Bulldozing Emissions

Emissions	TSP	PM10	PM2.5
Annual Emissions (t/y)	28.2	4.9	3.0
Max Hourly Emission Rate (g/s)	0.90	0.16	0.09
Max Hourly Emission Rate per Dozer (g/s)	0.30	0.05	0.03

Sample calculation for uncontrolled TSP emission factor for Bulldozing

EF = 2.6*5.8^1.2/10^1.3 = 1.074 kg/h

Sample calculation for TSP emission rate per Dozer

1.074 kg	1000 g_{TSP}	1 h		
h	1 kg_{TSP}	3600 s	=	0.298 g_{TSP} / s

Appendix B4: Blasting Operations Emission Spreadsheet

Project #1401701

Treasury Metals

WESTERN SURFACE COAL MINING - AP-42 Section 11.9
EXPLOSIVES DETONATION - AP-42 Section 13.3

Blasting operation particulate emissions: $E = 0.00022\ k * A^{1.5}$

- **E** emission factor
- **k** particle size multiplier (1, 0.52 and 0.03 for TSP, PM_{10} and $PM_{2.5}$)
- **A** blast surface area (m^2)

Input Required
Calculated Value / Do Not Edit
Comments
Table Heading (do not edit)

Soource ID	Source Description	Total Blast Area (m^2)	Shot Size (Charge) (Mg)	Explosive Type	Number of Blasts			Base AP-42 Emission Factor				Base Emission Rate				Additional Control Efficiency Applied (%)	Final Controlled Emission Rate							
					Hourly	Daily	Annual	TSP (kg/blast)	PM_{10} (kg/blast)	$PM_{2.5}$ (kg/blast)	NOx [1] (kg/Mg_{expl})	TSP (g/s)	PM_{10} (g/s)	$PM_{2.5}$ (g/s)	NOx (g/s)		TSP (g/s)	Data Quality Rating	PM_{10} (g/s)	Data Quality Rating	$PM_{2.5}$ (g/s)	Data Quality Rating	NOx (g/s)	Data Quality Rating
BLAST	Blasting once a day at 1 pm	2500	0.025	ANFO	1	1	1	2.8E+01	1.4E+01	8.3E-01	8.0E+00	7.6E+00	4.0E+00	2.3E-01	5.6E-02		7.6E+00	C	4.0E+00	C	2.3E-01	C	5.6E-02	D

[1] NOx emission factor taken directly from AP-42 Chapter 13.3, based on type of explosive used. Provided in kg of NOx per Mg of explosive charge used.

Sample calculation for uncontrolled TSP emission factor for Source BLAST: Blasting once a day at 1 pm.

EF = 0.00022 x (1) x (2500 m)^1.5 = 2.8E+01 kg TSP / blast

Sample calculation for TSP emission rate for Source BLAST: Blasting once a day at 1 pm.

1 blast	2.8E+01 kg_{TSP}	1 h	1000 g_{TSP}	1 $g_{TSP\ uncontrolled}$		
1 h	1 blast	3600 s	1 kg_{TSP}	1 g_{TSP}	=	7.6E+00 g_{TSP} / s

Sample calculation for NOx uncontrolled emission factor for Source BLAST: Blasting once a day at 1 pm.

0.025 $Mg_{explosive}$	1 blast	8.0E+00 kg_{NOx}	1 h	1000 g_{NOx}		
1 blast	1 h	1 $Mg_{explosive}$	3600 s	1 kg_{NOx}	=	5.6E-02 g_{NOx} / s

Comments
Total blast area, number of holes and charge per hole provide by Treasury Metals

Appendix B5: Wind Erosion of Tailings Spreadsheet

Project #1401701

Treasury Metals

Emission of Fine Grained Particulates from Desert Soils, W.G. Nickling and J. A. Gillies

Equation 15 - Mine Tailings

Erosion from Tailings: F = 1.59 * 10^-12 * U*^2.93 (g/cm² s)

F Soil flux in g/cm² s

U^* Friction velocity (cm/s)

Friction velocity at tailings can be calculated from Prandtls' equation as follows

$U^* = k * U_{10} / \ln(z/z_o)$

Where:

k = Von Karman Constant, 0.4

U_{10} = Velocity at length z

z = 10m above ground

z_o = Roughness length of the surface

U_{10} will be obtained from MOE meteorological data

z_o is assumed to be average of the roughness lengths of the two tailings sites in Emission of Fine Grained Particulates from Desert Soils, W.G. Nickling and J. A. Gillies

z_o = 0.016 cm

Wind erosion of tailings occurs when wind speed is above threshold velocity U^*_t

U^*_t is assumed to be average of the threshold velocities for the two tailings sites in Emission of Fine Grained Particulates from Desert Soils, W.G. Nickling and J. A. Gillies

U^*_t = 0.2 m/s

Sample Calculation: with an assumed velocity of 10 m/s at 10m above ground

Description	Value	Unit	Comments
Dry Unvegetated Tailings area at Goliath Gold Mine	75000	m²	Provided by Treasury Metals. Unvegetated area is 10% of total tailings area
Unvegetated dry tailings area at Goliath Gold Mine	750,000,000	cm²	
Friction velocity	0.36	m/s	Using Prandtl's equation
Soil flux	5.88E-08	g/cm² s	
Emission rate	44.08	g/s	Wind erosion emission rate from unvegetated tailings area

Note:

[1] Hourly emission file prepared based on hourly AERMET wind speeds

Appendix B6: Vent Raises Emissions Spreadsheet

Parameter	Source		Units	Comments
	V1	V2		
Flow	740,000	740,000	CFM	Provided by Treasury Metals
Flow	349.24	349.24	m^3/s	Calculation

Emission Factors

Contaminant	Emission Factor		Reference
	Value	Units	
TSP	0.86	mg/m³	Report on Mine Vent Exhaust Testing, Falconbridge Limited, Bovar Env. Project 541-6254, February 1996
Oil Mist	0.01574	mg/m³	Report on Mine Vent Exhaust Testing, Falconbridge Limited, Bovar Env. Project 541-6254, February 1996
NOx	3.94	mg/m³	Report on Mine Vent Exhaust Testing, Falconbridge Limited, Bovar Env. Project 541-6254, February 1996
CO	4.32	mg/m³	Report on Mine Vent Exhaust Testing, Falconbridge Limited, Bovar Env. Project 541-6254, February 1996

Calculated Emissions

Contaminant	Emission Rate		Rating
	V1 [g/s]	V2 [g/s]	
TSP	3.0E-01	3.0E-01	Above Average
Oil Mist	5.5E-03	5.5E-03	Above Average
NOx	1.4E+00	1.4E+00	Above Average
CO	1.5E+00	1.5E+00	Above Average

Appendix B7: Combustion Spreadsheet (Stationary Combustion) RWDI Project #1401701

RWDI Project Name:	Treasury Metals
RWDI Project Number:	1401701
Manufacturer:	
Engine Model:	

Parameter	Units	Value
Engine Fuel		Diesel
Fuel Heating Value	(Btu/gal)	137000
Stroke Cycle		4-Stroke
Engine Loading	(%)	
Burn Style		Lean
NOx Controlled?		No

Rating (enter one set of units)	Units	Value
Electrical Power Output (kW)	(kW)	500
Generator Transfer Efficiency	(%)	90
Engine Combustion Efficiency	(%)	
Calculated Engine Output	(hp)	744
	(kW)	556
	(hp)	744.444
Calculated Engine Input	(hp)	

Manufacturer Emissions Data	Units	Factor
Oxides of Sulphur (SOx)	(g/hp-hr)	
Oxides of Nitrogen (NO_x)	(g/hp-hr)	
Carbon Monoxide (CO)	(g/hp-hr)	
PM	(g/hp-hr)	
Source:		

Fuel Sulphur Information	Units	Value
Natural Gas Sulphur Content	(%)	
Fuel Oil Sulphur Content	(%)	0.0015

Exhaust Temperature	Units	Value
Exhaust Temperature (ºC)	(ºC)	
Calculated Exit Temperature	(K)	273
Exhaust Flow Rate	cfm	
	m³/s	

Emission Factors	Emission Factor		Data Quality	Source of Emission Factor	Emission Rate	
	Valule	Units			Valule	Units
Oxides of Sulphur (SOx)	1.2135E-05	(lb/hp-hr)	B	AP 42 (10/1996) Ch 3.4, Tables 3.4-1	1.14E-03	g/s
Oxides of Nitrogen (NOx)	0.024	(lb/hp-hr)	B	AP 42 (10/1996) Ch 3.4, Tables 3.4-1	2.25E+00	g/s
Carbon Monoxide (CO)	0.0055	(lb/hp-hr)	C	AP 42 (10/1996) Ch 3.4, Tables 3.4-1	5.16E-01	g/s
Total Particulate Matter (TSP)	0.0007	(lb/hp-hr)	B	AP 42 (10/1996) Ch 3.4, Tables 3.4-1	6.57E-02	g/s

Appendix B8: Combustion Spreadsheet (Stationary Combustion)

RWDI Project #1401701

RWDI Project Name:	Treasury Metals
RWDI Project Number:	1401701
Manufacturer:	
Engine Model:	

Parameter	Units	Value
Engine Fuel		Diesel
Fuel Heating Value	(Btu/gal)	137000
Stroke Cycle		4-Stroke
Engine Loading	(%)	
Burn Style		Lean
NOx Controlled?		No

Rating (enter one set of units)	Units	Value
Electrical Power Output (kW)	(kW)	150
Generator Transfer Efficiency	(%)	90
Engine Combustion Efficiency	(%)	
Calculated Engine Output	(hp)	223
	(kW)	167
	(hp)	223.333
Calculated Engine Input	(hp)	

Manufacturer Emissions Data	Units	Factor
Oxides of Sulphur (SOx)	(g/hp-hr)	
Oxides of Nitrogen (NO_x)	(g/hp-hr)	
Carbon Monoxide (CO)	(g/hp-hr)	
PM	(g/hp-hr)	
Source:		

Fuel Sulphur Information	Units	Value
Natural Gas Sulphur Content	(%)	
Fuel Oil Sulphur Content	(%)	0.0015

Exhaust Temperature	Units	Value
Exhaust Temperature (ºC)	(ºC)	
Calculated Exit Temperature	(K)	273
Exhaust Flow Rate	cfm	
	m³/s	

Emission Factors	Emission Factor		Data Quality	Source of Emission Factor	Emission Rate	
	Valule	Units			Valule	Units
Oxides of Sulphur (SOx)	0.00205	(lb/hp-hr)	B	AP 42 (10/1996) Ch 3.3, Tables 3.3-1	5.77E-02	g/s
Oxides of Nitrogen (NOx)	0.031	(lb/hp-hr)	B	AP 42 (10/1996) Ch 3.3, Tables 3.3-1	8.72E-01	g/s
Carbon Monoxide (CO)	0.00668	(lb/hp-hr)	C	AP 42 (10/1996) Ch 3.3, Tables 3.3-1	1.88E-01	g/s
Total Particulate Matter (TSP)	0.0022	(lb/hp-hr)	B	AP 42 (10/1996) Ch 3.3, Tables 3.3-1	6.19E-02	g/s

Appendix B9: Baghouse Emissions Spreadsheet

Treasury Metals

Baghouse Exhaust Flowrate		In-stack Concentration		Hourly Emission Rate		
m^3/h[1]	m^3/s	mg/m^3 [2]	g/m^3	TSP (g/s)	PM10 (g/s) [3]	PM2.5 (g/s) [3]
1,000	0.28	20	0.02	0.01	0.01	0.01

Notes:

[1] Provided by Treasury Metals for the crusher baghouse (BAGHOUSE) in an email on June 23, 2014

[2] MOE guideline on baghouse emissions

[3] Assumed to be same as TSP emissions

[4] Source parameters for the gold smelting furnace baghouse (BAGHOUSE2) were assuemd to be the same as the crusher baghouse

Appendix B10: Combustion Spreadsheet for Natural Gas-Fired Kiln Burner

RWDI Project #1401701

RWDI Project Name:	Treasury Metals
RWDI Project Number:	1401701
Boiler Information for Unit:	115 kW heater

Denotes user specified value (read comments)

Parameter	Value	Units
Fuel Type	Natural Gas	
Fuel Heating Value	1020	(Btu/scf)
Fuel Density		(lb/gal)
Firing Configuration	Wall-fired	
Boiler Efficiency	80%	(%)
Excess Air	5%	(%)

Exhaust Information	Value	Units
Exhaust Temperature (ºC)	125	(ºC)
Calculated Exit Temperature	398	(K)

Fuel Sulphur Information	Value	Units
Natural Gas Sulphur Content	2000	(grains/10^6scf)
Fuel Oil Sulphur Content	0	(%)

Rating (enter one set of units)	Value	Units
Boiler Heat Input (kW)	115	(kW)
Calculated Heat Input	0.39	(MMBtu/hr)
Boiler Size Cut-off	<100	(MMBtu/hr)

Pollution Controls	Value	Units
NSPS	n/a	
Low-NOx Burners	no	
Flue-gas Recirculation	no	

Fuel & Air Parameters	Value	Units	Sample Calculation / Comment
Fuel Consumption	382	(scf/h)	= (0.39 MMBTU/h) x (1000000 BTU/MMBTU) / (1020 BTU/scf)
	10818	(L/h)	
Fuel Molar Flow Rate (NG Only)	458	(mol'h)	= (382 scf/h) x (28.32 L/scf) x (101.3 kPa) / (8.314 L·kPa/mol·K) / (288 K)
Fuel Mass Flow Rate	7	(kg/h)	= (458 mol/h) x (16.03 g/mol) / (1000 g/kg)
Stoichiometric Ratio (NG only)	10.996	ratio	= 1 CO2 + 2 H2O + 0.05 O2 + 2 x 3.76 x (1 + 0.05) N2 per mol CH4
Theoretical Moist Air (Oil Only)	not applicable		
Combustion Air	4578	(mol/h)	= (458 mol fuel / h) x (2 mol O2 / mol fuel) x (1 + (15% XS Air)) x (4.76 mol air / mol O2)
	132	(kg/h)	= (4578 mol air / h) x (28.8 g air / mol air) / (1000 g / kg)
	108	(m³/h) @ 60ºF	= (4578 mol/h) x (8.314 L·kPa/mol·K) x (288 K) / (101.3 kPa) / (1000 L/m³)
	64	(scfm)	= (108 m³/h) x (35.31 ft³/m³) / (60 min/h)

Exhaust Parameters	Value	Units	Sample Calculation
Exhaust Gas Molar Flow (NG only)	5036	(mol/h)	= (458 mol/h) x (10.996 mol exhaust / mol fuel)
Theoretical Flue Gas (Oil Only)	not applicable	(m^3_{air} / L_{fuel})	
Exhaust Gas Mass Flow Rate	133	(kg/h)	= (458 mol/h) x (10.996 mol exhaust / mol fuel)
Exhaust Gas Flow	165	(Am³/h)	= (5036 mol/h) x (8.314 L·kPa/mol·K) x (398 K) / (101.3 kPa) / (1000 L/m³)
	0.05	(Am³/s)	= (165 m³ / h) / (3600 s / h)
	119	(m³/h) @ 60ºF	= (165 m³/h) x (288K) / (398K)
	70	(scfm)	= (119 m³ / h) x (35.31 ft³ / m³) / (60 min / h)

Criteria Contaminants	Emission Factor		Emission Rate		Data Quality	Sample Calculation
	Value	Units	Value	Units		
Sulphur Dioxide	0.6	(lb/10^6scf)	2.89E-05	(g/s)	A	= (382 scf/h) x (0.6 lb / 10^6 scf) x (453.6 g / lb) / (3660 s / h)
Oxides of Nitrogen	100	(lb/10^6scf)	4.81E-03	(g/s)	B	= (382 scf/h) x (100 lb / 10^6 scf) x (453.6 g / lb) / (3660 s / h)
Carbon Monoxide	84	(lb/10^6scf)	4.04E-03	(g/s)	B	= (382 scf/h) x (84 lb / 10^6 scf) x (453.6 g / lb) / (3660 s / h)
Filterable Particulate	7.6	(lb/10^6scf)	3.66E-04	(g/s)	D	= (382 scf/h) x (7.6 lb / 10^6 scf) x (453.6 g / lb) / (3660 s / h)
Condensible Particulate	--		--			
Total Particulate	7.6	(lb/10^6scf)	3.66E-04	(g/s)	D	= (382 scf/h) x (7.6 lb / 10^6 scf) x (453.6 g / lb) / (3660 s / h)

Note: Total Particulate = Filterable + Condensible, if applicable. Lowest data quality rating of either filterable or condensible applied.

Revision Date:	2012-11-20
Prepared by:	
Checked by:	

Appendix B11: Combustion Spreadsheet for Natural Gas-Fired Heater

RWDI Project #1401701

RWDI Project Name:	Treasury Metals
RWDI Project Number:	1401701
Boiler Information for Unit:	900 kW heater

Denotes user specified value (read comments)

Parameter	Value	Units
Fuel Type	Natural Gas	
Fuel Heating Value	1020	(Btu/scf)
Fuel Density		(lb/gal)
Firing Configuration	Wall-fired	
Boiler Efficiency	80%	(%)
Excess Air	5%	(%)

Exhaust Information	Value	Units
Exhaust Temperature (ºC)	125	(ºC)
Calculated Exit Temperature	398	(K)

Fuel Sulphur Information	Value	Units
Natural Gas Sulphur Content	2000	(grains/10^6scf)
Fuel Oil Sulphur Content	0	(%)

Rating (enter one set of units)	Value	Units
Boiler Heat Input (kW)	900	(kW)
Calculated Heat Input	3.07	(MMBtu/hr)
Boiler Size Cut-off	<100	(MMBtu/hr)

Pollution Controls	Value	Units
NSPS	n/a	
Low-NOx Burners	no	
Flue-gas Recirculation	no	

Fuel & Air Parameters	Value	Units	Sample Calculation / Comment
Fuel Consumption	3010	(scf/h)	= (3.07 MMBTU/h) x (1000000 BTU/MMBTU) / (1020 BTU/scf)
	85243	(L/h)	
Fuel Molar Flow Rate (NG Only)	3606	(mol'h)	= (3010 scf/h) x (28.32 L/scf) x (101.3 kPa) / (8.314 L·kPa/mol·K) / (288 K)
Fuel Mass Flow Rate	58	(kg/h)	= (3606 mol/h) x (16.03 g/mol) / (1000 g/kg)
Stoichiometric Ratio (NG only)	10.996	ratio	= 1 CO2 + 2 H2O + 0.05 O2 + 2 x 3.76 x (1 + 0.05) N2 per mol CH4
Theoretical Moist Air (Oil Only)	not applicable		
Combustion Air	36046	(mol/h)	= (3606 mol fuel / h) x (2 mol O2 / mol fuel) x (1 + (15% XS Air)) x (4.76 mol air / mol O2)
	1038	(kg/h)	= (36046 mol air / h) x (28.8 g air / mol air) / (1000 g / kg)
	852	(m³/h) @ 60ºF	= (36046 mol/h) x (8.314 L·kPa/mol·K) x (288 K) / (101.3 kPa) / (1000 L/m³)
	501	(scfm)	= (852 m³/h) x (35.31 ft³/m³) / (60 min/h)

Exhaust Parameters	Value	Units	Sample Calculation
Exhaust Gas Molar Flow (NG only)	39652	(mol/h)	= (3606 mol/h) x (10.996 mol exhaust / mol fuel)
Theoretical Flue Gas (Oil Only)	not applicable	(m^3_{air} / L_{fuel})	
Exhaust Gas Mass Flow Rate	1100	(kg/h)	= (3606 mol/h) x (10.996 mol exhaust / mol fuel)
Exhaust Gas Flow	1295	(Am³/h)	= (39652 mol/h) x (8.314 L·kPa/mol·K) x (398 K) / (101.3 kPa) / (1000 L/m³)
	0.36	(Am³/s)	= (1295 m³ / h) / (3600 s / h)
	937	(m³/h) @ 60ºF	= (1295 m³/h) x (288K) / (398K)
	551	(scfm)	= (937 m³ / h) x (35.31 ft³ / m³) / (60 min / h)

Criteria Contaminants	Emission Factor		Emission Rate		Data Quality	Sample Calculation
	Value	Units	Value	Units		
Sulphur Dioxide	0.6	(lb/10^6scf)	2.28E-04	(g/s)	A	= (3010 scf/h) x (0.6 lb / 10^6 scf) x (453.6 g / lb) / (3660 s / h)
Oxides of Nitrogen	100	(lb/10^6scf)	3.79E-02	(g/s)	B	= (3010 scf/h) x (100 lb / 10^6 scf) x (453.6 g / lb) / (3660 s / h)
Carbon Monoxide	84	(lb/10^6scf)	3.19E-02	(g/s)	B	= (3010 scf/h) x (84 lb / 10^6 scf) x (453.6 g / lb) / (3660 s / h)
Filterable Particulate	7.6	(lb/10^6scf)	2.88E-03	(g/s)	D	= (3010 scf/h) x (7.6 lb / 10^6 scf) x (453.6 g / lb) / (3660 s / h)
Condensible Particulate	--		--			
Total Particulate	7.6	(lb/10^6scf)	2.88E-03	(g/s)	D	= (3010 scf/h) x (7.6 lb / 10^6 scf) x (453.6 g / lb) / (3660 s / h)

Note: Total Particulate = Filterable + Condensible, if applicable. Lowest data quality rating of either filterable or condensible applied.

Revision Date:	2012-11-20
Prepared by:	
Checked by:	

Appendix B12: Carbon in Leach Tanks Emission Spreadsheet

Treasury Metals

Project #1401701

Parameter	Source	Units	
	S26		
Flow Rate through tanks	757	CFM	
	0.36	m^3/s	
HCN Concentration	1	ppm	
Temperature	298	K	
Atmospheric pressure	101.3	kPa	
Molecular weight of HCN	27.0253	kPa	

Emission Rate Calculation

$$\frac{0.36\ m^3_{air}}{1\ s} \times \frac{1\ mol_{HCN}}{1000000\ mol_{air}} \times \frac{101.3}{298} \times \frac{1\ mol_{air}\ K}{8.314\ L_{air}\ kPa} \times \frac{L_{air}}{m^3_{air}} \times \frac{27.0253\ g_{HCN}}{1\ mol_{HCN}} = 3.95E\text{-}04\ g_{HCN}\ /\ s$$

Appendix B13: Drilling Emissions Spreadsheet

Treasury Metals

Project #1401701

Legend
Input Required
Calculated Value / Do Not Edit
Comment required
Table Heading (do not edit)

Soource ID [1]	Source Description / Process Decription	AP-42 Process Description [2]	Process Code [3]	AP-42 Chapter	Processing Rate			Base AP-42 Emission Factor			Base Emission Rate			Additional Control Efficiency Applied	Final Controlled Emission Rate					
					Hourly (Mg/h)	Daily (Mg/d)	Annual (Mg/a)	TSP (kg/Mg)	PM_{10} (kg/Mg)	$PM_{2.5}$ (kg/Mg)	TSP (g/s)	PM_{10} (g/s)	$PM_{2.5}$ (g/s)	(%)	TSP (g/s)	Data Quality Rating	PM_{10} (g/s)	Data Quality Rating	$PM_{2.5}$ (g/s)	Data Quality Rating
DRILLING	Drilling	Wet drilling: unfragmented stone	15	11.19.2-1	338			1.1E-04	4.0E-05	6.0E-06	1.0E-02	3.8E-03	5.6E-04		1.0E-02	E	3.8E-03	E	5.6E-04	E

[1] ID corresponds to process flow diagram for facility and / or material

[2] AP-42 process listed as "controlled" reflects between 70-90% control due to high moisture / water sprays, as described in AP-42 Section 11.19.2.

[3] Process code used by spreadsheet to pull correct factor based on slected activity - does not require entry.

Sample calculation for TSP emissions from Source DRILLING: Drilling

$$\frac{338\ Mg_{processed}}{1\ h} \times \frac{1.1E\text{-}04\ kg_{TSP}}{1\ Mg_{processed}} \times \frac{1\ h}{3600\ s} \times \frac{1000\ g_{TSP}}{1\ kg_{TSP}} \times \frac{1\ g_{TSP\ uncontrolled}}{1\ g_{TSP}} = 1.0E\text{-}02\ g_{TSP} / s$$

Comments

25 holes drilled in an hour
Hole depth = 10 m
Hole diameter = 0.8 m (assumed)
Volume drilled = 125.66 m³
Density = 2691 kg/m³ (for granite)
Hourly processing rate = 338.1511 Mg/h

APPENDIX C

Appendix C: Supporting Information for Assessment of Negligibility

Contaminant Name	Contaminant CAS Number	Source ID	Source Description	Contaminant Emission Rate (by source) (g/s)	Distance to Property Line (m)	Criteria [1] 50% of Standard or de minimus (µg/m³)	Regulation Schedule #	Criteria Averaging Time (hours)	Table B-1 1-hour Dispersion Factor for Shortest Distance to Property Line [2] (µg/m³ / g/s)	Table B-1 Dispersion Factor Converted to Criteria Averaging Time (µg/m³ / g/s)	Predicted Concentration (µg/m³)	Contaminant Negligible?
TSP	N/A		All Sources	1.00E+01	20	60	3	24	10000	4107	4.13E+04	no
Gold	7440-57-5		All Sources	4.08E-05	20	0.05	De Minimis	24	10000	4107	1.67E-01	no
Silver	7440-22-4		All Sources	6.09E-05	20	0.5	3	24	10000	4107	2.50E-01	yes
Copper	7440-50-8		All Sources	1.03E-03	20	25	3	24	10000	4107	4.23E+00	yes
Iron	15438-31-0		All Sources	5.94E-05	20	2	3	24	10000	4107	2.44E-01	yes
(As Metallic Iron)	1309-37-1		All Sources	1.70E-04	20	12.5	3	24	10000	4107	6.98E-01	yes
Lead	7439-92-1		All Sources	4.27E-03	20	0.25	3	24	10000	4107	1.75E+01	no
Zinc	7440-66-6		All Sources	9.94E-03	20	60	3	24	10000	4107	4.08E+01	yes
Aluminium	7429-90-5		All Sources	1.49E-04	20	2.4	JSL	24	10000	4107	6.13E-01	yes
(As Aluminium Oxide)	1344-28-1		All Sources	2.82E-04	20	60	Guidelines	24	10000	4107	1.16E+00	yes
Arsenic	7440-38-2		All Sources	8.68E-04	20	0.15	Guidelines	24	10000	4107	3.57E+00	no
Barium	7440-39-3		All Sources	1.18E-02	20	5	Guidelines	24	10000	4107	4.86E+01	no
Beryllium	7440-41-7		All Sources	5.95E-05	20	0.05	3	24	10000	4107	2.44E-01	no
Bismuth	7440-69-9		All Sources	2.68E-04	20	0.05	De Minimis	24	10000	4107	1.10E+00	no
Calcium [3]	7440-70-2		All Sources	6.05E-05	20	5	3	24	10000	4107	2.48E-01	yes
Cadmium	7440-43-9		All Sources	9.23E-05	20	0.0125	3	24	10000	4107	3.79E-01	no
Cobalt	7440-48-4		All Sources	2.96E-04	20	0.05	Guidelines	24	10000	4107	1.22E+00	no
Chromium	7440-47-3		All Sources	3.64E-03	20	0.25	3	24	10000	4107	1.49E+01	no
Potassium [4]	7440-09-7		All Sources	4.01E-05	20	14	Guidelines	24	10000	4107	1.65E-01	yes
Lithium	7439-93-2		All Sources	4.99E-04	20	10	3	24	10000	4107	2.05E+00	yes
Magnesium [5]	7439-95-4		All Sources	4.42E-05	20	60	Guidelines	24	10000	4107	1.82E-01	yes
Manganese	7439-96-5		All Sources	1.40E-02	20	0.2	3	24	10000	4107	5.75E+01	no
Molybdenum	7439-98-7		All Sources	1.89E-04	20	60	Guidelines	24	10000	4107	7.75E-01	yes
Nickel	7440-02-0		All Sources	9.65E-04	20	0.02	3	8760	10000	787	7.60E-01	no
Phosphorous	7723-14-0		All Sources	1.27E-02	20	0.175	JSL	24	10000	4107	5.21E+01	no
Antimony	7440-36-0		All Sources	1.63E-04	20	12.5	3	24	10000	4107	6.69E-01	yes
Selenium	7782-49-2		All Sources	2.28E-04	20	5	Guidelines	24	10000	4107	9.38E-01	yes
Tin	7440-31-5		All Sources	5.83E-04	20	5	3	24	10000	4107	2.39E+00	yes
Strontium	7440-24-6		All Sources	3.96E-03	20	60	Guidelines	24	10000	4107	1.63E+01	yes
Titanium	7440-32-6		All Sources	4.50E-02	20	60	3	24	10000	4107	1.85E+02	no
Thallium	7440-28-0		All Sources	4.20E-04	20	0.12	JSL	24	10000	4107	1.72E+00	no
Vanadium	7440-62-2		All Sources	1.19E-03	20	1	3	24	10000	4107	4.89E+00	no
Tungsten	7440-33-7		All Sources	2.89E-04	20	2	JSL	24	10000	4107	1.19E+00	yes
Yttrium	7440-65-5		All Sources	1.81E-04	20	1.2	JSL	24	10000	4107	7.42E-01	yes
Sulphur	7704-34-9		All Sources	6.97E-05	20	10	JSL	24	10000	4107	2.86E-01	yes
Uranium	7440-61-1		All Sources	2.52E-04	20	0.015	Guidelines	8760	10000	787	1.99E-01	no
Gallium	7440-55-3		All Sources	4.99E-04	20	0.05	De Minimis	24	10000	4107	2.05E+00	no
Lanthanum	7439-91-0		All Sources	4.13E-04	20	0.05	De Minimis	24	10000	4107	1.70E+00	no
Scandium	7440-20-2		All Sources	1.34E-04	20	0.05	De Minimis	24	10000	4107	5.50E-01	no
Thorium	7440-29-1		All Sources	5.05E-04	20	0.05	De Minimis	24	10000	4107	2.07E+00	no
Platinum	7440-06-4		All Sources	4.98E-04	20	0.1	Guidelines	24	10000	4107	2.05E+00	no
Palladium	7657-10-1		All Sources	2.89E-04	20	5	Guidelines	24	10000	4107	1.19E+00	yes
Rhodium	7440-16-6		All Sources	1.52E-04	20	0.2	JSL	24	10000	4107	6.23E-01	no
Sodium [6]	7440-23-5		All Sources	3.45E-05	20	5	Guidelines	24	10000	4107	1.42E-01	yes
NOx	10102-44-0		All Sources	5.96E+00	20	100	3	24	10000	4107	2.45E+04	no
CO	630-08-0		All Sources	3.00E+00	20	3000	3	0.5	10000	12142	3.64E+04	no
Hydrogen Cyanide	74-90-8		All Sources	3.95E-04	20	4	3	24	10000	4107	1.62E+00	yes

Notes:

[1] 50% of MOE Schedule 1, 2 or 3 Standard, or de-minimus values as per Appendix B of the Procedure for Preparing an ESDM Report.

[2] Use dispersion factor associated with shortest distance to property line for all sources emitting the contaminant. The shortest distance between a source and receptor (property line) has been conservatively assumed to be 20m.

[3] Calcium emissions compared to Calcium Oxide limit

[4] Potassium emissions compared to Potassium Oxide limit

[5] Magnesium emissions compared to Magnesium Oxide limit

[6] Sodium emissions compared to Sodium Oxide limit

Sample Calculation - for Calcium

Calculation of Predicted Concentration (µg/m³) = Emission Rate (g/s) x Dispersion Factor from Table B-1 (µg/m³ / g/s emission)

0.00006 g/s x 4107 µg/m³ / g/s emission

0.25 µg/m³

Assessment of Significance

Predicted Concentration = 0.25 µg/m³

Criteria (50% of Standard) = 5 µg/m³

Is Concentration < 50% of Standard? = yes

APPENDIX D

Appendix D1: Metals Impact Assessment

Treasury Metals

Project #1401701

Metal	CAS Number	Metal % in Dust: Ore	Metal % in Dust: Waste Rock	ROAD1	ROAD2	ROAD3	ROAD4	DOZER1	DOZER2	DOZER3	ORE1	LGORE1	WST1	ORE2	LGORE2	WST2	LOADER	BLAST	TAILING	VENT1	VENT2	Total (µg/m³)
Origin of Dust				Waste	Waste	Waste	Waste	Ore	Ore	Waste	Ore	Ore	Waste	Ore	Ore	Waste	Ore	Waste	Ore	Ore	Ore	
Maximum AERMOD 24-hr TSP Concentration by Source (µg/m³)				247.24	11.97	17.74	91.64	29.08	76.05	17.82	0.10	0.10	1.07	0.09	0.29	0.62	0.14	4.15	34.85	0.92	0.49	
Maximum Metals Concentration (µg/m³)																						
Gold	7440-57-5	0.001603%	0.000090%	2.2E-04	1.1E-05	1.6E-05	8.2E-05	4.7E-04	1.2E-03	1.6E-05	1.5E-06	1.6E-06	9.6E-07	1.4E-06	4.7E-06	5.6E-07	2.2E-06	3.7E-06	5.6E-04	1.5E-05	7.9E-06	2.6E-03
Silver	7440-22-4	0.001340%	0.000149%	3.7E-04	1.8E-05	2.7E-05	1.4E-04	3.9E-04	1.0E-03	2.7E-05	1.3E-06	1.3E-06	1.6E-06	1.1E-06	3.9E-06	9.3E-07	1.9E-06	6.2E-06	0.0E+00	1.2E-05	6.6E-06	2.0E-03
Iron	15438-31-0	0.013004%	0.003333%	8.2E-03	4.0E-04	5.9E-04	3.1E-03	3.8E-03	9.9E-03	5.9E-04	1.2E-05	1.3E-05	3.6E-05	1.1E-05	3.8E-05	2.1E-05	1.8E-05	1.4E-04	4.5E-03	1.2E-04	6.4E-05	3.2E-02
Iron	15438-31-0	0.000246%	0.000235%	5.8E-04	2.8E-05	4.2E-05	2.1E-04	7.2E-05	1.9E-04	4.2E-05	2.3E-07	2.5E-07	2.5E-06	2.1E-07	7.2E-07	1.5E-06	3.4E-07	9.7E-06	8.6E-05	2.3E-06	1.2E-06	1.3E-03
Lead	7439-92-1	0.086079%	0.011128%	2.8E-02	1.3E-03	2.0E-03	1.0E-02	2.5E-02	6.5E-02	2.0E-03	8.2E-05	8.6E-05	1.2E-04	7.3E-05	2.5E-04	6.9E-05	1.2E-04	4.6E-04	3.0E-02	7.9E-04	4.2E-04	1.7E-01
Zinc	7440-66-6	0.189639%	0.026836%	6.6E-02	3.2E-03	4.8E-03	2.5E-02	5.5E-02	1.4E-01	4.8E-03	1.8E-04	1.9E-04	2.9E-04	1.6E-04	5.5E-04	1.7E-04	2.6E-04	1.1E-03	6.6E-02	1.7E-03	9.3E-04	3.7E-01
Aluminium	7429-90-5	0.000559%	0.000594%	1.5E-03	7.1E-05	1.1E-04	5.4E-04	1.6E-04	4.3E-04	1.1E-04	5.3E-07	5.6E-07	6.3E-06	4.8E-07	1.6E-06	3.7E-06	7.8E-07	2.5E-05	1.9E-04	5.1E-06	2.7E-06	3.1E-03
Arsenic	7440-38-2	0.006484%	0.003185%	7.9E-03	3.8E-04	5.7E-04	2.9E-03	1.9E-03	4.9E-03	5.7E-04	6.2E-06	6.5E-06	3.4E-05	5.5E-06	1.9E-05	2.0E-05	9.0E-06	1.3E-04	2.3E-03	5.9E-05	3.2E-05	2.2E-02
Barium	7440-39-3	0.046766%	0.046903%	1.2E-01	5.6E-03	8.3E-03	4.3E-02	1.4E-02	3.6E-02	8.4E-03	4.4E-05	4.7E-05	5.0E-04	4.0E-05	1.4E-04	2.9E-04	6.5E-05	1.9E-03	1.6E-02	4.3E-04	2.3E-04	2.5E-01
Beryllium	7440-41-7	0.000242%	0.000235%	5.8E-04	2.8E-05	4.2E-05	2.2E-04	7.0E-05	1.8E-04	4.2E-05	2.3E-07	2.4E-07	2.5E-06	2.1E-07	7.0E-07	1.5E-06	3.4E-07	9.7E-06	8.4E-05	2.2E-06	1.2E-06	1.3E-03
Bismuth	7440-69-9	0.000992%	0.001066%	2.6E-03	1.3E-04	1.9E-04	9.8E-04	2.9E-04	7.5E-04	1.9E-04	9.4E-07	9.9E-07	1.1E-05	8.4E-07	2.9E-06	6.6E-06	1.4E-06	4.4E-05	3.5E-04	9.1E-06	4.9E-06	5.6E-03
Calcium	7440-70-2	0.000106%	0.000177%	4.4E-04	2.1E-05	3.1E-05	1.6E-04	3.1E-05	8.0E-05	3.1E-05	1.0E-07	1.1E-07	1.9E-06	9.0E-08	3.1E-07	1.1E-06	1.5E-07	7.3E-06	3.7E-05	9.7E-07	5.2E-07	8.4E-04
Cadmium	7440-43-9	0.000700%	0.000338%	8.4E-04	4.0E-05	6.0E-05	3.1E-04	2.0E-04	5.3E-04	6.0E-05	6.6E-07	7.0E-07	3.6E-06	5.9E-07	2.0E-06	2.1E-06	9.7E-07	1.4E-05	2.4E-04	6.4E-06	3.4E-06	2.3E-03
Cobalt	7440-48-4	0.000997%	0.001187%	2.9E-03	1.4E-04	2.1E-04	1.1E-03	2.9E-04	7.6E-04	2.1E-04	9.5E-07	1.0E-06	1.3E-05	8.5E-07	2.9E-06	7.4E-06	1.4E-06	4.9E-05	3.5E-04	9.1E-06	4.9E-06	6.1E-03
Chromium	7440-47-3	0.014801%	0.014371%	3.6E-02	1.7E-03	2.5E-03	1.3E-02	4.3E-03	1.1E-02	2.6E-03	1.4E-05	1.5E-05	1.5E-04	1.3E-05	4.3E-05	8.9E-05	2.1E-05	6.0E-04	5.2E-03	1.4E-04	7.3E-05	7.7E-02
Potassium	7440-09-7	0.000108%	0.000111%	2.7E-04	1.3E-05	2.0E-05	1.0E-04	3.2E-05	8.2E-05	2.0E-05	1.0E-07	1.1E-07	1.2E-06	9.2E-08	3.2E-07	6.9E-07	1.5E-07	4.6E-06	3.8E-05	9.9E-07	5.3E-07	5.9E-04
Lithium	7439-93-2	0.001723%	0.001996%	4.9E-03	2.4E-04	3.5E-04	1.8E-03	5.0E-04	1.3E-03	3.6E-04	1.6E-06	1.7E-06	2.1E-05	1.5E-06	5.0E-06	1.2E-05	2.4E-06	8.3E-05	6.0E-04	1.6E-05	8.4E-06	1.0E-02
Magnesium	7439-95-4	0.000085%	0.000107%	2.7E-04	1.3E-05	1.9E-05	9.8E-05	2.5E-05	6.5E-05	1.9E-05	8.1E-08	8.5E-08	1.1E-06	7.2E-08	2.5E-07	6.7E-07	1.2E-07	4.4E-06	3.0E-05	7.8E-07	4.2E-07	5.4E-04
Manganese	7439-96-5	0.046026%	0.056253%	1.4E-01	6.7E-03	1.0E-02	5.2E-02	1.3E-02	3.5E-02	1.0E-02	4.4E-05	4.6E-05	6.0E-04	3.9E-05	1.3E-04	3.5E-04	6.4E-05	2.3E-03	1.6E-02	4.2E-04	2.3E-04	2.9E-01
Molybdenum	7439-98-7	0.000895%	0.000736%	1.8E-03	8.8E-05	1.3E-04	6.7E-04	2.6E-04	6.8E-04	1.3E-04	8.5E-07	9.0E-07	7.9E-06	7.6E-07	2.6E-06	4.6E-06	1.2E-06	3.0E-05	3.1E-04	8.2E-06	4.4E-06	4.2E-03
Nickel	7440-02-0	0.003730%	0.003833%	9.5E-03	4.6E-04	6.8E-04	3.5E-03	1.1E-03	2.8E-03	6.8E-04	3.5E-06	3.7E-06	4.1E-05	3.2E-06	1.1E-05	2.4E-05	5.2E-06	1.6E-04	1.3E-03	3.4E-05	1.8E-05	2.0E-02
Phosphorous	7723-14-0	0.045455%	0.050639%	1.3E-01	6.1E-03	9.0E-03	4.6E-02	1.3E-02	3.5E-02	9.0E-03	4.3E-05	4.5E-05	5.4E-04	3.9E-05	1.3E-04	3.1E-04	6.3E-05	2.1E-03	1.6E-02	4.2E-04	2.2E-04	2.6E-01
Antimony	7440-36-0	0.001899%	0.000540%	1.3E-03	6.5E-05	9.6E-05	5.0E-04	5.5E-04	1.4E-03	9.6E-05	1.8E-06	1.9E-06	5.8E-06	1.6E-06	5.5E-06	3.4E-06	2.6E-06	2.2E-05	6.6E-04	1.7E-05	9.3E-06	4.8E-03
Selenium	7782-49-2	0.000965%	0.000899%	2.2E-03	1.1E-04	1.6E-04	8.2E-04	2.8E-04	7.3E-04	1.6E-04	9.2E-07	9.7E-07	9.6E-06	8.2E-07	2.8E-06	5.6E-06	1.3E-06	3.7E-05	3.4E-04	8.8E-06	4.7E-06	4.9E-03
Tin	7440-31-5	0.002213%	0.002318%	5.7E-03	2.8E-04	4.1E-04	2.1E-03	6.4E-04	1.7E-03	4.1E-04	2.1E-06	2.2E-06	2.5E-05	1.9E-06	6.4E-06	1.4E-05	3.1E-06	9.6E-05	7.7E-04	2.0E-05	1.1E-05	1.2E-02
Strontium	7440-24-6	0.009954%	0.016159%	4.0E-02	1.9E-03	2.9E-03	1.5E-02	2.9E-03	7.6E-03	2.9E-03	9.5E-06	1.0E-05	1.7E-04	8.5E-06	2.9E-05	1.0E-04	1.4E-05	6.7E-04	3.5E-03	9.1E-05	4.9E-05	7.8E-02
Titanium	7440-32-6	0.146360%	0.181008%	4.5E-01	2.2E-02	3.2E-02	1.7E-01	4.3E-02	1.1E-01	3.2E-02	1.4E-04	1.5E-04	1.9E-03	1.2E-04	4.3E-04	1.1E-03	2.0E-04	7.5E-03	5.1E-02	1.3E-03	7.2E-04	9.2E-01
Thallium	7440-28-0	0.001364%	0.001689%	4.2E-03	2.0E-04	3.0E-04	1.5E-03	4.0E-04	1.0E-03	3.0E-04	1.3E-06	1.4E-06	1.8E-05	1.2E-06	4.0E-06	1.0E-05	1.9E-06	7.0E-05	4.8E-04	1.2E-05	6.7E-06	8.6E-03
Vanadium	7440-62-2	0.003775%	0.004796%	1.2E-02	5.7E-04	8.5E-04	4.4E-03	1.1E-03	2.9E-03	8.5E-04	3.6E-06	3.8E-06	5.1E-05	3.2E-06	1.1E-05	3.0E-05	5.2E-06	2.0E-04	1.3E-03	3.5E-05	1.8E-05	2.4E-02
Tungsten	7440-33-7	0.002546%	0.001029%	2.5E-03	1.2E-04	1.8E-04	9.4E-04	7.4E-04	1.9E-03	1.8E-04	2.4E-06	2.5E-06	1.1E-05	2.2E-06	7.4E-06	6.4E-06	3.5E-06	4.3E-05	8.9E-04	2.3E-05	1.2E-05	7.7E-03
Yttrium	7440-65-5	0.000596%	0.000726%	1.8E-03	8.7E-05	1.3E-04	6.7E-04	1.7E-04	4.5E-04	1.3E-04	5.7E-07	6.0E-07	7.8E-06	5.1E-07	1.7E-06	4.5E-06	8.3E-07	3.0E-05	2.1E-04	5.5E-06	2.9E-06	3.7E-03
Sulphur	7704-34-9	0.000902%	0.000224%	5.5E-04	2.7E-05	4.0E-05	2.1E-04	2.6E-04	6.9E-04	4.0E-05	8.6E-07	9.0E-07	2.4E-06	7.7E-07	2.6E-06	1.4E-06	1.3E-06	9.3E-06	3.1E-04	8.2E-06	4.4E-06	2.2E-03
Uranium	7440-61-1	0.001000%	0.001000%	2.5E-03	1.2E-04	1.8E-04	9.2E-04	2.9E-04	7.6E-04	1.8E-04	9.5E-07	1.0E-06	1.1E-05	8.5E-07	2.9E-06	6.2E-06	1.4E-06	4.1E-05	3.5E-04	9.2E-06	4.9E-06	5.3E-03
Gallium	7440-55-3	0.001905%	0.001985%	4.9E-03	2.4E-04	3.5E-04	1.8E-03	5.5E-04	1.4E-03	3.5E-04	1.8E-06	1.9E-06	2.1E-05	1.6E-06	5.5E-06	1.2E-05	2.6E-06	8.2E-05	6.6E-04	1.7E-05	9.3E-06	1.0E-02
Lanthanum	7439-91-0	0.001667%	0.001633%	4.0E-03	2.0E-04	2.9E-04	1.5E-03	4.8E-04	1.3E-03	2.9E-04	1.6E-06	1.7E-06	1.7E-05	1.4E-06	4.9E-06	1.0E-05	2.3E-06	6.8E-05	5.8E-04	1.5E-05	8.2E-06	8.8E-03
Scandium	7440-20-2	0.000624%	0.000522%	1.3E-03	6.3E-05	9.3E-05	4.8E-04	1.8E-04	4.7E-04	9.3E-05	5.9E-07	6.2E-07	5.6E-06	5.3E-07	1.8E-06	3.2E-06	8.7E-07	2.2E-05	2.2E-04	5.7E-06	3.1E-06	2.9E-03
Thorium	7440-29-1	0.002000%	0.002000%	4.9E-03	2.4E-04	3.5E-04	1.8E-03	5.8E-04	1.5E-03	3.6E-04	1.9E-06	2.0E-06	2.1E-05	1.7E-06	5.8E-06	1.2E-05	2.8E-06	8.3E-05	7.0E-04	1.8E-05	9.8E-06	1.1E-02
Platinum	7440-06-4	0.001500%	0.002014%	5.0E-03	2.4E-04	3.6E-04	1.8E-03	4.4E-04	1.1E-03	3.6E-04	1.4E-06	1.5E-06	2.2E-05	1.3E-06	4.4E-06	1.2E-05	2.1E-06	8.3E-05	5.2E-04	1.4E-05	7.4E-06	1.0E-02
Palladium	7657-10-1	0.001000%	0.001155%	2.9E-03	1.4E-04	2.0E-04	1.1E-03	2.9E-04	7.6E-04	2.1E-04	9.5E-07	1.0E-06	1.2E-05	8.5E-07	2.9E-06	7.2E-06	1.4E-06	4.8E-05	3.5E-04	9.2E-06	4.9E-06	6.0E-03
Rhodium	7440-16-6	0.000650%	0.000597%	1.5E-03	7.1E-05	1.1E-04	5.5E-04	1.9E-04	4.9E-04	1.1E-04	6.2E-07	6.5E-07	6.4E-06	5.5E-07	1.9E-06	3.7E-06	9.0E-07	2.5E-05	2.3E-04	5.9E-06	3.2E-06	3.3E-03
Sodium	7440-23-5	0.000037%	0.000082%	2.0E-04	9.8E-06	1.5E-05	7.5E-05	1.1E-05	2.8E-05	1.5E-05	3.5E-08	3.7E-08	8.8E-07	3.2E-08	1.1E-07	5.1E-07	5.2E-08	3.4E-06	1.3E-05	3.4E-07	1.8E-07	3.7E-04

Metal	CAS Number	Metal % in Dust: Ore	Metal % in Dust: Waste Rock	ROAD1	ROAD2	ROAD3	ROAD4	DOZER1	DOZER2	DOZER3	ORE1	LGORE1	WST1	ORE2	LGORE2	WST2	LOADER	BLAST	TAILING	VENT1	VENT2	Total (µg/m³)
Maximum AERMOD Annual TSP Concentration by Source (µg/m³)				39.94	1.56	2.30	13.51	1.54	6.34	0.74	0.02	0.02	0.24	0.02	0.07	0.11	0.03	0.37	0.35	0.08	0.04	
Maximum Metals Concentration (µg/m³)																						
Nickel	7440-02-0	0.003730%	0.003833%	1.5E-03	6.0E-05	8.8E-05	5.2E-04	5.7E-05	2.4E-04	2.8E-05	7.6E-07	8.2E-07	9.2E-06	6.2E-07	2.6E-06	4.3E-06	1.1E-06	1.4E-05	1.3E-05	2.8E-06	1.5E-06	2.6E-03
Uranium	7440-61-1	0.001000%	0.001000%	4.0E-04	1.6E-05	2.3E-05	1.4E-04	1.5E-05	6.3E-05	7.4E-06	2.0E-07	2.2E-07	2.4E-06	1.7E-07	6.9E-07	1.1E-06	2.9E-07	3.7E-06	3.5E-06	7.6E-07	4.0E-07	6.7E-04

APPENDIX J-4

BEST MANAGEMENT PRACTICES PLAN FOR DUST

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Treasury Metals Incorporated
Goliath Gold Project

Wabigoon, Ontario

Final Report

Best Management Practices Plan for Dust

RWDI #1401701
October 15, 2014

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1 INTRODUCTION

1.1 Components of a Best Management Practices Plan

A Best Management Practice Plan (BMP) for dust is a detailed document that outlines the fugitive dust sources at a given site and describes the measures that shall be used to control emissions from these sources. The BMP is used to manage fugitive dust emissions, from sources such as on-site haul routes, material processing, material handling, and wind erosion. According to the MOE, the BMP for dust must include the following:

- Details regarding the size and composition of the dust;
- A description of the emission sources from the facility;
- A summary of control measures that are or will be put in place as part of the BMP;
- An implementation schedule for the control measures;
- An implementation plan for the control measures;
- Details regarding the inspection and maintenance schedule; and,
- A description of the planned monitoring and record keeping activities.

1.2 Size and Composition of Fugitive Dust

Typically, the dust at a gold mining operation has the following characteristics:

- Primarily composed of material with the same metal content as the ore, low-grade ore, and waste rock material extracted from the mining operations;
- Dust from the tailings management facility will contain a lower percentage of key metals, but will otherwise be similar to the ore extracted from the mining operations;
- Fraction of dust smaller than 10 micrometres (PM10), 19-55% ; and,
- Fraction of dust smaller than 2.5 micrometres (PM2.5), 3-14% 1

1.3 Overview of the Best Management Practices Plan

This document provides a separate section for fugitive dust source at the facility, including description of each source, complete with control measures applicable to that source.

- Site preparation and closure activities
- On-site traffic on paved roads/areas and unpaved roads/areas;
- Open pit extraction operations
- Material handling operations,
- Material conveying systems and processing;

- Waste rock and ore stock piles;
- Tailings management facility; and,
- General work areas and material spills.

1.4 Definitions

The following terms have specific definitions with respect to this Best Management Practices Plan:

Dry Conditions: Maximum daytime temperature at or above 25ºC, mean wind speed at or above 25km/h and relative humidity value below 75%,

Water Truck: The water truck must be equipped with both spray bars for even distribution of water on road surfaces, and water cannon, capable of reaching the highest stockpiles at the facility. Truck capacity should be on the order of 5,000 US Gal / 20,000L.

2 SITE PREPARATION ACTIVITIES

2.1 Activities Included

- Overburden removal using an excavator or loader and off-road haul trucks.
- Berm construction using off-road haul trucks and bulldozer.

2.2 Controls

2.2.1 Overburden Removal

- Avoid overburden removal, if possible, during dry months, i.e. July, August and September and during peak periods of extraction.
- Alternatively, cease overburden removal when dry conditions are anticipated; activities are within 300 m of a residence; and winds are anticipated to be blowing towards the residence.
- If activities must be conducted during dry periods and within 300 m of a residence, a truck-mounted water spray cannon can be used to reduce the potential impact from these operations by wetting areas to be disturbed.
- Loading of trucks shall be done in such a manner that the drop height from the bucket to the bed of the truck (or material already loaded into the truck) is kept to a minimum.
- Load sizes shall be controlled to ensure material does not fall from the loaded truck.

2.2.2 Berm Construction

- Avoid berm construction, if possible, during dry months, i.e. July, August and September.
- Alternatively, cease berm construction when dry conditions are anticipated; activities are within 300 m of a residence; and winds are anticipated to be blowing towards the residence.

- If activities must be conducted during dry periods and within 300 m of a residence, a truck-mounted water spray cannon can be used to reduce the potential impact from these operations by wetting material once it has been placed.
- Where possible, conducting dumping operations in locations that are sheltered from the wind while operations are taking place. Piles should be constructed in such a way that new material is added on the downwind side of the pile for the prevailing winds (e.g., build the pile from west to east, generally).
- Minimize the drop height from truck box to the ground at dump location.
- Stabilize all new berms as quickly as possible using vegetation or other means.

2.2.3 Haul Routes

- See Section 4.

3 SITE CLOSURE ACTIVITIES

3.1 Activities Included

- Loading of waste rock into haul trucks for placement during closure operations.
- Placement and handling of material during construction / closure operations.
- Rehabilitation using front-end loader, off-road haul trucks and bulldozer

3.2 Controls

3.2.1 Loading Operations

- Loading of trucks shall be done in such a manner that the drop height from the bucket to the bed of the truck (or material already loaded into the truck) is kept to a minimum.
- Load sizes shall be controlled to ensure material does not fall from the loaded truck.
- Loading operations should be curtailed when dry conditions are anticipated and visible dust is observed during loading operations.

3.2.2 Placement and Handling of Material (Construction / Closure)

- Plan these operations on a campaign basis during non-freeze-up conditions to allow the use of water for dust suppression, and in the spring when the moisture content of surface material is typically higher.
- The water spray cannon on the water truck can be used to wet dry surface material before it is excavated, during placement, and if required, after placement.
- Operations should be curtailed when dry conditions are anticipated and visible dust is observed during bulldozing operations.
- Minimize the drop height from truck box to the ground at dump location.

3.2.3 Rehabilitation

- Avoid earth moving and bulldozing or grading, if possible, during dry months, i.e. July, August, and September.
- Alternatively, cease overburden removal when dry conditions are anticipated; activities are within 300 m of a residence; and winds are anticipated to be blowing towards the residence.
- If activities must be conducted during dry periods and within 300 m of a residence, a truck-mounted water spray cannon can be used to reduce the potential impact from these operations by wetting material once it has been placed.
- Stabilize all rehabilitated areas as quickly as possible using vegetation or other means.

3.2.4 Haul Routes

- See Section 4.

4 HAUL ROUTES

4.1 Activities Included

- Fugitive dust emissions unpaved from haul routes is are the most significant source of fugitive dust and potential impacts due to operations at the facility.
- Unpaved haul routes for truck traffic, including:
- Within the open pit;
- From the open pit to the crusher ore stockpile, low-grade ore stockpile, or waste rock stockpile.
- From the processing plant to paved portion of haul route.
- Paved haul route for truck traffic near the site entrance.

4.2 Controls

4.2.1 Unpaved Haul Routes

- A water truck and/or irrigation system and water supply shall be available to provide water to all significant unpaved traffic areas.
- The watering system shall be able to deliver the water evenly over the haul route surface, and shall have the capacity to deploy water on all active haul routes at a rate of at least 1 L/m2/hour.
- At the start of each day, prior to trucks accessing the haul routes, the travel surfaces will be inspected, and water will be applied if dry conditions are being experienced;
- The watering rate and frequency shall vary, depending on surface moisture conditions and traffic conditions, and will be adjusted as needed to prevent recurrences of visible dust throughout the day (under dry conditions watering may need to be repeated hourly through the day).

- In general, watering should be initiated whenever the site manager or scale operator observes trucks producing a trailing cloud of dust greater than about 1/3 of a truck length.
- A speed limit of 25 km/h shall be posted near the site entrance. Truck operators will be directed to observe the speed limit whenever dry conditions are anticipated.

4.2.2 Paved Haul Routes

- A section of the internal haul route, extending from the public road into the site, shall be paved. The length of the paved section should be at least 100m in length. This will help to reduce drag-out from unpaved roads onto public roads.
- The facility shall have the capability to flush the on-site paved surface using the water truck.
- At a minimum, under dry conditions the paved entrance area shall be inspected at the end of each day's shift, and flushed if necessary to provide a clean entrance for the start of the next day's operations.
- The frequency of flushing shall vary, depending on surface moisture conditions and traffic levels, and shall be triggered, as soon as practical, whenever routine inspections indicate that that pavement is not clean (may need to be flushed once or twice per day, during peak operating periods).

5 OPEN PIT EXTRACTION OPERATIONS

5.1 Activities Included

- Drilling in the open pit.
- Blasting in the open pit.

5.2 Controls

5.2.1 Drilling

- Drilling equipment shall be equipped with fabric dust collection systems or wet-suppression equipment, and these controls shall be maintained in good working order.

5.2.2 Blasting

- Blasting plans shall be designed to minimize the area per blast.
- Phased blasting should be employed to maximize the blasting efficiency.
- Where possible, blasting and excavation should move in an east to west direction.

6 MATERIAL HANDLING OPERATIONS

6.1 Activities Included

- Excavation and loading of off-road haul trucks at active face in the open pit and at the waste rock pile during closure operations.
- Dumping of material at the Ore Stockpile, Low-Grade Ore Stockpile; and Waste Rock Stockpile.
- Bulldozing operations at the Ore Stockpile, Low-Grade Ore Stockpile; and Waste Rock Stockpile.
- Loading of ore into the primary crusher by front end loader.

6.2 Controls

6.2.1 Excavation and Loading Operations

- Loading of trucks shall be done in such a manner that the drop height from the bucket to the bed of the truck (or material already loaded into the truck) is kept to a minimum.
- Load sizes shall be controlled to ensure material does not fall from the loaded truck.
- Loading operations should be curtailed when dry conditions are anticipated and visible dust is observed during loading operations.

6.2.2 Waste Rock Dumping Operations

- Dumping operations should be curtailed when dry conditions are anticipated and visible dust is observed during dumping operations.
- Where possible, conducting dumping operations in locations that are sheltered from the wind while operations are taking place. Piles should be constructed in such a way that new material is added on the downwind side of the pile for the prevailing winds (e.g., build the pile from west to east, generally).
- Minimize the drop height from truck box to the ground at dump location.

6.2.3 Bulldozing Operations

- Bulldozing operations should be curtailed when dry conditions are anticipated and visible dust is observed during bulldozing operations.

6.2.4 Loading Ore into Primary Crusher

- Minimize the drop height from front-end loader bucket to the crusher hopper.
- Equip the primary crusher with water spray bars to wet down the hopper area as required (e.g., if feedstock is less than 3% moisture).
- If fugitive dust becomes a significant concern at this location, the installation of a 3-sided wind screen around the hopper should be investigated.

7 MATERIAL CONVEYING SYSTEMS AND PROCESSING

7.1 Activities Included

- Crushing, screening, and milling at the mill complex.

7.2 Controls

7.2.1 Mill Complex

- At present, we do not have specific milling details, so the controls listed here are generic mineral mill recommendations.
- All equipment should be located inside of buildings or dedicated enclosures.
- All process-related building vents should be directed to suitable dust collection devices prior to being exhausted. The dust collected in these units may be returned to the extraction process.
- The processing plant shall be equipped with a water spray system to minimize airborne dust in the dry milling areas. The dust collected in these units may be returned to the extraction process.
- Watering rate will be set as needed to suppress visible dust.
- Bay doors shall be closed at all times, except when necessary for equipment ingress or egress from buildings.
- Openings in mill buildings for conveyors or other equipment shall be sealed where possible.

8 WASTE ROCK AND ORE STOCKPILES

8.1 Activities Included

- Building and maintaining the ore, low-grade ore and waste rock stockpiles.

8.2 Controls

8.2.1 Waste Rock and Ore Stockpiles

- As noted in Section 6, piles should be constructed in such a way that new material is added on the downwind side of the pile for the prevailing winds (e.g., build the pile from west to east, generally).
- The water spray cannon on the water truck can be used to wet areas where material has been recently placed, or any areas where visible dust is observed.
- Where a portion of a stockpile will not be disturbed for an extended period, it should be covered with a suitable material as soon as possible. Suitable cover material can include, but is not limited to:
- Industrial tarp / geotextile;
- MOE-approved dust suppressants; and,

- Soils and vegetation.

9 TAILINGS MANAGEMENT FACILITY

9.1 Activities Included

- Wind erosion of dry / exposed tailings material.

9.2 Controls

9.2.1 Tailings Management Facility

- Periodically move the tailings discharge location in order to ensure that the majority of the tailings remain below the surface of the water at all times.
- Exposed areas of the tailings management facility should be covered with a suitable cover material, and / or vegetated as soon as possible if exposure will be prolonged. Suitable cover material can include, but is not limited to:
- Crimped straw;
- Industrial tarp / geotextile
- MOE-approved dust suppressants; or
- Coarse material from the waste rock pile.

10 GENERAL WORK AREAS & SPILLS

10.1 Activities Included

- Includes any areas not already covered under this BMP.
- Includes any area of the site where fine-grained material is spilled, allowing for the potential of wind erosion of that material.

10.2 Controls

10.2.1 General Work Areas

- Good housekeeping practices will be maintained at all times, to ensure fine material is not left exposed for potential erosion by winds or res-suspension by passing vehicles or equipment.
- Areas not used for vehicle travel or specific work duties should be vegetated as soon as possible, and that vegetation should be maintained in suitable condition to minimize the potential for wind erosion.

10.2.2 Spills

- Spills of any fine-grained material should be cleaned up as soon as practicable.

- In the event that a spill of fine-grained material cannot be cleaned up quickly, it should be covered to prevent wind erosion.

11 ADMINISTRATION

11.1 Implementation Schedule

- All control measures relevant to a specific phase of the mine should be in a state of readiness before that phase of the mine commences.
- Where additional controls are deemed necessary, and have been identified, these controls shall be implemented as soon as practicable.

11.2 Implementation Plan

- Formal training on new and existing operating procedures shall be provided to relevant new and existing staff at a minimum of once every 2 years, and in the event of changes to the BMPP.
- The company's management shall communicate the BMPP to responsible supervisors, who shall ensure personnel are following operating procedures defined in the BMP.
- The Site Manager shall be responsible for ensuring the BMPP is followed.
- Management shall ensure the BMPP is reviewed annually.
- The BMPP shall be kept on file at the site office.
- At the time of implementation, specific responsibilities will be assigned to specific job title or individuals.

12 INSPECTION, MONITORING & RECORD KEEPING

12.1 Inspection and Maintenance

- Weekly inspection and maintenance of the water truck will be performed to ensure the equipment is always in good condition.
- Weekly inspection of the road surfaces will be carried out, and maintenance will be performed as soon as practicable.
- Water spray systems for the processing equipment should be inspected regularly to ensure it is in good condition;

12.2 Monitoring

- Weather forecasts will be checked daily, to plan for current and next-day watering needs.
- Visual inspection for dusty conditions shall occur at a minimum of hourly daily during dry conditions and twice per day otherwise.

- The Site Manager will be responsible for monitoring current conditions and weather forecasts from Environment Canada to subsequently help plan for current and next day watering needs and other measures.
- An on-site meteorological station is strongly advised to provide an indication of when dry conditions exist, which can be used to inform site operators of watering requirements. The station will also provide site specific data to interpret complaints and other events.

12.3 Record Keeping

- Records shall be kept of when and how dust control measures are implemented and when complaints are received, if any. As a minimum, the following activities or events shall be recorded:
- Watering is applied on paved roads, unpaved roads and regularly travelled areas;
- Visible dust is observed; and,
- A complaint is received.

13 COMPLAINT TRACKING AND RESOLUTION

13.1 Complaint Tracking

- A sign posted at the site entrance shall include a phone number for neighbours to call if they have concerns.
- The operator should request that the local MOE office and the Township notify them immediately if they receive a complaint, to allow for prompt company response and follow-up.
- Complainants should be requested to identify the location of the incident as well as the time of day that it was detected.
- The site operator should record the operational conditions during the time period to which the complaint applies, as well as weather conditions and other relevant data.

13.2 Complaint Resolution

When a complaint is received, the Site Manager shall ensure the following steps are taken:

1. Inspect the site and surrounding area to identify possible sources of visible dust;
2. Obtain weather data for the time of the event; and,
3. Note all on-site activities at the time that the complaint was made.
4. If the information indicates that the facility is not the source of the dust complaint, the complainant shall be notified of this finding.
5. If it is determined that the complaint may, in fact, have been related to the facility operations, the following response procedures shall be followed, in the order provided below:

- Level 1 - Correction of operations as soon as practical. The Site Manager shall ensure that all element of the BMPP are being followed. Control measures shall be stepped up or operations may be curtailed, as required.
- Level 2 – Review of Best Management Practice Plan. If the Level 1 response does not adequately resolve the problem, the BMPP shall be reviewed to look for additional control measures to address the source of the dust complaint.
- Level 3 – Operational modifications. If the Level 2 response does not adequately resolve the problem, the operator shall commit to making physical changes to the facility to address the source of the dust complaint, such as additional enclosures, relocation of equipment, or additional paving.