Howse Property Direct Shipping Ore Mine

Air Dispersion Modelling Report

For the Environmental Preview Report (EPR) pursuant to Part 10 of the Environmental Protection Act of Newfoundland and Labrador

March 2016

AECOM Projects No.: 60330281 / 60344074

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	2016-03-03	Final	Denis Lalonde	<original by="" signed=""></original>

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1 Introduction

Howse Minerals Limited (HML) is planning on developing the direct shipping ore (DSO) deposit at the Howse Property with the support of adjacent infrastructure. On December 22, 2014, the Newfoundland and Labrador Department of Environment and Conservation (NLDEC) issued Guidelines for Environmental Preview Report (EPR) for the Howse DSO Mine¹ for the project. The EPR guidelines identify the potential environment effects to be considered. One of the effects to consider is air quality as described in Section 6 of the EPR Guidelines: "An air quality assessment must be provided that evaluates the potential impacts of the Howse project. This should include atmospheric dispersion modelling of air emissions of NO₂, TPM, PM₁₀ and PM_{2.5} resulting from project operations".

In February 2015, a draft Air Dispersion Modelling Report (ADMR) was submitted to the Canadian Environmental Assessment Agency (CEAA) and First Nations (FN) groups; this draft ADMR was prepared as per CEAA Guidelines² and submitted as part of an Environmental Impact Statement (EIS) under Federal regulations. Subsequently, the CEAA and FN provided HML with a series of comments and questions on the draft ADMR. To ensure accurate understanding of some comments/questions versus the air dispersion modelling approach used for the Howse project, follow-up discussions were held between HML and CEAA. A final version of the Federal ADMR incorporating results of these discussions has been prepared in January 2016. Afterwards, NLDEC provided clarifications of its expectations and requirements for the final version of the Provincial ADMR, through email exchanges with HML in January/February 2016³. Consequently, the Federal and Provincial ADMR for the Howse Project are different. This final provincial ADMR incorporates NLDEC's requirements, in addition to selected improvements that have been applied while preparing the Federal version of the ADMR.

The Newfoundland and Labrador reader is cautioned that the Federal ADMR results and data were used for assessing other valued components such as Human Health, socio-economics, etc. Consequently, in the EPR main volume, when a reference is made to air quality and modelling results, it refers to the Federal Air Quality Component Assessment. For complete description and explanation, the reader should consult the Federal ADMR.

The objective of this study is to evaluate if the Howse Project emission sources meet the applicable NL Ambient Air Quality Standards. The Howse Project is located in the vicinity of the larger (DSO) complex operated by Tata Steel Minerals Canada Ltd (TSMC). The DSO complex comprises several mining and ore processing areas. From startup to decommissioning, the mining and operation schedules of each area vary in time and this was taken into account when establishing the air dispersion modelling approach. From an air quality effects standpoint, Table 1-1 lists the key areas of the DSO and Howse projects and how they were integrated in the present air quality study for the Howse EPR, based on their respective schedule of operation and locations.

More specifically, this study evaluates the impact on air quality from activities related to these main sources from DSO-wide activities:

- a) Mining (drilling, excavation, loading, unloading, piles, blasting⁴, etc.);
- b) Power generation (diesel generators);
- c) Transportation (emissions from vehicle engines and road dust):
- d) Operation of the main processing plant (diesel generators, crushing, screening, ore drying, stockpiles, train loading, etc.);
- e) Operation of Plant 2 (ore crushing, drying, screening, stockpiles);
- f) Operation of Howse Mini-Plant on the east side of the rail loop (ore crushing, drying, screening, stockpiles), and
- g) Operation of crushing and screening facility related to the FN quarry.

Note regarding items f and g in the above list. In June 2015, the proponent decided to include the Howse Mini-Plant as part of the Howse DSO project (see detailed description in section 2.4.1.6). The Howse Mini-Plant

http://www.env.gov.nl.ca/env/env_assessment/projects/Y2014/1751/1751_EPR_Guidelines.pdf.

http://www.ceaa-acee.gc.ca/050/documents/p80067/99633E.pdf

³ Emails: B. Lawrence to L. Didillon (2016-01-20); D. Pittman to L. Didillon (2016-01-29); D. Pittman to D. Lalonde (2016-02-04)

Modelling results inclusive of blasting need are not required; B. Lawrence to L. Didillon (email, 2016-01-21)

replaces the crushing and screening facility that was originally planned and included in the draft ADMR dated February 2015. Although a First Nations Quarry was in the initial planning stages under the Howse Project, this activity is currently no longer considered, and that for the foreseeable future. However, the First Nations Quarry is included as an air emission source in this report and consequently in the results presented herein. We propose that this scenario is a 'worst-case' scenario and will continue to be evaluated for its effects on air quality.

Detailed source descriptions and emissions can be found in the following sections. A project description with additional information on the DSO process and context of the project can be found in the main EPR report of the Howse Project.

As required, the air quality parameters evaluated for this air quality assessment study are:

- Total Particulate Matter (TPM);
- Particulate Matter less than 10 microns (PM₁₀);
- Particulate Matter less than 2.5 microns (PM_{2.5});
- Nitrogen dioxide (NO₂).

To complement the study, the following parameters were also evaluated:

- Sulfur dioxide (SO₂);
- Carbon monoxide (CO).

The Howse property is located in the Province of Newfoundland and Labrador (NL) in close proximity to the Quebec border. The selected local study area is limited to land located in NL and the regional study area unavoidably covers both provinces. In all cases, only receptors located in NL and at which the NL jurisdiction applies are considered. Modelled concentrations at the receptors are then compared to NL air quality standards of Schedule A of NL Regulation 39/04⁵.

To predict the effects of the Project's emissions sources on air quality, the air dispersion model used in this study is CALPUFF, an air modelling program available from the United States Environmental Protection Agency (USEPA) and the preferred model⁶ for dispersion modelling studies in NL. It is important to note that for different previous DSO phases, air dispersion modelling has been conducted for compliance demonstration or for environmental impact statement (EIS) purposes. For example, the EIS for the Elross Lake Area Iron Ore Mine (ELAIOM) submitted to the Government of Newfoundland and Labrador in 2009⁷ and the Direct-Shipping Ore Project 2A (Goodwood, Leroy1, Sunny1 and Kivivik 3S deposits) submitted to the Government of Quebec in 2009⁸ both contained a dispersion modelling study. More recently (late 2014), a compliance air dispersion modelling study for the DSO3 complex was submitted to the government of Newfoundland and Labrador to obtain an operating license. When applicable, data and methodologies from these previous air modelling efforts were incorporated in the current Howse project air quality assessments. To ensure consistency, some key aspects and/or methodologies of previous studies were used for the Howse project EIS, including the following:

- Dispersion modelling software is CALPUFF;
- Meteorological data;
- Topographical data;
- Terrain usage (land use); and
- Emission factors for emissions sources such as roads, vehicle engines, diesel generators, drills, truck loading and unloading, etc.

http://www.assembly.nl.ca/legislation/sr/regulations/rc040039.htm.

Guideline for Plume Dispersion Modelling of the Department of Environment and Conservation of the Government of Newfoundland and Labrador (GD-PPD-019.2, 2nd revision, Sept. 2012).

http://www.env.gov.nl.ca/env/env_assessment/projects/Y2010/1380/index.html

http://www.mddelcc.gouv.gc.ca/evaluations/projet-nord.htm

The highest air quality impact will be observed during the Operations phase due to the operation of the processing plants and full scale production (eg. mining and ore hauling). The other two phases of the project consist of:

- a) Site Preparation and Construction (SPC) Phase: This phase consists mostly of construction of the access/haul road and bypass road, pit development, installation of the Howse Mini-Plant and transportation/traffic.
- b) Decommissioning and Reclamation (DR) Phase: This phase consists mostly of transportation and traffic and final site restoration.

The types of air contaminants and the areas from which air emissions will occur during the SPC and DR phases will be similar to those encountered during the operation phase. During all three phases, air emissions from diesel powered engines, dust emissions due to vehicle movements on unpaved roads and blasting will occur, but rates of air emissions during the operation phase will be continuous and of a higher intensity. One important reason why the nature of the air contaminants remains the same during the three phases is the fact that all the power used at the site is generated by diesel equipment; the site is not connected to the power grid. Air emissions intensity during the operation phase will be significantly? Higher than during the SPC and DR phases due to continuous intensive mining and processing at the Howse Mini-Plant. Consequently, the air quality dispersion modelling study was conducted for the operations phase only.

This report is divided into two sections: 1) description of the air dispersion modelling methodology and 2) presentation of results.

Table 1-1 DSO and Howse Projects - Schedules and Inclusion in the Air Quality Study

Project Area	Main Air Emission Sources	Expected Operation Schedule	Inclusion in this Air Quality Study
DSO3	Mining activities at Fleming 7N and Timmins 3N deposits Ore processing at the Main Processing Plant Ore processing at Plant 2 Road transportation and ore hauling Ore loading to rail cars Workers' Camp.	DSO3 operations started in 2015 (currently in commissioning stages). DSO3 and Howse will operate simultaneously after Howse starts up in 2017.	The DSO3 complex is located within the Air Quality LSA. DSO3 air emission sources are included in this study and considered as part of the baseline (pre-Howse) condition.
DSO4	Mining activities at Kivivic and Goodwood/Sunny deposits Road transportation and ore hauling (on Goodwood Road).	DSO4 operations started in 2015 (currently in commissioning stages). DSO4 and Howse will operate simultaneously after Howse starts up in 2017.	The DSO4 deposits are located approximately 22 km from Howse, are outside the LSA, and emissions associated to DSO4 mining activities are not included in air quality study. However, the ore mined at DSO4 will be hauled to the DSO3 Main processing plant. Air emissions from ore hauling on the 9.6 km portion of the Goodwood road located within the LSA are included in this air quality study and considered as part of the baseline (pre-Howse) condition.
HOWSE	Mining activities at Howse deposit Road transportation and ore hauling Ore processing at the Howse Mini-Plant FN crushing/Screening facility ⁹ .	2017	Included in this air quality study.

Although a First Nations Quarry was in the initial planning stages under the Howse Project, this activity is currently no longer considered, and that for the foreseeable future. However, the First Nations Quarry is included as an air emission source in this report and consequently in the results presented herein. We propose that this scenario is a 'worst-case' scenario and will continue to be evaluated for its effects on air quality.

2 Air Dispersion Modelling Methodology

The effects on air quality were estimated by means of atmospheric pollution dispersion modelling of the emissions from the Project's sources using the California Puff Model or CALPUFF program of the United States Environmental Protection Agency (USEPA). The methodology used for modelling is presented in this section and comprises the following four elements:

- description of the dispersion model used;
- · description of the study areas;
- context and modelling approach; and,
- modelling parameters and inputs.

2.1 Description of the Dispersion Model Used

The CALPUFF model is the atmospheric pollution dispersion model recommended in the *Guideline for Plume Dispersion Modelling* of the Department of Environment and Conservation of the Government of Newfoundland and Labrador (GD-PPD-019.2, 2nd revision, Sept. 2012).

CALPUFF is a Lagrangian puff modelling system for the simulation of variable spatial and temporal conditions. Atmospheric emissions are modelled as a series of puffs which disperse according to wind direction over a given period. These puffs disperse vertically and horizontally in the atmosphere. They are influenced by the topography. Thus, a change in wind direction will influence the results of the modelling. The CALPUFF model adapts to various modelling situations. The flexibility of the model allows for the various characteristics associated with the local context to be taken into account. CALPUFF is especially useful in situations in which particulate matter is transported over long distances, with light and calm wind conditions (speed less than 0.5 m/s), wind inversions, such as land breezes and sea breezes, and complex wind configurations associated with very rugged terrains. In addition, parameters such as dry deposition, wet deposition and particulate matter sizing have been incorporated into the CALPUFF input files as described in the *Guideline for Plume Dispersion Modelling*. Dustfall rates presented in the results of this study are equivalent to TPM deposition calculated by the model.

The system is made up of three programs: CALMET, CALPUFF and CALPOST. CALMET allows for the processing of meteorological data and the obtaining of hourly tridimensional meteorological data specific to the study area. Once processed, the meteorological data obtained with CALMET are used by CALPUFF, the atmospheric dispersion modelling program. Lastly, CALPOST allows for the processing and analysis of the modelling results. The V6.334, V6.42 and V6.292 versions of CALMET, CALPUFF and CALPOST were used within the framework of this study.

2.2 Description of Study Area

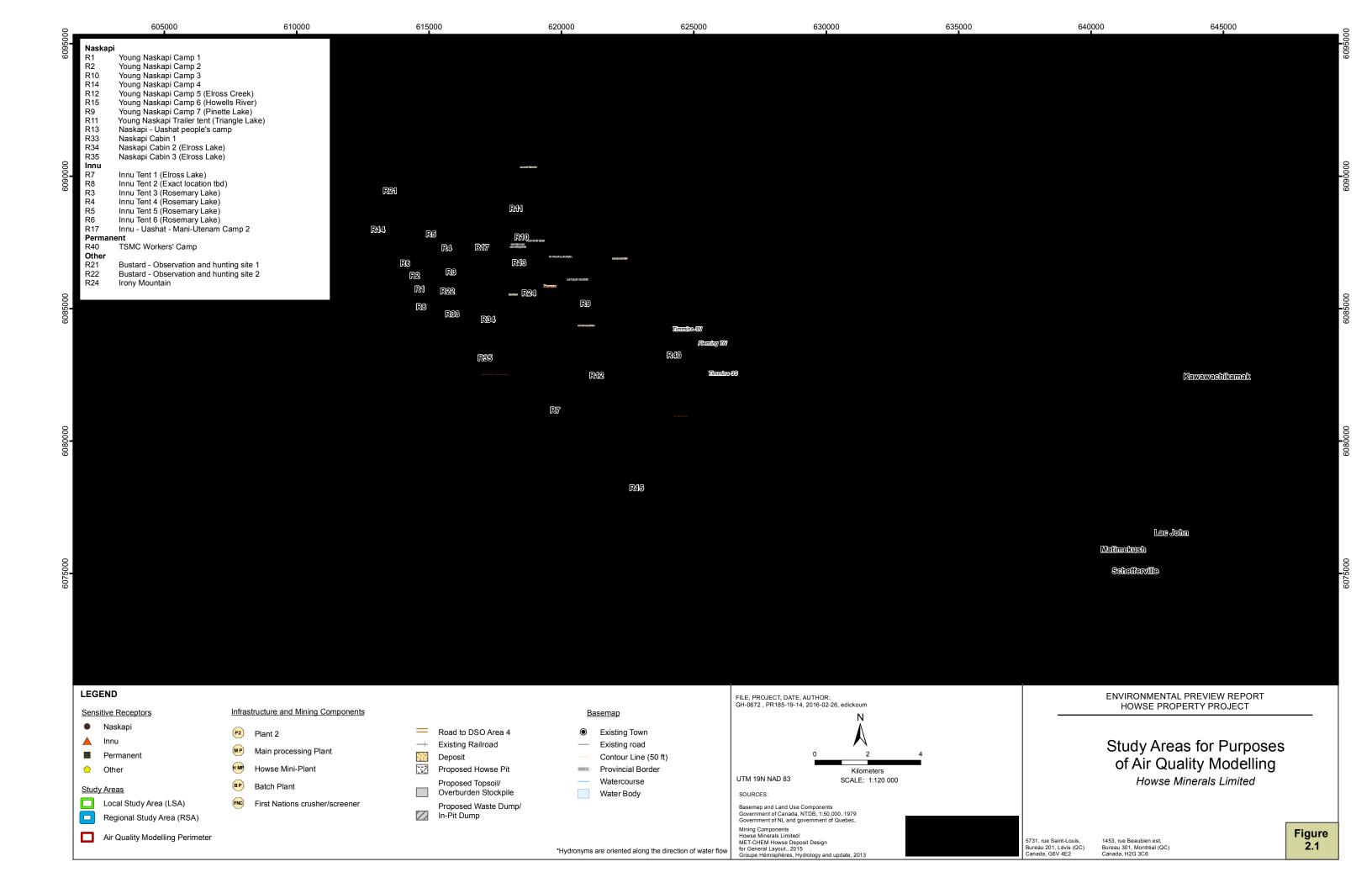
The Local Study Area (LSA) is selected based on the requirements of the air dispersion modelling software used for effects assessments and provincial regulatory requirements on dispersion modelling methodology. LSA for the purposes of modelling the dispersion of pollutants covers an area of approximately 2000 km². Centered at the UTM coordinates East – 623 000 m, North – 6 082 500 m, located at the center of DSO3, this area extends 17 km north to south and 20 km east to west and stops at the border between NL and QC (see Figure 2.1). The LSA is characterized by rugged relief, with drops of up to 300 metres. It is covered in large part by coniferous forests and tundra. A list of sensitive receptors in the study area was provided to AECOM; these sensitive receptors are described in Section 2.4.5 and include several sites used by the Innus and Naskapis. The LSA includes areas likely to be directly impacted by the mine development.

The regional study area (RSA) is a larger area extending east to include the towns of Schefferville and Kawawachikamach, and the Matimekush-Lac John community, located approximately 20 km east of the project. These four towns/communities were also considered sensitive receptors and were included in this study. The RSA covers an area of 520 km². Centered at the UTM coordinates East – 628 200 m, North – 6 082 130 m, located half way between DSO2 and DSO3, this area extends 17 km north to south and 40.5 km east to west (see Figure 2.1). Note that the towns listed above are not included as sensitive receptors in this study because they

are not located in NL, however it was determined in another study that the project's effects on air quality in these towns were negligible.

Figure 2.1 presents the study areas selected for modelling and shows the following site features:

- Location of NL sensitive receptors, including the workers' camp;
- Howse mining area; and
- Processing plants: Main Processing Plant and Plant 2 under the DSO3 project and Howse Mini-Plant under the Howse Project. As mentioned before, the crusher/screener at the FN Quarry is shown on Figure 2.1 (id: FNC) and included in the modeling results, even though it is no longer considered for the project.



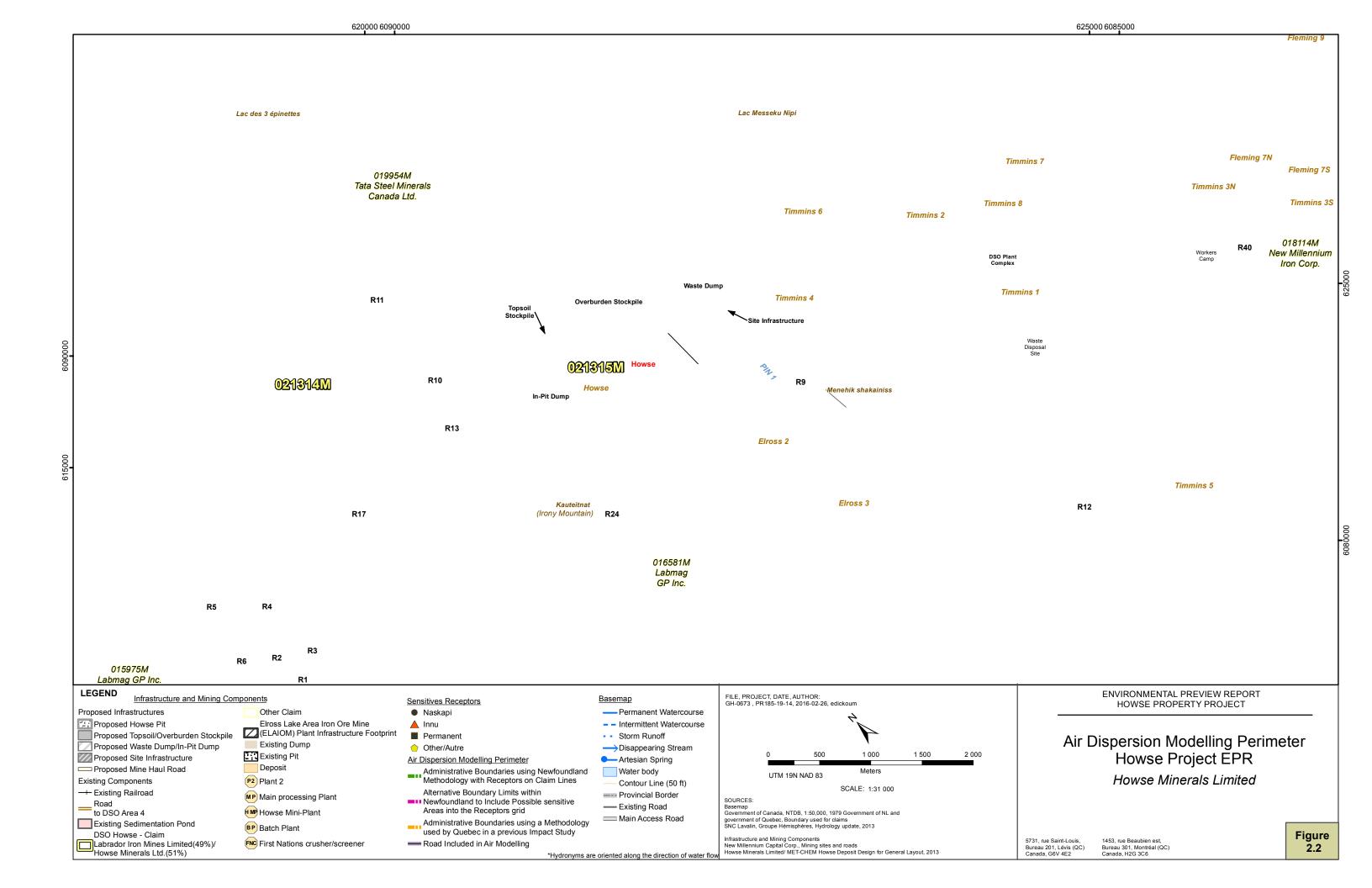
2.3 Context and modelling approach

2.3.1 Air Dispersion Modelling Perimeter

As mentioned in the introduction of this report, the Howse Project is located in the vicinity of the larger DSO complex operated by TSMC. The DSO complex comprises several mining areas. The DSO3 area is located approximately 4 km from the Howse mining area and is considered the heart of the complex; that is where the ore is processed and loaded on rail cars for shipment. The DSO3 area main infrastructures already in place (or currently in advanced construction phase) are: Main Processing Plant (e.g. Dome), Plant 2, rail loop, batch plant, workers' camp and maintenance buildings / garages. All these will be operational prior to the startup of the Howse project. The Howse project itself will add the following infrastructures: the Howse Mini-Plant located besides the rail loop (east side) and a crusher/screener for the FN quarry.

To include emission sources from the Howse activities only (e.g. ore mining, Howse Mini-Plant processing activities, crusher/screener at FN quarry and hauling⁹) in the air quality assessment would underestimate the resulting air quality exposure at local receptors and would not be representative of the overall impact of the mining/processing activities in the study area. Consequently, it was decided that the air quality effects assessment for the Howse Project would be evaluated as an add-on to other activities from the DSO complex and the air modelling approach would be as follows:

- A modelling perimeter including activities of DSO3 and Howse was established, see Figure 2.2.
- The modelling perimeter encompasses air emissions associated with:
 - Howse project (mining operations and infrastructures);
 - DSO3 area mining operations and infrastructures;
 - Ore hauling from the DSO4 area.
- Emission sources from within the modelling perimeter are considered and are included as inputs to the dispersion modelling software.
- The area within the air quality modelling perimeter was excluded for assessment purposes as this area is restricted to the general public because of safety and security concerns and subject to work-place safety standards rather than ambient air quality thresholds. The air model grid receptors located within the modelling perimeter are excluded from the study. The only sensitive receptor located within the perimeter is the workers' camp and air quality at this receptor has been assessed.
- The air quality modelling perimeter lines were established based on locations of:
 - claim lines:
 - sensitive receptors such as camps, hunting and picking sites, and natural elements (lakes);
 - the QC/NL border; and,
 - compatibility with previous modelling efforts performed for other TSMC DSO sites in this region.



2.3.2 Definition of contributors to Air Quality Effects

The Howse project will be integrated in the larger TSMC DSO complex. As shown in Table 1-1, mining and processing activities at DSO3 and DSO4 areas will start before Howse starts. To evaluate the cumulative effects on air quality and meet the EPR guidelines for this project, Howse, DSO3 and DSO4 must all be considered in the air modelling study.

To compartmentalize the air modelling inputs and to facilitate results interpretation, the resulting concentrations at each receptor will consist of five (5) contributors from the DSO complex as described in Table 2-1.

Table 2-1 Five (5) Contributors to the Cumulative Effect on Air Quality

Contrib. #	Contribution from	Description		
(1)	Background concentrations	Corresponds to pre-DSO3 air quality level. Background concentrations are provided by NLDEC		
(2)	Concentrations due to emissions from DSO3 operations (see list of sources in Section 2.4.1 and Appendix A)	DSO3 sources are located with the air quality modelling perimeter and therefore included in the air quality study. DSO3 Deposits: Fleming 7N (2016-2021) and Fleming 3N (2022-2026). Very close to each other. In addition to ore hauling trucks, smaller vehicle movements within the air quality modelling perimeter were included. One sensitive receptor located within property limit = Workers' camp.		
(3)	Concentrations due to emissions from ore hauling from the DSO4	DSO4 deposits are located approximately about 20 km to the North-West of the Howse Property. Mining activities at these deposits are far and have an insignificant impact in the LSA. However, ore hauling from the DSO4 pits to the Main processing plant and rail loop does fall within the LSA and the air quality modelling perimeter. Contribution of DSO4 ore hauling on a 9.6 km road section is included in the air quality study. From a practical air model input standpoint, Contributor (3) is included in Contributor (2) and is not reported separately.		
(4)	Concentrations due to emissions from Other Projects in the RSA	TSMC DSO3 and DSO4 are actual and active projects, and are included in the air quality study as explained above. Due to the plunging iron ore prices (from \$150/tonne in early 2013 to \$50/tonne currently), it is anticipated that other iron ore projects in the region such as Taconite, Block 103 and Lac Otelnuk projects will be delayed or cancelled. Therefore, these projects are still hypothetical and information on the location of mining and processing activities is not available. Consequently, future potential air emissions effects from these projects are considered as being zero for the air dispersion modeling study.		
(5)	Concentrations due to emissions from Howse operations	Howse sources are located with the air quality modelling perimeter and therefore included in the air quality study.		

2.3.3 Project Air Quality Criteria - Criteria Air Contaminants (CAC)

This air modelling study is performed in the context of an environmental preview report under the NL regulations. The Howse Property and the DSO3 complex and its mining areas are located in the Province of Newfoundland and Labrador (NL), in close proximity to the Quebec (QC) border.

Table 2-2 presents NL's ambient air quality standards for the six pollutants evaluated in this study.

In NL¹⁰, compliance for modelled impacts for any given year is to be based on the:

- 9th highest level at any given receptor for 1-hour averaging period;
- 6th highest level at any given receptor for 3-hour averaging period;
- 3rd highest level at any given receptor for 8-hour averaging period; and
- 2nd highest level at any given receptor for 24-hour averaging period.

As indicated by NLDEC¹¹, air dispersion modelling results in this report are to be compared with NL ambient air quality standards using the applicable nth levels shown above.

http://www.env.gov.nl.ca/env/env_protection/science/gd_ppd_009_4.pdf.

D. Pittman to L. Didillon (email 2016-01-29)

Table 2-2 Air Quality Standards - Newfoundland and Labrador (NLR 39/04, Schedule A)

Pollutant Averaging Period		NL Air quality standards ⁽¹⁾ (μg/m³)
TPM	1-yr	60
I FIVI	24-hr	120
PM ₁₀	24-hr	50
DM	1-yr	8.8
PM _{2.5}	24-hr	25
	1-yr	60
80	24-hr	300
SO₂	3-hr	600
	1-hr	900
	1-yr	100
NO ₂	24-hr	200
	1-hr	400
60	8-hr	15 000
СО	1-hr	35 000

Reference: Air Pollution Control Regulations, 2004 Newfoundland and Labrador Regulations 39/04, Schedule A – Table I: Ambient Air Quality Standards at Reference Conditions.

2.3.4 Background Ambient Air Concentrations

Background concentrations represent concentrations present before the Howse project starts. As shown in Table 1-1, between now and the start of the Howse project, other parts of TSMC's DSO Complex will start operating at production capacity. Note that the main processing plant located in the DSO3 area has been under intensive construction for most of 2015 and is currently in the commissioning phase.

Typically, there are two methods of obtaining background concentrations:

- a) In-situ air monitoring: In-situ air monitoring was conducted in 2006. The objective of this monitoring was to establish existing air concentrations prior to the beginning industrial activities. We are unaware of any other actual measured data for the Schefferville region.
- b) <u>Background concentrations provided by the regulator</u>: The Province of NL provides background concentrations to be used when representative monitoring data is unavailable.

The selected background concentrations are presented in Table 2-3.

As explained in Section 2.3.2, five (5) contributors to the air quality effects are included in this study. Pre-Howse air quality is represented by the summation of four (4) contributors:

- (1) Background concentrations
- + (2)* Concentrations due to emissions from DSO3 operations
- + (3)* Concentrations due to emissions from ore hauling from the DSO4
- + (4)* Concentrations due to emissions from other Projects in the RSA
- Pre-Howse Air Quality ("Baseline Condition")
- + (5) Concentrations due to emissions from Howse operations

- Cumulative Air Quality Effect
- From a technical modelling standpoint, resulting ambient air concentrations from contributors (2), (3) and (4) are presented together.

Table 2-3 Background ambient air concentrations used in the Howse Project Air Quality Study

Pollutant	Averaging Period	NL ⁽¹⁾ (µg/m³)	In-situ monitoring ⁽²⁾	Used in this study (µg/m³)
	1 yr	15		15
TPM	24 hr	15	7.9	15
	1 hr ⁽³⁾	15		15
DM	24 hr	10		10
PM ₁₀	1 hr ⁽³⁾	10		10
	1 yr	5		5
PM _{2.5}	24 hr	5	4	5
	1 hr ⁽³⁾	5		5
	1 yr	5		5
SO ₂	24 hr	5		5
302	3 hr	5		5
	1 hr	5		5
	1 yr	3.8		3.8
NO ₂	24 hr	3.8		3.8
	1 hr	3.8		3.8
CO	8 hr	114		114
CO	1 hr	114		114

D. Pittman to D. Lalonde (email 2016-02-04).

Howse project description document. In-situ air monitoring conducted in 2006. There are no NL ambient air quality standards for TPM, PM_{10} and $PM_{2.5}$ (1 hr averaging period), but in the tables of results of this ADMR, 1-hr averaging period data is presented for all pollutants, background concentrations listed in the above table have been applied.

2.4 Modelling parameters and inputs

This section presents the data used for modelling. Modelling parameters are divided into four categories: data related to emission sources including emissions inventories, meteorological data, data related to receptors, and project specific modelling scenarios.

2.4.1 Data Related to Emission Sources

The following sub-sections describe the sources of emissions, the methodology used to estimate emission rates and how this information was used in the dispersion model. The data related to emission sources include the physical characteristics of the sources, the emission rates of pollutants and their duration. Detailed calculations to establish emission rates for each source are presented in Appendix A and a summary table of data used for modelling is included in Appendix B.

General layouts of the sites (Howse and DSO3) are presented in Appendix C. These layouts were used to determine the coordinates of emission sources (i.e. stack, stockpiles, conveyors' transfer points, etc.).

To provide a conservative assessment of air quality and to meet the modelling approach criteria set out in Section 2.3, air emission rates and intensities were estimated on the basis of the maximum operation scenario projected for years 2016 to 2027. Table 2-4 presents the mining plan summary for Howse, DSO3 and DSO4 for years 2016 to 2027, as provided by TSMC in the fall of 2015 for the purpose of the air modelling study. As shown in Table 2-4, the maximum production rates from each area were selected as calculation basis:

Howse:

It is assumed that maximum mined materials will occur in year 2022. For calculations of the air model inputs, these values from year 2022 were used and conservatively assumed to be applicable every year.

DSO3:

It is assumed that between 2016 and 2026, two deposits will be mined in the DSO3 area: Fleming 7N (from 2016 to 2021) and Timmins 3N (from 2022 to 2026). As can be seen in Figure 2.2, Fleming 7N and Timmins 3N are located very close to each other, in the Northeast section of the air quality modelling perimeter. Fleming 7N is located the closest to the perimeter and its mining intensity will be higher than Timmins 3N. Consequently, the maximum Fleming 7N mining rate (Year 2017) was selected and used in calculations for the air model inputs. These values from Fleming 7N Year 2017 were conservatively assumed to be applicable every year.

DSO4:

A portion of the road on which hauling trucks for DSO4 are moving is included in the air model. The DSO4 area includes several deposits (Goodwood, Sunny, Kivivic 1C, 2, 3N, etc.). Annual production rates associated to DSO4 deposits are shown in Table 2-4. For calculations of the air model inputs, the maximum mining year (Year 2022) was used and conservatively assumed to be applicable every year.

A more detailed mining plan covering years 2016 to 2027 is provided in Appendix A. This plan was provided by TSMC in the fall of 2015 for the purpose of the air modelling study.

Table 2-4 Mining Plan and Maximum Production Rates Used in Air Modelling Study

MINE P	LAN SUI	MMARY (Highlighte	ed data i	ndicate r	maximur	n year s	elected f	or air m	odeling)				Max applied in air
Mining Area and Production	Unit	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	modelling study
HOWSE				•						•				HOWSE
Ore to Main Plant	kt													
Ore to Howse Mini-Plant	kt		1319	3077	3077	3077	3246	3077	3077	3077	3077	3077	3077	3077
Ore to Plant 2	kt													
Overburden	kt	6346	5095	6295			6687	6778	6778	6778	3388	3388	3388	6778
Waste	kt		112	332	2866	2879	2242	3968	3968	3968	6916	6916	6916	3968
Total mined	kt	6346	6525	9703	5943	5956	12175	13823	13823	13823	13381	13381	13381	13823
DSO3 - Fleming 7N				•										DSO3 - Fleming 7N
Ore to Main Plant	kt													
Ore to Howse Mini-Plant	kt													
Ore to Plant 2	kt	485	1109	1103	1105	1123	977							1109
Overburden	kt	452	46											46
Waste	kt	1533	2228	1628	1622	1550	1367							2228
Total mined	kt	2471	3383	2730	2726	2673	2344							3383
DSO3 - Timmins 3N														DSO3 - Timmins 3N
Ore to Main Plant	kt													
Ore to Howse Mini-Plant	kt													
Ore to Plant 2	kt							47	384	521	662	420		(4)
Overburden	kt							1193	211					(1)
Waste	kt							1240	2578	1715	1247	313		
Total mined	kt							2479	3173	2236	1909	733		
DSO3 - Timmins 7, 4N, 4S														DSO3 - Timmins 7, 4N, 4S
No production at these deposits	kt													
DSO4 to Main Plant														DSO4 to Main Plant
Ore hauled from DSO4 to Main Plant	kt	2377	6409	6308	6375	6298	6455	7384	7085	6931	6763	6961	4194	7384

Fleming 7N and Timmins 3N are located very close to each other, in the Northeast section of the air quality modelling perimeter. Fleming 7N is located the closest to the perimeter and its mining intensity will be higher than Timmins 3N. Consequently, the maximum Fleming 7N mining rate (Year 2017) was selected and used in calculations for the air model inputs.

The following emissions sources are located inside the air modelling perimeter and are included in the Howse Project air dispersion modelling:

- A total of fourteen (14) diesel generators (see Table 2-5).
- Mining operations for the Howse and Fleming 7N mining sites which are located within the air modelling perimeter. Mining operations include drilling, excavating, loading/unloading.
- Ore/waste/overburden transportation to/from all mining sites listed in Table 2-4 (dust from unpaved roads and emissions from engines).
- Sand and gravel transportation by dump trucks (10-wheelers) to/from the FN quarry. The FN Quarry is to be located in close proximity to the Howse deposit⁹.
- Small Equipment and personnel vehicles.
- Main Plant operations (crushers, conveyors, process exhaust from main stack, load/unload, train loading).
- Plant 2 operations (crushers, dryer, mixer, conveyors).
- Howse Mini-plant operations (crusher, dryers, conveyors).
- FN Quarry (crushers, screener, conveyors).
- Wind erosion from ore, waste and overburden piles.

Sub-sections below provide more information on each type of emission sources.

2.4.1.1 Mining Operations

Iron ore will be extracted by conventional open-pit mining techniques. Mining operations considered for modelling include the four activities below:

- drilling (diesel-driven drills will drill 160 mm diameter holes for blasting);
- blasting (using a bulk emulsion of ammonium nitrate);
- · excavating (hydraulic excavator); and,
- loading and unloading of ore, overburden and waste rock.

Mining operations at Fleming 7N (F7N) and Howse sites were included in the assessment because they are located within the air modelling perimeter (see Section 2.4.1). Note NLDEC considers that air models are not readily capable of dealing with sub-hourly such as blasting events and results presented in Section 3 do not include blasting operations.

For the F7N deposit site, ore will be transported to Plant 2 or to a low grade ore stockpile located close to the deposit and waste rock will be transported by truck and dumped at piles located close to the deposit. For modelling, all ore extracted from pit F7N to be hauled by truck to Plant 2. This is a conservative assumption regarding ore transportation for calculating the number of trips per year.

For the Howse deposit site, the material will be transported to the Howse Mini-Plant to be located to the east of the railing loop. Following the treatment process (including primary crushing/screening and drying), the ore will be hauled to the rail loop for shipment.

The emission of pollutants generated by these activities were estimated on the basis of the most recent version of Publication AP-42 of the USEPA and Sections 11.9 (Dust emissions from drilling and blasting), 13.2.4 (dust emissions for loading/unloading and excavation) and based on technical specifications provided by the potential suppliers of mining equipment.

To consistently represent mining activities, a single area (7500 m²) located in the center of each active pit was modelled. This area corresponds to the area affected by each blast (e.g. 144 holes per blast, with each hole affecting a 7.2m x 7.2m area). All emissions associated with drilling, excavating and loading activities were considered to be located within this area source.

At the F7N deposit, excavating and loading activities of the three types of materials (ore, waste, overburden) were considered to be evenly distributed throughout the months of operation e.g., 365 days/year, 24h/day. At the Howse deposit, excavating and loading activities of ore and waste material were considered to be evenly

distributed throughout the 7 months of operation (April to October), while overburden clearing activities were considered to be evenly distributed throughout 5 winter months (November to March). The emission rates of pollutants generated by excavation and truck loading vary according to the water content of the material (i.e., ore, overburden and waste rock) and to the average wind speed.

Drilling operations were considered to be distributed the same way as excavating and loading activities. As a conservative assumption, it was considered that one drill would be in operation at each pit all year long. The number of holes drilled per year was established by using the ratio of tonnes of material per hole drilled, based on the Mining Plan. Particulate matter emissions from drilling activities were then estimated using equations from USEPA AP-42, Section 11.9.

2.4.1.2 Diesel Generators

A total of fourteen (14) diesel generators will be in operation within the air dispersion modelling perimeter. The generators and operating scenarios are listed in Table 2-5.

Table 2-5 Diesel Generators

Area	Location	Qty	Power Rating (each)	Manufact.	Model	Operating scenarios used in modelling
DSO3	Concrete Batch Plant	1	157.5 kW	Caterpillar	157.5 ekW	100% load – 24 hrs/day, 12 months/year
DSO3	Main Plant	5	2825 kW	Caterpillar	C175-16	Winter operations 5 units at 75% load – 24 hrs/day, 7 months/year Summer operations 3 units at 75% load – 24 hrs/day, 5 months/year
DSO3	Plant 2	1	1935 kW	MTU	DP1935D6SRW	Operating at 1710 ekW – 24 hrs/day, 12 months/year
DSO3	Mixer at Plant 2	1	182 kW	FPT	N67-TE2X	80% load – 24 hrs/day, 12 months/year
DSO3	Howse Mini-Plant	1	1935 kW	MTU	DP1935D6SRW	75% load – 24 hrs/day, 7 months/year
Howse	FN Quarry Crusher & Screener ⁹	1	275 kW	Caterpillar	275 ekW	100% load- 24 hrs/day, 7 months/year
DSO3	Worker's Camp	3	275 kW	Caterpillar	275 ekW	100% load- 24 hrs/day, 12 months/year
DSO3	Worker's Camp	1	1000 kW	Caterpillar	1000 ekW	100% load- 24 hrs/day, 12 months/year

The emission rates of the generators were established based on information provided by the generators' supplier. For particulate matter, the emission rates for TPM (Total Particulate Matter), PM_{10} (particulates with a diameter less than 10 microns) and $PM_{2.5}$ (particulates with a diameter less than 2.5 microns) are equivalent, since it is considered that all particulate matter from the generators have a diameter less than 1 micron. The emission rates of sulphur dioxide (SO_2) were estimated based on the fuel consumption rates and the average sulphur content in fuel oil of 0.0015% (Arctic diesel specifications).

NOx, CO and VOC emission data were obtained from the diesel generators manufacturers or EPA emissions factors. Emissions calculations, methodology and source of data are presented in Appendix A.

2.4.1.3 Transportation

All roads are unpaved and five main transportation groups were included in the study:

- Hauling trucks for material transport (ore, waste and overburden) from the Howse pit;
- Hauling trucks for material transport (ore, waste and overburden) from the F7N pit;
- Hauling trucks for material transport (ore, waste and overburden) from the DSO4 pits;
- Personnel vehicles on all roads (pickup trucks);

Sand and gravel transport from the FN Quarry with dump-trucks (10-wheelers)⁹.

Transporting materials or personnel by trucks on unpaved roads constitutes a source of dust. Roads within the air modelling perimeter were included in this study and calculations of hauling rates and frequency to/from mining areas are available in Appendix A. Roads included in the model are represented in Figure 2.2. For the purpose of inputting road emissions data in the Calpuff model, roads were divided in several segments representative of expected transport volumes. Emission rates (g/s) and annual emissions (tonnes per year) from each segment are included in the Emissions Inventory presented in Section 2.4.2. It is anticipated that roads will be regularly sprayed with water during dry weather to reduce dust emissions. In evaluating the emission rates of particulates, it was estimated that spraying the roads with water regularly would reduce the production of dust emissions by 70%. Roads are covered with snow and ice seven months per year (from mid-October to mid-May), dust emissions from road sources are greatly reduced during this period. The mitigating effects of precipitation and snow cover have been taken into account by applying a monthly Precipitation factor (P). The monthly P factor values were evaluated based on Environment Canada climate normal data for the period of 1971 to 2000 for the meteorological station at Schefferville airport. Although P values are applied based on particulate matter emissions coming from unpaved roads, the portion of the overall emissions coming from truck engines is kept intact. The resulting P value attenuation is shown in Appendix A.

The evaluation of the emission rates of particulates from unpaved roads was based on the equation taken from Publication AP-42 of the USEPA, Section 13.2.2 (USEPA 2006b). This equation evaluates the emission rate per kilometer travelled on the basis of the silt content of the road surface and the average weight of the vehicle. Since the roads will be built with waste rock, the silt content was determined using granulometric data of waste rock.

The emissions of particulates, NO_x , SO_2 and CO produced by truck engines were also considered in the air dispersion modelling. Particulates (PM, PM_{10} and $PM_{2.5}$), SO_2 , NO_x and CO emissions, generated by diesel engine vehicles, were based on the technical specifications of the vehicle suppliers. The emission rate of sulphur dioxide (SO_2) was estimated based on the fuel consumption rate, with an average sulphur content in fuel oil of 0.0015% (Arctic diesel specifications) for hauling trucks and dump trucks (10-wheelers) and of 0.003% for personnel transport vehicles.

The transportation activities were modelled as area sources. Due to limitations of the model, roads were segmented into several area sources, each of them measuring 20 m wide and a maximum length of approximately 200 m.

2.4.1.4 Main Plant Operations

The Main Processing Plant is located in the DSO3 area. The Main Plant is currently in the commissioning period and is described in further details in the EIS text. Emissions related to the operation of the Main Plant are considered for modelling purposes as a three steps process: activities before entering the Main Plant, activities occurring inside the dome converging to the main stack exhaust, and activities after the Main Plant when the processed product is leaving the enclosure of the dome.

Activities before the Main Plant:

The activities before the Main Plant were modelled as two volume sources:

- Unloading trucks, chute into crusher, primary crusher, chute on conveyor;
- Chute from conveyor into crusher, secondary crusher, chute on conveyor.

An assumption was made that all product material will be processed through primary and secondary crushers, at their nominal capacity of 700 tonnes per hour, modelled for 24 hour days during year round operations, regardless of which pit the material comes from. As mentioned previously, ore from the Howse pit will be transported to and processed at the Howse Mini-Plant, located at the Eastern corner of the railing loop.

The emission factors taken from AP-42 of the USEPA, Section 11.19.2, were used to estimate emissions for truck unloading, chute, primary and secondary crushers and conveyor transfer points.

Process activities inside the dome:

In summary, the main unit operations and equipment of the Main Plant are:

- Surge bins;
- Scrubbers;
- Crushers:
- Screens;
- Conveyors;
- Rod and ball mills;
- Gravity separation mainly jigs, spirals and hydroclassifier;
- Wet magnetic separation equipment;
- Hydrocyclones;
- Thickeners;
- Filters:
- Power/heat generation through the operation of five (5) diesel generators (Gen Set);
- Rotary dryer (with stand-alone diesel burner);
- Flash dryer (with backup diesel burner);
- Electrostatic precipitator;
- Heat recovery / gas scrubber;
- Main stack.

A review of air emissions points from the Main Plant dome has been conducted. Table 2-6 summarizes the dome emission points and how they have been integrated in the air modelling study. Detailed emissions calculations and emission point characteristics are provided in Appendix A.

Table 2-6 Main Plant Dome Emission Points

Emission Source(s)	Emissions point(s)	Integration in air model
Five (5) diesel generators (Gen Set) Rotary dryer (with stand-alone diesel burner) Flash dryer (with backup diesel burner) Electrostatic precipitator Heat recovery / gas scrubber	Main Stack	One point source (vertical) Two operating modes: Drying Mode (during winter): 5 generators @ 75% load + 1 flash dryer + 1 rotary dryer No Drying Mode (during summer): 3 generators @ 75% load
	10 South Wall Vents	One point source (horizontal) Exhaust flow rates different Winter vs Summer
Inside Air – Dome Ventilation	4 North Wall Vents	One point source (horizontal) Exhaust flow rates different Winter vs Summer
	4 roof exhaust	One point source (vertical) Exhaust flow rates different Winter vs Summer
2 drum filter vacuum pumps vents and one pan filter suction blower vent	3 exhaust pipes	One point source (horizontal) 24h/24h - 12 months per year

Activities after the Main Plant:

Activities after the Main Plant were modelled as five volume sources and one point source as indicated below:

Volume sources:

- Telescopic chute from the Sinterfines conveyor to the Sinterfines stockpile;
- Telescopic chute from the Superfines conveyor to the Superfines stockpiles;
- Loaders extracting product from stockpiles and dropping it on the reclaim conveyor during rail loading;
- Uni-load loading system (chute from conveyor directly into rail cars);

Plant 2 product being unloaded from truck and loaded on the reclaim conveyor during rail loading.

Point source:

Bin vent dust collector at the train Load-out tower.

Emission factors taken from AP-42 of the USEPA, Sections 11.9.2 and 13.2.4 were used to estimate dust emissions for conveyor transfer points, truck unloading, as well as material handling by loaders. With respect to transport of the processed ore on conveyors, the emission factor for controlled emissions was used to take into account the ore moisture content (Canada's NPRI guidelines recommends to use the *controlled* emission factors with material of moisture higher than 1.5%). As a conservative assumption, it was modelled that all processed material coming from Main Plant had a moisture level of 2%. The bin vent dust collector manufacturer was contacted to obtain the particulate emission rate from this equipment. Details of assumptions used for modelling and calculations are included in Appendix A.

2.4.1.5 Plant 2 Operations

Plant 2 is located in the DSO3 area and is currently operational. For this modelling study, the ore from Fleming 7N and Timmins 3N pits will be processed at Plant 2. Plant 2 operations aim to prepare a product with moisture below transportable moisture level through a crushing and drying process. Particulate matter will be emitted from ore handling and crushing operations at Plant 2. The particulate emission sources considered at Plant 2 include:

- Truck Unloading;
- Jaw Crusher;
- Feed Conveyor #1;
- Feed Conveyor #2;
- 1 Dryer (NOx, SO₂, CO emissions in addition to particulate emissions);
- Diesel generator (NOx, SO₂, CO emissions in addition to particulate emissions);
- Transfer Conveyor #3;
- Screen;
- Lump Stacker Conveyor;
- Transfer Conveyor #4;
- Fines Stacker Conveyor;
- Transfer Conveyor #5;
- Transfer Conveyor #6;
- · Cone Crusher;
- · Truck Loading.

The emission factors taken from Publication AP-42, Section 11.9.2 (USEPA 2004) for conveyor transfer points were used to estimate those emissions. With respect to the handling of the crushed ore, the emission factor for controlled emissions was used to take into account the ore moisture content. Ore unloading and loading as well as crushing and screening systems will produce particulate emissions. They were estimated using the emission factors taken from Publication AP-42, Section 13.2.4 (USEPA 1982).

In addition to these operations, the generator providing power to the mixer located at Plant 2 has been modelled as 24 hours/day, all year operations as a conservative assumption. The mixer's purpose is to make the iron ore less friable at very low temperatures by treating the ore coming out of the dryer with a polymer that is water absorbent.

All activities at Plant 2 were modelled as two volume sources: activities before the dryer and activities after the dryer. The exceptions to this grouping exercise are the dryer itself, and the two generators on site (for mixer and power generation of Plant 2), which were modelled using a point source for each of them.

At Plant 2, a dryer is installed on the crusher pad for drying iron ore to reduce its water content down to 6%, ensuring shipping below the transportable moisture limit. The 9' x 52' rotary dryer equipped with a bag house. The

dryer/bag house stack height is 15 meters above ground, exiting vertically *without* rain cap. The fuel used at the dryer is arctic diesel (sulphur content of 0.0015%). The related emission factors were provided by the equipment supplier for particulates, NO_x, SO₂, and CO for a 450 tonnes/hour throughput. As a conservative assumption, drying activities at Plant 2 were modelled as 24 hours/day, all year operations.

Detailed emissions calculations used for modelling are available in Appendix A.

2.4.1.6 Howse Mini-Plant

The Howse Mini-Plant will be constructed in the DSO3 area at the east of the railing loop (see location on Figure 2.2) and will be used to process the ore from the Howse pit. The ore from Howse will be transported by hauling trucks to the Howse Mini-Plant. This plant has the same engineering design to Plant 2, except that there will be no mixer and there will be two dryers instead of one. Consequently, particulate emission sources from the Howse Mini-Plant include:

- Truck Unloading;
- Jaw Crusher;
- Feed Conveyor #1;
- Feed Conveyor #2;
- 2 Dryers (NOx, SO₂, CO emissions in addition to particulate emissions);
- Diesel generator (NOx, SO₂, CO emissions in addition to particulate emissions);
- Transfer Conveyor #3;
- Screen;
- Lump Stacker Conveyor;
- Transfer Conveyor #4;
- Fines Stacker Conveyor;
- Transfer Conveyor #5;
- Transfer Conveyor #6;
- Cone Crusher;
- Truck Loading.

The emission factors taken from Publication AP-42, Section 11.9.2 (USEPA 2004) for conveyor transfer points were used to estimate those emissions. With respect to the handling of the crushed ore, the emission factor for controlled emissions was used to take into account the ore moisture content. Ore unloading and loading as well as crushing and screening systems will produce particulate emissions. They were estimated using the emission factors taken from Publication AP-42, Section 13.2.4 (USEPA 1982). Emissions were modelled as 24 hours/day, 7 months per year.

Activities at the Howse were modelled as two volume sources (before and after drying). The two dryers and the Howse generator were modelled as point sources.

At the Howse Mini-Plant, two dryers will be installed for drying iron ore to reduce its water content down to 6%, ensuring shipping below the transportable moisture limit. The 9' x 52' rotary dryers are equipped with a baghouse each. The dryer/baghouse stacks' height are 15 meters above ground, exiting vertically. The fuel used at the dryers is arctic diesel (sulphur content of 0.0015%). The related emission factors were provided by the equipment supplier for particulates, NO_x, SO₂, CO and VOC for a 450 tonnes/hour; these emission factors are scaled down to 320 tonnes/hour to represent the emissions from each of the two dryers. The drying activities at Howse Mini-Plant were modelled as 24 hours/day, 7 months/year operation.

Detailed emissions calculations used for modelling are available in Appendix A.

2.4.1.7 First Nation Quarry

Although a First Nations Quarry was in the initial planning stages under the Howse Project, this activity is currently no longer considered, and that for the foreseeable future. However, the First Nations Quarry is included as an air emission source in this report and consequently in the results presented herein. We propose that this scenario is a 'worst-case' scenario and will continue to be evaluated for its effects on air quality. Paragraphs below provide the FN Quarry parameters used in the air model.

The Howse project is considering the development of a quarry (referred to as FN Quarry in this report) to produce sand and gravel for sale to the local community as construction material. Production from the FN Quarry is targeted at 100 000 tonnes per year. Definitive location and engineering plans were not available at the time of writing this report, but it was requested that emissions related to this activity be included in the air modelling study. It was assumed that the sand and gravel from the FN Quarry will be processed at a crushing/screening plant (referred to as FN Crusher/Screener). The sand and gravel will then be transported by dump trucks (10-wheelers) principally to communities located in the Schefferville area. The anticipated location of the FN Crusher/Screener is indicated on Figure 2.1. Unit operations of the FN Crusher/Screener were assumed to be similar to those present at Plant 2, but without mixing and drying activities, and include the following:

- Dump trucks (10-wheelers) unloading;
- Crusher;
- Feed Conveyor #1;
- Feed Conveyor #2;
- Diesel generator (NOx, SO₂, CO, VOC emissions in addition to particulate emissions);
- Screen;
- Transfer Conveyor #4;
- Fines Stacker Conveyor;
- Transfer Conveyor #5;
- Transfer Conveyor #6;
- Dump trucks (10-wheelers) loading.

The emission factors taken from Publication AP-42, Section 11.9.2 (USEPA 2004) for conveyor transfer points were used to estimate those emissions. With respect to the handling of the quarry materials, the emission factor for controlled emissions was used to take into account the ore moisture content. Sand and gravel unloading and loading as well as crushing and screening systems will generate particulate emissions. They were estimated using the emission factors taken from Publication AP-42, Section 13.2.4 (USEPA 1982). Emissions were modelled as 24 hours/day, 7 months per year.

Activities at the FN Crusher/Screener were modelled as a volume sources and the generator was modelled as a point source. Detailed emissions calculations used for modelling are available in Appendix A.

2.4.1.8 Stockpiles

The "More Complex" equation from "Mojave Desert Air Quality Management District, Antelope Valley Air Pollution Control District, Emissions Inventory Guidance, Mineral Handling Handbook and Processing Industries, April 10, 2000" was used to calculate particulate emissions from wind erosion. The latest document "Proposed Revisions to Fine Fraction Ratios Used for AP-42 Fugitive Dust Emission Factors, 2006" has been used to revise the PM_{2.5}/PM₁₀ ratio from 0.40 to 0.15 for Industrial Wind Erosion which is applicable to storage piles of crushed aggregate materials, such as coal or metallic ore piles. For active piles, it should be noted that since the piled material is spread over the entire pile surface all year long, the piles (stockpiles and dump piles) are considered as 100% active as a conservative assumption for the calculations.

A complete layout of the multiple stockpiles in place at the mining site is included in Appendix C. The following data was used to model stockpiles as area sources:

Average density of stockpiled material is 3 tonnes per cubic meter;

- Silt content of stockpiled material was determined to be 1.5%¹² (except for final product stockpiles);
- Silt content of stockpiled final products were determined to be 11.2% for the Sinterfines stockpile and 84.5% for the two Superfines stockpiles, all of which are located east of the Main Plant near the rail loop;
- Using the same methodology as described in the previous section addressing transportation, P values were applied on particulate matter emissions to take into account the mitigating effect of precipitation and snow;
- Days with unobstructed winds higher than 12 mph occurred 35% of the time.

Table 2-7 shows the list of piles included in this study.

Table 2-7 Piles included in air quality modelling study

Type of pile	Location / Pit
Overburden & Waste	Fleming 7N
Overburden & Waste	Timmins 7
Overburden & Waste	Howse
Stockpiles	Near Timmins 4
Stockpiles	North of Main Plant
Stockpiles	Near Plant 2
Stockpiles	Near Fleming 7N
Stockpiles	Near and to the east of Fleming 7N
Stockpiles	At Main Plant
Stockpile	Sinterfines at Main Plant
Stockpile	Superfines at Main Plant
Stockpiles	Near Howse Mini-Plant

2.4.2 Air Emissions Inventory

Table 2-8 presents the annual emissions inventory for the Howse Project's main air pollutants.

Table 2-9 presents the annual emissions inventory for the DSO3 and DSO4 areas' main air pollutants.

The basis for the calculations is presented in section 2.4.1. Detailed inventory calculation tables are available in Appendix G.

Table 2-8 Annual Emissions Inventory – Howse Project

Project Area	ANNUAL EMISSIONS INVENTORY (1)								
	TPM	PM ₁₀	PM _{2.5}	NOx	СО	SO ₂			
HOWSE	231.4	121.9	64.2	283.2	146.3	2.2			

⁽¹⁾ Based on maximum production year (see Section 2.4.1).

¹² Phone conversation with Loic Didillon (Tata Steel Minerals Canada). April 1, 2014.

Table 2-9 Annual Emissions Inventory – DSO3 and DSO4 Areas

Duningt Area	ANNUAL EMISSIONS INVENTORY (1)								
Project Area	TPM	PM ₁₀	PM _{2.5}	NOx	СО	SO ₂			
DSO3	301.9	99.1	22.8	1550.7	200.1	3.2			
DSO4 (2)	259.2	73.9	8.4	124.6	68.7	0.1			

Based on maximum production year (see Section 2.4.1).

2.4.3 Fuel Usage Inventory

As indicated in previous sections, equipment on-site (mobile and stationary) will be using diesel fuel.

Table 2-10 presents the annual fuel usage inventory for the Howse Project's. For this fuel inventory, the FN Quarry related fuel usage (one diesel generator for the FN Crusher/screener and hauling by dump trucks) was put separately in Table 2-12. However, for the air dispersion modelling study, the FN Quarry activities were included as an integral part of the Howse Project.

Table 2-11 and Table 2-12 present the annual fuel usage inventory for the DSO3 and DSO4 Areas respectively.

Detailed fuel usage inventory tables and calculations are available in Appendix H.

Table 2-10 Annual Fuel Usage – Howse Project

Source	Diesel Fuel Usage *				
Jource	Liters / year				
Howse Mini-Plant	21 033 917				
Hauling Trucks	3 261 224				
Howse Pit Mining Activities	1 151 064				
Total	25 446 205				

Fuel usage for the FN crusher/screener to be installed on the Howse Project Property is included in Table 2-12 below.

Table 2-11 Annual Fuel Usage – DSO3 Area

Source	Diesel Fuel Usage				
Source	Liters / year				
Main Processing Plant	26 072 640				
Workers' Camp Generators	4 493 880				
Plant 2	25 973 172				
DSO3 Hauling trucks and TSMC personnel vehicles	585 143				
Batch Plant Generator	439 752				
Fleming 7N Pit Mining Activities	920 851				
Total	58 485 438				

Includes a 9.6 km section of the Goodwood Road where Hauling trucks transport ore from the DSO4 area. DSO4 mining activities not included.

Table 2-12 Annual Fuel Usage – DSO4 Area and FN Quarry⁹

Source	Diesel Fuel Usage *		
Source	Liters / year		
Goodwood Road from DSO4*	5 012 539		
Diesel Generator at FN Crusher / screener	703 428		
FN Quarry Hauling (Dump Trucks - 10 wheelers) ⁹	794 128		
Total	6 510 095		

Considers transport on the section of the Goodwood Road located within the air quality modelling perimeter only, which corresponds to a length of 9.6 km.

2.4.4 Meteorological Data

The CALMET program was used to generate meteorological data files. The program used the following elements to generate wind fields:

- Meteorological data obtained by a non-hydrostatic mesoscale assessment technique using Mesoscale Model (MM 5) (operated by the Canadian company Lakes Environmental) for years 2004 to 2008 were used as baseline data. This set of years was retained because they were used for all previous air modelling studies for other TSMC DSO Projects, they are considered representative of the current conditions and, meet the objectives of this air modelling study. The data grid provided by Lakes Environmental had a resolution of 12 km and covered a surface area of 30 km by 20 km. The UTM coordinates of the central point were: East 628 000 m, North 6 081 000 m (zone 19). An explanatory document is provided in Appendix D.
- The domain of the meteorological grid generated by the program had a surface area of 600 km², which extends 10 km north and 10 km south, and 15 km east and 15 km west, in relation to the central point (UTM East 628 000 m, North 6 081 000 m). The resolution of the meteorological grid was of 500 m by 500 m.
- The vertical levels of the meteorological grid data were 20 m, 50 m, 100 m, 200 m, 500 m, 1000 m, 2000 m and 3300 m.
- The CALMET land use grid is shown in Appendix E. Land use data were obtained directly from the Government of Newfoundland and Labrador and processed with CTGPROC so they could be processed by CALMET. The land use data in the study area were used by CALMET to calculate parameters such as surface roughness. Even though land use varies within the study area, the capabilities of CALMET are such that a given land use can be associated with each section of the meteorological grid.
- In accordance with *Guideline for Plume Dispersion Modelling* (GNL, 2012), parameterization of land use data regarding Albedo, z0, Bowen and other parameters was defined for three different GEO.dat files to better represent seasonal land use for the area of study "Western and Central Labrador".
- Terrain elevation data were obtained from digital databases with greater than 5 m precision.
- All other CALMET default options and factors were selected.

2.4.5 General Receptor Grid and Specific Sensitive Receptors

General Receptor Grid

To meet the requirements of the *Guideline for Plume Dispersion Modelling* of the Department of Environment and Conservation of the Government of Newfoundland and Labrador (GNL 2002), two Cartesian grids of receptors as well as discrete receptors were defined. The terrain elevation data used in the grids was obtained from the digital database having greater than 5 m precision.

The larger Cartesian grid covers a surface area of 340 km². It covers the DSO2 and DSO3 sites and is centered at the Main Plant. The North-west corner start close to Howells Rover and the South-eastern corner extends close to Stork Lake. This grid resolution is 500 m by 500 m.

The second Cartesian grid covers a surface area of 16 km². It extends along the DSO3 facilities for a distance of 4 km and covers a strip of land of 4 km in width. Its resolution is 200 m by 200 m. It was not necessary to use a

grid of 50 m resolution (as required in the *Guideline for Plume Dispersion Modelling*) because the zone for which such a grid is required falls within the boundaries of the air quality perimeter. In addition to this general receptors grid, refer to Section 2.3.1 for explanation on how the modelling perimeter was established.

The receptors were positioned at ground level. General grid receptors located within the air quality modelling perimeter were removed from the modelling file in order to evaluate the ambient concentrations outside this boundary. General grid receptors located at less than 100 m from roads were also removed.

This removal process only excludes grid receptors, which are not specifically designated as sensitive receptors where humans live, hunt or do other activities. None of the sensitive receptors discussed in the next paragraph were removed from the model.

Sensitive Receptors

A list of discrete sensitive receptors was established and provided to AECOM for the air dispersion modelling study. Table 2-13 show the list of receptors located in NL. The location of these receptors is presented on Figure 2.1.

Table 2-13 Discrete Sensitive Receptors

ID*	FINAL Description	Province	X Easting (km)	Y Northing (km)	Z Elevation (m)	Distance and direction relative to Howse Deposit
R1	Young Naskapi Camp 1	NL	615.0828	6086.3313	498	4.21 km, W
R2	Young Naskapi Camp 2	NL	615.0068	6086.4258	498	4.29 km, W
R3	Innu Tent 3 (Rosemary Lake)	NL	615.2457	6086.3324	499	4.05 km, W
R4	Innu Tent 4 (Rosemary Lake)	NL	615.2376	6086.9500	499	4.11 km, W
R5	Innu Tent 5 (Rosemary Lake)	NL	614.8537	6087.3314	500	4.56 km, WNW
R6	Innu Tent 6 (Rosemary Lake)	NL	614.6857	6086.7490	498	4.63 km, W
R7	Innu Tent 1 (Elross Lake)	NL	619.3356	6080.8277	500	5.44 km, S
R8	Innu Tent 2 (Exact location tbd)	NL	614.4960	6084.5808	505	5.08 km, WSW
R9	Young Naskapi Camp 7 (Pinette Lake)	NL	620.4557	6084.8152	636	1.86 km, SE
R10	Young Naskapi Camp 3	NL	617.9290	6087.3644	606	1.75 km, NW
R11	Young Naskapi Trailer tent (Triangle Lake)	NL	618.0872	6088.3173	580	2.38 km, NNW
R12	Young Naskapi Camp 5 (Elross Creek)	NL	621.5380	6082.0124	579	4.81 km, SSE
R13	Naskapi - Uashat people's camp	NL	617.7971	6087.0367	619	1.68 km, WNW
R14	Young Naskapi Camp 4	NL	613.0674	6087.5092	514	6.35 km, WNW
R15	Young Naskapi Camp 6 (Howells River)	NL	622.2957	6077.8614	515	8.92 km, SSE
R17	Innu - Uashat - Mani-Utenam Camp 2	NL	616.4962	6086.9704	556	2.88 km, WNW
R21	Bustard - Observation and hunting site 1	NL	612.9988	6089.0819	521	6.89 km, WNW
R22	Bustard - Observation and hunting site 2	NL	615.1038	6086.0116	514	4.19 km, W
R24	Irony Mountain	NL	618.2357	6085.2228	835	1.48 km, SW
R33	Naskapi Cabin 1	NL	615.3395	6084.424	502	4.36 km, WSW
R34	Naskapi Cabin 2 (Elross Lake)	NL	616.6907	6084.223	502	3.3 km, SW
R35	Naskapi Cabin 3 (Elross Lake)	NL	616.9098	6082.671	498	4.31 km, SSW
R40	TSMC Workers' Camp	NL	624.465	6082.765	742	6.25 km, SE

^{*} Receptors R16, R18-R20, R25-R32, R36-R39 are located in the province of QC and not included in this provincial ADMR.

2.4.6 Chemical transformation methods

To meet the requirements of the *Guideline for Plume Dispersion Modelling* of the Department of Environment and Conservation (GD-PPD-019.2), the RIVAD/ISORROPIA chemical transformation module was activated in CALPUFF.

One of the requirements of activating this module was the need to input specific NO and NO_2 emission rates separately, instead of modelling NO_x emissions directly and treating the results as a post-process step to obtain NO_2 concentrations.

Table A.1 in Appendix A of the GD-PPD-019.2, lists default in-stack NO_2/NO_x ratios to be used where in-stack emissions of NO and NO_2 are not available. As all NO_x emitting sources on-site are diesel powered, a NO_2/NO_x in-stack ratio of 0.2 was used for modelling. Additionally, calculations related to the conversion of volume-based NO_2/NO_x ratios to mass-based ratios are included in Appendix A.

2.4.7 Air modelling of blasting events

As indicated in Section 2.4.1.1, modelling results of blasting events are not required to be included in this ADMR due to limitations of the air model.

3 Modelling Results and Discussion

To optimize air dispersion modelling and computing time, project sources have been divided into several CALPUFF modelling input files. Concentration results obtained for each modelling have been compiled with CALSUM and then post processed with CALPOST. CALPUFF and CALPOST input files are referenced in Appendix E and Appendix F, but due to their number and volume, they are available electronically on request.

Section 2.3.4 explains how background concentrations and baseline concentrations due to other projects (e.g. DSO3 and DSO4) are incorporated in the results. Resulting concentrations are compared to the NL ambient air quality standards presented in Sections 2.3.3.

The results from the air dispersion modelling for all air pollutants assessed in this study are presented in this report in tabular format at the sensitive receptor locations, and also at grid receptors having the highest impacts.

Each table has a similar format and contains:

- Identification of averaging period and pollutants
- NL Ambient Air Quality Standards
- · Background concentrations
- Separate resulting concentrations for each DSO Areas included in the air modelling study:
 - DSO3 and DSO4 only:
 - Howse Only:
 - Combined DSO3, DSO4 and Howse:
 - All: Background + DSO3, DSO4 and Howse.
- Selected Sensitive Receptors. Section 2.4.5 describes the 23 sensitive receptors located in NL and included in this study.
- Grid Receptors with highest impacts. The maximum modelled concentrations at grid receptors located on or
 outside the air quality modelling perimeter (e.g. typically referred to as "Off-Property Limits" concentrations).
 Maximum concentrations in NL are reported. These grid receptors are NOT sensitive receptors; they are just
 equally spaced geographical points entered in the Calpuff model as per air modelling guidelines.

3.1 **Tables of Results**

Table 3-1

			RESUL	TS - 1 Y	r AVG.	
	Pollutant	TDM	DN 410	DMO F	502	NO2
						NO2
	0 0					1-yr
	,					100 1 st
	Level of Talik	I	I I	l.	I.	l l'
	BACKGROUND CONCENTRATIONS - PRE-DSO3	15	10	5	5	3.8
ID	Description	TPM, 1-yr	PM10, 1-yr	PM2.5, 1-yr	SO2, 1-yr	NO2, 1-y
R1	Young Naskapi Camp 1	0.1	0.0	0.0	0.0	0.2
R2	Young Naskapi Camp 2	0.1	0.0	0.0	0.0	0.2
		0.1	0.0	0.0	0.0	0.2
						0.2
						0.2
						0.3
						0.3
	,					1.5
						0.6
						0.6
		0.2	0.1	0.1	0.0	1.1
		0.3	0.1	0.0	0.0	0.7
R14	Young Naskapi Camp 4	0.0	0.0	0.0	0.0	0.2
R15	Young Naskapi Camp 6 (Howells River)	0.1	0.0	0.0	0.0	0.4
R17	Innu - Uashat - Mani-Utenam Camp 2	0.1	0.0	0.0	0.0	0.3
		0.0	0.0	0.0	0.0	0.1
						0.3
						1.5
	· · · · · · · · · · · · · · · · · · ·					0.3
						0.3
						0.4 18.6
	·					13.8
	on Property Ellint Waximum Newroandland/Labradon	7.0	3.0	0.7	0.0	13.0
ID	Name	TPM, 1-yr	PM10, 1-yr	PM2.5, 1-yr	SO2, 1-yr	NO2, 1-
	v i	0.1	0.0	0.0	0.0	0.1
						0.1
						0.1
						0.1
						0.1
						0.1
	,					0.1
						1.2
						0.8
	0 1 1		0.2		0.0	0.5
R12	Young Naskapi Camp 5 (Elross Creek)	0.2	0.1	0.0	0.0	0.3
		0.6	0.3	0.1	0.0	1.0
	0	0.0	0.0	0.0	0.0	0.1
	*	0.1	0.0	0.0	0.0	0.1
		0.1	0.1	0.0	0.0	0.2
	J.	0.0	0.0	0.0	0.0	0.0
	Bustard - Observation and hunting site 2	0.1	0.0	0.0	0.0	0.1
	Irony Mountain	0.8	0.4	0.1	0.0	1.2
			0.0			
R33	Naskapi Cabin 1	0.1	0.0	0.0	0.0	0.1
R33 R34			0.0 0.0 0.0			
	R1 R2 R3 R4 R5 R6 R7 R8 R9 R110 R11 R22 R24 R33 R34 R5 R6 R7 R8 R9 R110 R11 R22 R24 R33 R4 R5 R6 R7 R8 R9 R11 R11 R12 R13 R14 R15 R10 R11 R11 R12 R13 R14 R15 R10 R11 R11 R12 R13 R14 R15 R10 R11 R11 R11 R11 R11 R11 R11 R11 R11	Averaging Period NL Ambient Air Quality Standard Level or rank * BACKGROUND CONCENTRATIONS - PRE-DSO3 ID Description R1 Young Naskapi Camp 1 R2 Young Naskapi Camp 2 R3 Innu Tent 3 (Rosemary Lake) R4 Innu Tent 4 (Rosemary Lake) R5 Innu Tent 5 (Rosemary Lake) R6 Innu Tent 6 (Rosemary Lake) R7 Innu Tent 1 (Elross Lake) R8 Innu Tent 2 (Exact location tbd) R9 Young Naskapi Camp 7 (Pinette Lake) R10 Young Naskapi Camp 5 (Elross Creek) R11 Young Naskapi Camp 5 (Elross Creek) R12 Young Naskapi Camp 6 (Howells River) R13 Naskapi - Uashat people's camp R14 Young Naskapi Camp 6 (Howells River) R15 Young Naskapi Camp 6 (Howells River) R17 Innu - Uashat - Mani-Utenam Camp 2 R21 Bustard - Observation and hunting site 1 R22 Bustard - Observation and hunting site 1 R33 Naskapi Cabin 1 R34 Naskapi Cabin 2 (Elross Lake) R35 Naskapi Cabin 3 (Elross Lake) R36 Naskapi Cabin 3 (Elross Lake) R37 Naskapi Cabin 3 (Elross Lake) R38 Innu Tent 4 (Rosemary Lake) R59 Innu Tent 5 (Rosemary Lake) R50 Innu Tent 5 (Rosemary Lake) R51 Innu Tent 6 (Rosemary Lake) R52 Innu Tent 1 (Elross Lake) R53 Innu Tent 1 (Elross Lake) R54 Innu Tent 1 (Elross Lake) R55 Innu Tent 1 (Elross Lake) R56 Innu Tent 1 (Elross Lake) R57 Innu Tent 1 (Elross Lake) R58 Innu Tent 1 (Elross Lake) R59 Innu Tent 1 (Elross Lake) R50 Innu Tent 1 (Elross Lake) R51 Innu Tent 1 (Elross Lake) R52 Innu Tent 1 (Elross Lake) R53 Innu Tent 1 (Elross Lake) R54 Innu Tent 1 (Elross Lake) R55 Innu Tent 1 (Elross Lake) R56 Innu Tent 1 (Elross Lake) R57 Innu Tent 1 (Elross Lake) R58 Innu Tent 1 (Elross Lake) R59 Innu Tent 1 (Elross Lake) R50 Innu Tent 1 (Elross Lake) R51 Innu Tent 1 (Elross Lake) R52 Innu Tent 2 (Exact Iocation tbd) R54 Innu Tent 3 (Rosemary Lake) R55 Innu Tent 4 (Rosemary Lake) R56 Innu Tent 5 (Rosemary Lake) R57 Innu Tent 1 (Elross Lake) R58 Innu Tent 2 (Exact Iocation tbd) R59 Innu Tent 3 (Rosemary Lake) R50 Innu Tent 4 (Rosemary Lake) R51 Innu Tent 5 (Rosemary Lake) R51 Innu Tent 6 (Rosemary Lake) R51 Innu Tent 6 (Rosemary Lake) R51 Innu Tent 6 (Rosemary Lake) R51 In	Pollutant TPM	Pollutant	Pollutant TPM	Averaging Period 1-yr 1-yr 1-yr 1-yr 1-yr NL Ambient Air Quality Standard 60 8.8 60

[&]quot;Off-Property Limit" Maximum - Newfoundland/Labrador - all values in $\mu g/m^3$. Red cell, if any, indicates above criteria.

R40 TSMC Workers' Camp

0.2

0.5

0.0

0.0

2.1

5.5

0.7

2.1

1.7

^{*} nth highest levels as per NL Guidance Document GD-PPD-009.4 (2012)

Table 3-1 Summary Results – Annual Concentrations (Continued)

RESULTS - 1 Yr AVG. (cont'd)

PM2.5

1-yr

1-yr

NO2

1-yr

		Averaging Period	1-yr	1-yr	1-yr	1-yr	1-yr
		NL Ambient Air Quality Standard	60		8.8	60	100
		Level or rank *	1 st	1 st	1 st	1 st	1 st
					'		'
		BACKGROUND CONCENTRATIONS - PRE-DSO3	15	10	5	5	3.8
	ID	Name	TPM, 1-yr	DM10 1 vr	PM2.5, 1-yr	SO2, 1-yr	NO2, 1-y
	R1	Young Naskapi Camp 1	0.1	0.1	0.0	0.0	0.3
		Young Naskapi Camp 2	0.1	0.1	0.0	0.0	0.3
		Innu Tent 3 (Rosemary Lake)	0.1	0.1	0.0	0.0	0.3
		Innu Tent 4 (Rosemary Lake)	0.1	0.1	0.0	0.0	0.3
		Innu Tent 5 (Rosemary Lake)	0.1	0.1	0.0	0.0	0.3
		Innu Tent 6 (Rosemary Lake)	0.1	0.1	0.0	0.0	0.3
K	R7	Innu Tent 1 (Elross Lake)	0.1	0.1	0.0	0.0	0.4
\geq	R8	Innu Tent 2 (Exact location tbd)	0.1	0.1	0.0	0.0	0.4
	R9	Young Naskapi Camp 7 (Pinette Lake)	1.4	0.7	0.2	0.0	2.7
工		Young Naskapi Camp 3	0.8	0.4	0.1	0.0	1.4
+	R11	Young Naskapi Trailer tent (Triangle Lake)	0.6	0.3	0.1	0.0	1.1
74	R12	Young Naskapi Camp 5 (Elross Creek)	0.4	0.2	0.1	0.0	1.3
$\tilde{\Sigma}$	R13	Naskapi - Uashat people's camp	0.9	0.5	0.1	0.0	1.6
DSO3 + DSO4 + HOWSE	R14	Young Naskapi Camp 4	0.1	0.0	0.0	0.0	0.2
+	R15	Young Naskapi Camp 6 (Howells River)	0.1	0.1	0.0	0.0	0.5
$\ddot{\circ}$	R17	Innu - Uashat - Mani-Utenam Camp 2	0.2	0.1	0.0	0.0	0.5
$\tilde{\mathcal{S}}$	R21	Bustard - Observation and hunting site 1	0.1	0.0	0.0	0.0	0.2
_	R22	Bustard - Observation and hunting site 2	0.1	0.1	0.0	0.0	0.4
	R24	Irony Mountain	1.1	0.6	0.2	0.0	2.6
	R33	Naskapi Cabin 1	0.1	0.1	0.0	0.0	0.4
	R34	Naskapi Cabin 2 (Elross Lake)	0.1	0.1	0.0	0.0	0.4
	INST			0.1	0.0	0.0	0.5
		Naskapi Cabin 3 (Elross Lake)	0.1	0.1	0.0		
	R35	Naskapi Cabin 3 (Elross Lake) TSMC Workers' Camp	4.2	2.1	0.8	0.1	19.8
	R35 R40	TSMC Workers' Camp	4.2	2.1	0.8	0.1	·
	R35						19.8 16.4
	R35 R40	TSMC Workers' Camp	4.2	2.1	0.8	0.1	·
	R35 R40	TSMC Workers' Camp "Off-Property Limit" Maximum - Newfoundland/Labrador	12.8	2.1 4.9	1.1	0.1	16.4
	R35 R40	TSMC Workers' Camp	12.8	2.1 4.9	0.8	0.1	
	R35 R40 	TSMC Workers' Camp "Off-Property Limit" Maximum - Newfoundland/Labrador	12.8	2.1 4.9	1.1	0.1	16.4
	R35 R40 ID R1 R2	TSMC Workers' Camp "Off-Property Limit" Maximum - Newfoundland/Labrador Name Young Naskapi Camp 1 Young Naskapi Camp 2	4.2 12.8 TPM, 1-yr	2.1 4.9 PM10, 1-yr	0.8 1.1 PM2.5, 1-yr	0.1 0.0 SO2, 1-yr	16.4 NO2, 1-y
	R35 R40 ID R1 R2	TSMC Workers' Camp "Off-Property Limit" Maximum - Newfoundland/Labrador Name Young Naskapi Camp 1	4.2 12.8 TPM, 1-yr 15.1	2.1 4.9 PM10, 1-yr 10.1	0.8 1.1 PM2.5, 1-yr 5.0	0.1 0.0 SO2, 1-yr 5.0	16.4 NO2, 1-y 4.1
SE	R35 R40 ID R1 R2	TSMC Workers' Camp "Off-Property Limit" Maximum - Newfoundland/Labrador Name Young Naskapi Camp 1 Young Naskapi Camp 2	4.2 12.8 TPM, 1-yr 15.1 15.1	2.1 4.9 PM10, 1-yr 10.1 10.1	0.8 1.1 PM2.5, 1-yr 5.0 5.0	0.1 0.0 SO2, 1-yr 5.0 5.0	16.4 NO2, 1-y 4.1 4.1
)W/SE	R35 R40 ID R1 R2 R3 R4	TSMC Workers' Camp "Off-Property Limit" Maximum - Newfoundland/Labrador Name Young Naskapi Camp 1 Young Naskapi Camp 2 Innu Tent 3 (Rosemary Lake)	4.2 12.8 TPM, 1-yr 15.1 15.1	2.1 4.9 PM10, 1-yr 10.1 10.1	0.8 1.1 PM2.5, 1-yr 5.0 5.0 5.0	0.1 0.0 SO2, 1-yr 5.0 5.0	16.4 NO2, 1-y 4.1 4.1 4.1
HOWSE	R35 R40 ID R1 R2 R3 R4 R5	TSMC Workers' Camp "Off-Property Limit" Maximum - Newfoundland/Labrador Name Young Naskapi Camp 1 Young Naskapi Camp 2 Innu Tent 3 (Rosemary Lake) Innu Tent 4 (Rosemary Lake)	4.2 12.8 TPM, 1-yr 15.1 15.1 15.1	2.1 4.9 PM10, 1-yr 10.1 10.1 10.1	0.8 1.1 PM2.5, 1-yr 5.0 5.0 5.0	0.1 0.0 SO2, 1-yr 5.0 5.0 5.0	16.4 NO2, 1-y 4.1 4.1 4.1
+ HOWSE	R35 R40 ID R1 R2 R3 R4 R5	TSMC Workers' Camp "Off-Property Limit" Maximum - Newfoundland/Labrador Name Young Naskapi Camp 1 Young Naskapi Camp 2 Innu Tent 3 (Rosemary Lake) Innu Tent 4 (Rosemary Lake) Innu Tent 5 (Rosemary Lake)	4.2 12.8 TPM, 1-yr 15.1 15.1 15.1 15.1 15.1	2.1 4.9 PM10, 1-yr 10.1 10.1 10.1 10.1	0.8 1.1 PM2.5, 1-yr 5.0 5.0 5.0 5.0	0.1 0.0 SO2, 1-yr 5.0 5.0 5.0 5.0	16.4 NO2, 1-y 4.1 4.1 4.1 4.1
O4 + HOWSE	R35 R40 ID R1 R2 R3 R4 R5 R6 R7	TSMC Workers' Camp "Off-Property Limit" Maximum - Newfoundland/Labrador Name Young Naskapi Camp 1 Young Naskapi Camp 2 Innu Tent 3 (Rosemary Lake) Innu Tent 4 (Rosemary Lake) Innu Tent 5 (Rosemary Lake) Innu Tent 6 (Rosemary Lake)	4.2 12.8 TPM, 1-yr 15.1 15.1 15.1 15.1 15.1	2.1 4.9 PM10, 1-yr 10.1 10.1 10.1 10.1 10.1	0.8 1.1 PM2.5, 1-yr 5.0 5.0 5.0 5.0 5.0	0.1 0.0 SO2, 1-yr 5.0 5.0 5.0 5.0 5.0	16.4 NO2, 1-y 4.1 4.1 4.1 4.1 4.1 4.1
JSO4 + HOWSE	R35 R40 ID R1 R2 R3 R4 R5 R6 R7 R8	TSMC Workers' Camp "Off-Property Limit" Maximum - Newfoundland/Labrador Name Young Naskapi Camp 1 Young Naskapi Camp 2 Innu Tent 3 (Rosemary Lake) Innu Tent 4 (Rosemary Lake) Innu Tent 5 (Rosemary Lake) Innu Tent 6 (Rosemary Lake) Innu Tent 1 (Elross Lake) Innu Tent 2 (Exact location tbd)	4.2 12.8 TPM, 1-yr 15.1 15.1 15.1 15.1 15.1 15.1 15.1	2.1 4.9 PM10, 1-yr 10.1 10.1 10.1 10.1 10.1 10.1	0.8 1.1 PM2.5, 1-yr 5.0 5.0 5.0 5.0 5.0 5.0	0.1 0.0 SO2, 1-yr 5.0 5.0 5.0 5.0 5.0 5.0	16.4 NO2, 1-y 4.1 4.1 4.1 4.1 4.1 4.1 4.1 4.1 4.2
+ DSO4 + HOWSE	R35 R40 ID R1 R2 R3 R4 R5 R6 R7 R8	TSMC Workers' Camp "Off-Property Limit" Maximum - Newfoundland/Labrador Name Young Naskapi Camp 1 Young Naskapi Camp 2 Innu Tent 3 (Rosemary Lake) Innu Tent 4 (Rosemary Lake) Innu Tent 5 (Rosemary Lake) Innu Tent 6 (Rosemary Lake) Innu Tent 1 (Elross Lake) Innu Tent 2 (Exact location tbd) Young Naskapi Camp 7 (Pinette Lake)	4.2 12.8 TPM, 1-yr 15.1 15.1 15.1 15.1 15.1 15.1 15.1 15.	2.1 4.9 PM10, 1-yr 10.1 10.1 10.1 10.1 10.1 10.1 10.1	0.8 1.1 PM2.5, 1-yr 5.0 5.0 5.0 5.0 5.0 5.0	0.1 0.0 SO2, 1-yr 5.0 5.0 5.0 5.0 5.0 5.0 5.0	16.4 NO2, 1-y 4.1 4.1 4.1 4.1 4.1 4.1 4.1 4.2 4.2
)3	R35 R40 ID R1 R2 R3 R4 R5 R6 R7 R8 R9 R10	TSMC Workers' Camp "Off-Property Limit" Maximum - Newfoundland/Labrador Name Young Naskapi Camp 1 Young Naskapi Camp 2 Innu Tent 3 (Rosemary Lake) Innu Tent 4 (Rosemary Lake) Innu Tent 5 (Rosemary Lake) Innu Tent 6 (Rosemary Lake) Innu Tent 1 (Elross Lake) Innu Tent 2 (Exact location tbd)	4.2 12.8 TPM, 1-yr 15.1 15.1 15.1 15.1 15.1 15.1 15.1 15.1 16.4	2.1 4.9 PM10, 1-yr 10.1 10.1 10.1 10.1 10.1 10.1 10.1 10.	0.8 1.1 PM2.5, 1-yr 5.0 5.0 5.0 5.0 5.0 5.0 5.0 5.0	0.1 0.0 SO2, 1-yr 5.0 5.0 5.0 5.0 5.0 5.0 5.0 5.0	16.4 NO2, 1-y 4.1 4.1 4.1 4.1 4.1 4.1 4.2 6.5
)3	R35 R40 ID R1 R2 R3 R4 R5 R6 R7 R8 R9 R10 R11	"Off-Property Limit" Maximum - Newfoundland/Labrador Name Young Naskapi Camp 1 Young Naskapi Camp 2 Innu Tent 3 (Rosemary Lake) Innu Tent 4 (Rosemary Lake) Innu Tent 5 (Rosemary Lake) Innu Tent 6 (Rosemary Lake) Innu Tent 1 (Elross Lake) Innu Tent 2 (Exact location tbd) Young Naskapi Camp 7 (Pinette Lake) Young Naskapi Camp 3 Young Naskapi Trailer tent (Triangle Lake)	4.2 12.8 TPM, 1-yr 15.1 15.1 15.1 15.1 15.1 15.1 15.1 15.1 15.1 15.1 15.1	2.1 4.9 PM10, 1-yr 10.1 10.1 10.1 10.1 10.1 10.1 10.1 10.1 10.1 10.1 10.1	0.8 1.1 PM2.5, 1-yr 5.0 5.0 5.0 5.0 5.0 5.0 5.0 5.	0.1 0.0 SO2, 1-yr 5.0 5.0 5.0 5.0 5.0 5.0 5.0 5.0	16.4 NO2, 1-y 4.1 4.1 4.1 4.1 4.1 4.1 4.2 6.5 5.2
)3	R35 R40 ID R1 R2 R3 R4 R5 R6 R7 R8 R9 R10 R11 R12	TSMC Workers' Camp "Off-Property Limit" Maximum - Newfoundland/Labrador Name Young Naskapi Camp 1 Young Naskapi Camp 2 Innu Tent 3 (Rosemary Lake) Innu Tent 4 (Rosemary Lake) Innu Tent 5 (Rosemary Lake) Innu Tent 6 (Rosemary Lake) Innu Tent 1 (Elross Lake) Innu Tent 2 (Exact location tbd) Young Naskapi Camp 7 (Pinette Lake) Young Naskapi Trailer tent (Triangle Lake) Young Naskapi Camp 5 (Elross Creek)	4.2 12.8 TPM, 1-yr 15.1 15.1 15.1 15.1 15.1 15.1 15.1 15.1 15.1 15.1 15.1 15.1	2.1 4.9 PM10, 1-yr 10.1 10.1 10.1 10.1 10.1 10.1 10.1 10.1 10.1 10.1 10.1 10.1	0.8 1.1 PM2.5, 1-yr 5.0 5.0 5.0 5.0 5.0 5.0 5.1 5.1	0.1 0.0 SO2, 1-yr 5.0 5.0 5.0 5.0 5.0 5.0 5.0 5.0	16.4 NO2, 1-y 4.1 4.1 4.1 4.1 4.1 4.1 4.2 4.2 6.5 5.2 4.9 5.1
)3	R35 R40 ID R1 R2 R3 R4 R5 R6 R7 R8 R9 R10 R11 R12 R13	TSMC Workers' Camp "Off-Property Limit" Maximum - Newfoundland/Labrador Name Young Naskapi Camp 1 Young Naskapi Camp 2 Innu Tent 3 (Rosemary Lake) Innu Tent 4 (Rosemary Lake) Innu Tent 5 (Rosemary Lake) Innu Tent 6 (Rosemary Lake) Innu Tent 1 (Elross Lake) Innu Tent 2 (Exact location tbd) Young Naskapi Camp 7 (Pinette Lake) Young Naskapi Trailer tent (Triangle Lake) Young Naskapi Camp 5 (Elross Creek) Naskapi - Uashat people's camp	4.2 12.8 TPM, 1-yr 15.1 15.1 15.1 15.1 15.1 15.1 15.1 15.1 15.1 15.1 15.1 15.1 15.1	2.1 4.9 PM10, 1-yr 10.1 10.1 10.1 10.1 10.1 10.1 10.1 10.1 10.1 10.1 10.1 10.1 10.1	0.8 1.1 PM2.5, 1-yr 5.0 5.0 5.0 5.0 5.0 5.0 5.1 5.1	0.1 0.0 SO2, 1-yr 5.0 5.0 5.0 5.0 5.0 5.0 5.0 5.0	16.4 NO2, 1-y 4.1 4.1 4.1 4.1 4.1 4.1 4.2 4.2 6.5 5.2 4.9 5.1 5.4
)3	R35 R40 ID R1 R2 R3 R4 R5 R6 R7 R8 R9 R10 R11 R12 R13 R14	TSMC Workers' Camp "Off-Property Limit" Maximum - Newfoundland/Labrador Name Young Naskapi Camp 1 Young Naskapi Camp 2 Innu Tent 3 (Rosemary Lake) Innu Tent 4 (Rosemary Lake) Innu Tent 5 (Rosemary Lake) Innu Tent 6 (Rosemary Lake) Innu Tent 1 (Elross Lake) Innu Tent 2 (Exact location tbd) Young Naskapi Camp 7 (Pinette Lake) Young Naskapi Trailer tent (Triangle Lake) Young Naskapi Camp 5 (Elross Creek) Naskapi - Uashat people's camp Young Naskapi Camp 4	4.2 12.8 TPM, 1-yr 15.1 15.1 15.1 15.1 15.1 15.1 15.1 15.1 15.1 15.1 15.1 15.1 15.1 15.1	2.1 4.9 PM10, 1-yr 10.1 10.1 10.1 10.1 10.1 10.1 10.1 10.1 10.1 10.1 10.5 10.6	0.8 1.1 PM2.5, 1-yr 5.0 5.0 5.0 5.0 5.0 5.0 5.1 5.1	0.1 0.0 SO2, 1-yr 5.0 5.0 5.0 5.0 5.0 5.0 5.0 5.0	16.4 NO2, 1-y 4.1 4.1 4.1 4.1 4.1 4.1 4.2 4.2 6.5 5.2 4.9 5.1 5.4 4.0
)3	R35 R40 ID R1 R2 R3 R4 R5 R6 R7 R8 R9 R10 R11 R12 R13 R14 R15	TSMC Workers' Camp "Off-Property Limit" Maximum - Newfoundland/Labrador Name Young Naskapi Camp 1 Young Naskapi Camp 2 Innu Tent 3 (Rosemary Lake) Innu Tent 4 (Rosemary Lake) Innu Tent 5 (Rosemary Lake) Innu Tent 6 (Rosemary Lake) Innu Tent 1 (Elross Lake) Innu Tent 2 (Exact location tbd) Young Naskapi Camp 7 (Pinette Lake) Young Naskapi Camp 3 Young Naskapi Camp 5 (Elross Creek) Naskapi - Uashat people's camp Young Naskapi Camp 4 Young Naskapi Camp 6 (Howells River)	4.2 12.8 TPM, 1-yr 15.1 15.0 15	2.1 4.9 PM10, 1-yr 10.1 10.1 10.1 10.1 10.1 10.1 10.1 10.1 10.1 10.7 10.4 10.3 10.2 10.5 10.0 10.1	0.8 1.1 PM2.5, 1-yr 5.0 5.0 5.0 5.0 5.0 5.0 5.1 5.1	0.1 0.0 SO2, 1-yr 5.0 5.0 5.0 5.0 5.0 5.0 5.0 5.0	16.4 NO2, 1-y 4.1 4.1 4.1 4.1 4.1 4.1 4.2 4.2 6.5 5.2 4.9 5.1 5.4 4.0 4.3
)3	R35 R40 ID R1 R2 R3 R4 R5 R6 R7 R8 R9 R10 R11 R12 R13 R14 R15 R17	TSMC Workers' Camp "Off-Property Limit" Maximum - Newfoundland/Labrador Name Young Naskapi Camp 1 Young Naskapi Camp 2 Innu Tent 3 (Rosemary Lake) Innu Tent 4 (Rosemary Lake) Innu Tent 5 (Rosemary Lake) Innu Tent 6 (Rosemary Lake) Innu Tent 1 (Elross Lake) Innu Tent 2 (Exact location tbd) Young Naskapi Camp 7 (Pinette Lake) Young Naskapi Camp 3 Young Naskapi Camp 5 (Elross Creek) Naskapi - Uashat people's camp Young Naskapi Camp 4 Young Naskapi Camp 6 (Howells River) Innu - Uashat - Mani-Utenam Camp 2	4.2 12.8 TPM, 1-yr 15.1 15.1 15.1 15.1 15.1 15.1 15.1 15.1 15.1 15.1 15.1 15.1 15.1 15.1 15.1 15.1 15.1 15.2	2.1 4.9 PM10, 1-yr 10.1	0.8 1.1 PM2.5, 1-yr 5.0 5.0 5.0 5.0 5.0 5.0 5.1 5.1	0.1 0.0 SO2, 1-yr 5.0 5.0 5.0 5.0 5.0 5.0 5.0 5.	16.4 NO2, 1-y 4.1 4.1 4.1 4.1 4.1 4.1 4.2 4.2 6.5 5.2 4.9 5.1 5.4 4.0 4.3 4.3
)3	R35 R40 ID R1 R2 R3 R4 R5 R6 R7 R8 R9 R10 R11 R12 R13 R14 R15 R17 R21	"Off-Property Limit" Maximum - Newfoundland/Labrador Name Young Naskapi Camp 1 Young Naskapi Camp 2 Innu Tent 3 (Rosemary Lake) Innu Tent 4 (Rosemary Lake) Innu Tent 5 (Rosemary Lake) Innu Tent 6 (Rosemary Lake) Innu Tent 1 (Elross Lake) Innu Tent 2 (Exact location tbd) Young Naskapi Camp 7 (Pinette Lake) Young Naskapi Camp 3 Young Naskapi Camp 5 (Elross Creek) Naskapi - Uashat people's camp Young Naskapi Camp 4 Young Naskapi Camp 6 (Howells River) Innu - Uashat - Mani-Utenam Camp 2 Bustard - Observation and hunting site 1	4.2 12.8 TPM, 1-yr 15.1 15.2 15.1	2.1 4.9 PM10, 1-yr 10.1	0.8 1.1 PM2.5, 1-yr 5.0 5.0 5.0 5.0 5.0 5.0 5.1 5.1	0.1 0.0 SO2, 1-yr 5.0 5.0 5.0 5.0 5.0 5.0 5.0 5.	16.4 NO2, 1-y 4.1 4.1 4.1 4.1 4.1 4.1 4.2 4.2 6.5 5.2 4.9 5.1 5.4 4.0 4.3 4.3
)3	R35 R40 ID R1 R2 R3 R4 R5 R6 R7 R8 R9 R10 R11 R12 R13 R14 R15 R17 R21 R21	TSMC Workers' Camp "Off-Property Limit" Maximum - Newfoundland/Labrador Name Young Naskapi Camp 1 Young Naskapi Camp 2 Innu Tent 3 (Rosemary Lake) Innu Tent 4 (Rosemary Lake) Innu Tent 5 (Rosemary Lake) Innu Tent 6 (Rosemary Lake) Innu Tent 1 (Elross Lake) Innu Tent 2 (Exact location tbd) Young Naskapi Camp 7 (Pinette Lake) Young Naskapi Camp 3 Young Naskapi Camp 5 (Elross Creek) Naskapi - Uashat people's camp Young Naskapi Camp 4 Young Naskapi Camp 6 (Howells River) Innu - Uashat - Mani-Utenam Camp 2 Bustard - Observation and hunting site 1 Bustard - Observation and hunting site 2	4.2 12.8 TPM, 1-yr 15.1	2.1 4.9 PM10, 1-yr 10.1 10.1 10.1 10.1 10.1 10.1 10.1 10.7 10.4 10.3 10.2 10.5 10.0 10.1 10.1 10.1 10.1	0.8 1.1 PM2.5, 1-yr 5.0 5.0 5.0 5.0 5.0 5.0 5.1 5.1	0.1 0.0 SO2, 1-yr 5.0 5.0 5.0 5.0 5.0 5.0 5.0 5.	16.4 NO2, 1-y 4.1 4.1 4.1 4.1 4.1 4.2 4.2 6.5 5.2 4.9 5.1 5.4 4.0 4.3 4.3 4.0 4.2
ALL: Background + DSO3 + DSO4 + HOWSE	R35 R40 ID R1 R2 R3 R4 R5 R6 R7 R8 R9 R10 R11 R12 R13 R14 R15 R17 R21 R22 R22 R24	TSMC Workers' Camp "Off-Property Limit" Maximum - Newfoundland/Labrador Name Young Naskapi Camp 1 Young Naskapi Camp 2 Innu Tent 3 (Rosemary Lake) Innu Tent 4 (Rosemary Lake) Innu Tent 5 (Rosemary Lake) Innu Tent 6 (Rosemary Lake) Innu Tent 1 (Elross Lake) Innu Tent 2 (Exact location tbd) Young Naskapi Camp 7 (Pinette Lake) Young Naskapi Trailer tent (Triangle Lake) Young Naskapi Trailer tent (Triangle Lake) Young Naskapi Camp 5 (Elross Creek) Naskapi - Uashat people's camp Young Naskapi Camp 4 Young Naskapi Camp 6 (Howells River) Innu - Uashat - Mani-Utenam Camp 2 Bustard - Observation and hunting site 1 Bustard - Observation and hunting site 2 Irony Mountain	4.2 12.8 TPM, 1-yr 15.1	2.1 4.9 PM10, 1-yr 10.1	0.8 1.1 PM2.5, 1-yr 5.0 5.0 5.0 5.0 5.0 5.0 5.1 5.1	0.1 0.0 SO2, 1-yr 5.0 5.0 5.0 5.0 5.0 5.0 5.0 5.	16.4 NO2, 1-y 4.1 4.1 4.1 4.1 4.1 4.1 4.2 4.2 6.5 5.2 4.9 5.1 5.4 4.0 4.3 4.3 4.0 4.2 6.4
)3	R35 R40 ID R1 R2 R3 R4 R5 R6 R7 R8 R9 R10 R11 R12 R13 R14 R15 R17 R22 R24 R33	TSMC Workers' Camp "Off-Property Limit" Maximum - Newfoundland/Labrador Name Young Naskapi Camp 1 Young Naskapi Camp 2 Innu Tent 3 (Rosemary Lake) Innu Tent 4 (Rosemary Lake) Innu Tent 5 (Rosemary Lake) Innu Tent 6 (Rosemary Lake) Innu Tent 1 (Elross Lake) Innu Tent 2 (Exact location tbd) Young Naskapi Camp 7 (Pinette Lake) Young Naskapi Trailer tent (Triangle Lake) Young Naskapi Camp 5 (Elross Creek) Naskapi - Uashat people's camp Young Naskapi Camp 4 Young Naskapi Camp 6 (Howells River) Innu - Uashat - Mani-Utenam Camp 2 Bustard - Observation and hunting site 1 Bustard - Observation and hunting site 2 Irony Mountain	4.2 12.8 TPM, 1-yr 15.1	2.1 4.9 PM10, 1-yr 10.1 10.6 10.1	0.8 1.1 PM2.5, 1-yr 5.0 5.0 5.0 5.0 5.0 5.0 5.1 5.1	0.1 0.0 SO2, 1-yr 5.0 5.0 5.0 5.0 5.0 5.0 5.0 5.	16.4 NO2, 1-y 4.1 4.1 4.1 4.1 4.1 4.1 4.2 4.2 6.5 5.2 4.9 5.1 5.4 4.0 4.3 4.3 4.0 4.2 6.4 4.2
)3	R35 R40 ID R1 R2 R3 R4 R5 R6 R7 R8 R9 R10 R11 R12 R13 R14 R15 R17 R21 R22 R24 R33 R34	TSMC Workers' Camp "Off-Property Limit" Maximum - Newfoundland/Labrador Name Young Naskapi Camp 1 Young Naskapi Camp 2 Innu Tent 3 (Rosemary Lake) Innu Tent 4 (Rosemary Lake) Innu Tent 5 (Rosemary Lake) Innu Tent 6 (Rosemary Lake) Innu Tent 1 (Elross Lake) Innu Tent 2 (Exact location tbd) Young Naskapi Camp 7 (Pinette Lake) Young Naskapi Trailer tent (Triangle Lake) Young Naskapi Trailer tent (Triangle Lake) Young Naskapi Camp 5 (Elross Creek) Naskapi - Uashat people's camp Young Naskapi Camp 4 Young Naskapi Camp 6 (Howells River) Innu - Uashat - Mani-Utenam Camp 2 Bustard - Observation and hunting site 1 Bustard - Observation and hunting site 2 Irony Mountain Naskapi Cabin 1 Naskapi Cabin 2 (Elross Lake)	4.2 12.8 TPM, 1-yr 15.1 15.1 15.1 15.1 15.1 15.1 15.1 15.1 15.1 15.4 15.9 15.1 15.1 15.1 15.1 15.1 15.1 15.1 15.1 15.1 15.1 15.1	2.1 4.9 PM10, 1-yr 10.1 10.1 10.1 10.1 10.1 10.1 10.1 10.7 10.4 10.3 10.2 10.5 10.0 10.1 10.1 10.1 10.1 10.1 10.1 10.1 10.1 10.1	0.8 1.1 PM2.5, 1-yr 5.0 5.0 5.0 5.0 5.0 5.0 5.1 5.1	0.1 0.0 SO2, 1-yr 5.0 5.0 5.0 5.0 5.0 5.0 5.0 5.	16.4 NO2, 1-y 4.1 4.1 4.1 4.1 4.1 4.1 4.2 4.2 6.5 5.2 4.9 5.1 5.4 4.0 4.3 4.3 4.0 4.2 6.4 4.2 4.2
)3	R35 R40 ID R1 R2 R3 R4 R5 R6 R7 R8 R9 R10 R11 R12 R13 R14 R15 R17 R22 R24 R33 R34 R33	"Off-Property Limit" Maximum - Newfoundland/Labrador Name Young Naskapi Camp 1 Young Naskapi Camp 2 Innu Tent 3 (Rosemary Lake) Innu Tent 4 (Rosemary Lake) Innu Tent 5 (Rosemary Lake) Innu Tent 6 (Rosemary Lake) Innu Tent 1 (Elross Lake) Innu Tent 2 (Exact location tbd) Young Naskapi Camp 7 (Pinette Lake) Young Naskapi Camp 3 Young Naskapi Trailer tent (Triangle Lake) Young Naskapi Camp 5 (Elross Creek) Naskapi - Uashat people's camp Young Naskapi Camp 6 (Howells River) Innu - Uashat - Mani-Utenam Camp 2 Bustard - Observation and hunting site 1 Bustard - Observation and hunting site 2 Irony Mountain Naskapi Cabin 1 Naskapi Cabin 3 (Elross Lake) Naskapi Cabin 3 (Elross Lake)	4.2 12.8 TPM, 1-yr 15.1 15.1 15.1 15.1 15.1 15.1 15.1 15.1 15.1 15.4 15.8 15.6 15.4 15.9 15.1 15.1 15.1 15.1 15.1 15.1 15.1 15.1	2.1 4.9 PM10, 1-yr 10.1 10.1 10.1 10.1 10.1 10.1 10.1 10.7 10.4 10.3 10.5 10.0 10.1 10.1 10.1 10.1 10.1 10.1 10.1 10.1 10.1 10.1	0.8 1.1 PM2.5, 1-yr 5.0 5.0 5.0 5.0 5.0 5.0 5.0 5.	0.1 0.0 SO2, 1-yr 5.0 5.0 5.0 5.0 5.0 5.0 5.0 5.0 5.0 5.0	16.4 NO2, 1-y 4.1 4.1 4.1 4.1 4.2 4.2 6.5 5.2 4.9 5.1 5.4 4.0 4.3 4.3 4.0 4.2 4.2 4.3
)3	R35 R40 ID R1 R2 R3 R4 R5 R6 R7 R8 R9 R10 R11 R12 R13 R14 R15 R17 R22 R24 R33 R34 R33	TSMC Workers' Camp "Off-Property Limit" Maximum - Newfoundland/Labrador Name Young Naskapi Camp 1 Young Naskapi Camp 2 Innu Tent 3 (Rosemary Lake) Innu Tent 4 (Rosemary Lake) Innu Tent 5 (Rosemary Lake) Innu Tent 6 (Rosemary Lake) Innu Tent 1 (Elross Lake) Innu Tent 2 (Exact location tbd) Young Naskapi Camp 7 (Pinette Lake) Young Naskapi Trailer tent (Triangle Lake) Young Naskapi Trailer tent (Triangle Lake) Young Naskapi Camp 5 (Elross Creek) Naskapi - Uashat people's camp Young Naskapi Camp 4 Young Naskapi Camp 6 (Howells River) Innu - Uashat - Mani-Utenam Camp 2 Bustard - Observation and hunting site 1 Bustard - Observation and hunting site 2 Irony Mountain Naskapi Cabin 1 Naskapi Cabin 2 (Elross Lake)	4.2 12.8 TPM, 1-yr 15.1 15.1 15.1 15.1 15.1 15.1 15.1 15.1 15.1 15.4 15.9 15.1 15.1 15.1 15.1 15.1 15.1 15.1 15.1 15.1 15.1 15.1	2.1 4.9 PM10, 1-yr 10.1 10.1 10.1 10.1 10.1 10.1 10.1 10.7 10.4 10.3 10.2 10.5 10.0 10.1 10.1 10.1 10.1 10.1 10.1 10.1 10.1 10.1	0.8 1.1 PM2.5, 1-yr 5.0 5.0 5.0 5.0 5.0 5.0 5.1 5.1	0.1 0.0 SO2, 1-yr 5.0 5.0 5.0 5.0 5.0 5.0 5.0 5.	16.4 NO2, 1-y 4.1 4.1 4.1 4.1 4.1 4.1 4.2 4.2 6.5 5.2 4.9 5.1 5.4 4.0 4.3 4.3 4.0 4.2 6.4 4.2 4.2

Pollutant

Averaging Period

TPM

PM10

1-yr

⁻ all values in $\mu g/m3$. Red cell, if any, indicates above criteria.

^{*} nth highest levels as per NL Guidance Document GD-PPD-009.4 (2012)

Table 3-2 Summary Results – Daily (24-hr) Concentrations

				<i>RESUL</i> 1	S - 24-H	Ir AVG.	
		Pollutant	TPM	PM10	PM2.5	SO2	NO2
		Averaging Period	24-hr	24-hr	24-hr	24-hr	24-hr
		NL Ambient Air Quality Standard	120	50	25	300	200
		· · · · · · · · · · · · · · · · · · ·		2 nd	2 nd	2 nd	2 nd
		Level or rank *	2 nd	2"	2"	2	2
		BACKGROUND CONCENTRATIONS - PRE-DSO3	15	10	5	5	3.8
	ID	Description	TPM, 24-hr	PM10, 24-hr	PM2.5, 24-hr	SO2, 24-hr	NO2, 24-hr
	R1	Young Naskapi Camp 1	0.8	0.4	0.3	0.0	5.8
	R2	Young Naskapi Camp 2	0.8	0.4	0.3	0.0	5.6
	R3	Innu Tent 3 (Rosemary Lake)	0.8	0.4	0.3	0.0	5.7
	R4	Innu Tent 4 (Rosemary Lake)	0.8	0.4	0.2	0.0	4.9
	R5	Innu Tent 5 (Rosemary Lake)	0.8	0.4	0.2	0.0	4.8
		Innu Tent 6 (Rosemary Lake)	0.9	0.5	0.3	0.0	5.5
	R7	Innu Tent 1 (Elross Lake)	0.8	0.5	0.3	0.0	6.1
DSO3 + DSO4 ONLY	R8	Innu Tent 2 (Exact location tbd)	0.9	0.6	0.4	0.0	10.3
\leq	R9	Young Naskapi Camp 7 (Pinette Lake)	4.4	2.6	2.0	0.0	44.5
0	R10	Young Naskapi Camp 3	2.6	1.0	0.7	0.0	17.1
7	R11	Young Naskapi Trailer tent (Triangle Lake)	2.0	1.0	0.5	0.0	13.7
SC	R12	Young Naskapi Camp 5 (Elross Creek)	2.0	1.4	1.2	0.0	25.2
	R13	Naskapi - Uashat people's camp	3.1	1.2	0.6	0.0	14.9
3+	R14	Young Naskapi Camp 4	0.6	0.4	0.2	0.0	4.5
Ö	R15	Young Naskapi Camp 6 (Howells River)	0.9	0.5	0.3	0.0	7.7
)S		Innu - Uashat - Mani-Utenam Camp 2	1.1	0.6	0.3	0.0	6.7
_	R21	Bustard - Observation and hunting site 1	0.6	0.3	0.1	0.0	2.3
	R22	Bustard - Observation and hunting site 2	0.9	0.5	0.4	0.0	7.0
	R24	Irony Mountain	4.5	2.4	1.3	0.0	34.3
	R33	Naskapi Cabin 1	1.0	0.7	0.5	0.0	10.8
	R34	Naskapi Cabin 2 (Elross Lake)	0.8	0.5	0.3	0.0	8.7
	R35	Naskapi Cabin 3 (Elross Lake)	0.9	0.6	0.4	0.0	7.5
	R40	TSMC Workers' Camp	16.1	7.9	5.6	0.5	203.7
		"Off-Property Limit" Maximum - Newfoundland/Labrador	85.9	31.1	6.2	0.1	139.6
	ID	Name	TPM, 24-hr	PM10, 24-hr	PM2.5, 24-hr	SO2, 24-hr	NO2, 24-hr
	R1	Young Naskapi Camp 1	1.5	0.7	0.2	0.0	1.8
		Young Naskapi Camp 2	1.5	0.7	0.2	0.0	1.8
	R3	i 	1.5	0.7	0.2		1.8
	R4	Innu Tent 3 (Rosemary Lake) Innu Tent 4 (Rosemary Lake)	1.8	0.7	0.2	0.0	2.0
		` , ,					
		Innu Tent 5 (Rosemary Lake)	1.9 1.6	0.9	0.2	0.0	2.3 1.8
		Innu Tent 6 (Rosemary Lake) Innu Tent 1 (Elross Lake)	1.0	0.8	0.2	0.0	1.4
	R8	Innu Tent 2 (Exact location tbd)	1.1	0.5	0.1	0.0	1.6
>	R9	Young Naskapi Camp 7 (Pinette Lake)	9.1	4.0	1.0	0.0	10.2
	R10	Young Naskapi Camp 7 (Pinette Lake)	10.4	5.0	1.0	0.0	10.2
	R11	Young Naskapi Camp 3 Young Naskapi Trailer tent (Triangle Lake)	5.6	2.5	0.5	0.0	6.5
Ε (R12	Young Naskapi Camp 5 (Elross Creek)	2.3	1.1	0.3	0.0	2.4
HOWSE ONLY	R13	Naskapi - Uashat people's camp	11.1	7.2	1.5	0.0	13.7
\leq	R14	Young Naskapi Camp 4	0.9	0.4	0.1	0.0	1.4
7		Young Naskapi Camp 6 (Howells River)	0.8	0.4	0.1	0.0	1.3
_	1/13	Toung waskapi camp o (Howells Kivel)	0.0	0.4	U. I	0.0	1.0

3.1

0.7

1.4

10.1

1.5

1.1

15.3

74.9

1.6

0.4

0.8

6.2

0.7

0.7

0.6

7.9

32.3

0.5

0.1

0.2

1.4

0.2

0.1

0.1

2.5

8.6

0.0

0.0

0.0

0.0

0.0

0.0

0.0

0.2

0.4

5.2

8.0

2.2

16.7

1.8

1.5

1.3

33.2

81.4

R17 Innu - Uashat - Mani-Utenam Camp 2

R24 Irony Mountain

R33 Naskapi Cabin 1

R34 Naskapi Cabin 2 (Elross Lake)

R35 Naskapi Cabin 3 (Elross Lake)

R40 TSMC Workers' Camp

R21 Bustard - Observation and hunting site 1

R22 Bustard - Observation and hunting site 2

^{-- &}quot;Off-Property Limit" Maximum - Newfoundland/Labrador - all values in µg/m³. Red cell, if any, indicates above criteria.

^{*} nth highest levels as per NL Guidance Document GD-PPD-009.4 (2012)

Table 3-2 Summary Results – Daily (24-hr) Concentrations (Continued)

RESULTS - 24-Hr AVG. (cont'd)

		Dollutant	TDM	DN 410	DIACE	con	NOO
		Pollutant		PM10	PM2.5	SO2	NO2
		Averaging Period	24-hr	24-hr	24-hr	24-hr	24-hr
		NL Ambient Air Quality Standard	120	50	25	300	200
		Level or rank *	2 nd	2 nd	2 nd	2 nd	2 nd
		DAGUADAUND AGUATUTA TIGUA DEFENDA					
		BACKGROUND CONCENTRATIONS - PRE-DSO3	15	10	5	5	3.8
	ID	Name	TPM, 24-hr	DM10 24 br	PM2.5, 24-hr	SO2, 24-hr	NO2, 24-hr
				'		•	
	R1	Young Naskapi Camp 1	2.1	1.0	0.4	0.0	7.4
	R2	Young Naskapi Camp 2	2.1	1.0	0.4	0.0	7.2
	R3	Innu Tent 3 (Rosemary Lake)	2.1	1.0	0.4	0.0	7.3
	R4	Innu Tent 4 (Rosemary Lake)	2.4	1.2	0.4	0.0	7.0
	R5	Innu Tent 5 (Rosemary Lake)	2.4	1.3	0.4	0.0	7.1
	R6	Innu Tent 6 (Rosemary Lake)	2.2	1.0	0.4	0.0	6.9
DSO3 + DSO4 + HOWSE	R7	Innu Tent 1 (Elross Lake)	2.1	1.0	0.3	0.0	7.1
\geq	R8	Innu Tent 2 (Exact location tbd)	1.6	1.1	0.5	0.0	11.7
0	R9	Young Naskapi Camp 7 (Pinette Lake)	11.1	5.4	2.0	0.0	44.5
工	R10	Young Naskapi Camp 3	12.0	5.8	1.4	0.0	27.3
+		Young Naskapi Trailer tent (Triangle Lake)	6.8	3.2	0.8	0.0	14.0
74		Young Naskapi Camp 5 (Elross Creek)	3.9	1.8	1.2	0.0	25.4
)S(R13	Naskapi - Uashat people's camp	15.8	8.0	1.7	0.0	20.1
	R14	Young Naskapi Camp 4	1.3	0.7	0.3	0.0	5.5
+	R15	Young Naskapi Camp 6 (Howells River)	1.7	0.9	0.3	0.0	7.7
03	R17	Innu - Uashat - Mani-Utenam Camp 2	4.1	2.0	0.7	0.0	12.1
)S(R21	Bustard - Observation and hunting site 1	1.4	0.7	0.1	0.0	3.1
		Bustard - Observation and hunting site 2	2.0	1.2	0.5	0.0	8.9
	R24	Irony Mountain	14.3	8.6	1.9	0.1	37.1
		Naskapi Cabin 1	1.8	1.1	0.6	0.0	12.0
		Naskapi Cabin 2 (Elross Lake)	2.0	0.9	0.4	0.0	8.7
		Naskapi Cabin 3 (Elross Lake)	1.8	1.0	0.4	0.0	7.6
		TSMC Workers' Camp	29.3	14.6	5.6	0.5	204.3
					,	,	
		"Off-Property Limit" Maximum - Newfoundland/Labrador	99.2	37.1	8.8	0.4	139.6
		"Off-Property Limit" Maximum - Newfoundland/Labrador	99.2	37.1	8.8	0.4	139.6
	ID	Name	TPM, 24-hr	PM10, 24-hr	PM2.5, 24-hr	SO2, 24-hr	NO2, 24-hr
	ID R1	Name Young Naskapi Camp 1	TPM, 24-hr 17.1	PM10, 24-hr 11.0	PM2.5, 24-hr 5.4	SO2, 24-hr 5.0	NO2, 24-hr 11.2
	ID R1 R2	Name Young Naskapi Camp 1 Young Naskapi Camp 2	TPM, 24-hr 17.1 17.1	PM10, 24-hr 11.0 11.0	PM2.5, 24-hr 5.4 5.4	SO2, 24-hr 5.0 5.0	NO2, 24-hr 11.2 11.0
	ID R1 R2 R3	Name Young Naskapi Camp 1 Young Naskapi Camp 2 Innu Tent 3 (Rosemary Lake)	TPM, 24-hr 17.1 17.1 17.1	PM10, 24-hr 11.0 11.0 11.0	PM2.5, 24-hr 5.4 5.4 5.4	SO2, 24-hr 5.0 5.0 5.0	NO2, 24-hr 11.2 11.0 11.1
SE	ID R1 R2 R3 R4	Name Young Naskapi Camp 1 Young Naskapi Camp 2 Innu Tent 3 (Rosemary Lake) Innu Tent 4 (Rosemary Lake)	TPM, 24-hr 17.1 17.1 17.1 17.4	PM10, 24-hr 11.0 11.0 11.0 11.2	PM2.5, 24-hr 5.4 5.4 5.4 5.4	SO2, 24-hr 5.0 5.0 5.0 5.0	NO2, 24-hr 11.2 11.0 11.1 10.8
)WSE	ID R1 R2 R3 R4 R5	Name Young Naskapi Camp 1 Young Naskapi Camp 2 Innu Tent 3 (Rosemary Lake) Innu Tent 4 (Rosemary Lake) Innu Tent 5 (Rosemary Lake)	TPM, 24-hr 17.1 17.1 17.1 17.4 17.4	PM10, 24-hr 11.0 11.0 11.0 11.2 11.3	PM2.5, 24-hr 5.4 5.4 5.4 5.4 5.4	\$02, 24-hr 5.0 5.0 5.0 5.0 5.0	NO2, 24-hr 11.2 11.0 11.1 10.8 10.9
HOWSE	R1 R2 R3 R4 R5 R6	Name Young Naskapi Camp 1 Young Naskapi Camp 2 Innu Tent 3 (Rosemary Lake) Innu Tent 4 (Rosemary Lake) Innu Tent 5 (Rosemary Lake) Innu Tent 6 (Rosemary Lake)	TPM, 24-hr 17.1 17.1 17.1 17.4 17.4 17.2	PM10, 24-hr 11.0 11.0 11.0 11.2 11.3 11.0	PM2.5, 24-hr 5.4 5.4 5.4 5.4 5.4 5.4 5.4 5.4	502, 24-hr 5.0 5.0 5.0 5.0 5.0 5.0	NO2, 24-hr 11.2 11.0 11.1 10.8 10.9 10.7
+ HOWSE	ID R1 R2 R3 R4 R5 R6	Name Young Naskapi Camp 1 Young Naskapi Camp 2 Innu Tent 3 (Rosemary Lake) Innu Tent 4 (Rosemary Lake) Innu Tent 5 (Rosemary Lake) Innu Tent 6 (Rosemary Lake) Innu Tent 1 (Elross Lake)	TPM, 24-hr 17.1 17.1 17.1 17.4 17.4 17.2 17.1	PM10, 24-hr 11.0 11.0 11.0 11.2 11.3 11.0	PM2.5, 24-hr 5.4 5.4 5.4 5.4 5.4 5.4 5.4 5.3	\$02, 24-hr 5.0 5.0 5.0 5.0 5.0 5.0 5.0 5.0	NO2, 24-hr 11.2 11.0 11.1 10.8 10.9 10.7 10.9
O4 + HOWSE	ID R1 R2 R3 R4 R5 R6 R7	Name Young Naskapi Camp 1 Young Naskapi Camp 2 Innu Tent 3 (Rosemary Lake) Innu Tent 4 (Rosemary Lake) Innu Tent 5 (Rosemary Lake) Innu Tent 6 (Rosemary Lake) Innu Tent 1 (Elross Lake) Innu Tent 2 (Exact location tbd)	TPM, 24-hr 17.1 17.1 17.1 17.4 17.4 17.2 17.1 16.6	PM10, 24-hr 11.0 11.0 11.0 11.2 11.3 11.0 11.0	PM2.5, 24-hr 5.4 5.4 5.4 5.4 5.4 5.4 5.4 5.4 5.5 5.5	\$02, 24-hr 5.0 5.0 5.0 5.0 5.0 5.0 5.0 5.0	NO2, 24-hr 11.2 11.0 11.1 10.8 10.9 10.7 10.9 15.5
JSO4 + HOWSE	ID R1 R2 R3 R4 R5 R6 R7 R8	Name Young Naskapi Camp 1 Young Naskapi Camp 2 Innu Tent 3 (Rosemary Lake) Innu Tent 4 (Rosemary Lake) Innu Tent 5 (Rosemary Lake) Innu Tent 6 (Rosemary Lake) Innu Tent 1 (Elross Lake) Innu Tent 2 (Exact location tbd) Young Naskapi Camp 7 (Pinette Lake)	TPM, 24-hr 17.1 17.1 17.1 17.4 17.4 17.2 17.1 16.6 26.1	PM10, 24-hr 11.0 11.0 11.0 11.2 11.3 11.0 11.0 11.1	PM2.5, 24-hr 5.4 5.4 5.4 5.4 5.4 5.4 5.4 5.4 5.5 7.0	\$02, 24-hr 5.0 5.0 5.0 5.0 5.0 5.0 5.0 5.0	NO2, 24-hr 11.2 11.0 11.1 10.8 10.9 10.7 10.9 15.5 48.3
+ DSO4 + HOWSE	ID R1 R2 R3 R4 R5 R6 R7 R8 R9	Name Young Naskapi Camp 1 Young Naskapi Camp 2 Innu Tent 3 (Rosemary Lake) Innu Tent 4 (Rosemary Lake) Innu Tent 5 (Rosemary Lake) Innu Tent 6 (Rosemary Lake) Innu Tent 1 (Elross Lake) Innu Tent 2 (Exact location tbd) Young Naskapi Camp 7 (Pinette Lake)	TPM, 24-hr 17.1 17.1 17.1 17.4 17.4 17.2 17.1 16.6	PM10, 24-hr 11.0 11.0 11.0 11.2 11.3 11.0 11.0	PM2.5, 24-hr 5.4 5.4 5.4 5.4 5.4 5.4 5.4 5.4 5.5 5.5	\$02, 24-hr 5.0 5.0 5.0 5.0 5.0 5.0 5.0 5.0	NO2, 24-hr 11.2 11.0 11.1 10.8 10.9 10.7 10.9 15.5
+	ID R1 R2 R3 R4 R5 R6 R7 R8 R9	Name Young Naskapi Camp 1 Young Naskapi Camp 2 Innu Tent 3 (Rosemary Lake) Innu Tent 4 (Rosemary Lake) Innu Tent 5 (Rosemary Lake) Innu Tent 6 (Rosemary Lake) Innu Tent 1 (Elross Lake) Innu Tent 2 (Exact location tbd) Young Naskapi Camp 7 (Pinette Lake) Young Naskapi Camp 3 Young Naskapi Trailer tent (Triangle Lake)	TPM, 24-hr 17.1 17.1 17.1 17.4 17.4 17.2 17.1 16.6 26.1 27.0 21.8	PM10, 24-hr 11.0 11.0 11.0 11.2 11.3 11.0 11.0 11.1	PM2.5, 24-hr 5.4 5.4 5.4 5.4 5.4 5.4 5.4 5.5 7.0 6.4 5.8	\$02, 24-hr 5.0 5.0 5.0 5.0 5.0 5.0 5.0 5.0	NO2, 24-hr 11.2 11.0 11.1 10.8 10.9 10.7 10.9 15.5 48.3
+	ID R1 R2 R3 R4 R5 R6 R7 R8 R9	Name Young Naskapi Camp 1 Young Naskapi Camp 2 Innu Tent 3 (Rosemary Lake) Innu Tent 4 (Rosemary Lake) Innu Tent 5 (Rosemary Lake) Innu Tent 6 (Rosemary Lake) Innu Tent 1 (Elross Lake) Innu Tent 2 (Exact location tbd) Young Naskapi Camp 7 (Pinette Lake)	TPM, 24-hr 17.1 17.1 17.1 17.4 17.4 17.2 17.1 16.6 26.1 27.0	PM10, 24-hr 11.0 11.0 11.0 11.2 11.3 11.0 11.0 11.1 15.4 15.8	PM2.5, 24-hr 5.4 5.4 5.4 5.4 5.4 5.4 5.4 5.3 6.6	\$02, 24-hr 5.0 5.0 5.0 5.0 5.0 5.0 5.0 5.0	NO2, 24-hr 11.2 11.0 11.1 10.8 10.9 10.7 10.9 15.5 48.3 31.1
+	ID R1 R2 R3 R4 R5 R6 R7 R8 R9 R10 R11	Name Young Naskapi Camp 1 Young Naskapi Camp 2 Innu Tent 3 (Rosemary Lake) Innu Tent 4 (Rosemary Lake) Innu Tent 5 (Rosemary Lake) Innu Tent 6 (Rosemary Lake) Innu Tent 1 (Elross Lake) Innu Tent 2 (Exact location tbd) Young Naskapi Camp 7 (Pinette Lake) Young Naskapi Camp 3 Young Naskapi Trailer tent (Triangle Lake)	TPM, 24-hr 17.1 17.1 17.1 17.4 17.4 17.2 17.1 16.6 26.1 27.0 21.8	PM10, 24-hr 11.0 11.0 11.0 11.2 11.3 11.0 11.0 11.1 15.4 15.8 13.2	PM2.5, 24-hr 5.4 5.4 5.4 5.4 5.4 5.4 5.4 5.5 7.0 6.4 5.8	\$02, 24-hr 5.0 5.0 5.0 5.0 5.0 5.0 5.0 5.0	NO2, 24-hr 11.2 11.0 11.1 10.8 10.9 10.7 10.9 15.5 48.3 31.1 17.8
+	ID R1 R2 R3 R4 R5 R6 R7 R8 R9 R10 R11 R12	Name Young Naskapi Camp 1 Young Naskapi Camp 2 Innu Tent 3 (Rosemary Lake) Innu Tent 4 (Rosemary Lake) Innu Tent 5 (Rosemary Lake) Innu Tent 6 (Rosemary Lake) Innu Tent 1 (Elross Lake) Innu Tent 2 (Exact location tbd) Young Naskapi Camp 7 (Pinette Lake) Young Naskapi Trailer tent (Triangle Lake) Young Naskapi Camp 5 (Elross Creek)	TPM, 24-hr 17.1 17.1 17.1 17.4 17.4 17.2 17.1 16.6 26.1 27.0 21.8 18.9	PM10, 24-hr 11.0 11.0 11.0 11.2 11.3 11.0 11.0 11.1 15.4 15.8 13.2 11.8	PM2.5, 24-hr 5.4 5.4 5.4 5.4 5.4 5.4 5.4 5.5 7.0 6.4 5.8 6.2	\$02, 24-hr 5.0 5.0 5.0 5.0 5.0 5.0 5.0 5.0 5.0 5.0	NO2, 24-hr 11.2 11.0 11.1 10.8 10.9 10.7 10.9 15.5 48.3 31.1 17.8 29.2
+	ID R1 R2 R3 R4 R5 R6 R7 R8 R9 R10 R11 R12 R13 R14	Name Young Naskapi Camp 1 Young Naskapi Camp 2 Innu Tent 3 (Rosemary Lake) Innu Tent 4 (Rosemary Lake) Innu Tent 5 (Rosemary Lake) Innu Tent 6 (Rosemary Lake) Innu Tent 1 (Elross Lake) Innu Tent 2 (Exact location tbd) Young Naskapi Camp 7 (Pinette Lake) Young Naskapi Camp 3 Young Naskapi Trailer tent (Triangle Lake) Young Naskapi Camp 5 (Elross Creek) Naskapi - Uashat people's camp	TPM, 24-hr 17.1 17.1 17.1 17.4 17.4 17.2 17.1 16.6 26.1 27.0 21.8 18.9 30.8	PM10, 24-hr 11.0 11.0 11.0 11.2 11.3 11.0 11.0 11.1 15.4 15.8 13.2 11.8 18.0	PM2.5, 24-hr 5.4 5.4 5.4 5.4 5.4 5.4 5.3 5.5 7.0 6.4 5.8 6.2 6.7	\$02, 24-hr 5.0 5.0 5.0 5.0 5.0 5.0 5.0 5.0 5.0 5.0	NO2, 24-hr 11.2 11.0 11.1 10.8 10.9 10.7 10.9 15.5 48.3 31.1 17.8 29.2 23.9
+	ID R1 R2 R3 R4 R5 R6 R7 R8 R9 R10 R11 R12 R13 R14	Name Young Naskapi Camp 1 Young Naskapi Camp 2 Innu Tent 3 (Rosemary Lake) Innu Tent 4 (Rosemary Lake) Innu Tent 5 (Rosemary Lake) Innu Tent 6 (Rosemary Lake) Innu Tent 1 (Elross Lake) Innu Tent 2 (Exact location tbd) Young Naskapi Camp 7 (Pinette Lake) Young Naskapi Trailer tent (Triangle Lake) Young Naskapi Camp 5 (Elross Creek) Naskapi - Uashat people's camp Young Naskapi Camp 4	TPM, 24-hr 17.1 17.1 17.1 17.4 17.4 17.2 17.1 16.6 26.1 27.0 21.8 18.9 30.8 16.3	PM10, 24-hr 11.0 11.0 11.0 11.2 11.3 11.0 11.0 11.1 15.4 15.8 13.2 11.8 18.0 10.7	PM2.5, 24-hr 5.4 5.4 5.4 5.4 5.4 5.4 5.3 5.5 7.0 6.4 5.8 6.2 6.7 5.3	\$02, 24-hr 5.0 5.0 5.0 5.0 5.0 5.0 5.0 5.0 5.0 5.0	NO2, 24-hr 11.2 11.0 11.1 10.8 10.9 10.7 10.9 15.5 48.3 31.1 17.8 29.2 23.9 9.3
+	R1 R2 R3 R4 R5 R6 R7 R8 R9 R10 R11 R12 R13 R14 R15 R17	Name Young Naskapi Camp 1 Young Naskapi Camp 2 Innu Tent 3 (Rosemary Lake) Innu Tent 4 (Rosemary Lake) Innu Tent 5 (Rosemary Lake) Innu Tent 6 (Rosemary Lake) Innu Tent 1 (Elross Lake) Innu Tent 1 (Elross Lake) Innu Tent 2 (Exact location tbd) Young Naskapi Camp 7 (Pinette Lake) Young Naskapi Camp 3 Young Naskapi Trailer tent (Triangle Lake) Young Naskapi Camp 5 (Elross Creek) Naskapi - Uashat people's camp Young Naskapi Camp 4 Young Naskapi Camp 6 (Howells River)	TPM, 24-hr 17.1 17.1 17.1 17.4 17.4 17.2 17.1 16.6 26.1 27.0 21.8 18.9 30.8 16.3 16.7	PM10, 24-hr 11.0 11.0 11.0 11.2 11.3 11.0 11.0 11.1 15.4 15.8 13.2 11.8 18.0 10.7 10.9	PM2.5, 24-hr 5.4 5.4 5.4 5.4 5.4 5.4 5.3 5.5 7.0 6.4 5.8 6.2 6.7 5.3 5.3	\$02, 24-hr 5.0 5.0 5.0 5.0 5.0 5.0 5.0 5.	NO2, 24-hr 11.2 11.0 11.1 10.8 10.9 10.7 10.9 15.5 48.3 31.1 17.8 29.2 23.9 9.3 11.5
+	R1 R2 R3 R4 R5 R6 R7 R8 R9 R10 R11 R12 R13 R14 R15 R17 R21	Name Young Naskapi Camp 1 Young Naskapi Camp 2 Innu Tent 3 (Rosemary Lake) Innu Tent 4 (Rosemary Lake) Innu Tent 5 (Rosemary Lake) Innu Tent 6 (Rosemary Lake) Innu Tent 1 (Elross Lake) Innu Tent 2 (Exact location tbd) Young Naskapi Camp 7 (Pinette Lake) Young Naskapi Trailer tent (Triangle Lake) Young Naskapi Camp 5 (Elross Creek) Naskapi - Uashat people's camp Young Naskapi Camp 4 Young Naskapi Camp 6 (Howells River) Innu - Uashat - Mani-Utenam Camp 2	TPM, 24-hr 17.1 17.1 17.1 17.4 17.4 17.2 17.1 16.6 26.1 27.0 21.8 18.9 30.8 16.3 16.7	PM10, 24-hr 11.0 11.0 11.0 11.2 11.3 11.0 11.0 11.1 15.4 15.8 13.2 11.8 18.0 10.7 10.9 12.0	PM2.5, 24-hr 5.4 5.4 5.4 5.4 5.4 5.4 5.5 7.0 6.4 5.8 6.2 6.7 5.3 5.5 7.0	\$02, 24-hr 5.0 5.0 5.0 5.0 5.0 5.0 5.0 5.	NO2, 24-hr 11.2 11.0 11.1 10.8 10.9 10.7 10.7 15.5 48.3 31.1 17.8 29.2 23.9 9.3 11.5
+	ID R1 R2 R3 R4 R5 R6 R7 R8 R9 R10 R11 R12 R13 R14 R15 R17 R21 R22	Name Young Naskapi Camp 1 Young Naskapi Camp 2 Innu Tent 3 (Rosemary Lake) Innu Tent 4 (Rosemary Lake) Innu Tent 5 (Rosemary Lake) Innu Tent 6 (Rosemary Lake) Innu Tent 1 (Elross Lake) Innu Tent 2 (Exact location tbd) Young Naskapi Camp 7 (Pinette Lake) Young Naskapi Trailer tent (Triangle Lake) Young Naskapi Trailer tent (Triangle Lake) Young Naskapi Camp 5 (Elross Creek) Naskapi - Uashat people's camp Young Naskapi Camp 4 Young Naskapi Camp 6 (Howells River) Innu - Uashat - Mani-Utenam Camp 2 Bustard - Observation and hunting site 1 Bustard - Observation and hunting site 2	TPM, 24-hr 17.1 17.1 17.1 17.4 17.4 17.2 17.1 16.6 26.1 27.0 21.8 18.9 30.8 16.3 16.7 19.1	PM10, 24-hr 11.0 11.0 11.0 11.1 11.2 11.3 11.0 11.0 11.1 15.4 15.8 13.2 11.8 18.0 10.7 10.9 12.0 10.7 11.2	PM2.5, 24-hr 5.4 5.4 5.4 5.4 5.4 5.4 5.3 5.5 7.0 6.4 5.8 6.2 6.7 5.3 5.3 5.7 5.1 5.5	\$02, 24-hr 5.0 5.0 5.0 5.0 5.0 5.0 5.0 5.	NO2, 24-hr 11.2 11.0 11.1 10.8 10.9 10.7 10.9 15.5 48.3 31.1 17.8 29.2 23.9 9.3 11.5 15.9 6.9
ALL: Background + DSO3 + DSO4 + HOWSE	ID R1 R2 R3 R4 R5 R6 R7 R8 R9 R10 R11 R12 R13 R14 R15 R17 R21 R22 R24	Name Young Naskapi Camp 1 Young Naskapi Camp 2 Innu Tent 3 (Rosemary Lake) Innu Tent 4 (Rosemary Lake) Innu Tent 5 (Rosemary Lake) Innu Tent 6 (Rosemary Lake) Innu Tent 1 (Elross Lake) Innu Tent 2 (Exact location tbd) Young Naskapi Camp 7 (Pinette Lake) Young Naskapi Trailer tent (Triangle Lake) Young Naskapi Trailer tent (Triangle Lake) Young Naskapi Camp 5 (Elross Creek) Naskapi - Uashat people's camp Young Naskapi Camp 4 Young Naskapi Camp 6 (Howells River) Innu - Uashat - Mani-Utenam Camp 2 Bustard - Observation and hunting site 1 Bustard - Observation and hunting site 2 Irony Mountain	TPM, 24-hr 17.1 17.1 17.1 17.4 17.4 17.2 17.1 16.6 26.1 27.0 21.8 18.9 30.8 16.3 16.7 19.1 16.4 17.0 29.3	PM10, 24-hr 11.0 11.0 11.0 11.2 11.3 11.0 11.0 11.1 15.4 15.8 13.2 11.8 18.0 10.7 10.9 12.0 10.7 11.2 18.6	PM2.5, 24-hr 5.4 5.4 5.4 5.4 5.4 5.4 5.3 5.5 7.0 6.4 5.8 6.2 6.7 5.3 5.7 5.1 5.5 6.9	\$02, 24-hr 5.0 5.0 5.0 5.0 5.0 5.0 5.0 5.	NO2, 24-hr 11.2 11.0 11.1 10.8 10.9 10.7 10.9 15.5 48.3 31.1 17.8 29.2 23.9 9.3 11.5 15.9 6.9 12.7 40.9
+	R1 R2 R3 R4 R5 R6 R7 R8 R9 R10 R11 R12 R13 R14 R15 R17 R21 R22 R24 R33	Name Young Naskapi Camp 1 Young Naskapi Camp 2 Innu Tent 3 (Rosemary Lake) Innu Tent 4 (Rosemary Lake) Innu Tent 5 (Rosemary Lake) Innu Tent 6 (Rosemary Lake) Innu Tent 1 (Elross Lake) Innu Tent 2 (Exact location tbd) Young Naskapi Camp 7 (Pinette Lake) Young Naskapi Trailer tent (Triangle Lake) Young Naskapi Trailer tent (Triangle Lake) Young Naskapi Camp 5 (Elross Creek) Naskapi - Uashat people's camp Young Naskapi Camp 4 Young Naskapi Camp 6 (Howells River) Innu - Uashat - Mani-Utenam Camp 2 Bustard - Observation and hunting site 1 Bustard - Observation and hunting site 2 Irony Mountain	TPM, 24-hr 17.1 17.1 17.1 17.4 17.4 17.2 17.1 16.6 26.1 27.0 21.8 18.9 30.8 16.3 16.7 19.1 16.4 17.0 29.3 16.8	PM10, 24-hr 11.0 11.0 11.0 11.2 11.3 11.0 11.0 11.1 15.4 15.8 13.2 11.8 18.0 10.7 10.9 12.0 10.7 11.2 18.6 11.1	PM2.5, 24-hr 5.4 5.4 5.4 5.4 5.4 5.4 5.3 5.5 7.0 6.4 5.8 6.2 6.7 5.3 5.7 5.1 5.5 6.9 5.6	\$02, 24-hr 5.0 5.0 5.0 5.0 5.0 5.0 5.0 5.	NO2, 24-hr 11.2 11.0 11.1 10.8 10.9 10.7 10.9 15.5 48.3 31.1 17.8 29.2 23.9 9.3 11.5 15.9 6.9 12.7 40.9
+	R1 R2 R3 R4 R5 R6 R7 R8 R9 R10 R11 R12 R13 R14 R15 R17 R21 R22 R24 R33 R34	Name Young Naskapi Camp 1 Young Naskapi Camp 2 Innu Tent 3 (Rosemary Lake) Innu Tent 4 (Rosemary Lake) Innu Tent 5 (Rosemary Lake) Innu Tent 6 (Rosemary Lake) Innu Tent 1 (Elross Lake) Innu Tent 2 (Exact location tbd) Young Naskapi Camp 7 (Pinette Lake) Young Naskapi Trailer tent (Triangle Lake) Young Naskapi Trailer tent (Triangle Lake) Young Naskapi Camp 5 (Elross Creek) Naskapi - Uashat people's camp Young Naskapi Camp 4 Young Naskapi Camp 6 (Howells River) Innu - Uashat - Mani-Utenam Camp 2 Bustard - Observation and hunting site 1 Bustard - Observation and hunting site 2 Irony Mountain Naskapi Cabin 1 Naskapi Cabin 2 (Elross Lake)	TPM, 24-hr 17.1 17.1 17.1 17.4 17.4 17.2 17.1 16.6 26.1 27.0 21.8 18.9 30.8 16.3 16.7 19.1 16.4 17.0 29.3 16.8 17.0	PM10, 24-hr 11.0 11.0 11.0 11.1 11.1 11.0 11.1 15.4 15.8 13.2 11.8 18.0 10.7 10.9 12.0 10.7 11.2 18.6 11.1 10.9	PM2.5, 24-hr 5.4 5.4 5.4 5.4 5.4 5.4 5.3 5.5 7.0 6.4 5.8 6.2 6.7 5.3 5.7 5.1 5.5 6.9 5.6	\$02, 24-hr 5.0 5.0 5.0 5.0 5.0 5.0 5.0 5.	NO2, 24-hr 11.2 11.0 11.1 10.8 10.9 10.7 10.9 15.5 48.3 31.1 17.8 29.2 23.9 9.3 11.5 15.9 6.9 12.7 40.9 15.8
+	R1 R2 R3 R4 R5 R6 R7 R8 R9 R10 R11 R12 R13 R14 R15 R17 R21 R22 R24 R33 R34 R35	Name Young Naskapi Camp 1 Young Naskapi Camp 2 Innu Tent 3 (Rosemary Lake) Innu Tent 4 (Rosemary Lake) Innu Tent 5 (Rosemary Lake) Innu Tent 6 (Rosemary Lake) Innu Tent 1 (Elross Lake) Innu Tent 2 (Exact location tbd) Young Naskapi Camp 7 (Pinette Lake) Young Naskapi Trailer tent (Triangle Lake) Young Naskapi Camp 5 (Elross Creek) Naskapi - Uashat people's camp Young Naskapi Camp 4 Young Naskapi Camp 6 (Howells River) Innu - Uashat - Mani-Utenam Camp 2 Bustard - Observation and hunting site 1 Bustard - Observation and hunting site 2 Irony Mountain Naskapi Cabin 2 (Elross Lake) Naskapi Cabin 3 (Elross Lake)	TPM, 24-hr 17.1 17.1 17.1 17.4 17.4 17.2 17.1 16.6 26.1 27.0 21.8 18.9 30.8 16.3 16.7 19.1 16.4 17.0 29.3 16.8 17.0 16.8	PM10, 24-hr 11.0 11.0 11.0 11.1 11.1 11.0 11.1 15.4 15.8 13.2 11.8 18.0 10.7 10.9 12.0 10.7 11.2 18.6 11.1 10.9 11.0	PM2.5, 24-hr 5.4 5.4 5.4 5.4 5.4 5.4 5.3 5.5 7.0 6.4 5.8 6.2 6.7 5.3 5.7 5.1 5.5 6.9 5.6 5.4 5.4	\$02, 24-hr 5.0 5.0 5.0 5.0 5.0 5.0 5.0 5.	NO2, 24-hr 11.2 11.0 11.1 10.8 10.9 10.7 10.9 15.5 48.3 31.1 17.8 29.2 23.9 9.3 11.5 15.9 6.9 12.7 40.9 15.8 12.5 11.4
+	R1 R2 R3 R4 R5 R6 R7 R8 R9 R10 R11 R12 R13 R14 R15 R17 R21 R22 R24 R33 R34 R35	Name Young Naskapi Camp 1 Young Naskapi Camp 2 Innu Tent 3 (Rosemary Lake) Innu Tent 4 (Rosemary Lake) Innu Tent 5 (Rosemary Lake) Innu Tent 6 (Rosemary Lake) Innu Tent 1 (Elross Lake) Innu Tent 2 (Exact location tbd) Young Naskapi Camp 7 (Pinette Lake) Young Naskapi Trailer tent (Triangle Lake) Young Naskapi Trailer tent (Triangle Lake) Young Naskapi Camp 5 (Elross Creek) Naskapi - Uashat people's camp Young Naskapi Camp 4 Young Naskapi Camp 6 (Howells River) Innu - Uashat - Mani-Utenam Camp 2 Bustard - Observation and hunting site 1 Bustard - Observation and hunting site 2 Irony Mountain Naskapi Cabin 1 Naskapi Cabin 2 (Elross Lake)	TPM, 24-hr 17.1 17.1 17.1 17.4 17.4 17.2 17.1 16.6 26.1 27.0 21.8 18.9 30.8 16.3 16.7 19.1 16.4 17.0 29.3 16.8 17.0	PM10, 24-hr 11.0 11.0 11.0 11.1 11.1 11.0 11.1 15.4 15.8 13.2 11.8 18.0 10.7 10.9 12.0 10.7 11.2 18.6 11.1 10.9	PM2.5, 24-hr 5.4 5.4 5.4 5.4 5.4 5.4 5.3 5.5 7.0 6.4 5.8 6.2 6.7 5.3 5.7 5.1 5.5 6.9 5.6	\$02, 24-hr 5.0 5.0 5.0 5.0 5.0 5.0 5.0 5.	NO2, 24-hr 11.2 11.0 11.1 10.8 10.9 10.7 10.9 15.5 48.3 31.1 17.8 29.2 23.9 9.3 11.5 15.9 6.9 12.7 40.9 15.8
+	R1 R2 R3 R4 R5 R6 R7 R8 R9 R10 R11 R12 R13 R14 R15 R17 R21 R22 R24 R33 R34 R35	Name Young Naskapi Camp 1 Young Naskapi Camp 2 Innu Tent 3 (Rosemary Lake) Innu Tent 4 (Rosemary Lake) Innu Tent 5 (Rosemary Lake) Innu Tent 6 (Rosemary Lake) Innu Tent 1 (Elross Lake) Innu Tent 2 (Exact location tbd) Young Naskapi Camp 7 (Pinette Lake) Young Naskapi Trailer tent (Triangle Lake) Young Naskapi Camp 5 (Elross Creek) Naskapi - Uashat people's camp Young Naskapi Camp 4 Young Naskapi Camp 6 (Howells River) Innu - Uashat - Mani-Utenam Camp 2 Bustard - Observation and hunting site 1 Bustard - Observation and hunting site 2 Irony Mountain Naskapi Cabin 2 (Elross Lake) Naskapi Cabin 3 (Elross Lake)	TPM, 24-hr 17.1 17.1 17.1 17.4 17.4 17.2 17.1 16.6 26.1 27.0 21.8 18.9 30.8 16.3 16.7 19.1 16.4 17.0 29.3 16.8 17.0 16.8	PM10, 24-hr 11.0 11.0 11.0 11.1 11.1 11.0 11.1 15.4 15.8 13.2 11.8 18.0 10.7 10.9 12.0 10.7 11.2 18.6 11.1 10.9 11.0	PM2.5, 24-hr 5.4 5.4 5.4 5.4 5.4 5.4 5.3 5.5 7.0 6.4 5.8 6.2 6.7 5.3 5.7 5.1 5.5 6.9 5.6 5.4 5.4	\$02, 24-hr 5.0 5.0 5.0 5.0 5.0 5.0 5.0 5.	NO2, 24-hr 11.2 11.0 11.1 10.8 10.9 10.7 10.9 15.5 48.3 31.1 17.8 29.2 23.9 9.3 11.5 15.9 6.9 12.7 40.9 15.8 12.5 11.4

⁻ all values in $\mu g/m3$. Red cell, if any, indicates above criteria.

^{*} nth highest levels as per NL Guidance Document GD-PPD-009.4 (2012)

Table 3-3 Summary Results – 1-Hr, 3-Hr, 8-Hr Concentrations

				RES	SULTS -	1-Hr, 3-	Hr, 8-Hi	r Avera	ges	
		Pollutant	SO2	500	NO2	со	со	TDM	DM10	DMO F
				SO2	NO2			TPM	PM10	PM2.5
		Averaging Period	3-hr	1-hr	1-hr	8-hr	1-hr	1-hr	1-hr	1-hr
		NL Ambient Air Quality Standard	600	900	400	15000	35000			
		Level or rank *	6 th	9 th	9 th	3 rd	9 th	9 th	9 th	9 th
		BACKGROUND CONCENTRATIONS - PRE-DSO3	5	5	3.8	114	114	15	10	5
	ID	Description	SO2, 3-hr	SO2, 1-hr	NO2, 1-hr	CO, 8-hr	CO, 1-hr	TPM, 1-hr	PM10, 1-hr	PM2.5, 1-hr
	R1	Young Naskapi Camp 1	0.0	0.0	19.2	1.6	2.6	2.7	1.6	1.0
	R2	Young Naskapi Camp 2	0.0	0.0	20.3	1.6	2.6	2.7	1.7	1.0
		Innu Tent 3 (Rosemary Lake)	0.0	0.0	18.8	1.5	2.5	2.6	1.5	1.0
		Innu Tent 4 (Rosemary Lake)	0.0	0.0	17.3	1.4	2.5	2.3	1.3	0.8
	R5 R6	Innu Tent 5 (Rosemary Lake) Innu Tent 6 (Rosemary Lake)	0.0	0.0	17.2 23.1	1.5 1.6	2.4 2.7	3.0 3.0	1.3 1.8	0.8 1.0
		Innu Tent 1 (Elross Lake)	0.0	0.0	20.7	1.4	2.3	2.5	1.6	1.0
ONLY		Innu Tent 2 (Exact location tbd)	0.0	0.0	35.6	2.7	3.4	2.5	2.0	1.6
\leq		Young Naskapi Camp 7 (Pinette Lake)	0.1	0.1	94.9	6.3	10.3	14.3	7.4	4.2
10	R10	Young Naskapi Camp 3	0.0	0.0	42.8	2.8	4.6	9.8	3.6	1.8
Õ		Young Naskapi Trailer tent (Triangle Lake)	0.0	0.0	31.1	2.5	4.0	5.1	2.5	1.3
DSO3 + DSO4		Young Naskapi Camp 5 (Elross Creek)	0.0	0.1	57.5	2.9	4.3	4.8	3.0	2.5
		Naskapi - Uashat people's camp	0.0	0.0	42.9	3.4	4.8	12.4	4.4	1.8
		Young Naskapi Camp 4	0.0	0.0	18.1 17.0	1.1	1.9	2.2 3.0	1.2 1.6	0.8
		Young Naskapi Camp 6 (Howells River) Innu - Uashat - Mani-Utenam Camp 2	0.0	0.0	24.7	1.1 1.5	2.2 2.5	3.3	1.7	1.0
		Bustard - Observation and hunting site 1	0.0	0.0	8.4	0.7	1.1	1.8	0.8	0.3
		Bustard - Observation and hunting site 2	0.0	0.0	22.3	1.6	2.7	3.2	1.7	1.2
		Irony Mountain	0.1	0.1	110.2	7.4	12.0	14.5	7.9	4.3
		Naskapi Cabin 1	0.0	0.0	33.7	2.7	3.7	2.9	2.1	1.4
	R34	Naskapi Cabin 2 (Elross Lake)	0.0	0.0	23.4	1.4	2.4	2.2	1.5	1.0
		Naskapi Cabin 3 (Elross Lake)	0.0	0.0	29.8	1.9	3.2	2.2	1.6	1.3
		TSMC Workers' Camp	0.7	0.7	382.8	62.7	100.3	67.9	33.6	11.2
		"Off-Property Limit" Maximum - Newfoundland/Labrador	0.3	0.3	311.2	69.5	96.8	345.7	118.5	16.4
	ID	Name	SO2, 3-hr	SO2, 1-hr	NO2, 1-hr	CO, 8-hr	CO, 1-hr	TPM, 1-hr	PM10, 1-hr	PM2.5, 1-hr
	R1	Young Naskapi Camp 1	0.0	0.0	7.6	3.3	5.6	4.2	2.8	0.7
	R2	Young Naskapi Camp 2	0.0	0.0	7.3	3.1	5.3	4.6	2.7	0.7
		Innu Tent 3 (Rosemary Lake)	0.0	0.0	7.3	3.2	5.4	4.1	2.6	0.7
		Innu Tent 4 (Rosemary Lake)	0.0	0.0	6.3	2.4	5.0	4.4	2.5	0.7
		Innu Tent 5 (Rosemary Lake)	0.0	0.0	6.4	2.6	4.8	5.6	3.0	0.7
		Innu Tent 6 (Rosemary Lake) Innu Tent 1 (Eiross Lake)	0.0	0.0	5.9 3.7	2.4 1.7	4.8 2.8	4.4 3.1	2.5 1.6	0.6 0.4
		Innu Tent 2 (Exact location tbd)	0.0	0.0	5.3	2.1	4.3	3.4	2.1	0.4
>		Young Naskapi Camp 7 (Pinette Lake)	0.0	0.1	43.9	20.4	39.7	27.0	16.7	4.6
ONLY		Young Naskapi Camp 3	0.0	0.0	48.8	21.4	43.2	39.7	19.6	5.3
0		Young Naskapi Trailer tent (Triangle Lake)	0.0	0.0	25.6	11.0	25.8	14.5	7.8	2.9
SE	R12	Young Naskapi Camp 5 (Elross Creek)	0.0	0.0	9.7	5.3	7.7	6.8	3.9	1.0
\leq		Naskapi - Uashat people's camp	0.0	0.1	72.8	29.9	67.4	53.9	33.1	8.1
HOWSE		Young Naskapi Camp 4	0.0	0.0	3.8	1.5	2.7	2.6	1.7	0.4
工		Young Naskapi Camp 6 (Howells River)	0.0	0.0	3.4	1.3	2.4	3.0	1.7	0.4
		Innu - Uashat - Mani-Utenam Camp 2 Bustard - Observation and hunting site 1	0.0	0.0	21.9 3.4	10.4 1.0	22.8 2.4	8.8 3.2	5.4 1.8	2.4 0.4
		Bustard - Observation and hunting site 1 Bustard - Observation and hunting site 2	0.0	0.0	8.5	3.0	6.5	3.2 4.4	2.9	0.4
		Irony Mountain	0.1	0.0	61.6	22.3	49.5	35.9	24.2	5.7
		Naskapi Cabin 1	0.0	0.0	5.7	2.8	5.1	3.5	2.3	0.6
	R34	Naskapi Cabin 2 (Elross Lake)	0.0	0.0	5.4	2.1	4.2	3.4	2.0	0.5
	R35	Naskapi Cabin 3 (Elross Lake)	0.0	0.0	4.7	2.0	4.6	3.3	2.2	0.6
	R40	TSMC Workers' Camp	0.6	0.8	149.7	17.1	32.9	53.2	25.3	10.3
		"Off-Property Limit" Maximum - Newfoundland/Labrador	0.9	1.2	225.6	149.7	210.4	312.4	154.7	29.0

⁻ all values in μg/m³. Red cell, if any, indicates above criteria.

^{*} nth highest levels as per NL Guidance Document GD-PPD-009.4 (2012)

Table 3-3 Summary Results – 1-Hr, 3-Hr, 8-Hr Concentrations (Continued)

				RES	SULTS -	1-Hr, 3-	Hr, 8-H	r Avera	ges	
				1	1	1		1	1	_
		Pollutant	SO2	SO2	NO2	CO	CO	TPM	PM10	PM2.5
		Averaging Period	3-hr	1-hr	1-hr	8-hr	1-hr	1-hr	1-hr	1-hr
		NL Ambient Air Quality Standard	600	900	400	15000	35000			
		Level or rank *	6 th	9 th	9 th	3 rd	9 th	9 th	9 th	9 th
		BACKGROUND CONCENTRATIONS - PRE-DSO3	5	5	4	114	114	15	10	5
	ID	Name	SO2, 3-hr	SO2, 1-hr	NO2, 1-hr	CO, 8-hr	CO, 1-hr	TPM, 1-hr	PM10, 1-hr	PM2.5, 1-hr
	R1	Young Naskapi Camp 1	0.0	0.0	22.5	4.1	6.9	5.6	3.6	1.3
	R2	Young Naskapi Camp 2	0.0	0.0	23.0	4.2	6.7	5.7	3.5	1.2
	R3	Innu Tent 3 (Rosemary Lake)	0.0	0.0	21.7	4.2	6.8	5.5	3.4	1.2
	R4	Innu Tent 4 (Rosemary Lake)	0.0	0.0	20.1	3.1	6.4	5.6	3.3	1.0
	R5	Innu Tent 5 (Rosemary Lake)	0.0	0.0	21.7	3.3	6.2	7.0	3.7	1.1
ш	R6	Innu Tent 6 (Rosemary Lake)	0.0	0.0	27.1	3.9	6.4	6.5	3.5	1.3
/SI	R7	Innu Tent 1 (Elross Lake)	0.0	0.0	22.1	2.5	3.7	4.8	2.9	1.2
+ HOWSE	R8	Innu Tent 2 (Exact location tbd)	0.0	0.0	40.1	4.4	6.2	5.2	3.4	1.7
모	R9	Young Naskapi Camp 7 (Pinette Lake)	0.1	0.1	97.6	21.3	41.7	33.7	18.8	5.1
+	R10	Young Naskapi Camp 3	0.1	0.1	61.8 36.1	22.6 11.6	44.3 26.1	42.8 16.5	20.6 9.0	5.8 3.0
DS04	R11 R12	Young Naskapi Trailer tent (Triangle Lake) Young Naskapi Camp 5 (Elross Creek)	0.0	0.0	57.7	5.5	9.1	9.8	5.2	2.6
SC	_	Naskapi - Uashat people's camp	0.0	0.1	77.2	30.6	69.4	57.2	34.0	8.8
\Box		Young Naskapi Camp 4	0.0	0.0	20.5	2.3	4.2	4.0	2.3	1.0
+		Young Naskapi Camp 6 (Howells River)	0.0	0.0	18.4	2.0	3.5	5.3	3.0	1.1
Ö	R17	Innu - Uashat - Mani-Utenam Camp 2	0.0	0.0	27.5	10.9	23.8	9.6	6.1	2.8
DSO3	R21	Bustard - Observation and hunting site 1	0.0	0.0	10.9	1.5	3.1	4.4	2.4	0.6
_	R22	Bustard - Observation and hunting site 2	0.0	0.0	25.2	4.8	7.8	6.1	3.9	1.3
	R24	Irony Mountain	0.2	0.3	123.7	28.2	51.2	46.4	26.7	6.3
	R33	Naskapi Cabin 1	0.0	0.0	40.5	4.6	6.5	5.8	3.5	1.9
	R34	Naskapi Cabin 2 (Elross Lake)	0.0	0.0	25.9	2.8	5.8	4.9	2.8	1.2
	R35	Naskapi Cabin 3 (Elross Lake)	0.0	0.0	34.5	2.9	6.1	5.0	3.5	1.4
	R40	TSMC Workers' Camp	0.9	1.1	384.7	62.9	100.4	108.3	55.4	12.1
		"Off-Property Limit" Maximum - Newfoundland/Labrador	0.9	1.2	313.4	152.7	212.1	358.7	158.3	29.3
	ID	Name	SO2, 3-hr	SO2, 1-hr	NO2, 1-hr	CO, 8-hr	CO, 1-hr	TPM, 1-hr	PM10, 1-hr	PM2.5, 1-hr
	R1	Young Naskapi Camp 1	5.0	5.0	26.3	118.1	120.9	20.6	13.6	6.3
	R2	Young Naskapi Camp 2	5.0	5.0	26.8	118.2	120.7	20.7	13.5	6.2
	R3	Innu Tent 3 (Rosemary Lake)	5.0	5.0	25.5	118.2	120.7	20.7	13.4	6.2
N.	R4	Innu Tent 4 (Rosemary Lake)	5.0	5.0	23.9	117.1	120.4	20.6	13.3	6.0
+ HOWSE	R5	Innu Tent 5 (Rosemary Lake)	5.0	5.0	25.5	117.3	120.2	22.0	13.7	6.1
유	_	Innu Tent 6 (Rosemary Lake)	5.0	5.0	30.9	117.9	120.4	21.5	13.5	6.3
		Innu Tent 1 (Elross Lake)	5.0	5.0	25.9	116.5	117.7	19.8	12.9	6.2
04	R8	Innu Tent 2 (Exact location tbd)	5.0	5.0	43.9	118.4	120.2	20.2	13.4	6.7
DS	R9	Young Naskapi Camp 7 (Pinette Lake)	5.1	5.1	101.4	135.3	155.7	48.7	28.8	10.1
+	R10	Young Naskapi Camp 3	5.1	5.1	65.6	136.6	158.3	57.8	30.6	10.8
03	R11	Young Naskapi Trailer tent (Triangle Lake)	5.0	5.0	39.9	125.6	140.1	31.5	19.0	8.0
DS	R12	Young Naskapi Camp 5 (Elross Creek)	5.0	5.1	61.5	119.5	123.1	24.8	15.2	7.6
+		Naskapi - Uashat people's camp	5.0	5.1	81.0	144.6	183.4	72.2	44.0	13.8
Ĭ,		Young Naskapi Camp 4	5.0	5.0	24.3	116.3	118.2	19.0	12.3	6.0
<u>l</u> o	R15	Young Naskapi Camp 6 (Howells River)	5.0	5.0	22.2	116.0	117.5	20.3	13.0	6.1
ALL: Background + DSO3 + DSO4	R17	Innu - Uashat - Mani-Utenam Camp 2	5.0	5.0	31.3	124.9	137.8	24.6	16.1	7.8
3a(R21	Bustard - Observation and hunting site 1	5.0	5.0	14.7	115.5	117.1	19.4	12.4	5.6
1 = 1	R22	Bustard - Observation and hunting site 2	5.0	5.0	29.0	118.8	121.8	21.1	13.9	6.3
AL		Irony Mountain Naskapi Cabin 1	5.2 5.0	5.3 5.0	127.5 44.3	142.2 118.6	165.2 120.5	61.4 20.8	36.7 13.5	11.3 6.9
	R33	Naskapi Cabin 1 Naskapi Cabin 2 (Elross Lake)	5.0	5.0	29.7	116.8	120.5	20.8 19.9	12.8	6.9
		Naskapi Cabin 3 (Elross Lake)	5.0	5.0	38.3	116.8	120.1	20.0	13.5	6.4
		TSMC Workers' Camp	5.9	6.1	388.5	176.9	214.4	123.3	65.4	17.1
	1140	TOIVIO VVOINCIS CAITIP	J. 7	0.1	300.3	170.9	∠ 14.4	123.3	05.4	17.1
		"Off-Property Limit" Maximum - Newfoundland/Labrador	5.9	6.2	317.2	266.7	326.1	373.7	168.3	34.3

⁻ all values in $\mu g/m3$. Red cell, if any, indicates above criteria.

^{*} nth highest levels as per NL Guidance Document GD-PPD-009.4 (2012)

3.2 Discussion of Results

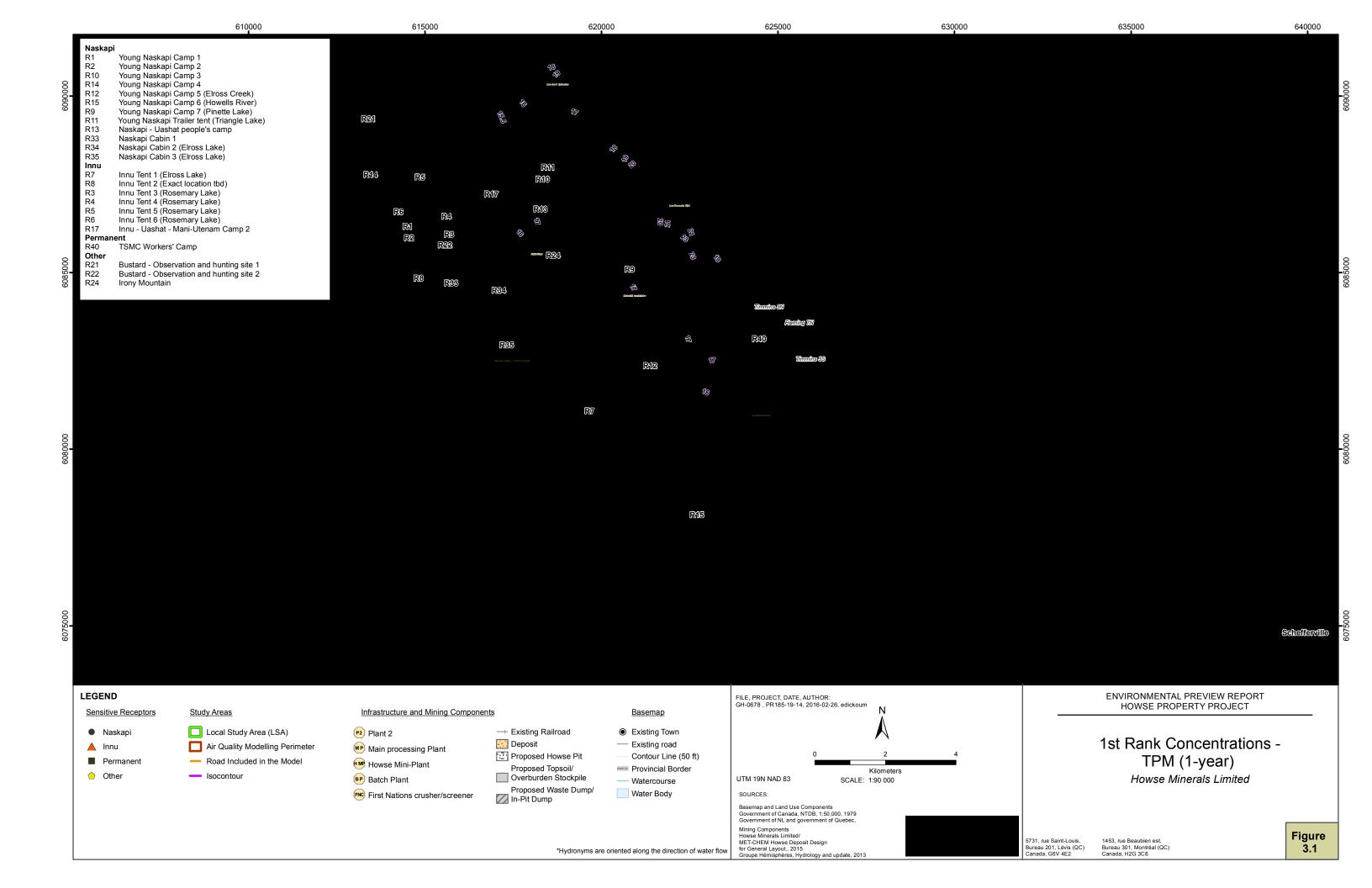
All NL ambient air quality standards are met, except for the NO_2 (24-hr) at the workers' camp (R40). This receptor is located within the air quality monitoring perimeter. As can be seen in Table 3-2, the maximum result at R40 when all cumulative sources are considered, NO_2 (24-hr) is 208.1 μ g/m³, slightly above the NL standard of 200 μ g/m³. Also shown in Table 3-2, the impact of the Howse project only at receptor R40 is 33.2 μ g/m³ for NO_2 (24-hr), which is well below the 200 μ g/m³.

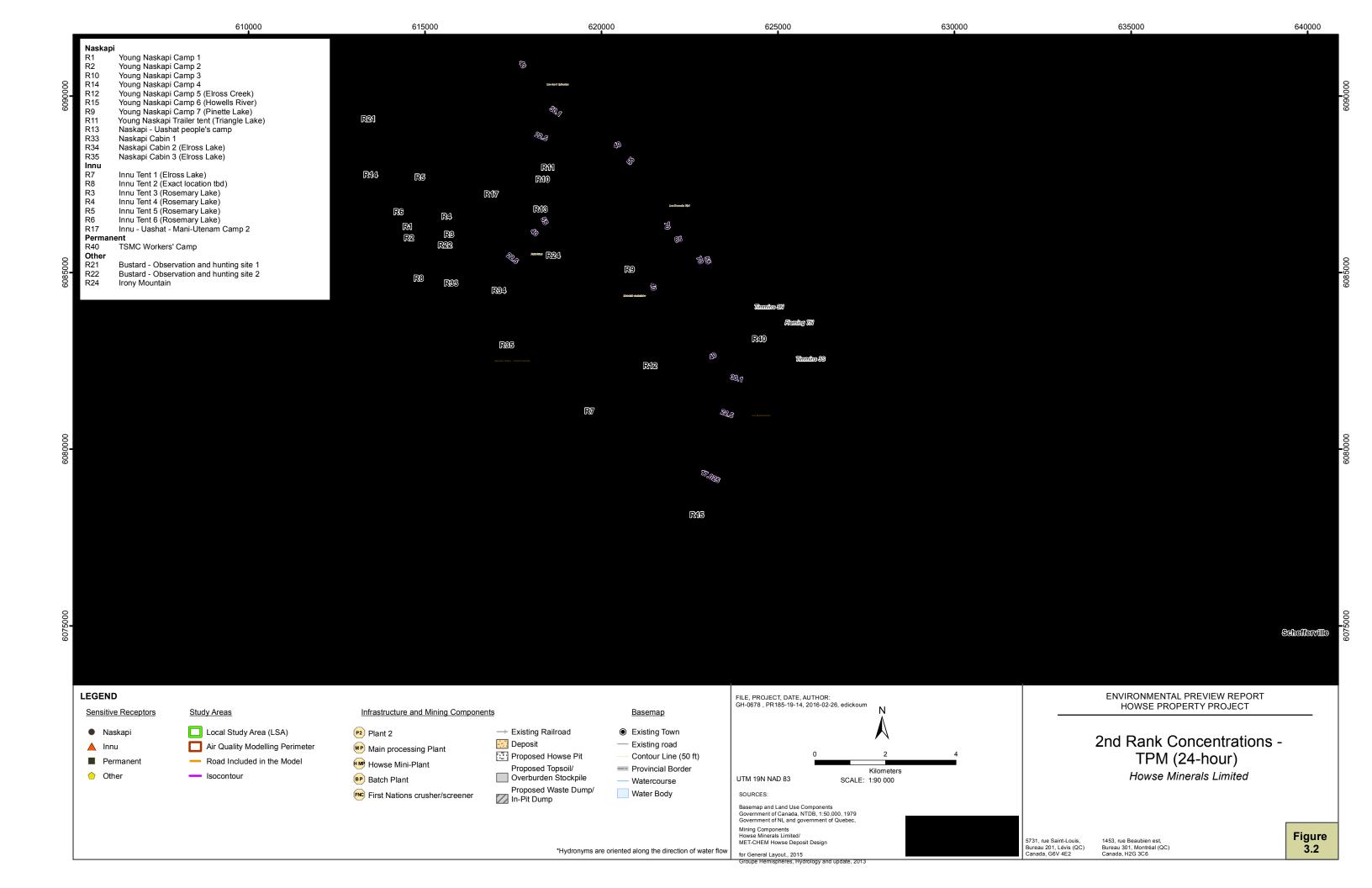
Considering the inputs to the air modelling study were conservative (e.g. worst-case), the noted exceedance for the single parameter NO_2 (24-hr) is highly unlikely to occur in reality.

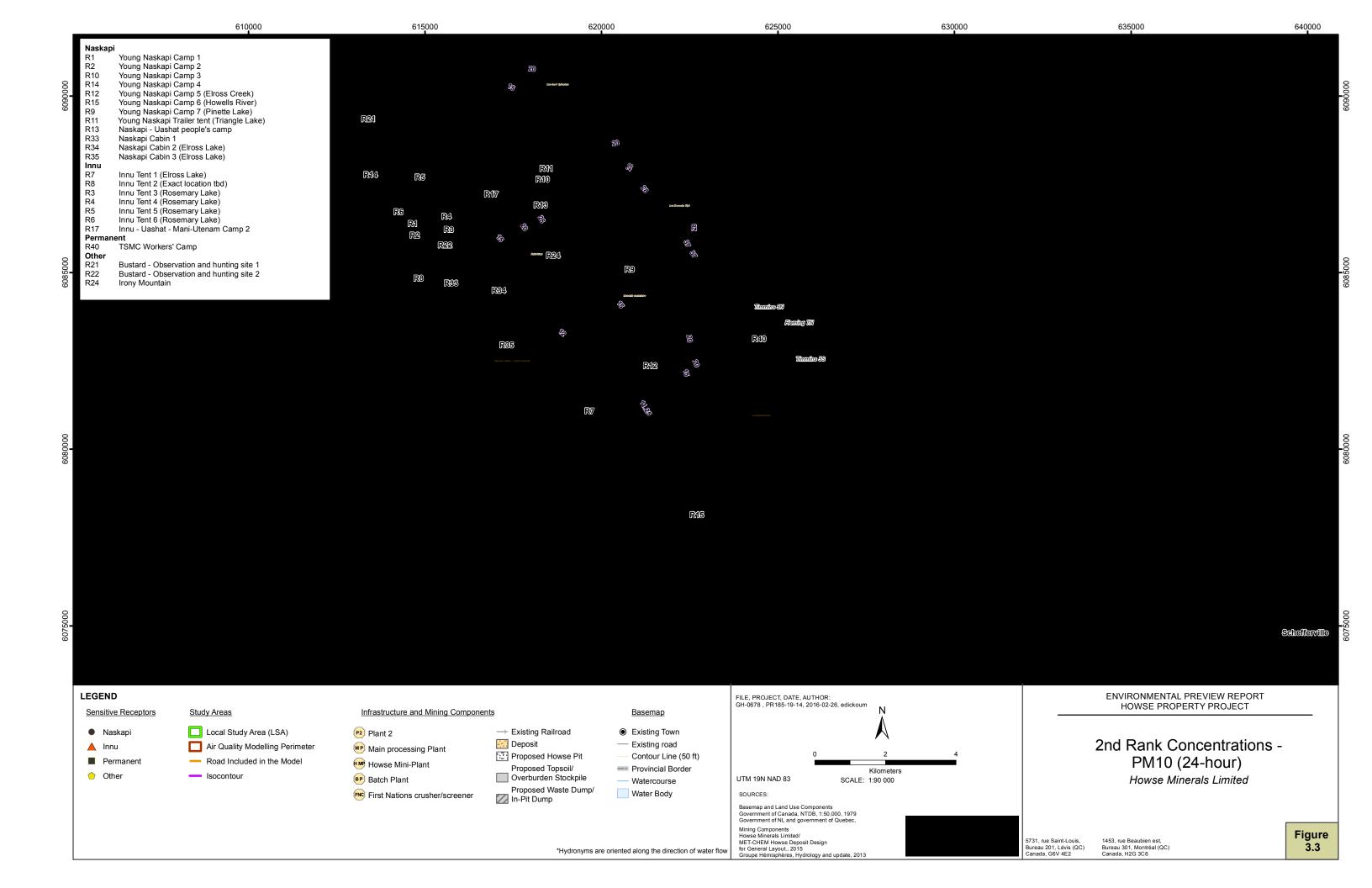
3.3 Isocentrations Contour Plots

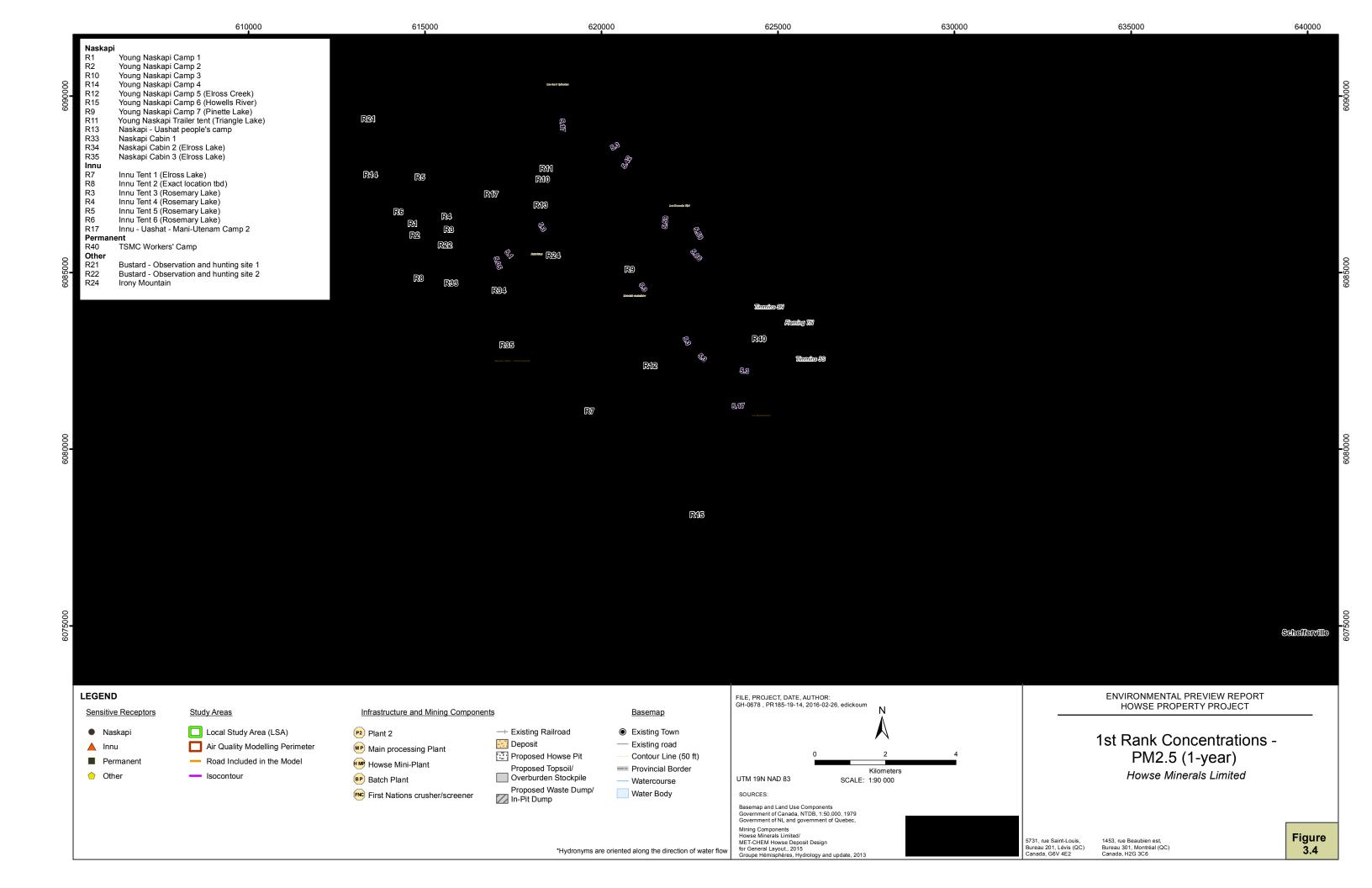
Isocentrations Contour Plots for all regulated air pollutants included in this study are presented in the following pages.

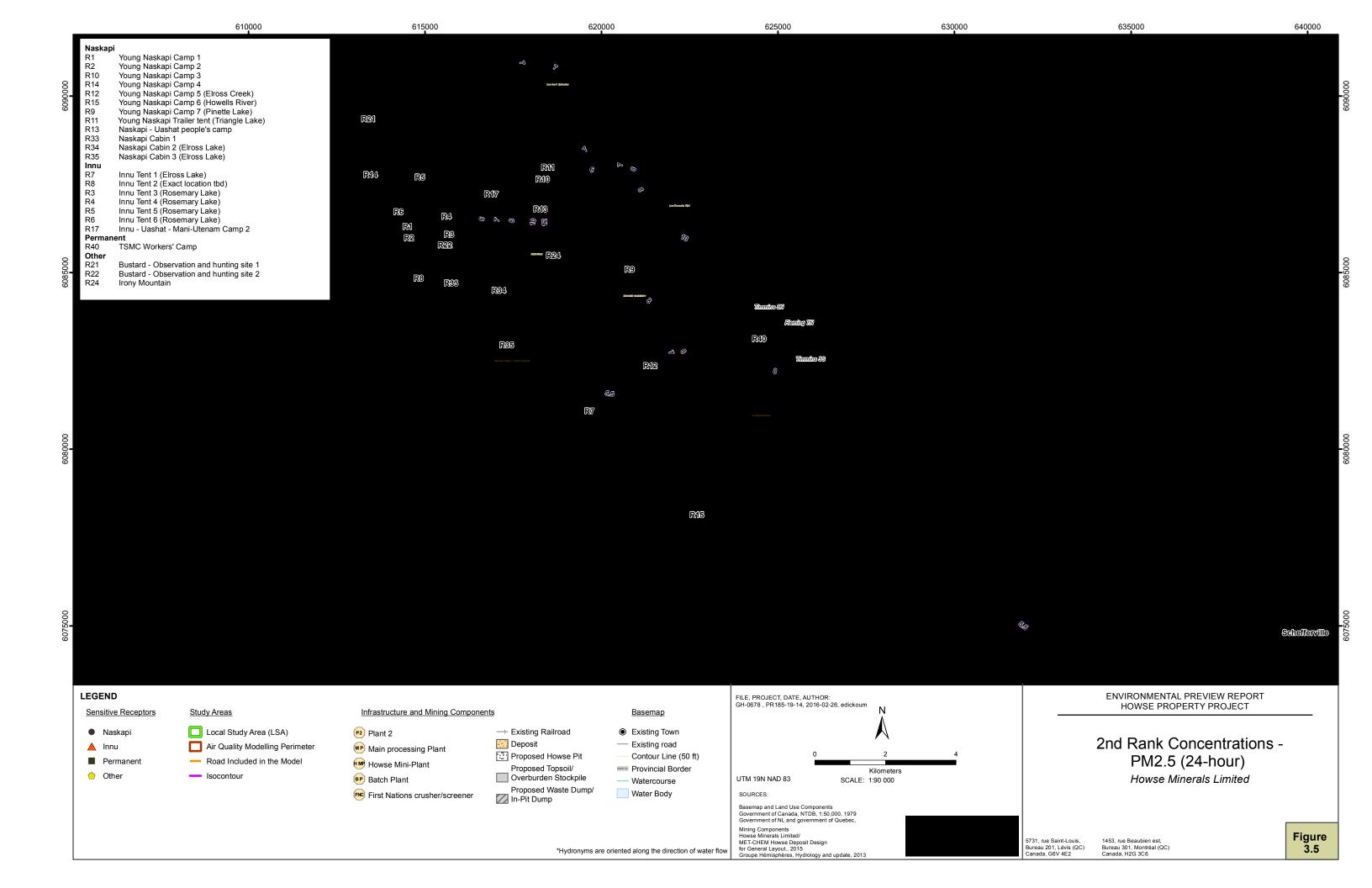
The contour plots reflect the nth level concentrations (see section 2.3.3) for the worst time period at which they occur.

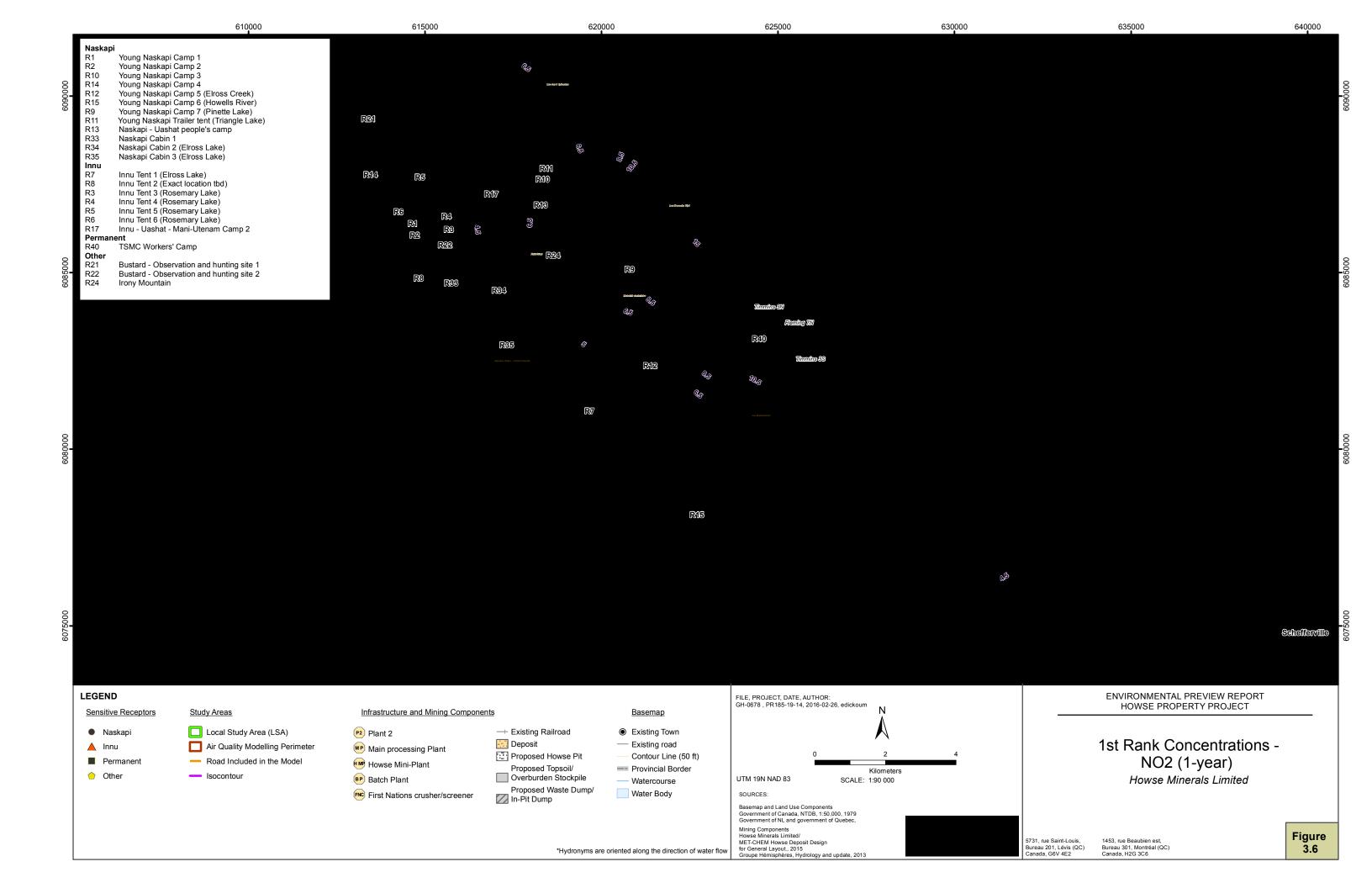


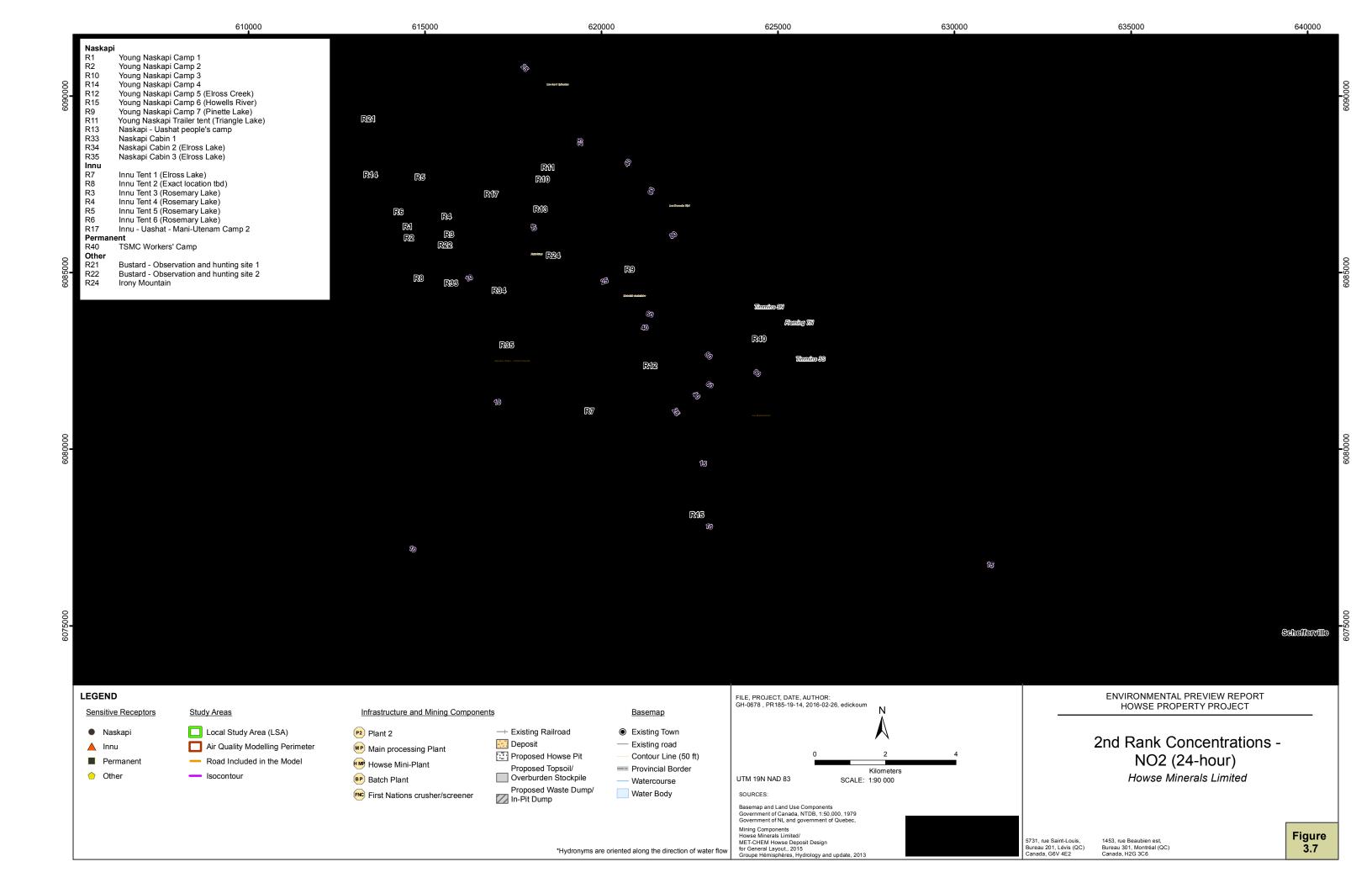


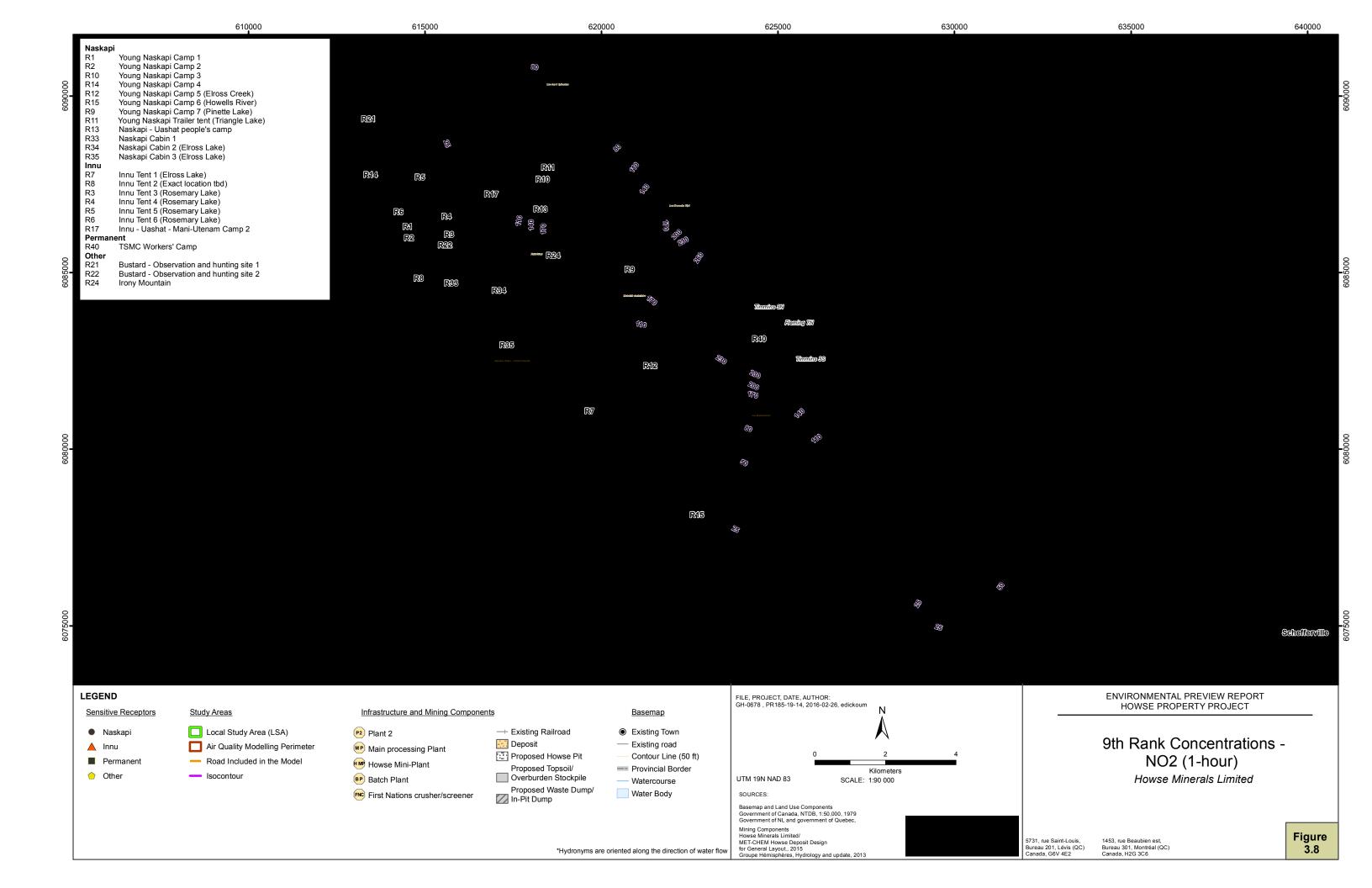


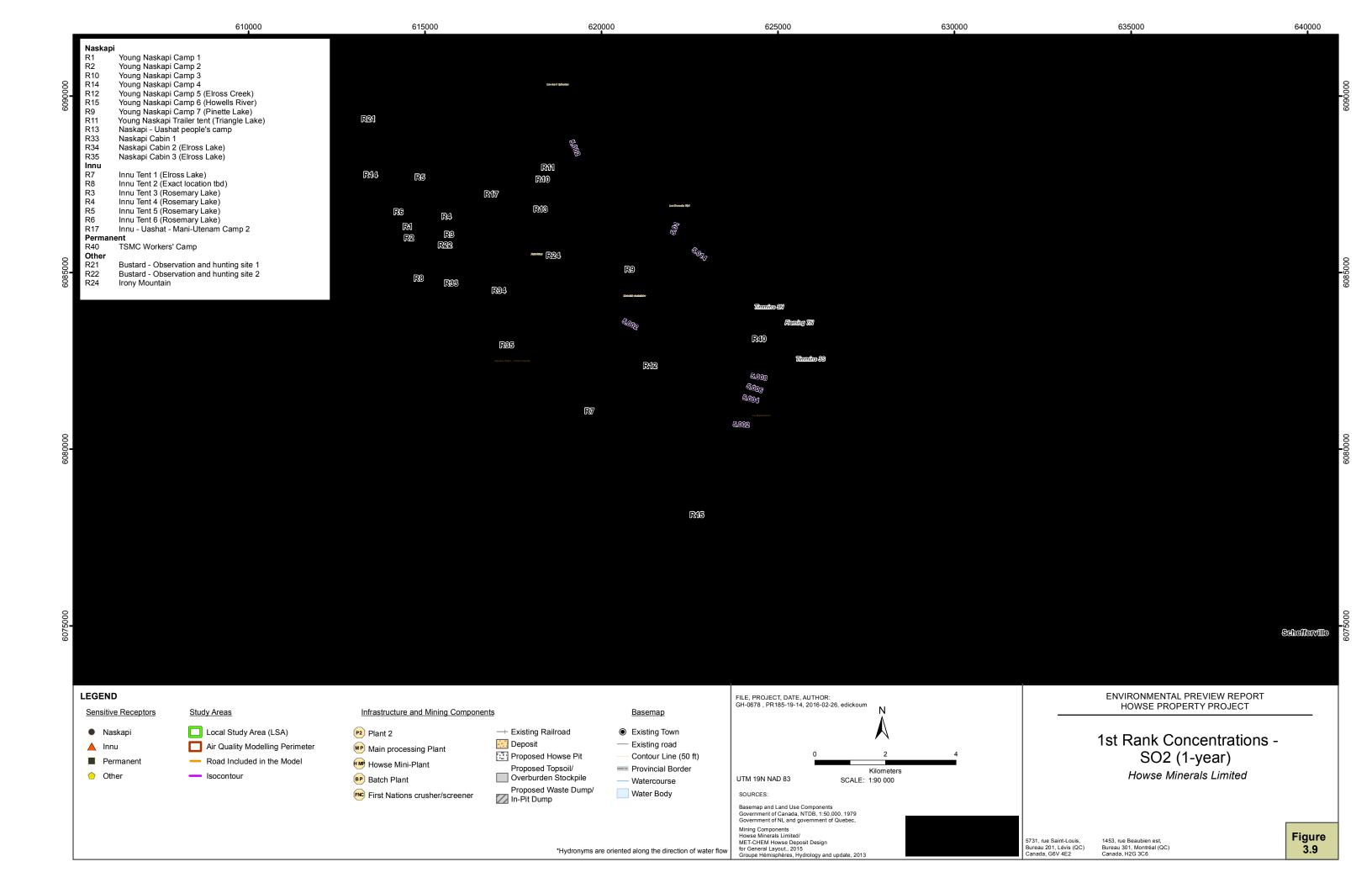


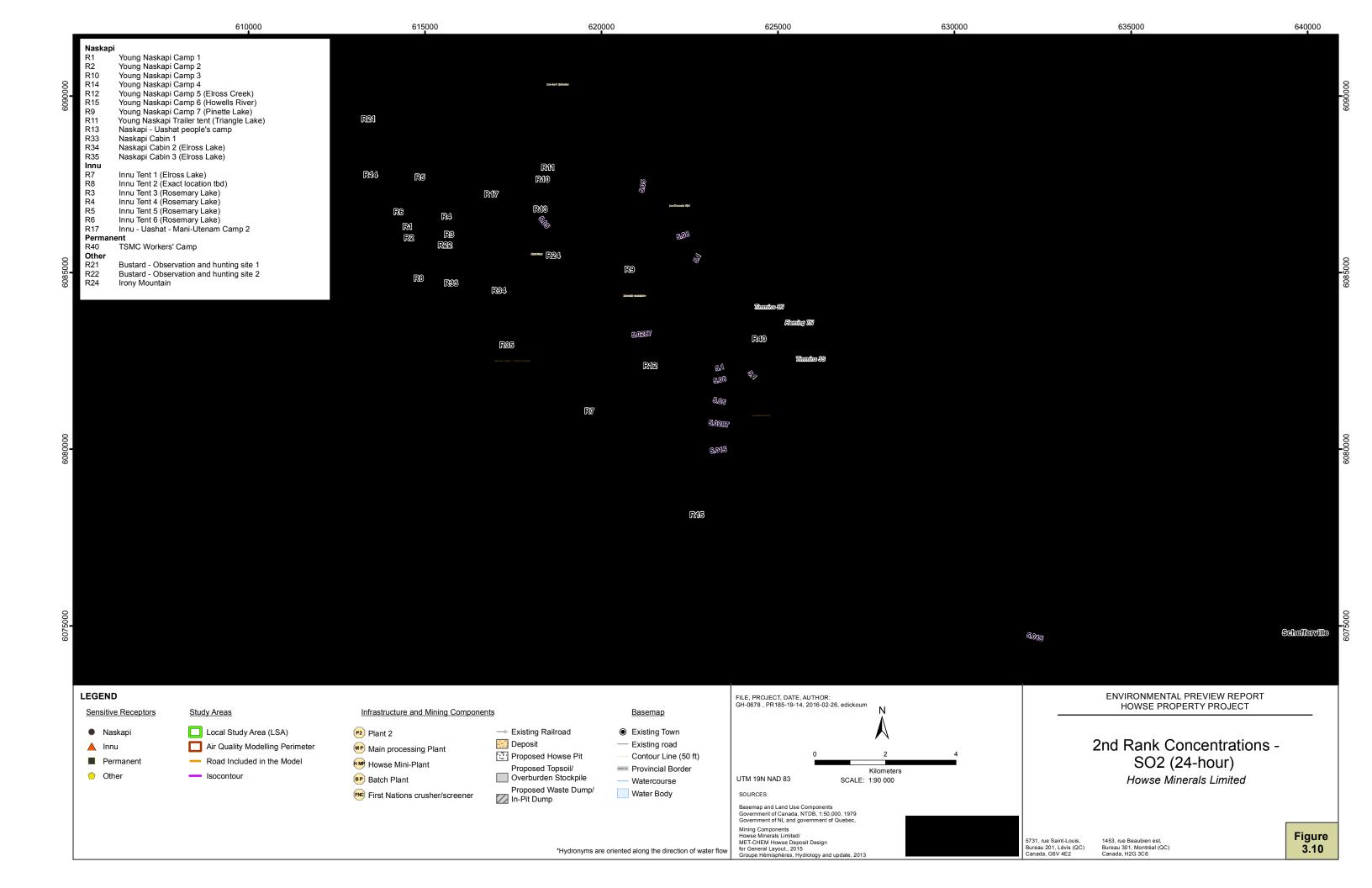


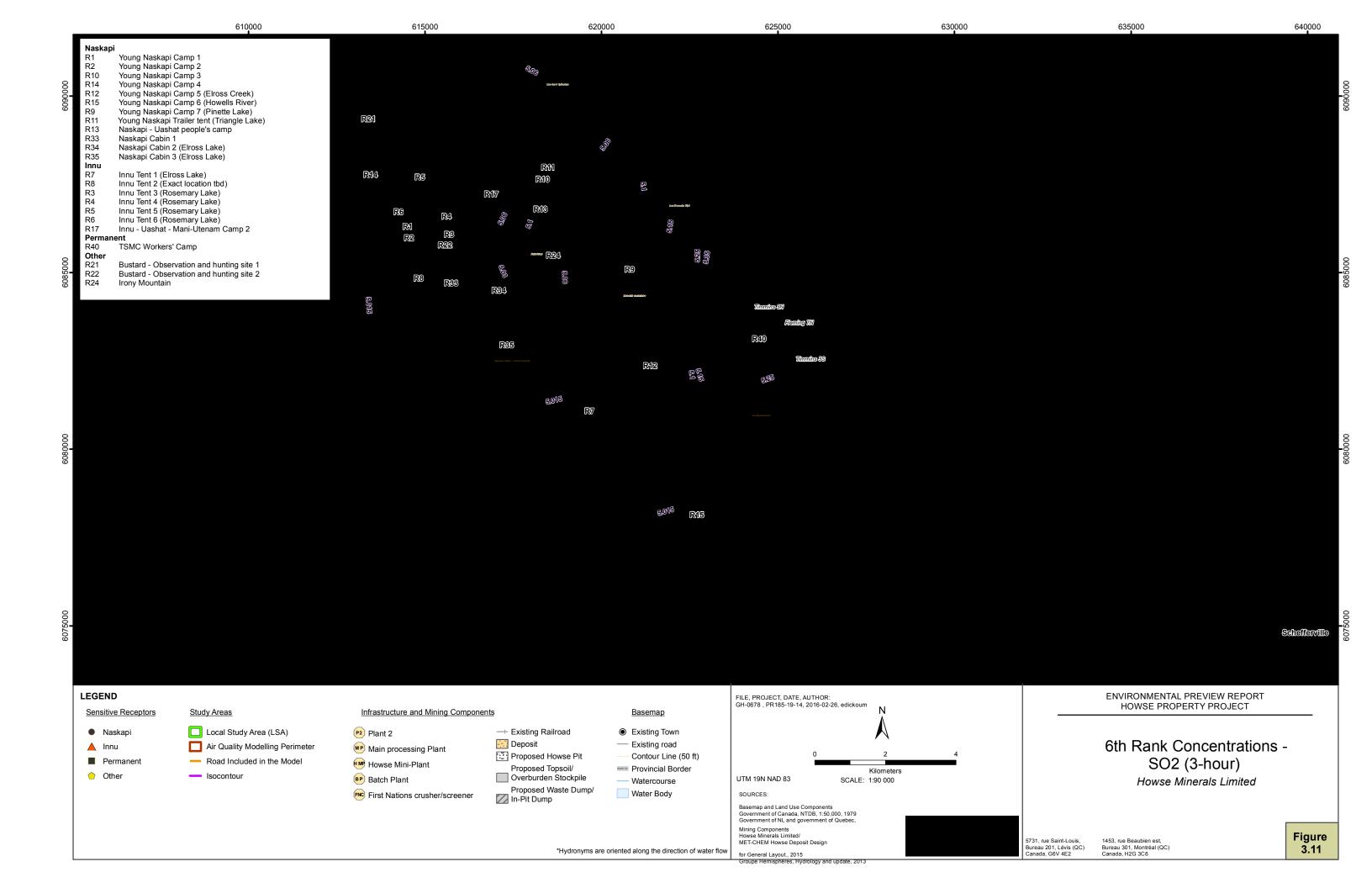


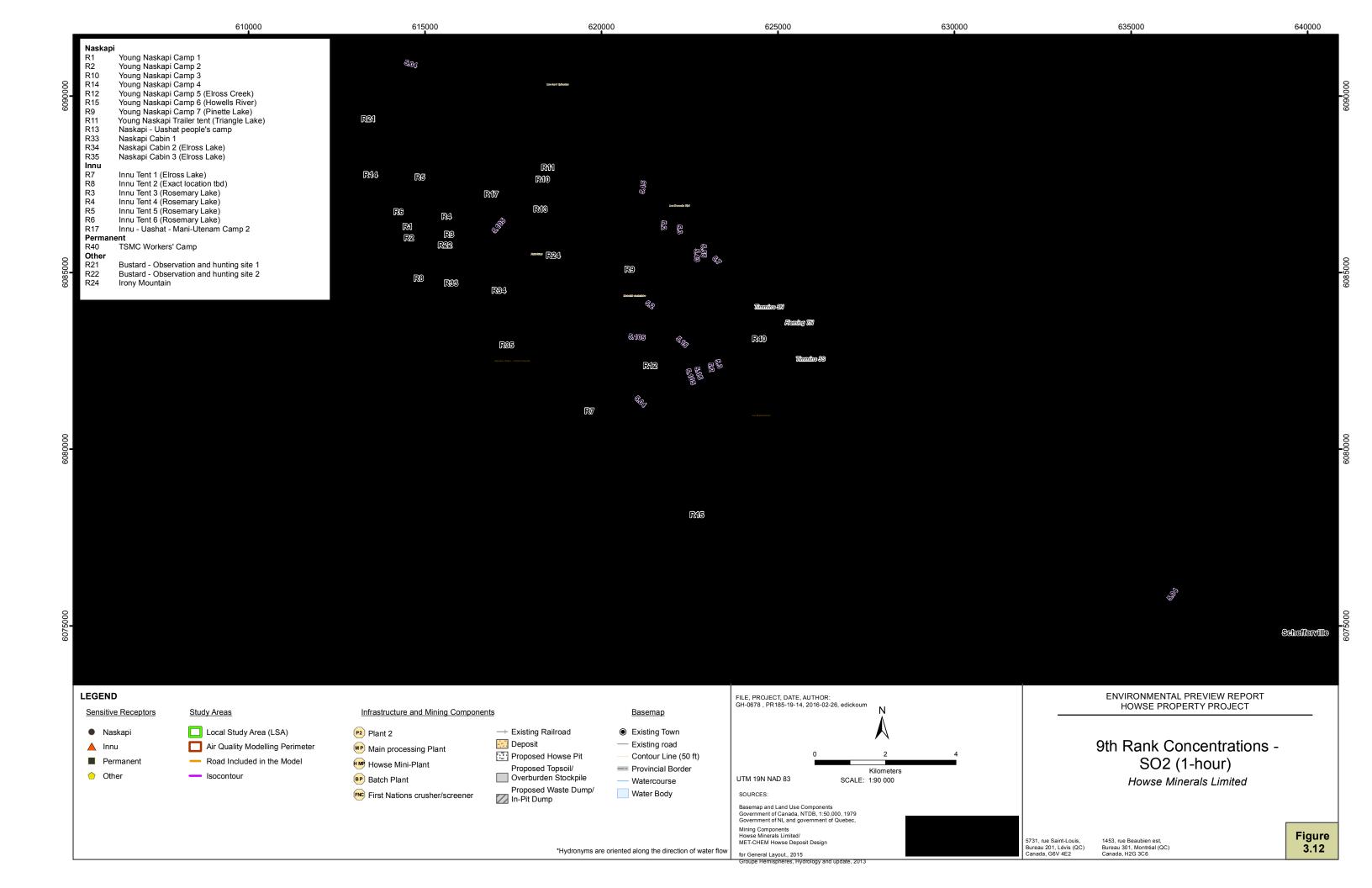


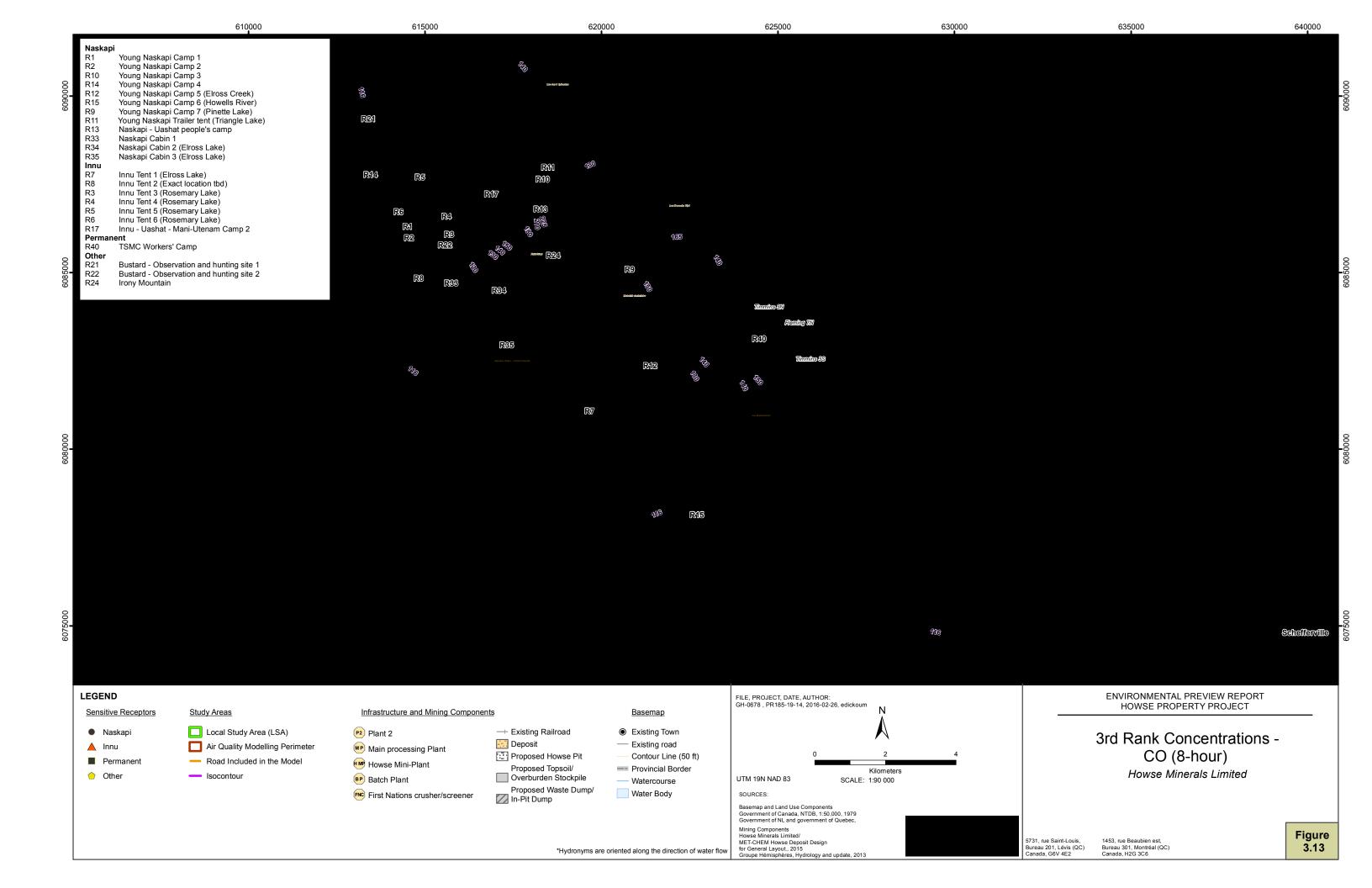


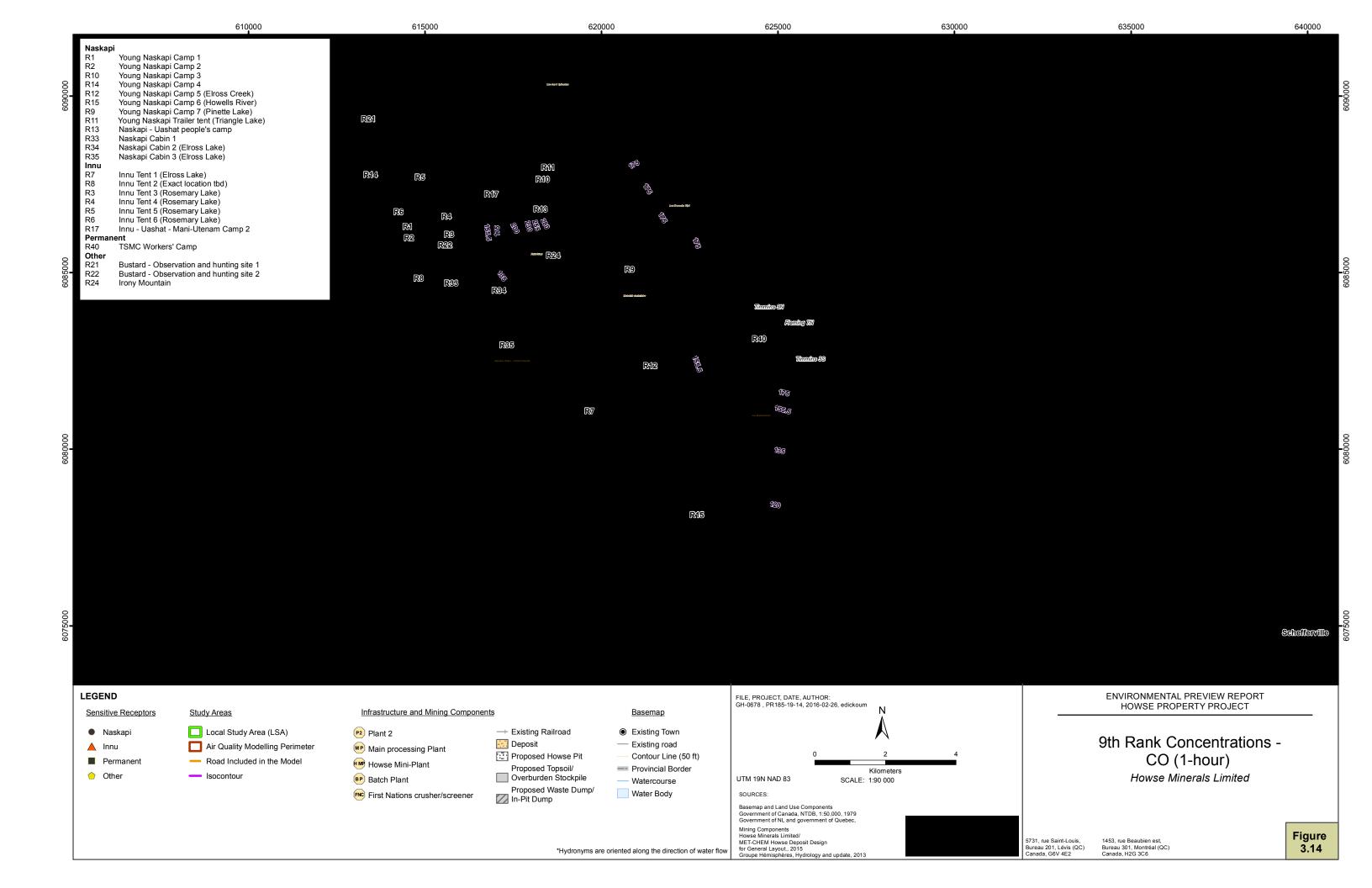












4 References

- U.S. EPA. 1996. AP-42 Fifth Edition, Volume I Chapter 3, Stationary Internal Combustion Sources, section 3.3: Gasoline and Diesel Industrial Engines, table 3.3-1.
- U.S. EPA. 1998a. AP-42 Fifth Edition, Volume I Chapter 11, Mineral Products Industry, section 11.9: Western Surface Coal Mining, table 11.9-2.
- U.S. EPA. 1998b. AP-42 Fifth Edition, Volume I Chapter 11, Mineral Products Industry, section 11.9: Western Surface Coal Mining, table 11.9-4.
- U.S. EPA. 1998c. AP-42 Fifth Edition, Volume I Chapter 1, External Combustion Sources, section 1.3, Fuel oil combustion, table 1.3-6 Industrial boiler burning distillate oil.
- U.S. EPA. 2006a. AP-42 Fifth Edition, Volume I Chapter 13, Miscellaneous Sources, section 13.2.4 Aggregate Handling and storage piles, equation (1).
- U.S. EPA. 2006b. AP-42 Fifth Edition, Volume I Chapter 13, Miscellaneous Sources, section 13.2.2 Unpaved Roads, Equation (1).
- U.S. EPA. 2004. AP-42 Fifth Edition, Volume I Chapter 11, Mineral Products Industry, section 11.19.2, Crushed Stone Processing and Pulverized Mineral Processing, table 11.19-2-1.
- U.S. EPA. 1982. AP-42 Fifth Edition, Volume I Chapter 11, Mineral Products Industry, section 11.24: Metallic Minerals Processing, table 11.24-1.
- U.S. EPA. 2009d. Exhaust and Crankcase Emission Factors for Nonroad Engine Modelling Compression-Ignition, table 8.
- Environment Canada. 2009. NPRI Pits and Quarries Guidance. Web Site.
 (http://www.ec.gc.ca/pdb/npri/documents/ToolBox/docs/pits_quarries_f.cfm#8_9) –(Mojave Desert Air Quality Management District, Antelope Valley Air Pollution Control District, Emissions Inventory Guidance, Mineral Handling Handbook and Processing Industries, April 10, 2000).
- Government of Newfoundland and Labrador 2002, Department of Environment & Conservation, Pollution Prevention Division, Guideline for Plume Dispersion Modelling (GD-PPD-019.2), June 2002 (revised September 18, 2012).
- Environment Canada, Canadian Climate Normals 1971-2000 Station Data, http://climate.weather.gc.ca/climate_normals/results_e.html?stnID=6098&lang=e&StationName=sche&SearchType=Contains&stnNameSubmit=go&dCode=4&dispBack=1

Appendix A Emission Rates Calculations

SELECTED FOR AIR N	ODELLING SCENARIO (MAXIMUM SCEN	NARIO)	
Mining Area and Pro	oduction	Unit	Air Modelling
HOW	SE		
	Ore to Main Plant	kt	0
	Ore to Howse Mini-Plant	kt	3,077
	Ore to Plant 2	kt	0
	Overburden	kt	6,778
	Waste	kt	3,968
	Total mined	kt	13,823
DSO3	- Fleming 7N		
	Ore to Main Plant	kt	0
	Ore to Howse Mini-Plant	kt	0
	Ore to Plant 2	kt	1,109
	Overburden	kt	46
	Waste	kt	2,228
	Total mined	kt	3,383
Ore hat	ıled from DSO4 to Main Plant	kt	7,384

			MIN	IE PLAN SUI	MMARY								
Mining Area and Production	Unit	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
HOWSE													
Ore to Main Plant	kt	0	0	0	0	0	0	0	0	0	0	0	0
Ore to Howse Mini-Plant	kt	0	1319	3077	3077	3077	3246	3077	3077	3077	3077	3077	3077
Ore to Plant 2	kt	0	0	0	0	0	0	0	0	0	0	0	0
Overburden	kt	6346	5095	6295	0	0	6687	6778	6778	6778	3388	3388	3388
Waste	kt	0	112	332	2866	2879	2242	3968	3968	3968	6916	6916	6916
Total mined	kt	6346	6525	9703	5943	5956	12175	13823	13823	13823	13381	13381	13381
DSO3 - Fleming 7N													
Ore to Main Plant	kt	0	0	0	0	0	0	0	0	0	0	0	0
Ore to Howse Mini-Plant	kt	0	0	0	0	0	0	0	0	0	0	0	0
Ore to Plant 2	kt	485	1109	1103	1105	1123	977	0	0	0	0	0	0
Overburden	kt	452	46	0	0	0	0	0	0	0	0	0	0
Waste	kt	1533	2228	1628	1622	1550	1367	0	0	0	0	0	0
Total mined	kt	2471	3383	2730	2726	2673	2344	0	0	0	0	0	0
DSO3 - Timmins 3N													
Ore to Main Plant	kt	0	0	0	0	0	0	0	0	0	0	0	0
Ore to Howse Mini-Plant	kt	0	0	0	0	0	0	0	0	0	0	0	0
Ore to Plant 2	kt	0	0	0	0	0	0	47	384	521	662	420	0
Overburden	kt	0	0	0	0	0	0	1193	211	0	0	0	0
Waste	kt	0	0	0	0	0	0	1240	2578	1715	1247	313	0
Total mined	kt	0	0	0	0	0	0	2479	3173	2236	1909	733	0
DSO3 - Timmins 7, Timmins 4N, Timmins 4S													
Ore to Main Plant	kt	0	0	0	0	0	0	0	0	0	0	0	0
Ore to Howse Mini-Plant	kt	0	0	0	0	0	0	0	0	0	0	0	0
Ore to Plant 2	kt	0	0	0	0	0	0	0	0	0	0	0	0
Overburden	kt	0	0	0	0	0	0	0	0	0	0	0	0
Waste	kt	0	0	0	0	0	0	0	0	0	0	0	0
Total mined	kt	0	0	0	0	0	0	0	0	0	0	0	0
Ore hauled from DSO4 to Main Plant	kt	2377	6409	6308	6375	6298	6455	7384	7085	6931	6763	6961	4194
Total Ore Production	kt	2863	8837	10488	10557	10498	10678	10507	10546	10528	10502	10458	7271

Description	Units	FY-2017			FY-2018	FY-201	9	FY-	2020	FY-2021		FY	FY	FY	FY	Tatal
		Summer Winte	er Su	ummer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	2022 - 24	2025 - 27	2028 - 30	2031 - 32	Total
Ore to Dry Plant	kt	1,200	0	2,800	0	2,800	0	2,800	C	2,80	0 0	8,400	8,400	8,400	5,642	43,243
Fe	%	64.2	0	64.7	0	62.8	O	62.9	C	62.	2 (62.8	63.2	62.4	62.7	62.9
SiO	%	4.4	0	3.8	0	6.2	0	(C	6	4 (6.4	5.8	7	6.9	6.2
Al	%	0.8	0	0.8	0	1	O	0.9	C	1.	2 (1	1	1.1	0.9	1
MnO	%	0.15	0	0.15	0	0.15	O	0.13	C	0.1	3 (0.16	0.14	0.11	0.08	0.13
LOI	%	3	0	3	0	3	C	2.8	C	:	3 (2.6	2.4	2.1	2.1	2.5
Ore to Stockpile		0	0	0	0	0	C	47	C	15	4 (0	0	1,872	779	2,851
Fe	%	0	0	0	0	0	C	55.1	C	56.	7 (0	0	58.8	59.2	58.8
SiO	%	0	0	0	0	0	C	16	C	14.	3 (0	0	11.6	11.6	11.8
Al	%	0	0	0	0	0	C	0.9	C	1.	2 (0	0	1.1	1	1.1
MnO	%	0	0	0	0	0	C	0.08	C	0.1	2 (0	0	0.11	0.06	0.1
LOI	%	0	0	0	0	0	O	3.2	C	3.	2 (0	0	2.8	2.2	2.7
Total	kt	102	4,636	302	5,728	2,608	C	2,620	C	2,04	0 6,085	29,337	28,130	13,182	6,754	107,297
Overburden	kt	0	4,636	0	5,728	0	C) (C)	0 6,085	18,503	9,248	0	0	49,975
Waste Rock	kt	102	0	302	0	2,608	C	2,620	C	2,04	0 0	10,834	18,881	13,182	6,754	57,322

Description	Units	FY-	2017		FY-2018	FY-201	.9	FY-	-2020	FY-2021		2022	2022 2023	2023 2024	2025	2026	2027	2028	2020	2020	2031	2032
		Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	2022	2023	2024	2023	2020	2027	2028	2023	2030	2031	2032
Ore to Dry Plant	kt	1,200	0	2,800	0	2,800	0	2,800	0	2,800	0	2,800	2,800	2,800	2,800	2800	2800	2800	2800	2800	2821	2821
Ore to Stockpile	kt	0	0	0	0	0	0	47	0	154	0	0	0	0	0	0	0	624	624	624	389.5	389.5
Total Ore	kt	1,200	0	2,800	0	2,800	0	2,847	0	2,954	0	2,800	2,800	2,800	2,800	2,800	2,800	3,424	3,424	3,424	3,211	3,211
Overburden	kt	0	4636	0	5728	0	0	0	0	0	6085	6,168	6,168	6167.666667	3082.666667	3082.666667	3082.666667	0	0	0	0	0
Waste Rock	kt	102	0	302	0	2608	0	2620	0	2040	0	3,611	3,611	3611.333333	6293.666667	6293.666667	6293.666667	4394	4394	4394	2251.333	2251.333

Description	Units	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Total Ore	kt	1200	2800	2800	2800	2954	2800	2800	2800	2800	2800	2800	3424	3424	3424	3210.5	3210.5
Overburden	kt	4636	5728	0	0	6085	6167.7	6167.7	6167.7	3082.7	3082.7	3082.7	0.0	0.0	0.0	0.0	0.0
Waste Rock	kt	102	302	2608	2620	2040	3611.3	3611.3	3611.3	3611.3	6293.7	6293.7	4394.0	4394.0	4394.0	4394.0	2251.3
Sum	Kt	5938	8830	5408	5420	11079	12579	12579	12579	9494	12176.3	12176.3	7818.0	7818.0	7818.0	7604.5	5461.8

 ROM
 OB
 WAS

 Annual Excavation (Mtpa)
 3.0769
 6.7777
 3.9685
 Moisture content
 9%

Days 200

 Sum total in kt
 13823.077

 Sum OB+WST in kt
 10746.154

Emissions from stockpiles wind erosion

Equation used:

$$FE = 1.12 \times 10^{-4} \times J \times 1.7 \times \left(\frac{s}{1.5}\right) \times \left(365 \times \frac{(365 - P)}{235}\right) \times \left(\frac{I}{15}\right)$$
(8, 11) ref: http://www.ec.gc.ca/pdb/npri/documents/ToolBox/docs/pits_quarries_f.cfm#8.5

s = Average silt load on stockpile (%)

P = Number of days per year were precipitation was at least 0,254 mm

I = Proportion of time per year where wind speed is > 19,3 km/hr (%)

J = Particulates aerodynamic factor Particulates aerodynamic factor of TPM, PMo and PM2.5 is :

J(TPM) = 1 J(PM10) = 0.5

PM2.5/PM10 ratio = 0.15

<--- Ref: Proposed Revisions to Fine Fraction Ratios Used for AP-42 Fugitive Dust Emission Factors, 200

2556 81818

Before applying Attenuation factor

Data

Average Density of stockpiled material tonnes/m3 Email Jean-Christophe Vanier, Ingenium Construction, 2014-03-31

Ref:Meteorological data 2004-2008

Hypothesis to consider moisture content and inactive parl

Before applying Attenuation factor Calculations

									FE	FE	FE					Emission r	ate
	Silt content	Total tonnage stockpiled	Angle of slant	Volume	Height	Exposed Diameter	Exposed Area	Equivalent Flat Diameter	TPM	PM 10	PM 2,5	TPM	PM 10	PM 2,5	TPM	PM 10	PM 2,5
	%	tonnes	degrees	m3	m	m	m2	m	kg/m²-yr	kg/m²-yr	kg/m²-yr	kg/yr	kg/yr	kg/yr	g/s	g/s	g/s
Dump - Flemming 7N	1.5		37		192.2	510	255 789		0.1622	0.0811	0.0122	41 478.0	20 739.0	3 110.9	1.3153	0.6576	0.0986
Overburden - Flemming 7N	1.5		37		114.5	304	90 884		0.1622	0.0811	0.0122	14 737.5	7 368.8	1 105.3	0.4673	0.2337	0.0350
Dump and Overburden- Timmins 4	1.5		37		114.5	304	90 884		0.1622	0.0811	0.0122	14 737.5	7 368.8	1 105.3	0.4673	0.2337	0.0350
Dump and Overburden-Timmins 7	1.5		37		120.0	319	99 797		0.1622	0.0811	0.0122	16 182.8	8 091.4	1 213.7	0.5132	0.2566	0.0385
Dump and Overburden-HOWSE	1.5		37		216.0	573	323 304		0.1622	0.0811	0.0122	52 426.1	26 213.1	3 932.0	1.6624	0.8312	0.1247
SP_T4 - Stockpiles near T4	1.5	167832	37	55944	31.2	83	6 738	92.6	0.1622	0.0811	0.0122	1 092.6	546.3	81.9	0.0346	0.0173	0.0026
SP_NP1 - Stockpiles North of Plant 1	1.5	62258	37	20753	22.4	59	3 479	66.6	0.1622	0.0811	0.0122	564.1	282.1	42.3	0.0179	0.0089	0.0013
SP_P2 - Stockpiles near Plant 2	1.5	322172	37	107391	38.8	103	10 408	115.1	0.1622	0.0811	0.0122	1 687.7	843.8	126.6	0.0535	0.0268	0.0040
SP_F7-1 - Stockpiles near T3 and F7	1.5	329976	37	109992	39.1	104	10 575	116.0	0.1622	0.0811	0.0122	1 714.8	857.4	128.6	0.0544	0.0272	0.0041
SP_F7_2 - Stockpiles near F7 (Eastern)	1.5	138292	37	46097	29.2	78	5 922	86.8	0.1622	0.0811	0.0122	960.3	480.2	72.0	0.0305	0.0152	0.0023
SP_P1 - Stockpiles at of Plant 1	1.5	100000	37	33333	26.2	70	4 771	77.9	0.1622	0.0811	0.0122	773.7	386.8	58.0	0.0245	0.0123	0.0018
SP_SIN - Sinterfines product stockpile	11.2		37		27.7	73	5 305		1.2108	0.6054	0.0908	6 423.5	3 211.8	481.8	0.2037	0.1018	0.0153
SP_SUP - Superfines product stockpile (Northern pile)			37		17.7	47	2 159										
SP_SUP - Superfines product stockpile (Southern pile)			37		17.0	45	1 997										
SP_SUP - Superfines product stockpiles (2 SP modeled as one)	84.5				17.3		4 156		9.1349	4.5674	0.6851	37 963.0	18 981.5	2 847.2	1.2038	0.6019	0.0903
SP HOW - Product, ROM & ROM backup stockpile (3 SP modelled as one)	1.5	261500	37	87167	36.2	96	9 056	107.4	0.1622	0.0811	0.0122	1 468.5	734.3	110.1	0.0466	0.0233	0.0035

* estimated from drawing GIS-ML-20-18-01

						Mon	ths					
	1	2	3	4	5	6	7	8	9	10	11	12
Days in the month	31	28.25	31	30	31	30	31	31	30	31	30	31
Days with Snow Depth >= 5 cm	31	28.25	31	29	16.8	0.7	0	0.05	0.13	11.3	25.9	31
Days with Precipitation >= 0.2 mm	17.1	14.3	16.4	16.2	15.8	16.1	19	18.4	20.4	21.8	21.3	19
Days with Snow Depth >= 5 cm												
+	31.0	28.3	31.0	29.5	24.0	16.4	19.0	18.4	20.4	25.2	28.8	31.0
[1 - (Snow>5cm) / (Days in month)] * (Precipitation>0.2mm) ***												
Monthly P value projected Yearly	365	365	365	359	283	200	224	217	249	296	351	365
Monthly attenuation factor [(365-P) / 235]	0.0000	0.0000	0.0000	0.0238	0.3488	0.7029	0.6012	0.6303	0.4949	0.2929	0.0616	0.0000

Ref: http://www.climate.weatheroffice.ec.gc.ca/climate_normals - Schefferville (1971-2000

*** The " [1 - (Snow>5cm) / (Days in month)] * (Precipitation>0.2mm) " expression determines the monthly percentage of days with precipitations > 0.2 mm with

the month, then assigns this percentage to the remaining days of the month which have no snow cove

Example: In a month of 30 days, there is 12 days of snow cover > 5cm and 24 days with precipitations > 0.2mm. Assuming equal repartition of the days with precipitations > 0.2mm ov all days of the month, there will be a fraction of 0.4 days (12/30) with snow cover, meaning a fraction of 0.6 days without snow cover, therefore 14.4 days (0.6x24) can be calculate as being days WITHOUT snow cover but WITH precipitations > 0.2mm. You can then add the number of days WITH snow cover to calculate the total number of days wi either Snow cover > 5 cm OR precipitations > 0.2mm. This number of days with attenuation can then be projected yearly to calculate a monthly P value that can applied independently to individual months which will fit into the equation quoted above originally designed for yearly calculatio (Snow>5cm) + [1 - (Snow>5cm) / (Days in month)] * (Precipitation>0.2mm) = 12 + [1 - 12/30] * 24 = 26.4 days with attenuation of the content ofMonthly P value projected yearly = 26.4 days / 30 days within the month * 365 days within the year = 321.2 day Monthly attenuation factor = [(365-P) / 235] = (365 - 321.2) / 235 = 0.186

Emissions from Kivivic Ore transportation activities (Engines)

Source: EPA Tier2 - S	pec sheet (7750	3. CAT Mining	a truck)											
PM	,	0.2	g/kW-h	https://www.di	eseInet.com/stan	dards/u	s/nonroad.php							
NOx	NMHC+NOx	6.4	g/kW-h		eselnet.com/stan									
СО		3.5	g/kW-h		eselnet.com/stan									
HC		0.400	g/kW-h		eselnet.com/stan			& FPA420-R-05	-015 Table 8 i	odf				
*EPA420-R-05-015; Ta	able8	0.100	8/		sociii ceilooni, seail	aa. as, a	s,	a 2.77.120 11 05	010 (00:00)	541				
<u>Data</u>	20.00													
Sulfur in fuel		0.0015%			DEE: Email Era	noois Sc	aulnior Evyon M	obil, Jan 5th, 2	011					
Sullui III luel			//		NEF. EIIIali FIA	riçuis se	aumer Exxom w	ODII, Jan Sin, 20	011					
F			mg/kg		. ====									
Engine Gross power			kW		neets 775G CAT	-	ruck)							
Motor load	n.	50%		nypotnesis base	d on motor work	cycle								
Engine power (50% loa	ad)		kW											
Fuel consumption		78.55						under various e	engine load co	nditions by V. Keco	ojevic and	D. Komljenov	ic	
Average speed			km/h	,	conv. Aug 16 20									
LHV		42 780 1		,	neets 775G CAT		,							
Densité diesel		0.8389	kg/l	,	eets 775G CAT		,							
PM < 1 um				Source : AP-42,	Gasoline And Di	esel Indi	ustrial Engines,	tableau 3.3-1.						
Transported ore weigh	nt			64.0	tonnes		Source: Spec	sheets 775G C	CAT Mining tru	ick)				
,				70.5	tons lb			sheets 775G C	-					
Weight empty vehicle				47.8	tonnes					,				
Weight empty venicle				52.7	tons lb									
W (average vehicle we	eight)			88.0	tons lb									
Nbre of hours / year				8760	hr/yr		Ref: New Mill	enium	365 days/yea	r				
Ore transport		Ore comi	ng from Kivivic	7 384 000	tonnes/yr									
		0.000			toes, y.									
Road Width:			20	m			Hypothesis							
Road max lenght			200	m			Lenght:width	atio 10:1, CALF	PUFF User Gu	uide, (Scire, 2000)				
Calaula														
Calculs		70.55	<i>n</i> -	,	0.5	L //s								0.0 1.4(D)/
Diesel Consumption pe	er vehicle	78.55		/		km/h							=	2.2 L/KPV
Diesel Consumption		78.55		X	0.8389	-							=	65.9 kg/h
Hp-h Diesel		65.9 1	kg/h	X	42780	kJ/kg	Х	1	h	/	2684.5	kJ/hp-h	=	1050.2 hp-h
DM Fasionian anto		007.5	347	v	0.0	-/134/ 1-		0.5	L //s	/	4000	0		(energy from the fuel)
PM Emission rate		307.5		X		g/kW-h			km/h	/	1000		=	0.0018 kg/KPV
CO Emission rate		307.5		X		g/kW-h			km/h	/	1000		=	0.0308 kg/KPV
NO _X Emissions rate		307.5		X		g/kW-h			km/h	/	1000		=	0.0562 kg/KPV
SO ₂ Emission rate (15	ppm sulphur)	2.2	L/km parcouru v	X		kg/L	X	15	mg S/kg	X	2	kg SO₂/kg S	=	5.65E-05 kg/KPV
HC Emission rate		307.5	kW	X	0.4	g/kW-h	1 /	35	km/h	/	1000	g/kg	=	0.0035 kg/KPV
Ore coming from K	ivivic													
Voy/year - go/ret	7 384 000	T/ year	/	64.0	tonnes	Х	2	aller-retour	=	230 750	voy/ ye	ar		
voy/year go/ret	7 304 000	i, you	,	04.0	tornes	^	-	uner retour		250 750	101/ 10	۵.		
PM(kg/km)	0.0018	kg/KPV	Х	230 750	voyages/ yea	r :	405	kg/km	=	405	g/m			
PM(g/s/m2)	405	g/m	/	20	m	/	31 536 000	S			=	6.43E-07	g/s/m2	
CO(kg/km)	0.0308	kg/KPV	X	230 750	voyages/ yea	r	7 096	kg/km	=	7 096	g/m			
CO(g/s/m2)	7 096	g/m	/	20	m	/	31 536 000	S			=	1.12E-05	g/s/m2	
NOx(kg/km)	0.06	kg/KPV	X	230 750	voyages/; yea	r	12 975	kg/km	=	12 975	g/m			
NOx(g/s/m2)	12 975	g/m	/	20	m	/	31 536 000	S			=	2.06E-05	g/s/m2	
	0.00000	kg/KPV	X	230 750	voyages/ year	. :	13	kg/km	=	13	g/m			
SO2(kg/km)	0.00006													
SO2(kg/km) SO2(g/s/m2)	13	g/m	/	20	m	/	31 536 000	S			=	2.07E-08	g/s/m2	
SO2(g/s/m2)	13	g/m	/			/					=	2.07E-08	g/s/m2	
			/ x /	20 230 750 20	m voyages/ yea	/ r :	31 536 000 810.9214286 31 536 000	s kg/km	=	810.9214286	= g/m	2.07E-08 1.29E-06	g/s/m2 g/s/m2	

Emissions from Kivivic Ore transportation activities (PM)

Equation used:

 $E = 0.282* k*(s/12)^a*(W/3)^b$

Ref.: U.S. EPA Fifth Edition, Volume I Chapter 13, Miscellaneous Sources, section 13.2.2 Unpaved Roads, Equation (1)

E = Emission factor (lb/Vehicule mile traveled)

k,a,b = constant

s= % silt

W= Vehicule average weight (tons lb)

Eext= E((365-P)/365)

Réf.: U.S. EPA Fifth Edition, Volume I Chapter 13, Miscellaneous Sources, section 13.2.2 Unpaved Roads, Equation (2)

Eext= Emmision factor - natural mitigation (lb/Vehicule mile traveled)

P = Number of days per year were precipitation was at least 0,254 mm

Applied monthly in CALPUFF as variable emission factors

Data

	PM2.5	PM10	MPT
k (lb/MVP)	0.15	1.50	4.90
a	0.90	0.90	0.70
b	0.45	0.45	0.45

Réf.: U.S. EPA Fifth Edition, Volume I Chapter 13, Miscellaneous Sources, section 13.2.2 Unpaved Roads, Table 13.2.2-2

s (% silt)	· · · · · · · · · · · · · · · · · · ·	8.0	%	Pierre concassée, ref: em - DSO Phase 2a(2) - silt.n	ail JC Bourassa 23 March 2010 nsg
Transported ore weight		64.0	tonnes	Source: Spec sheets 775	G CAT Mining truck)
		70.5	tons lb	Source: Spec sheets 775	G CAT Mining truck)
Weight empty vehicle		47.8	tonnes		
		52.7	tons lb		
W (average vehicle weight)		88.0	tons lb		
Ore transport	Ore coming from Kivivic	7,384,000	tonnes/yr		
Nb hours / year		8760	hr/yr	Ref: New Millenium	200 days/year
Road width	20 m	ı			
Road max lenght	200 m	1		Lenght:width ratio 10:1, C	ALPUFF User Guide, (Scire, 2000)

Emission control: road spray

Efficiency: **70%**

Source.: Environment Canada - NPRI Toolbox - Unpaved Industrial Road Dust Excel Calculator

http://ec.gc.ca/inrp-npri/default.asp?lang=En&n=6DE7F8BC-1

<u>Calculations</u>	induda										
Ore coming from K Voy/year - go/ret	7,384,000	T/year	/	64.0	tonnes/load	X	2	trips/load	=	230,750	trips/year
PM2.5 (kg/KPV)	0.13	lb/VMT	X	0.454	kg/lb	Х	0.621	km/mile	=	0.04	kg/VKT
PM2.5 (kg/km)	0.0379	kg/VKT	X	230,750	trips/year	=	8,738	kg/km yr	=	8,738	g/m year
PM2.5 (g/s m)	8,738	g/m year	/	31,536,000	s/yr	Χ	(1 - 0,70)		=	8.31E-05	g/s m
PM2.5 (g/s m2)	8.31E-05	g/s m	/	20	m				=	4.16E-06	g/s m2
PM10 (lb/year)	1.34	lb/MVP	X	0.454	kg/lb	Х	0.621	km/mile	=	0.38	kg/VKT
PM10 (kg/km)	0.38	kg/KPV	Χ	230,750	trips/year	=	87,380	kg/km yr	=	87,380	g/m year
PM10 (g/s m)	87,380	g/m year	/	31,536,000	s/yr	Χ	(1 - 0,70)		=	8.31E-04	g/s m
PM10 (g/s m2)	8.31E-04	g/s m	/	20	m				=	4.16E-05	g/s/m2
MPT (lb/year)	4.76	lb/MVP	X	0.454	kg/lb	Х	0.621	km/mile	=	1.34	kg/VKT
MPT (kg/ year)	1.34	kg/KPV	X	230,750	trips/year	=	309,552	kg/km yr	=	309,552	g/m year
MPT (g/s m)	309,552	g/m year	/	31,536,000	s/yr	Χ	(1 - 0,70)		=	2.94E-03	g/s m
MPT (g/s m2)	2.94E-03	g/s m	/	20	m				=	1.47E-04	g/s/m2

Emissions from 10 wheelers for HOWSE Overburden transportation activities (Engines)

Emissions from 1				ransportatioi	n activities (Er	ngine	s)							
Source: EPA MOVES	32014 for a 2010 D	-	-											
PM		0.0243269	g/km											
NOx		0.82285076	g/km											
CO		0.25617829	g/km											
HC		0.069	g/km											
*EPA420-R-05-015; T	Table8													
<u>Data</u>														
Sulfur in fuel		0.0015%			REF: Email Fra	nçois S	Saulnier Exxon I	Mobil, Jan 5th, 20	011					
		15 ו	mg/kg											
Engine Gross power		350 l	kW	Source: CT680	-CAT									
Motor load		50%		hypothesis bas	ed on motor work	cycle								
Engine power (50% lo	oad)	175.00 l	kW											
Fuel consumption		45.35	L/h	Source : Haul to	ruck fuel consump	tion ar	nd CO2 emission	n under various ei	ngine load co	onditions by V. Ke	cojevic and D. Koi	mljenovic		
Average speed		35 I	km/h											
LHV		42 780 I	kJ/kg											
Density of diesel		0.8389	kg/l											
PM < 1 um				Source : AP-42	, Gasoline And Di	esel In	dustrial Engines	s, tableau 3.3-1.						
Tuesca ante d' a se	-1			20.0			Carrage	//	//a: 00 html					
Transported ore weig	gnt			20.0	tonnes		Source:rittp:/	//www.ancai.com/i	101_89.ntm1					
Martin				22.0	tons lb		0	//			. 74FF00D7 40			
Weight empty vehicle	9			13.4	tonnes		Source: http:	//www.ec.gc.ca/lc	cpe-cepa/deta	ault.asp?lang=En&	&n=/1EF09D/-1&	offset=3#s_c_2_2		
				14.8	tons lb									
W (average vehicle w	veight)			25.8	tons lb									
Nbre of hours / year				2400	hr/yr		Assumption	of 12h/day activition	es, 200 days	/year				
Ore transport														
<u> </u>		Overburden b	y First Nation	s 100 000	tonnes/yr									
Road Width:				0 m			Hypothesis							
Road max lenght			20	0 m			Lenght:width	ratio 10:1, CALP	UFF User Gu	uide, (Scire, 2000)				
Calculs														
Diesel Consumption p	per vehicle	45.35 I	L/h	/	35	km/h			=		1.3 L	/KPV		
PM Emission rate		0.02433 (_	/	1000	g/kg			=		0.000024327 k	•		
CO Emission rate		0.25618	g/km	/	1000	g/kg			=		0.000256178 k	g/KPV		
NO _X Emissions rate		0.82285	g/km	/	1000	g/kg			=		0.000822851 k	g/KPV		
SO ₂ Emission rate (15	oppm sulphur)	1.3	L/km parcourt	יו X	0.8389	kg/L	X	15 n	ng S/kg	X	2 k	$kg SO_2/kg S =$	3.26E-05	kg/KPV
HC Emission rate		0.06935	g/km	/	1000	g/kg			=		0.000069351 k	g/KPV		
Overburden by Eir	est Nations													
Overburden by Fir Voy/year - go/ret	100 000	T/ year	/	20.0	tonnes	Х	2	aller-retour	=	10 000	voy/ year			
voy/year 50/1et	100 000	i, year	,	20.0	tornies	^	_	uner retour		10 000	voy/ year			
PM(kg/km)	0.0000243	kg/KPV	Х	10 000	voyages/ year	=	0.24327	kg/km	=	0.24327	g/m			
PM(g/s/m2)	0.24327	g/m	/	20	m	1	8 640 000	S S			=	1.41E-09	g/s/m2	
(8/ 3/2/	0.2.527	8/ ···	,			,	0 0 10 000	J					8, 0,	
CO(kg/km)	0.0002562	kg/KPV	Х	10 000	voyages/ year	=	2.56178	kg/km	=	2.56178	g/m			
CO(g/s/m2)	2.56178	g/m	/	20	m	1	8 640 000	S			=	1.48E-08	g/s/m2	
CO(B/ 3/ 1112)	2.50170	6/ · · ·	,	20		,	0 040 000	3				1.402 00	8/ 3/ IIIE	
NOx(kg/km)	0.0008229	kg/KPV	Х	10 000	voyages/ year	=	8.22851	kg/km	=	8.22851	g/m			
NOx(g/s/m2)	8.22851	g/m	/	20	m	/	8 640 000	S			=	4.76E-08	g/s/m2	
- (0, -,)			,			,	2 2 12 230	-					G, -, -	
SO2(kg/km)	0.0000326	kg/KPV	Х	10 000	voyages/ year	=	0.32608	kg/km	=	0.32608	g/m			
SO2(g/s/m2)	0.32608	g/m	/	20	m	/	8 640 000	s s			=	1.89E-09	g/s/m2	
,		<u>.</u>	,			,							J,	
HC(kg/km)	0.0000694	kg/KPV	Х	10 000	voyages/ year	=	0.69351	kg/km	=	0.69351	g/m			
HC(g/s/m2)	0.69351	g/m	/	20	m	/	8 640 000	s s			=	4.01E-09	g/s/m2	
	2.05552	or	,	=-	•••	,	2 2 .0 000	-					o, -, <u>-</u>	

Emissions from 10 wheelers for HOWSE Overburden transportation activities (PM)

Equation used:

E =0.282* k*(s/12)^a*(W/3)^b

E = Emission factor (lb/Vehicule mile traveled)

k,a,b = constant

s= % silt

W= Vehicule average weight (tons lb)

Eext= E((365-P)/365)

Ref.: U.S. EPA Fifth Edition, Volume I Chapter 13, Miscellaneous Sources, section 13.2.2 Unpaved Roads, Equation (1)

Réf.: U.S. EPA Fifth Edition, Volume I Chapter 13, Miscellaneous Sources, section 13.2.2 Unpaved Roads, Equation (2)

Applied monthly in CALPUFF as variable emission factors

<u>Data</u>

	PM2.5	PM10	MPT
k (lb/MVP)	0.15	1.50	4.90
a	0.90	0.90	0.70
b	0.45	0.45	0.45

Eext= Emmision factor - natural mitigation (lb/Vehicule mile traveled)

P = Number of days per year were precipitation was at least 0,254 mm

	PM2.5	PM10	MPT	Réf.: U.S. EPA Fifth
k (lb/MVP)	0.15	1.50	4.90	Roads, Table 13.2.2
a	0.90	0.90	0.70	
L	0.45	0.45	0.45	

Edition, Volume I Chapter 13, Miscellaneous Sources, section 13.2.2 Unpaved

Lenght:width ratio 10:1, CALPUFF User Guide, (Scire, 2000)

s (% silt)		8.0	%	Pierre concassée, ref: email JC Bourassa 23 March 2010 - DSO Phase 2a(2) - silt.msg
Transported ore weight		20.0	tonnes	Source:http://www.ancai.com/loi_89.html
		22.0	tons lb	
Weight empty vehicle		13.4	tonnes	Source: http://www.ec.gc.ca/lcpe-cepa/default.asp?lang=En&n=71EF09D7-1&offset=3#s_c_2_2
		14.8	tons lb	
W (average vehicle weight)		25.8	tons lb	
Ore transport	Overburden by First Nations	100,000	tonnes/yr	
Nb hours / year		2400	hr/yr	Assumption of 12h/day activities, 200 days/year
Road width	20 m			

Emission control: road spray

70% Efficiency:

Source.: Environment Canada - NPRI Toolbox - Unpaved Industrial Road Dust Excel Calculator

http://ec.gc.ca/inrp-npri/default.asp?lang=En&n=6DE7F8BC-1

200 m

Calculations

Road max lenght

<u>Calculations</u>											
Overburden by Firs	t Nations										
Voy/year - go/ret	100,000	T/year	/	20.0	tonnes/load	Χ	2	trips/load	=	10,000	trips/year
PM2.5 (kg/KPV)	0.08	lb/VMT	Χ	0.454	kg/lb	Χ	0.621	km/mile	=	0.02	kg/VKT
PM2.5 (kg/km)	0.0218	kg/VKT	Х	10,000	trips/year	=	218	kg/km yr	=	218	g/m year
PM2.5 (g/s m)	218	g/m year	/	8,640,000	s/yr	Χ	(1 - 0,70)		=	7.57E-06	g/s m
PM2.5 (g/s m2)	7.57E-06	g/s m	/	20	m				=	3.78E-07	g/s m2
PM10 (lb/year)	0.77	lb/MVP	Х	0.454	kg/lb	Х	0.621	km/mile	=	0.22	kg/VKT
PM10 (kg/km)	0.22	kg/KPV	Х	10,000	trips/year	=	2,179	kg/km yr	=	2,179	g/m year
PM10 (g/s m)	2,179	g/m year	/	8,640,000	s/yr	Χ	(1 - 0,70)		=	7.57E-05	g/s m
PM10 (g/s m2)	7.57E-05	g/s m	/	20	m				=	3.78E-06	g/s/m2
MPT (lb/year)	2.74	lb/MVP	Х	0.454	kg/lb	Х	0.621	km/mile	=	0.77	kg/VKT
MPT (kg//year)	0.77	kg/KPV	Х	10,000	trips/year	=	7,721	kg/km yr	=	7,721	g/m year
MPT (g/s m)	7,721	g/m year	/	8,640,000	s/yr	Χ	(1 - 0,70)		=	2.68E-04	g/s m
MPT (g/s m2)	2.68E-04	g/s m	/	20	m				=	1.34E-05	g/s/m2

Emissions from Pickup transportation activities (Engines)

Source: EPA MOVES2014 for a 2010 Gasoline Light Commercial Truck 0.00472805 PM NOx CO HC *EPA420-R-05-015; Table8 <u>Data</u> Sulfur in fuel 0.04083921 g/km g/km 0.006 g/km

0.0030% 30 mg/kg 269 kW 50% 134.28 kW 0.16 L/km 50 km/h 0.734 kg/L Engine Gross power
Motor load
Engine power (50% load)
Fuel consumption
Average speed
Density gasoline
PM < 1 um

Source: http://www.ec.gc.ca/energie-energy/defaulLasp?lang=En&n=9863FC87-1&offset=2#2.2.1 Source: Spec sheet F150 hypothesis based on motor work cycle

0.0 0.0 2.0 2.2 2.2

20 m 200 m

Source: Ford F150 Pickup Specification sheet
Source: Conference call with Loic Didillon on July 08, 2015
Source: http://publications.gc.ca/collections/collection_2014/ec/En14-170-2003-fra.pdf
Source: AP-42, Gasoline And Diesel Industrial Engines, tableau 3.3-1.

Weight empty vehicle W (average vehicle weight) Nbre of hours/ year Nbr of Travels btw 9-15 july Nbr of Travels per day

tonnes tons lb tonnes tons lb tons lb

Source: Spec sheets Pickup

Source: Spec sheets Pickup-supercrew

4563 2084 **300** 24 hr/yr travels travels/day travels/hr Assumption of 12.5h/day activities, 365 days/year Source: E-mail sent by Loic Didillon on July 18th, 2015 (2084 travels over 7 days) (300 travels over 12.5hr/day)

Percentage of Traveling rate to consider

Transported ore weight

Nbr of Travels per hour

Road Width:

Road max lenght

Pickup Rate travelling between DSO3 and DSO4 - 25% Pickup Rate travelling between DSO3 and Schefferville - 100% 25% 100%

Hypothesis

Lenght:width ratio 10:1, CALPUFF User Guide, (Scire, 2000)

Brochure - Ford F150

5L 4-valve-v8 FFV 4*2 combined Feul consumption (mpg) 15

GVWR 8200

360 Flex-fuel (FFV)

POWER (HP) Engine type

Calculs Diesel Consumption per vehicle PM Emission rate		0.16 L 0.00473 g	/km	/	50 ki 1000 g.	/kg			=		0.003130 L/ 0.000004728 kg	/KPV		
CO Emission rate		1.19968 g		/	1000 g				=		0.001199684 kg			
NO _X Emissions rate		0.04084 g		/	1000 g				=		0.000040839 kg			
SO ₂ Emission rate (30ppm sulphur)		0.003130 L	. ,	Х		g/L	X	30	mg S/kg	X		$_{1} SO_{2}/kg S =$	1.38E-07	kg/KPV
HC Emission rate		0.00586 g	/km	/	1000 g	/kg			=		0.000005860 kg	/KPV		
Pickup Rate travelling between D	SO2 and DSO4	25%												
travel/year - back and forth	24	travels/hr	x	4563	hr/yr	х	25%		=	27 375	voy/ year			
PM(kg/km)	0.0000047	kg/KPV	х	27 375	voyages/; year	=	0.12943	kg/km	=	0.12943	g/m			
PM(g/s/m2)	0.12943	g/m	/	20	m	/	16 425 000	S			=	3.94E-10	g/s/m2	
CO(kg/km)	0.0011997	kg/KPV	x /	27 375	voyages/ year	=	32.84135	kg/km	=	32.84135	g/m =	4 005 07		
CO(g/s/m2)	32.84135	g/m	/	20	m	/	16 425 000	S			=	1.00E-07	g/s/m2	
NOx(kg/km)	0.0000408	kg/KPV	х	27 375	voyages/ year	=	1.11797	kg/km	=	1.11797	g/m			
NOx(g/s/m2)	1.11797	g/m	ĵ,	20	m	/	16 425 000	S S		1.11737	=	3.40E-09	g/s/m2	
		8,	,			,							8/-/=	
SO2(kg/km)	0.0000001	kg/KPV	x	27 375	voyages/ year	=	0.00377	kg/km	=	0.00377	g/m			
SO2(g/s/m2)	0.00377	g/m	/	20	m	/	16 425 000	s			=	1.15E-11	g/s/m2	
HC(kg/km)	0.0000059	kg/KPV	Х	27 375	voyages/ year	=	0.16043	kg/km	=	0.16043	g/m			
HC(g/s/m2)	0.16043	g/m	/	20	m	/	16 425 000	S			=	4.88E-10	g/s/m2	
Pickup Rate travelling between D	SO2 and Schoff	orvillo - 100%												
travel/year - back and forth	24	travels/hr	х	4563	hr/yr	х	100%		=	109 500	voy/an			
travely year back and for an	2-7	craversy in	^	4303	, 4.	^	10070			103 300	101/1011			
PM(kg/km)	0.000004728	kg/KPV	x	109 500	voyages/: year	=	0.51772	kg/km	=	0.51772	g/m			
PM(g/s/m2)	0.51772	g/m	/	20	m	/	16 425 000	s			=	1.58E-09	g/s/m2	
CO(kg/km)	0.001199684	kg/KPV	X	109 500	voyages/ year	=	131.36541	kg/km	=	131.36541	g/m			
CO(g/s/m2)	131.36541	g/m	/	20	m	/	16 425 000	S			=	4.00E-07	g/s/m2	
NO (1 / 1)	0.000040000	I french		400 500			4.474.00			4.474.00	,			
NOx(kg/km) NOx(g/s/m2)	0.000040839 4.47189	kg/KPV g/m	x /	109 500 20	voyages/ year m	=	4.47189 16 425 000	kg/km	=	4.47189	g/m =	1.36E-08	g/s/m2	
NOX(g/s/m2)	4.47189	g/m	/	20	m	/	16 425 000	S			=	1.30E-08	g/s/m2	
SO2(kg/km)	0.000000138	kg/KPV	х	109 500	voyages/ year	=	0.01510	kg/km	=	0.01510	g/m			
SO2(g/s/m2)	0.01510	g/m	ĵ,	20	m	/	16 425 000	S S			=	4.60E-11	g/s/m2	
10			•			,		-				· · 	J/	
HC(kg/km)	0.0000059	kg/KPV	Х	109 500	voyages/ year	=	0.64172	kg/km	=	0.64172	g/m			
HC(g/s/m2)	0.64172	g/m	/	20	m	/	16 425 000	S			=	1.95E-09	g/s/m2	

Emissions from Pickup transportation activities (PM)

Equation used:

E = 0.282* k*(s/12)^a*(W/3)^b E = Emission factor (lb/Vehicule mile traveled)

k,a,b = constant

s= % silt

W= Vehicule average weight (tons lb)

Eext= E((365-P)/365)

Eext= Emmision factor - natural mitigation (lb/Vehicule mile traveled) P = Number of days per year were precipitation was at least 0,254 mm Ref.: U.S. EPA Fifth Edition, Volume I Chapter 13, Miscellaneous Sources, section 13.2.2 Unpaved Roads, Equation (1)

Réf.: U.S. EPA Fifth Edition, Volume I Chapter 13, Miscellaneous Sources, section 13.2.2 Unpaved Roads, Equation (2)

- DSO Phase 2a(2) - silt.msg

Source:http://www.ancai.com/loi_89.html

Applied monthly in CALPUFF as variable emission factors

D	ta

	PM2.5	PM10	MPT
k (lb/MVP)	0.15	1.50	4.90
a	0.90	0.90	0.70
b	0.45	0.45	0.45

Réf.: U.S. EPA Fifth Edition, Volume I Chapter 13, Miscellaneous Sources, section 13.2.2 Unpaved

Pierre concassée, ref: email JC Bourassa 23 March 2010

a	0.90	0.90	0.70
b	0.45	0.45	0.45
s (% silt)			

Transported ore weight 0.0 0.0 Weight empty vehicle 2.0 2.2 W (average vehicle weight) 2.2

Source: http://www.ec.gc.ca/lcpe-cepa/default.asp?lang=En&n=71EF09D7-1&offset=3#s_c_2_2

Percentage of Traveling rate to consider

Pickup Rate travelling between DSO3 and DSO4 - 25% Pickup Rate travelling between DSO3 and Schefferville - 100%

100% 4563 hr/yr 2084 300

25%

8.0

24

Assumption of 12.5h/day activities, 365 days/year

travels travels/day travels/hr

%

tons lb

tonnes

tons lb

tons lb

Source: E-mail sent by Loic Didillon on July 18th, 2015 (2084 travels over 7 days) (300 travels over 12.5hr/day)

Nbr of Travels btw 9-15 july Nbr of Travels per day Nbr of Travels per hour

Nbre of hours / year

20 m 200 m

Lenght:width ratio 10:1, CALPUFF User Guide, (Scire, 2000)

Emission control: road spray

70% Efficiency:

Source.: Environment Canada - NPRI Toolbox - Unpaved Industrial Road Dust Excel Calculator http://ec.gc.ca/inrp-npri/default.asp?lang=En&n=6DE7F8BC-1

Calculations

Road width

Road max lenght

<u>Calculations</u>											
Pickup Rate travelling betw travel/year - back and forth	veen DSO3 and 24	travels/hr	Х	4563	hr/yr	Х	25%		=	27 375	voy/ _{year}
DN 42 F (I /VD) ()	0.03	II- A /A 4T	٧,	0.454	1/11-	.,	0.634	loss for the		0.04	l h net
PM2.5 (kg/KPV)	0.03	lb/VMT	X X	0.454 27 375	kg/lb	X	0.621 197	km/mile kg/km yr	=	0.01 197	kg/VKT
PM2.5 (kg/km)		kg/VKT	Χ,		trips/year	=		kg/km yr	=	3.60E-06	g/m year
PM2.5 (g/s m)	197	g/m year	/	16 425 000	s/yr	Х	(1 - 0,70)		=		g/s m
PM2.5 (g/s m2)	3.60E-06	g/s m	/	20	m				=	1.80E-07	g/s m2
PM10 (lb/year)	0.26	lb/MVP	х	0.454	kg/lb	Х	0.621	km/mile	=	0.07	kg/VKT
PM10 (kg/km)	0.07	kg/KPV	Х	27 375	trips/year	=	1 973	kg/km yr	=	1 973	g/m year
PM10 (g/s m)	1 973	g/m year	/	16 425 000	s/yr	Χ	(1 - 0,70)		=	3.60E-05	g/s m
PM10 (g/s m2)	3.60E-05	g/s m	/	20	m				=	1.80E-06	g/s/m2
MPT (lb/ year)	0.91	lb/MVP	х	0.454	kg/lb	Х	0.621	km/mile	=	0.26	kg/VKT
MPT (kg/ year)	0.26	kg/KPV	Х	27 375	trips/year	=	6 990	kg/km yr	=	6 990	g/m year
MPT (g/s m)	6 990	g/m year	/	16 425 000	s/yr	Х	(1 - 0,70)		=	1.28E-04	g/s m
MPT (g/s m2)	1.28E-04	g/s m	/	20	m				=	6.38E-06	g/s/m2
Pickup Rate travelling betw	veen DSO3 and	d Schefferville -	100%								
travel/year - back and forth	24	travels/hr	x	4563	hr/yr	Х	100%		=	109 500	voy/ year
PM2.5 (kg/KPV)	0.03	lb/MVP	х	0.454	kg/lb	Х	0.621	km/mile	=	0.01	kg/VKT
PM2.5 (kg/km)	0.01	kg/KPV	Х	109 500	passages/ year	=	789	kg/km	=	789	g/m year
PM2.5 (g/s m)	789	g/m year	/	16 425 000	s/ year	Χ	(1 - 0,70)		=	1.44E-05	g/s m
PM2.5 (g/s m2)	1.44E-05	g/s m	/	20	m				=	7.21E-07	g/s/m2
PM10 (lb/year)	0.26	lb/MVP	х	0.454	kg/lb	х	0.621	km/mille	=	0.07	kg/VKT
PM10 (kg/km)	0.07	kg/KPV	Х	109 500	passages/ year	=	7 893	kg/km	=	7 893	g/m year
PM10 (g/s m)	7 893	g/m year	/	16 425 000	s/ year	Х	(1 - 0,70)		=	1.44E-04	g/s m
PM10 (g/s m2)	1.44E-04	g/s m	/	20	m				=	7.21E-06	g/s/m2
MPT (lb/year)	0.91	lb/MVP	x	0.454	kg/lb	х	0.621	km/mille	=	0.26	kg/VKT
MPT (kg, year)	0.26	kg/KPV	X	109 500	passages/ year	=	27 960	kg/km	=	27 960	g/m year
MPT (g/s m)	27 960	g/m year	/	16 425 000	s/ year	Х	(1 - 0,70)	-	=	5.11E-04	g/s m
MPT (g/s m2)	5.11E-04	g/s m	/	20	m		. , , ,		=	2.55E-05	g/s/m2

Emissions from HOWSE (es (Engines)											
Source: EPA Tier2 - Spec sheet	t (775G, CAT M					,	,							
PM		0.2		https://www.die										
NOx		6.4	0.	https://www.die										
CO		3.5		https://www.die										
HC		0.400	g/kW-h	https://www.die	selnet.com/stan	<u>dards/υ</u>	us/nonroad.php	& EPA420-F	R-05-015 Tab	le 8.pdf				
<u>Data</u>														
Sulfur in fuel		0.0015%			REF: Email Fran	ıçois Sa	aulnier Exxon N	∕lobil, Jan 5th	1, 2011					
		15 mg/kg												
Engine Gross power		615 kW		Source: Spec sh			truck)							
Motor load		50%		hypothesis base	d on motor work	cycle								
Engine power (50% load)		307.50 kW												
Fuel consumption		78.55 L/h		Source : Haul tru	ick fuel consump	tion and	d CO2 emission	n under vario	us engine lo	ad conditions b	v V. Kecoje	vic and D. Ko	mljenovic	
Average speed		35 km/h		Source : phone of	conv. Aug 16 201	1 - JC	Bourassa							
LHV		42 780 kJ/kg		Source: Spec sh	eets 775G CAT	Mining 1	truck)							
Density of Diesel		0.8389 kg/l		Source: Spec sh	eets 775G CAT	Mining 1	truck)							
PM < 1 um				Source : AP-42,	Gasoline And Die	esel Ind	lustrial Engines	, tableau 3.3	-1.					
Transported ore weight				64.0			Source: Spec			- 4				
Transported ore weight					tonnes					,				
Maiabb assatuus bisla				70.5	tons lb		Source: Spec	Sheets 1150	3 CAT WITHIN	g truck)				
Weight empty vehicle				47.8	tonnes									
				52.7	tons lb									
W (average vehicle weight)				88.0	tons lb									
Nbre of hours / year			HOWSE to O.B.	3600	hr/yr		Howse to Wa	ste/Ore		4800 hr/yr				
Note of flours / year		<u> </u>	HOWSE to O.B.	3000	111/ y1		nowse to wa	ste/OTE		4800 III/yi				
Ore transport			HOWEE +- O.B.	6 777 656										
Ore transport			HOWSE to O.B.		tonnes/yr									
			HOWSE Ore transport		tonnes/yr									
			HOWSE to Waste	3 968 498	tonnes/yr									
Road Width:			20				Hypothesis							
Road max lenght			200	m			Lenght:width	ratio 10:1, C	ALPUFF Use	r Guide, (Scire	2000)			
Calculs														
Diesel Consumption per vvehicle	е	78.55 L/h		/	35 k	m/h							=	2.2 L/KPV
Diesel Consumption		78.55 L/h		X	0.8389 k	g/I							=	65.9 kg/h
Hp-h Diesel		65.9 kg/h		X	42780 k	J/kg	X		1 h	/	2684.5 kJ	/hp-h	=	1050.2 hp-h
•		· ·										•		energy from the fuel)
PM Emission rate		307.5 kW		X	0.2	g/kW-h	/	3	35 km/h	/	1000 g/	ka	=	0.0018 kg/KPV
CO Emission rate		307.5 kW		X		g/kW-h			35 km/h	,	1000 g/	•	=	0.0308 kg/KPV
NO _x Emissions rate		307.5 kW		X		g/kW-h			35 km/h	,	1000 g/		=	0.0562 kg/KPV
	hur)		/ahia.da taa.allad (ICD\/)			-								-
SO ₂ Emission rate (15ppm sulpl	nur)		/ehicule travelled (KPV)	X		g/L	X		15 mg S/kg	X		SO₂/kg S	=	5.65E-05 kg/KPV
HC Emissions rate		307.5 kW		X	0.400	g/kW-h	/	3	35 km/h	/	1000 g/	kg	=	0.0035 kg/KPV
*EPA420-R-05-015; Table8														
HOWSE to O.B.														
travel/year - back and forth	6 777 656	T/ year	/	64.0	tonnes >	(2	aller-retour	=	211 802	voy/ year			
PM(kg/km)	0.0018	kg/KPV	X	211 802	voyages/ year	=	372	kg/km	=	372	g/m			
PM(g/s/m2)	372	g/m	/	20	m	/	12 960 000	S			=	1.44E-06	g/s/m2	
CO(kg/km)	0.0308	kg/KPV	X	211 802	voyages/ year	=	6 513	kg/km	=	6 513	g/m			
CO(g/s/m2)	6 513	g/m	/	20	m	/	12 960 000	s			=	2.51E-05	g/s/m2	
(8/ -/=/		8,	,			,							8, -,	
NOx(kg/km)	0.06	kg/KPV	х	211 802	voyages/ year		11 909	kg/km	=	11 909	g/m			
NOx(g/s/m2)	11 909	g/m	^	20	m	-,	12 960 000		-	11 303	=	4.59E-05	g/s/m2	
NOX(g/s/III2)	11 909	g/III	/	20	111	/	12 900 000	S			-	4.596-05	g/s/1112	
					/ W00r						,			
SO2(kg/km)	0.00006	kg/KPV	X	211 802	voyages/ year	=	12	kg/km	=	12	g/m			
SO2(g/s/m2)	12	g/m	/	20	m	/	12 960 000	S			=	4.62E-08	g/s/m2	
HC(kg/km)	0.0035	kg/KPV	X	211 802	voyages/ year	=	744	kg/km	=	744	g/m			
HC(g/s/m2)	744	g/m	/	20	m	/	12 960 000	S			=	2.872E-06	g/s/m2	
HOWSE Ore transport														
travel/year - back and forth	3 076 923	T/ year	/	64.0	tonnes >	(2	aller-retour	=	96 154	voy/ year			
PM(kg/km)	0.0018	kg/KPV	Х	96 154	voyages/ year	=	169	kg/km	=	169	g/m			
PM(g/s/m2)	169	g/m	/	20	m	/	17 280 000	S			=	4.89E-07	g/s/m2	
(0/ =//=/	203	o	,			,	200 000	,					o, v,	
CO(kg/km)	0.0308	kg/KPV	Х	96 154	voyages/ year	=	2 957	kg/km	=	2 957	g/m			
CO(g/s/m2)	2 957	g/m	,	20	m woyages/ your	,	17 280 000	Kg/KIII S	-	2 331	g/III =	8.56E-06	g/s/m2	
20/8/3/2/	2 331	p	,	20		,	1, 200 000	3			-	3.30L-00	DI 37 1112	
NOx(kg/km)	0.06	kg/KPV	Х	96 154	voyages/ year	Ε	5 407	kg/km	=	5 407	g/m			
NOx(g/s/m2)	5 407	g/m	,	20	m woyages/ year	-/	17 280 000	Kg/KIII S	-	5 407	g/m =	1.56E-05	g/s/m2	
NOX(g/3/1112)	3407	g/ 111	/	20	""	,	17 280 000	3			_	1.301-03	g/ 3/ 1112	
CO2(I/I)	0.00006	kg/KPV	V	00.154			-	l. = /l		-	-/			
SO2(kg/km)			X /	96 154	voyages/ year	= /	5 17 280 000	kg/km	=	5	g/m =	1.57E-08	-1-12	
SO2(g/s/m2)	5	g/m	/	20	m	/	17 280 000	S			=	1.5/E-U8	g/s/m2	
HC(kg/km)	0.0035	ka/KDV	v	06 154	vovagos /	_	220	ka/km	_	220	a/m			
HC(kg/km)	0.0035	kg/KPV	X	96 154	voyages/ year		338	kg/km	=	338	g/m	0.705.07	-1-1	
HC(g/s/m2)	338	g/m	/	20	m	/	17280000	S			=	9.78E-07	g/s/m2	
HOWEE: W.														
HOWSE to Waste	2022	T /	,				_	. 0						
travel/year - back and forth	3968498.2	T/: year	/	64	tonnes	Х	2	aller-retou	r =	124016	voy/ year			
PM(kg/km)	0.0017571	kg/KPV	X	124015.5678	voyages/ year	=	217.9130691	-	=	217.913				
PM(g/s/m2)	217.91307	g/m	/	20	m	/	17280000	S			=	6.30536E-07	g/s/m2	
CO(kg/km)	0.03075	kg/KPV	Х	124015.5678	voyages/ year	=	3813.478709	kg/km	=	3813.48	g/m			
CO(g/s/m2)	3813.4787	g/m	,	20	m	/	17280000	S				1.10344E-05	g/s/m2	
10,		<u>.</u>	•	-	•	•		-					J	
NOx(kg/km)	0.0562286	kg/KPV	х	124015.5678	voyages/ year	=	6973.21821	kg/km	=	6973.22	g/m			
NOx(g/s/m2)	6973.2182	g/m	/	20	m yoyugcs/ year	/	17280000	S S				2.01771E-05	g/s/m2	
- 100 -77		. ·	•		***	,		•				03	J,	
SO2(kg/km)	5.648E-05	kg/KPV	Х	124015.5678	voyages/ year	=	7.004933956	kg/km	=	7.00493	g/m			
SO2(g/s/m2)	7.004934	g/m	.,	20	m woyages/ year	,	17280000	Kg/KIII S	-	7.00433	0.	2.02689E-08	g/s/m2	
		o	,			,		,					0, 9, 1112	
HC(kg/km)	0.0035	kg/KPV	X	124 016	voyages/ year	=	436	kg/km	=	436	g/m			
HC(g/s/m2)	436	g/m	x /	20	voyages/ year m	-/	436 17280000	kg/km s	=	430	g/m =	1.26E-06	g/s/m2	
110(8/3/1112)	430	g/ · · ·	/	20	111	/	1/200000	5			-	1.206-00	g/ 3/ 111Z	

Equation used:

E =0.282* k*(s/12)^a*(W/3)^b

E = Emission factor (lb/Vehicule mile traveled)

k,a,b = constant

s= % silt

W= Vehicule average weight (tons lb)

Eext= E((365-P)/365)

Weight empty vehicle

Ore transport

W (average vehicle weight)

Ref.: U.S. EPA Fifth Edition, Volume I Chapter 13, Miscellaneous Sources, section 13.2.2 Unpaved Roads, Equation (1)

Réf.: U.S. EPA Fifth Edition, Volume I Chapter 13, Miscellaneous Sources, section 13.2.2 Unpaved Roads, Equation (2)

Applied monthly in CALPUFF as variable emission factors

<u>Data</u>

	PM2.5	PM10	MPT
k (lb/MVP)	0.15	1.50	4.90
a	0.90	0.90	0.70
b	0.45	0.45	0.45

Eext= Emmision factor - natural mitigation (lb/Vehicule mile traveled)

P = Number of days per year were precipitation was at least 0,254 mm

Réf.: U.S. EPA Fifth Edition, Volume I Chapter 13, Miscellaneous Sources, section 13.2.2 Unpaved Roads, Table 13.2.2-2

b	0.45	0.45	0.45	
s (% silt)				8.0
Transported ore weight				64.0
				70 5

Pierre concassée, ref: email JC Bourassa 23 March 2010 - DSO Phase 2a(2) - silt.msg

tons lb 47.8 tonnes 52.7 tons lb 88.0 tons lb Source: Spec sheets 775G CAT Mining truck) Source: Spec sheets 775G CAT Mining truck)

HOWSE to O.B. 6,777,656 tonnes/yr **HOWSE** Ore transport 3,076,923 tonnes/yr **HOWSE** to Waste 3,968,498 tonnes/yr

> O.B. 3600 Waste+Ore hr/yr 4800 hr/year

%

tonnes

Nb hours / year Road width 20 m Road max lenght 200 m

Lenght:width ratio 10:1, CALPUFF User Guide, (Scire, 2000)

Emission control: road spray

Efficiency: 70% Source : Environment Canada - NPRI Toolbox - Unpayed Industrial Road Dust Excel Calculator

	Efficiency:	70%	Source.: Enviror	nment Canada - NPF	RI Toolbox - Unpaved	Indust	rial Road Dust Exc	el Calculator			
			http://ed	c.gc.ca/inrp-npri/defa	ault.asp?lang=En&n=	=6DE7I	F8BC-1				
<u>Calculations</u>											
HOWSE to O.B.											
Voy/year - go/ret	6,777,656	T/year	/	64.0	tonnes/load	Χ	2	trips/load	=	211,802	trips/year
PM2.5 (kg/KPV)	0.13	lb/VMT	Х	0.454	kg/lb	Х	0.621	km/mile	=	0.04	kg/VKT
PM2.5 (kg/km)	0.0379	kg/VKT	X	211,802	trips/year	=	8,020	kg/km yr	=	8,020	g/m year
PM2.5 (g/s m)	8,020	g/m year	/	12,960,000	s/yr	Χ	(1 - 0,70)		=	1.86E-04	g/s m
PM2.5 (g/s m2)	1.86E-04	g/s m	/	20	m				=	9.28E-06	g/s m2
PM10 (lb/year)	1.34	lb/MVP	Х	0.454	kg/lb	Х	0.621	km/mile	=	0.38	kg/VKT
PM10 (kg/km)	0.38	kg/KPV	Χ	211,802	trips/year	=	80,204	kg/km yr	=	80,204	g/m year
PM10 (g/s m)	80,204	g/m year	/	12,960,000	s/yr	Χ	(1 - 0,70)		=	1.86E-03	g/s m
PM10 (g/s m2)	1.86E-03	g/s m	/	20	m				=	9.28E-05	g/s/m2
MPT (lb/year)	4.76	lb/MVP	Х	0.454	kg/lb	Х	0.621	km/mile	=	1.34	kg/VKT
MPT (kg/ year)	1.34	kg/KPV	X	211,802	trips/year	=	284,133	kg/km yr	=	284,133	g/m year
MPT (g/s m)	284,133	g/m year	/	12,960,000	s/yr	Χ	(1 - 0,70)		=	6.58E-03	g/s m
MPT (g/s m2)	6.58E-03	g/s m	/	20	m				=	3.29E-04	g/s/m2
HOWSE Ore transp	ort										
Voy/year - go/ret	3,076,923	T/year	/	64.0	tonnes/load	Х	2	trips/load	=	96,154	trips/year
PM2.5 (kg/KPV)	0.13	lb/MVP	Х	0.454	kg/lb	Х	0.621	km/mile	=	0.04	kg/VKT
PM2.5 (kg/km)	0.04	kg/KPV	Х	96,154	passages/ year	=	3,641	kg/km	=	3,641	g/m year
PM2.5 (g/s m)	3,641	g/m year	/	17,280,000	s/ year	Χ	(1 - 0,70)	<u>.</u>	=	6.32E-05	g/s m
PM2.5 (g/s m2)	6.32E-05	g/s m	/	20	m		, , ,		=	3.16E-06	g/s/m2
PM10 (lb/year)	1.34	lb/MVP	Χ	0.454	kg/lb	Χ	0.621	km/mille	=	0.38	kg/VKT
PM10 (kg/km)	0.38	kg/KPV	X	96,154	passages/ year	=	36,411	kg/km	=	36,411	g/m year
PM10 (g/s m)	36,411	g/m year	/	17,280,000	s/ year	Χ	(1 - 0,70)		=	6.32E-04	g/s m
PM10 (g/s m2)	6.32E-04	g/s m	/	20	m				=	3.16E-05	g/s/m2

(8/ 5=/	0.002 00	8/ 5	,							0.202 0 .	8/ -/
HOWSE Ore transp	<u>ort</u>										
Voy/year - go/ret	3,076,923	T/year	/	64.0	tonnes/load	Χ	2	trips/load	=	96,154	trips/year
PM2.5 (kg/KPV)	0.13	lb/MVP	Х	0.454	kg/lb	Х	0.621	km/mile	=	0.04	kg/VKT
PM2.5 (kg/km)	0.04	kg/KPV	Χ	96,154	passages/ year	=	3,641	kg/km	=	3,641	g/m year
PM2.5 (g/s m)	3,641	g/m year	/	17,280,000	s/ year	Χ	(1 - 0,70)		=	6.32E-05	g/s m
PM2.5 (g/s m2)	6.32E-05	g/s m	/	20	m				=	3.16E-06	g/s/m2
PM10 (lb/year)	1.34	lb/MVP	Χ	0.454	kg/lb	Χ	0.621	km/mille	=	0.38	kg/VKT
PM10 (kg/km)	0.38	kg/KPV	Χ	96,154	passages/ year	=	36,411	kg/km	=	36,411	g/m year
PM10 (g/s m)	36,411	g/m year	/	17,280,000	s/ year	Χ	(1 - 0,70)		=	6.32E-04	g/s m
PM10 (g/s m2)	6.32E-04	g/s m	/	20	m				=	3.16E-05	g/s/m2
MPT (lb/year)	4.76	lb/MVP	Χ	0.454	kg/lb	Χ	0.621	km/mille	=	1.34	kg/VKT
MPT (kg/ year)	1.34	kg/KPV	Χ	96,154	passages/ year	=	128,991	kg/km	=	128,991	g/m year
MPT (g/s m)	128,991	g/m year	/	17,280,000	s/ year	Χ	(1 - 0,70)		=	2.24E-03	g/s m
MPT (g/s m2)	2.24E-03	g/s m	/	20	m				=	1.12E-04	g/s/m2
HOWSE to Waste											
Voy/year - go/ret	3,968,498	T/year	/	64.0	tonnes/load	Χ	2	trips/load	=	124,016	trips/year
PM2.5 (kg/KPV)	0.13	lb/MVP	Х	0.454	kg/lb	Χ	0.621	km/mile	=	0.04	kg/VKT
PM2.5 (kg/km)	0.04	kg/KPV	Χ	124,016	passages/ year	=	4,696	kg/km	=	4,696	g/m year
PM2.5 (g/s m)	4,696	g/m year	/	17,280,000	s/ year	Χ	(1 - 0,70)		=	8.15E-05	g/s m
PM2.5 (g/s m2)	8.15E-05	g/s m	/	20	m				=	4.08E-06	g/s/m2
PM10 (lb/year)	1.34	lb/MVP	Х	0.454	kg/lb	Χ	0.621	km/mille	=	0.38	kg/VKT
PM10 (kg/km)	0.38	kg/KPV	Χ	124,016	passages/ year	=	46,962	kg/km	=	46,962	g/m year
PM10 (g/s m)	46,962	g/m year	/	17,280,000	s/ year	Χ	(1 - 0,70)		=	8.15E-04	g/s m
PM10 (g/s m2)	8.15E-04	g/s m	/	20	m				=	4.08E-05	g/s/m2
MPT (lb/year)	4.76	lb/MVP	Х	0.454	kg/lb	Х	0.621	km/mille	=	1.34	kg/VKT
MPT (kg/ year)	1.34	kg/KPV	Χ	124,016	passages/ year	=	166,367	kg/km	=	166,367	g/m year
MPT (g/s m)	166,367	g/m year	/	17,280,000	s/ year	Χ	(1 - 0,70)		=	2.89E-03	g/s m
MPT (g/s m2)	2.89E-03	g/s m	/	20	m				=	1.44E-04	g/s/m2

Emissions from DSO3 Ore transportation activities (PM)

Equation used:

E =0.282* k*(s/12)^a*(W/3)^b

E = Emission factor (lb/Vehicule mile traveled)

k,a,b = constant

s= % silt

W= Vehicule average weight (tons lb)

Eext= E((365-P)/365)

Eext= Emmision factor - natural mitigation (lb/Vehicule mile traveled)
P = Number of days per year were precipitation was at least 0,254 mm

Ref.: U.S. EPA Fifth Edition, Volume I Chapter 13, Miscellaneous Sources, section 13.2.2 Unpaved Roads, Equation (1)

Rrf.: U.S. EPA Fifth Edition, Volume I Chapter 13, Miscellaneous Sources, section 13.2.2 Unpaved Roads, Equation (2)

Applied monthly in CALPUFF as variable emission factors

L	Эε	ιt	а

	PM2.5	PM10	MPT
k (lb/MVP)	0.15	1.50	4.90
a	0.90	0.90	0.70
b	0.45	0.45	0.45

Réf.: U.S. EPA Fifth Edition, Volume I Chapter 13, Miscellaneous Sources, section 13.2.2 Unpaved Roads, Table 13.2.2-2

				Pierre concassée, ref: email JC Bourassa 23 Marc			
s (% silt)		8.0	%	- DSO Phase 2a(2) - silt.m	sg		
Transported ore weight		55.0	tonnes	Source: Spec sheets 773	F CAT Mining truck)		
		60.6	tons Ib	F CAT Mining truck)			
Weight empty vehicle		45.7	tonnes				
		50.4	tons lb				
W (average vehicle weight)		80.7	tons lb				
Ore transport							
	F7 to O.B. + Waste	2 273 750	tonnes/yr				
	F7 to Plant 2	1 109 110	tonnes/yr				
	Plant 2 to Rail loading	3 504 000	tonnes/yr				
Nb hours / year		8760	hr/yr	Ref: New Millenium	12 months/year		
Road width	20 m		• *	•	• •		
Road max lenght	200 m	า		Lenght:width ratio 10:1, CALPUFF User Guide, (Scire, 2000)			
Rodd max length				_			

Emission control: road spray

Efficiency:

70%

Source.: Environment Canada - NPRI Toolbox - Unpaved Industrial Road Dust Excel Calculator

http://ec.gc.ca/inrp-npri/default.asp?lang=En&n=6DE7F8BC-1

<u>Calculations</u>

Garcara crorris											
F7 to O.B. + Waste travel/year - back and forth	2 273 750	T/year	/	55.0	tonnes/load	х	2	trips/load	=	82 682	trips/year
, ,		, ,	,					1,			1 - 7 7
PM2.5 (kg/KPV)	0.13	lb/MVP	Χ	0.454	kg/lb	Χ	0.621	km/mile	=	0.04	kg/VKT
PM2.5 (kg/km)	0.04	kg/KPV	Χ	82 682	passages/ year	=	3 011	kg/km	=	3 011	g/m year
PM2.5 (g/s m)	3 011	g/m year	/	31 536 000	s/ year	Χ	(1 - 0,70)		=	2.86E-05	g/s m
PM2.5 (g/s m2)	2.86E-05	g/s m	/	20	m				=	1.43E-06	g/s/m2
PM10 (lb/year)	1.29	lb/MVP	X	0.454	kg/lb	Χ	0.621	km/mille	=	0.36	kg/VKT
PM10 (kg/km)	0.36	kg/KPV	X	82 682	passages/ year	=	30 114	kg/km	=	30 114	g/m year
PM10 (g/s m)	30 114	g/m year	/	31 536 000	s/ year	Χ	(1 - 0,70)		=	2.86E-04	g/s m
PM10 (g/s m2)	2.86E-04	g/s m	/	20	m				=	1.43E-05	g/s/m2
MPT (lb/year)	4.58	lb/MVP	X	0.454	kg/lb	Χ	0.621	km/mille	=	1.29	kg/VKT
MPT (kg/an)	1.29	kg/KPV	X	82 682	passages/ year	=	106 683	kg/km	=	106 683	g/m year
MPT (g/s m)	106 683	g/m year	/	31 536 000	s/ year	Χ	(1 - 0,70)		=	1.01E-03	g/s m
MPT (g/s m2)	1.01E-03	g/s m	/	20	m				=	5.07E-05	g/s/m2

F7 to Plant 2	1 100 110	/	,	55.0		.,	•			40.004	
travel/year - back and forth	1 109 110	T/year	/	55.0	tonnes/load	Х	2	trips/load	=	40 331	trips/year
PM2.5 (kg/KPV)	0.13	lb/MVP	Χ	0.454	kg/lb	Х	0.621	km/mile	=	0.04	kg/VKT
PM2.5 (kg/km)	0.04	kg/KPV	X	40 331	passages/ year	=	1 469	kg/km	=	1 469	g/m year
PM2.5 (g/s m)	1 469	g/m year	/	31 536 000	s/ year	Χ	(1 - 0,70)		=	1.40E-05	g/s m
PM2.5 (g/s m2)	1.40E-05	g/s m	/	20	m				=	6.99E-07	g/s/m2
PM10 (lb/year)	1.29	lb/MVP	X	0.454	kg/lb	Х	0.621	km/mille	=	0.36	kg/VKT
PM10 (kg/km)	0.36	kg/KPV	X	40 331	passages/ year	=	14 689	kg/km	=	14 689	g/m year
PM10 (g/s m)	14 689	g/m year	/	31 536 000	s/ year	Χ	(1 - 0,70)		=	1.40E-04	g/s m
PM10 (g/s m2)	1.40E-04	g/s m	/	20	m				=	6.99E-06	g/s/m2
MPT (lb/year)	4.58	lb/MVP	X	0.454	kg/lb	Х	0.621	km/mille	=	1.29	kg/VKT
MPT (kg/ year)	1.29	kg/KPV	X	40 331	passages/ year	=	52 039	kg/km	=	52 039	g/m year
MPT (g/s m)	52 039	g/m year	/	31 536 000	s/ year	Χ	(1 - 0,70)		=	4.95E-04	g/s m
MPT (g/s m2)	4.95E-04	g/s m	/	20	m				=	2.48E-05	g/s/m2
Plant 2 to Rail loading											
travel/year - back and forth	3 504 000	T/year	/	55.0	tonnes/load	X	2	trips/load	=	127 418	trips/year
PM2.5 (kg/KPV)	0.13	lb/MVP	X	0.454	kg/lb	Х	0.621	km/mile	=	0.04	kg/VKT
PM2.5 (kg/km)	0.04	kg/KPV	X	127 418	passages/ year	=	4 641	kg/km	=	4 641	g/m year
PM2.5 (g/s m)	4 641	g/m year	/	31 536 000	s/ year	Χ	(1 - 0,70)		=	4.41E-05	g/s m
PM2.5 (g/s m2)	4.41E-05	g/s m	/	20	m				=	2.21E-06	g/s/m2
PM10 (lb/year)	1.29	lb/MVP	X	0.454	kg/lb	Х	0.621	km/mille	=	0.36	kg/VKT
PM10 (kg/km)	0.36	kg/KPV	X	127 418	passages/ year	=	46 408	kg/km	=	46 408	g/m year
PM10 (g/s m)	46 408	g/m year	/	31 536 000	s/ year	Χ	(1 - 0,70)		=	4.41E-04	g/s m
PM10 (g/s m2)	4.41E-04	g/s m	/	20	m				=	2.21E-05	g/s/m2
MPT (lb/year)	4.58	lb/MVP	Х	0.454	kg/lb	Х	0.621	km/mille	=	1.29	kg/VKT
MPT (kg/ year)	1.29	kg/KPV	X	127 418	passages/ year	=	164 406	kg/km	=	164 406	g/m year
MPT (g/s m)											
,	164 406	g/m year	/	31 536 000	s/ year	Χ	(1 - 0,70)		=	1.56E-03	g/s m

Emissions from DSO3 Ore transportation activities (Engines)

Source: EPA Tier3 - Spec sheet (773F, CAT Mining truck)

PM 0.2 g/kW-h https://www.dieselnet.com/standards/us/nonroad.php
NOx NMHC+NOx 4 g/kW-h https://www.dieselnet.com/standards/us/nonroad.php
CO 3.5 g/kW-h https://www.dieselnet.com/standards/us/nonroad.php

HC 0.267 g/kW-h https://www.dieselnet.com/standards/us/nonroad.php & EPA420-R-05-015 Table 8.pdf

<u>Data</u>

Sulfur in fuel 0.0015% REF: Email François Saulnier Exxon Mobil, Jan 5th, 2011
15 mg/kg

Engine Net power 552 kW Source: Spec sheets 773F CAT Mining truck)
Motor load 50% hypothesis based on motor work cycle

 $\begin{array}{ccc} \text{Engine power (50\% load)} & 276.00 & \text{kW} \\ \text{Fuel consumption} & 70.66 & \text{L/h} \end{array}$

Fuel consumption 70.66 L/h Source : Haul truck fuel consumption and CO2 emission under various engine load conditions by V. Kecojevic and D. Komljenovic Average speed 35 km/h Source : phone conv. Aug 16 2011 - JC Bourassa

LHV 42 780 kJ/kg Source: Spec sheets 773F CAT Mining truck)
Density of Diesel 0.8389 kg/l Source: Spec sheets 773F CAT Mining truck)

PM < 1 um Source : AP-42, Gasoline And Diesel Industrial Engines, tableau 3.3-1.

Transported ore weight 55.0 tonnes CAT 773F (Email from Loic Didillon October 7th 2014)
60.6 tons lb Source: Spec sheets 773F CAT Mining truck)

 Weight empty vehicle
 45.7
 tonnes

 50.4
 tons lb

 W (average vehicle weight)
 80.7
 tons lb

276.0 kW

Nbre of hours / year 8760 hr/yr Ref: New Millenium 12 months/yr

0

F7 to O.B. + Waste 2 273 750 tonnes/yr
F7 to Plant 2 1 109 110 tonnes/yr
Plant 2 to Rail loading 3 504 000 tonnes/yr

 Road Width:
 20 m
 Hypothesis

 Road max lenght
 200 m
 Lenght:width ratio 10:1, CALPUFF User Guide, (Scire, 2000)

Calculs Diesel Consumption per vvehicle 70.66 L/h 35 km/h 2.0 L/KPV Diesel Consumption 70.66 L/h 0.8389 kg/l 59.3 kg/h Hp-h Diesel 59.3 kg/h Х 42780 kJ/kg Х 1 h 2684.5 kJ/hp-h 944.6 hp-h (energy from the fuel) 1000 g/kg PM Emission rate 276.0 kW Х 0.2 g/kW-h 35 km/h 0.0016 kg/KPV CO Emission rate 276 0 kW Х 3.5 g/kW-h 35 km/h 1000 g/kg 0.0276 kg/KPV 0.0315 kg/KPV NO_x Emissions rate 276.0 kW 4 g/kW-h 35 km/h 1000 g/kg SO₂ Emission rate (15ppm sulphur) 2.0 L/km parcouru Х 0.84 kg/L Х 15 mg S/kg 2 kg SO₂/kg S 5.08E-05 kg/KPV

35 km/h

0.267 g/kW-h

K:\05\21\500\ 521500_DSO Proj

1000 g/kg

0.0021 kg/KPV

*EPA420-R-05-015; Table8

HC Emissions rate*

F7 to O.B. + Waste travel/year - back and forth	2 273 750	T/ year	/	55.0	tonnes X		2	aller-retour	=	82 682	voy/; yea	r		
PM(kg/km)	0.0016	kg/KPV	x	82 682	voyages/ year	=	130	kg/km	=	130	g/m			
PM(g/s/m2)	130	g/m	/	20	m	/	31 536 000	S			=	2.07E-07	g/s/m2	
CO(kg/km)	0.0276	kg/KPV	х	82 682	voyages/ year	=	2 282	kg/km	=	2 282	g/m			
CO(g/s/m2)	2 282	g/m	/	20	m	/	31 536 000	S			=	3.62E-06	g/s/m2	
NOx(kg/km)	0.03	kg/KPV	х	82 682	voyages/ year	=	2 608	kg/km	=	2 608	g/m			
NOx(g/s/m2)	2 608	g/m	/	20	m	/	31 536 000	S			=	4.13E-06	g/s/m2	
SO2(kg/km)	0.00005	kg/KPV	х	82 682	voyages/ year	=	4	kg/km	=	4	g/m			
SO2(g/s/m2)	4	g/m	/	20	m	/	31 536 000	S			=	6.66E-09	g/s/m2	
HC(kg/km)	0.0021	kg/KPV	х	82 682	voyages/ year	=	174	kg/km	=	174	g/m			
HC(g/s/m2)	174	g/m	/	20	m	/	31 536 000	s			=	2.76E-07	g/s/m2	

F7 to Plant 2													
travel/year - back and forth	1 109 110	T/ year	/	55.0	tonnes X		2	aller-retour	=	40 331	voy/ year	r	
PM(kg/km)	0.0016	kg/KPV	Х	40 331	voyages/ year	=	64	kg/km	=	64	g/m		
PM(g/s/m2)	64	g/m	/	20	m	/	31 536 000	S			=	1.01E-07	g/s/m2
CO(kg/km)	0.0276	kg/KPV	х	40 331	voyages/ year	=	1 113	kg/km	=	1 113	g/m		
CO(g/s/m2)	1 113	g/m	/	20	m	/	31 536 000	S			=	1.76E-06	g/s/m2
NOx(kg/km)	0.03	kg/KPV	х	40 331	voyages/ vear	=	1 272	kg/km	=	1 272	g/m		
NOx(g/s/m2)	1 272	g/m	/	20	m	/	31 536 000	S			=	2.02E-06	g/s/m2
SO2(kg/km)	0.00005	kg/KPV	x	40 331	voyages/ year	=	2	kg/km	=	2	g/m		
SO2(g/s/m2)	2	g/m	/	20	m	/	31 536 000	S			=	3.25E-09	g/s/m2
HC(kg/km)	0.0021	kg/KPV	х	40 331	voyages/ year	=	85	kg/km	=	85	g/m		
HC(g/s/m2)	85	g/m	/	20	m	/	31 536 000	S			=	1.34E-07	g/s/m2
Plant 2 to Rail loading													
travel/year - back and forth	3 504 000	T/ year	/	55.0	tonnes X		2	aller-retour	=	127 418	voy/ year		
PM(kg/km)	0.0016	kg/KPV	x	127 418	voyages/ year	=	201	kg/km	=	201	g/m		
PM(g/s/m2)	201	g/m	/	20	m	/	31 536 000	S			=	3.19E-07	g/s/m2
CO(kg/km)	0.0276	kg/KPV	x	127 418	voyages/ year	=	3 517	kg/km	=	3 517	g/m		
CO(g/s/m2)	3 517	g/m	/	20	m	/	31 536 000	S			=	5.58E-06	g/s/m2
NOx(kg/km)	0.03	kg/KPV	x	127 418	voyages/ year	=	4 019	kg/km	=	4 019	g/m		
NOx(g/s/m2)	4 019	g/m	/	20	m	/	31 536 000	S			=	6.37E-06	g/s/m2
SO2(kg/km)	0.00005	kg/KPV	x	127 418	voyages/ year	=	6	kg/km	=	6	g/m		
SO2(g/s/m2)	6	g/m	/	20	m	/	31 536 000	S			=	1.03E-08	g/s/m2
HC(kg/km)	0.0021	kg/KPV	x	127 418	voyages/ year	=	268	kg/km	=	268	g/m		
HC(g/s/m2)	268	g/m	/	20	m	/	31 536 000	S			=	4.25E-07	g/s/m2

1) WINTER 7 months per year <u>Description of scenario</u>: all gases from generators are sent to the flash dryer, Rotary and flash Dryers and Energy Recovery (Scrubber)

Data Fuel Oil consumption: CAT175-16 Caterpillar spec sheet for 75% prime duty load x 5 generators = 516.8 L/hr x 5 2584 l/hr Generators Rotary and flash Dryer Total 3108 l/hr REF:FLSmidth drawing DSOT-DV-2750-PR-4852 rev 3 - Overestimation - conserv hyp. REF: Email François Saulnier Exxon Mobil, Jan 5th, 2011 Generators Fuel Oil consumption: 2150 kg/hr Dryers Fuel Oil consumption: 2586 kg/hr Total Fuel Oil consumption: 4736 kg/hr 45,000 kJ/kg REF: Email François Saulnier Exxon Mobil, Jan 5th, 2011 Building height 40.5 m Reference: drawing DSOT-DW-3300-GE-0002 Stack height 65.7 m 2.44 m 40 °C Diameter Reference: DSOT-VP-3210-MS-0170-0021 - I.D. = 96 inches REF: Mass Balance, R. Gagnon, June 16 Temperature 313 K REF:FLSmidth drawing DSOT-DV-2750-PR-4853 Gas flow at stack (wet) 170.60 t/hr Gas flow at stack (wet) 147,100 Nm³/hr REF:FLSmidth drawing DSOT-DV-2750-PR-4853 PM emission rate: 50 mg/Nm^{3:} Criteria required for the supplier Particulate flow after ESP- (PM 2.5) 7.36 kg/hr Scrubber - Heat recovery system Data from supplier (DUCON = Particulate flow after ESP- (PM 2.5) X wet scrubber typical efficiency Wet scrubber estimated efficiency Data from supplier (DUCON) 25% Particulate flow after dryer scrubber- (PM _{2.5}) 5.52 kg/hr All particulates are considered < 2.5 um Electrostatic precipitator & Scrubber efficiency

Calculations

Engine power

Gas flow at stack 147,100 Nm³/hr 313 K 4.7 m² 168,653 Am³/hr 273 K Gas velocity 168,653 Am3/hr 3600 s/hr 10.0 m/s Total Capacity 4736 kg/hr 45000 kJ/kg 1.E+06 kJ/GJ 213.1 GJ/hr Dryer capacity 2586 kg/hr 45000 kJ/kg 1.E+06 kJ/GJ 116.4 GJ/hr

Generators
Total number of engines 10281 Total 24h average load kW Ref: "Genset load calculations-winter.xlsx" sent by Plamen Kurktchiev 2118.75 kW

10593.75 total kW during Winter

1000 g/kg

61 MMBtu/hr (Rotary Dryer)

50 MMBtu/hr (Flash Dryer)

75% 100% Exhaust emission data: REF:CAT C175-16 performance data sheet [WYB01014] 31013 g/h 26338.33 21442 Nitrogen oxides (NOx) REF:CAT C175-16 performance data sheet [WYB01014] REF:CAT C175-16 performance data sheet [WYB01014] 1349 g/h 257 g/h Carbon Monoxide (CO) 1278.56 2651.8 255.7119 227.3 Particulate matter (PM) REF:CAT C175-16 performance data sheet [WYB01014] Hydrocarbon (HC) 758 g/h 530.37 Emission rate NOx 31013 g/h 3600 s/hr 43.1 g/s Emission rate CO 1349 g/h 3600 s/hr 1.9 g/s

(load approximately 75% for power requirement)

=2825kW *75%

Emission rate PM_{2.5} 257 g/h 3600 s/hr 0.4 g/s Emission rate HC 758 g/h 3600 s/hr 1.1 g/s Dryer Nitrogen oxides (NOx) Maximum NOx emission rate: 50 g/GJ - article 19 NFL Air Pollution control regulation , article 19 50 g/GJ

0.6 kg/ 10³ litres 0.24 kg/ 10³ litres Reference : AP-42, Fuel oil combustion, Table 1.3-1. Reference : AP-42, Fuel oil combustion, Table 1.3-1. Carbon Monoxide (CO) Particulate matter (PM) Hydrocarbon (HC) 0.03024 kg/ 103 litres Reference: AP-42, Fuel oil combustion, Table 1,3-3, Emission rate NO. 50.0 g/GJ 3600 s/hr 116.4 GJ/h 1.6 g/s Emission rate CO 3108 l/hr 0.52 g/s 0.60 g/litres 3600 s/hr Emission rate PM_{2.5} 0.24 g/litres 3108 l/hr 3600 s/hr 0.21 g/s 0.03 g/s

Emission rate HC 0.03 g/litres 3108 l/hr 3600 s/hr

Sulphur dioxide (SO2) 0.0015% REF: Email François Saulnier Exxon Mobil, Jan 5th, 2011 % of sulphur in oil 4736 kg/hr 0.0015% 2 kg SO₂/kg S Emission rate SO₂

2841.24375 hp

3600 s/hr 0.000%) 0.0395 g/s 0.039 g/s 3600 s/hr 24 30 d/month 0.7 tons SO2 over 7 months period 1,000,000 g/ton 7 months/y Particulate Matter (PM)

5.52 kg/hr 1000 g/kg 3600 s/hr 1.532 g/s 1.5 g/s 3600 s/hr 24 h/j 30 d/month

7 months/y 1000000 g/ton 27.8 tons over 7 months period

Nitrogen oxides (NOx) 44.690 g/s (Generator + Dryer) Emission rate NO_x

CO Emission rate CO 2.392 g/s (Generator + Dryer)

Hydrocarbon (HC)

1.079 g/s (Generator + Dryer) Emission rate HC

DSO PLANT - AIR DISPERSION MODELING

2) SUMMER

<u>Scenario description</u>: Drying not in function.

Data

Generators

Fuel Oil consumption: CAT175-16 Caterpillar spec sheet for 75% prime duty load x 3 generators = 516.8 L/hr x 5 1550 l/hr Generators

Oil density
Total Fuel Oil consumption: 832 kg/m³ REF: Email François Saulnier Exxon Mobil, Jan 5th, 2011 1290 kg/hr 45,000 kJ/kg REF: Email François Saulnier Exxon Mobil, Jan 5th, 2011 HV Building height 40.5 m Reference: drawing DSOT-DW-3300-GE-0002 Stack height Diameter 65.7 m

5 months per year

451.2 °C Temperature 724.2 K REF: supplier Data Sheet Gas flow from generators 81,270 m3/hr

2.44 m

Temperature (from generators) 451.2 °C 36,431 Nm³/hr REF:supplier Data Sheet
Gas flow for generators Gas flow at stack (wet) Calculations

36,431 Nm³/hr 724 K 4.7 m² Gas flow at stack 273 K Gas velocity Total Capacity 96,643 Am³/hr 3600 s/hr 1.E+06 kJ/GJ 1290 kg/hr 45000 kJ/kg

25.84 g/s

total kW required during Summer Total number of engines 6356 2118.75 kW Total 24h average load (Ref: "Genset load calculations-summer.xlsx" sent by Plamen Kurktchiev =2825kW *75% Engine power 6348 2841.24375 hp (load approximately 75% for power requirement) Exhaust emission data:

96,643 Am³/hr

5.7 m/s 58.0 GJ/hr

Nitrogen oxides (NOx)
Carbon Monoxide (CO) REF:CAT C175-16 performance data sheet [WYB01014] REF:CAT C175-16 performance data sheet [WYB01014] 31013 g/h 1349 g/h 257 g/h 758 g/h REF:CAT C175-16 performance data sheet [WYB01014] REF:CAT C175-16 performance data sheet [WYB01014] Particulate matter (PM) Hydrocarbon (HC) TO GENERATOR STACK 31013 g/h Emission rate NOx 3600 s/hr 25.8 g/s Emission rate CO Emission rate PM_{2.5} 1349 g/h 257 g/h 3600 s/hr 3600 s/hr 1.1 g/s 0.2 g/s TO GENERATOR STACK TO GENERATOR STACK

Reference: DSOT-VP-3210-MS-0170-0021 - I.D. = 96 inches

Emission rate HC 758.00 g/h 3600 s/hr 0.6 g/s TO GENERATOR STACK Sulphur dioxide (SO2) % of sulphur in oil 0.0015% REF: Email François Saulnier Exxon Mobil, Jan 5th, 2011

1290 kg/hr 2 kg SO₂/kg S 0%) 0.0015% 1000 g/kg Emission rate SO_2 generators 3600 s/hr TO GENERATOR STACK 0.011 g/s 30 d/month 0.011 g/s 3600 s/hr 24 h/d 1,000,000 g/ton 0.14 ton during summer 5 months/y

Particulate Matter (PM) 214 g/s X 5 months/y / Emission rate PM_{2.5} 0.214 g/s 3600 s/hr Х 24 h/j Х 30 d/month = 2.8 tons during summer 1,000,000 g/ton

Nitrogen oxides (NOx)

CO Emission rate CO

1.12 g/s

Hydrocarbon HC 0.63 g/s

Emissions from equipment at main Plant <u>Data</u> Capacity of crushers 6,132,000 tonnes/yr 16,800 tonnes/day 700 tonnes/hr Production data of year 2015-2017 (Conservative assumption that crushers are processing their nominal capacity 24h all year long) Production rate of the main Plant 3,227,184 tonnes/yr 8,842 tonnes/day 368.4 tonnes/hr Sinterfines production rate 61,891 tonnes/week Ref: Drawings DSOT-DV-2750-PR-4851/4852/4853 1,572,420 tonnes/yr 4,308 tonnes/day 179.5 tonnes/hr Superfines production rate 30,156 tonnes/week Ref: Drawings DSOT-DV-2750-PR-4851/4852/4853 Units References Period/ frequency Description Emission rate Notes

Descri	ption	Emission rate TPM	Emission rate PM 10	Emission rate PM 2.5	Units	References	Period/ frequency	Notes
	Reduction % below:	0.000070	0.000023	0.000065	kg/tonne			
A O	0%					1 .		
Apron Conveyor		0.000070	0.000023	0.000065	kg/tonne	1		Reference 1: Conveyor Transfer Point (controlled)
	Hourly rate % below: 100%	0.0490 0.0136	0.0161 0.00447	0.0046 0.00126	kg/hr g/s	-	12 months per year average rate over 24h	-
							average rate over 2411	
	Reduction % below:	0.000600	0.000270	0.0000500	kg/tonne			
Primary Crusher	0%	0.000600	0.000270	0.0000500	kg/tonne	1		Reference 1: Tertiary Crushing (controlled)
	Hourly rate % below:	0.4200	0.1890	0.0350	kg/hr		12 months per year	
	100%	0.1167	0.05250	0.00972	g/s		average rate over 24h	
	Reduction % below:	0.000070	0.000023	0.000065	kg/tonne			
Chute from Crusher	0%					1		Reference 1: Conveyor Transfer Point (controlled)
Chate non Crasher	Hourly rate % below:	0.000070 0.0490	0.000023 0.0161	0.0000065 0.0046	kg/tonne kg/hr		12 months per year	neterence 1. Conveyor transfer Point (Controlled)
	100%	0.0136	0.00447	0.00126	g/s	1	average rate over 24h	1
Unload + Conveyor + Prima	ary sizer + Chute	0.3125	0.1204	0.0212	g/s			s volume source VMP_SZ1
	Reduction % below:	0.000070	0.000023	0.000065	les/honne			
	0%	0.000070	0.000023	0.0000065	kg/tonne			
Conveyor		0.000070	0.000023	0.0000065	kg/tonne	1		Reference 1: Conveyor Transfer Point (controlled)
	Hourly rate % below:	0.0490	0.0161	0.0046	kg/hr		12 months per year	
	100%	0.0136	0.00447	0.00126	g/s		average rate over 24h	
	Reduction % below:	0.000600	0.000270	0.0000500	kg/tonne]		
Secondary Crusher	0%	0.000600	0.000270	0.0000500	kg/tonne	1		Reference 1: Tertiary Crushing (controlled)
,	Hourly rate % below:	0.4200	0.1890	0.0000500	kg/tonne kg/hr	1	12 months per year	3 (
	100%	0.1167	0.05250	0.00972	g/s	1	average rate over 24h	1
	Reduction % below: 0%	0.000070	0.000023	0.0000065	kg/tonne	-		-
Chute from Crusher	0 /6	0.000070	0.000023	0.000065	kg/tonne	1		Reference 1: Conveyor Transfer Point (controlled)
	Hourly rate % below:	0.0490	0.0161	0.0046	kg/hr		12 months per year	
	100%	0.0136	0.00447	0.00126	g/s		average rate over 24h	
Conveyor + Secondary size	r + Chute	0.1439	0.0614	0.0123	g/s		a	s volume source VMP_SZ2
	Reduction % below:	0.000070	0.000023	0.0000065	kg/tonne			Reference 1: Conveyor Transfer Point (controlled)
Conveyor to	75%					1		Defended 3: Dock and Julius and Salara de Australia de Australia
Sinterfines stockpiles	Hourly rate % below:	0.00018 0.0064	0.000006 0.0021	0.0000016 0.0006	kg/tonne kg/hr		12 months per year	Reference 2: Dust emission control - telescopic chute: 75% reduction (Table 3, NPI, "Emission estimation Technique Manual for Mining and
	100%	0.0018	0.00059	0.00017	g/s	1	average rate over 24h	Processiong of Non-Metal Minerals, 1999)
Conveyor to Sinterfines sto	ockpiles	0.001791	0.000588	0.000166	g/s		a	s volume source VMP_SIN
	Reduction % below:	0.000070	0.000023	0.0000065	kg/tonne			Reference 1: Conveyor Transfer Point (controlled)
Conveyor to	75%					1		Reference 2: Dust emission control - telescopic chute: 75% reduction
Superfines stockpiles	Hourly rate % below:	0.000018 0.0031	0.000006 0.0010	0.000016 0.0003	kg/tonne kg/hr	-	12 months nor cons	(Table 3, NPI, "Emission estimation Technique Manual for Mining and
	100%	0.0009	0.00029	0.0008	g/s		12 months per year average rate over 24h	Processiong of Non-Metal Minerals, 1999)
Conveyor to Superfines sto		0.0008726	0.0002867	0.0000810	g/s			s volume source VMP_SUP
	1						Hours of operation per day:	
Whool loaders estivitie-	1					1	16	- With 7 trains/week loading 16 hours/day.
Wheel loaders activities Loading / Unloading into Belt Feeder during Rail Loading						1	Hourly rate % below:	- Train is assumed to have 240 cars loaded at 100 tonnes/car therefore havin 24000 tonnes/train. - It is assumed that during rail loading, Bypass Tower is diverting main plant output one of the product to the reclaim conveyor (rate substracted – average rate between superfines and sinterfines)
	_1	2.8431	0.9951	0.1507	g/s over 16h	-	100%	
Load/Unload during Rail Lo	pading	1.8954	0.6634	0.1005	g/s over 24h		as	volume source VMP_HDRL
	Reduction % below:	0.000070	0.000023	0.000065	kg/tonne		Hours of operation per day:	
	90%					1	16	- With 7 trains/week loading 16 hours/day.
Rail loading		0.00000700	0.00000230	0.00000065	kg/tonne	1,2		-Train is assumed to have 240 cars loaded at 100 tonnes/car therefore havin 24000 tonnes/train.
	Haushusata 9/ 5-1	1					Heuris rate 0/ 5 -1	Reference 1: Conveyor Transfer Point (controlled)
	Hourly rate % below: 100%	0.0029167	0.0009583	0.0002708	g/s over 16h	1	Hourly rate % below: 100%	Reference 2: Uni-load loading system : 90% reduction
	100 /6	0.0023107	0.000303	C.0002700	9/3 3 4 El 1011	†	100 /0	<u> </u>
Rail loading		0.0019	0.0006	0.0002	g/s over 24h		a	s volume source VMP_RAIL

4 ROOF VENTS, 14 WALL FANS AND 3 VACUUM PUMPS

Reference Drawing No.: DSOT-DW-3144-MS-0165

DSOT-DW-3144-MS-0109





4 roof vents at the top of the dome. Each roof vent is connected to two fans. For air recirculation and exchanges.

14 wall vents on the side of the dome, approx. 8 m high. 10 vents on the South side (road side) and 4 vents on the North side (Admin building side). For air recirculation and exchanges.

3 vacuum pumps, 1 used at the Pan Filter and 2 used at the Drum Filters. Exhaust pipe diameter (50 cm and 40 cm respectively). These vents extend horizontally outside of the Dome wall (North-East corner)

A. INVENTORY

A. INVENTORT					
	Parameter	Units	Summer	Winter	Notes
	Months per year	months	5	7	
	Flow Rate (total 14 fans)	cfm	289300	125358	From DSOT-DW-3144-MS-0165
	riow nate (total 14 lalis)	Nm3/hr	491519	212983	Assume air is at 25°C
	Flow rate per fan	cfm	20664	8954	Design fan capacity is 22,000 cfm
	riow rate per fair	Nm3/hr	35109	15213	
Wall exhausts	Dust Concentration in exhaust	mg/Nm3	1.0	1.0	Equals Dust Concentration inside Dome. Assume all PM2.5 Engineering Estimate based on Ref. 1
		kg/h	0.49	0.21	0 11 0 11 111111
		g/s	0.137	0.059	
	Dust Emissions (total 14 fans)	Tonnes/period	1.79	1.09	
		Tonnes/year	2.	88	
	1		•		•
	Elevi Deta (tetal 4 fere)	cfm	150000	0	From DSOT-DW-3144-MS-0165
	Flow Rate (total 4 fans)	Nm3/hr	254849	0	Assume air is at 25°C
Roof exhausts	Dust Concentration inside Dome. Assume all PM _{2.5}	mg/Nm3	1	7 125358 From DSOT-DW-3144-1 212983 Assume air is at 25°C 8954 Design fan capacity is 2 15213 1.0 Equals Dust Concentral Engineering Estimate b 0.21 0.059 1.09 38 0 From DSOT-DW-3144-1 0 Assume air is at 25°C 1 Engineering Estimate b 0.00 0.000 0.000 0.000 0.000 0.000 0.000 0.005 0.93 See calculations below 59	Engineering Estimate based on Ref. 1
ROOT EXTIGUSES		kg/h	0.25	0.00	
	Dust Emissions (total 4 fans)	g/s	0.071	0.000	
	Dust Emissions (total 4 fails)	Tonnes/period	0.93	0.00	
		Tonnes/year	0.	93	
	•	•			•
		kg/h	0.18	0.18	
3 Vacuum Pumps	3 exhausts	g/s	0.05	0.05	See calculations helow
S vacuum rumps	3 extrausts	Tonnes/period	0.66	0.93	See calculations below
		Tonnes/year	1.	125358	
	<u>-</u>				_
Wall Fans + Vacuum Pumps +	Total Emissions	tonnes/period	3.39		
Roof exhausts	Dust Concentration in exhaust Dust Emissions (total 14 fans) Flow Rate (total 4 fans) Dust Concentration inside Dome. Assume all	tonnes/year	5.	41	

Ref. 1: Using Ventilation Control Technology to Reduce Respirable Dust Exposures at U.S. Metal/Nonmetal Mining Operations, NIOSH, USA

B. DATA TO USE IN AIR MODELING

1. Wall Exhausts SOUTH (Main Road Side)

Model as one horizontal stack, located in the center, SOUTH side of the dome at 8 meter high. 2 conditions: winter and summer

	Parameter	Units	Summer	Winter	Notes
all Exhausts - SOUTH	Months per year	months	5	7	Notes
	10 vents on South Side	Each, Nm3/hr	35109	15213	Ref: DSOT-DW-3144-MS-0165
	10 Vents on South Side	Total, Nm3/hr	351085	152130	Ref: DSOT-DW-3144-MS-0165
	Dust Concentration in exhaust	mg/Nm3	1.0	1.0	Equals Dust Concentration inside Dome. Assume all PM2.5
	Dust Concentration in exhaust	IIIg/IVIII3	1.0	1.0	Engineering Estimate based on Ref. 1
all Exhausts - SOUTH	Dust Emissions (total 10 fans)	kg/h	0.35	0.15	
Wall Exhausts 500111	Dust Emissions (total 10 lans)	g/s	0.098	0.042	
	Exhaust Temperature	°C	2	25	Average. Equals dome inside air temperature.
	Exhaust orientation		Horiz	ontal	For modeling, Vs = 0.1 m/s
	Exhaust velocity	m/s	0	.1	For modeling, Vs = 0.1 m/s due to downward horizontal orientation
	Exhaust height	meters	7	.3	Ref: DSOT-DW-3300-GE-0002
	Dimension		3 m x	1.27 m	Actual dimensions (Ref: DSOT-DW-3300-GE-0002)
	Dimension	m	11.1	7.3	Equivalent diameter for modelling a vertical velocity of 0.1 m/s

2. Wall Exhausts NORTH (Admin Building Side)

Model as one horizontal stack, located in the center, NORTH side of the dome at 8 meter high. 2 conditions: winter and summer

	Parameter	Units	Summer	Winter	Notes			
	Months per year	months	5	7	Notes			
	4 vents on North Side	Each, Nm3/hr	35109	15213	Ref: DSOT-DW-3144-MS-0165			
	4 vents on North Side	Total, Nm3/hr	140434	60852	Ref: DSOT-DW-3144-MS-0165			
	8 4 6 4 4 4 4 4 4 4 4	/112	4.0	4.0	Equals Dust Concentration inside Dome. Assume all PM _{2.5}			
	Dust Concentration in exhaust	mg/Nm3	1.0	1.0	Engineering Estimate based on Ref. 1			
Wall Exhausts - NORTH	Dust Emissions (total 4 fans)	kg/h	0.14	0.06	Assume all PM _{2.5}			
Wali Exilausts - NORTH	Dust Emissions (total 4 fans)	g/s	0.039	0.017	Assume all PM _{2.5}			
	Exhaust Temperature	°C	2	.5	Average. Equals dome inside air temperature.			
	Exhaust orientation		Horiz	ontal	For modeling, Vs = 0.1 m/s			
	Exhaust velocity	m/s	0	.1	For modeling, Vs = 0.1 m/s due to downward horizontal orientation			
	Exhaust height	meters	7	.3	Ref: DSOT-DW-3300-GE-0002			
	Dimension		3 m x	1.27 m	Actual dimensions (Ref: DSOT-DW-3300-GE-0002)			
	Dilliension	m	11 1	7.2	Equivalent diameter for modelling a vertical velocity of 0.1 m/s			

3. Vacuum Pumps NORTH-EAST corner of the Dome

Model as one horizontal stack, located at the North-East corner of the dome. 7 meter high. 2 conditions: winter and summer

	Parameter	Units	Summer	Winter	Notes				
	Months per year	months	5	7	12 months per year, constant. Ref: DSOT-DW-3144-MS-0165				
	Total Air Flow	Total, cfm		10700	Ref: DSOT-DW-3144-MS-0165				
2 drum filter vacuum pumps	Total All Flow	Total, Nm3/hr	18179	18179					
	Dust Concentration in exhaust	mg/Nm3	10	10	Engineering Estimate				
	Dust Emissions (total)	kg/h	0.18	0.18					
and one pan filter suction	Dust Emissions (total)	g/s	0.050	0.050					
blower	Exhaust Temperature	°C	25						
blower	Exhaust orientation		Horizontal		Each of the three vacuum pump has an exhaust pipe (40/50 cm). These pipes				
	Exhaust height	meters	7.0		extend horizontally outside of the Dome wall (North-East corner), 10 meters from the Dome wall. 7 meters above ground. For air modeling purposes they				
	Dimension	m	0.5	51	are grouped into one horizontal stack				
	Differsion	""	8.0	8.0	Equivalent diameter for modelling a vertical velocity of 0.1 m/s				

4. Roof Exhaust

 $Model \ as \ one \ vertical \ stack, \ located \ in \ the \ center \ of \ the \ dome. \ 2 \ conditions: \ winter \ and \ summer$

	Parameter	Units	Summer	Winter	Notes
	Months per year	months	5	7	
	4 roof exhausts	Each, Nm3/hr	63712	0	2 fans are connected to each roof exhaust. 63,712 Nm3/hr air flow is for both fans
		Total, Nm3/hr	254849	0	Ref: DSOT-DW-3144-MS-0165
	Dust Concentration in exhaust	mg/Nm3	1.0	1.0	Equals Dust Concentration inside Dome. Assume all PM2.5
Roof Exhausts	Dust Concentration in exhaust	IIIg/NIII3	1.0	1.0	Engineering Estimate based on Ref. 1
ROUI EXIIAUSES	Dust Emissions (total 4 exhausts)	kg/h	0.25	0	
	Dust Emissions (total 4 exhausts)	g/s	0.0708	0	
	Exhaust Temperature	°C	2	5	Average. Equals dome inside air temperature.
	Exhaust orientation		Ver	tical	Model as one horizontal stack, located in the center of the dome
	Dimension	cm	20	00	Diameter (Ref: DSOT-DW-3144-MS-0109).
	Exhaust velocity	m/s	5.6	0	Calculated
	Exhaust height	meters	46.	29	Ref: DSOT-DW-3144-MS-0109

DUST COLLECTOR (FABRIC FILTER) - RAIL LOAD-OUT TOWER - BIN VENT

Reference Drawing No.:

Ultra Industries Inc - Customer data 10/31/12





PCE Sales and Engineering. Drawing 2K12-460-10

The rail load-out tower bin vent dust collector is located at the load-out tower and captures dust emissions from processed ore falling from the conveyor in the bin. The dust collector exhaust on the side of the load-out tower, through a 513 mm diameter outlet, horizontally, approximately 35 m above ground.

Potential dust emissions from this source are negligeable and were not included in air modeling

A. INVENTORY AND MODELING PARAMETERS

Parameter	Units	Yearly	Notes
Months per year	months	12	
Hours per day	hours	16	
Flow Rate	Nm3/hr	8496	Ref: Ultra Industries Inc - Customer data 10/31/12
Maximum Inlet Dust Loading Concentration	g/Nm3	42.6	Ref: Ultra Industries Inc - Customer data 10/31/12
Outlet Dust Concentration	mg/Nm3	50.0	Ref: Email from Daniel Hahn, Ultra Industries. 27-Aug-2015. Dust Emissions = 0.02 gr/acf = 45.8 mg/m3, rounded up to 50 mg/Nm3
Collector efficiency (Calculated)	%	99.9%	Typical new equipment design efficiencies are between 99 and 99.9% (ref. USEPA Document Air Pollution Control Technology Fact Sheet)
	kg/h	0.42	Maximum hourly rate
Dust Emission Rate	g/s, daily average	0.079	Calculated, hourly rate multiplied by 16 hours/d over 24 hours
	tonnes/year	2.48	16 hours per day. 365 days per year
Exhaust Temperature	°C	0	Ref: Ultra Industries Inc - Customer data 10/31/12
Exhaust orientation		Horizontal	
Exhaust velocity	m/s	10.5	Calculated
Exhaust height	meters	35	Ref: Ultra Industries Inc - Customer data 10/31/12
Exhaust diameter	m	0.513	Actual diameter. Ref: Ultra Industries Inc - Customer data 10/31/12
Lanaust diameter	m	5.2	Equivalent diameter for modelling a vertical velocity of 0.1 m/s

Emissions from truck loading activities at F7N

Equation used:

EF = $k * 0.0016 * (U/2.2)^1.3 * (M/2)^1.4$ (kg/tons) Ref: 1

TPM k= 1 PM10 k= 0.35 PM2.5 k=0.053

M (moisture) %:

9

Ref: Adam Friedberg, email August 2014

U average wind speed (m/s):

4.6

M/s

Ref: Adam Friedberg, email August 2014

Ref: http://www.climate.weatheroffice.ec.gc.ca/climate_normals

1- U.S. EPA Fifth Edition, Volume I Chapter 13, Miscellaneous Sources, section 13.2.4 Aggregate Handling and storage piles, equation (1)

<u>Data:</u> Duration Surface				8760 7,563	hours m2		24 h/day, All year Surface corresponding	approx. to the area	a affected by a	a blast	
									•		
<u>Calculation:</u> MPT (kg/yr)	0.000508227	kg/T	Х	3,382,860	T/year	=	1719	kg/yr			
MPT (kg/h)	1,719	kg/yr	/	8,760	h/year	=	0.2	kg/h			
MPT (g/s)	0.2	kg/h	X	1,000	g/kg	/	3600	s/h	=	0.0545	g/s
MPT (g/m2/s)	0.0545	g/s	/	7,563	m2	=	7.20892E-06	g/m2/s			o.
PM-10 (kg/yr)	0.00017788	kg/T	Х	3,382,860	T/year	=	602	kg/yr			
PM-10 (kg/h)	602	kg/yr	/	8,760	h/year	=	0.1	kg/h			
PM-10 (g/s)	0.1	kg/h	Χ	1,000	g/kg	/	3600	s/h	=	0.0191	g/s
PM-10 (g/m2/s)	0.0191	g/s	/	7,563	m2	=	2.52312E-06	g/m2/s			
PM-2.5 (kg/yr)	2.69361E-05	kg/T	Х	3,382,860	T/year	=	91	kg/yr			
PM-2.5 (kg/h)	91	kg/yr	/	8,760	h/year	=	0.0	kg/h			
PM-2.5 (g/s)	0.0	kg/h	Χ	1,000	g/kg	/	3600	s/h	=	0.0029	g/s
PM-2.5 (g/m2/s)	0.0029	g/s	/	7,563	m2	=	3.82073E-07	g/m2/s			

Emissions from bulldozer excavation activities at F7N

Equation used:

EF = 2.6 * (s)^1.2 * (M)^-1.3

0.013

0.0036

g/s

1- U.S. EPA AP-42 Fifth Edition, Volume I Chapter 11, Mineral Products Industry, section 11.9: Western Surface Coal Mining, tableau 11.9-2.

1,000

7,563

(kg/hr)

Data:	
-------	--

PM-2.5 (g/s)

MPT (g/s/m2)

Data.														
M (Moisture content)	%:	9 9	%		Ref: Adam Friedberg, email August 2014									
s: Silt content		1.5 9	%		Ref: Loic Dillon, Mars 2014									
PM10 factor		0.35			Réf.: AP-42	U.S. EPA Fifth I	Edition, Volume I Chapt	er 13, Miscellaneou	s Sources, sec	ction 13.2.4 Aggrega	ate Handling			
PM2.5 factor		0.053			and storage piles (k values for Equation 1)									
Surface	rce 7,563 m2					esponding appro	x. to the area affecte	d by a blast						
<u>Calculations</u>														
MPT (g/s)	0.2	kg/hr	Х	1,000	g/s	/	3600	s/hr	=	0.068	g/s			
MPT (g/s/m2)	0.068	g/s	/	7,563	m2	=	8.93E-06	g/s m2						
PM-10 (g/s)	0.09	kg/hr	Χ	1,000	g/s	/	3600	s/hr	=	0.024	g/s			
MPT (g/s/m2)	0.024	g/s	/	7,563	m2	=	3.13E-06	g/s m2						

g/s

m2

3600

4.73E-07

s/hr

g/s m2

0.0036

g/s

Emissions from truck loading activities at HOWSE (O.B.--- 5 months/year)

Equation used:

EF = k * 0.0016 * (U/2.2)^1.3 * (M/2)^-1.4 (kg/tons) Ref: 1 TPM k= 1 PM10 k= 0.35 PM2.5 k=0.053

M (moisture) %: 9 Ref: Adam Friedberg, email August 2014

U average wind speed (m/s):

4.6 m/s Ref: http://www.climate.weatheroffice.ec.gc.ca/climate_normals

 $\begin{array}{llll} \text{TPM (kg/t)} = & 0.000508227 & \text{kg/t} \\ \text{PM10 (kg/t)} = & 0.00017788 & \text{kg/t} \\ \text{PM-2.5 (kg/t)} = & 2.69361E-05 & \text{kg/t} \\ \end{array}$

1- U.S. EPA Fifth Edition, Volume I Chapter 13, Miscellaneous Sources, section 13.2.4 Aggregate Handling and storage piles, equation (1)

<u>Data:</u> Duration Surface				3600 hours 7,563 m2			24 h/day, 150 days/year Surface corresponding approx. to the area affected by a blast						
<u>Calculation:</u>													
MPT (kg/yr)	0.000508227	kg/T	Χ	6,777,656	T/year	=	3445	kg/yr					
MPT (kg/h)	3,445	kg/yr	/	3,600	h/year	=	1.0	kg/h					
MPT (g/s)	1.0	kg/h	Χ	1,000	g/kg	/	3600	s/h	=	0.2658	g/s		
MPT (g/m2/s)	0.2658	g/s	/	7,563	m2	=	3.51453E-05	g/m2/s					
PM-10 (kg/yr)	0.00017788	kg/T	х	6,777,656	T/year	=	1206	kg/yr					
PM-10 (kg/h)	1,206	kg/yr	/	3,600	h/year	=	0.3	kg/h					
PM-10 (g/s)	0.3	kg/h	Χ	1,000	g/kg	/	3600	s/h	=	0.0930	g/s		
PM-10 (g/m2/s)	0.0930	g/s	/	7,563	m2	=	1.23009E-05	g/m2/s					
PM-2.5 (kg/yr)	2.69361E-05	kg/T	X	6,777,656	T/year	=	183	kg/yr					
PM-2.5 (kg/h)	183	kg/yr	/	3,600	h/year	=	0.1	kg/h					
PM-2.5 (g/s)	0.1	kg/h	Χ	1,000	g/kg	/	3600	s/h	=	0.0141	g/s		
PM-2.5 (g/m2/s)	0.0141	g/s	/	7,563	m2	=	1.8627E-06	g/m2/s					

Emissions from bulldozer excavation activities at HOWSE (O.B.---5 months/year)

Equation used:

 $EF = 2.6 * (s)^1.2 * (M)^-1.3$ (kg/hr)

1- U.S. EPA AP-42 Fifth Edition, Volume I Chapter 11, Mineral Products Industry, section 11.9: Western Surface Coal Mining, tableau 11.9-2.

Data:

M (Moisture content) %:

9 %

Ref: Adam Friedberg, email August 2014

S: Silt content

1.5 %

Ref: Loic Dillon, Mars 2014

PM10 factor

PM2.5 factor

0.053

Ref: AP-42

U.S. EPA Fifth Edition, Volume I Chapter 13, Miscellaneous Sources, section 13.2.4 Aggregate Handling and storage piles (k values for Equation 1)

Surface

7,563 m2

Surface corresponding approx. to the area affected by a blast

carcarations

MPT (g/s)	0.2	kg/hr	Х	1,000	g/s	/	3600	s/hr	=	0.068	g/s
MPT (g/s/m2)	0.068	g/s	/	7,563	m2	=	8.93E-06	g/s m2			
PM-10 (g/s)	0.09	kg/hr	Χ	1,000	g/s	/	3600	s/hr	=	0.024	g/s
MPT (g/s/m2)	0.024	g/s	/	7,563	m2	=	3.13E-06	g/s m2			
PM-2.5 (g/s)	0.013	kg/hr	Χ	1,000	g/s	/	3600	s/hr	=	0.0036	g/s
MPT (g/s/m2)	0.0036	g/s	/	7,563	m2	=	4.73E-07	g/s m2			

Emissions from truck loading activities at HOWSE (Ore+Waste---- 7 months/year)

Equation used:

EF = k * 0.0016 * (U/2.2)^1.3 * (M/2)^-1.4 (kg/tons) Ref: 1 TPM k= 1 PM10 k= 0.35 PM2.5 k=0.053

M (moisture) %: 9 Ref: Adam Friedberg, email August 2014

U average wind speed (m/s):

4.6 m/s Ref: http://www.climate.weatheroffice.ec.gc.ca/climate_normals

1- U.S. EPA Fifth Edition, Volume I Chapter 13, Miscellaneous Sources, section 13.2.4 Aggregate Handling and storage piles, equation (1)

<u>Data:</u> 4800 24 h/day, 200 days/year Duration hours Surface 7,563 m2 Surface corresponding approx. to the area affected by a blast Calculation: MPT (kg/yr) 0.000508227 kg/T 7,045,421 T/year 3581 kg/yr 3,581 4,800 0.7 MPT (kg/h) kg/yr h/year kg/h 0.7 MPT (g/s) kg/h Χ 1,000 g/kg 3600 s/h 0.2072 g/s MPT (g/m2/s) 0.2072 g/s 7,563 m2 2.74003E-05 g/m2/s PM-10 (kg/yr) 0.00017788 kg/T 7,045,421 T/year 1253 kg/yr PM-10 (kg/h) 1,253 kg/yr 4,800 h/year 0.3 kg/h PM-10 (g/s) 0.3 kg/h Χ 1,000 3600 s/h 0.0725 g/s g/kg 9.59012E-06 PM-10 (g/m2/s) 0.0725 g/s 7,563 m2 g/m2/s PM-2.5 (kg/yr) 2.69361E-05 190 kg/T 7,045,421 T/year kg/yr PM-2.5 (kg/h) 190 kg/yr 4,800 h/year 0.0 kg/h 0.0 kg/h 1,000 3600 s/h 0.0110 PM-2.5 (g/s) Χ g/kg g/s 0.0110 g/s 7,563 1.45222E-06 PM-2.5 (g/m2/s) m2 g/m2/s

Emissions from bulldozer excavation activities at HOWSE (Ore+Waste---- 7 months/year)

Equation used:

 $EF = 2.6 * (s)^1.2 * (M)^-1.3$ (kg/hr)

1- U.S. EPA AP-42 Fifth Edition, Volume I Chapter 11, Mineral Products Industry, section 11.9: Western Surface Coal Mining, tableau 11.9-2.

Data:

<u>Calculations</u>											
MPT (g/s)	0.2	kg/hr	Х	1,000	g/s	/	3600	s/hr	=	0.068	g/s
MPT (g/s/m2)	0.068	g/s	/	7,563	m2	=	8.93E-06	g/s m2			
PM-10 (g/s)	0.09	kg/hr	Χ	1,000	g/s	/	3600	s/hr	=	0.024	g/s
MPT (g/s/m2)	0.024	g/s	/	7,563	m2	=	3.13E-06	g/s m2			
PM-2.5 (g/s)	0.013	kg/hr	Χ	1,000	g/s	/	3600	s/hr	=	0.0036	g/s
MPT (g/s/m2)	0.0036	g/s	/	7,563	m2	=	4.73E-07	g/s m2			

Emissions from truck unloading activities of OverBurden and Waste from F7N

Equation used:

EF = k * 0.0016 * (U/2.2)^1.3 * (M/2)^-1.4 (kg/tons) Ref: 1 TPM k= 1 PM10 k= 0.35 PM2.5 k=0.053

M (moisture) %: 9 Ref: Adam Friedberg, email August 2014

U average wind speed (m/s): 4.6 m/s Ref: http://www.climate.weatheroffice.ec.gc.ca/climate_normals

1- U.S. EPA Fifth Edition, Volume I Chapter 13, Miscellaneous Sources, section 13.2.4 Aggregate Handling and storage piles , equation (1)

<u>Data:</u>											
Duration				8760	hours		24 h/day, All year				
Surface				30 000	m2		Surface corresponding	approx. to the a	rea of o	peration	
							Ref: Email Jeff Casso	ff, March 20 2	012		
Calculation:											
MPT (kg/yr)	0.000508227	kg/T	Χ	2 273 750	T/year	=	1156	kg/yr			
MPT (kg/h)	1 156	kg/yr	/	8 760	h/year	=	0.1	kg/h			
MPT (g/s)	0.1	kg/h	Х	1 000	g/kg	/	3600	s/h	=	0.0366	g/s
MPT (g/m2/s)	0.0366	g/s	/	30 000	m2	=	1.22144E-06	g/m2/s			
PM-10 (kg/yr)	0.00017788	kg/T	Х	2 273 750	T/year	=	404	kg/yr			
PM-10 (kg/h)	404	kg/yr	/	8 760	h/year	=	0.0	kg/h			
PM-10 (g/s)	0.0	kg/h	Х	1 000	g/kg	/	3600	s/h	=	0.0128	g/s
PM-10 (g/m2/s)	0.0128	g/s	/	30 000	m2	=	4.27505E-07	g/m2/s			
PM-2.5 (kg/yr)	2.69361E-05	kg/T	Х	2 273 750	T/year	=	61	kg/yr			
PM-2.5 (kg/h)	61	kg/yr	/	8 760	h/year	=	0.0	kg/h			
PM-2.5 (g/s)	0.0	kg/h	X	1 000	g/kg	/	3600	s/h	=	0.0019	g/s
PM-2.5 (g/m2/s)	0.0019	g/s	,	30 000	m2	=	6.47364E-08	g/m2/s		5.5015	8/3
1 141 2.3 (8/11/2/3)	0.0013	ы э	,	30 000	1112	_	51-7 304L-00	6/ 1112/3			

Emissions from truck unloading activities of OverBurden and Waste at HOWSE (O.B. --- 5 month/year)

Equation used:

EF = k * 0.0016 * (U/2.2)^1.3 * (M/2)^-1.4 (kg/tons) Ref: 1 TPM k= 1 PM10 k= 0.35 PM2.5 k=0.053

M (moisture) %: 9 Ref: Adam Friedberg, email August 2014

U average wind speed (m/s): 4.6 m/s Ref: http://www.climate.weatheroffice.ec.gc.ca/climate_normals

 $\begin{tabular}{lll} TPM (kg/t) = & 0.000508227 & kg/t \\ PM10 (kg/t) = & 0.00017788 & kg/t \\ PM-2.5 (kg/t) = & 2.69361E-05 & kg/t \\ \end{tabular}$

1- U.S. EPA Fifth Edition, Volume I Chapter 13, Miscellaneous Sources, section 13.2.4 Aggregate Handling and storage piles, equation (1)

<u>Data:</u>											
Duration				3600	hours		24 h/day, 150 days/y	rear ear			
Surface				30 000	m2		Surface corresponding	approx. to the a	rea of o	peration	
							Ref: Email Jeff Casso	ff, March 20 2	012		
Calculation:											
MPT (kg/yr)	0.000508227	kg/T	Χ	6 777 656	T/year	=	3445	kg/yr			
MPT (kg/h)	3 445	kg/yr	/	3 600	h/year	=	0.957	kg/h			
MPT (g/s)	1.0	kg/h	Χ	1 000	g/kg	/	3600	s/h	=	0.2658	g/s
MPT (g/m2/s)	0.2658	g/s	/	30 000	m2	=	8.85954E-06	g/m2/s			
PM-10 (kg/yr)	0.00017788	kg/T	Х	6 777 656	T/year	=	1206	kg/yr			
PM-10 (kg/h)	1 206	kg/yr	/	3 600	h/year	=	0.335	kg/h			
PM-10 (g/s)	0.3	kg/h	Χ	1 000	g/kg	/	3600	s/h	=	0.0930	g/s
PM-10 (g/m2/s)	0.0930	g/s	/	30 000	m2	=	3.10084E-06	g/m2/s			
PM-2.5 (kg/yr)	2.69361E-05	kg/T	Х	6 777 656	T/year	=.	183	kg/yr			
PM-2.5 (kg/h)	183	kg/yr	/	3 600	h/year	=	0.0507	kg/h			
PM-2.5 (g/s)	0.1	kg/h	Χ	1 000	g/kg	/	3600	s/h	=	0.0141	g/s
PM-2.5 (g/m2/s)	0.0141	g/s	/	30 000	m2	=	4.69556E-07	g/m2/s			

Emissions from truck unloading activities of OverBurden and Waste at HOWSE (Waste --- 7 month/year)

Equation used:

EF = k * 0.0016 * (U/2.2)^1.3 * (M/2)^-1.4 (kg/tons) Ref: 1 PM10 k= 0.35 TPM k= 1 PM2.5 k=0.053

M (moisture) %: Ref: Adam Friedberg, email August 2014

U average wind speed (m/s): 4.6 m/s $\textit{Ref:} \ \textit{http://www.climate.weatheroffice.ec.gc.ca/climate_normals}$

TPM (kg/t) =0.000508227 kg/t PM10 (kg/t)= 0.00017788 kg/t PM-2.5 (kg/t) = 2.69361E-05 kg/t

1- U.S. EPA Fifth Edition, Volume I Chapter 13, Miscellaneous Sources, section 13.2.4 Aggregate Handling and storage piles, equation (1)

<u>Data:</u> Duration Surface				4800 30 000	hours m2		24 h/day, 200 days/y Surface corresponding Ref: Email Jeff Casso	approx. to the a		peration	
<u>Calculation:</u>											
MPT (kg/yr)	0.000508227	kg/T	Х	3 968 498	T/year	=	2017	kg/yr			
MPT (kg/h)	2 017	kg/yr	/	4 800	h/year	=	0.420	kg/h			
MPT (g/s)	0.4	kg/h	Х	1 000	g/kg	/	3600	s/h	=	0.1167	g/s
MPT (g/m2/s)	0.1167	g/s	/	30 000	m2	=	3.89062E-06	g/m2/s			
PM-10 (kg/yr)	0.00017788	kg/T	х	3 968 498	T/year	=	706	kg/yr			
PM-10 (kg/h)	706	kg/yr	/	4 800	h/year	=	0.147	kg/h			
PM-10 (g/s)	0.1	kg/h	Х	1 000	g/kg	/	3600	s/h	=	0.0409	g/s
PM-10 (g/m2/s)	0.0409	g/s	/	30 000	m2	=	1.36172E-06	g/m2/s			
PM-2.5 (kg/yr)	2.69361E-05	kg/T	х	3 968 498	T/year	=	107	kg/yr			
PM-2.5 (kg/h)	107	kg/yr	/	4 800	h/year	=	0.0223	kg/h			
PM-2.5 (g/s)	0.0	kg/h	Χ	1 000	g/kg	/	3600	s/h	=	0.0062	g/s
PM-2.5 (g/m2/s)	0.0062	g/s	/	30 000	m2	=	2.06203E-07	g/m2/s			

$\underline{\textbf{Calculations of emission factors of additional diesel powered equipment:}}$

Name	Description	Qty Tier level	Engine power (kW)	Estimated load	Corresponding PM EF for Tier/Power (g/kW-hr)	Corresponding NOx EF for Tier/Power (g/kW-hr)	Corresponding CO EF for Tier/Power (g/kW-hr)	Corresponding HC EF for Tier/Power (g/kW-hr)**	TPM EF (g/s)	PM10 EF (g/s)	PM2.5 EF (g/s)	SO2 EF (g/s)	NOx EF (g/s)	CO EF (g/s)	HC EF (g/s)
Drill: Gardner Denver SCH5000 DTH	Engine: Caterpillar C11	1 3	242	50%	0.2	4.0	3.5	0.2667	0.00672	0.00672	0.00672	0.000182	0.134	0.118	0.009
Drill: Cubex 920XR	Engine: Caterpillar C15	1 3	403	50%	0.2	4.0	3.5	0.2667	0.01119	0.01119	0.01119	0.000182	0.224	0.196	0.015
Excavator: Caterpillar 390	Engine: Caterpillar C18 ACERT	2 4i	390	50%	0.02	4.0	3.5	0.2667	0.00108	0.00108	0.00108	0.000182	0.217	0.190	0.014
Excavator: Komatsu 1250	Engine: Komatsu SAA6D170E-3	1 2	486	50%	0.2	6.4	3.5	0.4000	0.01350	0.01350	0.01350	0.000182	0.432	0.236	0.027
Excavator: Komatsu 490	Engine: Komatsu SAA6D125E-6-A	1 4i	270	50%	0.02	4.0	3.5	0.2667	0.00075	0.00075	0.00075	0.000182	0.150	0.131	0.010
Dozer: Caterpillar D8	Engine: Caterpillar C15 ACERT	4 4i	237	50%	0.02	4.0	3.5	0.2667	0.00066	0.00066	0.00066	0.000182	0.132	0.115	0.009
Loader: Caterpillar 988	Engine: Caterpillar C18 ACERT	3 3	414	50%	0.2	4.0	3.5	0.2667	0.01150	0.01150	0.01150	0.000182	0.230	0.201	0.015
Water Truck: Caterpillar 773	773F Tier 3	1 3	524	50%	0.2	4.0	3.5	0.2667	0.01456	0.01456	0.01456	0.000182	0.291	0.255	0.019
Grader: Caterpillar 16M	Engine: Caterpillar C13 ACERT VHP	1 4i	221	50%	0.02	4.0	3.5	0.2667	0.00061	0.00061	0.00061	0.000182	0.123	0.107	0.008
Grader: Caterpillar 14M	Engine: Caterpillar C11 ACERT VHP	1 3	219	50%	0.20	4.0	3.5	0.2667	0.00608	0.00608	0.00608	0.000182	0.122	0.106	0.008
Compactor/Roller: Dynapac CS76	Engine: Caterpillar C6.6	2 3	130	50%	0.2	4.0	3.5	0.2667	0.00361	0.00361	0.00361	0.000182	0.072	0.063	0.005
Loader: Caterpillar IT 38	Engine: Caterpillar C6.6 ACERT	1 3	147	50%	0.2	4.0	3.5	0.2667	0.00408	0.00408	0.00408	0.000182	0.082	0.071	0.005
Lighting Plants: Magnum MLT3060	Engine: Mitsubishi L3E-W461ML***	8 4i	10.5	100%	0.4	7.5	6.6	0.8036	0.00117	0.00117	0.00117	0.000015	0.022	0.019	0.002
6" Dewatering Pumps: Godwin Dri-Prime CD150M	Engine: John Deere 4045TF290	3 4i	55	100%	0.3	4.7	5.0	0.2686	0.00458	0.00458	0.00458	0.000076	0.072	0.076	0.004
Locomotive at rail loop	Tier 1 engine : Line-Haul Duty-Cycle during rail loading (Notch levels conservatively estimated as 84% Idle, 6% notch 1, 5% notch 2, 5% notch 3)	1 1	113 bhp		0.22 g/bhp-hr	7.4 g/bhp-hr	2.2 g/bhp-hr	0.55 g/bhp-hr	0.0069	0.0069	0.0069	0.000364	0.232	0.069	0.017

^{**} Tier3 EF are used for Tier 4i in EPA420-R-05-015; Table8

For SO2 emission factor calculations, which is based on fuel consumption, fuel consumption has been very conservatively rounded up to a CAT773 truck running at 50% load:

Oil consumption 26.28 L/hr X 832 kg/m³ / Emission rate SO₂ 21.9 kg/hr X 0.0015%

3600 s/hr **0.000182** g/s 1000 l/m3 2 kg SO₂/kg S X 1000 21.9 kg/hr

g/kg /

** Conversion Factors for Hydrocarbon Emission Components NR-002c. Report EPA420-R-05-015; Table8

* All diesel fuel on site is 15ppm sulphur

References for calculations

Name	References
Drill: Gardner Denver SCH5000 DTH	http://www.womp-int.com/story/2007vol5/story027.htm http://www.hastingsdeering.com.au/home/news/Caterpillar_in_the_track_drill_business https://mining.cat.com/products/surface-mining/drills/track#MD5125 http://www.drillerschoiceinc.com/PDF/Reedrill/sch5000.pdf
Drill: Cubex 920XR	http://www2.sandvik.com/sandvik/0120/internet/Poland/S004947.nsf/Alldocs/Products*5CDrill*rigs*and*rock*drills*5CSurface*DTH*drill*rigs*2AQXR920 http://mining.sandvik.com/sandvik/0120/Global/Internet/S003137.nsf/LUSL/SLFrameForm17B6F9E690B5F4CDFC1257965003C9724?OpenDocument
Excavator: Caterpillar 390	http://www.cat.com/en_AU/products/new/equipment/excavators/large-excavators/17859554.html https://www.dieselnet.com/news/2010/04cat.php
Excavator: Komatsu 1250	http://www.komatsu.com.au/AboutKomatsu/NewsAndPublications/Brochures/New%20Equipment%20Brochures/Excavator/PC1250LC-7/PC1250LC-7.pdf http://www.ritchiespecs.com/specification?type=&category=Hydraulic+Excavator&make=Komatsu&model=PC1250-7&modelid=103548
Excavator: Komatsu 490	http://www.komatsuamerica.com/equipment/excavators/70001-260000lbs/pc490lc-10
Dozer: Caterpillar D8	http://www.cat.com/en_US/products/new/equipment/dozers.html http://www.cat.com/en_US/products/new/equipment/dozers/large-dozers/18175886.html
Loader: Caterpillar 988	http://media.lectura-specs.com/data_sheets/it_38h_en(255).pdf
Water Truck: Caterpillar 773	Same as hauling trucks for ore transport
Grader: Caterpillar 16M	http://www.cat.com/en_US/products/new/equipment/motor-graders/m-series-motor-graders/18346813.html https://mining.cat.com/products/surface-mining/motor-graders
Compactor/Roller: Dynapac CS76	http://xml.catmms.com/servlet/ImageServlet?imageId=C334049
Loader: Caterpillar IT 38	http://media.lectura-specs.com/data_sheets/it_38h_en(255).pdf
Lighting Plants: Magnum MLT3060	http://www.m-p-llc.com/products/lighttowers/series3000/mlt3060.html http://www.det-mitsubishi.com/en/mitsubishi-diesel-motoren/toepassingen/magnum
6" Dewatering Pumps: Godwin Dri-Prime CD150M	http://godwinpumps.com/index.php/godwin-products/cd-range/cd150m/http://www.deere.com/en_US/products/engines_and_drivetrain/industrial/interim_tier_4/powertech_m/4045_series/4045TF290_A.page
Locomotive at rail loop	Table 5.3 for % of avg rated bhp for switch-haul locomotives: http://www.polb.com/civica/filebank/blobdload.asp?BlobID=5377
EPA Tier levels	Nonroad Compression-Ignition Engines Exhaust Emission Standards : http://www.epa.gov/otaq/standards/nonroad/nonroadci.htm Locomotives Exhaust Emission Standards : http://www.epa.gov/otaq/standards/nonroad/locomotives.htm

Emissions from conveyors and various transfer points equipment at HOWSE Mini Plant

<u>Data</u> Capacity INPUT to Mini Plant

3,076,923 tonnes/yr 15,385 tonnes/day 641 tonnes/hr

(Projected Yearly data from Dryer throughput applied for 24 hours operations)

Size of stockpiles is used to estimate 0-10mm vs 10-32mm percentages for process flow

OUTPUT from Mini Plant 2,978,723 tonnes/yr (Dried product) 14,893.62 tonnes/day 620.57 tonnes/hr

9% 6% Moisture content IN Moisture content OUT

Des	scription	Emission rate TPM	Emission rate PM 10	Emission rate PM 2.5	Units	References	Period/ frequency	Notes
	Reduction % below:	0.000600	0.000270	0.0000500	ka/tonno			
	0%	0.000600	0.000270	0.0000500	kg/tonne	-		-
Jaw Crusher		0.000600	0.000270	0.0000500	kg/tonne	1		Reference 1: Tertiary Crushing (controlled)
	Hourly rate % below:	0.3846	0.1731	0.0321	kg/hr		7 months per year	
	100%	0.1068	0.04808	0.00890	g/s		average rate over 24h	
	Reduction % below:	0.000070	0.000023	0.0000065	kg/tonne			
Feed Conveyor #1	0%	0.000070	0.000023	0.0000065	kg/tonne	1		Reference 1: Conveyor Transfer Point (controlled)
,.	Hourly rate % below:	0.0449	0.000023	0.0000	kg/tolille kg/hr	-	7 months per year	
	100%	0.0125	0.00410	0.00116	g/s	†	average rate over 24h	-
	Reduction % below:	0.000070	0.000023	0.0000065	kg/tonne			
Food Convover #2	0%					1		Reference 1: Conveyor Transfer Point (controlled)
Feed Conveyor #2		0.000070	0.000023	0.0000065	kg/tonne	1		Reference 1. Conveyor transfer Point (controlled)
	Hourly rate % below:	0.0449	0.0147	0.0042	kg/hr		7 months per year	_
	100%	0.0125	0.00410	0.00116	g/s		average rate over 24h	
PRE-Dryer Volume So	urce	0.2223	0.0879	0.0160	g/s		Including	g Truck Unloading at Ramp
	Reduction % below:	0.000070	0.000023	0.0000065	R Y I			
Tf 0	0%					1 ,		
Transfer Conveyor #3		0.000070	0.000023	0.0000065	kg/tonne	1		Reference 1: Conveyor Transfer Point (controlled)
	Hourly rate % below:	0.0434	0.0143	0.0040	kg/hr		7 months per year	
	100%	0.0121	0.00396	0.00112	g/s		average rate over 24h	
	Reduction % below:	0.001100	0.000370	0.000025	kg/tonne			
Screen	0%					1		Reference 1: Screening (controlled)
Screen	11	0.001100	0.000370	0.000025	kg/tonne	1	- ·	Reference 1. Screening (controlled)
	Hourly rate % below: 100%	0.6826 0.1896	0.2296 0.06378	0.0155 0.00431	kg/hr		7 months per year	_
	100%	0.1896	0.00378	0.00431	g/s		average rate over 24h	
	Reduction % below:	0.000070	0.000023	0.0000065	kg/tonne			
Transfer Conveyor #4	0%	0.000070	0.000023	0.0000065	les /honne	1		Reference 1: Conveyor Transfer Point (controlled)
	Hourly rate % below:	0.0000	0.000023	0.0000	kg/tonne kg/hr		7 months per year	
	0%	0.0000	0.0000	0.0000	g/s	-	average rate over 24h	-
		0.000	0.0000	0.0000	8, -		avorago rato ovoi 2 iii	
	Reduction % below:	0.000070	0.000023	0.0000065	kg/tonne			
Fines Stacker Conveyor	0%	0.000070	0.000023	0.0000065	kg/tonne	1		Reference 1: Conveyor Transfer Point (controlled)
	Hourly rate % below:	0.0000	0.0000	0.0000	kg/hr	1	7 months per year	
	0%	0.0000	0.00000	0.00000	g/s	1	average rate over 24h	
	Reduction % below:	0.000070	0.000023	0.0000065	kg/tonne			
Transfer Conveyor #5	0%	0.000070	0.000022	0.0000055	lan (hannan	1		Reference 1: Conveyor Transfer Point (controlled)
(to Cone Crusher)	Hourly rate % below:	0.000070 0.0043	0.000023 0.0014	0.000065 0.0004	kg/tonne	-	7 months per year	Telefence 1. conveyor mansier rome (controlled)
	10%	0.0012	0.0014	0.0004	kg/hr g/s	-	average rate over 24h	-
		0.0012	0.00040	0.00011	g/ s		average rate over 2411	
Transfer Conveyor #6	Reduction % below: 0%	0.000070	0.000023	0.0000065	kg/tonne	1		-
(to Cone Crusher)		0.000070	0.000023	0.0000065	kg/tonne	1		Reference 1: Conveyor Transfer Point (controlled)
/	Hourly rate % below:	0.0043	0.0014	0.0004	kg/hr]	7 months per year	
	10%	0.0012	0.00040	0.00011	g/s		average rate over 24h	
	Reduction % below:	0.000600	0.000270	0.0000500	kg/tonne			
Cone Crusher	0%	0.000600	0.000270	0.0000500	kg/tonne	1		Reference 1: Tertiary Crushing (controlled)
	Hourly rate % below:	0.0372	0.0168	0.000300	kg/tollile kg/hr	1	7 months per year	- · · · · · · · · · · · · · · · · · · ·
	10%	0.0103	0.00465	0.0031	g/s	1	average rate over 24h	╡
	10 /0	0.0103	0.00403	0.00000	b/ 3	l	avoiage rate over 2411	<u> </u>

(1) Source : U.S. EPA Fifth Edition, Volume I Chapter 11, Wet suppression system is used to control dust emission:			ılverized Mineral Proce	essing, table 11.19-2-	1						
Emissions from truck unloading activities at entra	nce of Mini Plant with unproc	essed product									
Equation used:											
EF = k * 0.0016 * (U/2.2)^1.3 * (M/2)^-1.4			(kg/tons)	Ref: 1							
TPM k= 1	PM10 k= 0.35		PM2.5 k=0.053								
M (moisture) %:	9				Ref: Adam Friedberg, emo	ail August 2014					
U average wind speed (m/s):		4.6	m/s		Ref: http://www.climate.	weatheroffice.ec.gc.ca/clima	te_normals				
TPM (kg/t) =	0.000508227	kg/t									
PM10 (kg/t)=	0.00017788	kg/t									
PM-2.5 (kg/t) =	2.69361E-05	kg/t									
1- U.S. EPA Fifth Edition, Volume I Chapter 13, Miscellaneous S	Sources, section 13.2.4 Aggregate Han		oiles , equation (1)								
<u>Data:</u>											
Duration				4800	hours		24 h/day, 7 month/year				
Surface				1,000	m2		Surface corresponding approx. to the area of operation				
				,							
Calculation:	0.000508227	k~ /⊤	v	2 076 022	Throat	_	1564	lea fran			
MPT (kg/yr)		kg/T	X	3,076,923	T/year	=		kg/yr			
MPT (kg/h)	1,564	kg/yr	/	4,800	h/year	=	0.3	kg/h		0.000	,
MPT (g/s)	0.3	kg/h	X	1,000	g/kg	/	3600	s/h	=	0.0905	g/s
MPT (g/m2/s)	0.0905	g/s	/	1,000	m2	=	9.04963E-05	g/m2/s			
PM-10 (kg/yr)	0.00017788	kg/T	Х	3,076,923	T/year	=	547	kg/yr			
PM-10 (kg/h)	547	kg/yr	/	4,800	h/year	=	0.1	kg/h			
PM-10 (g/s)	0.1	kg/h	X	1,000	g/kg	/	3600	s/h	=	0.0317	g/s
PM-10 (g/m2/s)	0.0317	g/s	/	1,000	m2	=	3.16737E-05	g/m2/s			6/ -
		. –			_,						
PM-2.5 (kg/yr)	2.69361E-05	kg/T	X	3,076,923	T/year	=	83	kg/yr			
PM-2.5 (kg/h)	83	kg/yr	/	4,800	h/year	=	0.0	kg/h			
PM-2.5 (g/s)	0.0	kg/h	X	1,000	g/kg	/	3600	s/h	=	0.0048	g/s
PM-2.5 (g/m2/s)	0.0048	g/s	/	1,000	m2	=	4.79631E-06	g/m2/s			
Emissions from truck loading activities leaving Min	ni Plant with processed produ	ıct									
EF = k * 0.0016 * (U/2.2)^1.3 * (M/2)^-1.4			(kg/tons)	Ref: 1							
TPM k=1	PM10 k= 0.35		PM2.5 k=0.053	nej. 1							
M (moisture) %:	6		1 WIZ.5 K-0.055		(Mini Plant output moistu	ire taraet)					
U average wind speed (m/s):	Ü	4.6	m/s			weatheroffice.ec.gc.ca/clima	te_normals				
TDM (\rangle \alpha /t \) =	0.00006574	k-a /+									
TPM (kg/t) =	0.000896574	kg/t									
PM10 (kg/t)=	0.000313801	kg/t									
PM-2.5 (kg/t) = 1- U.S. EPA Fifth Edition, Volume I Chapter 13, Miscellaneous S	4.75184E-05 Sources, section 13.2.4 Aggregate Han	kg/t dlina and storage p	oiles . equation (1)								
	35.5	3	()								
Data:											
Duration				4800	hours		24 h/day, 7 month/year				
Surface				1,000	m2		Surface corresponding approx. to the area of operation				
Calculation:											
MPT (kg/yr)	0.000896574	kg/T	Х	2,978,723	T/year	=	2671	kg/yr			
MPT (kg/h)	2,671	kg/yr	/	4,800	h/year	=	0.6	kg/h			
MPT (g/s)	0.6	kg/h	Х	1,000	g/kg	/	3600	s/h	=	0.1546	g/s
MPT (g/m2/s)	0.1546	g/s	/	1,000	m2	=	0.000154551	g/m2/s			
DNA 10 (kg/kg)	0.000343904	l. ~ /⊤	V	2 070 722	T/	_	035	l /			
PM-10 (kg/yr)	0.000313801	kg/T	X	2,978,723	T/year	=	935	kg/yr			
PM-10 (kg/h)	935	kg/yr	/	4,800	h/year	=	0.2	kg/h		0.05.1	_,
PM-10 (g/s)	0.2	kg/h	X	1,000	g/kg	/	3600	s/h	=	0.0541	g/s
PM-10 (g/m2/s)	0.0541	g/s	/	1,000	m2	=	5.40929E-05	g/m2/s			
PM-2.5 (kg/yr)	4.75184E-05	kg/T	х	2,978,723	T/year	=	142	kg/yr			
PM-2.5 (kg/h)	142	kg/yr	/	4,800	h/year	=	0.0	kg/h			
PM-2.5 (g/s)	0.0	kg/h	X	1,000	g/kg	/	3600	s/h	=	0.0082	g/s
PM-2.5 (g/m2/s)	0.0082	g/s	/	1,000	m2	=	8.19121E-06	g/m2/s			
		-									

Including Truck Loading at Plant Exit

POST-Dryer Volume Source

0.3690

0.1273

0.0147

g/s

Emission Estimations for each of the two identical Dryer/Baghouse Stacks at Howse Mini Plant

		250	metric tons/h			
	S	short tons/year				
	#2 Fuel Oil	uel Oil BagHouse Total Exhaus				
MPT	6.00	9.00	15.00			
PM10		4.50	4.50			
PM2.5		1.35	1.35			
NOx	72.00	0.00	72.00			
SO2	42.60	0.00	42.60			
CO	15.00	0.00	15.00			
HC**	0.76	0.00	0.76			

		metric tons/h					
	short tons/year						
	#2 Fuel Oil	#2 Fuel Oil BagHouse Total Exhaust					
MPT	10.20	11.52	21.72				
PM10		5.76	5.76				
PM2.5		1.73	1.73				
NOx	122.40	0.00	122.40				
SO2	72.42	0.00	72.42				
CO	25.50	0.00	25.50				
HC	1.29	0.00	1.29				

* Based on Emission Estimations sheet provided by used equipment supplier "Worldwide Recycling Equipment Sales, LLC"
(Estimations for 250 metric tons/h and 450 metric tons/h)

^{**} http://www3.epa.gov/ttn/chief/ap42/ch01/final/c01s03.pdf -Table 1.3-3.

	metric tons/h				
	metric tons/year				
	#2 Fuel Oil BagHouse Total Exhaus				
MPT	5.44	8.16	13.61		
PM10*	5.44	4.08	4.08		
PM2.5*	5.44	1.22	1.22		
NOx	65.32	0.00	65.32		
SO2	38.65	0.00	38.65		
CO	13.61	0.00	13.61		
HC	0.69	0.00	0.69		

		450	metric tons/h	
		metric tons/year		Dryer
	#2 Fuel Oil	BagHouse	Total Exhaust	(g/s)
MPT	9.25	10.45	19.70	0.6335
PM10*	9.25	5.23	14.48	0.4655
PM2.5*	9.25	1.57	10.82	0.3479
NOx	111.04	0.00	111.04	3.5699
SO2	65.70	0.00	65.70	2.1122
CO	23.13	0.00	23.13	0.7437
HC	1.17	0.00	1.17	0.0375

^{*} All PM attributed to PM2.5 for modeling purposes

Stack Height =	15	m
Gas Flow Generator =	3567	CFIV
Gas Flow Dryer =	64000	CFN
Temperature Outlet Gen =	709	K
Temperature Outlet Dryer =	373	K

Ajustments for su	ulfur content in fuel oil
Concentration used as reference =	1000 ppm
Sulfur in diesel fuel on-site =	15 ppm
Ratio of original EF to consider =	0.015

		320.5	metric tons/h
	S		
	#2 Fuel Oil	BagHouse	Total Exhaust
MPT	7.48	9.89	17.37
PM10		4.94	4.94
PM2.5		1.48	1.48
NOx	89.77	0.00	89.77
SO2	53.11	0.00	53.11
CO	18.70	0.00	18.70
HC	0.94	0.00	0.94

320.51

metric tons/year

BagHouse

8.97

4.49

1.35

0.00

0.00

0.00

0.00

MPT

PM10*

PM2.5*

NOx

SO2

CO

нс

6.79

6.79

81.44

0.72

16.97

0.86

metric tons/h

Total Exhaust

15.76

11.27

8.13

81.44

0.72

16.97

0.86

Dryer

(g/s)

0.51

0.36

0.26

2.62

0.0232

0.55 0.03

Firing rate at 450 tons/h	170 I	MMBTU/h	
Baghouse Vent at 250 tons/h	50000	CFM	
Baghouse Vent at 450 tons/h	64000	CFM	
Firing rate at 320.5 tons/h	124.679487		MMBTU/h
aghouse Vent at 320.5 tons/h	54935.8974		CFM

100 MMBTU/h

Firing rate at 250 tons/h

Flow rate	25.9268563	Cubic meter/sec
Speed	13	m/s
Α	1.99	m2
R	0.80	m
Diameter	1.59	m

1	short ton	= 0.90718474 metric ton
360	days/year	
24	h/day	
3600	seconds/h	
1000000	g/metric ton	

<u>Data</u> Capacity

INPUT to Plant 2

OUTPUT from Plant 2

(Dried product)

3,942,000 tonnes/yr 10,800 tonnes/day 450 tonnes/hr (Projected Yearly data from Dryer throughput applied for 24 hours operations)

Size of stockpiles is used to estimate 0-10mm vs 10-32mm percentages for process flow 0-10 mm (kT) = 40 88.9% 10-32 mm (kT) = 5 11.1%

3,504,000 tonnes/yr (Dried product) 9,600 tonnes/day 400 tonnes/hr 67,200 tonnes/week

		400	tonnes/hr					
[Description	Emission rate TPM	Emission rate PM 10	Emission rate PM 2.5	Units	References	Period/ frequency	Notes
	Reduction % below:	0.000600	0.000270	0.0000500	kg/tonne			
Jaw Crusher	0%	0.000600	0.000270	0.0000500	kg/tonne	1		Reference 1: Tertiary Crushing (controlled)
	Hourly rate % below:	0.2700	0.1215	0.0225	kg/hr		12 months per year	
	100%	0.0750	0.03375	0.00625	g/s		average rate over 24h	
	Reduction % below:	0.000070	0.000023	0.0000065	kg/tonne			
Feed Conveyor #1	0%	0.000070	0.000023	0.0000065	kg/tonne	1		Reference 1: Conveyor Transfer Point (controlled)
	Hourly rate % below:	0.0315	0.0104	0.0029	kg/hr		12 months per year	
	100%	0.0088	0.00288	0.00081	g/s		average rate over 24h	
	Reduction % below:	0.000070	0.000023	0.0000065	kg/tonne			
Feed Conveyor #2	0%	0.000070	0.000023	0.0000065	kg/tonne	1		Reference 1: Conveyor Transfer Point (controlled)
	Hourly rate % below:	0.0315	0.0104	0.0029	kg/hr		12 months per year	
	100%	0.0088	0.00288	0.00081	g/s		average rate over 24h	<u> </u>
PRE-Dryer Volume S	Source	0.1560	0.0617	0.0112	g/s		In	cluding Truck Unloading at Ramp
				DR	YE	R		
	Reduction % below:	0.000070	0.000023	0.0000065	kg/tonne			Reference 1: Conveyor Transfer Point (controlled)

				DR	YE	R		
	Reduction % below:	0.000070	0.000023	0.0000065	kg/tonne			Reference 1: Conveyor Transfer Point (controlled)
Addition of 2 conveyors	0%	0.000070	0.000023	0.0000065	kg/tonne	1		Converyors Chutes are conservatively assumed to process ALL material IN and
IN and OUT of the MIXER	Hourly rate % below:	0.000070	0.00023	0.00065	kg/tollile kg/hr	1	12 months per year	OUT of the MIXER as if Mixer was operated all year and processing all Plant 2
	100%	0.0156	0.0051	0.0014	g/s	1	average rate over 24h	material (for modeling simplicity).
	Reduction % below:	0.000070	0.000023	0.0000065	kg/tonne			
Transfer Conveyor #3	0%	0.000070	0.000023	0.0000065	kg/tonne	1		Reference 1: Conveyor Transfer Point (controlled)
	Hourly rate % below:	0.0280	0.0092	0.0026	kg/hr		12 months per year	
	100%	0.0078	0.00256	0.00072	g/s		average rate over 24h	
	Reduction % below:	0.001100	0.000370	0.000025	kg/tonne			
Screen	0%	0.001100	0.000370	0.000025	kg/tonne	1		Reference 1: Screening (controlled)
	Hourly rate % below:	0.4400	0.1480	0.0100	kg/hr	1	12 months per year	
	100%	0.1222	0.04111	0.00278	g/s	1	average rate over 24h	
	Reduction % below:	0.000070	0.000023	0.0000065	kg/tonne			
Lump Stacker Conveyor	0%					1		Reference 1: Conveyor Transfer Point (controlled)
		0.000070	0.000023	0.0000065	kg/tonne	4		
	Hourly rate % below:	0.0031	0.0010	0.0003	kg/hr	4	12 months per year	_
	11%	0.0009	0.00028	0.00008	g/s		average rate over 24h	
	Reduction % below: 0%	0.000070	0.000023	0.0000065	kg/tonne	ļ		
Transfer Conveyor #4	0 70	0.000070	0.000023	0.0000065	kg/tonne	1		Reference 1: Conveyor Transfer Point (controlled)
	Hourly rate % below:	0.0249	0.0082	0.0023	kg/hr		12 months per year	
	89%	0.0069	0.00227	0.00064	g/s		average rate over 24h	
	Reduction % below:	0.000070	0.000023	0.0000065	kg/tonne			
Fines Stacker Conveyor	0%	0.000070	0.000023	0.0000065	kg/tonne	1		Reference 1: Conveyor Transfer Point (controlled)
	Hourly rate % below:	0.0249	0.0082	0.0023	kg/hr		12 months per year	
	89%	0.0069	0.00227	0.00064	g/s		average rate over 24h	
	Reduction % below:	0.000070	0.000023	0.0000065	kg/tonne			
Transfer Conveyor #5 (to Cone Crusher)	0%	0.000070	0.000023	0.0000065	kg/tonne	1		Reference 1: Conveyor Transfer Point (controlled)
	Hourly rate % below:	0.0028	0.0009	0.0003	kg/hr	4	12 months per year	
	10%	0.0008	0.00026	0.00007	g/s		average rate over 24h	
T ((Reduction % below:	0.000070	0.000023	0.0000065	kg/tonne			
Transfer Conveyor #6 (to Cone Crusher)	0 /0	0.000070	0.000023	0.0000065	kg/tonne	1		Reference 1: Conveyor Transfer Point (controlled)
(Hourly rate % below:	0.0028	0.0009	0.0003	kg/hr		12 months per year	
	10%	0.0008	0.00026	0.00007	g/s		average rate over 24h	

POST-Dryer Volume Source		0.2681	0.0920	0.0123	g/s	Including Truck Loading at Plant Exit				
	10%	0.0067	0.00300	0.00056	g/s		average rate over 24h			
Cone Crusher	Hourly rate % below:	0.0240	0.0108	0.0020	kg/hr		12 months per year			
	0%	0.000600	0.000270	0.0000500	kg/tonne	1		Reference 1: Tertiary Crushing (controlled)		
	Reduction % below:	0.000600	0.000270	0.0000500	kg/tonne					

(1) Source : U.S. EPA Fifth Edition, Volume I Chapter 11, section 11.19. 2, Crushed Stone Processing and Pulverized Mineral Processing, table 11.19-2-1 Wet suppression system is used to control dust emissions (moisture content of 0,55 % to 2,88 %).

Emissions from truck unloading activities at entrance	of Plant 2 with unprocesse	d product									
Equation used: EF = k * 0.0016 * (U/2.2)^1.3 * (M/2)^-1.4 TPM k= 1 M (moisture) %: U average wind speed (m/s):	PM10 k= 0.35	4.6	(kg/tons) PM2.5 k=0.053 m/s	Ref: 1		berg, email August 2014 v.climate.weatheroffice.ec.,	gc.ca/climate_normals				
TPM (kg/t) = PM10 (kg/t)= PM-2.5 (kg/t) =	0.000508227 0.00017788 2.69361E-05	kg/t kg/t kg/t									
1- U.S. EPA Fifth Edition, Volume I Chapter 13, Miscellaneous Sourc	es, section 13.2.4 Aggregate Han	dling and storage p	iles , equation (1)								
<u>Data:</u> Duration				8760	hours		24 h/day, All year				
Surface				1,000	m2		Surface corresponding approx. to the area of operation				
<u>Calculation:</u>											
MPT (kg/yr)	0.000508227	kg/T	Х	3,942,000	T/year	=	2003	kg/yr			
MPT (kg/h)	2,003	kg/yr	/	8,760	h/year	=	0.2	kg/h			
MPT (g/s)	0.2	kg/h	X	1,000	g/kg	/	3600	s/h	=	0.0635	g/s
MPT (g/m2/s)	0.0635	g/s	/	1,000	m2	=	6.35284E-05	g/m2/s			
PM-10 (kg/yr)	0.00017788	kg/T	Х	3,942,000	T/year	=	701	kg/yr			
PM-10 (kg/h)	701	kg/yr	/	8,760	h/year	=	0.1	kg/h			
PM-10 (g/s)	0.1	kg/h	Х	1,000	g/kg	/	3600	s/h	=	0.0222	g/s
PM-10 (g/m2/s)	0.0222	g/s	/	1,000	m2	=	2.2235E-05	g/m2/s			
204.25 (1. / .)	2 002045 05	. /-		2 2 4 2 2 2 2	/		100				
PM-2.5 (kg/yr)	2.69361E-05	kg/T	X	3,942,000	T/year	=	106	kg/yr			
PM-2.5 (kg/h)	106	kg/yr	/	8,760	h/year	=	0.0	kg/h			
PM-2.5 (g/s)	0.0	kg/h	Х	1,000	g/kg	/	3600	s/h	=	0.0034	g/s
PM-2.5 (g/m2/s)	0.0034	g/s	/	1,000	m2	=	3.36701E-06	g/m2/s			
Emissions from truck loading activities leaving Plant 2 <u>Equation used:</u>	with processed product										
EF = k * 0.0016 * (U/2.2)^1.3 * (M/2)^-1.4			(kg/tons)	Ref: 1							
TPM k= 1	PM10 k= 0.35		PM2.5 k=0.053								
M (moisture) %:	6				(Plant 2 output i	moisture target)					
U average wind speed (m/s):		4.6	m/s		Ref: http://www	v.climate.weatheroffice.ec.	gc.ca/climate_normals				
TPM $(kg/t) =$	0.000896574	kg/t									
PM10 (kg/t)=	0.000313801	kg/t									
PM-2.5 (kg/t) =	4.75184E-05	kg/t									
1- U.S. EPA Fifth Edition, Volume I Chapter 13, Miscellaneous Source			iles , equation (1)								
		0 0,									
<u>Data:</u>											
Duration				8760	hours		24 h/day, All year				
Surface				1,000	m2		Surface corresponding approx. to the area of operation				
<u>Calculation:</u>											
MPT (kg/yr)	0.000896574	kg/T	X	3,504,000	T/year	=	3142	kg/yr			
MPT (kg/h)	3,142	kg/yr	/	8,760	h/year	=	0.4	kg/h			
MPT (g/s)	0.4	kg/h	Х	1,000	g/kg	/	3600	s/h	=	0.0996	g/s
MPT (g/m2/s)	0.0996	g/s	/	1,000	m2	=	9.96193E-05	g/m2/s			
PM-10 (kg/yr)	0.000313801	kg/T	Х	3,504,000	T/year	=	1100	kg/yr			
PM-10 (kg/h)	1,100	kg/yr	/	8,760	h/year	=	0.1	kg/h			
PM-10 (g/s)	0.1	kg/h	X	1,000	g/kg	/	3600	s/h	=	0.0349	g/s
PM-10 (g/m2/s)	0.0349	g/s	/	1,000	m2	=	3.48667E-05	g/m2/s			
DM 3.5 (log/sm)	4.754045.05	l., /~	v	2.504.000	Τ,		407				
PM-2.5 (kg/yr)	4.75184E-05	kg/T	X	3,504,000	T/year	=	167	kg/yr			
PM-2.5 (kg/h)	167	kg/yr	/	8,760	h/year	=	0.0	kg/h			
PM-2.5 (g/s)	0.0	kg/h	X	1,000	g/kg	/	3600	s/h	=	0.0053	g/s
PM-2.5 (g/m2/s)	0.0053	g/s	/	1,000	m2	=	5.27982E-06	g/m2/s			

Emission Estimations for Dryer/Baghouse at Plant 2

250 metric tons/h

		short tons/year	
	#2 Fuel Oil	BagHouse	Total Exhaust
MPT	6.00	9.00	15.00
PM10		4.50	4.50
PM2.5		1.35	1.35
NOx	72.00	0.00	72.00
SO2	42.60	0.00	42.60
CO	15.00	0.00	15.00
HC**	0.76	0.00	0.76

450 metric tons/h

		short tons/year	
	#2 Fuel Oil	BagHouse	Total Exhaust
MPT	10.20	11.52	21.72
PM10		5.76	5.76
PM2.5		1.73	1.73
NOx	122.40	0.00	122.40
SO2	72.42	0.00	72.42
CO	25.50	0.00	25.50
HC	1.29	0.00	1.29

Firing rate at 250 tons/h
Firing rate at 450 tons/h
Baghouse Vent at 250 tons/h
Baghouse Vent at 450 tons/h

100 MMBTU/h
170 MMBTU/h
50000 CFM
64000 CFM

^{**} http://www3.epa.gov/ttn/chief/ap42/ch01/final/c01s03.pdf -Table 1.3-3.

tric tons/l

		230	metric tons, n
		metric tons/year	
	#2 Fuel Oil	BagHouse	Total Exhaust
MPT	5.44	8.16	13.61
PM10*	5.44	4.08	4.08
PM2.5*	5.44	1.22	1.22
NOx	65.32	0.00	65.32
SO2	38.65	0.00	38.65
CO	13.61	0.00	13.61
HC	0.69	0.00	0.69

		450	metric tons/h	
		metric tons/yea	r	Dryer
	#2 Fuel Oil	BagHouse	Total Exhaust	(g/s)
MPT	9.25	10.45	19.70	0.6335
PM10*	9.25	5.23	14.48	0.4655
PM2.5*	9.25	1.57	10.82	0.3479
NOx	111.04	0.00	111.04	3.5699
SO2	0.985	0.00	0.99	0.0317
СО	23.13	0.00	23.13	0.7437
HC	1.17	0.00	1.17	0.0375

* All PM attributed to PM2.5 for modeling purposes

 Stack Height =
 15 m

 Gas Flow Generator =
 3567 CFM

 Gas Flow Dryer =
 64000 CFM

 Temperature Outlet Gen =
 709 K

 Temperature Outlet Dryer =
 373 K

Ajustments for sulfur content in fuel oil

Concentration used as reference = 1000 ppm

Sulfur in diesel fuel on-site = 15 ppm

Ratio of original EF to consider = 0.015

1 short ton 360 days/year 24 h/day 3600 seconds/h 1000000 g/metric ton 0.90718474 metric ton

^{*} Based on Emission Estimations sheet provided by used equipment supplier "Worldwide Recycling Equipment Sales, LLC" (Estimations for 250 metric tons/h and 450 metric tons/h)

Emissions from conveyors and various transfer points equipment at FN Quarry

<u>Data</u> Capacity INPUT to FN Quarry

T to FN Quarry 100 000 tonnes/yr 500.00 tonnes/day

500.00 tonnes/day 21 tonnes/hr

Days in operation per year = 200 days

Des	cription	Emission rate TPM	Emission rate PM 10	Emission rate PM 2.5	Units	References	Period/ frequency	Notes			
	Reduction % below:	0.000600	0.000270	0.0000500	kg/tonne			_			
Crusher		0.000600	0.000270	0.0000500	kg/tonne	1		Reference 1: Tertiary Crushing (controlled)			
	Hourly rate % below:	0.0138	0.0062	0.0011	kg/hr		7 months per year				
	110%	0.0038	0.00172	0.00032	g/s		average rate over 24h				
	Reduction % below: 0%	0.000070	0.000023	0.0000065	kg/tonne						
Feed Conveyor #1	0%	0.000070	0.000023	0.0000065	kg/tonne	1		Reference 1: Conveyor Transfer Point (controlled)			
	Hourly rate % below:	0.0016	0.0005	0.0001	kg/hr		7 months per year				
	110%	0.0004	0.00015	0.00004	g/s		average rate over 24h				
	Reduction % below:	0.000070	0.000023	0.0000065	kg/tonne						
Feed Conveyor #2	0%	0.000070	0.000023	0.0000065	kg/tonne	1		Reference 1: Conveyor Transfer Point (controlled)			
	Hourly rate % below:	0.0016	0.0005	0.0001	kg/hr		7 months per year				
	110%	0.0004	0.00015	0.00004	g/s		average rate over 24h				
	Reduction % below:	0.001100	0.000370	0.000025	kg/tonne						
Screen	0%	0.001100	0.000370	0.000025	kg/tonne	1		Reference 1: Screening (controlled)			
	Hourly rate % below:	0.0252	0.0085	0.0006	kg/hr		7 months per year				
	110%	0.0070	0.00236	0.00016	g/s		average rate over 24h				
	Reduction % below:	0.000070	0.000023	0.0000065	kg/tonne						
Transfer Conveyor #4	0%	0.000070	0.000023	0.0000065	kg/tonne	1		Reference 1: Conveyor Transfer Point (controlled)			
	Hourly rate % below:	0.0015	0.0005	0.0001	kg/hr		7 months per year				
	100%	0.0004	0.00013	0.00004	g/s		average rate over 24h	1			
	Reduction % below:	0.000070	0.000023	0.0000065	kg/tonne						
Fines Stacker Conveyor	0%	0.000070	0.000023	0.0000065	kg/tonne	1		Reference 1: Conveyor Transfer Point (controlled)			
	Hourly rate % below:	0.0015	0.0005	0.0001	kg/hr		7 months per year				
	100%	0.0004	0.00013	0.00004	g/s		average rate over 24h				
	Reduction % below:	0.000070	0.000023	0.0000065	kg/tonne						
Transfer Conveyor #5 (back to Jaw Crusher)	0%	0.000070	0.000023	0.0000065	kg/tonne	1		Reference 1: Conveyor Transfer Point (controlled)			
(basic to saw orderior)	Hourly rate % below:	0.0001	0.0000	0.0000	kg/hr		7 months per year				
	10%	0.0000	0.00001	0.00000	g/s		average rate over 24h				
	Reduction % below:	0.000070	0.000023	0.0000065	kg/tonne						
Transfer Conveyor #6 (back to Jaw Crusher)	0%	0.000070	0.000023	0.0000065	kg/tonne	1		Reference 1: Conveyor Transfer Point (controlled)			
()	Hourly rate % below:	0.0001	0.0000	0.0000	kg/hr		7 months per year				
	10%	0.0000	0.00001	0.00000	g/s		average rate over 24h				
FN Quarry Volume So	ource	0.0185	0.0067	0.0010	g/s over 200 days						

(1) Source: U.S. EPA Fifth Edition, Volume I Chapter 11, section 11.19. 2, Crushed Stone Processing and Pulverized Mineral Processing, table 11.19-2-1 Wet suppression system is used to control dust emissions (moisture content of 0,55 % to 2,88 %).

Emissions from 10-wheelers unloading of uncrushed ore at entrance of the plant, and from 10-wheelers loading activities of crushed ore when leaving the FN Quarry

Equation used: $EF = k*0.0016*(U/2.2)^1.3*(M/2)^-1.4$ TPM $k=1$ M (moisture) %: U average wind speed (m/s): $TPM (kg/t) = PM10 (kg/t) = PM-2.5 (kg/t) = 1-U.S. EPA Fifth Edition, Volume I Chapter 13, Miscellaneous Sourier PM-2.5 (kg/t) = 1-U.S. EPA Fifth Edition, Volume I Chapter 13, Miscellaneous Sourier PM-2.5 (kg/t) = 1-U.S. EPA Fifth Edition, Volume I Chapter 13, Miscellaneous Sourier PM-2.5 (kg/t) = 1-U.S. EPA Fifth Edition, Volume I Chapter 13, Miscellaneous Sourier PM-2.5 (kg/t) = 1-U.S. EPA Fifth Edition, Volume I Chapter 13, Miscellaneous Sourier PM-2.5 (kg/t) = 1-U.S. EPA Fifth Edition, Volume I Chapter 13, Miscellaneous Sourier PM-2.5 (kg/t) = 1-U.S. EPA Fifth Edition, Volume I Chapter 13, Miscellaneous Sourier PM-2.5 (kg/t) = 1-U.S. EPA Fifth Edition, Volume I Chapter 13, Miscellaneous Sourier PM-2.5 (kg/t) = 1-U.S. EPA Fifth Edition, Volume I Chapter 13, Miscellaneous Sourier PM-2.5 (kg/t) = 1-U.S. EPA Fifth Edition, Volume I Chapter 13, Miscellaneous Sourier PM-2.5 (kg/t) = 1-U.S. EPA Fifth Edition, Volume I Chapter 13, Miscellaneous Sourier PM-2.5 (kg/t) = 1-U.S. EPA Fifth Edition, Volume I Chapter 13, Miscellaneous Sourier PM-2.5 (kg/t) = 1-U.S. EPA Fifth Edition, Volume I Chapter 13, Miscellaneous Sourier PM-2.5 (kg/t) = 1-U.S. EPA Fifth Edition, Volume I Chapter 13, Miscellaneous Sourier PM-2.5 (kg/t) = 1-U.S. EPA Fifth Edition, Volume I Chapter 13, Miscellaneous Sourier PM-2.5 (kg/t) = 1-U.S. EPA Fifth Edition PM-2.5 (kg/t) = 1-U$	PM10 k= 0.35 9 0.000508227 0.00017788 2.69361E-05 roes, section 13.2.4 Aggregate	4.6 kg/t kg/t kg/t Handling and storag	(kg/tons) PM2.5 k=0.053 m/s	Ref: 1	Ref: http://www.ci	imate.weatheroffice.ec.	gc.ca/climate_normals				
<u>Data:</u> Duration Surface				4 800 1 000	hours m2		24 h/day, 7 months/year Surface corresponding approx. to the area of operation				
Calculation: MPT (kg/yr) MPT (kg/h) MPT (g/s) MPT (g/s)	0.000508227 102 0.0 0.0059	kg/T kg/yr kg/h g/s	x / x /	200 000 4 800 1 000 1 000	T/year h/year g/kg m2	= = / =	102 0.0 3600 5.88226E-06	kg/yr kg/h s/h g /m2/s	=	0.0059	g/s
PM-10 (kg/yr) PM-10 (kg/h) PM-10 (g/s) PM-10 (g/m2/s)	0.00017788 36 0.0 0.0021	kg/T kg/yr kg/h g/s	x / x /	200 000 4 800 1 000 1 000	T/year h/year g/kg m2	= = / =	36 0.0 3600 2.05879E-06	kg/yr kg/h s/h g /m2/s	=	0.0021	g/s
PM-2.5 (kg/yr) PM-2.5 (kg/h) PM-2.5 (g/s) PM-2.5 (g/m2/s)	2.69361E-05 5 0.0 0.0003	kg/T kg/yr kg/h g/s	x / x /	200 000 4 800 1 000 1 000	T/year h/year g/kg m2	= = / =	5 0.0 3600 3.1176E-07	kg/yr kg/h s/h g/m2/s	=	0.0003	g/s

Drilling emissions

References:

1- U.S. EPA AP-42 Fifth Edition, Volume I Chapter 11, Mineral Products Industry, section 11.9: Western Surface Coal Mining, tableau 11.9-2.

2- U.S. EPA AP-42 Fifth Edition, Volume I Chapter 11, Mineral Products Industry, section 11.9: Western Surface Coal Mining, tableau 11.9-4.

3- Mojave Desert Air Quality Management District, Antelope Valley Air Pollution Control District, Emissions Inventory Guidance, Mineral Handling Handbook and Processing Industries, 10 avril 2000

^{**} Factors based on water drilling

<u>Data</u>	Production data of year 2015										
	Ore		Overburden		Waste		Total				
Timmins 3N	384,450	tons/yr	210,600	tons/yr	2,577,500	tons/yr	3,172,550	tons/yr	Overburden		
Fleming 7N	1,109,110	tons/yr	45,900	tons/yr	2,227,850	tons/yr	3,382,860	tons/yr	365 days/yr		
HOWSE	3,076,923	tons/yr	6,777,656	tons/yr	3,968,498	tons/yr	13,823,077	tons/yr	Overburden		
*C 11 & 12 do not have refere	*C 11 & 12 do not have reference because the related tab was not usefull and was deleted.										

Waste days/yr

hr/day

365

24

A = horizontal area (m^2), for blasting at depth ≤ 21 m, by explosion

Surface 7,563 m2 Surface corresponding approx. to the area affected by a blast, considering 250 holes drilled (Ref: Email Jeff Cassoff, March 20 2012)

Tonnes of material / hole 1,920 tonnes/hole drilled Based on 2013 tonnes blasted/ # holes ratio (Mining Plan)

Number of Holes Drilled	Ore		Overburden		Waste		Total			
Timmins 3N	201	holes	110	holes	1,343	holes	1,654	holes		
Fleming 7N	578	holes	24	holes	1,161	holes	1,763	holes		
HOWSE	1,603	holes	3,531	holes	2,067	holes	7,201	holes		<u></u>
HOWSE with 50% blasted	801.50	holes	1,766	holes	1,034	holes	3,601	holes	50	% blasted
(because of softer material)								HOWSE OB schedule =	150	days/year
							HOW	SE Ore+Waste schedule =	200	days/year

Calculations

Description		Variables	Emission rate TPM	Emission rate PM 10	Emission rate PM 2.5	Units	References	period/ frequency	Notes
Timmins 3N - Hole drilling	А	30.25	0.59	0.31	0.31	kg/hole	2, 3	24h/24h - 12 months	
(All)	nt	1654	976	513	513	kg/yr			
			0.031	0.016	0.016	g/s			12 months per year
			4.09E-06	2.15E-06	2.15E-06	g/m2/s			
Flemming 7N- Hole drilling	А	30.25	0.59	0.31	0.31	kg/hole	2, 3	24h/24h - 12 months	
(All)	nt	1763	1,040	547	547	kg/yr			
			0.033	0.017	0.017	g/s			12 months per year
			4.36E-06	2.29E-06	2.29E-06	g/m2/s			
HOWSE - OB only	A	30.25	0.59	0.31	0.31	kg/hole	2, 3	24h/24h - 5 months	Only 50% of material blasted
Hole drilling (Softer material =	nt	1766	1,042	547	547	kg/yr			
only 50% blasted)			0.080	0.042	0.042	g/s over 150 days			150 days per year (5 months per year)
			1.06E-05	5.58E-06	5.58E-06	g/m2/s			
HOWSE - Ore+Waste only	A	30.25	0.59	0.31	0.31	kg/hole	2, 3	24h/24h - 7 months	Only 50% of material blasted
Hole drilling (Softer material =	nt	1835	1,083	569	569	kg/yr			
only 50% blasted)			0.053	0.022	0.022				200 days per year
			0.063	0.033	0.033	g/s over 200 days			(7 months per year)
			8.28E-06	4.35E-06	4.35E-06	g/m2/s			

0521500 April 2014

Blasting emissions

Equation used:

1- U.S. EPA AP-42 Fifth Edition, Volume I Chapter 11, Mineral Products Industry, section 11.9: Western Surface Coal Mining, tableau 11.9-2.

A = horizontal area (m^2), for blasting at depth ≤ 21 m, by explosion

Surface 7,563 m2 Surface corresponding approx. to the area affected by a blast

Ref: Mining Plan 2013

Ref: Email Jeff Cassoff, March 20 2012

Lenght and width of blast area 87 m Burden 8 m Spacing 8 m

Density 3 tonnes/m3 Bench Height 10 m

Number of holes in each direction 12 holes Nb drilled holes/blast 144 Tonnes/ blast 226,875 tonnes

	F7N	HOWSE
Tonnes from pit per month	281,905	2,102,260
Percentage to be blasted	100%	50%
Tonnes to be blasted per month	281,905	1,051,130
Number of blasts per month	1.24	4.63

Volume source parameters

Equivalent diameter of area =

98.12683

Release Height = Initial Sigma-y = 100 m (from equivalent diameter of blasted zone)

Initial Sigma-z =

Ref: Alpha Coal Mine Project Air Quality Assessment - Supplementary Report, URS, 2011

(http://gvkhancockcoal.com/documents/Publications/EIS/ACPSEIS2011/Volume2/Volume%202%20Appendix%20%20P%20Air%20Quality%20Issue%203%20Final.pdf)

Modeling parameter

NO2/NOx ratio used for modeling of blasting emissions was chosen as 0.5 instead of the 0.2 used for all diesel engines for a conservative and acceptable value.

Ref: Additional Clarification Regarding Application of Appendix W ModelingGuidance for the 1-hour NO2, National Ambient Air Quality Standard, USEPA, 2011

(http://www.epa.gov/scram001/guidance/clarification/Additional_Clarifications_AppendixW_Hourly-NO2-NAAQS_FINAL_03-01-2011.pdf)

Calculations

Emission rate TPM	Emission rate PM 10			References	Comments	
TPM = 0,00022 x (Area)^1,5	PM10 = TPM x 0.52	PM2.5 = TPM x 0.03				
144.68	75.24	4.341	kg/explosion	1		
40.19	20.90	1.206	g/s		over 1 hour	
5.31E-03	2.76E-03	1.59E-04	g/s/m2		Divided by blasting surface	

Explosives - emission rates calculation

Equation used:

1- U.S. EPA AP-42 Fifth Edition, Volume I Chapter 13, section 13.3: Explosive detonation

Data

0.15 kg/tonne ore and waste blasted Explosive ut. rate:

Ref: Based on weekly ... rate- Andrew Garrity December 16th, 2014)

Tonnes/ blast

226,875 tonnes Surface 7,563 m2

Surface corresponding approx. to the area affected by a blast

Ref: Email Jeff Cassoff, March 20 2012

Ref: AP42-C13S03 Table 13.3-1

Calculations

Explosive ut. Rate (kg/blast):

34,031 kg (kg of gas/ton of explosive)

34.000000

Apex Gold 2171 (listed in AP-42 as ANFO) SO2

1 000000 NO_{x} 8.000000 HC 0.000000

kg emitted / blast	Emission rates (g/s)	Emission rates (g/m2/s
1157.1	321.4063	4.25E-02
34.0	9.4531	1.25E-03
272.3	75.6250	1.00E-02
0.0	0.0000	0.00E+00

* rates calculated over an hour

Emission rate (kg emitted / blast)= Emission rates (g/s)=

Emission rate (kg of gas/ton of explosive) *Explosive rate (kg/blast)/1000 Emission rate (kg emitted / blast)*1000/3600

Emission rates (g/s)/surface (m2)

Example of CO

Emission rates (g/m2/s)=

Emission rate (kg emitted / blast)= 34.000000 34031.25 Emission rates (g/s)= 1157.0625 1000 Emission rates (g/m2/s)= 321.40625 7,563

1157.06 1000 3600 321.41 4.25E-02

Réf: http://www.climate.weatheroffice.ec.gc.ca/climate_normals - Schefferville (1971-2000)

	0	0	0	0.015333	0.224599	0.452522	0.387097	0.405796	0.318613	0.188595	0.039633	0
		Months Months										
	1	2	3	4	5	6	7	8	9	10	11	12
Days in the month	31	28.25	31	30	31	30	31	31	30	31	30	31
Days with Snow Depth >= 1 cm	31	28.25	31	30	21.7	1.1	0	0.09	0.74	17.4	28.5	31
Days with Snow Depth >= 5 cm	31	28.25	31	29	16.8	0.7	0	0.05	0.13	11.3	25.9	31
Days with Precipitation >= 0.2 mm	17.1	14.3	16.4	16.2	15.8	16.1	19	18.4	20.4	21.8	21.3	19
Days with Rainfall >= 0.2 mm	0.3	0.3	1	2.9	8.6	14.7	19	18.4	17.2	7.3	1.8	0.64
Days with Snowfall >= 0.2 cm	17.4	14.3	16.6	14.6	10.3	3.4	0.17	0.33	6.4	19	21.3	19.2
Days with Snow Depth >= 1 cm												
+	31.0	28.3	31.0	30.0	26.4	16.6	19.0	18.4	20.6	27.0	29.6	31.0
[1 - (Snow>1cm) / (Days in month)] * (Precipitation>0.2mm)												
Fraction of days without attenuation	0.0000	0.0000	0.0000	0.0000	0.1471	0.4463	0.3871	0.4053	0.3121	0.1302	0.0145	0.0000
Days with Snow Depth >= 5 cm												
+	31.0	28.3	31.0	29.5	24.0	16.4	19.0	18.4	20.4	25.2	28.8	31.0
[1 - (Snow>5cm) / (Days in month)] * (Precipitation>0.2mm) ***												
Fraction of days without attenuation	0.0000	0.0000	0.0000	0.0153	0.2246	0.4525	0.3871	0.4058	0.3186	0.1886	0.0396	0.0000

Ref: http://www.climate.weatheroffice.ec.gc.ca/climate_normals - Schefferville (1971-2000)

Example: In a month of 30 days, there is 12 days of snow cover > 5cm and 24 days with precipitations > 0.2mm. Assuming equal repartition of the days with precipitations > 0.2mm over all days of the month, there will be a fraction of 0.4 days (12/30) with snow cover, meaning a fraction of 0.6 days without snow cover, therefore 14.4 days (0.6x24) can be calculated as being days WITHOUT snow cover but WITH precipitations > 0.2mm. You can then add the number of days WITH snow cover to calculate the total number of days with either Snow cover > 5 cm OR precipitations > 0.2mm. This number of days with attenuation can then be projected yearly to calculate a monthly P value that can be applied independently to individual months which will fit into the correction equations for dust control of unpaved roads. This is ultimately used to calculate monthly variable emission factors as input into CALPUFF for unpaved roads emissions.

(Snow>5cm) + [1 - (Snow>5cm) / (Days in month)] * (Precipitation>0.2mm) = 12 + [1 - 12/30] * 24 = 26.4 days with attenuation Fraction of days of the month without attenuation = [(30 days within the month) - (26.4 days with attenuation)] / (30 days within the month) = 0.120

^{***} The "[1 - (Snow>5cm) / (Days in month)] * (Precipitation>0.2mm) " expression determines the monthly percentage of days with precipitations > 0.2 mm within the month, then assigns this percentage to the remaining days of the month which have no snow cover.

Calculations for NO2/NOx ratio

From guidance GD-PPD-019.1 of Newfoundland and Labrador:

Table 9.1

Emission Source	In-stack NO ₂ / NO _x ratio
Power Boilers	0.1
Compressors and Gas Turbines	0.6
Diesel Power Generating Units	0.2

Based on the PVMRM method, ratios are molar-based.

Considering emission factors are always given as "mass of NOx (expressed as NO2)", new mass based ratios must be calculated for NO2 and NO to pre-process emission factors of those two substances for CALPUFF input.

Molar masses

NO2 = 46.005 g/mol NO = 30.006 g/mol

1 g NOx (expressed as NO2) = 1 g NOx (expressed as NO2) / 46.005 g NO2/mol NOx 1 g NOx (expressed as NO2) = 0.021737 mol NOx

<u>Calculation example for Diesel Power Generating Units</u>

[NO2] = 0.2 x [NOx] = 0.2 x 0.021737 = 0.004347 mol NO2 [NO] = 0.8 x [NOx] = 0.8 x 0.021737 = 0.017389 mol NO

g NO2 = 0.004347354 mol NO2 x 46.005 g NO2/mol NO2 = 0.2 g NO2 / g NOx g NO = 0.017389414 mol NO x 30.006 g NO/mol NO = 0.52179 g NO / g NOx

Conversion table

NO2 / NOx ratio	g NO2/g NOx	g NO/g NOx
0.1	0.1	0.5870
0.2	0.2	0.5218
0.3	0.3	0.4566
0.4	0.4	0.3913
0.5	0.5	0.3261
0.6	0.6	0.2609
0.7	0.7	0.1957
0.8	0.8	0.1304
0.9	0.9	0.0652
0.05	0.05	0.6196
0.15	0.15	0.5544
0.25	0.25	0.4892

Emissions from the 2MW generator at HOWSE Plant

Generator 1935 ekW operating at Prime 75% Load

Data

Reference: Ingenius Construction Howse Plant Design Generator specifications

Generator power	1451 ekW
Fuel oil consumption	397 L/hr

0.0015%

Reference: email Rock Gagnon, March 14 2011

Reference: at 75% Prime

% of sulphur in oil Oil density 832 kg/m³

REF: Email François Saulnier Exxon Mobil, Jan 5th, 2011

IHV 42 780 kJ/kg Reference: Diesel Generator Technical data sheet - Caterpillar 275 ekW

Gas flow at stack 504 m3/min Stack height 3.35 m

0.450 m 505 °C Reference: Ingenius Construction Plant 2 Design Generator specifications

Diameter Temperature 778 K

Emission factor NO_X 7.100 g/kWh Emission factor CO 0.600 g/kWh Emission factor PM2.5/ PM10/ PMT 0.0600 g/kWh 0.4733 g/kWh Reference: TSMC PLANT 2-Permit information Reference: TSMC PLANT 2-Permit information Reference: TSMC PLANT 2-Permit information

Emission factor HC All particulates are considered < 1 um Reference: TSMC PLANT 2-Permit information & EPA420-R-05-015.pdf Reference: AP-42, Gasoline And Diesel Industrial Engines, tableau 3.3-1.

Calculations

Gas velocity	504 m3/min	X	60 min/hr	/	0.15904 m ²	/	3600 s/hr	=	52.82 m/s
Oil consumption	397 L/hr	Χ	832 kg/m ³	/	1000 l/m3			=	330.3 kg/hr
Emission rate SO ₂	330.3 kg/hr	Χ	0.0015%	Χ	2 kg SO ₂ /kg S	Χ	1000 g/kg	/	
Emission rate SO_2	3600 s/hr							=	0.0027525 g/s
Emission rate PM _{2.5}	1451 ekW		x		0.06 g/kWh	/	3600 s/hr	=	0.0241875 g/s
Emission rate NO _X	1451 ekW		Х		7.100 g/kWh	/	3600 s/hr	=	2.8622 g/s
Emission rate CO	1451 ekW		х		0.600 g/kWh	/	3600 s/hr	=	0.2419 g/s
Emission rate HC	1451 ekW		Х		0.473 g/kWh	/	3600 s/hr	=	0.1908 g/s

CALPUFF input - gas velocity (to correct speed that is too high with a more conservative assumption) CALPUFF input - Diameter (to correct speed that is too high with a more conservative assumption)

15 m/s

m calculation details: = real stack diameter*(real Gas velocity/calpuff input Gas velocity)^0.5

Emissions from the 2MW generator at Plant 2

Generator 1935 ekW operating at Prime 75% Load <u>Data</u>

Reference: Ingenius Construction Plant 2 Design Generator specifications

Generator power	1451 ekW

Fuel oil consumption 397 L/hr Reference: at 75% Prime

% of sulphur in oil 0.0015% Reference: email Rock Gagnon, March 14 2011

Oil density 832 kg/m³ REF: Email François Saulnier Exxon Mobil, Jan 5th, 2011

IHV 42 780 kJ/kg Reference: Diesel Generator Technical data sheet - Caterpillar 275 ekW

Gas flow at stack 504 m3/min Stack height 3.35 m

 Diameter
 0.450 m

 505 °C
 778 K

Reference: Ingenius Construction Plant 2 Design Generator specifications

0.600 g/kWh Reference: TSMC PLANT 2-Permit information
0.0600 g/kWh Reference: TSMC PLANT 2-Permit information
0.4733 g/kWh Reference: TSMC PLANT 2-Permit information & EPA420-R-05-015

Reference: TSMC PLANT 2-Permit information

Emission factor HC

All particulates are considered < 1 um

Reference: AP-42, Gasoline And Diesel Industrial Engines, tableau 3.3-1.

Calculations

Gas velocity	504 m3/min	Χ	60 min/hr	/	0.15904 m ²	/	3600 s/hr	=	52.82 m/s
Oil consumption	397 L/hr	Χ	832 kg/m ³	/	1000 l/m3			=	330.3 kg/hr
Emission rate SO ₂	330.3 kg/hr	Χ	0.0015%	Χ	2 kg SO₂/kg S	Χ	1000 g/kg	/	
Emission rate 30 ₂	3600 s/hr							=	0.0027525 g/s
Emission rate PM _{2.5}	1451 ekW		X		0.06 g/kWh	/	3600 s/hr	=	0.0241875 g/s
					oros g/KVVII	•	3333 3,		0.02 0. 0 g/0
Emission rate NO _X	1451 ekW		Χ		7.100 g/kWh	/	3600 s/hr	=	2.8622 g/s
					-				
Emission rate CO	1451 ekW		Χ		0.600 g/kWh	/	3600 s/hr	=	0.2419 g/s
Emission rate HC	1451 ekW		X		0.473 g/kWh	/	3600 s/hr	=	0.1908 g/s

CALPUFF input - gas velocity (to correct speed that is too high with a more conservative assumption)
CALPUFF input - Diameter (to correct speed that is too high with a more conservative assumption)

15 m/s

0.84 m calculation details: = real stack diameter*(real Gas velocity/calpuff input Gas velocity)^0.5

Emissions from generator (of RapidMixer 400)

Generator at 80% load Reference: FPT N67-TE2X Engine specs ----->

Reference: Email de TATA Steel (Loïc Didillion)

Fuel oil consumption 38.90 L/hr Reference: FPT N67-TE2X Engine specs
% of sulphur in oil 0.0015% Reference : email Rock Gagnon, March 14 2011

Oil density 832 kg/m³ REF: Email François Saulnier Exxon Mobil, Jan 5th, 2011

IHV 42,780 kJ/kg Reference: Specs sheets for generators CAT Prime 725 ekW and CUMMINS 800DQFAB 795 ekW

Generator power (@ 80% load) 146 ekW Reference: FPT N67-TE2X Engine specs

Gas flow at stack 28.6 m3/min Reference: Similarly sized CAT Generator 175eKW

Stack height 4 m Reference: Estimated Height from the RAPIDMIX400 Mixer pictures in which the generator is enclosed --->

Diameter 0.15 m Reference: Similarly sized CAT Generator 175eKW

Reference: Similarly sized CAT Generator 175eKW

Reference: Similarly sized CAT Generator 175eKW

Temperature 666 °C Reference: Similarly sized CAT Generator 175eKW 939 K

Emission factor NO_X
2.983 g/hp-hr
Reference: EPA Tier 3 engine
Emission factor CO
2.610 g/hp-hr
Reference: EPA Tier 3 engine
Reference: EPA Tier 3 engine
Reference: EPA Tier 3 engine

Emission factor HC 0.19886 g/hp-hr Reference: EPA Tier 3 engine & EPA420-R-05-015 Table 8.pdf

All particulates are considered < 1 um

Calculations

Data

Gas velocity Oil consumption	28.6 m3/min 38.90 L/hr	X X	60 min/hr 832 kg/m ³	/	0.018 m ² 1000 l/m3	1	3600 s/hr	= =	27.0 m/s 32.4 kg/hr
Emission rate PM _{2.5}	146 ekW	Х	1.341 hp/kW	Χ	0.14914 g/hp-hr	1	3600 s/hr	=	0.0081 g/s
Emission rate SO ₂	32.4 kg/hr	X	0.0015%	X	2 kg SO ₂ /kg S	Χ	1000 g/kg	1	
Emission rate 30 ₂	3600 s/hr							=	0.00026971 g/s
Emission rate NO _X	146 ekW	X	1.341 hp/kW	Х	2.98 g/hp-hr	1	3600 s/hr	=	0.1618 g/s
Emission rate CO	146 ekW	X	1.341 hp/kW	X	2.61 g/hp-hr	1	3600 s/hr	=	0.142 g/s
Emission rate HC	146 ekW	Χ	1.341 hp/kW	Χ	0.20 g/hp-hr	1	3600 s/hr	=	0.011 g/s

CALPUFF input - gas velocity (in order to simulate a horizontal stack)

CALPUFF input - Diameter (in order to simulate a horizontal stack)

0.1 m/s

2.46 m calculation details: = real stack diameter*(real Gas velocity/calpuff input Gas velocity)^0.5



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Emissions from generators (at Concrete Batch Plant)

Generators at 100% load		Reference: CAT Prime 157.5 kW Prime Diesel 60 Hz Engine family APKXL06.6PJ1
<u>Data</u>		
Generator power (@ 100% load)	157.5 kW	Reference: CAT Prime 157.5 kW Prime Diesel 60 Hz Engine family APKXL06.6PJ1
Fuel oil consumption	50.2 L/hr	Reference: 100% Load
% of sulphur in oil	0.0015%	Reference : email Rock Gagnon, March 14 2011
Oil density	832 kg/m ³	REF: Email François Saulnier Exxon Mobil, Jan 5th, 2011
IHV	42,780 kJ/kg	Reference: Diesel Generator Technical data sheet - Caterpillar 275 ekW
Gas flow at stack	28.6 m3/min	Reference: CAT Prime 157.5 kW Prime Diesel 60 Hz Engine family APKXL06.6PJ1
Stack height	4.6 m	Reference: email, Bruno Savard, December 14 2012
Diameter	0.153 m	Reference: Hewitt, drawing ME101402, revF
Temperature	666 °C 939 K	Reference: CAT Prime 157.5 kW Prime Diesel 60 Hz Engine family APKXL06.6PJ1
Emission factor NO _X	4.00 g/kW-hr	Reference: EPA Tier 3 engine
Emission factor CO	3.50 g/kW-hr	Reference: EPA Tier 3 engine
Emission factor PM2.5/ PM10/ PMT	0.2 g/kW-hr	Reference: EPA Tier 3 engine
Emission factor HC	0.267 g/kW-hr	Reference: EPA Tier 3 engine
All particulates are considered < 1 um		Reference: AP-42, Gasoline And Diesel Industrial Engines, tableau 3.3-1.

Calculations

Gas velocity	28.6 m3/min	Х	60 min/hr	1	0.0184 m ²	1	3600 s/hr	=	25.9 m/s
Oil consumption	50.2 L/hr	Χ	832 kg/m ³	/	1000 l/m3			=	41.8 kg/hr
Emission rate SO ₂	41.8 kg/hr	Χ	0.0015%	Χ	2 kg SO ₂ /kg S	Χ	1000 g/kg	1	
Emission rate 30 ₂	3600 s/hr							=	0.0003481 g/s
Emission rate PM _{2.5}	157.5 kW	Х	0.2 g/kW-hr	1	3600 s/hr	=	0.0087500 g/s		
Emission rate NO _X	157.5 kW	X	4.00 g/kW-hr	1	3600 s/hr	=	0.1750000 g/s		
Emission rate CO	157.5 kW	X	3.50 g/kW-hr	1	3600 s/hr	=	0.1531250 g/s		
Emission rate HC	157.5 kW	X	0.27 g/kW-hr	1	3600 s/hr	=	0.0116667 g/s		

Emissions from generators (First Nation Quarry)

Generators at 100% load Data

Fuel oil consumption (3 generators) % of sulphur in oil	80.3 L/hr 0.0015%	Reference: Diesel Generator Technical data sheet - Caterpillar 275 ekW - hyp:100% load Reference: email Rock Gagnon, March 14 2011
Oil density IHV Generator power (3 @ 100% load)	832 kg/m ³ 42,780 kJ/kg 275 ekW	REF: Email François Saulnier Exxon Mobil, Jan 5th, 2011 Reference: Diesel Generator Technical data sheet - Caterpillar 275 ekW Reference: Diesel Generator Technical data sheet - Caterpillar 275 ekW
Gas flow at stack Stack height	53.76 m3/min 2.75 m	Reference: Diesel Generator Technical data sheet - Caterpillar 275 ekW Reference: Hewitt, drawing ME403196 rev 0
Diameter Temperature	0.15 m 497 °C 770 K	(Visit on site Nov.25 2014, approximately 6 inches) Reference: Diesel Generator Technical data sheet - Caterpillar 275 ekW
Emission factor NO _X Emission factor CO Emission factor PM2.5/ PM10/ PMT Emission factor HC All particulates are considered < 1 um	3.71 g/hp-hr 0.23 g/hp-hr 0.03 g/hp-hr 0.07 g/hp-hr	Reference: Diesel Generator Technical data sheet - Caterpillar 275 ekW Reference: Diesel Generator Technical data sheet - Caterpillar 275 ekW Reference: Diesel Generator Tecnical data sheet - Caterpillar 275 ekW Reference: Diesel Generator Tecnical data sheet - Caterpillar 275 ekW Reference: AP-42, Gasoline And Diesel Industrial Engines, tableau 3.3-1.

Calculations

Gas velocity Oil consumption	54 m3/min 80.3 L/hr	X X	60 min/hr 832 kg/m³	/ /	0.0 m ² 1000 l/m3	1	3600 s/hr	=	50.7 m/s 66.8 kg/hr
Emission rate PM _{2.5}	275 ekW	Χ	1.341 hp/kW	X	0.03 g/hp-hr	1	3600 s/hr	=	0.003073 g/s
Emission rate SO ₂	66.8 kg/hr	Χ	0.0015%	X	2 kg SO ₂ /kg S	Χ	1000 g/kg	/	
Emission rate Co ₂	3600 s/hr							=	0.0005567 g/s
Emission rate NO _X	275 ekW	Χ	1.341 hp/kW	Χ	3.7 g/hp-hr	1	3600 s/hr	=	0.380043 g/s
Emission rate CO	275 ekW	Χ	1.341 hp/kW	Χ	0.23 g/hp-hr	1	3600 s/hr	=	0.02356 g/s
Emission rate HC	275 ekW	Χ	1.341 hp/kW	X	0.07 g/hp-hr	1	3600 s/hr	=	0.00717 g/s

CALPUFF input - gas velocity (to correct speed that is too high with a more conservative assumption)
CALPUFF input - Diameter (to correct speed that is too high with a more conservative assumption)

15 m/s

0.28 m calculation details: = real stack diameter*(real Gas velocity/calpuff input Gas velocity)^0.5

Emissions from generators (Near Workers' Camp)- GEN 1-2-3

Generators at 100% load Data

Fuel oil consumption (3 generators)	80.3 L/hr	Reference: Diesel Generator Technical data sheet - Caterpillar 275 ekW - hyp:100% load
% of sulphur in oil	0.0015%	Reference : email Rock Gagnon, March 14 2011
Oil density	832 kg/m ³	REF: Email François Saulnier Exxon Mobil, Jan 5th, 2011
IHV	42,780 kJ/kg	Reference: Diesel Generator Technical data sheet - Caterpillar 275 ekW
Generator power (3 @ 100% load)	275 ekW	Reference: Diesel Generator Technical data sheet - Caterpillar 275 ekW
Gas flow at stack	53.76 m3/min	Reference: Diesel Generator Technical data sheet - Caterpillar 275 ekW
Stack height	2.75 m	Reference: Hewitt, drawing ME403196 rev 0
Diameter	0.15 m	(Visit on site Nov.25 2014, approximately 6 inches)
Tomporatura	497 °C	Reference: Diesel Generator Technical data sheet - Caterpillar 275 ekW
Temperature	770 K	
Emission factor NO _X	3.71 g/hp-hr	Reference: Diesel Generator Technical data sheet - Caterpillar 275 ekW
Emission factor CO	0.23 g/hp-hr	Reference: Diesel Generator Technical data sheet - Caterpillar 275 ekW
Emission factor PM2.5/ PM10/ PMT	0.03 g/hp-hr	Reference: Diesel Generator Tecnical data sheet - Caterpillar 275 ekW
Emission factor HC	0.07 g/hp-hr	Reference: Diesel Generator Tecnical data sheet - Caterpillar 275 ekW
All particulates are considered < 1 um		Reference: AP-42, Gasoline And Diesel Industrial Engines, tableau 3.3-1.

Calculations

Gas velocity Oil consumption	54 m3/min 80.3 L/hr	X X	60 min/hr 832 kg/m ³	/ /	0.0 m ² 1000 l/m3	1	3600 s/hr	=	50.7 m/s 66.8 kg/hr
Emission rate PM _{2.5}	275 ekW	X	1.341 hp/kW	X	0.03 g/hp-hr	1	3600 s/hr	=	0.003073 g/s
Emission rate SO ₂	66.8 kg/hr	Χ	0.0015%	Χ	2 kg SO ₂ /kg S	Χ	1000 g/kg	1	
Emission rate 90g	3600 s/hr							=	0.0005567 g/s
Emission rate NO _X	275 ekW	Χ	1.341 hp/kW	X	3.7 g/hp-hr	1	3600 s/hr	=	0.380043 g/s
Emission rate CO	275 ekW	Χ	1.341 hp/kW	X	0.23 g/hp-hr	1	3600 s/hr	=	0.02356 g/s
Emission rate HC	275 ekW	Χ	1.341 hp/kW	X	0.07 g/hp-hr	1	3600 s/hr	=	0.00717 g/s

CALPUFF input - gas velocity (to correct speed that is too high with a more conservative assumption)

15 m/s

CALPUFF input - Diameter (to correct speed that is too high with a more conservative assumption)

0.28 m calculation details: = real stack diameter*(real Gas velocity/calpuff input Gas velocity)^0.5

Emissions from generators (near Worker's Camp) - GENCP4

Gen4

Generator 1000 ekW operating at 100% Standby		Reference: Caterpillar C32 1000ekW - Specs
<u>Data</u>		Reference: Caterpillar C32 1000ekW - Performance data - DM9933
Generator power	1000 ekW	Reference: Caterpillar C32 1000ekW - Specs
Fuel oil consumption	272.1 L/hr	Reference: 100% Load
% of sulphur in oil	0.0015%	Reference : email Rock Gagnon, March 14 2011
Oil density	832 kg/m ³	REF: Email François Saulnier Exxon Mobil, Jan 5th, 2011
IHV	42,780 kJ/kg	Reference: Caterpillar C32 1000ekW - Specs
Gas flow at stack	228 m3/min	Reference: Caterpillar C32 1000ekW - Specs
Stack height	2.75 m	
Diameter	0.150 m	(Visit on site Nov.25 2014, approximately 6 inches, expecting similar diameter when this generator is installed)
Tomporatura	476 °C	Reference: Caterpillar C32 1000ekW - Specs
Temperature	749 K	

Emission factor NO_X 6611.13 g/hr Reference: Caterpillar C32 1000ekW - Performance data - DM9933 Emission factor CO 174.33 g/hr Reference: Caterpillar C32 1000ekW - Performance data - DM9933 24.138 g/hr Reference: Caterpillar C32 1000ekW - Performance data - DM9933 Emission factor PM2.5/ PM10/ PMT Emission factor HC 13.410 g/hr

All particulates are considered < 1 um

Hypothesis

Generator is working at 300kW, 24 hour per day

Calculations

Gas velocity Oil consumption	228 m3/min 272.1 L/hr	X X	60 min/hr 832 kg/m ³	<i> </i>	0.01767 m ² 1000 l/m3	1	3600 s/hr	=	215.41 m/s 226.4 kg/hr		
Emission rate SO ₂	226.4 kg/hr 3600 s/hr	X	0.0015%	X	2 kg SO₂/kg S	Χ	1000 g/kg	/ =	0.001887 g/s		
Emission rate PM _{2.5}					24.138 g/hr	1	3600 s/hr	=	0.0067050 g/s	NO2/NOx ration NO_2 (g/s)	o = 0.2 NO (g/s)
Emission rate NO _X					6611.13 g/hr	/	3600 s/hr	=	1.8364250 g/s	0.367	0.958
Emission rate CO					174.33 g/hr	/	3600 s/hr	=	0.0484250 g/s		
Emission rate HC					13.41 g/hr	/	3600 s/hr	=	0.0037250 g/s		

CALPUFF input - gas velocity (to correct speed that is too high with a more conservative assumption) CALPUFF input - Diameter (to correct speed that is too high with a more conservative assumption)

15 m/s

0.57 m calculation details: = real stack diameter*(real Gas velocity/calpuff input Gas velocity)^0.5

Appendix B Summary Table of Modelling Data

	0521500 Emission rate TOTAL Emission rate																						
	SOURCE	TYPE (1)	IDENTIFICATION	Lenght	Width	Height Grou	on (init. Lat.	Szo (init. vert. dim)*	Release height /		PM10	PM2.5	SO2	ission rate NOx	со	нс	TSP	PM10	PM2.5	SO2	NOx	со	нс
OVERBURDEN+WASTE	All operations Piles - wind erosion (OB + WST)			(m)	(m)	(m) (m) - 740		(m) 0	m 86	g/s 1.819 1.7826		g/s 0.136	g/s	g/s	g/s	g/s		g/s/m2 3.353E-06 3.305E-06	5.030E-07	g/s/m2	g/s/m2	g/s/m2	g/s/m2
F7N	Unload. O.B. + Unload WST	surface	F7_WST	surface totale	269676		-	-	-	0.0366	0.0128	0.0019					1.359E-07	4.756E-08	7.202E-09				
OVERBURDEN+WASTE Timmins 7	Piles - wind erosion	surface	T7_WST	surface totale	e: 79700	710	-			0.5132	0.2566	0.0385					6.44E-06	3.22E-06	4.83E-07				
OVERBURDEN+WASTE	Wind erosion + Unload O.B. Piles - wind erosion	surface	HOW_WST			- 660	-	0 -	20.0	1.9282 1.6624	0.8312	0.1388 0.1247				Wind erosion + Unload O. Piles - wind erosion		8.532E-07 7.673E-07					
HOWSE	Unload. O.B. (winter) Unload WST (summer) Excavation	Gundoo	HOW_W31	surface totale	1083297	- 640	-	2.3	- 5	0.2658 0.1167 0.068	0.0930 0.0409	0.0141				Unload. O.B. (winter) Unload WST (summer)	1.077E-07	8.587E-08 3.771E-08 1.32E-05	5.710E-09	9.72E-08	1.27E-04	1.07E-04	8.42E-06
Flemming 7N	Loading drilling Engines: Truck+Excav+Loader+Drill	surface	F7N	surface:		x. to the area affected b	-	-	-	0.055	0.019 0.0173	0.003 0.0173	0.000729	0.9541	0.7994	0.0632							
HOWSE	Excavation Loading drilling	surface	HOWSE	c surface:		- 550	-	2.3	5	0.1351 0.2658 0.0804	0.0473 0.0930	0.0072					6.99E-05	3.01E-05	1.42E-05	1.21E-07	1.61E-04	1.31E-04	1.06E-05
	Engines: Truck+Excav+Excav+Loader+Drill Blasting			Surface corres	sponding approx	x. to the area affected b		7.5	0		0.0432	0.0432 1.206	0.0009 9.453	1.2079 75.625	0.9861 321.406	0.0796 0.000							1
Flemming 7N	Distinct	Volume	VBLAST_F7N	020.2420	0000.222	-	-	-	-	40.400	00.000	1000	0.450	75.005	001.400	0.000							
HOWSE	Blasting	Volume	VBLAST_H	6085.199	6085.199	550	100	7.5		40.190	20.899	1.206	9.453	75.625	321.406	0.000							
Stockpiles near T4	Piles - wind erosion	surface	SP_T4	diameter:		700	-	0.0	15.6	0.03465	0.01732	0.002599					5.14E-06	2.57E-06	3.86E-07				
Otockpiics fical 14	Piles - wind erosion	Surface	3F_14	surface:	6738	710	-	0.0	11.2	0.01789	0.008944	0.001342					5.14E-06	2.57E-06	3.86E-07				#
Stockpiles North of Plant 1		surface	SP_NP1	diameter: surface:			-	-	-														
Stockpiles near Plant 2	Piles - wind erosion	surface	SP_P2	diameter: surface:	115.1 10408	715	-	0.0	19.4	0.05352	0.02676	0.004014					5.14E-06	2.57E-06	3.86E-07				1
	Piles - wind erosion					- 725		0.0	19.5	0.05438	0.02719	0.004078					5.14E-06	2.57E-06	3.86E-07				#
Stockpiles near T3 and F7		surface	SP_F7_1	diameter: surface:	116.0 10575		-	-	-														<u>‡</u>
Stockpiles near F7 (Eastern)	Piles - wind erosion	surface	SP_F7_2	diameter: surface:	86.8 5922	740 		0.0	14.6	0.03045	0.01523	0.002284					5.14E-06	2.57E-06	3.86E-07				
Stockpiles at Plant 1	Piles - wind erosion	surface	SP_P1	diameter:	77.9	683	-	0.0	13.1	0.02453	0.01227	0.00184					5.14E-06	2.57E-06	3.86E-07				
Otockpiios at Fiant 1	Piles - wind erosion	Surface	3F_F1	surface:	4771	682	-	0.0	13.8	0.20369	0.10184	0.01528					4.81E-05	2.40E-05	3.61E-06				<u></u>
Stockpile - Sinterfines		surface	SP_SIN	surface:	4237		-	-	-														1
Stockpile - Superfines	Piles - wind erosion	surface	SP_SUP	surface:	3319	682	-	0.0	8.7	1.20380	0.60190	0.09028					3.63E-04	1.81E-04	2.72E-05				
	Piles - wind erosion			ouridoo.	5010	690	-	0.0	18.1	0.04657	0.02328	0.00349					6.44E-06	3.22E-06	4.83E-07				+
Stockpile - HOWSE	Road : Dust + Truck Engine	surface	SP_HOW	surface:	7232	2	-	-	-						ET L. ODAMAGTE		5.0055.05	4 4505 05	4 0005 00	0.0005.00	1 1055 00	0.0405.00	0.7575.0
7 to O.B. + Waste	Road : Dust + Truck Engine	surface	RF7WST_xx	- 20	- 20	3 See inpi	it tile -	2.3	-	5					F7 to OB/WASTE F7 to OB/WASTE : Engine		5.095E-05 2.067E-07	2.067E-07	2.067E-07	6.660E-09 6.660E-09	4.135E-06	3.618E-06	2.757E-07
				-	-	-	-	-	-						F7 to OB/WASTE : PM		5.074E-05	1.432E-05	1.432E-06	0.000E+00	0.000E+00	0.000E+00	
7 to Plant 2	Road : Dust + Truck Engine	surface	RF7_xx	- 20	- 20	3 See inpr	ut file -	2.3	-	5					F7 to P2 F7 to P2 : Engine F7 to P2 : PM		2.485E-05 1.009E-07	7.088E-06 1.009E-07	7.995E-07 1.009E-07	3.249E-09 3.249E-09 0.000E+00	2.017E-06	1.765E-06 1.765E-06	
lant 2 to Rail loading	Road : Dust + Truck Engine			- 20	- 20	- - 0 3 See inpi	t file -	2.3	-	5					P2 to Rail		7.852E-05	2.239E-05		1.026E-08		5.576E-06	4.248E-07
		surface	RP2_xx		-	-	-	-	-						P2 to Rail : Engine P2 to Rail : PM					1.026E-08 0.000E+00			
IOWSE to O.B.	Road : Dust + Truck Engine	aurfa a a	RH_OB_xx	20	00 20	3 See inpi	t file -	2.3	-	5					Howse to OB Howse to OB : Engine		3.303E-04 1.436E-06	9.427E-05 1.436E-06	1.072E-05 1.436E-06	4.616E-08 4.616E-08	4.595E-05 4.595E-05	2.513E-05 2.513E-05	
		surface	KII_OB_XX	-	-	-	-	-	-						Howse to OB : PM		3.289E-04	9.283E-05	9.283E-06	0.000E+00	0.000E+00	0.000E+00	0.000E+00
overburden by First Nations	Road : Dust + Truck Engine	surface	RQUA_xx	- 20	- 20	3 See inpi	ut file -	2.3	-	5					OB to First Nations OB to First Nations : Engine		1.341E-05 1.408E-09	1.408E-09	1.408E-09	1.887E-09	4.762E-08 4.762E-08	1.483E-08	
IOWSE to Waste	Dood - Dust - Touch Foring		RFN_xx	-	- - 00 20		- -	-	-	-					OB to First Nations : PM Howse to WST		1.340E-05	3.784E-06	3.784E-07	0.000E+00 2.027E-08	0.000E+00	0.000E+00	
IOWSE to Waste	Road : Dust + Truck Engine	surface	RH_WST_xx		-	3 See inpi		2.3	-	5					Howse to WST : Engine Howse to WST : PM		6.305E-07 1.444E-04	6.305E-07	6.305E-07 4.077E-06	2.027E-08	2.018E-05	1.103E-05	
lowse Ore + Howse Waste	Road : Dust + Truck Engine			- 20	- 20	- 3 See inpo	t file -	2.3	-	5					Howse Ore + Howse Waste		2.58E-04	7.35E-05	8.36E-06	3.60E-08	3.58E-05	1.96E-05	
		surface -	RH_01 to 11	-	-	-	-	-	-						Howse Ore + Howse Waste : Engine Howse Ore + Howse Waste : PM		1.12E-06 2.56E-04	1.12E-06 7.24E-05	1.12E-06 7.24E-06	3.60E-08 0.00E+00	3.58E-05 0.00E+00	1.96E-05 0.00E+00	2.24E-06 0.00E+00
lowse Ore + 10wheelers	Road : Dust + Truck Engine			- 20	- 20	- 2 0	- t file	- 2.3	-	5					Howse Ore + 10 wheelers		1.26E-04	3.59E-05	4.03E-06	1.76E-08	1.57E-05	8.57E-06	9.82E-07
onse ore a fowneeders	TOOL - DUST THUCK ENGINE	surface	RH_12 to 25	- 20	- 20	3 See inpi	n ille -	- 2.3	-	0					Howse Ore + 10 wheelers : Engine		4.90E-07	4.90E-07	4.90E-07	1.76E-08	1.57E-05	8.57E-06	9.82E-07
				-	-	-	-	-	-						Howse Ore + 10 wheelers : PM		1.25E-04	3.54E-05	3.54E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ore from HOWSE to Mini Plant	Road : Dust + Truck Engine	a4:	RH_26 to 35	- 20	20	3 See inpi	ut file -	2.3	-	5					Howse Ore to MiniPlant Howse Ore to MiniPlant : Engine		1.12E-04 4.89E-07	3.21E-05 4.89E-07	3.65E-06 4.89E-07	1.57E-08 1.57E-08	1.56E-05 1.56E-05	8.56E-06 8.56E-06	9.78E-07 9.78E-07
		surface		-	-	-	-	-	-						Howse Ore to MiniPlant : PM Howse Ore to MiniPlant IN & OUT		1.12E-04 2.25E-04	3.16E-05 6.42E-05	3.16E-06 7.30E-06	0.00E+00 3.14E-08	0.00E+00 3.13E-05	0.00E+00 1.71E-05	0.00E+00 1.96E-06
rickups DSO3 (100%)	Road : Dust + Truck Engine		RPK_01 to 18	- 20	00 20	3 See inpi	ut file -	2.3	-	5					Pickups at 100% rate (DSO3) Pickups at 100% rate (DSO3): Engine		2.554E-05 1.576E-09	7.209E-06 1.576E-09	7.224E-07 1.576E-09	4.595E-11 4.595E-11	1.361E-08 1.361E-08	3.999E-07 3.999E-07	
			N1 N_01 10 10	-	-	-	-	-	-						Pickups at 100% rate (DSO3) : PM		2.553E-05		7.208E-07			0.000E+00	
		surface													Pickups + 10wheelers (for Winter calc.) Pickups at 100% rate (DSO3) : Engine		3.894E-05 1.576E-09	1.099E-05 1.576E-09	1.102E-06 1.576E-09	1.933E-09 4.595E-11	6.123E-08 1.361E-08	4.147E-07 3.999E-07	5.967E-09 1.953E-09
		-3.000		-	-	-	-	-	-						Pickups at 100% rate (DSO3) : PM		2.553E-05	7.208E-06	7.208E-07	0.000E+00		0.000E+00	
															Pickups + 10wheelers (for Summer calc.) Pickups + 10wheelers (Summer) : Engine		3.894E-05 2.984E-09	1.099E-05 2.984E-09	1.102E-06 2.984E-09	1.933E-09 1.933E-09	6.123E-08 6.123E-08	4.147E-07 4.147E-07	
Ore from DSO4 + 25% pickups	Road : Dust + Truck Engine	-		- 20	20	- 3 See inpi	- -	- 2.3	-	5					Pickups + 10wheelers (Summer) : PM Ore from DSO4 + 25% pickups		3.894E-05 1.54E-04	1.099E-05 4.40E-05	1.099E-06 4.98E-06	0.000E+00 2.07E-08	0.000E+00 2.06E-05	0.000E+00 1.13E-05	0.000E+00 1.29E-06
	rioda . Duat - Huck Eligilie	ı L		20	_{τυ} 20	3 See inpi	at ille -	2.3	1	υ	1				5.5 IIOIII 550 7 ± 2576 pickups		1.04E=04	T.40E-U0	÷.30⊑•00	2.01⊏-00	∠.∪∪⊏=UƏ	1.13E=U5	1.29E-06 1.29E-06

Modeling data - DSO Project

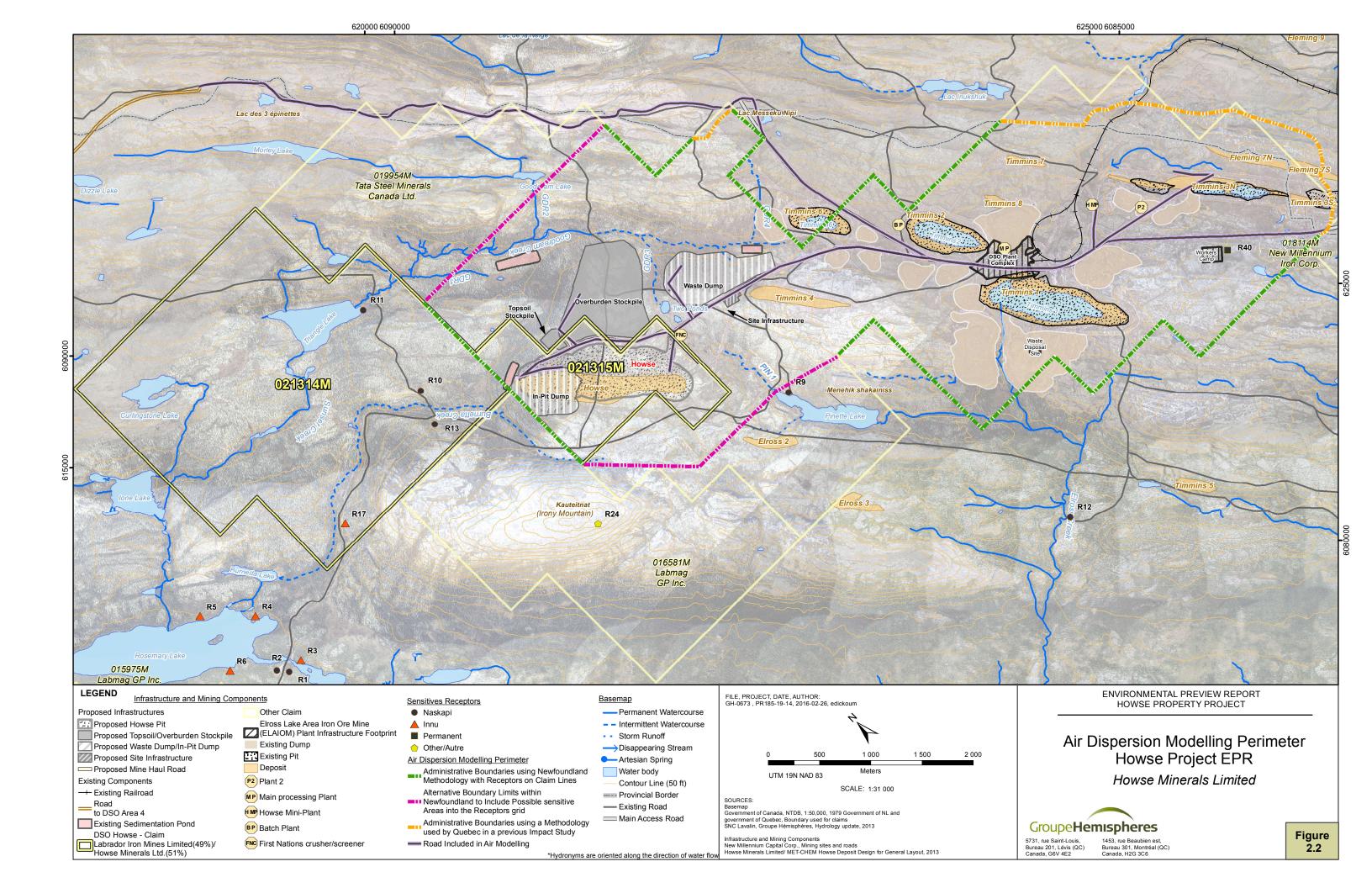
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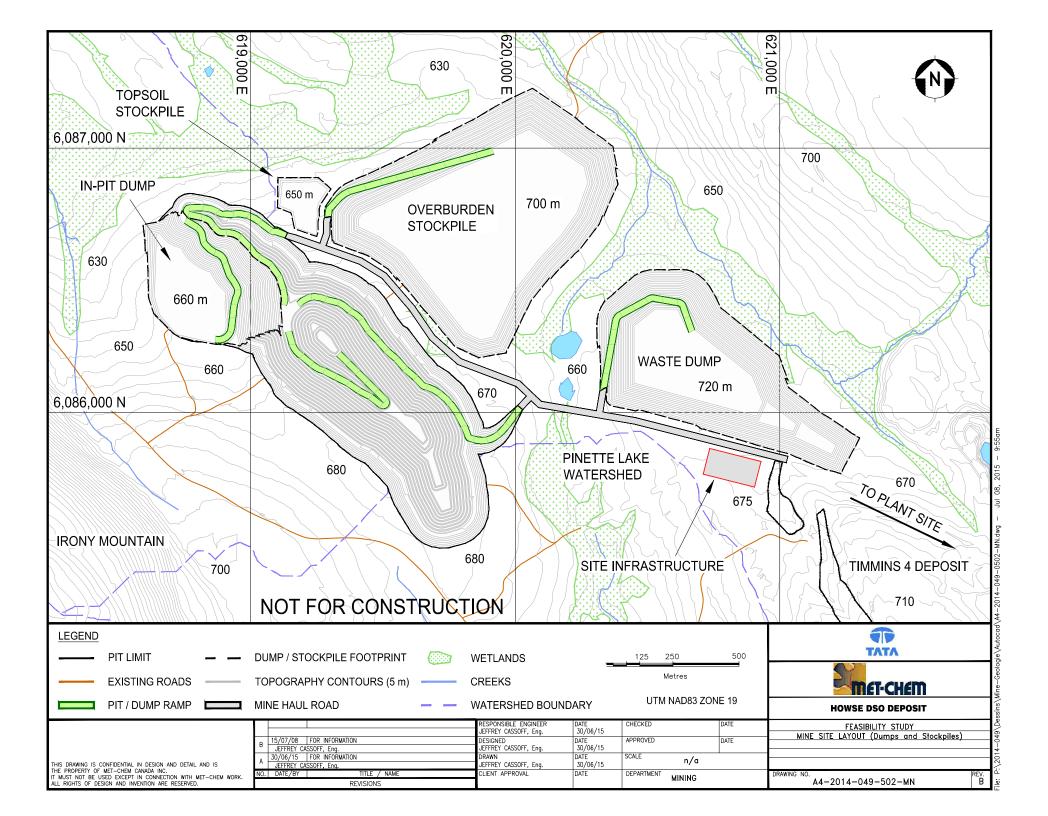
												Emission rate								TOTAL Emission rate						
	SOURCE	TYPE (1)	IDENTIFICATION	Lenght	Width	Height	Groud elevation	Syo (init. Lat. dim)	Szo (init. vert. dim)*	Release height / effective height **	TSP	PM10	PM2.5	SO2	NOx	со	нс	TSP	PM10	PM2.5	SO2	NOx	СО	нс		
				(m)	(m)	(m)	(m)	(m)	(m)	m	g/s	g/s	g/s	g/s	g/s	g/s	g/s	g/s/m2	g/s/m2	g/s/m2	g/s/m2	g/s/m2	g/s/m2	g/s/m2		
		0011000	R_KIV_01 to 45	-	-	-		-	-	-						Ore from DSO4 + 25% pickups : PM		1.54E-04	4.34E-05	4.34E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00		
				-	-	-		-	-	-																
Unload + Conveyor + Primary sizer + Chute	See "Pre_Post_MainPlant" sheet	volume	VMP_SZ1				698	0.9	3.0	10.5	0.312	0.120	0.021										<u> </u>			
Conveyor + Secondary sizer + Chute	See "Pre_Post_MainPlant" sheet	volume	VMP_SZ2				695	0.7	2.1	13.5	0.144	0.061	0.012													
Conveyor to Sinterfines stockpiles	See "Pre_Post_MainPlant" sheet	volume	VMP_SIN				685	0.3	0.5	28.7	0.001791	0.000588	0.000166													
Conveyor to Superfines stockpiles	See "Pre_Post_MainPlant" sheet	volume	VMP_SUP				685	0.3	0.5	18.3	0.000873	0.000287	0.000081													
Load/Unload during Rail Loading	See "Pre_Post_MainPlant" sheet + Engines: 4 loaders	volume	VMP_HDRL				685	0.9	1.8	4.9	1.941	0.709	0.146	0.00073	0.920	0.805	0.061									
Rail loading	See "Pre_Post_MainPlant" sheet	volume	VMP_RAIL				684	5.2	3.8	4.1	0.001944	0.000639	0.000181													
Pre Dryer-Plant 2	See "DSO3-P2_Plant" sheet	volume	VP2_PreDry				715	1.6	2.3	5	0.156	0.062	0.011													
Post Dryer-Plant 2	See "DSO3-P2_Plant" sheet	volume	VP2_PostDry				715	1.7	0.8	6.5	0.268	0.092	0.012													
Pre Dryer-Howse Mini Plant	See "Howse_Plant" Sheet	volume	VHOW_PreDry				690	1.6	2.3	5	0.222	0.088	0.016													
Post Dryer-Howse Mini Plant	See "Howse_Plant_New" sheet	volume	VHOW_PostDry				690	1.7	0.8	6.5	0.393	0.135	0.017													
VOLUME-Quarry Mini Plant	See "Howse_Plant_New" Sheet	volume	VQUA				670	1.6	2.3	5	0.018	0.007	0.001													
Dryer stack at Mini Plant	Stack- 7 month per year	Point	HOW_Dry			15	690	-			5.066E-01	3.624E-01	2.614E-01	2.324E-02	2.618E+00	5.455E-01	2.749E-02									
Dryer stack 2 at Mini Plant	Stack- 7 month per year	Point	HOW_Dry2			15	690	_	_	_	5.066E-01	3.624E-01	2.614E-01	2.324E-02	2.618E+00	5.455E-01	2.749E-02									
GEN CP 1 / 2 / 3	Stack - Yearly	point	GENCP 1-2-3	-	-	3.5	742	-	_	_	3.07E-03	3.07E-03	3.07E-03	5.57E-04	3.80E-01	2.36E-02	7.171E-03									
GEN CP 4	Stack - Yearly	point	GENCP_4	-	-	2.75	742	-	-	-	6.71E-03	6.71E-03	6.71E-03	1.89E-03	1.84E+00	4.84E-02	3.73E-03									
GEN 2MW Plant 2	Stack - Yearly	point	GENP2_1	-	-	3.35	715	-	-	-	2.42E-02	2.42E-02	2.42E-02	2.75E-03	2.86E+00	2.42E-01	1.91E-01									
GEN 2MW HOWSE Plant	Stack - Yearly	point	GENHOW_1	-	-	3.35	690	-	-	-	2.42E-02	2.42E-02	2.42E-02	2.75E-03	2.86E+00	2.42E-01	1.91E-01									
GEN Quarry Mini Plant	Stack - Yearly	point	GENQUA			3.5	670				3.07E-03	3.07E-03	3.07E-03	5.57E-04	3.80E-01	2.36E-02	7.171E-03									
GEN Batch Plant	Stack - Yearly	point	GENBATCH	-	-	4.6	695	-	-	-	8.75E-03	8.75E-03	8.75E-03	3.48E-04	1.75E-01	1.53E-01	1.17E-02									
GEN Mixer Plant 2	Stack - Yearly	point	GENMIX	-	_	4.0	715	_	_	-	8.09E-03	8.09E-03	8.09E-03	2.70E-04	1.62E-01	1.42E-01	1.08E-02									
Dryer Stack at Plant 2	Stack - Yearly	point	DRYER	-	-	15	715	-		-	6.33E-01	4.65E-01	3.48E-01	3.17E-02	3.57E+00	7.44E-01	3.75E-02									
Roof Vent at Main Plant	Stack - Summer - 5 months per year	point	MP_RF_S	-	-	46.3	679	D=2m	T=298 K	v=5.6m/s	7.079E-02	7.079E-02	7.079E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00						<u> </u>			
Wall Vent South of Main Plant	Stack - Winter - 7 months per year	point	MP_W_S_W	-	-	7.3	679	Deq=7.3m	T=298 K	v=0.1m/s	4.226E-02	4.226E-02	4.226E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00									
Wall Vent South of Main Plant	Stack - Summer - 5 months per year	point	MP_W_S_S	-	-	7.3	679	Deq=11.1n	T=298 K	v=0.1m/s	9.752E-02	9.752E-02	9.752E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00									
Wall Vent North of Main Plant	Stack - Winter - 7 months per year	point	MP_W_N_W	-		7.3	679	Deq=7.3m	T=298 K	v=0.1m/s	1.690E-02	1.690E-02	1.690E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00									
Wall Vent North of Main Plant	Stack - Summer - 5 months per year	point	MP_W_N_S	-		7.3	679	Deq=11.1n	T=298 K	v=0.1m/s	3.901E-02	3.901E-02	3.901E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00									
Vaccum Pumps vent at M.Plant	Stack - Yearly	point	MP_VAC	-	-	7.0	679	Deq=8.0m	T=298 K	v=0.1m/s	5.050E-02	5.050E-02	5.050E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00									
Bin vent at Rail Loading	Stack - Yearly	point	RL_BIN	-	-	35	684	Deq=5.2m	T=273 K	v=0.1m/s	7.867E-02	7.867E-02	7.867E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00									
Dryer Stack at Main Plant	Stack - Summer - 5 months per year	point	S1_W	-	-	65.7	679	-	-	-	1.53E+00	1.53E+00	1.53E+00	3.95E-02	4.47E+01	2.39E+00	1.08E+00									
Dryer Stack at Main Plant	Stack - Summer operations	point	S1_S	-	-	65.7	679	-	-	-	2.14E-01	2.14E-01	2.14E-01	1.07E-02	2.58E+01	1.12E+00	6.32E-01									

^{*} NOTE: Important when modelling mechanically generated emissions (ie: roads), Source AERMOD USER GUIDE, 2006, p 4-8 Exception for storage piles and dumps: These area sources have no initial vertical dispersion ---> Szo = 0

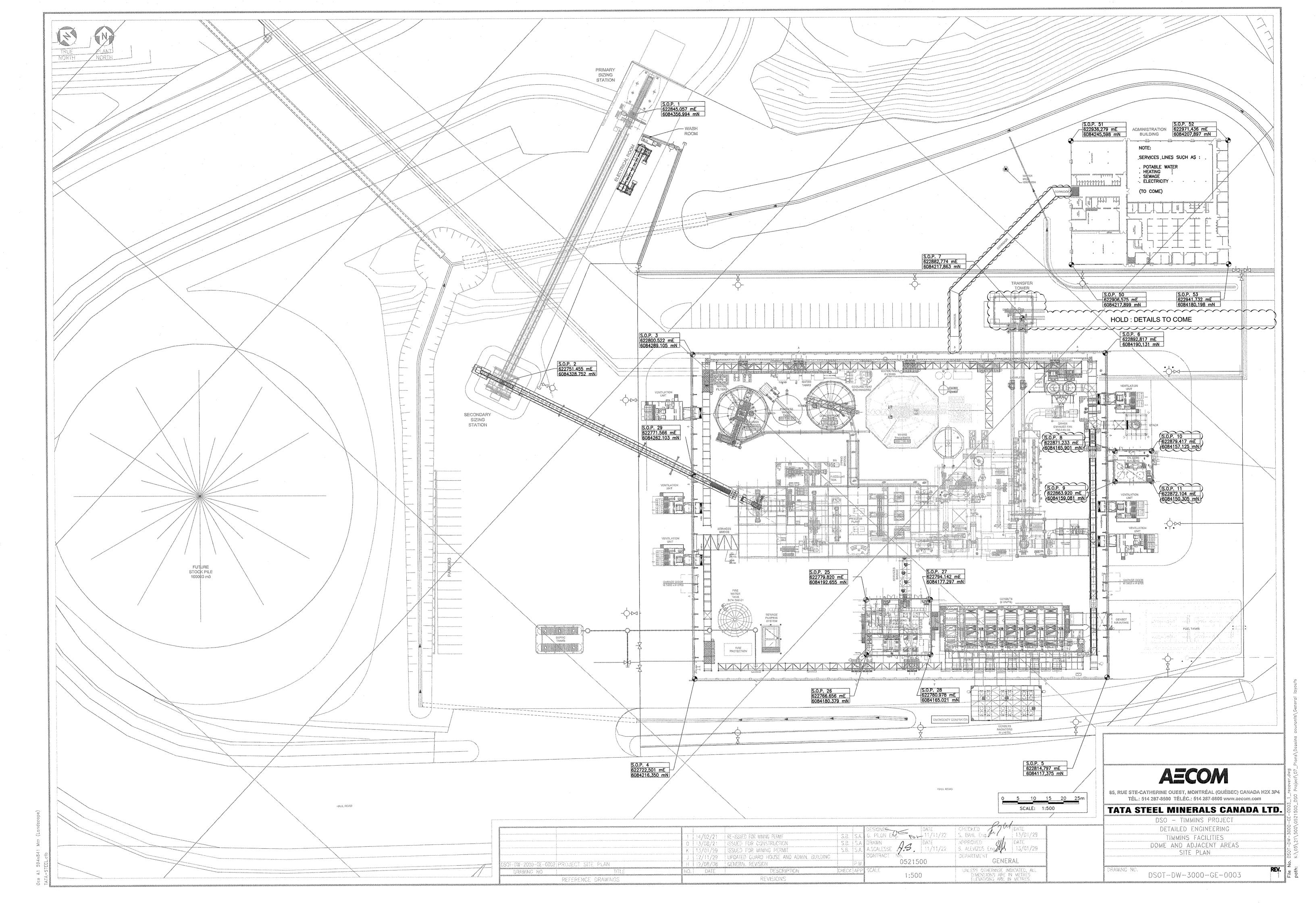
** Hypothesis: equal source height, wind erosion= pile average height. Excavation and roads= truck height.

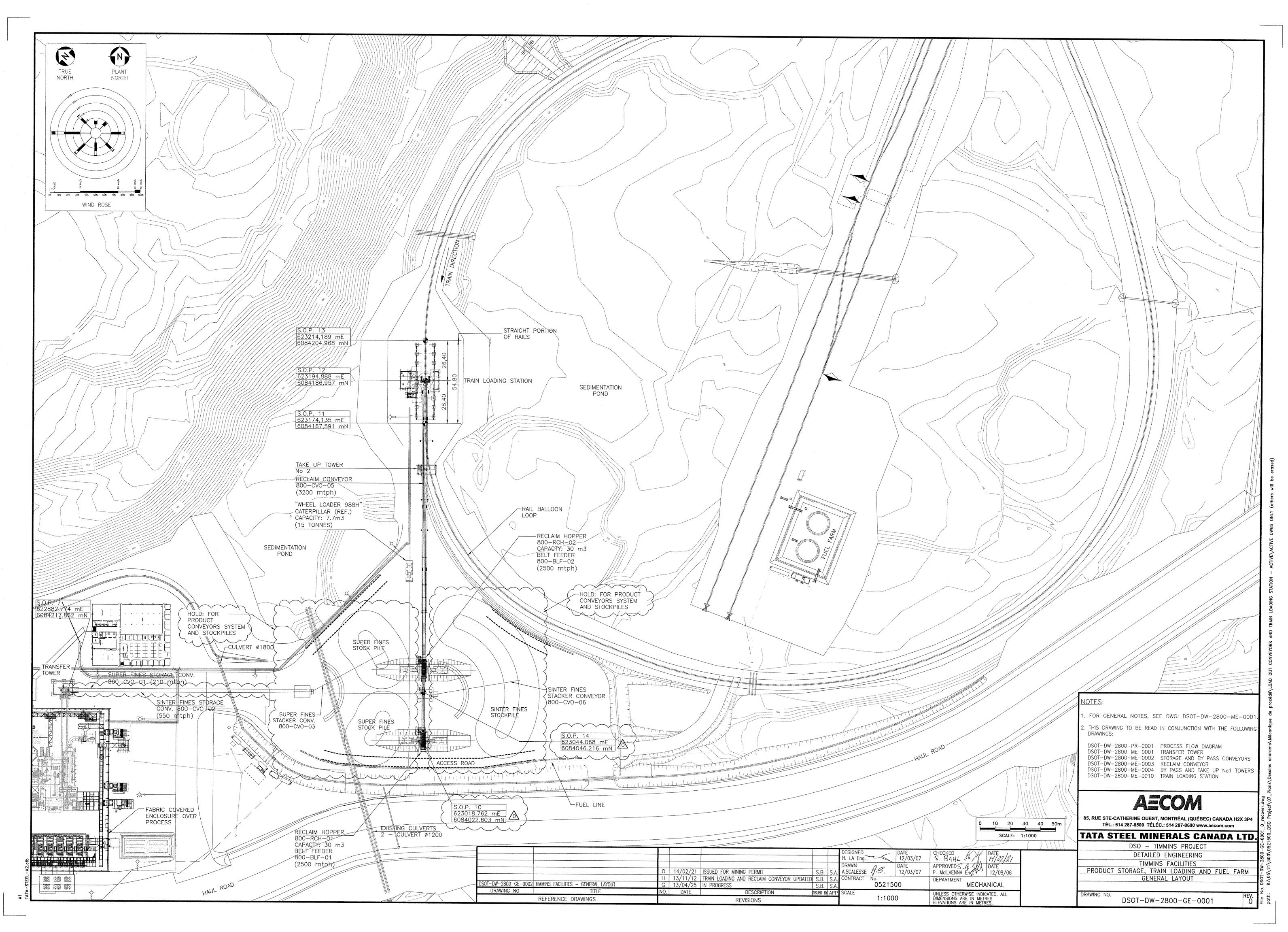
Appendix C General Site Layouts

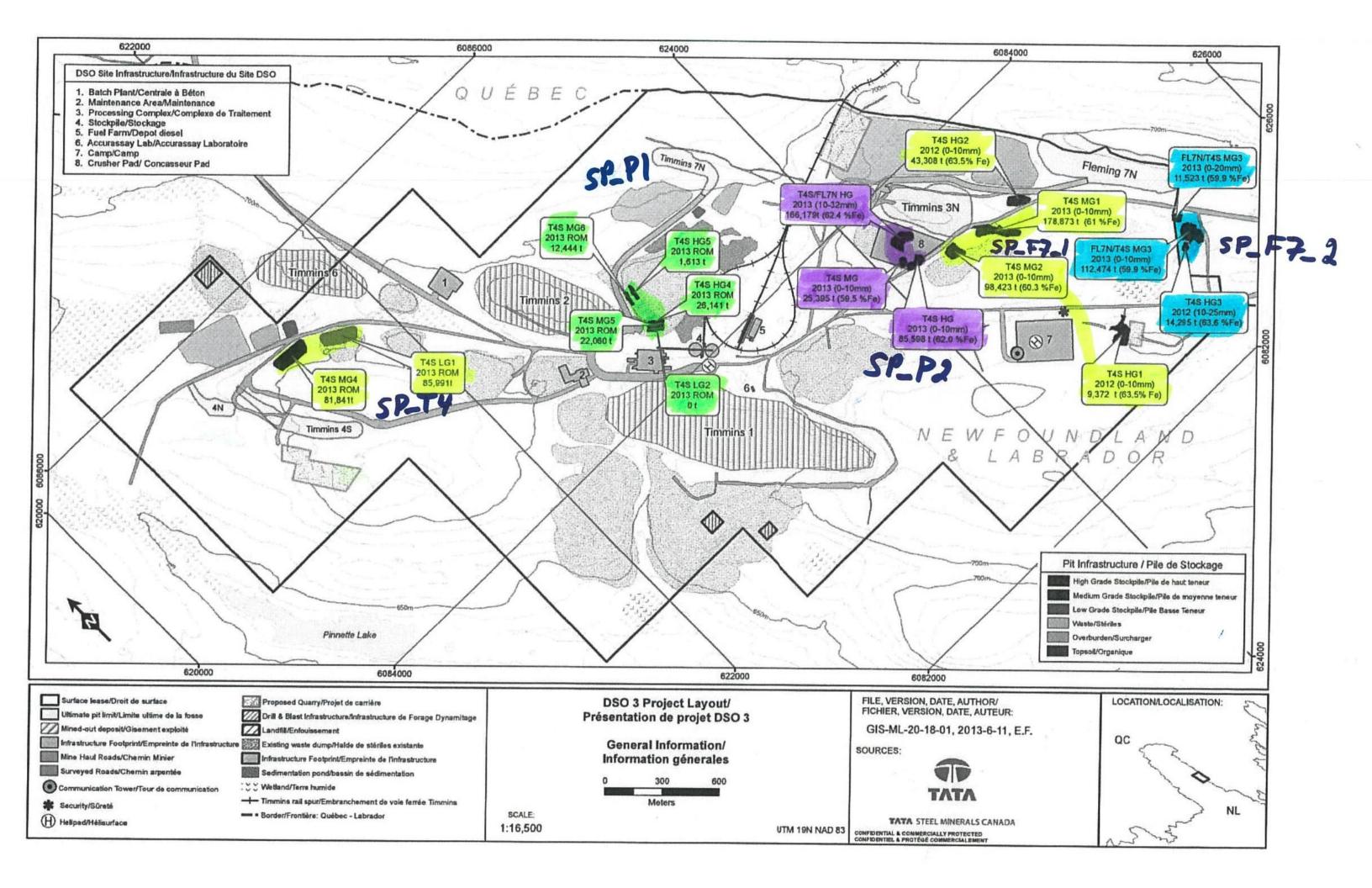


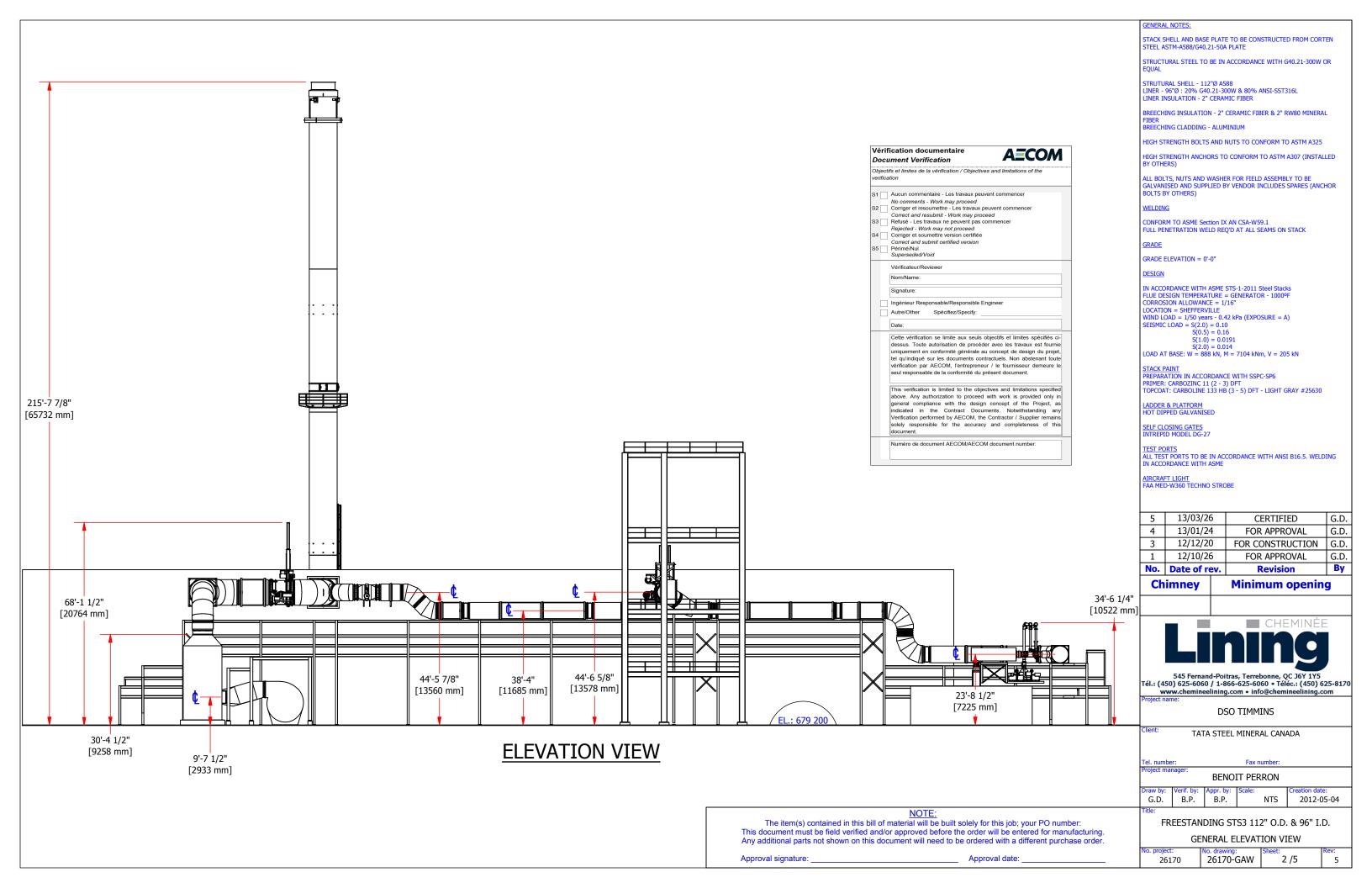












Appendix D MM5 Meteorological Data Explanatory Document

MM5 Meteorological Data for CALPUFF CALMET Ready Data

Ordered by: Emmanuelle Becaert, Tecsult Inc.

Location: Shefferville, Québec

Latitude, Longitude of Center: 54.859701 N, 67.005833 W

Period: 2004-01-01 00:00 Z to 2008-12-31 23:00 Z

Vertical Levels: 18 (lowest level at 15 m above ground level (AGL)

Spatial Resolution: 12 km

UTM Zone: 19

Time Zone: Divided between UTC -5 (Eastern) / UTC -4 (Atlantic)

Domain Extents:

Centre: 54.859701 N, 67.005833 W (degrees)

Area: 40 km (X) x 40 km (Y)



Using MM5 Data to Run CALMET Using the CALPUFF View Interface

See below instructions on how to setup CALMET to run MM5 data. Please note that these instructions are based on CALMET Model Version 6 options.

CALMET - Run Information Screen

Starting Time: Specify the start time for the MM5 data you want to run **Ending Time:** Specify the end time for the MM5 data you want to run

Time Zone: specify the time zone for your modeling area

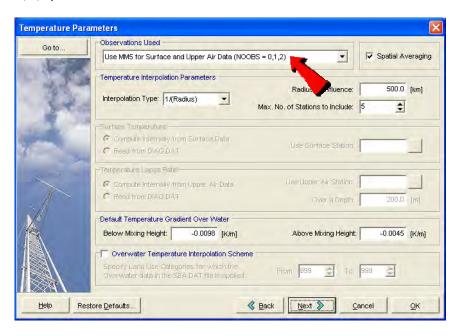
Select the option **MM4/5M3D** for Surface & Overwater, Upper Air, and Precipitation options.





CALMET - Temperature Parameters Screen

Observations Used: Select Use "MM5 for Surface and Upper Air Data (NOOBS = 0,1,2)"



CALMET - Wind Field Options Screen

Wind Field Model Selection: select "Diagnostic Wind Module"

Use Prognostic Wind Fields: check this option

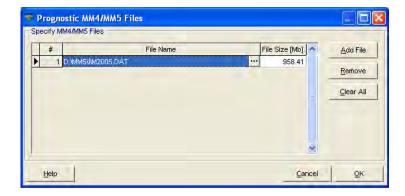
Output From: select "MM5"
As: select "Initial Guess Field"

Ignore Layer 1 of Upper Air Stations: Check this option

Vertical Extrapolation of Surface Winds: select "Do Not Extrapolate"



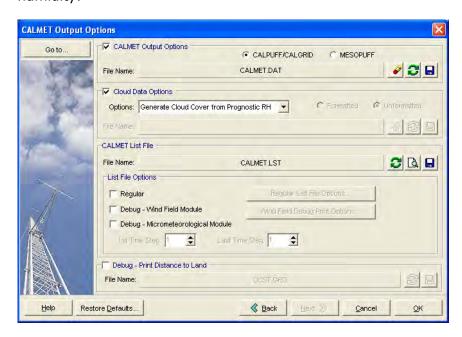
Press the **MM4/5 Files** button () and specify in this screen your MM5 data file(s).



CALMET - CALMET Output Options Screen

Cloud Data Options: select this option

Options: select "Generate Cloud Cover from Prognostic RH". RH stands for relative humidity.



By: Ryan Freedman



MM5 INFORMATION

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1 Scope

1.1 Overview

This document is intended to provide some additional detail about the MM5 run for Shefferville, Québec ordered by Tecsult Inc.

2 Referenced Documents

AERMET_MM5_Shefferville_Quebec_2004-2008_Readme.pdf

3 Document History

DATE	VERSION	AUTHOR	DESCRIPTION
26-Mar-	0.1	Ryan	Initial Draft
2009		Freedman	

By: Ryan Freedman



4 MM5 Information

4.1 Global Reanalysis Data and Met Stations

MM5 cannot directly use conventional meteorological data from airport reports. Instead, the model uses objective analysis of global weather reports. Objective analysis is a process of analyzing the observed data and outputting them into a regular grid. The meteorological field is "balanced" to take account of the energy and momentum equations of the atmosphere. These objective analyses are products of global models, which are maintained by national weather centers or federal agencies such as UKMO (United Kingdom Meteorological Office) or NCEP (National Center for Environmental Protection).

MM5 runs at Lakes Environmental use NCEP Global Reanalysis as initialization input to MM5, with available data covering 1999 to 2008. The NCEP reanalysis has a resolution of 2.5 degrees by 2.5 degrees for the entire globe, given at every 6 hour interval. For further details, please refer to the website: http://dss.ucar.edu/datasets/ds090.0/.

Figure 1 on the following page displays the MM5 stations used for the Tecsult Inc. Shefferville, Québec run.

Note that the final model output is not the direct data from these stations. The global reanalysis data is used as a first guess in the modeling and to guide the model. Any model requires input data of some sort to initialize the model, but the output which comes out of the MM5 run is modeled data and not observational. This distinction is important.

By: Ryan Freedman

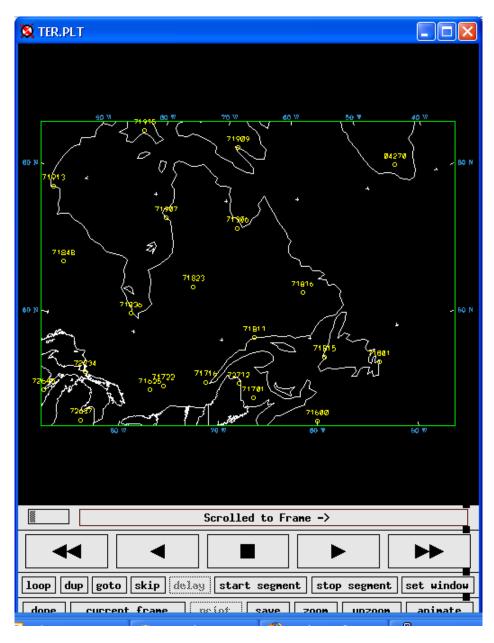


Figure 1: Global Reanalysis Met Stations Used for the Shefferville, Québec MM5 Run.



4.2 Modeling Domain

Figure 2 displays the modeling domains used for the Shefferville, Québec MM5 run. The processing uses a three-domain nested grid. The three domains used are shown in the figure. The data point in each grid become more densely packed as the domain size decreases from the outer, coarse grid to the denser, final grid in the center.

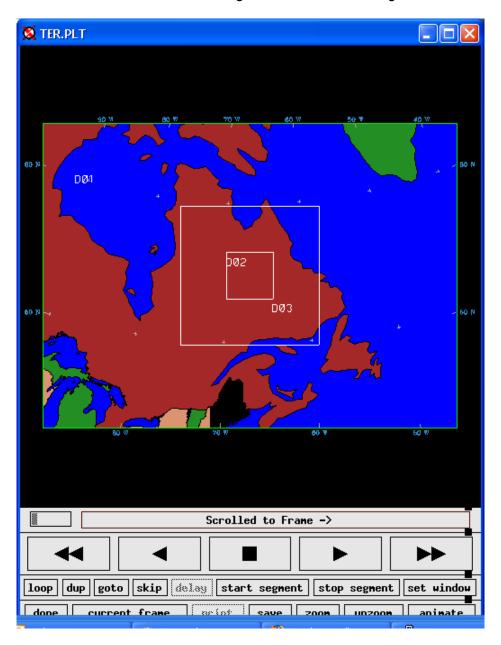


Figure 2: Modeling Domains Used for the Shefferville, Québec MM5 Run



4.3 Terrain Elevations

Figure 3 displays the terrain elevations for the innermost domain used in the Shefferville, Québec MM5 run. The central point of the MM5 run is at the center of this image.

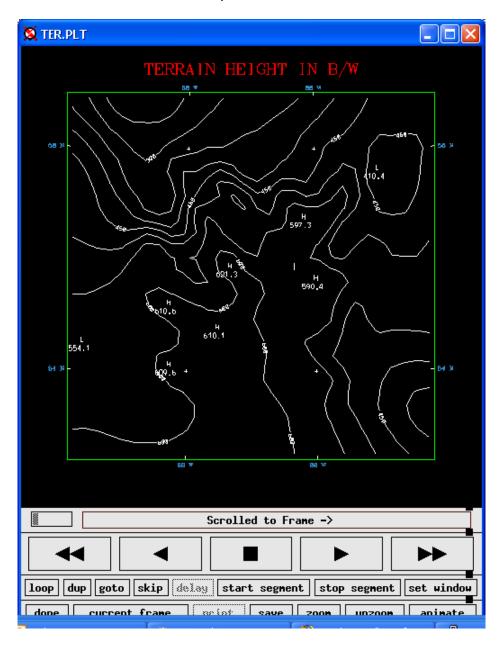


Figure 3: Terrain Elevations for the Shefferville, Québec MM5 Run

Appendix E
CALMET Land Use Grid
(ZIP file available electronically)

Appendix F
CALPUFF Input Files and
CALPOST Input-Output Files
(ZIP file available electronically)

Appendix G
Annual Air Emissions Inventory Detailed Tables of Results

					TPM			PM10			PM2.5	
Source ID used for modeling (blank if not modeled)	Source Type	Description of Source	Schedule of operation for modeling	g/s	tonnes/yr	Contribution to the annual emission total (%)	g/s	tonnes/yr	Contribution to the annual emission total (%)	g/s	tonnes/yr	Contribution to the annual emission total (%)
			DSO3									
SP_F7_1	Surface	Stockpiles near F7 - 1: Wind erosion	24H/24h-12 months per year	0.04	0.45	0.2%	0.02	0.2	0.2%	0.00	0.0	0.1%
SP_F7_2	Surface	Stockpiles near F7 - 2: Wind erosion	24H/24h-12 months per year	0.02	0.25	0.1%	0.01	0.1	0.1%	0.00	0.0	0.0%
SP_P2	Surface	Stockpiles near Plant 2: Wind erosion	24H/24h-12 months per year	0.04	0.45	0.2%	0.02	0.2	0.2%	0.00	0.0	0.1%
SP_T4	Surface	Stockpiles near T4: Wind erosion	24H/24h-12 months per year	0.02	0.29	0.1%	0.01	0.1	0.1%	0.00	0.0	0.0%
SP_P1	Surface	Stockpiles west of Main Plant: Wind erosion	24H/24h-12 months per year	0.02	0.20	0.1%	0.01	0.1	0.1%	0.00	0.0	0.0%
SP_NP1	Surface	Stockpiles north of Main Plant: Wind erosion	24H/24h-12 months per year	0.01	0.15	0.1%	0.01	0.1	0.1%	0.00	0.0	0.0%
SP_SIN	Surface	Stockpile of final product: Sinterfines: Wind erosion	24H/24h-12 months per year	0.14	1.70	0.7%	0.07	0.8	0.7%	0.01	0.1	0.2%
SP_SUP	Surface	Stockpiles of final product: Superfines: Wind erosion	24H/24h-12 months per year	0.85	10.04	4.3%	0.42	5.0	4.1%	0.06	0.8	1.2%
F7N	Surface	F7 pit: Drilling/Excavation/Loading/Engines (Truck+Excav+Loader+Drill)	24H/24h-12 months per year	0.19	6.12	2.6%	0.10	3.1	2.6%	0.06	2.0	3.1%
F7_WST	Surface	F7 Waste/OB dump: Unloading/Erosion	24H/24h-12 months per year	1.29	16.28	7.0%	0.64	8.1	6.6%	0.10	1.2	1.9%
T7_WST	Surface	T7 Waste/OB dump: Erosion	24H/24h-12 months per year	0.36	4.28	1.9%	0.18	2.1	1.8%	0.03	0.3	0.5%
VBLAST_F7N	Volume	F7 pit blast	12 months- 1 blast/week in summer and 1 blast/month winter (Total 30 blasts/yr)	40.19	4.28	1.8%	20.90	2.5	2.0%	1.21	0.1	0.2%
GENCP_1	Point	Generator 1 at Workers' Camp : CAT 275ekW	24H/24h-12 months per year	0.00	0.10	0.0%	0.00	0.1	0.1%	0.00	0.1	0.2%
GENCP_2	Point	Generator 2 at Workers' Camp : CAT 275ekW	24H/24h-12 months per year	0.00	0.10	0.0%	0.00	0.1	0.1%	0.00	0.1	0.2%
GENCP_3	Point	Generator 3 at Workers' Camp : CAT 275ekW	24H/24h-12 months per year	0.00	0.10	0.0%	0.00	0.1	0.1%	0.00	0.1	0.2%
GENCP_4	Point	Generator 4 at Workers' Camp: CAT C32 1000eKW	24H/24h-12 months per year	0.01	0.21	0.1%	0.01	0.2	0.2%	0.01	0.2	0.3%
GENP2_1	Point	Generator at Plant 2 : MTU DP1935D6SRW 2MW	24H/24h-12 months per year	0.02	0.76	0.3%	0.02	0.8	0.6%	0.02	0.8	1.2%
GENBATCH	Point	Generator at Batch Plant : CAT 157.5 ekW	24H/24h-12 months per year	0.01	0.28	0.1%	0.01	0.3	0.2%	0.01	0.3	0.4%
GENMIX	Point	Mixer generator at Plant 2: 146 ekW	24H/24h-12 months per year	0.01	0.26	0.1%	0.01	0.3	0.2%	0.01	0.3	0.4%
RF7WST_xx	Surface	Roads between F7 and F7_WST (0.8 Km): Unpaved road + Engine	24h/24h - 12 months per year	0.43	7.07	3.1%	0.12	2.0	1.7%	0.01	0.2	0.4%
RF7_xx	Surface	Roads between F7 and Plant 2 (1 Km): Unpaved road + Engine	24h/24h - 12 months per year	0.21	3.45	1.5%	0.07	1.2	1.0%	0.01	0.1	0.2%
RP2_xx	Surface	Roads between Plant 2 and Rail loading (1.2 Km) : Unpaved road + Engine	24h/24h - 12 months per year	0.98	16.34	7.1%	0.28	4.7	3.8%	0.03	0.5	0.8%
RPK_xx	Surface	Road to main gate, pick-up travels (3.6 Km)	24h/24h - 12 months per year	0.83	9.98	4.3%	0.24	2.8	2.3%	0.02	0.3	0.4%
DRYER	Point	Dryer located at Plant 2	24h/24h - 12 months per year	0.63	19.98	8.6%	0.47	14.7	12.0%	0.35	11.0	17.1%
VP2_PREDRY	Volume	Plant 2 operations before dryer: Unloading/Crushing/Conveyors	24h/24h - 12 months per year	0.16	4.92	2.1%	0.06	1.9	1.6%	0.01	0.4	0.6%
VP2_POSTDRY	Volume	Plant 2 operations after dryer: Conveyors/Screening/Crushing/Loading	24h/24h - 12 months per year	0.27	8.45	3.7%	0.09	2.9	2.4%	0.01	0.4	0.6%
VMP_SZ1	Volume	Primary sizer before Main Plant: Unloading/Conveyors/Crushing	24h/24h - 12 months per year	0.31	9.85	4.3%	0.12	3.8	3.1%	0.02	0.7	1.0%
VMP_SZ2	Volume	Secondary sizer before Main Plant: Conveyors/Crushing	24h/24h - 12 months per year	0.14	4.54	2.0%	0.06	1.9	1.6%	0.01	0.4	0.6%
VMP_SIN	Volume	Rail loop activities: Conveyor's chute on Sinterfines stockpile	24h/24h - 12 months per year	0.00	0.06	0.0%	0.00	0.0	0.0%	0.00	0.0	0.0%
VMP_SUP	Volume	Rail loop activities: Conveyor's chute on Superfines stockpiles	24h/24h - 12 months per year	0.00	0.03	0.0%	0.00	0.0	0.0%	0.00	0.0	0.0%
VMP_HDRL	Volume	Rail loop activities: Handling of product to the loading conveyor	24h/24h - 12 months per year	1.94	61.22	26.5%	0.71	22.4	18.3%	0.15	4.6	7.2%
VMP_RAIL	Volume	Rail loop activities: Conveyor's chute into rail cars	24h/24h - 12 months per year	0.00	0.06	0.0%	0.00	0.0	0.0%	0.00	0.0	0.0%
S1_W & S1_S	Point	Stack at Main Plant: Winter. Drying Mode, 5 generators @ 75% load + 1 flash dryer + 1 rotary dryer Stack at Main Plant: Summer. No Drying Mode, 3 generators @ 75% load	24h/24h - Oct. to April - Drying Mode 24h/24h - May to Sept No Drying Mode	0.98	30.90	13.4%	1.75	30.9	25.3%	1.75	30.9	48.1%
MP_W_S_W & MP_W_S_S	Point	10 South Wall Vents - Exhaust flow rates different Winter vs Summer	24h/24h - 12 months per year	0.07	2.06	0.9%	0.07	2.1	1.7%	0.07	2.1	3.2%
MP_W_N_W & MP_W_N_S	Point	4 North Wall Vents - Exhaust flow rates different Winter vs Summer	24h/24h - 12 months per year	0.03	0.83	0.4%	0.03	0.8	0.7%	0.03	0.8	1.3%
MP_RF_S	Point	4 Roof Exhausts	24h/24h - 5 months/year (winter)	0.07	0.94	0.4%	0.07	0.9	0.8%	0.07	0.9	1.5%
MP_VAC	Point	2 drum filter vacuum pumps vents and one pan filter suction blower vent	24h/24h - 12 months per year	0.05	1.59	0.7%	0.05	1.6	1.3%	0.05	1.6	2.5%
RL_BIN	Point	Dust Collector - Bin vent	24h/24h - 12 months per year	0.08	2.48	1.1%	0.08	2.5	2.0%	0.08	2.5	3.9%
		Lighting Plants: Magnum MLT3060	24h/24h - 12 months per year	0.00	0.04	0.0%	0.00	0.0	0.0%	0.00	0.0	0.1%
		6" Dewatering Pumps: Godwin Dri-Prime CD150M	24h/24h - 12 months per year	0.00	0.14	0.1%	0.00	0.1	0.1%	0.00	0.1	0.2%
		Locomotives at rail loop	7 ore train/wk (16h/tr.) 2 freight trains/wk (estim. at 4hrs/wk)	0.01	0.14	0.1%	0.01	0.14	0.1%	0.01	0.14	0.2%
		Accurassay Laboratory	24h/24h - 12 months per year	0.000638	0.020120	0.0087%	0.000172	0.00542	0.0044%	0.00042	0.01337	0.0208%
		· · · · · · · · · · · · · · · · · · ·		-								

TOTAL ANNUAL EMISSIONS - DSO3	 231.4	100%	 121.9	100%	 64.2	100%

					TPM			PM10			PM2.5	
Source ID used for modeling (blank if not modeled)	Source Type	Description of Source	Schedule of operation for modeling	g/s	tonnes/yr	Contribution to the annual emission total (%)	g/s	tonnes/yr	Contribution to the annual emission total (%)	g/s	tonnes/yr	Contribution to the annual emission total (%)
			HOWSE									
VHOW PreDry	Volume	Howse Mini Plant operations before dryer: Unloading/Crushing/Conveyors	24h/24h - 7 months/year (summer)	0.22	4.11	1.4%	0.09	1.6	1.6%	0.02	0.3	1.3%
VHOW PostDry	Volume	Howse Mini Plant operations after dryer: Conveyors/Screening/Crushing/Loading	24h/24h - 7 months/year (summer)	0.39	7.27	2.4%	0.14	2.5	2.5%	0.02	0.3	1.4%
VQUA	Volume	FN Quarry crushing facility	24h/24h - 7 months/year (summer)	0.02	0.34	0.1%	0.01	0.1	0.1%	0.00	0.0	0.1%
HOW Dry	Point	Dryer 1 located at HOWSE Mini Plant	24h/24h - 7 months/year (summer)	0.51	9.37	3.1%	0.36	6.7	6.8%	0.26	4.8	21.2%
HOW Dry2	Point	Dryer 2 located at HOWSE Mini Plant	24h/24h - 7 months/year (summer)	0.51	9.37	3.1%	0.36	6.7	6.8%	0.26	4.8	21.2%
RH OB xx	Surface	Roads between Howse pit to OB (2 Km)	24h/24h - 5 months/year (winter)	2.22	24.27	8.0%	0.63	6.9	7.0%	0.07	0.8	3.5%
RH WST xx	Surface	Roads between Howse pit to waste (0.6 Km)	24h/24h - 7 months/year (summer)	0.92	12.25	4.1%	0.26	3.5	3.5%	0.03	0.4	1.7%
RH 00A, 01 to 11	Surface	Road for Howse Ore/Waste transport from Howse Pit to Howse waste dump (2.4 Km)	24h/24h - 7 months/year (summer)	6.50	87.02	28.8%	1.86	24.8	25.1%	0.21	2.8	12.4%
RH 12 to 25	Surface	Road for Howse Ore/FN Quarry sand transport (2.8 Km)	24h/24h - 7 months/year (summer)	3.66	48.47	16.1%	1.04	13.8	13.9%	0.12	1.6	6.8%
RH 26 to 29	Surface	Roads between Howse Pit to Howse MiniPlant (Ore transport) (0.8 Km)-In	24h/24h - 7 months/year (summer)	0.95	12.67	4.2%	0.27	3.6	3.6%	0.03	0.4	1.8%
RH 30 to 35	Surface	Roads between Howse Pit to Howse MiniPlant (Ore transport) (1.2 Km)-In and Out	24h/24h - 7 months/year (summer)	2.84	38.00	12.6%	0.54	7.2	7.3%	0.06	0.8	3.6%
RQUA xx	Surface	First Nations Quarry to main road (10 wheeler) (0.6 Km)	24h/24h - 7 months/year (summer)	0.07	0.86	0.3%	0.02	0.2	0.2%	0.00	0.0	0.1%
RFN xx	Surface	First Nations Quarry to site main gate (10 wheeler) (3.6 Km)	24h/24h - 7 months/year (summer)	0.44	5.13	1.7%	0.12	1.4	1.5%	0.01	0.1	0.6%
GENHOW_1	Point	Generator at Howse Mini Plant-2 MW	24H/24h-7 months per year	0.02	0.45	0.1%	0.02	0.4	0.5%	0.02	0.4	2.0%
GENQUA	Point	Generator at FN quarry crushing facility: CAT 275ekW	24H/24h-7 months per year	0.00	0.06	0.0%	0.00	0.1	0.1%	0.00	0.1	0.2%
VBLAST_H	Volume	HOWSE pit blast	12 months- 1 blast/week in summer and 1 blast/month winter (Total 33 blasts/yr)	40.19	4.77	1.6%	20.90	2.1	2.1%	1.21	0.1	0.5%
HOW_WST	Surface	HOWSE OB/Waste dump: Unloading/Erosion	24H/24h-12 months per year	1.30	20.59	6.8%	0.63	9.9	10.0%	0.09	1.5	6.5%
SP_HOW	Surface	Stockpiles of final product, near Howse Mini Plant	24H/24h-12 months per year	0.03	0.39	0.1%	0.02	0.2	0.2%	0.00	0.0	0.1%
HOWSE	Surface	Howse pit: Drilling/Excavation/Loading/Engines (Truck+2 Excavators +Loader+Drill)	24H/24h-7 months per year	0.52	16.54	5.5%	0.23	7.1	7.2%	0.11	3.4	14.8%
•			TOTAL ANNUAL EMISSIONS - HOWSE		301.9	100%		99.1	100%		22.8	100%
	I		10 IALAMOAL LIMISSIONS - HOWSE		301.3	100/0		JJ.1	100/0		22.0	100/0
			DSO4 *									
R_KIV_xx	Surface	Ore from DSO4 (hauling trucks) + pickups (9.6 Km)	24h/24h - 12 months per year	15.50	259.2	100%	4.42	73.9	100%	0.50	8.4	100%
			TOTAL ANNUAL EMISSIONS - DSO4 *		259.2	100%		73.9	100%		8.4	100%

^{*} Includes only portion of Goodwood road located within the air quality modeling perimeter for the Howse EIS

Source ID used for modeling (blank if not						
modeled)	Source Type	Description of Source	Schedule of operation for modeling	g/s	tonnes/yr	Contribution to the yearly emission total (%)
		DSO3				
	Surface	Stockpiles near F7 - 1: Wind erosion	24H/24h-12 months per year			
	Surface	Stockpiles near F7 - 2: Wind erosion	24H/24h-12 months per year			
	Surface	Stockpiles near Plant 2: Wind erosion	24H/24h-12 months per year			
	Surface	Stockpiles near T4: Wind erosion	24H/24h-12 months per year			
	Surface	Stockpiles west of Main Plant: Wind erosion	24H/24h-12 months per year			
	Surface	Stockpiles north of Main Plant: Wind erosion	24H/24h-12 months per year			
	Surface	Stockpile of final product: Sinterfines: Wind erosion	24H/24h-12 months per year			
	Surface	Stockpiles of final product: Superfines: Wind erosion	24H/24h-12 months per year			
F7N	Surface	F7 pit: Drilling/Excavation/Loading/Engines (Truck+Excav+Loader+Drill)	24H/24h-12 months per year	0.95	30.09	1.9%
	Surface	F7 Waste/OB dump: Unloading/Erosion	24H/24h-12 months per year			
	Surface	T7 Waste/OB dump: Erosion	24H/24h-12 months per year			
		·· · · ·	12 months- 1 blast/week in summer and 1			
VBLAST_F7N	Volume	F7 pit blast	blast/month winter (Total 30 blasts/yr)	75.63	8.0	0.5%
GENCP 1	Point	Generator 1 at Workers' Camp : CAT 275ekW	24H/24h-12 months per year	0.38	12.0	0.8%
GENCP 2	Point	Generator 2 at Workers' Camp : CAT 275ekW	24H/24h-12 months per year	0.38	12.0	0.8%
GENCP 3	Point	Generator 3 at Workers' Camp : CAT 275ekW	24H/24h-12 months per year	0.38	12.0	0.8%
GENCP 4	Point	Generator 4 at Workers' Camp : CAT C32 1000eKW	24H/24h-12 months per year	1.84	57.9	3.7%
GENP2 1	Point	Generator at Plant 2 : MTU DP1935D6SRW 2MW	24H/24h-12 months per year	2.86	90.3	5.8%
GENBATCH	Point	Generator at Batch Plant : CAT 157.5 ekW	24H/24h-12 months per year	0.18	5.5	0.4%
GENMIX	Point	Mixer generator at Plant 2: 146 ekW	24H/24h-12 months per year	0.16	5.1	0.3%
RF7WST_xx	Surface	Roads between F7 and F7_WST (0.8 Km): Unpaved road + Engine	24h/24h - 12 months per year	0.07	2.1	0.1%
RF7 xx	Surface	Roads between F7 and Plant 2 (1 Km): Unpaved road + Engine	24h/24h - 12 months per year	0.04	1.3	0.1%
RP2 xx	Surface	Roads between Plant 2 and Rail loading (1.2 Km) : Unpaved road + Engine	24h/24h - 12 months per year	0.15	4.8	0.3%
RPK xx	Surface	road to site main gateby pick-up (3.6 Km)	24h/24h - 12 months per year	0.00098	0.031	0.002%
DRYER	Point	Dryer located at Plant 2	24h/24h - 12 months per year	3.57	112.6	7.3%
	Volume	Plant 2 operations before dryer: Unloading/Crushing/Conveyors	24h/24h - 12 months per year	0.07	11210	7.1070
	Volume	Plant 2 operations after dryer: Conveyors/Screening/Crushing/Loading	24h/24h - 12 months per year			
	Volume	Primary sizer before Main Plant: Unloading/Conveyors/Crushing	24h/24h - 12 months per year			
	Volume	Secondary sizer before Main Plant: Conveyors/Crushing	24h/24h - 12 months per year			
+	Volume	Rail loop activities: Conveyor's chute on Sinterfines stockpile	24h/24h - 12 months per year			
	Volume	Rail loop activities: Conveyor's chute on Superfines stockpiles	24h/24h - 12 months per year			
VMP_HDRL	Volume	Rail loop activities: Handling of product to the loading conveyor	24h/24h - 12 months per year	0.92	29.0	1.9%
	Volume	Rail loop activities: Conveyor's chute into rail cars	24h/24h - 12 months per year	0.52		2.570
	Volume	Stack at Main Plant: Winter. Drying Mode, 5 generators @ 75% load + 1 flash dryer + 1 rotary dryer	24h/24h - Oct. to April - Drying Mode			
S1_W & S1_S	Point		, , ,	36.84	1160.2	74.8%
		Stack at Main Plant: Summer. No Drying Mode, 3 generators @ 75% load	24h/24h - May to Sept No Drying Mode			
	Point	10 South Wall Vents - Exhaust flow rates different Winter vs Summer	24h/24h - 12 months per year			
	Point	4 North Wall Vents - Exhaust flow rates different Winter vs Summer	24h/24h - 12 months per year			
	Point	4 Roof Exhausts	24h/24h - 5 months/year (winter)			
	Point	2 drum filter vacuum pumps vents and one pan filter suction blower vent	24h/24h - 12 months per year			
	Point	Dust Collector - Bin vent	24h/24h - 12 months per year			
	Mobile	Lighting Plants: Magnum MLT3060	24h/24h - 12 months per year	0.02	0.7	0.0%
	Point	6" Dewatering Pumps: Godwin Dri-Prime CD150M	24h/24h - 12 months per year	0.07	2.3	0.1%
	Mobile Point	Locomotives at rail loop Accurassay Laboratory	7 ore train/wk (16h/tr.) 2 freight trains/wk 24h/24h - 12 months per year	0.23	0.0	0.3%

					NOx	
Source ID used for modeling (blank if not modeled)	Source Type	Description of Source	Schedule of operation for modeling	g/s	tonnes/yr	Contribution to the yearly emission total (%)
		HOWSE				
	Volume	Howse Mini Plant operations before dryer: Unloading/Crushing/Conveyors	24h/24h - 7 months/year (summer)			
	Volume	Howse Mini Plant operations after dryer: Conveyors/Screening/Crushing/Loading	24h/24h - 7 months/year (summer)			
	Volume	FN Quarry crushing facility	24h/24h - 7 months/year (summer)			
HOW_Dry	Point	Dryer 1 located at HOWSE Mini Plant	24h/24h - 7 months/year (summer)	2.62	48.4	17.1%
HOW_Dry2	Point	Dryer 2 located at HOWSE Mini Plant	24h/24h - 7 months/year (summer)	2.62	48.4	17.1%
RH_OB_xx	Surface	Roads between Howse pit to OB (2 Km)	24h/24h - 5 months/year (winter)	1.84	24.0	8.5%
RH_WST_xx	Surface	Roads between Howse pit to waste (0.6 Km)	24h/24h - 7 months/year (summer)	0.24	4.5	1.6%
RH_00A, 01 to 11	Surface	Road for Howse Ore/Waste transport from Howse Pit to Howse waste dump (2.4 Km)	24h/24h - 7 months/year (summer)	1.72	31.8	11.2%
RH_12 to 25	Surface	Road for Howse Ore/FN Quarry sand transport (2.8 Km)	24h/24h - 7 months/year (summer)	0.88	16.2	5.7%
RH_26 to 29	Surface	Roads between Howse Pit to Howse MiniPlant (Ore transport) (0.8 Km)-In	24h/24h - 7 months/year (summer)	0.25	4.6	1.6%
RH_30 to 35	Surface	Roads between Howse Pit to Howse MiniPlant (Ore transport) (1.2 Km)-In and Out	24h/24h - 7 months/year (summer)	0.75	13.9	4.9%
RQUA_xx	Surface	First Nations Quarry to main road (10 wheeler) (0.6 Km)	24h/24h - 7 months/year (summer)	0.00057	0.0	0.0%
RFN_xx	Surface	First Nations Quarry to site main gate (10 wheeler) (3.6 Km)	24h/24h - 7 months/year (summer)	0.00343	0.1	0.0%
GENHOW_1	Point	Generator at Howse Mini Plant-2 MW	24H/24h-7 months per year	2.86	52.9	18.7%
GENQUA	Point	Generator at FN quarry crushing facility: CAT 275ekW	24H/24h-7 months per year	0.38	7.0	2.5%
	Volume	HOWER oit block	12 months- 1 blast/week in summer and 1	75.63	9.0	3.2%
	volume	HOWSE pit blast	blast/month winter (Total 33 blasts/yr)	75.03	9.0	3.2%
	Surface	HOWSE OB/Waste dump: Unloading/Erosion	24H/24h-12 months per year			
SP_HOW	Surface	Stockpiles of final product, near Howse Mini Plant	24H/24h-12 months per year			
HOWSE	Surface	Howse pit: Drilling/Excavation/Loading/Engines (Truck+2 Excavators +Loader+Drill)	24H/24h-7 months per year	1.21	22.3	7.9%
			TOTAL ANNUAL EMISSIONS - HOWSE		283.2	100%
		DSO4 *				
R_KIV_xx	Surface	Ore from DSO4 (hauling trucks) + pickups (9.6 Km)	24h/24h - 12 months per year	3.95	124.6	100%
			TOTAL ANNUAL EMISSIONS - DSO4 *		124.6	100%

^{*} Includes only portion of Goodwood road located within the air quality modeling perimeter for the Howse EIS

					СО	
Source ID used for modeling (blank if not modeled)	Source Type	Description of Source	Schedule of operation for modeling	g/s	tonnes/yr	Contribution to the yearly emission total (%)
		DSO3				
	Surface	Stockpiles near F7 - 1: Wind erosion	24H/24h-12 months per year			
	Surface	Stockpiles near F7 - 2: Wind erosion	24H/24h-12 months per year			
	Surface	Stockpiles near Plant 2: Wind erosion	24H/24h-12 months per year			
	Surface	Stockpiles near T4: Wind erosion	24H/24h-12 months per year			
	Surface	Stockpiles west of Main Plant: Wind erosion	24H/24h-12 months per year			
	Surface	Stockpiles north of Main Plant: Wind erosion	24H/24h-12 months per year			
	Surface	Stockpile of final product: Sinterfines: Wind erosion	24H/24h-12 months per year			
	Surface	Stockpiles of final product: Superfines: Wind erosion	24H/24h-12 months per year			
F7N	Surface	F7 pit: Drilling/Excavation/Loading/Engines (Truck+Excav+Loader+Drill)	24H/24h-12 months per year	0.80	25.21	12.6%
	Surface	F7 Waste/OB dump: Unloading/Erosion	24H/24h-12 months per year			
	Surface	T7 Waste/OB dump: Erosion	24H/24h-12 months per year			
		·	12 months- 1 blast/week in summer and 1			
VBLAST_F7N	Volume	F7 pit blast	blast/month winter (Total 30 blasts/yr)	321.41	34.2	17.1%
GENCP 1	Point	Generator 1 at Workers' Camp : CAT 275ekW	24H/24h-12 months per year	0.02	0.7	0.4%
GENCP_2	Point	Generator 2 at Workers' Camp : CAT 275ekW	24H/24h-12 months per year	0.02	0.7	0.4%
GENCP_3	Point	Generator 3 at Workers' Camp : CAT 275ekW	24H/24h-12 months per year	0.02	0.7	0.4%
GENCP 4	Point	Generator 4 at Workers' Camp : CAT C32 1000eKW	24H/24h-12 months per year	0.05	1.5	0.8%
GENP2 1	Point	Generator at Plant 2 : MTU DP1935D6SRW 2MW	24H/24h-12 months per year	0.24	7.6	3.8%
GENBATCH	Point	Generator at Plant : CAT 157.5 ekW	24H/24h-12 months per year	0.15	4.8	2.4%
GENMIX	Point	Mixer generator at Plant 2: 146 ekW	24H/24h-12 months per year	0.14	4.5	2.2%
RF7WST xx	Surface	Roads between F7 and F7_WST (0.8 Km): Unpaved road + Engine	24h/24h - 12 months per year	0.06	1.8	0.9%
RF7 xx	Surface	Roads between F7 and Plant 2 (1 Km): Unpaved road + Engine	24h/24h - 12 months per year	0.04	1.1	0.6%
RP2 xx	Surface	Roads between 17 and Plait 2 (1 km): Unpaved road + Engine Roads between Plant 2 and Rail loading (1.2 Km): Unpaved road + Engine	24h/24h - 12 months per year	0.13	4.2	2.1%
RPK_xx	Surface	road to site main gateby pick-up (3.6 Km)	24h/24h - 12 months per year	0.02879	0.908	0.454%
DRYER	Point	Dryer located at Plant 2	24h/24h - 12 months per year	0.02879	23.5	11.7%
DITTER	Volume	Plant 2 operations before dryer: Unloading/Crushing/Conveyors	24h/24h - 12 months per year	0.74	23.3	11.7/0
	Volume	Plant 2 operations before dryer: Onloading/Crushing/Conveyors Plant 2 operations after dryer: Conveyors/Screening/Crushing/Loading	24h/24h - 12 months per year		+	
		Primary sizer before Main Plant: Unloading/Conveyors/Crushing				
	Volume		24h/24h - 12 months per year			
	Volume	Secondary sizer before Main Plant: Conveyors/Crushing	24h/24h - 12 months per year			
	Volume	Rail loop activities: Conveyor's chute on Sinterfines stockpile	24h/24h - 12 months per year			
VAAD LIDDI	Volume	Rail loop activities: Conveyor's chute on Superfines stockpiles	24h/24h - 12 months per year	0.01	25.4	12.70/
VMP_HDRL	Volume	Rail loop activities: Handling of product to the loading conveyor	24h/24h - 12 months per year	0.81	25.4	12.7%
	Volume	Rail loop activities: Conveyor's chute into rail cars	24h/24h - 12 months per year			
S1_W & S1_S	Point	Stack at Main Plant: Winter. Drying Mode, 5 generators @ 75% load + 1 flash dryer + 1 rotary dryer	24h/24h - Oct. to April - Drying Mode	1.86	58.7	29.3%
		Stack at Main Plant: Summer. No Drying Mode, 3 generators @ 75% load	24h/24h - May to Sept No Drying Mode			
	Point	10 South Wall Vents - Exhaust flow rates different Winter vs Summer	24h/24h - 12 months per year			
	Point	4 North Wall Vents - Exhaust flow rates different Winter vs Summer	24h/24h - 12 months per year			
	Point	4 Roof Exhausts	24h/24h - 5 months/year (winter)			
	Point	2 drum filter vacuum pumps vents and one pan filter suction blower vent	24h/24h - 12 months per year			
	Point	Dust Collector - Bin vent	24h/24h - 12 months per year			
		Lighting Plants: Magnum MLT3060	24h/24h - 12 months per year	0.02	0.6	0.3%
		6" Dewatering Pumps: Godwin Dri-Prime CD150M	24h/24h - 12 months per year	0.08	2.4	1.2%
		Locomotives at rail loop	7 ore train/wk (16h/tr.) 2 freight trains/wk	0.07	1.4	0.7%
		Accurassay Laboratory	24h/24h - 12 months per year	0.00	0.0	0.0%

TOTAL ANNUAL EMISSIONS - DSO		200.1	100%	
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					СО	
Source ID used for modeling (blank if not modeled)	Source Type	Description of Source	Schedule of operation for modeling	g/s	tonnes/yr	Contribution to the yearly emission total (%)
		HOWSE				
	Volume	Howse Mini Plant operations before dryer: Unloading/Crushing/Conveyors	24h/24h - 7 months/year (summer)			
	Volume	Howse Mini Plant operations after dryer: Conveyors/Screening/Crushing/Loading	24h/24h - 7 months/year (summer)			
	Volume	FN Quarry crushing facility	24h/24h - 7 months/year (summer)			
HOW_Dry	Point	Dryer 1 located at HOWSE Mini Plant	24h/24h - 7 months/year (summer)	0.55	10.1	6.9%
HOW_Dry2	Point	Dryer 2 located at HOWSE Mini Plant	24h/24h - 7 months/year (summer)	0.55	10.1	6.9%
RH_OB_xx	Surface	Roads between Howse pit to OB (2 Km)	24h/24h - 5 months/year (winter)	1.01	13.1	9.0%
RH_WST_xx	Surface	Roads between Howse pit to waste (0.6 Km)	24h/24h - 7 months/year (summer)	0.13	2.4	1.7%
RH_00A, 01 to 11	Surface	Road for Howse Ore/Waste transport from Howse Pit to Howse waste dump (2.4 Km)	24h/24h - 7 months/year (summer)	0.94	17.4	11.9%
RH_12 to 25	Surface	Road for Howse Ore/FN Quarry sand transport (2.8 Km)	24h/24h - 7 months/year (summer)	0.48	8.9	6.1%
RH_26 to 29	Surface	Roads between Howse Pit to Howse MiniPlant (Ore transport) (0.8 Km)-In	24h/24h - 7 months/year (summer)	0.14	2.5	1.7%
RH_30 to 35	Surface	Roads between Howse Pit to Howse MiniPlant (Ore transport) (1.2 Km)-In and Out	24h/24h - 7 months/year (summer)	0.41	7.6	5.2%
RQUA_xx	Surface	First Nations Quarry to main road (10 wheeler) (0.6 Km)	24h/24h - 7 months/year (summer)	0.00018	0.0	0.0%
RFN_xx	Surface	First Nations Quarry to site main gate (10 wheeler) (3.6 Km)	24h/24h - 7 months/year (summer)	0.00107	0.0	0.0%
GENHOW_1	Point	Generator at Howse Mini Plant-2 MW	24H/24h-7 months per year	0.24	4.5	3.1%
GENQUA	Point	Generator at FN quarry crushing facility: CAT 275ekW	24H/24h-7 months per year	0.02	0.4	0.3%
	Volume	HOWSE pit blast	12 months- 1 blast/week in summer and 1 blast/month winter (Total 33 blasts/yr)	321.41	38.2	26.1%
	Surface	HOWSE OB/Waste dump: Unloading/Erosion	24H/24h-12 months per year			
SP_HOW	Surface	Stockpiles of final product, near Howse Mini Plant	24H/24h-12 months per year			
HOWSE	Surface	Howse pit: Drilling/Excavation/Loading/Engines (Truck+2 Excavators +Loader+Drill)	24H/24h-12 months per year	0.99	31.1	21.3%
	[TOTAL ANNUAL EMISSIONS - HOWSE		146.3	100%
	•					
5 40	- ·	DS04 *	241/241 42	0.10		40001
R_KIV_xx	Surface	Ore from DSO4 (hauling trucks) + pickups (9.6 Km)	24h/24h - 12 months per year	2.18	68.7	100%
	ſ		TOTAL ANNUAL EMISSIONS - DSO4 *		68.7	100%

^{*} Includes only portion of Goodwood road located within the air quality modeling perimeter for the Howse EIS

					SO2	
Source ID used for modeling (blank if not Source Type modeled)		Description of Source	Schedule of operation for modeling	g/s	tonnes/yr	Contribution to the yearly emission total (%)
		DSO3				
	Surface	Stockpiles near F7 - 1: Wind erosion	24H/24h-12 months per year			
	Surface	Stockpiles near F7 - 2: Wind erosion	24H/24h-12 months per year			
	Surface	Stockpiles near Plant 2: Wind erosion	24H/24h-12 months per year			
	Surface	Stockpiles near T4: Wind erosion	24H/24h-12 months per year			
	Surface	Stockpiles west of Main Plant: Wind erosion	24H/24h-12 months per year			
	Surface	Stockpiles north of Main Plant: Wind erosion	24H/24h-12 months per year			
	Surface	Stockpile of final product: Sinterfines: Wind erosion	24H/24h-12 months per year			
	Surface	Stockpiles of final product: Superfines: Wind erosion	24H/24h-12 months per year			
F7N	Surface	F7 pit: Drilling/Excavation/Loading/Engines (Truck+Excav+Loader+Drill)	24H/24h-12 months per year	0.0007	0.02	0.7%
	Surface	F7 Waste/OB dump: Unloading/Erosion	24H/24h-12 months per year			
	Surface	T7 Waste/OB dump: Erosion	24H/24h-12 months per year			
			12 months- 1 blast/week in summer and 1			
VBLAST_F7N	Volume	F7 pit blast	blast/month winter (Total 30 blasts/yr)	9.45	1.0	31.8%
GENCP 1	Point	Generator 1 at Workers' Camp : CAT 275ekW	24H/24h-12 months per year	0.0006	0.02	0.6%
GENCP_2	Point	Generator 2 at Workers' Camp : CAT 275ekW	24H/24h-12 months per year	0.0006	0.02	0.6%
GENCP_3	Point	Generator 3 at Workers' Camp : CAT 275ekW	24H/24h-12 months per year	0.0006	0.02	0.6%
GENCP_4	Point	Generator 4 at Workers' Camp : CAT C32 1000eKW	24H/24h-12 months per year	0.0019	0.02	1.9%
GENP2 1	Point	Generator at Plant 2 : MTU DP1935D6SRW 2MW		0.0019	0.087	2.7%
GENP2_1 GENBATCH	Point	Generator at Plant 2 . WHO DP1933D63KW 2WW Generator at Batch Plant : CAT 157.5 ekW	24H/24h-12 months per year	0.0028	0.087	0.3%
			24H/24h-12 months per year			
GENMIX	Point	Mixer generator at Plant 2: 146 ekW	24H/24h-12 months per year	0.0003	0.009	0.3%
RF7WST_xx	Surface	Roads between F7 and F7_WST (0.8 Km): Unpaved road + Engine	24h/24h - 12 months per year	0.0001	0.003	0.1%
RF7_xx	Surface	Roads between F7 and Plant 2 (1 Km): Unpaved road + Engine	24h/24h - 12 months per year	0.0001	0.002	0.1%
RP2_xx	Surface	Roads between Plant 2 and Rail loading (1.2 Km): Unpaved road + Engine	24h/24h - 12 months per year	0.0002	0.008	0.2%
RPK_xx	Surface	road to site main gateby pick-up (3.6 Km)	24h/24h - 12 months per year	3.30874E-06	1.043E-04	0.003%
DRYER	Point	Dryer located at Plant 2	24h/24h - 12 months per year	0.03	1.0	31.6%
	Volume	Plant 2 operations before dryer: Unloading/Crushing/Conveyors	24h/24h - 12 months per year			
	Volume	Plant 2 operations after dryer: Conveyors/Screening/Crushing/Loading	24h/24h - 12 months per year			
	Volume	Primary sizer before Main Plant: Unloading/Conveyors/Crushing	24h/24h - 12 months per year			
	Volume	Secondary sizer before Main Plant: Conveyors/Crushing	24h/24h - 12 months per year			
	Volume	Rail loop activities: Conveyor's chute on Sinterfines stockpile	24h/24h - 12 months per year			
	Volume	Rail loop activities: Conveyor's chute on Superfines stockpiles	24h/24h - 12 months per year			
VMP_HDRL	Volume	Rail loop activities: Handling of product to the loading conveyor	24h/24h - 12 months per year	0.0007	0.02	0.7%
	Volume	Rail loop activities: Conveyor's chute into rail cars	24h/24h - 12 months per year			
C4 VV 0 C4 C	Deint	Stack at Main Plant: Winter. Drying Mode, 5 generators @ 75% load + 1 flash dryer + 1 rotary dryer	24h/24h - Oct. to April - Drying Mode	0.03	0.0	27.40/
S1_W & S1_S	Point	Stack at Main Plant: Summer. No Drying Mode, 3 generators @ 75% load	24h/24h - May to Sept No Drying Mode	0.03	0.9	27.4%
	Point	10 South Wall Vents - Exhaust flow rates different Winter vs Summer	24h/24h - 12 months per year			
	Point	4 North Wall Vents - Exhaust flow rates different Winter vs Summer	24h/24h - 12 months per year			
	Point	4 Roof Exhausts	24h/24h - 5 months/year (winter)			
	Point	2 drum filter vacuum pumps vents and one pan filter suction blower vent	24h/24h - 12 months per year			
	Point	Dust Collector - Bin vent	24h/24h - 12 months per year			
	. 5/110	Lighting Plants: Magnum MLT3060	24h/24h - 12 months per year	0.000015	0.0005	0.01%
		6" Dewatering Pumps: Godwin Dri-Prime CD150M	24h/24h - 12 months per year	0.000013	0.0003	0.01%
		o bewatering i amps. doawin bit-tilile ebijoin	2411/2411 12 months per year	0.000070	0.0024	0.0070
		Locomotives at rail loop	7 ore train/wk (16h/tr.) 2 freight trains/wk	0.00036	0.0076	0.24%
		Accurassay Laboratory	24h/24h - 12 months per year	0.00	0.0	0.0%

					SO2	
Source ID used for modeling (blank if not modeled)	Source Type	Description of Source	Schedule of operation for modeling	g/s	tonnes/yr	Contribution to the yearly emission total (%)
		HOWSE				
	Volume	Howse Mini Plant operations before dryer: Unloading/Crushing/Conveyors	24h/24h - 7 months/year (summer)			
	Volume	Howse Mini Plant operations after dryer: Conveyors/Screening/Crushing/Loading	24h/24h - 7 months/year (summer)			
	Volume	FN Quarry crushing facility	24h/24h - 7 months/year (summer)			
HOW_Dry	Point	Dryer 1 located at HOWSE Mini Plant	24h/24h - 7 months/year (summer)	0.02	0.4	19.8%
HOW_Dry2	Point	Dryer 2 located at HOWSE Mini Plant	24h/24h - 7 months/year (summer)	0.02	0.4	19.8%
RH_OB_xx	Surface	Roads between Howse pit to OB (2 Km)	24h/24h - 5 months/year (winter)	0.00	0.0	1.1%
RH_WST_xx	Surface	Roads between Howse pit to waste (0.6 Km)	24h/24h - 7 months/year (summer)	0.00	0.0	0.2%
RH_00A, 01 to 11	Surface	Road for Howse Ore/Waste transport from Howse Pit to Howse waste dump (2.4 Km)	24h/24h - 7 months/year (summer)	0.00	0.0	1.5%
RH_12 to 25	Surface	Road for Howse Ore/FN Quarry sand transport (2.8 Km)	24h/24h - 7 months/year (summer)	0.00	0.0	0.8%
RH_26 to 29	Surface	Roads between Howse Pit to Howse MiniPlant (Ore transport) (0.8 Km)-In	24h/24h - 7 months/year (summer)	0.00	0.0	0.2%
RH_30 to 35	Surface	Roads between Howse Pit to Howse MiniPlant (Ore transport) (1.2 Km)-In and Out	24h/24h - 7 months/year (summer)	0.00	0.0	0.6%
RQUA_xx	Surface	First Nations Quarry to main road (10 wheeler) (0.6 Km)	24h/24h - 7 months/year (summer)	0.00002	0.0	0.0%
RFN_xx	Surface	First Nations Quarry to site main gate (10 wheeler) (3.6 Km)	24h/24h - 7 months/year (summer)	0.00014	0.0	0.1%
GENHOW_1	Point	Generator at Howse Mini Plant-2 MW	24H/24h-7 months per year	0.0028	0.1	2.3%
GENQUA	Point	Generator at FN quarry crushing facility: CAT 275ekW	24H/24h-7 months per year	0.00	0.0	0.5%
	Volume	HOWSE pit blast	12 months- 1 blast/week in summer and 1 blast/month winter (Total 33 blasts/yr)	9.45	1.1	51.7%
	Surface	HOWSE OB/Waste dump: Unloading/Erosion	24H/24h-12 months per year			
SP_HOW	Surface	Stockpiles of final product, near Howse Mini Plant	24H/24h-12 months per year			
HOWSE	Surface	Howse pit: Drilling/Excavation/Loading/Engines (Truck+2 Excavators +Loader+Drill)	24H/24h-12 months per year	0.0009	0.0	1.3%
			TOTAL ANNUAL EMISSIONS - HOWSE		2.2	100%
1			10 IAL ANTOAL LINISSICIAS - HOWSE		£.£	100/0
		DSO4 *				
R_KIV_xx	Surface	Ore from DSO4 (hauling trucks) + pickups (9.6 Km)	24h/24h - 12 months per year	0.004	0.1	100%
			TOTAL ANNUAL EMISSIONS - DSO4 *		0.1	100%

^{*} Includes only portion of Goodwood road located within the air quality modeling perimeter for the Howse EIS

				Hydrocarbons			
Source ID used for modeling (blank if not modeled)	School Source Type Description of Source School Description of Source		Schedule of operation for modeling	g/s	tonnes/yr	Contribution to the yearly emission total (%)	
		DSO3					
	Surface	Stockpiles near F7 - 1: Wind erosion	24H/24h-12 months per year				
	Surface	Stockpiles near F7 - 2: Wind erosion	24H/24h-12 months per year				
	Surface	Stockpiles near Plant 2: Wind erosion	24H/24h-12 months per year				
	Surface	Stockpiles near T4: Wind erosion	24H/24h-12 months per year				
	Surface	Stockpiles west of Main Plant: Wind erosion	24H/24h-12 months per year				
	Surface	Stockpiles north of Main Plant: Wind erosion	24H/24h-12 months per year				
	Surface	Stockpile of final product: Sinterfines: Wind erosion	24H/24h-12 months per year				
	Surface	Stockpiles of final product: Superfines: Wind erosion	24H/24h-12 months per year				
F7N	Surface	F7 pit: Drilling/Excavation/Loading/Engines (Truck+Excav+Loader+Drill)	24H/24h-12 months per year	0.06	1.99	4.8%	
	Surface	F7 Waste/OB dump: Unloading/Erosion	24H/24h-12 months per year				
	Surface	T7 Waste/OB dump: Erosion	24H/24h-12 months per year				
			12 months- 1 blast/week in summer and 1				
VBLAST_F7N	Volume	F7 pit blast	blast/month winter (Total 30 blasts/yr)	0.00	0.0	0.0%	
GENCP 1	Point	Generator 1 at Workers' Camp : CAT 275ekW	24H/24h-12 months per year	0.01	0.2	0.5%	
GENCP_2	Point	Generator 2 at Workers' Camp : CAT 275ekW	24H/24h-12 months per year	0.01	0.2	0.5%	
GENCP_3	Point	Generator 3 at Workers' Camp : CAT 275ekW	24H/24h-12 months per year	0.01	0.2	0.5%	
GENCP 4	Point	Generator 4 at Workers' Camp : CAT C32 1000eKW	24H/24h-12 months per year	0.0037	0.1	0.3%	
GENP2 1	Point	Generator at Plant 2 : MTU DP1935D6SRW 2MW	24H/24h-12 months per year	0.19	6.0	14.4%	
GENBATCH	Point	Generator at Plant : CAT 157.5 ekW	24H/24h-12 months per year	0.13	0.4	0.9%	
GENMIX	Point	Mixer generator at Plant 2: 146 ekW	24H/24h-12 months per year	0.01	0.4	0.8%	
RF7WST xx	Surface	Roads between F7 and F7_WST (0.8 Km): Unpaved road + Engine	24h/24h - 12 months per year	0.0044	0.3	0.3%	
RF7_xx	Surface	Roads between F7 and Plant 2 (1 Km): Unpaved road + Engine	24h/24h - 12 months per year	0.0027	0.1	0.2%	
RP2_xx	Surface	Roads between Plant 2 and Rail loading (1.2 Km): Unpaved road + Engine	24h/24h - 12 months per year	0.010	0.3	0.8%	
RPK_xx	Surface	road to site main gate by pick-up (3.6 Km)	24h/24h - 12 months per year	0.00014	0.004	0.011%	
DRYER	Point	Dryer located at Plant 2	24h/24h - 12 months per year	0.04	1.2	2.8%	
	Volume	Plant 2 operations before dryer: Unloading/Crushing/Conveyors	24h/24h - 12 months per year				
	Volume	Plant 2 operations after dryer: Conveyors/Screening/Crushing/Loading	24h/24h - 12 months per year				
	Volume	Primary sizer before Main Plant: Unloading/Conveyors/Crushing	24h/24h - 12 months per year				
	Volume	Secondary sizer before Main Plant: Conveyors/Crushing	24h/24h - 12 months per year				
	Volume	Rail loop activities: Conveyor's chute on Sinterfines stockpile	24h/24h - 12 months per year				
	Volume	Rail loop activities: Conveyor's chute on Superfines stockpiles	24h/24h - 12 months per year				
VMP_HDRL	Volume	Rail loop activities: Handling of product to the loading conveyor	24h/24h - 12 months per year	0.06	1.9	4.6%	
	Volume	Rail loop activities: Conveyor's chute into rail cars	24h/24h - 12 months per year				
C1 \N/9 C1 C	Doint	Stack at Main Plant: Winter. Drying Mode, 5 generators @ 75% load + 1 flash dryer + 1 rotary dryer	24h/24h - Oct. to April - Drying Mode	0.89	28.1	67.2%	
S1_W & S1_S	Point	Stack at Main Plant: Summer. No Drying Mode, 3 generators @ 75% load	24h/24h - May to Sept No Drying Mode	0.89	28.1	07.2%	
	Point	10 South Wall Vents - Exhaust flow rates different Winter vs Summer	24h/24h - 12 months per year				
	Point	4 North Wall Vents - Exhaust flow rates different Winter vs Summer	24h/24h - 12 months per year				
	Point	4 Roof Exhausts	24h/24h - 5 months/year (winter)				
	Point	2 drum filter vacuum pumps vents and one pan filter suction blower vent	24h/24h - 12 months per year				
	Point	Dust Collector - Bin vent	24h/24h - 12 months per year				
		Lighting Plants: Magnum MLT3060	24h/24h - 12 months per year	0.002	0.1	0.2%	
		6" Dewatering Pumps: Godwin Dri-Prime CD150M	24h/24h - 12 months per year	0.004	0.1	0.3%	
		Locomotives at rail loop	7 ore train/wk (16h/tr.) 2 freight trains/wk	0.02	0.4	0.86%	
		Accurassay Laboratory	24h/24h - 12 months per year	0.00	0.0	0.0%	

					Hydrocarb	ons
Source ID used for modeling (blank if not modeled)	plank if not Source Type Description of Source		Schedule of operation for modeling	g/s	tonnes/yr	Contribution to the yearly emission total (%)
		HOWSE				
	Volume	Howse Mini Plant operations before dryer: Unloading/Crushing/Conveyors	24h/24h - 7 months/year (summer)			
	Volume	Howse Mini Plant operations after dryer: Conveyors/Screening/Crushing/Loading	24h/24h - 7 months/year (summer)			
	Volume	FN Quarry crushing facility	24h/24h - 7 months/year (summer)			
HOW_Dry	Point	Dryer 1 located at HOWSE Mini Plant	24h/24h - 7 months/year (summer)	0.03	0.5	3.9%
HOW_Dry2	Point	Dryer 2 located at HOWSE Mini Plant	24h/24h - 7 months/year (summer)	0.03	0.5	3.9%
RH_OB_xx	Surface	Roads between Howse pit to OB (2 Km)	24h/24h - 5 months/year (winter)	0.11	1.5	11.4%
RH_WST_xx	Surface	Roads between Howse pit to waste (0.6 Km)	24h/24h - 7 months/year (summer)	0.02	0.3	2.1%
RH_00A, 01 to 11	Surface	Road for Howse Ore/Waste transport from Howse Pit to Howse waste dump (2.4 Km)	24h/24h - 7 months/year (summer)	0.11	2.0	15.1%
RH_12 to 25	Surface	Road for Howse Ore/FN Quarry sand transport (2.8 Km)	24h/24h - 7 months/year (summer)	0.05	1.0	7.7%
RH_26 to 29	Surface	Roads between Howse Pit to Howse MiniPlant (Ore transport) (0.8 Km)-In	24h/24h - 7 months/year (summer)	0.02	0.3	2.2%
RH_30 to 35	Surface	Roads between Howse Pit to Howse MiniPlant (Ore transport) (1.2 Km)-In and Out	24h/24h - 7 months/year (summer)	0.05	0.9	6.6%
RQUA_xx	Surface	First Nations Quarry to main road (10 wheeler) (0.6 Km)	24h/24h - 7 months/year (summer)	0.00005	0.0	0.0%
RFN_xx	Surface	First Nations Quarry to site main gate (10 wheeler) (3.6 Km)	24h/24h - 7 months/year (summer)	0.00029	0.0	0.0%
GENHOW_1	Point	Generator at Howse Mini Plant-2 MW	24H/24h-7 months per year	0.19	3.5	26.9%
GENQUA	Point	Generator at FN quarry crushing facility : CAT 275ekW	24H/24h-7 months per year	0.01	0.1	1.0%
	Volume	HOWSE pit blast	12 months- 1 blast/week in summer and 1 blast/month winter (Total 33 blasts/yr)	0.00	0.0	0.0%
	Surface	HOWSE OB/Waste dump: Unloading/Erosion	24H/24h-12 months per year			
SP_HOW	Surface	Stockpiles of final product, near Howse Mini Plant	24H/24h-12 months per year			
HOWSE	Surface	Howse pit: Drilling/Excavation/Loading/Engines (Truck+2 Excavators +Loader+Drill)	24H/24h-12 months per year	0.08	2.5	19.1%
		-	TOTAL ANNUAL EMISSIONS - HOWSE		13.1	100%
		DSO4 *				
R_KIV_xx	Surface	Ore from DSO4 (hauling trucks) + pickups (9.6 Km)	24h/24h - 12 months per year	0.25	7.8	100%
			TOTAL ANNUAL EMISSIONS - DSO4 *		7.8	100%

^{*} Includes only portion of Goodwood road located within the air quality modeling perimeter for the Howse EIS

Appendix H Annual Fuel Usage Inventory -Detailed Tables of Result

ANNUAL FUEL USAGE - DSO3 / HOWSE / DSO4

For sources located within the Air Quality Modelling Perimeter as part of the Howse Environmental Impact Statement for the CEAA

SUMMARY

Total Diesel Usage (L/year)								
HOWSE	L/yr	DSO3	L/yr	DSO4 and FN Quarry	L/yr			
Howse Mini Plant	21,033,917	MAIN PLANT	26,072,640	Goodwood Road from/to DSO4 (Kivivic Pits) - Hauling trucks and Pickups *	5,012,539			
HOWSE Hauling trucks	3,261,224	Workers' Camp	4,493,880	Diesel Generator at FN Quarry	703,428			
HOWSE Pit Mining Activities	1,151,064	Plant 2	25,973,172	FN Quarry Hauling Trucks (10 wheelers only)	794,128			
		DSO3 Hauling trucks and pickups travels for field personnel	585,143					
		Diesel Generator (157.5 ekW) Batch Plant	439,752					
		Fleming 7N Pit - Mining Activities	920,851					
SUM HOWSE=	25,446,205	SUM DSO3=	58,485,438	SUM DSO4 and FN Quarry	6,510,095			

A- HOWSE ACTIVITIES

	Howse Mini Plant										
Emission Source ID	Description	Unit	Operation schedule	L/HR	HR/YR	L/YR	Notes				
GENHOW_1	2MW Diesel Generator - HOWSE Mini Plant	1	24h/24h - 7 months per year	397	5110	2,028,670	Assumes continuous operation at 100% generator load				
How_Dry	Diesel burner for ore dryer (125 MMBtu/hr)	1	24h/24h - 7 months per year	3719	5110	9,502,624	Assumes an average burner firing rate of 50% over the operating period				
How_Dry2	Diesel burner for ore dryer (125 MMBtu/hr)	1	24h/24h - 7 months per year	3719	5110	9,502,624	Assumes an average burner firing rate of 50% over the operating period				
		_	<u> </u>	<u> </u>	SUM=	21 033 917					

	HOWSE Hauling trucks								
Emission Source ID	Description **	Trips/yr	Speed (km/h)	L/HR	Length of each trip (km)	Time/trip (hr)	Hours for all trips/year	L/YR	
RH_OB_xx	Hauling Trucks - Howse Main road to Howse O.B	211,802	35	78.55	2	0.057	12103	950,688	
RH_WST_xx	Hauling Trucks - Howse Main road to Howse Waste	124,016	35	78.55	0.6	0.017	2126	166,996	
RH_00A, 01 to 11	Hauling Trucks - Howse pit to Howse Main road & Portion of Howse Main road	124016 (Howse pit to waste) 211802 (Howse pit to O.B)	35	78.55	2.4	0.069	10805	848,759	
RH_12 to 25	Howse Main Road (close to Howse Waste) to Main Plant	96,154	35	78.55	2.8	0.08	7692	604,231	
RH_26 to 29	Hauling Trucks - Main Plant to Rail loop	96,154	35	78.55	0.8	0.023	2198	172,637	
RH_30 to 35	Hauling Trucks - Rail loop to Howse Mini Plant	192,308	35	78.55	1.2	0.034	6593	517,912	
** Corresponds to roa	ad segments used in the air modeling study for the Howse EIS						SUM=	3,261,224	

		Howse Pit Mining Equipment G	Group			
Emission Source ID	Description	Units in group	Operation schedule	L/HR/Unit	HR/YR	L/YR
HOWSE	HOWSE Pit Mining Activities	Truck+Excav+Excav+Loader+Drill (5 units)	24h/24h - 12 months per year	26.28	8760	1,151,064
					SUM=	1,151,064

B- DSO3 ACTIVITIES

	MAIN PLANT										
Source of Emission	Description	Unit	Operation schedule	L/HR	HR/YR	L/YR	Notes				
	Gen Set in Drying Mode (2825 ekW each)	5	24h/24h - 7 months/year (Oct. to April)	517	5040	13,023,360	Drying Mode = 5 generators at 75% load				
1_W	Rotary Dryer (61 MMBtu/hr)	1	24h/24h - 7 months/year (Oct. to April)	1710	3600	6,156,000	Assumes continuous operation with the burner at 61 MMBtu/hr (70% of max capacity)				
	Flash Dryer (50 MMBtu/hr)	1	24h/24h - 7 months/year (Oct. to April)	1398	3600	5,032,800	Assumes continuous operation with the burner at 50 MMBtu/hr (68% of max capacity)				
.1_S	Gen Set in No Drying Mode (2825 ekW each)	3	24h/24h - 5 months/year (May to Sept.)	517	3600	1,860,480	No Drying Mode = 3 generators at 75% load				
					SUM=	26,072,640					

	Workers' Camp											
Emission Source ID	Description	Unit	Operation schedule	L/HR	HR/YR	L/YR	Notes					
GENCP_1-2-3	Diesel Generators #1, 2, 3 (275 ekW each)	3	24h/24h - 12 months per year	80.3	8760	2,110,284	Consequatively assumed 100% generator lead and all 4 generators energting continuously					
GENCP_4	Diesel Generator #4 (1000 ekW)	1	24h/24h - 12 months per year	272.1	8760	2,383,596	Conservatively assumes 100% generator load and all 4 generators operating continuously.					
					SUM=	4,493,880						

	Plant 2											
Emission Source ID	Description	Unit	Operation schedule	L/HR	HR/YR	L/YR	Notes					
GENP2_1	2MW Diesel Generator - Plant 2	1	24h/24h - 12 months per year	397	8760	3,477,720	Assumes operation at 75% generator load					
GENMIX	Diesel Generator (182 ekW) Mixer	1	24h/24h - 12 months per year	38.90	8760	340,764	Assumes operation at 80% generator load					
Dryer	Diesel burner for ore dryer (170 MMBtu/hr)	1	24h/24h - 12 months per year	5058	8760	22,154,688	Assumes an average burner firing rate of 50% over the operating period					
					SUM=	25,973,172						

B- DSO3 ACTIVITIES (CONT'D)

	DSO3 Hauling trucks and pickups travels for field personnel											
Emission Source ID	Description **	Trips/yr	Speed (km/h)	L/HR	Length of each trip (km)	Time/trip (hr)	Hours for all trips/year	L/YR				
RF7WST_xx	Hauling Trucks - F7 to O.B/WST	82,682	35	70.66	0.8	0.023	1890	133,539				
RF7_xx	Hauling Trucks - F7 to Plant 2	40,331	35	70.66	1	0.029	1152	81,423				
RP2_xx	Hauling Trucks - Plant 2 to Rail loop	127,418	35	70.66	1.2	0.034	4369	308,686				
Emission Source ID	Description	No of trip/yr	Speed (km/h)	L/Km	Length of each trip (km)	km/year		L/YR				
RPK_xx	Main Plant to site main gate (travelled by pick-ups)	109,500	50	0.156	3.6	394200		61,495				
** Corresponds to roa	* Corresponds to road segments used in the air modeling study for the Howse EIS											

	BATCH PLANT										
Emission Source ID	Description	Unit	Operation schedule	L/HR	HR/YR	L/YR	Notes				
GENBATCH	Diesel Generator (157.5 ekW) Batch Plant	1	24h/24h - 12 months per year	50.2	8760	439,752	Assumes operation at 100% load				
					SUM=	439.752					

Fleming 7N Pit Mining Equipment Group											
Emission Source ID	Description	Description Units in group		L/HR/Unit	HR/YR	L/YR					
F7N	Fleming 7N Pit - Mining Activities	Truck+Excav+Loader+Drill (4 units)	24h/24h - 12 months per year	26.28	8760	920,851					
					SUM=	920,851					

C- DSO4* AND FIRST NATION QUARRY

	Goodwood Road from/to DSO4 (Kivivic Pits) - Hauling trucks and Pickups *											
Emission Source ID	Description	Vehicle Type	Speed (km/h)	L/HR	Length of each trip (km)	No of trip/yr	Time/trip (hr)	Hours for all trips/year	km/year	L/YR		
R KIV xx	R KIV xx Goodwood Road from DSO4 (Kivivic)*	Kivivic Ore Hauling trucks	35	78.55	9.6	230,750	0.274	63291		4,971,542		
N_KIV_XX	Goodwood Road Hoffi D3O4 (KIVIVIC)	Pickups	50	0.156 (L/km)	9.6	27375	0.192		 262800	40,997		
									SUM=	5.012.539		

^{*} Considers transport on the section of the Goodwood Road located within the air quality modeling perimeter only ,which corresponds to a length of 9.6 km. Excludes the additional 11 km (approx) of road to reach DSO4 deposits and excludes DSO4 mining activities

	FN Quarry Diesel Generator										
Emission Source ID	Description	Unit	Operation schedule	L/HR	HR/YR	L/YR	Notes				
GENQUA	Diesel Generator (275 ekW) at FN Quarry	1	24h/24h - 7 months per year	80.3	8760	703,428	Assumes operation at 100% load				
		_	_		SUM=	703,428					

	FN Quarry Hauling Trucks (10 wheelers only)										
Emission Source ID	Description	Speed (km/h)	L/HR	Length of each trip (km)	No of trip/yr	Time/trip (hr)	Hours for all trips/year	L/YR			
RH_12 to 25	Howse Waste to Main Plant	35	45.35	2.8	10,000	0.08	800	36280			
RQUA_xx	FN Quarry to Howse Main road	35	45.35	0.6	10,000	0.017	171	7774			
RFN_xx	Main Plant to site main gate	35	45	4	10,000	0.1029	1,029	46,646			
							SUM=	794,128			