APPENDIX 9

Technical Data Report: Air Quality

EAGLE GOLD PROJECT

Technical Data Report:
Air Quality

FINAL REPORT

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EXECUTIVE SUMMARY

Stantec Consulting Ltd. was retained by Victoria Gold Corp.(VIT) to prepare an Air Quality Technical Data Report (TDR) for the Eagle Gold Project (the Project). This Report contains background information, methods, and results used to assess potential Air Quality effects from the Project (Section 6.6 of the Project Proposal).

The Air Quality TDR contains a detailed description of current air quality and climatic conditions in the region surrounding the Project. Available data are used in conjunction with applicable regulations to determine potential Project effects during the Project construction and operations phases (Section 6.6 of the Project Proposal). Air emissions during the decommission phase are not considered as activity levels are expected to be scaled down from those during the construction Phase.

Short-term (i.e., hourly, daily) and long-term (i.e., annual) emission rates were determined for Total Suspended Particulates (TSP), respirable particulates ($PM_{2.5}$), Nitrogen Dioxide (NO_2), Carbon Monoxide (CO), and Sulphur Dioxide (SO_2) during the construction and operations phases of the Project. Greenhouse Gas (GHG) emissions were also quantified and compared to applicable territorial and national values. It was determined that GHG emissions generated by Project activities are negligible in comparison to the Yukon and Canada totals.

Dispersion modelling was used to determine the effects of TSP, $PM_{2.5}$, NO_2, CO and SO_2 emissions generated by Project activities. Maximum ambient concentrations were predicted and compared to applicable National Ambient Air Quality Objectives (NAAQO). During the construction phase, exceedances were identified in TSP and $PM_{2.5}$ 24-hour concentrations. During the operations phase, exceedances only occurred when predicting 24-hour TSP concentrations in a very small area located close to the open pit.

Exceedances in predicted ambient TSP and $PM_{2.5}$ concentrations were attributed to the modelling method. The dispersion model approach did not incorporate wet deposition (a naturally occurring PM removal mechanism) in its computational method. In addition, as a conservative approach the short-term (24-hour) emissions assumed construction and operations activities occurred simultaneously. It is more likely that the mining fleet will work intermittently on an hourly and daily basis. Under the modeled conditions, the predicted TSP and $PM_{2.5}$ concentrations thought to provide a conservative estimate of actual Project conditions.

ABBREVIATIONS AND ACRONYMS

AAQO .... Ambient Air Quality Objectives

ADR .... adsorption, desorption and recovery

AENV .... Alberta Environment

BATEA .... Best Available Technology Economically Achievable

°C .... Celsius degrees

CACs .... Criteria Air Contaminants

CCME .... Canadian Council of Ministers of the Environment

CEPA .... Canadian Environmental Protection Act

CH_4 .... Methane

cm .... centimetre

CO .... carbon monoxide

CO_2 .... carbon dioxide

CO_{2e} .... carbon dioxide equivalents

CWS .... Canadian Wildlife Service

EA .... Environmental Assessment

EC .... Environment Canada

g .... grams

GHG .... greenhouse gas

GVM .... gross vehicle mass

GWP .... global warming potential

hr .... hour

Ha .... hectares

HC .... Health Canada

HP .... horsepower

IPCC .... Intergovernmental Panel on Climate Change

JWA .... Jacques Whitford AXYS Ltd.

°K .... Kelvin degrees

k .... thousand

km ..... kilometre

kt ..... kilotonnes

kW ..... kilowatts

L ..... litre

m asl ..... metres above sea level

M ..... million

mm ..... millimetre

Mt ..... Million tonnes

NAAQO ..... National Ambient Air Quality Objectives

NAPS ..... National Air Pollution Surveillance Network

N_2O ..... nitrous oxide

NO ..... nitrogen oxide

NO_X ..... oxides of nitrogen

NO_2 ..... nitrogen dioxide

O_3 ..... ozone

OLM ..... Ozone Limiting Method

PM ..... particulate matter

PM_{10} ..... inhalable particulate matter with diameter less than 10 µm

$PM_{2.5}$ ..... respirable particulate matter with diameter less than 2.5 µm

ppb ..... parts per billion

ppm ..... parts per million

RAA ..... Regional Assessment Area

s ..... second

SO_2 ..... sulphur dioxide

TDR ..... Technical Data Report

tph ..... tonnes per hour

TSP ..... total suspended particulates

US EPA ..... United States Environmental Protection Agency

UTM ..... Universal Transverse Mercator

$\mu g\ m^3$ ..... micrograms per metre cubed

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1 INTRODUCTION

This Technical Data Report (TDR) contains background information, methods, and results pertaining to the Air Quality assessment of the Project (Section 6.6 of the Project Proposal). The Eagle Gold Project (the Project) is located in central Yukon, approximately 45 km north-northeast of Mayo YT in the upper Haggart Creek drainage basin, which includes the Dublin Gulch drainage basin.

The Air Quality TDR contains a detailed description of current air quality and climatic conditions in the region surrounding the Project. Available data are used in conjunction with applicable regulations to determining potential Project effects during the Project's construction and operations phases (Section 6.6 of the Project Proposal). The effect of potential Project emissions was evaluated using the results obtained from dispersion modelling simulations. Dispersion model predictions provide a link between the emissions and the meteorology. They help determine how concentrations vary across the assessment area in response to terrain and other surface factors. All modelling was conducted in accordance with prevailing procedures for screening assessments.

1.1 Scope of Assessment

Project activities will result in the release of substances that, owing to their physical and chemical properties, are classed as air contaminants. These emissions are activity-dependant. This TDR provides an emissions inventory for the following two categories of air contaminants; criteria air contaminants (CACs) and greenhouse gases (GHGs). Further details on CACs and GHGs are provided below.

1.1.1 Criteria Air Contaminants

CACs consist of Total Suspended Particles (TSP), respirable particulate matter ($PM_{2.5}$), nitrogen dioxide (NO_2), carbon monoxide (CO), and sulphur dioxide (SO_2). CACs are regulated by Environment Canada (EC) and Health Canada (HC) with oversight for the National Ambient Air Quality Objectives (Health Canada 2007). $PM_{2.5}$ and ozone (O_3) concentration standards, known as the Canada Wide Standard (CWS), have been set by the Canadian Council of Ministers of the Environment (CCME 2000). For ease of reference when required, the NAAQO and CWS will be collectively referred to as the "regulatory objectives". Section 5.5 discusses the regulatory objectives in detail.

Particulate Matter (PM) is characterized based on the diameter of the particle and includes both $PM_{2.5}$ and TSP. The size of a particle determines the velocity with which gravitational settling occurs. $PM_{2.5}$ is defined to be equal or less than 2.5 µm. TSP range in size from 0.001 to 500 µm (a human hair is about 70 µm in diameter). Depending on their size and other properties, particles may remain suspended in the air for a few seconds or indefinitely. Generally, large particles settle out very close to the source.

The air quality and epidemiological communities have shifted their research interests in recent years from TSP to $PM_{2.5}$ due to concerns related to human health effects. Very fine particles can be transported over large distances and can penetrate deep into the respiratory tract. Short-term exposure to elevated concentrations of $PM_{2.5}$ can irritate the lungs and cause lung constriction, producing shortness of breath and coughing. Long-term exposure can lead to asthma, lung disease, decreased lung function, and cardiovascular problems (US EPA 2006). Consequently, the quantification of PM emissions generated by the Project is important to accurately assess the potential effects on health and quality of life.

During the construction phase, dust related PM emissions will be caused by site clearing and grubbing, soil salvaging and stockpiling, site grading, borrow area development, camp and haul road construction, and surface disruption from vehicle movement. Combustion $PM_{2.5}$ emissions are from large construction vehicles and equipment exhausts. The operations phase will also have dust related TSP and $PM_{2.5}$ emissions as a result of open pit mining, ore processing activities, and surface disruption from vehicle movement. Combustion $PM_{2.5}$ emission sources include the exhaust from large vehicles and the operation of generators, boilers and regenerator kiln.

Nitrogen Dioxide (NO_2) is produced in most combustion processes including in the operation of internal combustion engines. NO_2 is an orange to brown gas that is corrosive, and irritating at high concentrations. Most NO_2 in the atmosphere is formed by the oxidation of nitric oxide (NO), which is emitted directly by diesel fuel combustion processes in internal combustion engines. The levels of NO and NO_2, and the ratio of the two gases, together with the presence of hydrocarbons and sunlight, are the most important factors in the formation of ground-level ozone and other oxidants. Oxidation in combination with atmospheric water forms nitric acid, a constituent of acid rain.

Project-related NO_x emissions will result from the operation of vehicles, generators, boilers, and regenerator kiln.

Carbon Monoxide (CO) is a colourless, odourless gas and is a product of incomplete combustion from internal combustion engines. Project-related CO emissions will result from the operation of vehicles, generators, boilers, and regenerator kilns.

Sulphur Dioxide (SO_2) is a colourless gas with a distinctive pungent sulphur odour. It is produced in combustion processes by the oxidation of diesel fuel containing sulphur. At high enough concentrations, SO_2 can have negative effects on plant and animal health, particularly with respect to their respiratory systems. In addition, SO_2 can be further oxidized and may combine with water to form sulphuric acid, another constituent of acid rain.

1.1.2 Greenhouse Gases

GHGs consist of carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). The latter two compounds are usually presented as CO_2 equivalent (CO_{2e}). The prevailing scientific theory links increases in atmospheric concentrations of GHGs to alterations in the earth's climate. Current research has established a relationship between GHG increases and increases in temperature, moisture, and the occurrence of severe weather events such as drought, flood, and storms.

1.2 Objectives

The TDR presents the methods and results used for the air quality assessment found in Section 6.6 of the Project Proposal. The following key information will be presented:

- Existing ambient air quality and climate baseline conditions
- Air quality emissions estimation techniques
- CAC emissions inventory
- Air quality dispersion modelling methods and results
- GHG emissions inventory.

Where necessary, construction and operations mitigation measures used to minimize or avoid effects on air quality are stated.

Section 2 of the TDR identifies the air quality assessment area. Section 3 describes the air quality and climatic baseline conditions. Section 4 details the emissions estimates followed by the dispersion modeling described in Section 5. Section 6 reports the results. The Greenhouse Gas (GHG) emissions are described in Section 7.

2 Air Quality Assessment Area

The scope of the assessment was focused by selecting an assessment area such that a meaningful analysis of Project effects could be made. Based on the meteorological conditions of the site and the nature of the proposed Project, a 30 km by 30 km Regional Assessment Area (RAA) centred on the Project site was determined to be sufficient to assess Project effects on air quality.

The RAA is centered on the mine site. The receptor grid is laid out as follows:

- 250-m spacing within 4.5 km from the sources of interest (9 km by 9 km)
- 500-m spacing within 7.5 km from the sources of interest (15 km by 15 km)
- 1,000-m spacing beyond 7.5 km
- 100 m spacing along the mine facility perimeter
- No receptors within the mine site area.

Figure 2-1 shows the geographic location of the proposed Project and the RAA.

3 Baseline Conditions

The following summary of baseline conditions considers both the climatic conditions and air quality in the region of the Project.

An understanding of regional climate and meteorological events is required as these events can influence all phases of the Project. Ambient meteorological conditions will influence the transport and dispersion of air emissions from the Project, and must be considered as part of the Project environmental assessment. Wind speed, wind direction, and atmospheric turbulence are major meteorological elements that influence the dispersion of airborne contaminants. The climate baseline (Section 3.1) considers measurable climatic parameters at the nearest regional climate stations in the assessment area.

Understanding the existing air quality helps to establish the link between the air emissions (the cause) and resultant changes in ambient air quality (the effect), and allows for an assessment of potential effects of Project-related emissions. Section 3.2 summarizes the available ambient air quality data.

3.1 Climate Baseline

The Dublin Gulch area is characterized by a “continental” type climate with moderate annual precipitation and a large temperature range. Summers are short and can be hot, while winters are long and cold with moderate snowfall. Rainstorm events can occur frequently during the summer and may contribute between 30 to 40% of the annual precipitation. Higher elevations are snow-free by mid-June. Frost action may occur at any time during the summer or fall. The Baseline Climate Report (Appendix 7 of the Project Proposal) was completed in 2010. It describes local and regional climate conditions and provides details of the study area, methods of analysis, and data sets for temperature, rainfall, wind direction, wind speed, relative humidity, and solar radiation.

Regional climatic data are available from several stations in the area which provide a long-term database (Appendix 7). Historical climatic information of the project site was available from 1993 – 1996. Climate data collection was renewed in August 2007 at the Potato Hills climate site (1,420 m above sea level [m asl]), one of the historic data collection sites, and a second climate station (Camp), was installed in August 2009 at the old climate station site near the existing camp (823 m asl). Details of the operation of the climate stations are provided in Appendix 7.

Climatic baseline conditions are an important component of the air quality baseline. Understanding both the existing climate and air quality helps establish the link between cause (emissions) and effect (resultant changes in air quality), and allows for an assessment of potential effects of the Project-related emissions on the existing environment. A climate baseline typically provides the analyses of many parameters, whereas the air quality subset focuses on the wind regimes, temperatures, precipitation patterns, and the low level atmospheric temperature structures. The wind regimes determine the amount and general direction of air contaminant dispersion, and how far and where the air-contaminants may deposit and accumulate. Temperatures and precipitation patterns determine the amount of natural dust-emissions suppression and air-contaminant scavenging. Low level atmospheric temperature profiles in concert with near surface winds determine the amount of vertical mixing.

3.1.1 Air Temperature

The mean annual temperature for 2008 was -4.2°C at the Potato Hills climate station. The mean July temperature was 10.4°C and the mean January temperature was -18.5°C. The maximum recorded temperature on site (Camp Station) was 26.9°C in July and the minimum recorded temperature was -36.5°C in January. The recorded temperature range at the site is 63.4°C.

Temperature inversions are important since air pollutants do not disperse as readily, and provide the possibility for greater pollution episodes and shorter length depositions. The terrain elevation for the Potato Hills station is approximately 600 m higher than the Camp Station, an appreciable difference. During the period in which Potato Hills and Camp Stations collected data simultaneously, Potato Hills almost always reported colder temperatures than the Camp station (Figure 4-1, Appendix 7 of the Project Proposal).

Examination of the data indicates mild and short-term temperature inversions, (besides night-time inversions) occur from late September to May. These may typically last from 1 to 3 days with mean temperature inversions of 2 to 6°C. There are rare instances of brief stronger inversions during the winter. These typically last several days longer and have steeper temperature gradients and likely reflect the respective locations of the stations on the escalating terrain. It is not expected that pollutant buildup due to temperature inversions will occur over sufficient periods to appreciably degrade the air quality.

Annually, spring thaws begin in April when daily maximum temperatures exceed 0°C, although daily mean temperatures may not rise above freezing until May. Annual maximums occur in July and daily mean temperatures begin to recede during late August and September. However, daily minimums may drop below freezing at night during August. Daily freezing conditions begin in October and annual minimums occur in January.

Long-term temperature data from Mayo demonstrate there has not been any long-term warming or cooling trend in the region over the last 80 years (Figure 5-1, Section 5.1, Appendix 7 of the Project Proposal). Over the period of record, the mean annual temperature at Mayo has fluctuated approximately 4°C. Over this period, there has been larger variability in annual minimum temperatures, while annual maximum temperatures have stayed relatively constant.

3.1.2 Precipitation

Long-term estimates of precipitation relied on analyses of regional climate data from stations in Mayo, Dawson, Klondike, Elsa, and Keno Hill. Details of this analysis are provided in the Baseline Climate Report (Appendix 7 of the Project Proposal). Comparison of Project site data to Mayo data demonstrated that the Potato Hills station received approximately 1.3 times more monthly precipitation. This reflects the geographic effect common to mountainous regions and is evident in the Project site precipitation estimates. The estimated mean annual precipitation at the project site ranges from 389 mm to 528 mm based on the elevation range at the project site. Rainfall, snowfall, and surface lying moisture and snow are natural dust suppressants.

Based on the regional and local data, monthly precipitation totals are highest in July and lowest in February. Snowfall begins in late September or October, and continues until May. Between 2008 and 2010, precipitation (>0.2mm) was observed an average of 67 days per year.

3.1.3 Relative Humidity

Relative humidity is the ratio of the amount of water vapour actually in the air compared to the maximum amount of water vapour required for saturation at a particular temperature. It is therefore the ratio (usually expressed as percent) of the air's water vapour content to its capacity.

Relative humidity is recorded at the Potato Hills station. Monitoring data were available for analysis between 2007 and 2009. In general, the winter months tended to have higher relative humidity compared to summer conditions. The maximum mean monthly relative humidity was 91% in October 2008, while the minimum was 37.4% in May 2009. The October 2007 to September 2008 mean of 77.4% was somewhat higher than the October 2008 to September 2009 mean of 71.1%, perhaps reflecting the overall lower temperatures and higher precipitation values during the October 2007 to September 2008 period.

3.1.4 Snow Depth

Based on regression analysis of regional snowfall data, the estimated mean annual snowfall accumulation is 269 cm at Potato Hills and 190 cm at the Camp station. Based on the regional and local data, the largest accumulations occur during the period of November through January. Higher elevations have greater snowpacks, and snow depths are usually deepest in early April with snow persisting into May or June. Lower elevation snow depths are greatest in March with the snow gone by the start of May.

3.1.5 Wind Direction

The dominant wind direction (data during 2007 – 2009) at the Potato Hills station was west-northwest, and the mean wind speed for 2008 was 2.9 m/s. The dominant wind direction at the Camp station (data from August 2009 – October 2009) was from the north and mean wind speed was approximately 1.3 m/s. Winds less than 2 m/s are frequent, suggesting a high incidence of stagnant days.

The difference in dominant wind direction and mean wind speed between the stations reflects the local physiography of the project site. The Camp station is relatively protected in the Haggart Creek valley, and winds appear to be funneled down the valley axis, while the Potato Hills station is open to the prevailing winds.

Annually, the mean monthly wind speeds were greatest in the late winter and early spring and lowest during the late summer and early fall months.

3.2 Air Quality Baseline

Little is known of the existing air quality regime in the Project area. The closest air quality monitoring station is the EC National Air Pollution Surveillance Network (NAPS) station in Whitehorse, Yukon. Since Whitehorse has many more anthropogenic emission sources than the Dublin Gulch area, it is assumed to be non-representative of the Dublin Gulch area. Therefore, Whitehorse ambient air quality levels were not used to define the air quality baseline for this Project.

No other permitted industrial activities were identified in the Dublin Gulch area.[1] Due to the remote location gaseous air-contaminants should be minimal. Any baseline air-contaminants are likely to be fine particulate matter as only fine particulate matter will survive long range transport. In this context, the baseline Project site air quality with respect to CACs and GHGs will be pristine.

Baseline data were not available to quantify $PM_{2.5}$ concentrations at the Project site. Based on previous mining experience in remote locations, ambient $PM_{2.5}$ concentrations are expected in the range of 2 to 3 $\mu g/m^3$ during the summer months.

4 Emissions Estimation

Air emissions are calculated for various types of dust and combustion sources identified during the construction (Section 4.1) and operations (Section 4.2) phase of the Project. Air emissions during the Decommission Phase (Section 4.3) are not considered as reclamation activities are expected to be scaled down from those during the construction phase.

Emission rates are estimated based on activity data presented in Section 5 (Project Description) of the Project Proposal for the following substances of interest: total suspended particulates (TSP), respirable particulate matter ($PM_{2.5}$), nitrogen dioxide (NO_2), carbon monoxide (CO), sulphur dioxide (SO_2), and greenhouse gases (GHGs), where appropriate. Estimated emission rates are used in air dispersion model (Section 5) to evaluate the potential effects of Project activities on the assessment area.

In this assessment combustion emissions from generators, boilers and a regenerator kiln are characterized as ‘Point sources’ as they originate from a stack. Vehicle exhaust and dust emissions are characterized as ‘Fugitive Emissions’ as they do not originate from a specific point. They are treated as area sources because mining vehicles are mobile within a defined area.

Regional air emission associated with other existing, approved or planned operations are also considered. It was determined that there are no other projects within the RAA. Consequently, emissions from other existing or proposed projects were not incorporated into overall ambient air quality predictions.

[1] Jenson, Environmental Programs Branch, Yukon, 2009, pers. comm.

4.1 Construction Phase

For the purposes of estimating air emissions associated with the Project construction phase, information regarding the type and quantity of equipment and activity rates are outlined in the Project Description (Section 5 of the Project Proposal). This information formed the basis of the air emissions calculations, in combination with literature documenting emission rates for various types of equipment and vehicles. Construction sources can be grouped into two categories; diesel engine exhaust (from fuel combustion) and dust emissions (from surface soil disruption). Emissions were estimated for the following construction activities:

- Use of large vehicles and mining equipment will cause combustion CAC emissions.
- Site clearing and grubbing will be done with large construction vehicles. Soil disruption during site preparation will generate significant PM emissions.
- Disposal of cleared vegetation will cause CAC emissions, especially PM emissions.
- Salvaging and stockpiling of top and sub soils will cause PM emissions.
- Blasting, site grading, overburden removal and disposal will cause soil disruption at the Project site, discharging PM from the surface.
- Development of quarry and borrow areas and the salvaging and stockpiling of top and sub soils will cause soil disruption and PM emissions.
- Development of the construction and operations camps will require site preparation and installation of camp infrastructure, generating CACs.
- Construction of mine site infrastructure will cause soil disruption and PM emissions.

This information and emission data extracted from the references for various types of equipment and vehicles formed the basis of the air emissions calculations. A summary of the equipment list for the Project construction phase is presented in Table 4-1.

table 4-1: Equipment Associated with Project Construction

Category	Equipment Type Used	Maximum Number of Units	Fuel Type	Engine Power (HP)	Total Unit Operating Time (hr) [1]
Support Equipment (mainly for stockpiles and conveyours)	Feller/Buncher	1	Diesel	305	3,000
	Log Skidder	1	Diesel	200	3,000
	HIAB Flat Bed Utility Truck	1	Diesel	200	5,261
	Track Dozer	2	Diesel	310	3,000
	Backhoe/Loader	1	Diesel	300	3,000
	Tandem Dump Truck	4	Diesel	300	3,000
	Wheel Loader	1	Diesel	800	1,500
	Mobile Crusher	1	Diesel	420	3,000
	Motor Grader	1	Diesel	265	1,500
	Wheel Tractor Scraper	1	Diesel	193	3,000
	Fork Lift	1	Diesel	50	3,000
	Concrete Mixing Trucks	2	Diesel	200	1,500
	Mobile Crane	1	Diesel	300	1,500
Major Equipment	Sandvik DX800 Drill	1	Diesel	225	3,000
	Excavator	3	Diesel	400	3,000
	Haul Truck	10	Diesel	400	3,000
	Cat D10 Track Dozer	1	Diesel	580	1,500
	Cat D8 Track Dozer	2	Diesel	310	1,500
	Cat 16H Motor Grader	1	Diesel	265	1,500
	Light Vehicles	3	Diesel	300	3,000
Support Equipment (mainly for roads and ADR waste rock storage areas)	Cat 992 Wheel Loader	1	Diesel	800	1,500
	Track Dozer	1	Diesel	310	3,000
	Hitachi EX1900 Excavator	2	Diesel	1,087	3,000
	Personnel Carrier	2	Diesel	300	3,000
	Compactor	1	Diesel	150	3,000
	Cat 16H Motor Grader	1	Diesel	265	3,000
Secondary Support Equipment	Personnel Carrier	2	Diesel	300	3,000
	Flatbed Truck	1	Diesel	215	1500
	Water Truck, 14,000 gal	1	Diesel	550	3,000
Power Supply	Generators (850 kW total)	12	Diesel	N/A	15,000

NOTES:
[1] Total unit operating time for construction equipment for the period starting Jan. 1, 2012 and ending Aug. 13, 2013. Equipment is assumed to be inactive during the winter months (Oct. 29, 2012 – Mar. 15, 2013).

Estimates are made for short and long term periods. Short-term rates (i.e., hourly and daily) are determined for sources that are assumed to operate continuously for those time durations. Long-term rates (i.e., annual) account for the down periods when Project emitters are inactive. Emission rates for both are summarized in Table 4-2. Table 4-3 provides detailed emission rates for all considered sources. Assumptions used to calculate emission rates are summarized below.

Table 4-2: Summary of CAC Emission Rates during Construction

Source Category	Emission Rate (g/s)				
	TSP	$PM_{2.5}$	NO_x	CO	SO_2
Short-term					
Fugitive Dust	29.16	0.75	NA[b]		
Construction Vehicles and Equipment Exhaust [a]	0.15	0.15	5.17	13.61	0.008
Total Short-term Construction Emissions	**29.31**	**0.90**	**5.17**	**13.61**	**0.008**
Long-term					
Fugitive Dust	7.22	0.19	NA		
Construction Vehicles and Equipment Exhaust [a]	0.02	0.02	1.42	1.99	0.004
Total Long-term Construction Emissions	**7.24**	**0.21**	**1.42**	**1.99**	**0.004**

NOTE:

[a] PM emissions ($PM_{2.5}$,and TSP) values for heavy equipment consist of $PM_{2.5}$ emissions produced from fuel combustion
[b] NA-Not Applicable—dust does not contain these gases.

Table 4-3: Detailed CAC Emission Rates during Construction

Source Group or Activity	Emission Rate (g/s)				
	TSP	$PM_{2.5}$	NO_x	CO	SO_2
Short-term Exhaust Sources					
500 kw Generator	0.0050	0.0050	0.71	0.057	0.0019
250 kW Generator	0.0025	0.0025	0.35	0.029	0.0010
Support Equipment (mainly for stockpiles, conveyors)	0.035	0.035	0.95	3.79	0.0015
Major Equipment	0.032	0.032	0.65	5.63	0.0015
Support Equipment (mainly for roads, ADR waste rock storage areas)	0.067	0.067	2.26	3.10	0.0009
Secondary Support Equipment	0.0057	0.0057	0.11	0.99	0.0003
10 Generators @ 10 kW apiece	0.0010	0.0010	0.14	0.011	0.0004
Short-term Dust Sources					
Support Equipment (mainly for stockpiles, conveyors)	5.90	0.15	NA[b]		
Major Equipment	19.07	0.49			
Support Equipment (mainly for roads, ADR waste rock storage areas)	2.51	0.06			
Secondary Support Equipment	1.35	0.03			
Blasting	0.32	0.01			
Total Short-term Construction Emissions	**29.31**	**0.90**	**5.17**	**13.61**	**0.0076**
Long-term Exhaust Sources					
500 kw Generator	0.0050	0.0050	0.71	0.057	0.0019
250 kW Generator	0.0025	0.0025	0.35	0.029	0.0010
Support Equipment (mainly for stockpiles, conveyors)	0.0029	0.0029	0.059	0.51	0.0002
Major Equipment	0.0046	0.0046	0.092	0.80	0.0002
Support Equipment (mainly for roads, ADR waste rock storage areas)	0.0025	0.0025	0.051	0.44	0.0001
Secondary Support Equipment	0.0008	0.0008	0.016	0.14	0.00004
10 Generators @ 10 kW apiece	0.0010	0.0010	0.14	0.011	0.0004
Long-term Dust Sources					
Support Equipment (mainly for stockpiles, conveyors)	1.38	0.04	NA		
Major Equipment	4.86	0.12			
Support Equipment (mainly for roads, ADR waste rock storage areas)	0.62	0.016			
Secondary Support Equipment	0.31	0.0079			
Blasting	0.052	0.0016			
Total Long-term Construction Emissions	**7.24**	**0.21**	**1.42**	**1.99**	**0.004**

NOTE:

[a] PM emissions ($PM_{2.5}$,and TSP) values for heavy equipment consist of $PM_{2.5}$ emissions produced from fuel combustion

[b] NA—Not applicable—dust does not contain these gases

4.1.1 Point Sources

A total of twelve power generators will be used during the construction phase:

- One 500 kW generator
- One 250 kW generator
- Ten generators at 10 kW each.

All diesel generators used to supply power to the site during the construction phase are assumed to operate continuously at 75% operation load factor. Emission rates are estimated based on manufacturer's specifications (Caterpillar 2006).

4.1.2 Fugitive Combustion Sources

Project-related CAC emissions from combustion sources are quantified based on source type, quantity, and maximum operating time. Emission rates were obtained from literature for various types of equipment, vehicles and ore mining processes. During the construction phase, CAC emissions were estimated based on expected peak mine operation and production levels.

All of the major mining equipment is assumed to be diesel fired. For diesel-fired combustion equipment, applied emission factors are defined by the United States Environmental Protection Agency (US EPA) and the *Canada Environmental Protection Act* (CEPA, Tier 4 Emission Limits for Off-Road Heavy Duty Diesel Engines [Environment Canada 2006]). To comply with sulphur regulations for off-road diesel, a fuel sulphur content of 15 ppm in diesel was assumed (Environment Canada 2006).

4.1.3 Fugitive Dust Sources

Estimation of dust-related PM emissions from construction activities are described below. Emission rates are calculated by assuming the dust control program will achieve 85% reduction efficiency.

Haul roads emissions estimates are based on emissions defined by US EPA AP-42 for Unpaved Roads (US EPA 2006). Dust emissions are generated as a result of vehicles mobilized to complete construction activities. A 5.0% silt loading was applied, as recommended by the US EPA (2006) for quarry and stone mining haul roads.

Blasting emission estimates are based on emission factors defined in US EPA AP-42 for Western Surface Coal Mining (US EPA 1998). It is assumed that one blast period will occur each day and each blast will impact an area of about 2,500 m^2.

4.2 Operations Phase

Emissions associated with Project operations include fugitive dust from construction vehicles and equipment, and point source emissions from the adsorption, desorption and recovery (ADR) facility. Emissions were estimated for the following operations activities:

- Use of large vehicles and mining equipment will cause combustion CAC and dust emissions.

- Open-pit mining including blasting, ore/waste hauling will cause soil disruption and PM emissions.
- Ore processing, including crushing, hauling, and the use of conveyor systems will cause PM emissions at transfer points. Gold heap leach facility (HLF) operation will require finely-ground ore transferred to the HLF, causing PM emissions.
- Quarry and borrow areas activities during normal pit operation will cause soil disruption and generate PM emissions.

The equipment fleet expected to be used for the operations phase of the Project was obtained from the Eagle Gold Pre-Feasibility Study (URS/Scott Wilson 2010). This information and emission data extracted from the references for various types of equipment and vehicles formed the basis of the air emissions calculations. A summary of the equipment list for the Project operations phase is presented in Table 4-4.

Table 4-4: Equipment Associated with Project Operations

Category	Equipment Type Used	Maximum Number of Units	Fuel Type	Engine Power (hp)	Unit Operating Time (hr/year)
Major Equipment	Reichdrill C-700 Drill	2	Diesel	700	5,197
	Sandvik DX800 Drill	1	Diesel	225	2,053
	Hitachi EX1900 Excavator	2	Diesel	1,087	5,007
Support Equipment	Cat 992 Wheel Loader	1	Diesel	800	4,302
	Cat D10 Track Dozer	1	Diesel	580	2,859
	Cat D8 Track Dozer	1	Diesel	310	3,801
	Cat 16H Motor Grader	1	Diesel	265	4,795
	Cat 777 Haul Truck (91t, 161 GVM)	9	Diesel	1,016	5,111
	Water Truck, 14,000 gal	1	Diesel	550	5,069
Ancillary Equipment	Backhoe	1	Diesel	300	1,754
	Front End Loader	1	Diesel	800	877
	Fuel/Lube Truck	1	Diesel	500	3,508
	Service Truck	1	Diesel	400	3,508
	Tire Manipulator	1	Diesel	400	702
	Mobile Lighting Units	8	Diesel	11	3,577
	Personnel Carrier	2	Diesel	300	1,052
	Light Vehicles	14	Diesel	300	1,715
	Mine Rescue	1	Diesel	300	351

Category	Equipment Type Used	Maximum Number of Units	Fuel Type	Engine Power (hp)	Unit Operating Time (hr/year)
Other Equipment (ADR)	Light Vehicles	3	Diesel	300	1,715
	All Terrain Forklift	1	Diesel	50	877
	Warehouse Forklift	1	Diesel	50	3,508
	Plant Forklift	2	Diesel	50	3,508
	Backhoe/Loader CAT 938G	1	Diesel	172	702
	Bobcat Loader	1	Diesel	140	3,577
	Flatbed Truck (Warehouse)	1	Diesel	215	5,261
	Maintenance Vehicles	2	Diesel	300	1,052
	Heating Solution Boiler (600 HP)	1	Diesel	NA	8,400
	Solution Boiler (350 HP)	1	Diesel	NA	8,400
	Carbon Regeneration Kiln	1	Diesel	NA	8,400

NOTES:
NA = not applicable

As with construction, operations emission estimates are made for short and long term periods. Short-term rates (i.e., hourly and daily) are determined for sources that are assumed to operate continuously. Long-term rates (i.e., annual) factor in the down periods when Project emitters are inactive. Both short-term and long-term emission rates are summarized in Table 4-5. Table 4-6 and Table 4-7 provide detailed short-term and long-term emission rates for all sources of emission. Fugitive dust emissions were estimated for operational drilling, blasting, truck loading and unloading, primary crushing, secondary crushing, re-grinding, material handling and transfer, haul road and access road use. Assumptions used to calculate emission rates are summarized below.

Table 4-5: Summary of CAC Emission Rates during Operations

Source Category	Emission Rate (g/s)				
	TSP	$PM_{2.5}$	NO_x	CO	SO_2
Short-term					
Fugitive dust	19.52	0.54	NA[b]		
ADR facility	0.26	0.12	1.21	0.34	0.001
Construction vehicles and equipment	0.32	0.32	10.36	18.25	0.005
Total Short-term Operations Emissions	**20.10**	**0.98**	**11.57**	**18.59**	**0.007**
Long-term					
Fugitive dust	10.23	0.30	NA		
ADR facility	0.26	0.12	1.21	0.34	0.001
Construction vehicles and equipment	0.03	0.03	0.52	4.53	0.001
Total Long-term Operations Emissions	**10.51**	**0.45**	**1.73**	**4.87**	**0.002**

NOTE:
[a] PM emissions ($PM_{2.5}$,and TSP) values for heavy equipment consist of $PM_{2.5}$ emissions produced from fuel combustion
[b] NA—Not applicable—dust does not contain these gases

Table 4-6: Detailed Short-term CAC Emission Rates during Operations

Source Group or Activity	Emission Rate (g/s)				
	TSP	$PM_{2.5}$	NO_x	CO	SO_2
Short-term Exhaust Sources					
Heating Solution Boiler (23.9 million Btu/hr)	0.003	0.003	0.762	0.216	0.0003
Solution Boiler (7 million Btu/hr)	0.003	0.003	0.445	0.126	0.0002
Carbon Regeneration Kiln	0.252	0.115	0.003	0.000	0.0007
Major Equipment - operation	0.052	0.052	1.706	2.744	0.0006
Support Equipment	0.214	0.214	7.324	8.413	0.0022
Ancillary Equipment	0.045	0.045	1.143	5.480	0.0020
Other Equipment ADR	0.009	0.009	0.186	1.608	0.0007
Short-term Dust Sources					
Major Equipment	0.844	0.022	NA[b]		
Support Equipment	12.026	0.309			
Ancillary Equipment	3.652	0.094			
Other Equipment ADR	1.688	0.043			
Blasting	0.318	0.010			
Truck Loading	0.030	0.001			
Drilling	0.241	0.005			
Truck Unloading	0.048	0.005			
Primary Crusher	0.451	0.036			
Material Handling and Transfer	0.226	0.018			
Total Short-term Operations Emissions	**20.10**	**0.98**	**11.57**	**18.59**	**0.007**

NOTE:
[a] PM emissions ($PM_{2.5}$,and TSP) values for heavy equipment consist of $PM_{2.5}$ emissions produced from fuel combustion
[b] NA—Not applicable—dust does not contain these gases

Table 4-7: Detailed Long-term CAC Emission Rates during Operations

Source Group or Activity	Emission Rate (g/s)				
	TSP	$PM_{2.5}$	NO_x	CO	SO_2
Long-term Exhaust Sources					
Heating Solution Boiler (23.9 million Btu/hr)	0.003	0.003	0.762	0.216	0.00030
Solution Boiler (7 million Btu/hr)	0.003	0.003	0.445	0.126	0.00016
Carbon Regeneration Kiln	0.252	0.115	0.003	0.000	0.00070
Major Equipment - operation	0.005	0.005	0.105	0.906	0.00020
Support Equipment	0.016	0.016	0.320	2.776	0.00071
Ancillary Equipment	0.004	0.004	0.073	0.628	0.00026
Other Equipment ADR	0.001	0.001	0.025	0.219	0.00010
Long-term Dust Sources					
Major Equipment	0.483	0.012	NA[b]		
Support Equipment	6.877	0.177			
Ancillary Equipment	1.107	0.028			
Other Equipment ADR	0.447	0.011			
Blasting	0.318	0.010			
Truck Loading	0.030	0.001			
Drilling	0.241	0.005			
Truck Unloading	0.048	0.005			
Primary Crusher	0.451	0.036			
Material Handling and Transfer	0.226	0.018			
Total Long-term Operations Emissions	**10.51**	**0.45**	**1.73**	**4.87**	**0.002**

NOTE:
[a] PM emissions ($PM_{2.5}$,and TSP) values for heavy equipment consist of $PM_{2.5}$ emissions produced from fuel combustion
[b] NA—Not applicable—dust does not contain these gases

4.2.1 Point Sources

The following point sources will be active during the operations Phase:

- Heating Solution Boiler (600 HP)
- Solution Boiler (350 HP)
- Carbon Regeneration Kiln.

All three sources will be located at the adsorption, desorption and recovery (ADR) facility. Emissions were calculated from available engineering data. A fuel sulphur content of 15 ppm in diesel was assumed (Kucewicz 2010a, pers. comm.).

The Project will obtain electricity externally, and the generators used during the construction phase will not be in use, except in cases when emergency back-up is required during power outages.

4.2.2 Fugitive Combustion Sources

Project-related CAC emissions from combustion sources are quantified based on source type, quantity, and maximum operating time. Emission rates were obtained from literature for various types of equipment, vehicles and ore mining processes. During the operations phase CAC emissions were estimated based on expected peak mine operation and production levels.

All of the major mining equipment is assumed to be diesel fired. For diesel-fired combustion equipment, emission factors defined by the United States Environmental Protection Agency (US EPA) and the *Canada Environmental Protection Act* (CEPA, Tier 4 Emission Limits for Off-Road Heavy Duty Diesel Engines (Environment Canada 2006) are applied. To comply with sulphur regulations for off-road diesel, a fuel sulphur content of 15 ppm in diesel was assumed (Kucewicz 2010a, pers. comm.).

4.2.3 Fugitive Dust Sources

Estimation of dust-related PM emissions from the mine site processes is described below. Emission rates are calculated by assuming the dust control program will achieve 85% reduction efficiency.

Blasting emission estimates are based on emission factors defined in US EPA AP-42 for Western Surface Coal Mining (US EPA 1998). It is assumed that one blast period will occur each day and each blast will impact an area of about 2500 m^2. The impact area was determined by referencing another open-pit mine with similar blasting parameters (JWA 2006).

Drilling, truck loading and unloading emission estimates are based on emission factors defined in US EPA AP-42 for Crushed Stone Processing (US EPA 2004). A handling rate of about 52,000 tonnes/day (26,000 tonnes/day of ore and 26,000 tonnes/day of waste rock), were used in the calculation based on information provided in the Pre-Feasibility Study on the Eagle Gold Project (URS/Scott Wilson 2010). Activities will use water to mitigate dust emissions, resulting in insignificant emissions.

Primary crushing and materials handling and transfer emission estimates are based on emission factors defined in US EPA AP-42 for Metallic Minerals Processing (US EPA 1982). A processing rate of 26,000 tonnes/day at a 4.0% (by weight) ore moisture content is applied based on information provided in the Pre-feasibility Study on the Eagle Gold Project (URS/Scott Wilson 2010). The moisture content was verified with VIT (Kucewicz 2010b, pers. comm.). This classifies the US EPA emission factor as that applicable to unpaved surface moisture material.

Secondary crushing and re-grinding operation will be housed.

Heap leach facility loading emissions estimates are based on emission factors defined in US EPA AP-42 for Metallic Minerals Processing (US EAP 1982). Emissions were calculated by assuming a processing rate of 26,000 tonnes/day based on information provided in the Pre-feasibility Study on the Eagle Gold Project (URS/Scott Wilson 2010).

Haul roads emissions estimates are based on emissions defined by US EPA AP-42 for Unpaved Roads (US EPA 2006). A silt loading of 5.0% was applied (based upon quarry and stone mining haul roads), as recommended by the US EPA (2006).

4.3 Closure and Reclamation Phase

During closure and reclamation, construction equipment summarized in Table 4-1 is assumed to be used for reclamation purposes. Reclamation activities will be scaled down from those during the construction phase of the Project. Consequently, air emissions from the closure and reclamation phase will be lower than emissions generated from construction activities. For this reason, air emissions generated by reclamation activities are not considered further in this report.

4.4 Emissions Summary

Table 4-8 compares emission estimates during the construction phase and the operations phase. Project emissions from operations activities are much higher than construction emissions. Also, the construction phase is short-lived compared to the operations phase. Consequently, air dispersion modeling (presented in Section 5) is completed only for the Project operations phase.

Table 4-8: Project Phases Emissions Comparison

Project Phase	Emission Rate (tpy)				
	TSP	$PM_{2.5}$	NO_x	CO	SO_2
Construction	228	6.47	44.7	62.7	0.12
Operations	332	14.2	54.6	153.6	0.08

5 Dispersion Modelling

The effect of Project emissions on ambient air quality was evaluated using the results obtained from dispersion simulations. All modelling was conducted in accordance with prevailing procedures for screening assessments.

Assessed effects are associated with Project emissions during peak construction and operations phases. Dispersion model predictions provide a link between the emissions and the meteorology for any given hour and determine how concentrations vary across the assessment area in response to terrain and other surface factors. The location and magnitude of the maximum CAC GLCs within the RAA are of particular importance.The quantified effects provide basic information required to study compliance with the regulatory objectives (Section 5.5).

5.1 Dispersion Model Selection

Dispersion modelling predictions provide a link between air emissions and ambient air quality changes as a result of these emissions. Dispersion modelling was conducted using the United States Environmental Protection Agency (US EPA) CALPUFF dispersion modelling system (v6.262). The CALPUFF model is suitable for estimating ground-level air quality concentrations on both local and regional scales, from tens of meters to hundreds of kilometres.

The CALPUFF model is described in detail in Appendix A (this document). CALPUFF is a refined air dispersion model and is recommended for regulatory use by the British Columbia Ministry of the Environment, Alberta Environment, U.S. Environmental Protection Agency and other international regulatory agencies.

5.2 Meteorological Data

Meteorology plays a major role in determining air quality levels downwind of industrial and non-industrial emission sources. Year 2008 site-specific meteorological data were applied for dispersion modelling. Both hourly surface and 12-hourly upper-air meteorological data were required for the CALPUFF simulations. The upper air data were taken from the Whitehorse (Environment Canada) upper air station (Table 5-1). Most of the surface conditions were taken from the observations at the Eagle Gold Camp meteorological station. Meteorological parameters (cloud ceiling, opacity) not observed at the Camp Station were taken from the Yukon Mayo airport observations.

5.3 Topography and Receptors

Most of the terrain in the RAA lies between 500 and 1700 meters above sea level (m asl). The St. Elias mountain range to the west is the dominant physical feature in the region affecting climate. The modeling domain (Figure 2-1) defines the RAA where the majority of air quality effects from the Project are expected to occur. The RAA 30 km by 30 km area is centered on the mine site. The receptor grid is laid out as follows:

- 250-m spacing within 4.5 km from the sources of interest (9 km by 9 km)
- 500-m spacing within 7.5 km from the sources of interest (15 km by 15 km)
- 1,000-m spacing beyond 7.5 km
- 100 m spacing along the mine facility perimeter
- No receptors within the mine site area.

5.4 NO_X to NO_2 Conversion

Oxides of nitrogen (NO_x) are comprised of nitric oxide (NO) and nitrogen dioxide (NO_2). Of the several species of NO_x, only NO_2 concentrations are regulated by Alberta and Canada air quality guidelines. Since most sources emit uncertain ratios of NO_x species and these ratios change further in the atmosphere due to chemical reactions, a method for determining the amount of NO_2 in the plume must be determined. The Ozone Limited Method (OLM) was used in this assessment.

Hourly ground-level concentrations of O_3 are required for the OLM application. Since on-site ozone data were not available, ozone concentrations recommended by Alberta Environment (AENV 2009) were used for rural conditions (Table 5-1).

Table 5-1: AENV Recommended Rural Ozone Concentrations

Averaging Period	Rural Ozone Concentration (ppm)
1-hour average	0.05
24-hour average	0.040
Annual average	0.035

The OLM conversion methodology used the following equation (units in ppb):

$$\text{If } [O_3] > 0.9*[NO_x] \text{ then } [NO_2] = [NO_x]$$

otherwise,

$$[NO_2] = [O_3] + 0.1*[NO_x].$$

According to above equation, if the O_3 concentration is greater than 90% of the predicted NO_x concentrations, all the NO_x is assumed to be converted to NO_2. The OLM is based on the assumption that approximately 10% of the NO_x emissions are generated as NO_2. The majority of the emissions are in the form of *NO*, which reacts with ambient levels of O_3 to form additional NO_2.

5.5 Ambient Air Quality Objectives

Only federally regulated CACs are considered in this Project Proposal. The Project effect on Air Quality is determined by comparing predicted CAC concentrations against the regulatory objectives. These regulatory objectives are shown in Table 5-2. PM_{10} (PM of 10 microns or less) are not included in the assessment since a federal objective does not exist. National Ambient Air Quality Objectives (NAAQO) are rated as Desirable, Acceptable and Tolerable, and are historically defined as follows:

- **Maximum Desirable Level** is the long-term goal for Air Quality and provides a basis for anti-degradation policy for unpolluted parts of the country, and for the continuing development of control technology.
- **Maximum Acceptable Level** is intended to provide adequate protection against effects on soil, water, vegetation, materials, animals, 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 to protect the health of the general population.

Table 5-2: National Ambient Air Quality Objectives and Standards

Substance (Units)	Averaging Period	CWS[a]	NAAQO[b]		
			Maximum Desirable	Maximum Acceptable	Maximum Tolerable
TSP (µg/m^3)	24-hour	–	–	120	400
	Annual	–	60	70	–
$PM_{2.5}$ (µg/m^3)	24-hour	30	–	–	–
NO_2 (µg/m^3)	One-hour	–	–	400	1,000
	24-hour	–	–	200	300
	Annual	–	60	100	–
CO (µg/m^3)	One-hour	–	15,000	35,000	–
	Eight-hour	–	6,000	15,000	20,000
SO_2 (µg/m^3)	One-hour	–	450	900	–
	24-hour	–	150	300	800
	Annual	–	30	60	–

NOTES:
[a] Canadian Council of Ministers of the Environment (CCME 2000) Canada-wide Standard for Respirable Particulate Matter ($PM_{2.5}$). This objective is referenced to the 98th percentile 24-hr concentration averaged over three consecutive years.
[b] National Ambient Air Quality Objectives, or NAAQO (Health Canada 2007).
-Standard not established for these parameters.

5.6 Dispersion Modeling Scenarios

Two dispersion modelling scenarios were assessed using the CALPUFF dispersion model:

- Construction phase
- Operations phase.

Dry deposition simulations (often referred to as dustfall) were completed for the operations phase using the same dispersion model. Activities during the operations phase will result in much greater emissions (e.g. crushing of ore, haul trucks) than the construction phase, so it is assumed that dustfall during the construction phase would be substantially less than dustfall amounts predicted for the operations phase.

6 Dispersion Modelling Results

6.1 Construction Phase

Predicted maximum CAC concentrations on and outside the mine site are presented in Table 6-1 with reference to applicable regulatory objectives. All predicted maximums are below the regulatory objectives except for TSP and $PM_{2.5}$. The maximum TSP and $PM_{2.5}$ 24-hour concentrations of 1,251 and 35.1 µg/m^3 are predicted at the south perimeter of the mine site (Figure 6-1 and 6-2, respectively) in an area where the terrain is rising rapidly. The area of high predicted TSP and $PM_{2.5}$ concentrations surrounding the maximum is very small.

Table 6-1: Construction: Maximum Predicted CAC Concentrations

Substance	Averaging Period	Maximum Predicted Concentration (μg/m^3)	Regulatory Objective (μg/m^3)
TSP	24-hour	**1,251**	120[a]
	Annual	59.0	70[a]
$PM_{2.5}$	24-hour	**35.1**	30[b]
NO_2	One-hour	137	400[a]
	24-hour	99.7	200[a]
	Annual	12.2	100[a]
CO	One-hour	1,195	35,000[a]
	Eight-hour	988	15,000[a]
SO_2	One-hour	0.52	900[a]
	24-hour	0.31	300[a]
	Annual	0.03	60[a]

NOTES:
Values in **bold** identify exceedance to applicable NAAQO.
[a] National Ambient Air Quality Objectives, NAAQO. Maximum Allowable Objective Level. (Health Canada 2007).
[b] Canadian Council of Ministers of the Environment (CCME 2000) Canada-wide Standard for Respirable Particulate Matter ($PM_{2.5}$). This objective is referenced to the 98th percentile 24-hr concentration, averaged over three consecutive years.

6.2 Operations Phase

Predicted maximum CAC concentrations on and outside the mine site are summarized in Table 6-2 with reference to applicable regulatory objectives. All predicted maximums are below the regulatory objectives except for TSP. The maximum 24-hour TSP concentration of 397 μg/m^3 is predicted at the south perimeter of the mine site (Figure 6-3). The area of high predicted TSP values surrounding the maximum is very small.

Table 6-2: Operations: Maximum Predicted CAC Concentrations

Substance	Averaging Period	Maximum Predicted Concentration (µg/m³)	Regulatory Objective (µg/m³)
TSP	24-hour	**397**	120[a]
	Annual	38.4	70[a]
$PM_{2.5}$	24-hour	19.3	30[b]
NO_2	One-hour	145	400[a]
	24-hour	89.7	200[a]
	Annual	15.8	100[a]
CO	One-hour	1,311	35,000[a]
	Eight-hour	1,085	15,000[a]
SO_2	One-hour	0.40	900[a]
	24-hour	0.21	300[a]
	Annual	0.02	60[a]

NOTES:

Values in **bold** identify exceedance to applicable NAAQO.

[a] National Ambient Air Quality Objectives, NAAQO. Maximum Allowable Objective Level. (Health Canada, 2007).

[b] Canadian Council of Ministers of the Environment (CCME 2000) Canada-wide Standard for Respirable Particulate Matter ($PM_{2.5}$). This objective is referenced to the 98th percentile 24-hr concentration, averaged over three consecutive years.

6.3 Background Ambient Air Quality

Background air quality was not specifically measured because the project site is in a remote wilderness setting. With no nearby sources, background air quality was assumed pristine. During summer months, the ambient $PM_{2.5}$ maximum concentrations are expected to be in the range of 2 to 3 µg/m³.

6.4 Dustfall

CALPUFF dispersion model is used to predict $PM_{2.5}$ dustfall in the RAA. Removal of Project CACs through wet scavenging was not included as part of this modeling assessment. Based on available site meteorological data, precipitation is expected to decrease dustfall emissions by 18%. Since wet scavenging was not included in dustfall deposition modeling, there is a high degree of confidence that emissions are being over-estimated. Predicted metal dustfall results are utilized in the valued component assessment of Surficial Geology, Terrain and Soils (Section 6.4 of the Project Proposal) and Qualitative Human and Ecological Health Assessment (Appendix 31 of the Project Proposal).

Dustfall effects result from deposition of crustal $PM_{2.5}$ emitted by mine site dust sources. $PM_{2.5}$ generated by combustion sources are much smaller, remain airborne for much longer periods of time, and are not included in the dustfall predictions. Dustfall is predicted for the operations phase in milligrams per decameter squared per day (mg/dm²/d) (Figure 6-4). Total dustfall accumulation can be determined after considering the life cycle of the mine.

Qualitative Human and Ecological Health Assessments require a speciation of dustfall concentrations to determine the corresponding metals deposition. The composition of dustfall is very diverse and contains a large percentage of metals, most often in compound form. The metal portion of the dustfall speciation profile is presented in Table 6-3.

Table 6-3: Victoria Gold Assays Metals Speciation Profile

Metal	Symbol	Total Metal Composition	
silver	Ag	0.38	ppm
aluminum	Al	5.98	%
arsenic	As	89.0[a]	ppm
boron	B	212.41	ppm
beryllium	Be	2.82	ppm
barium	Ba	1099.77	ppm
calcium	Ca	1.90	%
cadmium	Cd	0.57	ppm
cobalt	Co	8.55	ppm
chromium	Cr	53.59	ppm
copper	Cu	26.79	ppm
iron	Fe	2.60	%
mercury	Hg	0.40	ppm
potassium	K	2.81	%
magnesium	Mg	0.78	%

Metal	Symbol	Total Metal Composition	
manganese	Mn	292.36	ppm
molybdenum	Mo	2.20	ppm
sodium	Na	1.08	%
nickel	Ni	21.17	ppm
phosphorus	P	461.03	ppm
lead	Pb	33.91	ppm
antimony	Sb	12.95	ppm
selenium	Se	1.00	ppm
strontium	Sr	317.77	ppm
titanium	Ti	0.26	%
thallium	Tl	4.35	ppm
vanadium	V	40.14	ppm
tungsten	W	30.00	ppm
zinc	Zn	97.22	ppm

NOTE:
[a] 50^{th} percentile median value

6.5 Summary

Dispersion modelling was used to determine the effect of emissions generated by Project Construction and operations activities on the current ambient air quality. Maximum ambient concentrations were predicted for TSP, $PM_{2.5}$, NO_2, CO and SO_2 in the context of applicable NAAQO. During the construction phase, exceedances were identified in predicted TSP and $PM_{2.5}$ 24-hour concentrations. The maximum 24-hour TSP concentrations exceeded NAAQO during the operations phase of the Project.

Exceedance in TSP and $PM_{2.5}$ can be attributed to the modelling method. The dispersion model approach did not incorporate wet deposition into its computational method. Wet deposition is a naturally occurring sink of PM dispersed in the atmosphere. Inclusion of wet deposition would reduce the predicted daily TSP and $PM_{2.5}$ concentrations predicted for the Project. In addition, as a conservative approach the short-term (24-hour) emissions assumed construction activities occurred simultaneously. It is more likely that the mining fleet worked intermittently during the construction phase of the Project. Under these conditions, the predicted TSP and $PM_{2.5}$ concentrations are thought to provide a conservative assessment of actual Project conditions.

7 Greenhouse Gas Emissions

This section quantifies GHG emissions for the construction and operations phase of the Project, and compares these emission rates to those of Yukon and federal emission totals.

Total greenhouse gas emissions are normally reported as carbon dioxide equivalents (CO_{2e}). This is accomplished by multiplying the emission rate of each substance by its global warming potential (GWP) relative to CO_2. The GWP of the three main greenhouse gases: carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O) are as follows: CO_2 = 1.0, CH_4 = 21, and N_2O = 310. Therefore, CO_{2e} is equal to ([CO_2 mass emission x 1] + [CH_4 mass emission x 21] + [N_2O mass emission x 310]).

7.1 Territorial and Federal GHG Emissions

The Yukon and Canadian total GHG emissions for the years 1990 to 2008 are presented in Table 7-1. The total GHG emissions were obtained from the National Inventory Report (Environment Canada 2010). Environment Canada's National GHG Inventory reports that 734,000 kt of CO_{2e} was emitted across Canada in 2008 (Table 7-1). This represents a decrease of 2.1% from 2007 levels. In comparison, the 2008 Yukon emissions were 350 kt of CO_{2e}, a decrease of 14 %from 2007 Yukon levels.

Table 7-1: National and Territorial GHG Emissions

Year	GHG Emissions (kt of CO_{2e} per year)	
	Yukon Territory Total	Canada Total
1990	531	592,000
2004	411	741,000
2005	394	731,000
2006	408	718,000
2007	407	750,000
2008	350	734,000

NOTES:
Source: Environment Canada. National Inventory Report. 1990 – 2008. Greenhouse Gas Sources and Sinks in Canada.

7.2 Project GHG Emissions

Project activities will result in the emission of CO_2 and other GHGs. Table 7-2 summarizes the overall Project GHG emission rates. The primary Project-related sources of GHGs include diesel generators, as well as equipment and vehicle exhaust. Construction and operations sources of GHG emissions are discussed in detail in subsequent sections in comparison to annual Territorial and Federal GHG emission inventories.

Table 7-2: Project GHG Emission Rates

Project Phase	GHG Source	Emission Rates (tonnes of CO_{2e})
Construction Phase	Generators (permanent locations)	9,792[1]
	Generators (rotating locations)	1,306[1]
	Heavy and support equipment	2,375[1]
	Construction Phase Total	**13,473[1]**
Operations Phase	Plant gold recovery equipment	4,267[2]
	Heavy mine and support equipment	3,498[2]
	Operations Phase Total	**7,765[2]**

NOTES:
[1] Emission rates were estimated for construction equipment operating between Jan. 1, 2012 and Aug. 13, 2013. Equipment is assumed to be inactive during the winter months (Oct. 29, 2012 – Mar. 15, 2013). Emissions presented are for the 15 months where construction was active.
[2] During the operations phase, emission rates are stated as tonnes of CO_{2e} per year.

7.2.1 Construction Phase

Table 7-3: Greenhouse Gas Emissions from Construction Activities

Emission Sources	Emission Rate			
	CO_2 (g/s)	CH_4 (g/s)	N_2O (g/s)	GHG (tonnes of CO_{2e} per operating period)[1]
500 kw Generator	205	0.012	0.0051	6,528
250 kW Generator	103	0.0058	0.0026	3,264
Support Equipment (mainly for stockpiles, conveyors)	29.2	0.0015	0.012	1,038
Major Equipment	13.4	0.0007	0.0054	474
Support Equipment (mainly for roads, ADR waste rock storage areas)	17.8	0.0009	0.0072	632
Secondary Support Equipment	6.52	0.0003	0.0026	232
10 generators @ 10 kW apiece	41.0	0.0023	0.0010	1,306
Construction Phase Total	**416**	**0.023**	**0.036**	**13,472**

NOTES:
[1] Emission rates estimated for construction equipment operating between Jan. 1, 2012 and Aug. 13, 2013. Equipment is assumed to be inactive during the winter months (Oct. 29, 2012 – Mar. 15, 2013).

Table 7-3 summarizes CO_2, CH_4, NO_2 and total GHG emissions estimated during the construction phase. The CO_{2e} emissions amount to 13,472 tonnes during construction. Unlike the Operations phase, GHG emissions generated by construction activities were determined for the complete phase of construction (equivalent to approximately 15 active months of construction). Construction GHG emissions are small compared to the Yukon and Canada totals (Table 7-1).

7.2.2 Operations Phase

Table 7-4 summarizes the annual CO_2, CH_4, NO_2 and total GHG emissions estimated during the Operations phase. CO_{2e} emissions sum to 7,765 tonnes per year. Operations GHG emissions will increase the Yukon 2008 emissions of 350 kt of CO_{2e} by 2.2 %. The Canada 2008 emissions (734,000 kt of CO_{2e}) will be increased by 0.001 % as a result of Project Operational GHG emissions. This indicates that Project emissions are small compared to the Yukon and Canada totals.

Table 7-4: Greenhouse Gas Emissions from Operations Activities

Emission Sources	Emission Rate			
	CO_2 (g/s)	CH_4 (g/s)	N_2O (g/s)	GHG (tonnes of CO_{2e} per year)
Heating Solution Boiler (23.9 million Btu/hr)	35.9	0.00033	0.0039	1,172
Solution Boiler (7 million Btu/hr)	19.3	0.00018	0.00021	612
Carbon Regeneration Kiln	78.6	0.00033	0.00039	2,483
Major Equipment – operation	21.5	0.00110	0.0087	764
Support Equipment	42.9	0.0022	0.017	1,525
Ancillary Equipment	19.9	0.0010	0.0080	706
Other Equipment ADR	14.2	0.00073	0.0057	503
Operations Phase Total	**98.5**	**0.0051**	**0.040**	**7,765**

8 Conclusions

The effect of Project emissions on ambient air quality was evaluated using the results obtained from dispersion simulations using the CALPUFF dispersion modelling system. The results of this assessment indicate that the maximum predicted ground-level concentrations for all air contaminants and project phases are below the relevant regulatory objectives. Based on the results of this assessment, potentially adverse effects on ambient air quality associated with the Project air emissions are not expected to occur.

9 Closure

Stantec has prepared this report for the sole benefit of VIT for the purpose of documenting baseline conditions in anticipation of an environmental assessment under the *Yukon Territory Environmental Assessment Act*. The report may not be relied upon by any other person or entity, other than for its intended purposes, without the express written consent of Stantec and VIT. Any use of this report by a third party, or any reliance on decisions made based upon it, are the responsibility of such third parties.

The information provided in this report was compiled from existing documents and data provided by VIT, field data compiled by Stantec, and by applying currently accepted industry standard mitigation and prevention principles. This report represents the best professional judgment of our personnel available at the time of its preparation. Stantec reserves the right to modify the contents of this report, in whole or in part, to reflect any new information that becomes available. If any conditions become apparent that differ significantly from our understanding of conditions as presented in this report, we request that we be notified immediately to reassess the conclusions provided herein.

10 References

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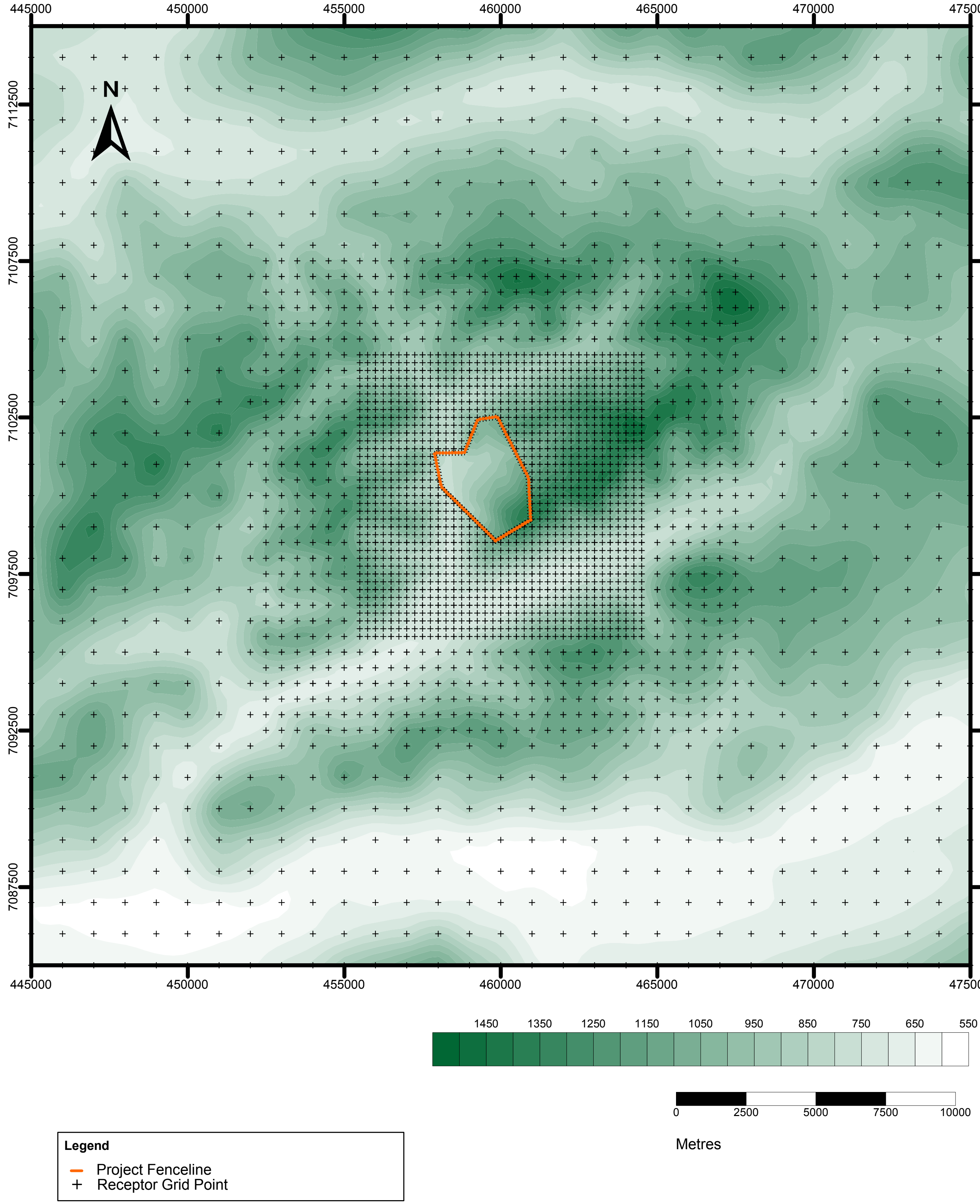
11 Figures

Please see the following pages.



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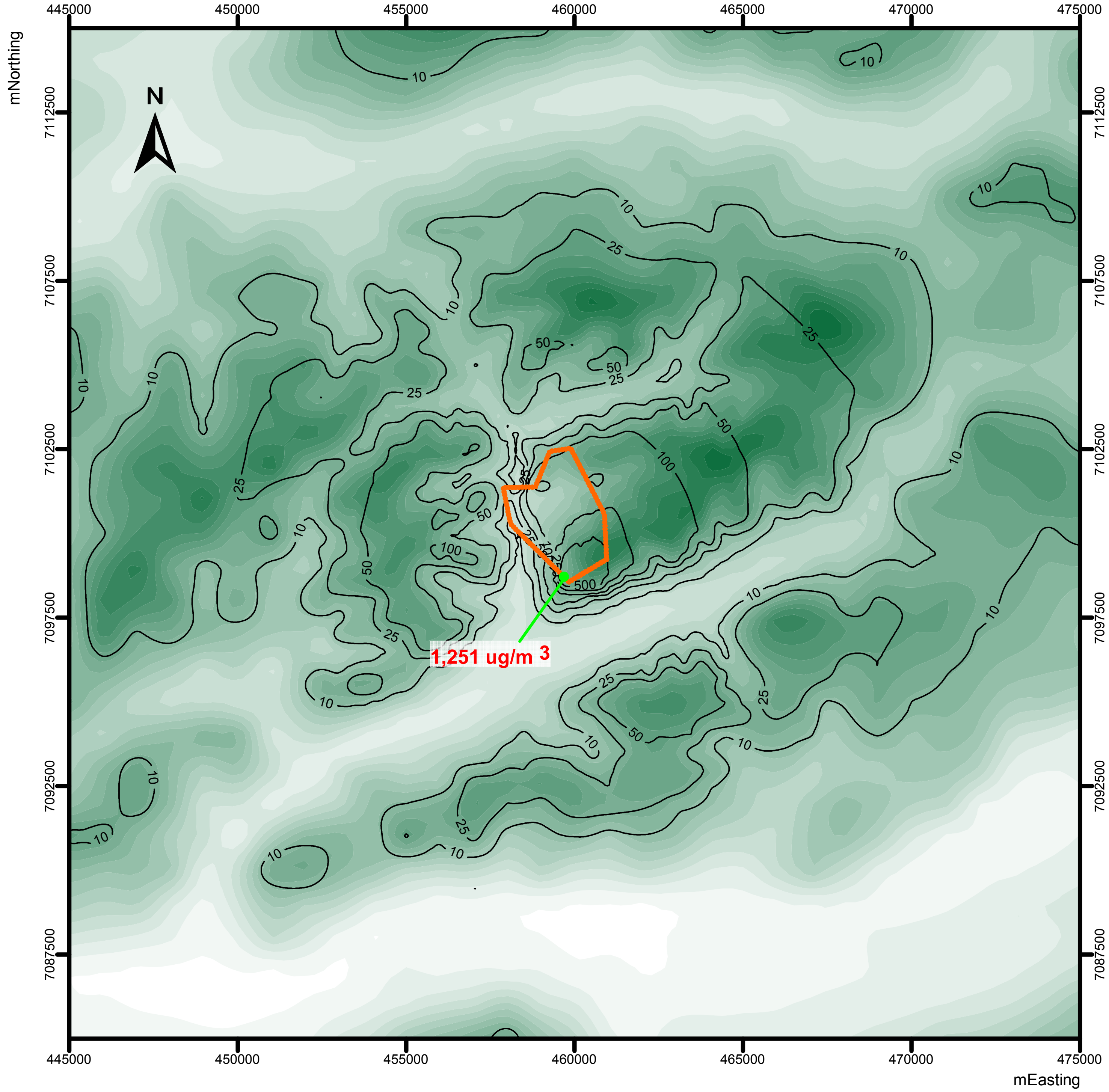
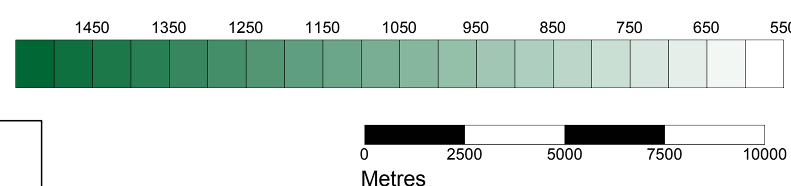
Victoria GOLD CORP

Eagle Gold Project
Air Quality Modelling Domain and Receptor Grid

PROJECTION UTM	DRAWN BY MK
DATUM NAD 83	CHECKED BY BK
DATE 2010-Sept-15	FIGURE NO. 2-1

Job No: 1490-10002





Legend

- Project Fenceline
- Predicted 24-hour TSP Concentration Isopleths: ug/m ^{3}
- Maximum TSP Concentration

National Ambient Air Quality Objective:
Maximum 24-hour TSP = 120 ug/m ^{3}

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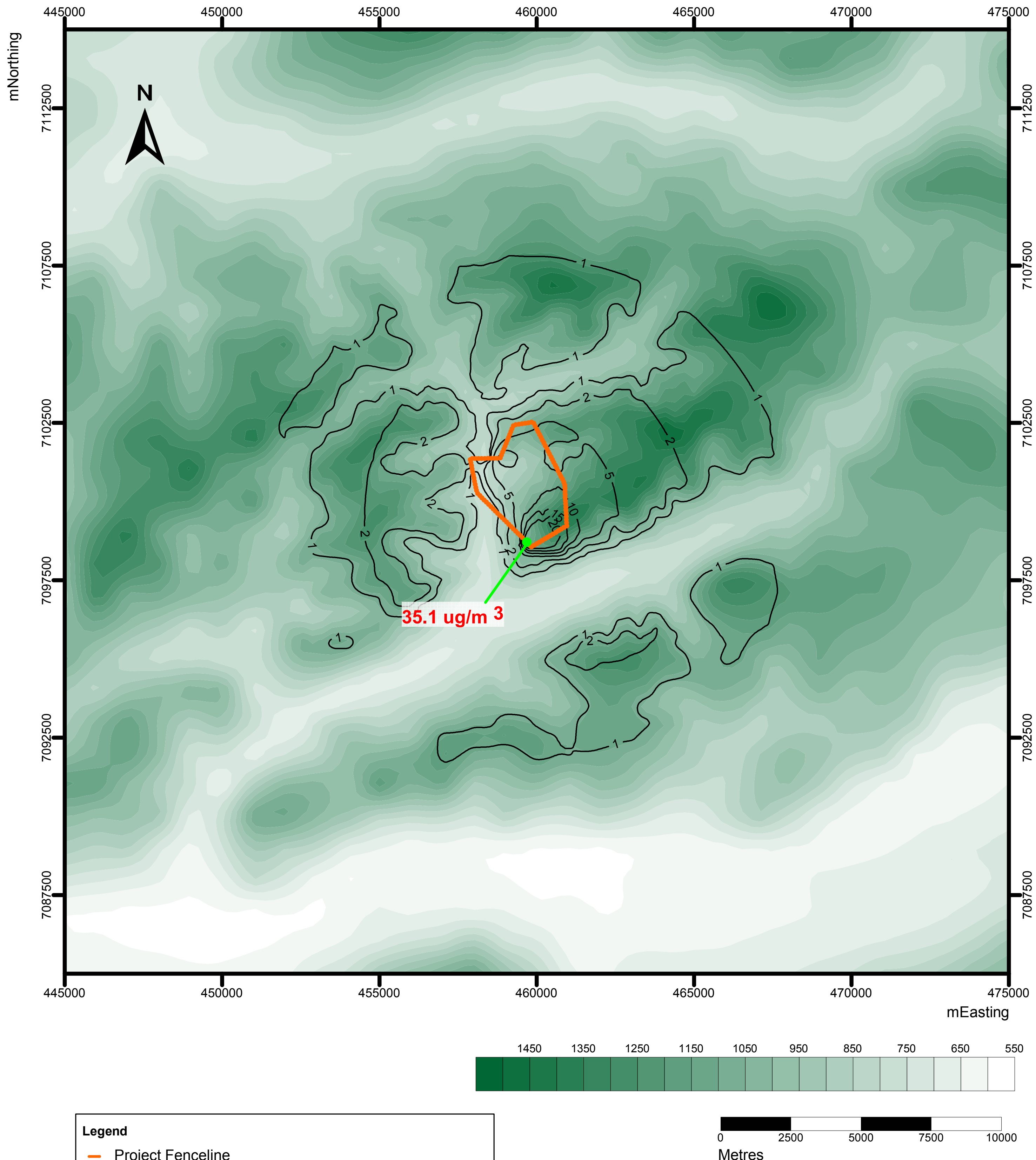
Maximum Predicted 24-hour TSP Concentrations during the Construction Phase

PROJECTION	UTM	DRAWN BY	MK
DATUM	NAD 83	CHECKED BY	BK
DATE	2010-Oct-19	FIGURE NO.	6-1

Job No: 1490-10002



Legend

- Project Fenceline
- Predicted 24-hour $PM_{2.5}$ Concentration Isopleths: ug/m ^{3}
- Maximum TSP Concentration

Canada Wide Standard:
Maximum 24-hour $PM_{2.5}$ = 30 ug/m ^{3}

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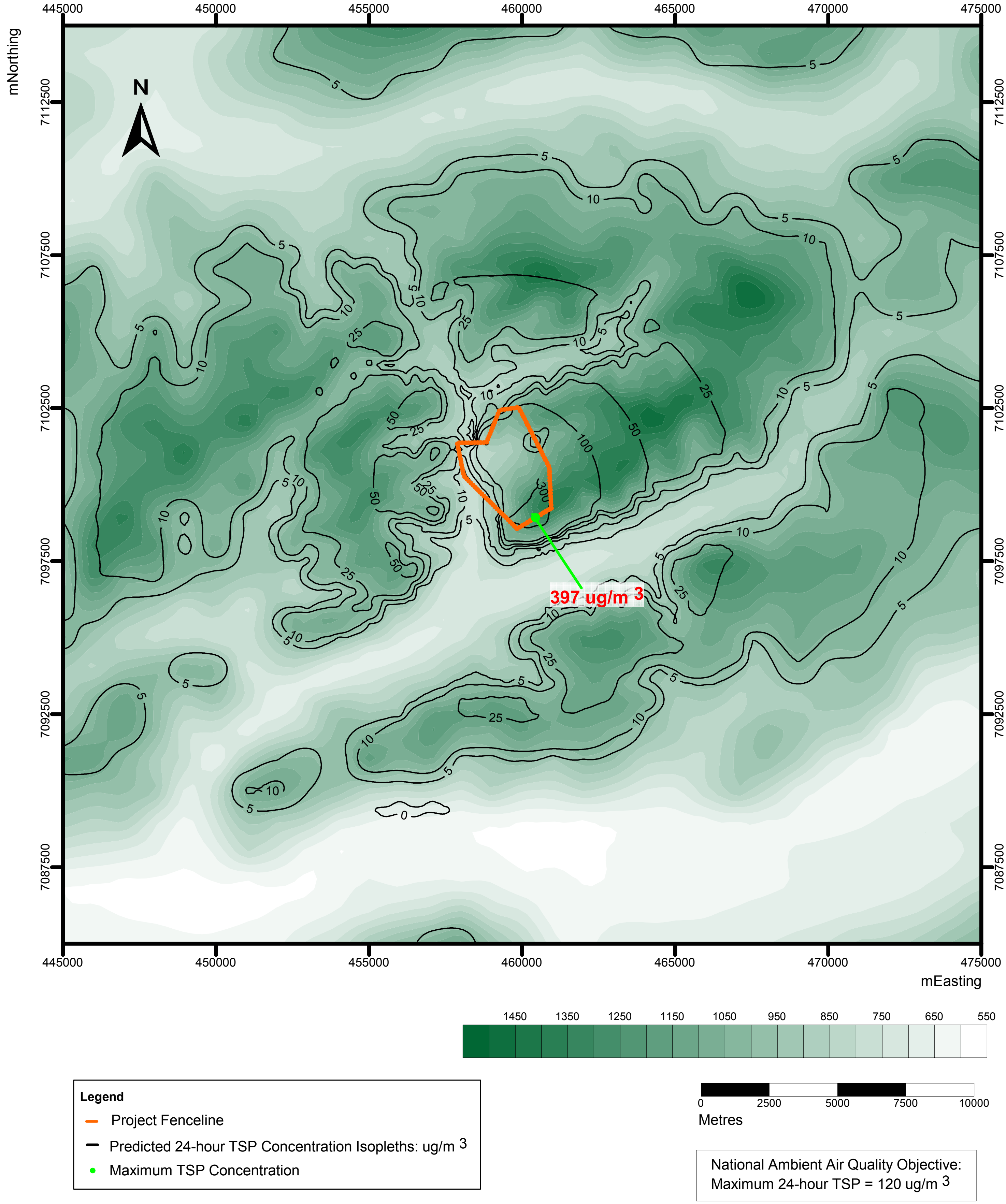
Maximum Predicted 24-hour $PM_{2.5}$ Concentrations during the Construction Phase

PROJECTION	UTM	DRAWN BY	MK
DATUM	NAD 83	CHECKED BY	BK
DATE	2010-Oct-20	FIGURE NO.	6-2

Job No: 1490-10002



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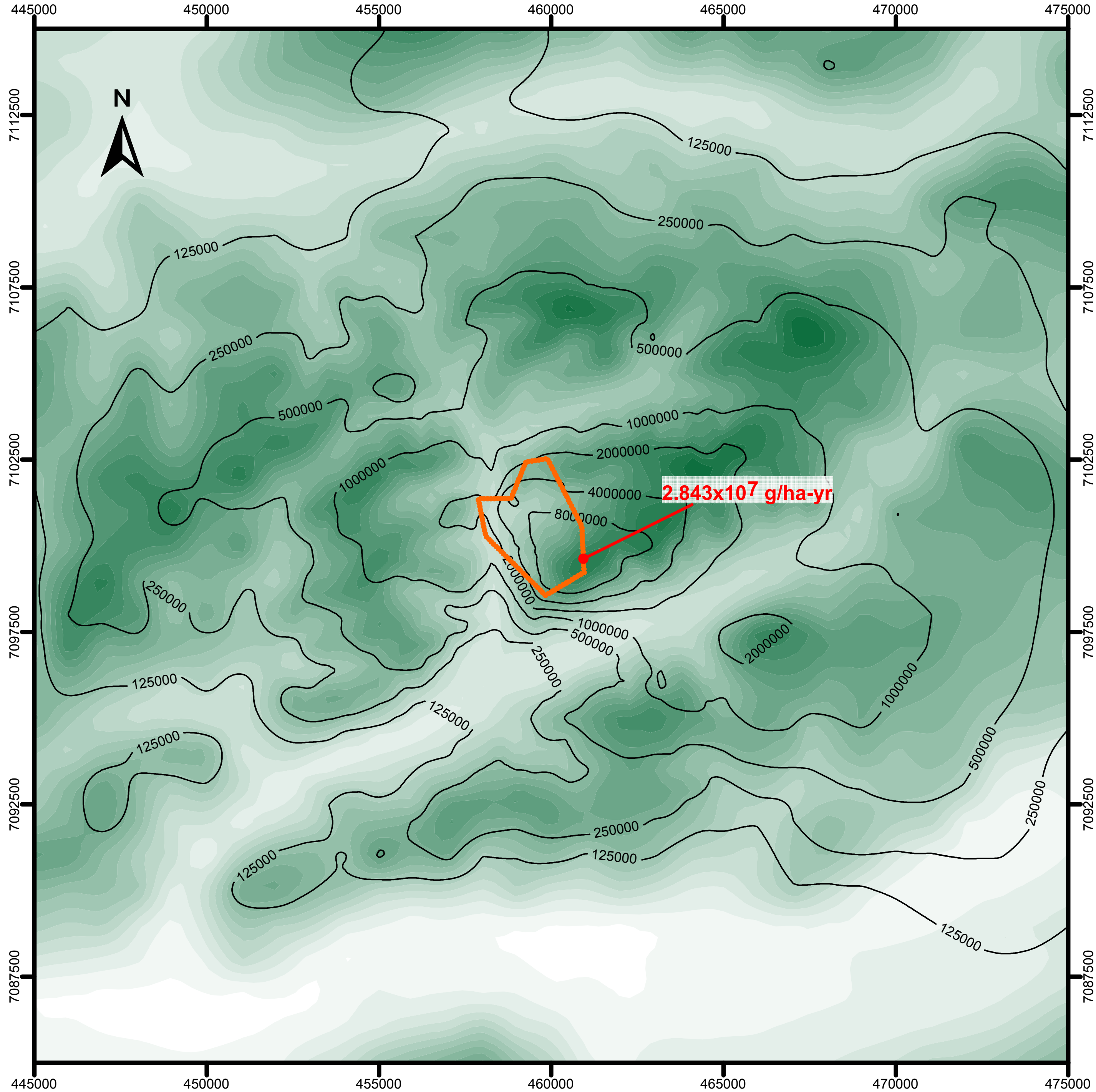
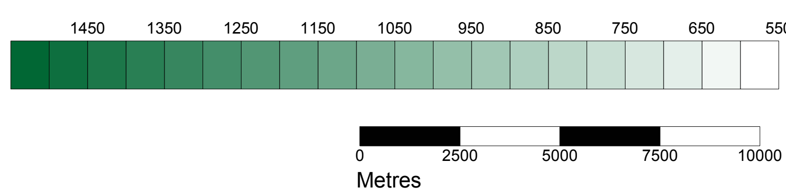
Maximum Predicted 24-hour TSP Concentrations during the Operations Phase

PROJECTION	UTM	DRAWN BY	MK
DATUM	NAD 83	CHECKED BY	BK
DATE	2010-Oct-19	FIGURE NO.	6-3

Job No: 1490-10002





Legend

- Project Fenceline
- $PM_{2.5}$ Deposition Concentration: g/ha yr
- Maximum Deposition Concentration

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Maximum Predicted Average Annual $PM_{2.5}$ Deposition (g/ha-ya) Associated with 85% reduction of emissions during Project Operations

PROJECTION	UTM	DRAWN BY	MK
DATUM	NAD 83	CHECKED BY	BK
DATE	2010-Sept-15	FIGURE NO.	6-4

Job No: 1490-10002

APPENDIX A

CALPUFF Methods and Assumption

TABLE OF CONTENTS

List of Tables

1 INTRODUCTION

Ambient air quality models are used to predict air quality changes (i.e., changes to ambient concentrations or deposition) associated with current and future emission scenarios. This section discusses the application of the CALPUFF dispersion model that was used to evaluate the proposed Project.

1.1 The CALPUFF Modelling System

CALPUFF is a multi-layer, multi-species, non-steady-state puff dispersion model, which can simulate the effects of time- and space-varying meteorological conditions on pollutant transport, transformation, and deposition. Several options are provided in CALPUFF for the computation of dispersion coefficients, including the use of turbulence measurements (σ_v and σ_w), the use of similarity theory to estimate σ_v and σ_w from modeled surface heat and momentum fluxes, or the use of Pasquill-Gifford (PG) or McElroy-Pooler (MP) dispersion coefficients. Options are provided to apply an averaging time correction or surface roughness length adjustment to the PG coefficients. For this assessment, the single meteorological station mode was applied and dispersion coefficients were determined from internally calculated σ_v and σ_w using micrometeorological variables.

CALPUFF contains algorithms for near-source effects such as pollutant removal (wet scavenging and dry deposition). Most of the algorithms contain options to treat the physical processes at differing levels of detail depending on the requirements for the particular model application.

2 CALPUFF MODELLING

2.1 Model Description

The following sections discuss CALPUFF modelling options and input data (i.e., meteorological data, receptor grids and terrain) that were applied in CALPUFF dispersion modelling for this air quality assessment.

2.2 Model Options

Table L1-1 provide a detailed summary of all CALPUFF model user options selected for the CALPUFF simulations of considered species. Model default values, as recommended by the United States Environmental Protection Agency (US EPA 1998), are presented for comparative purposes. In most cases, these default values were used.

Table 1-1: CALPUFF Options Used for the Eagle Gold Resources Project

Input Group	Parameter	US EPA Default	Eagle Gold	Description
Group 1: General Run Control Parameters	METRUN	0	0	Run all period in met file
	IBYR	-	2,008	Used only if METRUN=0
	IBMO	-	1	Used only if METRUN=0
	IBDY	-	1	Used only if METRUN=0
	IBHR	-	0	Used only if METRUN=0
	IEYR	-	2,008	Used only if METRUN=0
	IEMO	-	12	Used only if METRUN=0
	IEDY	-	31	Used only if METRUN=0
	IEHR	-	023	Used only if METRUN=0
	XBTZ	-	7	Time Zone, Mountain Standard Time
	NSECDT	3,600	3,600	Length of modeling time-step (s)
	NSPEC	5	7	Number of chemical species modelled
	NSE	3	7	Number of chemical species emitted
	ITEST	2	2	Continue with model execution after setup
	MRESTART	0	0	Do not write a restart file
	NRESPD	0	0	Write restart file only at last period
	METFM	1	5	ISC ASCII file
	MPRFFM	1	2	CTDM plus tower file
	AVET	60	60	Averaging time is 60 minutes
	PGTIME	60	60	PG Averaging time is 60 minutes
Group 2: Technical Options	MGAUSS	1	1	Gaussian distribution used in the near field
	MCTADJ	3	3	Partial Plume Path Adjustment Method of terrain adjustment
	MCTSG	0	0	Subgrid-scale complex terrain not modelled
	MSLUG	0	0	Near field puffs not elongated
	MTRANS	1	0	Transitional plume rise applied
	MTIP	1	0	Stack tip downwash applied
	MBDW	1	2	PRIME method is applied
	MSHEAR	0	1	Vertical wind shear modelled
	MSPLIT	0	0	No puff splitting allowed
	MCHEM	1	0	Chemical transformation rates computed
	MAQCHEM	0	0	Aqueous phase transformation not modelled
	MWET	1	0	Wet removal modeled
	MDRY	1	1	Dry removal modeled
	MDISP	3	2	Dispersion coefficients internally calculated
	MTURBVW	3	2	Use direct turbulence measurements to estimate dispersion (Not Used)
	MDISP2	3	3	Use PG coefficients when turbulence measurements not available

Input Group	Parameter	US EPA Default	Eagle Gold	Description
	MTAULY	0	0	Draxler default 617.284s
	MTAUADV	0	0	No turbulence advection is applied
	MCTURB	1	1	Standard CALPUFF subroutines is applied
	MROUGH	0	0	Sigma Y and Z adjusted for roughness
	MPARTL	1	0	Model partial plume penetration of elevated inversion
Group 2: Technical Options (*Continued…*)	MTINV	0	0	Strength of temperature inversion is computed from default gradients
	MPDF	0	0	Use PDF to compute near-field dispersion under convective conditions
	MSGTIBL	0	0	Sub-grid TIBL module is not used
	MBCON	0	0	Boundary conditions are not modelled
	MFOG	0	0	Not configured for fog model output
	MREG	1	0	Do not test options against defaults
Group 3: Species List	CSPEC	-	SO_2, NO_X, CO, TSP, PM_{10}, $PM_{2.5}$, VOC	List of chemical species
	-	SO_2		Modelled, Emitted
		NO_X		Modelled, Emitted
		CO		Modelled, Emitted
		TSP		Modelled, Emitted
	-	PM_{10}		Modelled, Emitted
		$PM_{2.5}$		Modelled
		VOC		Modelled, Emitted
Group 4: Grid Control Parameters	PMAP	UTM	UTM	Universal Transverse Mercator for Projection of all X, Y
	FEAST	0	0	False Easting (Not Used)
	FNORTH	0	0	False Northing (Not Used)
	IUTMZN	-	12	UTM Zone
	UTMHEM	N	N	Northern Hemisphere
	RLAT0	-	0N	Latitude of Projection Origin (Not Used)
	RLON0	-	0E	Longitude of Projection Origin (Not Used)
	XLAT1	-	0N	Latitude of 1st Parallel (Not Used)
	XLAT2	-	0N	Latitude of 2nd Parallel (Not Used)
	DATUM	WGS-84	NAR-C	North American 1983 GRS 80 Spheriod, Mean for Conus, NAD83
	NX	-	30	Number of X grid cells
	NY	-	30	Number of Y grid cells

Input Group	Parameter	US EPA Default	Eagle Gold	Description
	NZ	-	1	Number of vertical grid cells
	DGRIDKM	-	1.0	Grid spacing in X and Y directions (km)
	ZFACE	-	0, 5000	Vertical cell face heights of the NZ vertical layers
	XORIGKM	-	445	Reference Easting of SW corner of SW grid cell in UTM (km)
	YORIGKM	-	7,085	Reference Northing of SW corner of SW grid cell in UTM (km)
	IBCOMP	-	1	X index of lower left grid cell for computation
	JBCOMP	-	1	Y index of lower left grid cell for computation
	IECOMP	-	30	X index of upper right grid cell for computation
	JECOMP	-	30	Y index of upper right grid cell for computation
	LSAMP	T	F	Sampling grid is not used
Group 4: Grid Control Parameters	IBSAMP	-	0	X index of lower left grid cell for sampling
	JBSAMP	-	0	Y index of lower left grid cell for sampling
	IESAMP	-	0	X index of upper right grid cell for sampling
	JESAMP	-	0	Y index of upper right grid cell for sampling
	MESHDN	1	1	Nesting factor of sampling grid
	IBSAMP	-	0	X index of lower left grid cell for sampling
Group 5: Output Options	ICON	1	1	Create binary concentration output file
	IDRY	1	1	Binary dry flux output file is created
	IWET	1	0	Binary wet flux output file is created
	IVIS	1	0	Output file containing relative humidity is not created
	IQAPLOT	1	1	Create a standard series of output files suitable for plotting
	IMFLX	0	0	Diagnostic mass flux option not applied
	IMBAL	0	0	Do not report hourly mass balance for each species
	ICPRT	0	1	Do not print concentrations to list file
	IDPRT	0	1	Do not print dry fluxes to list file
	IWPRT	0	0	Do not print wet fluxes to list file
	ICFRQ	1	24	Concentration print interval in hours
	IDFRQ	1	24	Dry flux print interval in hours
	IWFRQ	1	24	Wet flux print interval in hours
	IPRTU	1	3	Output units are μg m^{-3} for concentration and μg $m^{-2} s^{-1}$ for fluxes
	IMESG	2	2	Track progress of run on screen
	-	SO_2 NO_X CO		Concentrations are saved to the hard disk. Concentrations, dry are not printed hourly.
	-	TSP VOC		

Input Group	Parameter	US EPA Default	Eagle Gold	Description
	-	PM_{10}	$PM_{2.5}$	
	LDEBUG	F	F	Do not print debug data
	IPFDEB	1	1	Debug options - First puff to track
	NPFDEB	1	1	Debug options - Number of puffs to track
	NN1	1	1	Debug options - Met period to start output
	NN2	10	10	Debug options - Met period to end output
Group 6: Subgrid Scale Complex Terrain Inputs	NHILL	0	0	Number of terrain features
	NCTREC	0	0	Number of complex terrain receptors
	MHILL	-	1	Hill data created by OPTHILL (Not Used)
	XHILL2M	1	1	Horizontal conversion factor to meters
	ZHILL2M	1	1	Vertical conversion factor to meters
	XCTDMKM	-	0	CTDM X origin relative to CALPUFF grid
	YCTDMKM	-	0	CTDM Y origin relative to CALPUFF grid
Group 7: Chemical Parameters for Dry Deposition of Gases				
Group 8: Size Parameters for Dry Deposition of Particles		**Geometric Mass Mean**		**Geometric Standard Deviation**
	TSP	10.0		4.0
	PM_{10}	2.0		2.0
	$PM_{2.5}$	0.48		2.0
Group 9: Miscellaneous Dry Deposition Parameters	RCUTR	30	30	Reference cuticle resistance
	RGR	10	10	Reference ground resistance
	REACTR	8	8	Reference pollutant reactivity
	NINT	9	9	Number of particle size intervals used to evaluate effective particle deposition velocity
	IVEG	1	1	Vegetation in unirrigated areas is active and unstressed
Group 10: Wet Deposition Parameters				
Group 11: Chemistry Parameters	MOZ	1	0	Monthly ozone values are used in chemistry
	BCKO3	12*80	12*80	Monthly ozone values are used in chemistry
	BCKH3	12*10	10.0, 10.0, 10.0, 10.0, 10.0, 10.0, 10.0, 10.0, 10.0, 10.0,	Constant background concentration in ppb

Input Group	Parameter	US EPA Default	Eagle Gold	Description
			10.0, 10.0	
	RNITE1	0.2	0.2	Night time SO_2 loss rate (% per hour)
	RNITE2	2	2	Night time NO_x loss rate (% per hour)
	RNITE3	2	2	Night time HNO_3 formation rate (% per hour)
	BCKH2O2	12*1	12*1	Background H_2O_2 (Not Used)
	BCKPMF	12*1.0	1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00	Background fine particulate matter (Not Used)
	OFRAC	12*0.20	0.15, 0.15, 0.20, 0.20, 0.20, 0.20, 0.20, 0.20, 0.20, 0.20, 0.20, 0.15	Organic fraction of fine particulate matter (Not Used)
	VCNX	12*50.	50.0, 50.0, 50.0, 50.0, 50.0, 50.0, 50.0, 50.0, 50.0, 50.0, 50.0, 50.0	VOC/NO_x ratio for chemistry (Not Used)
Group 12: Miscellaneous Dispersion and Computational Parameters	SYTDEP	550	550	Horizontal size of puff in meters beyond which Heffer dispersion is applied
	MHFTSZ	0	0	Do not use Heffer formulas for sigma Z
	JSUP	5	5	Stability class used to determine plume growth rates for puff above the boundary layer
	CONK1	0.01	0.01	Vertical dispersion constant for stable conditions
	CONK2	0.1	0.1	Vertical dispersion constant for neutral/unstable conditions
	TBD	0.5	0.5	ISC Transition-point
	IURB1	10	10	Lower range of land use categories for which urban dispersion is assumed
	IURB2	19	19	Upper range of land use categories for which urban dispersion is assumed
	ILANDUIN	20	20	Land use category for modelling domain
	ZOIN	0.25	0.25	Roughness length in meters for domain
	XLAIIN	3	3	Leaf area index for domain
	ELEVIN	0	0	Elevation above sea level in meters
	XLATIN	-999	-999	Latitude of met location in degrees
	XLONIN	-999	-999	Longitude of met location in degrees
	ANEMHT	10	10	Anemometer height in meters

Input Group	Parameter	US EPA Default	Eagle Gold	Description
	ISIGMAV	1	0	Read sigma-v from profile file (Not Used)
	IMIXCTDM	0	0	Predicted mixing heights are used (Not Used)
	XMXLEN	1	1.0	Maximum slug length
	XSAMLEN	1	1.0	Maximum travel distance of a puff in grid units during one sampling step
	MXNEW	99	99	Maximum number of puffs released from one source during one sampling step
	MXSAM	99	99	Max number of sampling steps during one time step for a puff
	NCOUNT	2	2	Number of iterations used to compute the transport wind for a sampling step that includes transitional plume rise
	SYMIN	1	1.0	Minimum sigma Y (m) for a new puff
	SZMIN	1	1.0	Minimum sigma Z (m) for a new puff
	SVMIN	0.5,0.5,0.5 0.5, 0.5, 0.5 .37, .37, .37, .37, .37, .37	0.5,0.5,0.5 0.5, 0.5, 0.5 .37, .37, .37, .37, .37, .37	Default minimum turbulence velocities for each stability class (Sigma-V)
	SWMIN	0.2, 0.12 0.08, 0.06 0.03, 0.016 .20, .12, .08, .06, .03, .016	0.2, 0.12 0.08, 0.06, 0.03, 0.016, .20, .12, .08, .06, .03, .016	Default minimum turbulence velocities for each stability class (Sigma-W)
	WSCALM	0.5	0.5	Minimum wind speed allowed for non-calm conditions in m s^{-1}
	XMAXZI	3000	3000	Maximum mixing height in meters
	XMINZI	50	50	Minimum mixing height in meters
	CDIV	0, 0	0, 0	Divergence criteria for dw dz^{-1} in meters
	WSCAT	1.54, 3.09, 5.14, 8.23, 10.8	1.54, 3.09, 5.14, 8.23, 10.8	Default wind speed classes - 5 upper bounds (m s^{-1}) are entered; the 6th class has no upper limit
	PLX0	0.15, 0.15, 0.20, 0.25, 0.30, 0.30	0.07, 0.07, 0.10, 0.15, 0.35, 0.55	Wind speed profile power-law exponents for stabilities 1 to 6 for 10 centimeter roughness length
	PTG0	0.02, 0.035	0.02, 0.035	Potential temperature gradient for stable classes

Input Group	Parameter	US EPA Default	Eagle Gold	Description
	PPC	0.5, 0.5, 0.5, 0.5, 0.35, 0.35	0.8, 0.7, 0.6, 0.5, 0.4, 0.35	Plume path coefficients for partial plume path adjustment terrain method.
	SL2PF	10	10	Slug to puff transition factor (Not used)
	NSPLIT	3	3	Number of puffs that result every time a puff is split (Not used)
	IRESPLIT	0,0,0,0,0, 0,0 0,0,0,0,0, 0,0 0,0,0,1,0, 0,0 0,0,0	0,0,0,0,0,0, 0 0,0,0,0,0,0, 0 0,0,0,1,0,0, 0 0,0,0	Times of day when puff can be split after being split previously (Not used)
Group 12: Miscellaneous Dispersion and Computational Parameters *(Continued…)*	ZISPLIT	100	100	Puff split only occurs if previous hours mixing height exceeds this value (Not used)
	ROLDMAX	0.25	0.25	Maximum allowable ratio previous hour mixing height to maximum mixing height experience by puff (Not used)
	NSPLITH	5	5	Number of puffs that result from each split (Not used)
	SYSPLITH	1	1	Minimum sigma-y off puff before it may be split (Not used)
	SHSPLITH	2	2	Minimum puff elongation rate due to wind shear, before it may be split (Not used)
	CNSPLITH	$1e^{-7}$	$1e^{-7}$	Minimum concentration (g m^{-3}) of each species in puff before it may be split (Not used)
	EPSSLUG	$1e^{-4}$	$1e^{-4}$	Fraction convergence criterion for numerical slug sampling integration
	EPSAREA	$1e^{-6}$	$1e^{-6}$	Fraction convergence criterion for numerical area sources integration
	DSRISE	1	1	Trajectory step-length (m) used for numerical rise integration
	HTMINBC	500	500	Minimum height to mix boundary condition puffs (m)
	RSAMPBC	10	10	Search radius (BC length segments) about a receptor for sampling nearest BC puff.
	MDEPBC	1	1	Near surface depletion adjustment when sampling BC puffs

Input Group	Parameter	US EPA Default	Eagle Gold	Description
Group 13: Point Source Parameters	NPT1	-	2	Number of point sources modelled (Application Case)
	IPTU	1	1	Units used for emissions (g s^{-1})
	NSPT1	0	0	Number of source-species combinations with variable emissions scaling factors
	NPT2	-	0	Number of point sources with variable emissions
Group 14: Area Source Parameters	NAR1	-	10	Number of polygon area sources modelled
	IARU	1	1	Units used for emissions (g m^{-2} s^{-1})
	NSAR1	0	0	Number of source-species combinations with variable emissions scaling factors
	NAR2	-	0	Number of area sources with variable emissions
Group 15: Line Source Parameters	NLN2	-	0	Number of buoyant line sources with variable location and emission parameters
	NLINES	-	0	Number of buoyant line sources
	ILNU	1	1	Units for line source emission rates is g s^{-1}
	NSLN1	0	0	Number of source-species combinations with variable emission scaling factors
	MXNSEG	7	7	Maximum number of segments used to model each line
	NLRISE	6	6	Number of distances at which transitional rise computed
	XL	-	0	Average building length
	HBL	-	0	Average building height
	WBL	-	0	Average building width
	WML	-	0	Average line sources width
	DXL	-	0	Average separation between buildings
	FPRIMEL	-	0	Average buoyancy parameter
Group 16: Volume Source Parameters	NVL1	-	0	Number of volume sources applied
	IVLU	1	1	Units used for volume sources (g s^{-1})
	NSVL1	0	0	Number of source-species combinations with variable emission scaling factors
	NSVL2	-	0	Number of volume sources with variable location and emission parameters
Group 17: Non-Girded Receptor Information	NREC	-	3278	Number of non-girded discrete receptors that compose the series of nested grids, and property boundary.