

TECHNICAL MEMORANDUM

DATE January 14, 2022

Project No. 21457143

TO Mr. Shawn Tylee, C.E.T., MBA
Rankin Construction Inc.

CC Natalie Jones, Sean McFarland

FROM Emily Lau

EMAIL Emily_Lau@golder.com

ADDENDUM TO AIR QUALITY IMPACT ASSESSMENT REPORT - PORT COLBORNE QUARRIES INC. PIT 3 EXTENSION

Please find herein an addendum to be read in conjunction with the December 2020 Air Quality Impact Assessment Report (AQIA) for the proposed extension of the existing Port Colborne Quarries to support a Category 2, Class "A" Quarry Below Water license application under the Aggregate Resources Act. This addendum has been completed to address selected Joint Agency Review Team (JART) peer review comments as summarized in Table 1 below. In particular, this addendum includes an assessment of updated operating Scenarios 1 through 4 which reflect the commitment of Port Colborne Quarries Inc. (via the Pit 3 Ext. Site Plans) to eventually relocate the crushing plant onto the existing Pit 3 quarry floor during the initial stages of Extraction Phase 1 of the Pit 3 Ext.

Table 1: JART Comments Addressed in Addendum

Comment ID	Comment	Location in Addendum
3.a.i	Figures to illustrate the receptor grids used for all of the dispersion modelling scenarios should be included in the report.	A figure illustrating the receptor grid for each scenario is provided in Appendix A – Receptor Grid Figures.
3.a.iii	Revise Table A1 and/or Table A2 in Appendix A, to include the same ‘Source identifier’ (ID) numbers for the individual sources, to clarify how the individual sources in listed by ID number in Table A1 relate to the grouping of sources listed in Table A2.	An updated version of Table A2 is provided in Appendix B – Tables A1 and A2.
3.a.iv	Clarify or correct whether the sources listed in Table A2 as ‘PR2’ through ‘SHIPROAD’ should be listed as ‘Volume’ or corrected to be ‘Line Volume’ sources.	This has been corrected to be listed as “Line Volume” sources in the updated version of Table A2 is provided in Appendix B – Tables A1 and A2.
3.b.i	In section 3.2 one example emission rate calculation is shown for the Crush Plant, representing the emissions from haul trucks unloading at the ‘grizzly feeder’. DST understands this is one of components of the crush plant described in section 1.1 of the report. The emission factor that is referenced from the EPA AP42 Table 11.19.2-1 (0.000008 kg/Mg for SPM) is actually not listed in the AP42 table. Also, the reference to the AP42 section 11.19 notes it is dated 2006; however, the most current published date of this section as listed on the EPA’s web site is dated 2004. The example emission rate calculation in this section shows an SPM emission rate of 1.00×10^{-3} g/s, whereas the total emission rate for the crush plant is shown in Table A1 to be 5.84×10^{-1} g/s. It seems apparent from this difference that other emission rate calculations and applicable emission factors contribute to the total emission rate for the crush plant (such as emissions from crushing steps, screening and material transfer). However, these other emission factors are not referenced in the report. Section 3.2 of the report should be revised to include a complete list of all the emission generating activities of the crush plant source, and the respective emission factors referenced for the emission rate calculations. Also, if emission factors for ‘controlled’ sources are referenced, there should be information provided to confirm that the emissions controls that will be used are consistent with the emission factor references.	Detailed emission calculations with clarifications are provided in Appendix C – Emission Calculations.

Comment ID	Comment	Location in Addendum
3.b.ii	In Section 3.3 it states that there are no emissions (such as SPM, PM-10 or PM-2.5) from the wash plant since the material processed is completely saturated. However, in Table A1 emission estimates are provided for this source and in Table A2 source details are listed for it. This section of the report should be revised to show the basis for the emission estimates if the wash plant source is used in the dispersion model scenarios.	Section 3.3 of the AQIA Report is correct, there are no emissions from the wash plant operations. The references to the wash plant have been removed from Tables A1 and A2, provided in Appendix B – Tables A1 and A2.
3.b.iii	In section 3.4 the emission rate calculation for emissions from stockpiles (due to wind erosion) refers to an emission control efficiency of 75%, obtained from Table 9-4 from the WRAP 2006 reference. It should be clarified in the report that this emission reduction applies to an emission control consisting of three-sided enclosures around stockpiles, to shield each stockpile from wind. This emission control should also be specifically mentioned in the BMPP report as a best management practice (BMP) that can be implemented for stockpiles, along with alternate BMPs mentioned in the BMPP report.	A detailed description of the control efficiency is provided in the calculation sheet for Source 3 Stockpile - Wind Erosion provided in Appendix C – Sample Emission Calculations.
3.b.v	In section 3.6, the emission rate calculation for dust emissions from unpaved roads, refers to a referenced emission control efficiency of 75%. This reference was obtained from Table 4 of the reference Australian National Pollutant Inventory, Emission Estimation Technique Manual For Mining, Version 3.1, January 2012. This emission control reference applies to application of water to an unpaved road at a specific application rate. However, section 3.6 indicates the emission control would be achieved due to implementation of a fugitive dust BMPP, including road watering and a speed limit. For clarification, the AQIA report could also refer to the combined use of the two emission controls, watering (55% control) and limiting vehicle speeds (44% control) that are listed in the reference WRAP 2006 Table 6-6. When combined these two control references are approximately equivalent to a 75% control efficiency. These emission controls are specifically mentioned in the BMPP report as BMPs to be implemented for unpaved roads.	A detailed description of the control efficiency is provided in the calculation sheet for Source 5 Unpaved Roads – Fugitive Dust provided in Appendix C – Sample Emission Calculations.
3.b.viii	In section 3.12, the emission rate calculations for combustion emissions from blasting operations are based on use of ammonium nitrate and fuel oil (ANFO) emulsion blend explosives. This section should include an explanation of how the maximum quantity of explosives to be used (6160 kg) was determined for the calculation of the emission rates. Also, if other explosives are to be used in blasting operations, other applicable contaminants (such as ammonia and hydrogen cyanide) should be added to the emissions calculations and air quality assessment.	The rationale for the amount of explosive used in the assessment and description of types of explosive to be used are provided on the calculation sheet for Source 10 Blasting – Combustion Gases provided in Appendix C – Sample Emission Calculations.

Comment ID	Comment	Location in Addendum
3.b.ix	For clarity of the emission rate calculations, a table should be included in the report (such as in Appendix A) to illustrate all of the inputs and outputs of the emission rate calculations. For example it is suggested that the table should list data in columns for each calculation listed in rows, including columns for the source ID number, source descriptive name, emission factor numeric value and units, reference for the emission factor, process/activity rate or quantity used in the calculation, calculated emission rate for the individual activity, and a total emission rate where several individual activity emission rates are combined to form the total emission rate of the source as shown in Table A1.	Updated versions of Table A1 and Table A2 are provided in Appendix B – Tables A1 and A2. Detailed emission calculations are provided in Appendix C – Sample Emission Calculations.
3.d.i	Section 3.1 mentions that in future PCQ may relocate the crushing and washing aggregate processing operations from the current location in Pit 1 area to Pit 3. It is not specifically stated whether the other aggregate processing operations (stockpiling and shipping access/egress routes) would also be relocated to Pit 3. It is stated that the dispersion model scenarios used are all based on the processing operations remaining at the current location. The rationale is that the on-site haul road emission sources have the highest emission rates with the longest length of road, which is the case for the current location of the processing operations. Thus, the rationale states that the model scenarios used are considered more conservative modelling approaches for assessment of the air quality impacts.	The figures, emission calculations and summary tables provided in this addendum consider the relocated crushing plant operations and truck entrance. Dispersion modelling results are summarized in Appendix D – Dispersion Modelling Results.
3.d.ii	DST is of the opinion that a dispersion modelling scenario involving the processing operations located in Pit 3 may generate higher predicted air quality impacts at receptors in the vicinity of Pit 3. This is due to the grouping of emission sources in a smaller overall area, with less distance for dispersion of emissions from all sources combined, even though the haul road sources will have lower emission rates.	The figures, emission calculations and summary tables provided in this addendum consider the relocated crushing plant operations and truck entrance. Dispersion modelling results are summarized in Appendix D – Dispersion Modelling Results.
3.d.iii	Subject to input from the regulatory authorities, an evaluation of air quality impacts associated with a possible future change in the location of the aggregate processing operations may need to be addressed in a separate application for approvals. If the change to the location of the processing operations is part of the current application, a suitably conservative dispersion model scenario should be developed to evaluate air quality impacts for the case of a facility layout where applicable emission sources are relocated to Pit 3.	The figures, emission calculations and summary tables provided in this addendum consider the relocated crushing plant operations and truck entrance. Dispersion modelling results are summarized in Appendix D – Dispersion Modelling Results.

Additional Comments

Blasting Emissions

In addition to the changes noted above in Table 1, the emission estimates for Scenarios 0 through 4 for gases emitted from blasting have been updated to more accurately reflect the composition of the 70% emulsion and 30% ANFO explosive mix used at the quarry. The updated calculation and a description of the methodology is provided in Appendix C – Sample Emission Calculations.

Updated Dispersion Modelling Results

Scenarios 1 through 4 have been updated to consider the relocated crushing plant operations and truck entrance. Similar to the original modelling assessment presented in the December 2020 AQIA Report, the updated maximum predicted cumulative concentrations of some indicator compounds are above the assessment criteria as summarized in Appendix D of this addendum. For all scenarios, the highest concentrations are generally located adjacent to the truck entrance and/or active extraction face. Further refinement and mitigation measures that can be implemented to potentially reduce the maximum predicted cumulative concentrations are discussed in Section 6.0 of the AQIA Report.

Do not hesitate to contact the undersigned if you require further information.

Golder Associates Ltd.



Emily Lau, B.A.Sc., P.Eng.
Air Quality Engineer

EKL/NCJ/ng



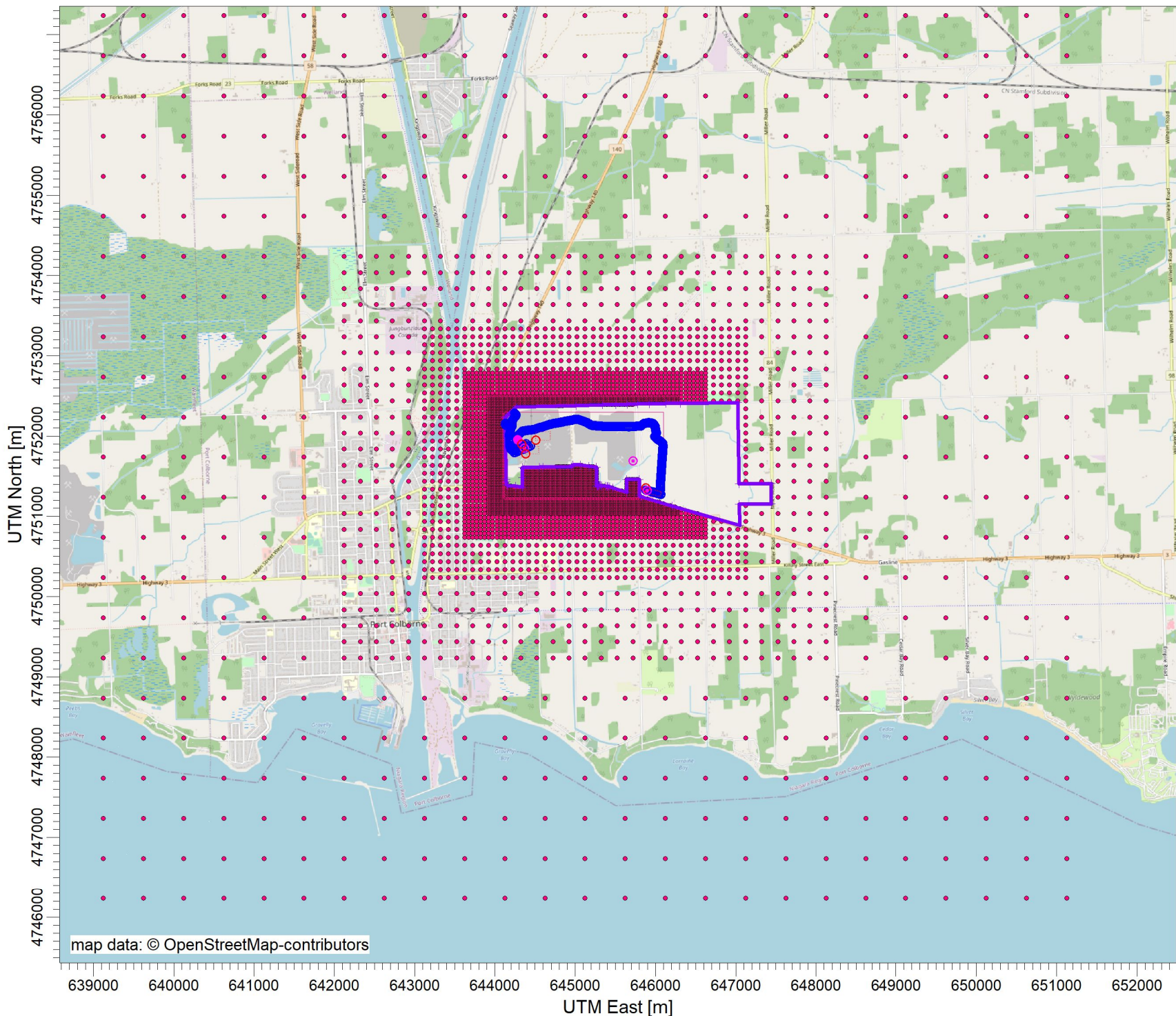
Natalie Jones, B.A.Sc., P.Eng.
Associate Partner, Senior Air Quality Specialist

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APPENDIX A

Receptor Grid Figures

Figure A0 - Scenario 0, Nested Grid Receptors
 Port Colborne Quarries Inc., Pit 3 Extension



LEGEND

-  Property Boundary
-  Nested Grid Receptors
-  Polygonal Area Source
-  Line Volume Source
-  Volume Source

SOURCES:

19

RECEPTORS:

11772

Made By: SLC

Checked By: EKL

DATE:

2022-01-06

SCALE:

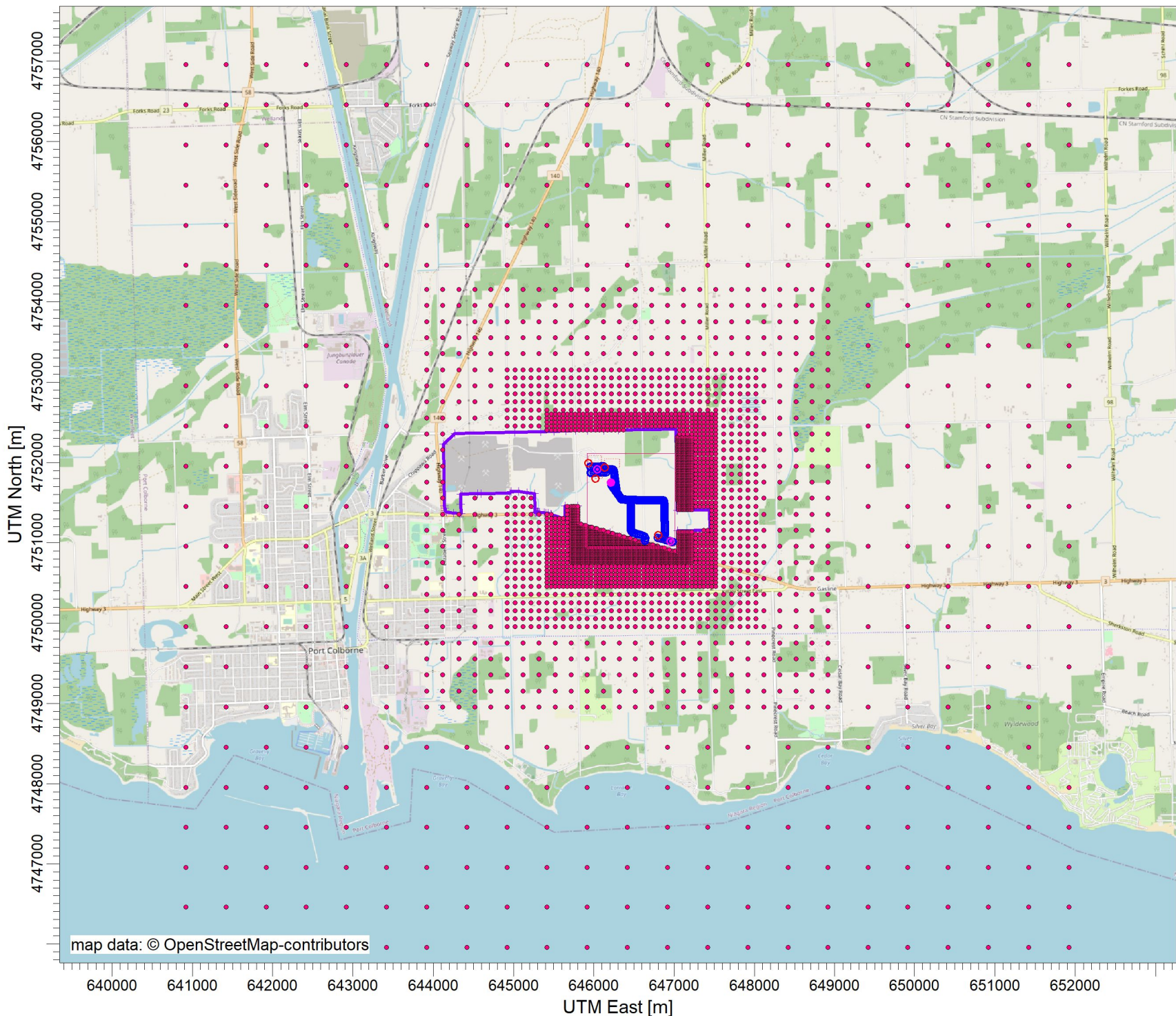
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PROJECT NO.:






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Figure A1 - Scenario 1, Nested Grid Receptors
PORT COLBORNE QUARRIES INC., PIT 3 EXTENSION



map data: © OpenStreetMap-contributors

LEGEND

-  Property Boundary
-  Nested Grid Receptors
-  Polygonal Area Source
-  Line Volume Source
-  Volume Source

SOURCES:

15

RECEPTORS:

8521

Made By: SLC

Checked By: EKL

DATE:

2022-01-06

SCALE:

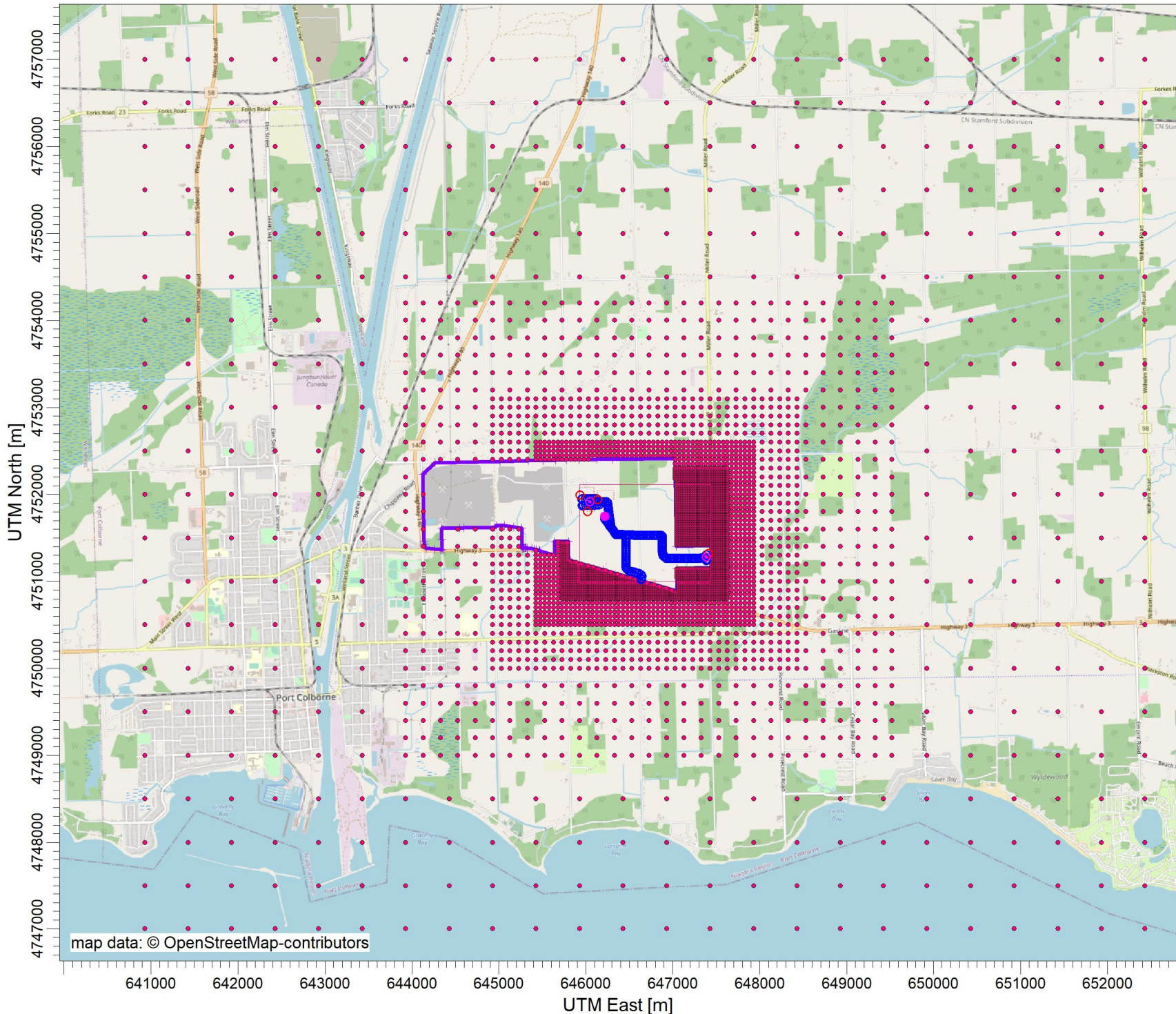
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PROJECT NO.:

21457143

Figure A2 - Scenario 2, Nested Grid Receptors
PORT COLBORNE QUARRIES INC., PIT 3 EXTENSION



LEGEND

-  Property Boundary
-  Nested Grid Receptors
-  Polygonal Area Source
-  Line Volume Source
-  Volume Source

SOURCES:

15

RECEPTORS:

9982

Made By: SLC

Checked By: EKL

DATE:

2022-01-06

SCALE:

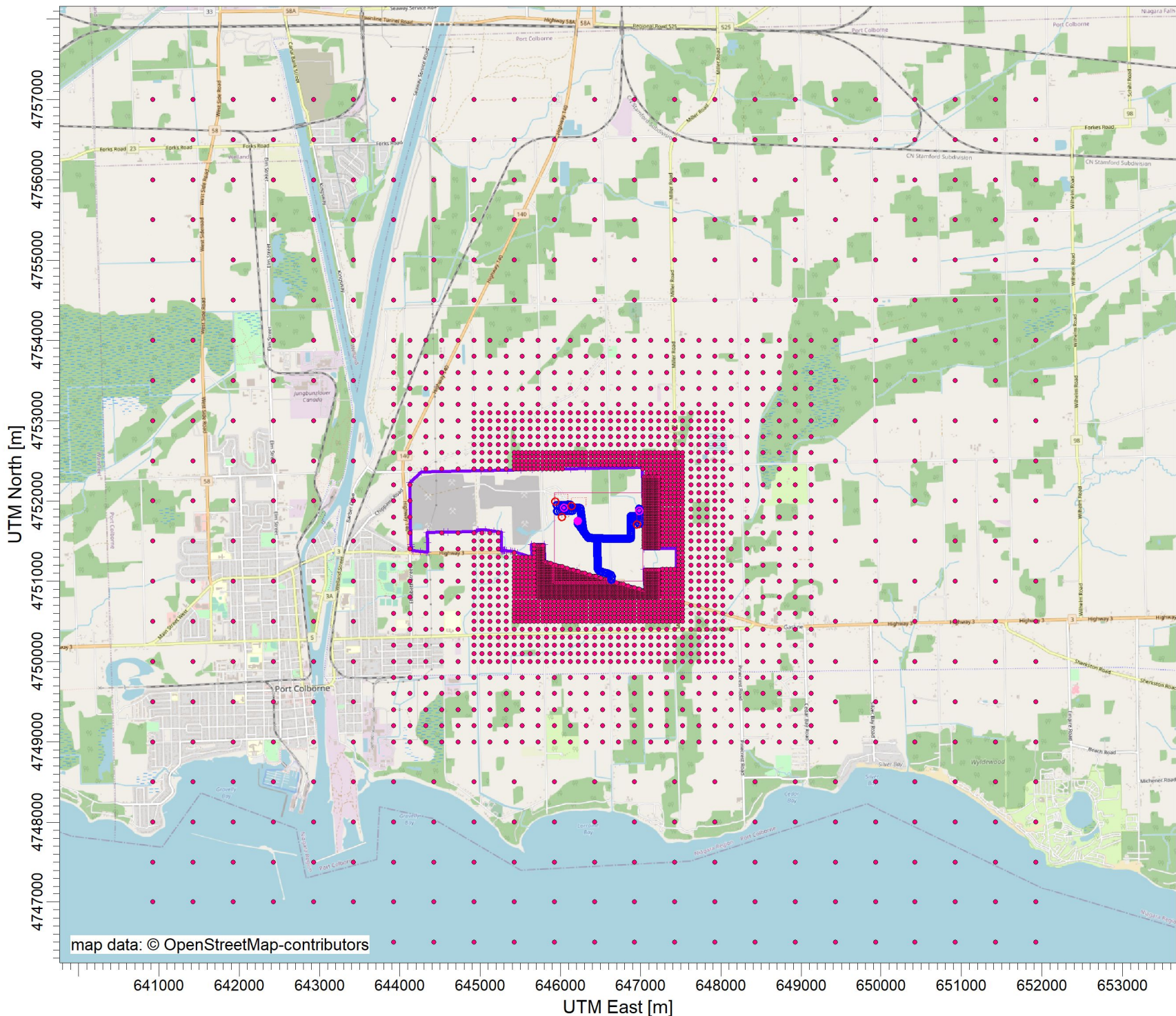
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PROJECT NO.:

21457143

Figure A3 - Scenario 3, Nested Grid Receptors
PORT COLBORNE QUARRIES INC., PIT 3 EXTENSION



LEGEND

-  Property Boundary
-  Nested Grid Receptors
-  Polygonal Area Source
-  Line Volume Source
-  Volume Source

SOURCES:

15

RECEPTORS:

8265

Made By: SLC

Checked By: EKL

DATE:

2022-01-06

SCALE:

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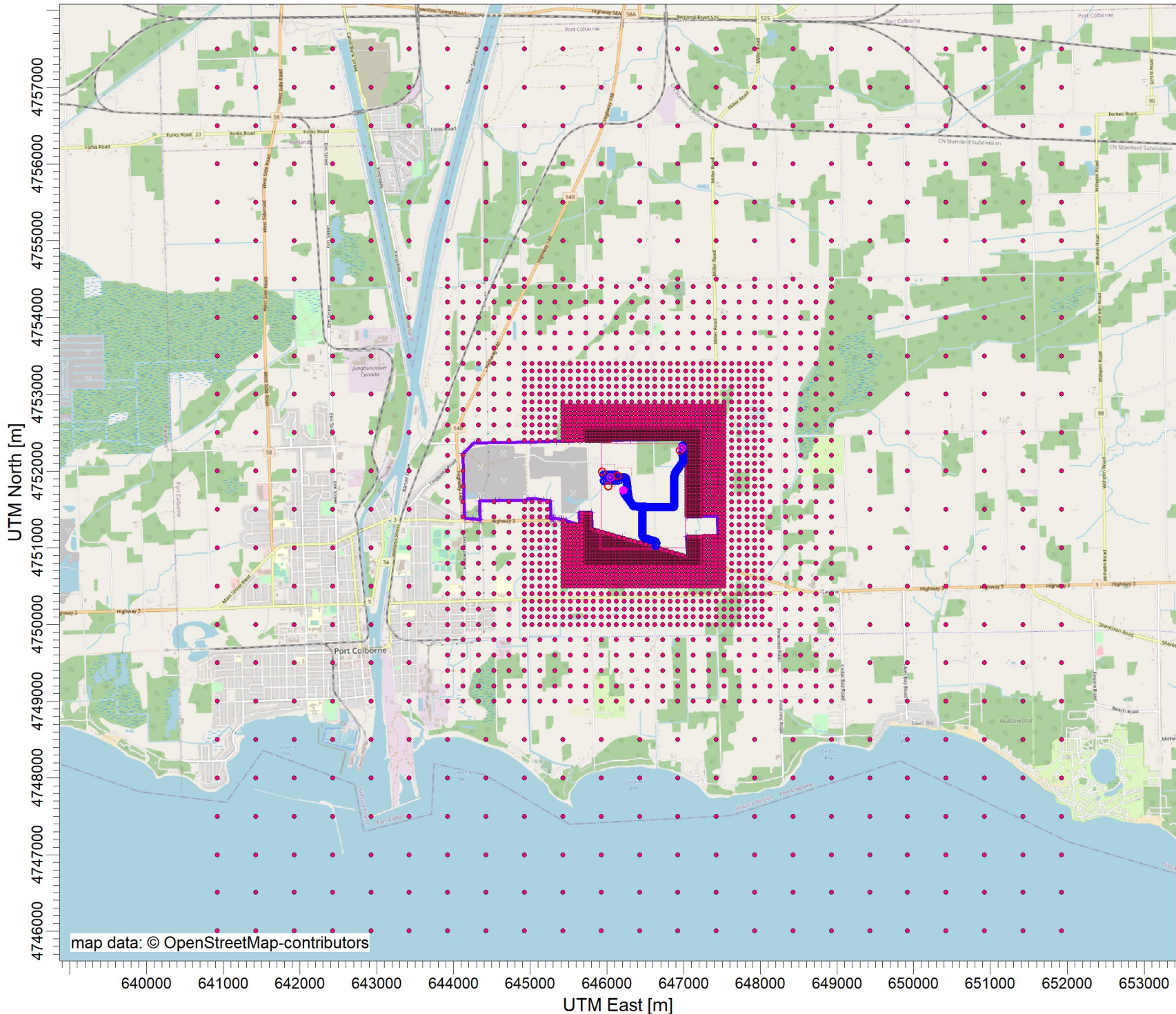


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



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map data: © OpenStreetMap-contributors

Figure A4 - Scenario 4, Nested Grid Receptors
PORT COLBORNE QUARRIES INC., PIT 3 EXTENSION



LEGEND

-  Property Boundary
-  Nested Grid Receptors
-  Polygonal Area Source
-  Line Volume Source
-  Volume Source

SOURCES:

15

RECEPTORS:

9382

Made By: SLC

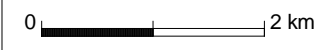
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DATE:

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PROJECT NO.:

21457143

map data: © OpenStreetMap-contributors

APPENDIX B

Tables A1 and A2

**Table A1-Sc0 - Operating Scenario 0 - Existing Operations
Source Summary Table**

Source Identifier	Source Description	Emission Data			
		Contaminant	CAS No.	1-hour Emission Rate [g/s]	24-hour Emission Rate [g/s]
1a	Crushing Plant	SPM	N/A	5.84E-01	—
		PM10	N/A	2.05E-01	—
		PM2.5	N/A	3.12E-02	—
		Crystalline silica	14808-60-7	1.35E-02	—
1b	Crushing Plant Drop Operations	SPM	N/A	see AERMOD Input file for hourly variable emissions	—
		PM10	N/A		—
		PM2.5	N/A		—
		Crystalline silica	14808-60-7		—
3-1	Crusher Stockpiles Wind Erosion	SPM	N/A	1.03E-02	—
		PM10	N/A	5.14E-03	—
		PM2.5	N/A	7.71E-04	—
		Crystalline silica	14808-60-7	3.38E-04	—
3-2	Wash Plant Stockpiles Wind Erosion	SPM	N/A	4.47E-02	—
		PM10	N/A	2.23E-02	—
		PM2.5	N/A	3.35E-03	—
		Crystalline silica	14808-60-7	1.47E-03	—
3-3	West Stockpiles Wind Erosion	SPM	N/A	6.70E-02	—
		PM10	N/A	3.35E-02	—
		PM2.5	N/A	5.02E-03	—
		Crystalline silica	14808-60-7	2.20E-03	—
4-1	Main Site Access	SPM	N/A	1.04E-02	—
		PM10	N/A	1.99E-03	—
		PM2.5	N/A	4.81E-04	—
		Crystalline silica	14808-60-7	1.31E-04	—
4-2	Main Site Egress	SPM	N/A	1.08E-02	—
		PM10	N/A	2.07E-03	—
		PM2.5	N/A	5.00E-04	—
		Crystalline silica	14808-60-7	1.36E-04	—
4-3	Road to Parking Lot	SPM	N/A	3.04E-03	—
		PM10	N/A	5.83E-04	—
		PM2.5	N/A	1.41E-04	—
		Crystalline silica	14808-60-7	3.83E-05	—
4-4	Paved Entrance to Pit	SPM	N/A	1.09E-02	—
		PM10	N/A	2.09E-03	—
		PM2.5	N/A	5.05E-04	—

**Table A1-Sc0 - Operating Scenario 0 - Existing Operations
Source Summary Table**

Source Identifier	Source Description	Emission Data			
		Contaminant	CAS No.	1-hour Emission Rate [g/s]	24-hour Emission Rate [g/s]
		Crystalline silica	14808-60-7	1.37E-04	—
5-1a	Stockpile Area 1 Loader Dust	SPM	N/A	4.53E-01	—
		PM10	N/A	1.15E-01	—
		PM2.5	N/A	1.15E-02	—
		Crystalline silica	14808-60-7	7.58E-03	—
5-1b	Stockpile Area 2 Loader Dust	SPM	N/A	4.47E-01	—
		PM10	N/A	1.14E-01	—
		PM2.5	N/A	1.14E-02	—
		Crystalline silica	14808-60-7	7.48E-03	—
5-2	Shipping Unpaved Road	SPM	N/A	3.30E-01	—
		PM10	N/A	8.42E-02	—
		PM2.5	N/A	8.42E-03	—
		Crystalline silica	14808-60-7	5.54E-03	—
5-3	Haul Road Dust	SPM	N/A	1.19E+01	—
		PM10	N/A	3.02E+00	—
		PM2.5	N/A	3.02E-01	—
		Crystalline silica	14808-60-7	1.99E-01	—
5-4	Extraction Face Loader Road Dust	SPM	N/A	5.38E-01	—
		PM10	N/A	1.37E-01	—
		PM2.5	N/A	1.37E-02	—
		Crystalline silica	14808-60-7	9.01E-03	—
6a-1	Stockpile Area Tailpipe	CO	630-08-0	8.02E-02	—
		SO2	7446-09-5	2.66E-04	—
		SPM	N/A	1.47E-02	—
		PM10	N/A	1.47E-02	—
		PM2.5	N/A	1.43E-02	—
		Nox	10102-44-0	1.42E-01	—
6a-2	Stockpile Area 2 Tailpipe	CO	630-08-0	9.17E-02	—
		SO2	7446-09-5	3.04E-04	—
		SPM	N/A	1.68E-02	—
		PM10	N/A	1.68E-02	—
		PM2.5	N/A	1.63E-02	—
		Nox	10102-44-0	1.62E-01	—
6a-3	Haul Road Non-Road Tail Pipe	CO	630-08-0	8.90E-01	—
		SO2	7446-09-5	1.98E-03	—
		SPM	N/A	1.09E-01	—
		PM10	N/A	1.09E-01	—
		PM2.5	N/A	1.06E-01	—
		Nox	10102-44-0	1.05E+00	—

**Table A1-Sc0 - Operating Scenario 0 - Existing Operations
Source Summary Table**

Source Identifier	Source Description	Emission Data			
		Contaminant	CAS No.	1-hour Emission Rate [g/s]	24-hour Emission Rate [g/s]
6a-4	Extraction Face Tailpipe	CO	630-08-0	4.33E-02	—
		SO2	7446-09-5	6.07E-04	—
		SPM	N/A	7.26E-03	—
		PM10	N/A	7.26E-03	—
		PM2.5	N/A	7.04E-03	—
		Nox	10102-44-0	1.149E-01	—
6a-5	Water Pump - Pit 2	CO	630-08-0	1.43E-02	—
		SO2	7446-09-5	6.99E-05	—
		SPM	N/A	3.90E-03	—
		PM10	N/A	3.90E-03	—
		PM2.5	N/A	3.78E-03	—
		Nox	10102-44-0	3.61E-02	—
6a-6	Water Pump - Pit 3	CO	630-08-0	1.67E-02	—
		SO2	7446-09-5	8.15E-05	—
		SPM	N/A	4.55E-03	—
		PM10	N/A	4.55E-03	—
		PM2.5	N/A	4.41E-03	—
		Nox	10102-44-0	4.21E-02	—
6b-1	Shipping Unpaved Road Tailpipe	CO	630-08-0	1.34E+00	—
		SO2	7446-09-5	7.14E-04	—
		SPM	N/A	8.63E-04	—
		PM10	N/A	8.63E-04	—
		PM2.5	N/A	8.37E-04	—
		Nox	10102-44-0	1.73E-02	—
6b-2	Main Site Access Road Tailpipe	CO	630-08-0	1.34E+00	—
		SO2	7446-09-5	7.14E-04	—
		SPM	N/A	8.63E-04	—
		PM10	N/A	8.63E-04	—
		PM2.5	N/A	8.37E-04	—
		Nox	10102-44-0	1.73E-02	—
6b-3	Main Site Egress Tailpipe	CO	630-08-0	1.34E+00	—
		SO2	7446-09-5	7.14E-04	—
		SPM	N/A	8.63E-04	—
		PM10	N/A	8.63E-04	—
		PM2.5	N/A	8.37E-04	—
		Nox	10102-44-0	1.73E-02	—
6b-4	Road to Parking Lot Tailpipe	CO	630-08-0	2.80E-04	—
		SO2	7446-09-5	2.77E-04	—
		SPM	N/A	2.00E-07	—
		PM10	N/A	2.00E-07	—

**Table A1-Sc0 - Operating Scenario 0 - Existing Operations
Source Summary Table**

Source Identifier	Source Description	Emission Data			
		Contaminant	CAS No.	1-hour Emission Rate [g/s]	24-hour Emission Rate [g/s]
		PM2.5	N/A	1.94E-07	—
		Nox	10102-44-0	1.07E-05	—
6b-5	Paved Entrance to Pit Tailpipe	CO	630-08-0	1.34E+00	—
		SO2	7446-09-5	4.37E-04	—
		SPM	N/A	8.63E-04	—
		PM10	N/A	8.63E-04	—
		PM2.5	N/A	8.37E-04	—
		Nox	10102-44-0	1.73E-02	—
6b-6	Haul Road Passenger Tailpipe	CO	630-08-0	8.35E-04	—
		SO2	7446-09-5	2.77E-04	—
		SPM	N/A	5.97E-07	—
		PM10	N/A	5.97E-07	—
		PM2.5	N/A	5.79E-07	—
		Nox	10102-44-0	3.18E-05	—
7a	Stockpile Material Handling	SPM	N/A	see AERMOD Input file for hourly variable emissions	—
		PM10	N/A		—
		PM2.5	N/A		—
		Crystalline silica	14808-60-7		—
7b	Extraction Face Material Handling	SPM	N/A	see AERMOD Input file for hourly variable emissions	—
		PM10	N/A		—
		PM2.5	N/A		—
		Crystalline silica	14808-60-7		—
8	Blast Hole Drilling	SPM	N/A	1.64E-02	—
		PM10	N/A	7.28E-03	—
		PM2.5	N/A	1.37E-03	—
		Crystalline silica	14808-60-7	4.79E-04	—
9	Quarry Blasting - Particulate	SPM	N/A	1.69E-01	—
		PM10	N/A	8.78E-02	—
		PM2.5	N/A	5.06E-03	—
		Crystalline silica	14808-60-7	5.77E-03	—
10	Quarry Blasting - Combustion Emissions	CO	630-08-0	3.78E+01	—
		SO2	7446-09-5	3.08E-02	5.13E-03
		Nox	10102-44-0	4.35E+00	9.24E-01

**Table A1-Sc1 - Operating Scenario 1
Source Summary Table**

Source Identifier	Source Description	Emission Data			
		Contaminant	CAS No.	1-hour Emission Rate [g/s]	24-hour Emission Rate (Blasting Only) [g/s]
1a	Crushing Plant	SPM	N/A	5.84E-01	—
		PM10	N/A	2.05E-01	—
		PM2.5	N/A	3.12E-02	—
		Crystalline silica	14808-60-7	1.35E-02	—
1b	Crushing Plant Drop Operations	SPM	N/A	see AERMOD Input file for hourly variable emissions	—
		PM10	N/A		—
		PM2.5	N/A		—
		Crystalline silica	14808-60-7		—
3-1	Crusher Stockpiles Wind Erosion	SPM	N/A	1.03E-02	—
		PM10	N/A	5.14E-03	—
		PM2.5	N/A	7.71E-04	—
		Crystalline silica	14808-60-7	3.38E-04	—
3-2	Wash Plant Stockpiles Wind Erosion	SPM	N/A	4.47E-02	—
		PM10	N/A	2.23E-02	—
		PM2.5	N/A	3.35E-03	—
		Crystalline silica	14808-60-7	1.47E-03	—
3-3	West Stockpiles Wind Erosion	SPM	N/A	6.70E-02	—
		PM10	N/A	3.35E-02	—
		PM2.5	N/A	5.02E-03	—
		Crystalline silica	14808-60-7	2.20E-03	—
4-5	Shipping Paved Road (Expansion Phases)	SPM	N/A	5.71E-02	—
		PM10	N/A	1.10E-02	—
		PM2.5	N/A	2.65E-03	—
		Crystalline silica	14808-60-7	7.21E-04	—
5-1a	Stockpile Area 1 Loader Dust	SPM	N/A	4.53E-01	—
		PM10	N/A	1.15E-01	—
		PM2.5	N/A	1.15E-02	—
		Crystalline silica	14808-60-7	7.58E-03	—
5-1b	Stockpile Area 2 Loader Dust	SPM	N/A	4.47E-01	—

**Table A1-Sc1 - Operating Scenario 1
Source Summary Table**

Source Identifier	Source Description	Emission Data			
		Contaminant	CAS No.	1-hour Emission Rate [g/s]	24-hour Emission Rate (Blasting Only) [g/s]
		PM10	N/A	1.14E-01	—
		PM2.5	N/A	1.14E-02	—
		Crystalline silica	14808-60-7	7.48E-03	—
5-3	Haul Road Dust	SPM	N/A	4.91E+00	—
		PM10	N/A	1.25E+00	—
		PM2.5	N/A	1.25E-01	—
		Crystalline silica	14808-60-7	8.22E-02	—
5-4	Extraction Face Loader Road Dust	SPM	N/A	5.38E-01	—
		PM10	N/A	1.37E-01	—
		PM2.5	N/A	1.37E-02	—
		Crystalline silica	14808-60-7	9.01E-03	—
5-5	Shipping Unpaved Road (Expansion Phases)	SPM	N/A	7.83E-01	—
		PM10	N/A	2.00E-01	—
		PM2.5	N/A	2.00E-02	—
		Crystalline silica	14808-60-7	1.31E-02	—
6a-1	Stockpile Area Tailpipe	CO	630-08-0	8.02E-02	—
		SO2	7446-09-5	2.66E-04	—
		SPM	N/A	1.47E-02	—
		PM10	N/A	1.47E-02	—
		PM2.5	N/A	1.43E-02	—
		Nox	10102-44-0	1.42E-01	—
6a-2	Stockpile Area 2 Tailpipe	CO	630-08-0	9.17E-02	—
		SO2	7446-09-5	3.04E-04	—
		SPM	N/A	1.68E-02	—
		PM10	N/A	1.68E-02	—
		PM2.5	N/A	1.63E-02	—
		Nox	10102-44-0	1.62E-01	—
6a-3	Haul Road Non-Road Tail Pipe	CO	630-08-0	8.90E-01	—
		SO2	7446-09-5	1.98E-03	—
		SPM	N/A	1.09E-01	—
		PM10	N/A	1.09E-01	—
		PM2.5	N/A	1.06E-01	—
		Nox	10102-44-0	1.05E+00	—
6a-4	Extraction Face Tailpipe	CO	630-08-0	4.33E-02	—
		SO2	7446-09-5	6.07E-04	—
		SPM	N/A	7.26E-03	—

**Table A1-Sc1 - Operating Scenario 1
Source Summary Table**

Source Identifier	Source Description	Emission Data			
		Contaminant	CAS No.	1-hour Emission Rate [g/s]	24-hour Emission Rate (Blasting Only) [g/s]
		PM10	N/A	7.26E-03	—
		PM2.5	N/A	7.04E-03	—
		Nox	10102-44-0	1.15E-01	—
6a-6	Water Pump - Pit 3	CO	630-08-0	1.67E-02	—
		SO2	7446-09-5	8.15E-05	—
		SPM	N/A	4.55E-03	—
		PM10	N/A	4.55E-03	—
		PM2.5	N/A	4.41E-03	—
		Nox	10102-44-0	4.21E-02	—
6b-6	Haul Road Passenger Tailpipe	CO	630-08-0	3.46E-04	—
		SO2	7446-09-5	2.77E-04	—
		SPM	N/A	2.47E-07	—
		PM10	N/A	2.47E-07	—
		PM2.5	N/A	2.40E-07	—
		Nox	10102-44-0	1.32E-05	—
6b-7	Shipping Paved Road Tailpipe (Expansion Phases)	CO	630-08-0	1.34E+00	—
		SO2	7446-09-5	7.14E-04	—
		SPM	N/A	8.64E-04	—
		PM10	N/A	8.64E-04	—
		PM2.5	N/A	8.38E-04	—
		Nox	10102-44-0	1.73E-02	—
6b-8	Shipping Unpaved Road Tailpipe (Expansion Phases)	CO	630-08-0	1.34E+00	—
		SO2	7446-09-5	7.14E-04	—
		SPM	N/A	8.63E-04	—
		PM10	N/A	8.63E-04	—
		PM2.5	N/A	8.37E-04	—
		Nox	10102-44-0	1.73E-02	—
7a	Stockpile Material Handling	SPM	N/A	see AERMOD Input file for hourly variable emissions	—
		PM10	N/A		—
		PM2.5	N/A		—
		Crystalline silica	14808-60-7		—
7b	Extraction Face Material Handling	SPM	N/A	see AERMOD Input file for hourly variable emissions	—
		PM10	N/A		—
		PM2.5	N/A		—
		Crystalline silica	14808-60-7		—
8	Blast Hole Drilling	SPM	N/A	1.64E-02	—
		PM10	N/A	7.28E-03	—
		PM2.5	N/A	1.37E-03	—

**Table A1-Sc1 - Operating Scenario 1
Source Summary Table**

Source Identifier	Source Description	Emission Data			
		Contaminant	CAS No.	1-hour Emission Rate [g/s]	24-hour Emission Rate (Blasting Only) [g/s]
		Crystalline silica	14808-60-7	4.79E-04	—
9	Quarry Blasting - Particulate	SPM	N/A	1.69E-01	—
		PM10	N/A	8.78E-02	—
		PM2.5	N/A	5.06E-03	—
		Crystalline silica	14808-60-7	5.77E-03	—
10	Quarry Blasting - Combustion Emissions	CO	630-08-0	3.78E+01	—
		SO2	7446-09-5	3.08E-02	5.13E-03
		Nox	10102-44-0	4.35E+00	9.24E-01

**Table A1-Sc2 - Operating Scenario 2
Source Summary Table**

Source Identifier	Source Description	Emission Data			
		Contaminant	CAS No.	1-hour Emission Rate [g/s]	24-hour Emission Rate (Blasting Only) [g/s]
1a	Crushing Plant	SPM	N/A	5.84E-01	—
		PM10	N/A	2.05E-01	—
		PM2.5	N/A	3.12E-02	—
		Crystalline silica	14808-60-7	1.35E-02	—
1b	Crushing Plant Drop Operations	SPM	N/A	see AERMOD Input file for hourly variable emissions	—
		PM10	N/A		—
		PM2.5	N/A		—
		Crystalline silica	14808-60-7		—
3-1	Crusher Stockpiles Wind Erosion	SPM	N/A	1.03E-02	—
		PM10	N/A	5.14E-03	—
		PM2.5	N/A	7.71E-04	—
		Crystalline silica	14808-60-7	3.38E-04	—
3-2	Wash Plant Stockpiles Wind Erosion	SPM	N/A	4.47E-02	—
		PM10	N/A	2.23E-02	—
		PM2.5	N/A	3.35E-03	—
		Crystalline silica	14808-60-7	1.47E-03	—
3-3	West Stockpiles Wind Erosion	SPM	N/A	6.70E-02	—
		PM10	N/A	3.35E-02	—
		PM2.5	N/A	5.02E-03	—
		Crystalline silica	14808-60-7	2.20E-03	—
4-5	Shipping Paved Road (Expansion Phases)	SPM	N/A	5.71E-02	—
		PM10	N/A	1.10E-02	—
		PM2.5	N/A	2.65E-03	—
		Crystalline silica	14808-60-7	7.21E-04	—
5-1a	Stockpile Area 1 Loader Dust	SPM	N/A	4.53E-01	—
		PM10	N/A	1.15E-01	—
		PM2.5	N/A	1.15E-02	—
		Crystalline silica	14808-60-7	7.58E-03	—
5-1b	Stockpile Area 2 Loader Dust	SPM	N/A	4.47E-01	—
		PM10	N/A	1.14E-01	—
		PM2.5	N/A	1.14E-02	—

**Table A1-Sc2 - Operating Scenario 2
Source Summary Table**

Source Identifier	Source Description	Emission Data			
		Contaminant	CAS No.	1-hour Emission Rate [g/s]	24-hour Emission Rate (Blasting Only) [g/s]
		Crystalline silica	14808-60-7	7.48E-03	—
5-3	Haul Road Dust	SPM	N/A	6.10E+00	—
		PM10	N/A	1.55E+00	—
		PM2.5	N/A	1.55E-01	—
		Crystalline silica	14808-60-7	1.02E-01	—
5-4	Extraction Face Loader Road Dust	SPM	N/A	5.38E-01	—
		PM10	N/A	1.37E-01	—
		PM2.5	N/A	1.37E-02	—
		Crystalline silica	14808-60-7	9.01E-03	—
5-5	Shipping Unpaved Road (Expansion Phases)	SPM	N/A	7.83E-01	—
		PM10	N/A	2.00E-01	—
		PM2.5	N/A	2.00E-02	—
		Crystalline silica	14808-60-7	1.31E-02	—
6a-1	Stockpile Area Tailpipe	CO	630-08-0	8.02E-02	—
		SO2	7446-09-5	2.66E-04	—
		SPM	N/A	1.47E-02	—
		PM10	N/A	1.47E-02	—
		PM2.5	N/A	1.43E-02	—
		Nox	10102-44-0	1.42E-01	—
6a-2	Stockpile Area 2 Tailpipe	CO	630-08-0	9.17E-02	—
		SO2	7446-09-5	3.04E-04	—
		SPM	N/A	1.68E-02	—
		PM10	N/A	1.68E-02	—
		PM2.5	N/A	1.63E-02	—
		Nox	10102-44-0	1.62E-01	—
6a-3	Haul Road Non-Road Tail Pipe	CO	630-08-0	8.90E-01	—
		SO2	7446-09-5	1.98E-03	—
		SPM	N/A	1.09E-01	—
		PM10	N/A	1.09E-01	—
		PM2.5	N/A	1.06E-01	—
		Nox	10102-44-0	1.05E+00	—
6a-4	Extraction Face Tailpipe	CO	630-08-0	4.33E-02	—
		SO2	7446-09-5	6.07E-04	—
		SPM	N/A	7.26E-03	—
		PM10	N/A	7.26E-03	—
		PM2.5	N/A	7.04E-03	—

**Table A1-Sc2 - Operating Scenario 2
Source Summary Table**

Source Identifier	Source Description	Emission Data			
		Contaminant	CAS No.	1-hour Emission Rate [g/s]	24-hour Emission Rate (Blasting Only) [g/s]
		Nox	10102-44-0	1.15E-01	—
6a-6	Water Pump - Pit 3	CO	630-08-0	1.67E-02	—
		SO2	7446-09-5	8.15E-05	—
		SPM	N/A	4.55E-03	—
		PM10	N/A	4.55E-03	—
		PM2.5	N/A	4.41E-03	—
		Nox	10102-44-0	4.21E-02	—
6b-6	Haul Road Passenger Tailpipe	CO	630-08-0	4.30E-04	—
		SO2	7446-09-5	2.77E-04	—
		SPM	N/A	3.07E-07	—
		PM10	N/A	3.07E-07	—
		PM2.5	N/A	2.98E-07	—
		Nox	10102-44-0	1.64E-05	—
6b-7	Shipping Paved Road Tailpipe (Expansion Phases)	CO	630-08-0	1.34E+00	—
		SO2	7446-09-5	7.14E-04	—
		SPM	N/A	8.64E-04	—
		PM10	N/A	8.64E-04	—
		PM2.5	N/A	8.38E-04	—
		Nox	10102-44-0	1.73E-02	—
6b-8	Shipping Unpaved Road Tailpipe (Expansion Phases)	CO	630-08-0	1.34E+00	—
		SO2	7446-09-5	7.14E-04	—
		SPM	N/A	8.63E-04	—
		PM10	N/A	8.63E-04	—
		PM2.5	N/A	8.37E-04	—
		Nox	10102-44-0	1.73E-02	—
7a	Stockpile Material Handling	SPM	N/A	see AERMOD Input file for hourly variable emissions	—
		PM10	N/A		—
		PM2.5	N/A		—
		Crystalline silica	14808-60-7		—
7b	Extraction Face Material Handling	SPM	N/A	see AERMOD Input file for hourly variable emissions	—
		PM10	N/A		—
		PM2.5	N/A		—
		Crystalline silica	14808-60-7		—
8	Blast Hole Drilling	SPM	N/A	1.64E-02	—
		PM10	N/A	7.28E-03	—
		PM2.5	N/A	1.37E-03	—
		Crystalline silica	14808-60-7	4.79E-04	—

**Table A1-Sc2 - Operating Scenario 2
Source Summary Table**

Source Identifier	Source Description	Emission Data			
		Contaminant	CAS No.	1-hour Emission Rate [g/s]	24-hour Emission Rate (Blasting Only) [g/s]
9	Quarry Blasting - Particulate	SPM	N/A	1.69E-01	—
		PM10	N/A	8.78E-02	—
		PM2.5	N/A	5.06E-03	—
		Crystalline silica	14808-60-7	5.77E-03	—
10	Quarry Blasting - Combustion Emissions	CO	630-08-0	3.78E+01	—
		SO2	7446-09-5	3.08E-02	5.13E-03
		Nox	10102-44-0	4.35E+00	9.24E-01

**Table A1-Sc3 - Operating Scenario 3
Source Summary Table**

Source Identifier	Source Description	Emission Data			
		Contaminant	CAS No.	1-hour Emission Rate [g/s]	24-hour Emission Rate (Blasting Only) [g/s]
1a	Crushing Plant	SPM	N/A	5.84E-01	—
		PM10	N/A	2.05E-01	—
		PM2.5	N/A	3.12E-02	—
		Crystalline silica	14808-60-7	1.35E-02	—
1b	Crushing Plant Drop Operations	SPM	N/A	see AERMOD Input file for hourly variable emissions	—
		PM10	N/A		—
		PM2.5	N/A		—
		Crystalline silica	14808-60-7		—
3-1	Crusher Stockpiles Wind Erosion	SPM	N/A	1.03E-02	—
		PM10	N/A	5.14E-03	—
		PM2.5	N/A	7.71E-04	—
		Crystalline silica	14808-60-7	3.38E-04	—
3-2	Wash Plant Stockpiles Wind Erosion	SPM	N/A	4.47E-02	—
		PM10	N/A	2.23E-02	—
		PM2.5	N/A	3.35E-03	—
		Crystalline silica	14808-60-7	1.47E-03	—
3-3	West Stockpiles Wind Erosion	SPM	N/A	6.70E-02	—
		PM10	N/A	3.35E-02	—
		PM2.5	N/A	5.02E-03	—
		Crystalline silica	14808-60-7	2.20E-03	—
4-5	Shipping Paved Road (Expansion Phases)	SPM	N/A	5.71E-02	—
		PM10	N/A	1.10E-02	—
		PM2.5	N/A	2.65E-03	—
		Crystalline silica	14808-60-7	7.21E-04	—
5-1a	Stockpile Area 1 Loader Dust	SPM	N/A	4.53E-01	—
		PM10	N/A	1.15E-01	—
		PM2.5	N/A	1.15E-02	—
		Crystalline silica	14808-60-7	7.58E-03	—
5-1b	Stockpile Area 2 Loader Dust	SPM	N/A	4.47E-01	—
		PM10	N/A	1.14E-01	—
		PM2.5	N/A	1.14E-02	—

**Table A1-Sc3 - Operating Scenario 3
Source Summary Table**

Source Identifier	Source Description	Emission Data			
		Contaminant	CAS No.	1-hour Emission Rate [g/s]	24-hour Emission Rate (Blasting Only) [g/s]
		Crystalline silica	14808-60-7	7.48E-03	—
5-3	Haul Road Dust	SPM	N/A	4.59E+00	—
		PM10	N/A	1.17E+00	—
		PM2.5	N/A	1.17E-01	—
		Crystalline silica	14808-60-7	7.70E-02	—
5-4	Extraction Face Loader Road Dust	SPM	N/A	5.38E-01	—
		PM10	N/A	1.37E-01	—
		PM2.5	N/A	1.37E-02	—
		Crystalline silica	14808-60-7	9.01E-03	—
5-5	Shipping Unpaved Road (Expansion Phases)	SPM	N/A	7.83E-01	—
		PM10	N/A	2.00E-01	—
		PM2.5	N/A	2.00E-02	—
		Crystalline silica	14808-60-7	1.31E-02	—
6a-1	Stockpile Area Tailpipe	CO	630-08-0	8.02E-02	—
		SO2	7446-09-5	2.66E-04	—
		SPM	N/A	1.47E-02	—
		PM10	N/A	1.47E-02	—
		PM2.5	N/A	1.43E-02	—
		Nox	10102-44-0	1.42E-01	—
6a-2	Stockpile Area 2 Tailpipe	CO	630-08-0	9.17E-02	—
		SO2	7446-09-5	3.04E-04	—
		SPM	N/A	1.68E-02	—
		PM10	N/A	1.68E-02	—
		PM2.5	N/A	1.63E-02	—
		Nox	10102-44-0	1.62E-01	—
6a-3	Haul Road Non-Road Tail Pipe	CO	630-08-0	8.90E-01	—
		SO2	7446-09-5	1.98E-03	—
		SPM	N/A	1.09E-01	—
		PM10	N/A	1.09E-01	—
		PM2.5	N/A	1.06E-01	—
		Nox	10102-44-0	1.05E+00	—
6a-4	Extraction Face Tailpipe	CO	630-08-0	4.33E-02	—
		SO2	7446-09-5	6.07E-04	—
		SPM	N/A	7.26E-03	—
		PM10	N/A	7.26E-03	—

**Table A1-Sc3 - Operating Scenario 3
Source Summary Table**

Source Identifier	Source Description	Emission Data			
		Contaminant	CAS No.	1-hour Emission Rate [g/s]	24-hour Emission Rate (Blasting Only) [g/s]
		PM2.5	N/A	7.04E-03	—
		Nox	10102-44-0	1.15E-01	—
6a-6	Water Pump - Pit 3	CO	630-08-0	1.67E-02	—
		SO2	7446-09-5	8.15E-05	—
		SPM	N/A	4.55E-03	—
		PM10	N/A	4.55E-03	—
		PM2.5	N/A	4.41E-03	—
		Nox	10102-44-0	4.21E-02	—
6b-6	Haul Road Passenger Tailpipe	CO	630-08-0	3.24E-04	—
		SO2	7446-09-5	2.77E-04	—
		SPM	N/A	2.31E-07	—
		PM10	N/A	2.31E-07	—
		PM2.5	N/A	2.24E-07	—
		Nox	10102-44-0	1.23E-05	—
6b-7	Shipping Paved Road Tailpipe (Expansion Phases)	CO	630-08-0	1.34E+00	—
		SO2	7446-09-5	7.14E-04	—
		SPM	N/A	8.64E-04	—
		PM10	N/A	8.64E-04	—
		PM2.5	N/A	8.38E-04	—
		Nox	10102-44-0	1.73E-02	—
6b-8	Shipping Unpaved Road Tailpipe (Expansion Phases)	CO	630-08-0	1.34E+00	—
		SO2	7446-09-5	7.14E-04	—
		SPM	N/A	8.63E-04	—
		PM10	N/A	8.63E-04	—
		PM2.5	N/A	8.37E-04	—
		Nox	10102-44-0	1.73E-02	—
7a	Stockpile Material Handling	SPM	N/A	see AERMOD Input file for hourly variable emissions	—
		PM10	N/A		—
		PM2.5	N/A		—
		Crystalline silica	14808-60-7		—
7b	Extraction Face Material Handling	SPM	N/A	see AERMOD Input file for hourly variable	—
		PM10	N/A		—

**Table A1-Sc3 - Operating Scenario 3
Source Summary Table**

Source Identifier	Source Description	Emission Data			
		Contaminant	CAS No.	1-hour Emission Rate [g/s]	24-hour Emission Rate (Blasting Only) [g/s]
		PM2.5	N/A	hourly variable emissions	—
		Crystalline silica	14808-60-7		—
8	Blast Hole Drilling	SPM	N/A	1.64E-02	—
		PM10	N/A	7.28E-03	—
		PM2.5	N/A	1.37E-03	—
		Crystalline silica	14808-60-7	4.79E-04	—
9	Quarry Blasting - Particulate	SPM	N/A	1.69E-01	—
		PM10	N/A	8.78E-02	—
		PM2.5	N/A	5.06E-03	—
		Crystalline silica	14808-60-7	5.77E-03	—
10	Quarry Blasting - Combustion Emissions	CO	630-08-0	3.78E+01	—
		SO2	7446-09-5	3.08E-02	5.13E-03
		Nox	10102-44-0	4.35E+00	9.24E-01

**Table A1-Sc4 - Operating Scenario 4
Source Summary Table**

Source Identifier	Source Description	Emission Data			
		Contaminant	CAS No.	1-hour Emission Rate [g/s]	24-hour Emission Rate (Blasting Only) [g/s]
1a	Crushing Plant	SPM	N/A	5.84E-01	—
		PM10	N/A	2.05E-01	—
		PM2.5	N/A	3.12E-02	—
		Crystalline silica	14808-60-7	1.35E-02	—
1b	Crushing Plant Drop Operations	SPM	N/A	see AERMOD Input file for hourly variable emissions	—
		PM10	N/A		—
		PM2.5	N/A		—
		Crystalline silica	14808-60-7		—
3-1	Crusher Stockpiles Wind Erosion	SPM	N/A	1.03E-02	—
		PM10	N/A	5.14E-03	—
		PM2.5	N/A	7.71E-04	—
		Crystalline silica	14808-60-7	3.38E-04	—
3-2	Wash Plant Stockpiles Wind Erosion	SPM	N/A	4.47E-02	—
		PM10	N/A	2.23E-02	—
		PM2.5	N/A	3.35E-03	—
		Crystalline silica	14808-60-7	1.47E-03	—
3-3	West Stockpiles Wind Erosion	SPM	N/A	6.70E-02	—
		PM10	N/A	3.35E-02	—
		PM2.5	N/A	5.02E-03	—
		Crystalline silica	14808-60-7	2.20E-03	—
4-5	Shipping Paved Road (Expansion Phases)	SPM	N/A	5.71E-02	—
		PM10	N/A	1.10E-02	—
		PM2.5	N/A	2.65E-03	—
		Crystalline silica	14808-60-7	7.21E-04	—
5-1a	Stockpile Area 1 Loader Dust	SPM	N/A	4.53E-01	—
		PM10	N/A	1.15E-01	—
		PM2.5	N/A	1.15E-02	—
		Crystalline silica	14808-60-7	7.58E-03	—
5-1b	Stockpile Area 2 Loader Dust	SPM	N/A	4.47E-01	—
		PM10	N/A	1.14E-01	—
		PM2.5	N/A	1.14E-02	—
		Crystalline silica	14808-60-7	7.48E-03	—
5-3	Haul Road Dust	SPM	N/A	6.54E+00	—

**Table A1-Sc4 - Operating Scenario 4
Source Summary Table**

Source Identifier	Source Description	Emission Data			
		Contaminant	CAS No.	1-hour Emission Rate [g/s]	24-hour Emission Rate (Blasting Only) [g/s]
		PM10	N/A	1.67E+00	—
		PM2.5	N/A	1.67E-01	—
		Crystalline silica	14808-60-7	1.10E-01	—
5-4	Extraction Face Loader Road Dust	SPM	N/A	5.38E-01	—
		PM10	N/A	1.37E-01	—
		PM2.5	N/A	1.37E-02	—
		Crystalline silica	14808-60-7	9.01E-03	—
5-5	Shipping Unpaved Road (Expansion Phases)	SPM	N/A	7.83E-01	—
		PM10	N/A	2.00E-01	—
		PM2.5	N/A	2.00E-02	—
		Crystalline silica	14808-60-7	1.31E-02	—
6a-1	Stockpile Area Tailpipe	CO	630-08-0	8.02E-02	—
		SO2	7446-09-5	2.66E-04	—
		SPM	N/A	1.47E-02	—
		PM10	N/A	1.47E-02	—
		PM2.5	N/A	1.429E-02	—
		Nox	10102-44-0	1.42E-01	—
6a-2	Stockpile Area 2 Tailpipe	CO	630-08-0	9.17E-02	—
		SO2	7446-09-5	3.04E-04	—
		SPM	N/A	1.68E-02	—
		PM10	N/A	1.68E-02	—
		PM2.5	N/A	1.632E-02	—
		Nox	10102-44-0	1.62E-01	—
6a-3	Haul Road Non-Road Tail Pipe	CO	630-08-0	8.895E-01	—
		SO2	7446-09-5	1.978E-03	—
		SPM	N/A	1.093E-01	—
		PM10	N/A	1.093E-01	—
		PM2.5	N/A	1.061E-01	—
		Nox	10102-44-0	1.052E+00	—
6a-4	Extraction Face Tailpipe	CO	630-08-0	4.33E-02	—
		SO2	7446-09-5	6.068E-04	—
		SPM	N/A	7.2551E-03	—
		PM10	N/A	7.26E-03	—
		PM2.5	N/A	7.04E-03	—
		Nox	10102-44-0	1.149E-01	—

**Table A1-Sc4 - Operating Scenario 4
Source Summary Table**

Source Identifier	Source Description	Emission Data			
		Contaminant	CAS No.	1-hour Emission Rate [g/s]	24-hour Emission Rate (Blasting Only) [g/s]
6a-6	Water Pump - Pit 3	CO	630-08-0	1.67E-02	—
		SO2	7446-09-5	8.154E-05	—
		SPM	N/A	4.5499E-03	—
		PM10	N/A	4.55E-03	—
		PM2.5	N/A	4.41E-03	—
		Nox	10102-44-0	4.214E-02	—
6b-6	Haul Road Passenger Tailpipe	CO	630-08-0	4.606E-04	—
		SO2	7446-09-5	2.774E-04	—
		SPM	N/A	3.290E-07	—
		PM10	N/A	3.290E-07	—
		PM2.5	N/A	3.191E-07	—
		Nox	10102-44-0	1.755E-05	—
6b-7	Shipping Paved Road Tailpipe (Expansion Phases)	CO	630-08-0	1.339E+00	—
		SO2	7446-09-5	7.144E-04	—
		SPM	N/A	8.640E-04	—
		PM10	N/A	8.640E-04	—
		PM2.5	N/A	8.381E-04	—
		Nox	10102-44-0	1.731E-02	—
6b-8	Shipping Unpaved Road Tailpipe (Expansion Phases)	CO	630-08-0	1.338E+00	—
		SO2	7446-09-5	7.144E-04	—
		SPM	N/A	8.633E-04	—
		PM10	N/A	8.633E-04	—
		PM2.5	N/A	8.374E-04	—
		Nox	10102-44-0	1.727E-02	—
7a	Stockpile Material Handling	SPM	N/A	see AERMOD Input file for hourly variable emissions	—
		PM10	N/A		—
		PM2.5	N/A		—
		Crystalline silica	14808-60-7		—
7b	Extraction Face Material Handling	SPM	N/A	see AERMOD Input file for hourly variable emissions	—
		PM10	N/A		—
		PM2.5	N/A		—
		Crystalline silica	14808-60-7		—

**Table A1-Sc4 - Operating Scenario 4
Source Summary Table**

Source Identifier	Source Description	Emission Data			
		Contaminant	CAS No.	1-hour Emission Rate [g/s]	24-hour Emission Rate (Blasting Only) [g/s]
8	Blast Hole Drilling	SPM	N/A	1.6389E-02	—
		PM10	N/A	7.28E-03	—
		PM2.5	N/A	1.37E-03	—
		Crystalline silica	14808-60-7	4.79E-04	—
9	Quarry Blasting - Particulate	SPM	N/A	1.688E-01	—
		PM10	N/A	8.777E-02	—
		PM2.5	N/A	5.064E-03	—
		Crystalline silica	14808-60-7	5.77E-03	—
10	Quarry Blasting - Combustion Emissions	CO	630-08-0	3.78E+01	—
		SO2	7446-09-5	3.08E-02	5.13E-03
		Nox	10102-44-0	4.35E+00	9.24E-01

**Table A2-Sc0 - Operating Scenario 0 - Existing Operations
Dispersion Modelling Source Summary Table**

Modelling ID	Source ID(s)	Source Type	Modelling Source Data						Emissions Data			
			Length [m]	Width [m]	Initial Vertical Dimension	Area	Release Height [m]	Source Coordinates (x,y) [m]	Contaminant	CAS No.	Maximum Emission Rate [g/s-m ²]	
											1-hour	24-hour
CRSHWIND	3-1	Area	88.5	37.44	2.09	3313.44	4.50	644332.76, 4751898.15	SPM	N/A	3.10E-06	—
									PM10	N/A	1.55E-06	—
									PM2.5	N/A	2.33E-07	—
									Crystalline silica	14808-60-7	1.02E-07	—
WASHWIND	3-2	Area	162.02	93.94	2.09	15220.2	4.50	644384.50, 4751778.34	SPM	N/A	2.94E-06	—
									PM10	N/A	1.47E-06	—
									PM2.5	N/A	2.20E-07	—
									Crystalline silica	14808-60-7	9.65E-08	—
WESTWIND	3-3	Area	184.8	104.81	2.09	19368.9	4.50	644507.67, 4751950.96	SPM	N/A	3.46E-06	—
									PM10	N/A	1.73E-06	—
									PM2.5	N/A	2.59E-07	—
									Crystalline silica	14808-60-7	1.14E-07	—
BLAST	9, 10	Areapoly	N/A	N/A	N/A	12509.1	1.00	645882.29, 4751356.10	NOx	10102-44-0	3.47E-04	7.39E-05
									SPM	N/A	1.35E-05	—
									PM10	N/A	7.02E-06	—
									PM2.5	N/A	4.05E-07	—
									SO2	7446-09-5	2.46E-06	4.10E-07
									CO	630-08-0	3.02E-03	—
									Crystalline silica	14808-60-7	4.61E-07	—
Modelling ID	Source ID(s)	Source Type	Number of Volume Sources	Initial Lateral Dimension	Initial Vertical Dimension	Length of Side [m]	Release Height [m]	Source Coordinates (x,y) [m]	Contaminant	CAS No.	Maximum Emission Rate [g/s]	
											1-hour	24-hour
CRUSH	1a	Volume	1	10.33	7.77	44.44	8.35	644286.30, 4751955.64	SPM	N/A	5.84E-01	—
									PM10	N/A	2.05E-01	—
									PM2.5	N/A	3.12E-02	—
									Crystalline silica	14808-60-7	1.35E-02	—
CRSHDRP	1b	Volume	1	10.33	7.77	44.44	8.35	644286.30, 4751955.64	SPM	N/A	see AERMOD Input file for hourly variable emissions	—
									PM10	N/A		—
									PM2.5	N/A		—
									Crystalline silica	14808-60-7		—
SHPTRCK	7a	Volume	1	0.47	0.40	2.00	2.60	644368.96, 4751851.28	SPM	N/A	see AERMOD Input file for hourly variable emissions	—
									PM10	N/A		—
									PM2.5	N/A		—
									Crystalline silica	14808-60-7		—

**Table A2-Sc0 - Operating Scenario 0 - Existing Operations
Dispersion Modelling Source Summary Table**

Modelling ID	Source ID(s)	Source Type	Number of Volume Sources	Initial Lateral Dimension	Initial Vertical Dimension	Length of Side [m]	Release Height [m]	Source Coordinates (x,y) [m]	Contaminant	CAS No.	Maximum Emission Rate [g/s]	
											1-hour	24-hour
PR1	4-1, 6b-2	Line Volume	11	4.01	2.13	N/A	2.29	see AERMOD input file for coordinates of each volume source	NOx	10102-44-0	1.73E-02	—
									SPM	N/A	1.12E-02	—
									PM10	N/A	2.85E-03	—
									PM2.5	N/A	1.32E-03	—
									SO2	7446-09-5	7.14E-04	—
									CO	630-08-0	1.34E+00	—
PR2	4-2, 6b-3	Line Volume	11	4.01	2.13	N/A	2.29	see AERMOD input file for coordinates of each volume source	NOx	10102-44-0	1.73E-02	—
									SPM	N/A	1.16E-02	—
									PM10	N/A	2.93E-03	—
									PM2.5	N/A	1.34E-03	—
									SO2	7446-09-5	7.14E-04	—
									CO	630-08-0	1.34E+00	—
PR3	4-3, 6b-4	Line Volume	14	6.33	1.52	N/A	1.63	see AERMOD input file for coordinates of each volume source	NOx	10102-44-0	1.07E-05	—
									SPM	N/A	3.04E-03	—
									PM10	N/A	5.83E-04	—
									PM2.5	N/A	1.41E-04	—
									SO2	7446-09-5	2.77E-04	—
									CO	630-08-0	2.80E-04	—
PR4	4-4, 6b-5	Line Volume	3	8.18	2.74	N/A	2.95	see AERMOD input file for coordinates of each volume source	NOx	10102-44-0	1.73E-02	—
									SPM	N/A	1.17E-02	—
									PM10	N/A	2.95E-03	—
									PM2.5	N/A	1.34E-03	—
									SO2	7446-09-5	4.37E-04	—
									CO	630-08-0	1.34E+00	—
HAULROAD	5-3, 6a-3,6b-6	Line Volume	177	7.57	3.51	N/A	4.44	see AERMOD input file for coordinates of each volume source	NOx	10102-44-0	1.05E+00	—
									SPM	N/A	1.20E+01	—
									PM10	N/A	3.13E+00	—
									PM2.5	N/A	4.08E-01	—
									SO2	7446-09-5	2.26E-03	—
									CO	630-08-0	8.90E-01	—
SHIPROAD	5-2,6b-1	Line Volume	26	8.18	2.74	N/A	3.47	see AERMOD input file for coordinates of each volume source	NOx	10102-44-0	1.73E-02	—
									SPM	N/A	3.31E-01	—
									PM10	N/A	8.51E-02	—
									PM2.5	N/A	9.26E-03	—
									SO2	7446-09-5	7.14E-04	—
									CO	630-08-0	1.34E+00	—
								Crystalline silica	14808-60-7	5.54E-03	—	

**Table A2-Sc0 - Operating Scenario 0 - Existing Operations
Dispersion Modelling Source Summary Table**

Modelling ID	Source ID(s)	Source Type	Number of Volume Sources	Initial Lateral Dimension	Initial Vertical Dimension	Length of Side [m]	Release Height [m]	Source Coordinates (x,y) [m]	Contaminant	CAS No.	Maximum Emission Rate [g/s]	
											1-hour	24-hour
PUMP2	6a-5	Volume	1	0.23	0.70	1.00	0.75	645721.60, 4751690.75	NOx	10102-44-0	3.61E-02	—
									SPM	N/A	3.90E-03	—
									PM10	N/A	3.90E-03	—
									PM2.5	N/A	3.78E-03	—
									SO2	7446-09-5	6.99E-05	—
									CO	630-08-0	1.43E-02	—
PUMP3	6a-6	Volume	1	0.23	0.70	1.00	0.75	646958.91, 4751019.84	NOx	10102-44-0	4.21E-02	—
									SPM	N/A	4.55E-03	—
									PM10	N/A	4.55E-03	—
									PM2.5	N/A	4.41E-03	—
									SO2	7446-09-5	8.15E-05	—
									CO	630-08-0	1.67E-02	—
CRSHLOAD	5-1a, 6a-1	Line Volume	7	12.09	2.82	20.00	3.57	see AERMOD input file for coordinates of each volume source	NOx	10102-44-0	1.42E-01	—
									SPM	N/A	4.67E-01	—
									PM10	N/A	1.30E-01	—
									PM2.5	N/A	2.58E-02	—
									SO2	7446-09-5	2.66E-04	—
									CO	630-08-0	8.02E-02	—
									Crystalline silica	14808-60-7	7.58E-03	—
WASHLOAD	5-1b, 6a-2	Line Volume	9	12.09	2.82	20.00	3.57	see AERMOD input file for coordinates of each volume source	NOx	10102-44-0	1.62E-01	—
									SPM	N/A	4.63E-01	—
									PM10	N/A	1.31E-01	—
									PM2.5	N/A	2.77E-02	—
									SO2	7446-09-5	3.04E-04	—
									CO	630-08-0	9.17E-02	—
									Crystalline silica	14808-60-7	7.48E-03	—
EXTFUG	5-4, 6a-4, 8	Line Volume	8	12.09	3.16	20.00	4.00	see AERMOD input file for coordinates of each volume source	NOx	10102-44-0	1.15E-01	—
									SPM	N/A	5.61E-01	—
									PM10	N/A	1.52E-01	—
									PM2.5	N/A	2.21E-02	—
									SO2	7446-09-5	6.07E-04	—
									CO	630-08-0	4.33E-02	—
									Crystalline silica	14808-60-7	9.49E-03	—
EXTLOAD	7b	Line Volume	1	0.93	0.77	4.00	3.33	see AERMOD input file for coordinates of each volume source	SPM	N/A	see AERMOD Input file for hourly variable emissions	—
									PM10	N/A		—
									PM2.5	N/A		—
									Crystalline silica	14808-60-7		—

**Table A2-Sc1 - Operating Scenario 1
Dispersion Modelling Source Summary Table**

Modelling ID	Source ID(s)	Source Type	Modelling Source Data						Emissions Data			
			Length [m]	Width [m]	Initial Vertical Dimension	Area	Release Height [m]	Source Coordinates (x,y) [m]	Contaminant	CAS No.	Maximum Emission Rate [g/s-m ²]	
											1-hour	24-hour
CRSHWIND	3-1	Area	88.5	37.44	2.09	3313.44	4.50	644332.76, 4751898.15	SPM	N/A	3.10E-06	—
									PM10	N/A	1.55E-06	—
									PM2.5	N/A	2.33E-07	—
									Crystalline silica	14808-60-7	1.02E-07	—
WASHWIND	3-2	Area	162.02	93.94	2.09	15220.2	4.50	644384.50, 4751778.34	SPM	N/A	2.94E-06	—
									PM10	N/A	1.47E-06	—
									PM2.5	N/A	2.20E-07	—
									Crystalline silica	14808-60-7	9.65E-08	—
WESTWIND	3-3	Area	184.8	104.81	2.09	19368.9	4.50	644507.67, 4751950.96	SPM	N/A	3.46E-06	—
									PM10	N/A	1.73E-06	—
									PM2.5	N/A	2.59E-07	—
									Crystalline silica	14808-60-7	1.14E-07	—
BLAST	9, 10	Areapoly	N/A	N/A	N/A	12509.1	1.00	645882.29, 4751356.10	NOx	10102-44-0	3.47E-04	7.39E-05
									SPM	N/A	1.35E-05	—
									PM10	N/A	7.02E-06	—
									PM2.5	N/A	4.05E-07	—
									SO2	7446-09-5	2.46E-06	4.10E-07
									CO	630-08-0	3.02E-03	—
									Crystalline silica	14808-60-7	4.61E-07	—
Modelling ID	Source ID(s)	Source Type	Number of Volume Sources	Initial Lateral Dimension	Initial Vertical Dimension	Length of Side [m]	Release Height [m]	Source Coordinates (x,y) [m]	Contaminant	CAS No.	Maximum Emission Rate [g/s]	
CRUSH	1a	Volume	1	10.33	1.86	44.44	2.00	644286.30, 4751955.64	SPM	N/A	5.84E-01	—
									PM10	N/A	2.05E-01	—
									PM2.5	N/A	3.12E-02	—
									Crystalline silica	14808-60-7	1.35E-02	—
CRSHDRP	1b	Volume	1	10.33	1.86	44.44	2.00	644286.30, 4751955.64	SPM	N/A	see AERMOD Input file for hourly variable emissions	—
									PM10	N/A		—
									PM2.5	N/A		—
									Crystalline silica	14808-60-7		—
SHPTRCK	7a	Volume	1	0.47	0.40	2.00	2.60	644368.96, 4751851.28	SPM	N/A	see AERMOD Input file for hourly variable emissions	—
									PM10	N/A		—
									PM2.5	N/A		—
									Crystalline silica	14808-60-7		—

**Table A2-Sc1 - Operating Scenario 1
Dispersion Modelling Source Summary Table**

Modelling ID	Source ID(s)	Source Type	Number of Volume Sources	Initial Lateral Dimension	Initial Vertical Dimension	Length of Side [m]	Release Height [m]	Source Coordinates (x,y) [m]	Contaminant	CAS No.	Maximum Emission Rate [g/s]	
											1-hour	24-hour
PSHIP	4-5	Line Volume	10	12.09	2.74	20.00	2.95	see AERMOD input file for coordinates of each volume source	NOx	10102-44-0	1.73E-02	—
									SPM	N/A	5.80E-02	—
									PM10	N/A	1.18E-02	—
									PM2.5	N/A	3.49E-03	—
									SO2	7446-09-5	7.14E-04	—
									CO	630-08-0	1.34E+00	—
									Crystalline silica	14808-60-7	7.21E-04	—
HAULROAD	5-3, 6a-3,6b-6	Line Volume	71	7.57	3.51	N/A	4.44	see AERMOD input file for coordinates of each volume source	NOx	10102-44-0	1.05E+00	—
									SPM	N/A	5.02E+00	—
									PM10	N/A	1.36E+00	—
									PM2.5	N/A	2.31E-01	—
									SO2	7446-09-5	2.26E-03	—
									CO	630-08-0	8.90E-01	—
									Crystalline silica	14808-60-7	8.22E-02	—
SHIPROAD	5-5, 6b-8	Line Volume	51	9.77	2.74	N/A	2.95	see AERMOD input file for coordinates of each volume source	NOx	10102-44-0	1.73E-02	—
									SPM	N/A	7.84E-01	—
									PM10	N/A	2.01E-01	—
									PM2.5	N/A	2.08E-02	—
									SO2	7446-09-5	7.14E-04	—
									CO	630-08-0	1.34E+00	—
									Crystalline silica	14808-60-7	1.31E-02	—
PUMP3	6a-3	Volume	1	0.23	0.70	1.00	0.75	645895.82, 4751318.93	NOx	10102-44-0	4.21E-02	—
									SPM	N/A	4.55E-03	—
									PM10	N/A	4.55E-03	—
									PM2.5	N/A	4.41E-03	—
									SO2	7446-09-5	8.15E-05	—
									CO	630-08-0	1.67E-02	—
CRSHLOAD	5-1a, 6a-1	Line Volume	7	12.09	2.82	20.00	3.57	see AERMOD input file for coordinates of each volume source	NOx	10102-44-0	1.42E-01	—
									SPM	N/A	4.67E-01	—
									PM10	N/A	1.30E-01	—
									PM2.5	N/A	2.58E-02	—
									SO2	7446-09-5	2.66E-04	—
									CO	630-08-0	8.02E-02	—
									Crystalline silica	14808-60-7	7.58E-03	—
WASHLOAD	5-1b, 6a-2	Line Volume	9	12.09	2.82	20.00	3.57	see AERMOD input file for coordinates of each volume source	NOx	10102-44-0	1.62E-01	—
									SPM	N/A	4.63E-01	—
									PM10	N/A	1.31E-01	—
									PM2.5	N/A	2.77E-02	—
									SO2	7446-09-5	3.04E-04	—
									CO	630-08-0	9.17E-02	—
									Crystalline silica	14808-60-7	7.48E-03	—

**Table A2-Sc1 - Operating Scenario 1
Dispersion Modelling Source Summary Table**

Modelling ID	Source ID(s)	Source Type	Number of Volume Sources	Initial Lateral Dimension	Initial Vertical Dimension	Length of Side [m]	Release Height [m]	Source Coordinates (x,y) [m]	Contaminant	CAS No.	Maximum Emission Rate [g/s]	
											1-hour	24-hour
EXTFUG	5-4, 6a-4, 8	Line Volume	8	12.09	3.16	20.00	4.00	see AERMOD input file for coordinates of each volume source	NOx	10102-44-0	1.15E-01	—
									SPM	N/A	5.61E-01	—
									PM10	N/A	1.52E-01	—
									PM2.5	N/A	2.21E-02	—
									SO2	7446-09-5	6.07E-04	—
									CO	630-08-0	4.33E-02	—
EXTLOAD	7b	Volume	1	0.93	0.77	4.00	3.33	see AERMOD input file for coordinates of each volume source	Crystalline silica	14808-60-7	9.49E-03	—
									SPM	N/A	—	—
									PM10	N/A	—	—
									PM2.5	N/A	—	—
									Crystalline silica	14808-60-7	—	—

**Table A2-Sc1 - Operating Scenario 2
Dispersion Modelling Source Summary Table**

Modelling ID	Source ID(s)	Source Type	Modelling Source Data						Emissions Data			
			Length [m]	Width [m]	Initial Vertical Dimension	Area	Release Height [m]	Source Coordinates (x,y) [m]	Contaminant	CAS No.	Maximum Emission Rate [g/s-m ²]	
											1-hour	24-hour
CRSHWIND	3-1	Area	88.5	37.44	2.09	3313.44	4.50	644332.76, 4751898.15	SPM	N/A	3.10E-06	—
									PM10	N/A	1.55E-06	—
									PM2.5	N/A	2.33E-07	—
									Crystalline silica	14808-60-7	1.02E-07	—
WASHWIND	3-2	Area	162.02	93.94	2.09	15220.2	4.50	644384.50, 4751778.34	SPM	N/A	2.94E-06	—
									PM10	N/A	1.47E-06	—
									PM2.5	N/A	2.20E-07	—
									Crystalline silica	14808-60-7	9.65E-08	—
WESTWIND	3-3	Area	184.8	104.81	2.09	19368.9	4.50	644507.67, 4751950.96	SPM	N/A	3.46E-06	—
									PM10	N/A	1.73E-06	—
									PM2.5	N/A	2.59E-07	—
									Crystalline silica	14808-60-7	1.14E-07	—
BLAST	9, 10	Areapoly	N/A	N/A	N/A	4919.8	1.00	645882.29, 4751356.10	NOx	10102-44-0	8.83E-04	1.88E-04
									SPM	N/A	3.43E-05	—
									PM10	N/A	1.78E-05	—
									PM2.5	N/A	1.03E-06	—
									SO2	7446-09-5	6.26E-06	1.04E-06
									CO	630-08-0	7.69E-03	—
									Crystalline silica	14808-60-7	1.17E-06	—
Modelling ID	Source ID(s)	Source Type	Number of Volume Sources	Initial Lateral Dimension	Initial Vertical Dimension	Length of Side [m]	Release Height [m]	Source Coordinates (x,y) [m]	Contaminant	CAS No.	Maximum Emission Rate [g/s]	
											1-hour	24-hour
CRUSH	1a	Volume	1	10.33	1.86	44.44	2.00	644286.30, 4751955.64	SPM	N/A	5.84E-01	—
									PM10	N/A	2.05E-01	—
									PM2.5	N/A	3.12E-02	—
									Crystalline silica	14808-60-7	1.35E-02	—
CRSHDRP	1b	Volume	1	10.33	1.86	44.44	2.00	644286.30, 4751955.64	SPM	N/A	see AERMOD Input file for hourly variable emissions	—
									PM10	N/A		—
									PM2.5	N/A		—
									Crystalline silica	14808-60-7		—
SHPTRCK	7a	Volume	1	0.47	0.40	2.00	2.60	644368.96, 4751851.28	SPM	N/A	see AERMOD Input file for hourly variable emissions	—
									PM10	N/A		—
									PM2.5	N/A		—
									Crystalline silica	14808-60-7		—

**Table A2-Sc1 - Operating Scenario 2
Dispersion Modelling Source Summary Table**

Modelling ID	Source ID(s)	Source Type	Number of Volume Sources	Initial Lateral Dimension	Initial Vertical Dimension	Length of Side [m]	Release Height [m]	Source Coordinates (x,y) [m]	Contaminant	CAS No.	Maximum Emission Rate [g/s]	
											1-hour	24-hour
PSHIP	4-5	Line Volume	10	12.09	2.74	20.00	2.95	see AERMOD input file for coordinates of each volume source	NOx	10102-44-0	1.73E-02	—
									SPM	N/A	5.80E-02	—
									PM10	N/A	1.18E-02	—
									PM2.5	N/A	3.49E-03	—
									SO2	7446-09-5	7.14E-04	—
									CO	630-08-0	1.34E+00	—
HAULROAD	5-3, 6a-3,6b-6	Line Volume	91	7.57	3.51	N/A	4.44	see AERMOD input file for coordinates of each volume source	NOx	10102-44-0	1.05E+00	—
									SPM	N/A	6.21E+00	—
									PM10	N/A	1.66E+00	—
									PM2.5	N/A	2.61E-01	—
									SO2	7446-09-5	2.26E-03	—
									CO	630-08-0	8.90E-01	—
SHIPROAD	5-5, 6b-8	Line Volume	51	9.77	2.74	N/A	2.95	see AERMOD input file for coordinates of each volume source	NOx	10102-44-0	1.73E-02	—
									SPM	N/A	7.84E-01	—
									PM10	N/A	2.01E-01	—
									PM2.5	N/A	2.08E-02	—
									SO2	7446-09-5	7.14E-04	—
									CO	630-08-0	1.34E+00	—
PUMP3	6a-6	Volume	1	0.23	0.70	1.00	0.75	647383.65, 4751280.95	NOx	10102-44-0	4.21E-02	—
									SPM	N/A	4.55E-03	—
									PM10	N/A	4.55E-03	—
									PM2.5	N/A	4.41E-03	—
									SO2	7446-09-5	8.15E-05	—
									CO	630-08-0	1.67E-02	—
CRSHLOAD	5-1a, 6a-1	Line Volume	7	12.09	2.82	20.00	3.57	see AERMOD input file for coordinates of each volume source	NOx	10102-44-0	1.42E-01	—
									SPM	N/A	4.67E-01	—
									PM10	N/A	1.30E-01	—
									PM2.5	N/A	2.58E-02	—
									SO2	7446-09-5	2.66E-04	—
									CO	630-08-0	8.02E-02	—
WASHLOAD	5-1b, 6a-2	Line Volume	9	12.09	2.82	20.00	3.57	see AERMOD input file for coordinates of each volume source	NOx	10102-44-0	1.62E-01	—
									SPM	N/A	4.63E-01	—
									PM10	N/A	1.31E-01	—
									PM2.5	N/A	2.77E-02	—
									SO2	7446-09-5	3.04E-04	—
									CO	630-08-0	9.17E-02	—
								Crystalline silica	14808-60-7	7.48E-03	—	

**Table A2-Sc1 - Operating Scenario 2
Dispersion Modelling Source Summary Table**

Modelling ID	Source ID(s)	Source Type	Number of Volume Sources	Initial Lateral Dimension	Initial Vertical Dimension	Length of Side [m]	Release Height [m]	Source Coordinates (x,y) [m]	Contaminant	CAS No.	Maximum Emission Rate [g/s]	
											1-hour	24-hour
EXTFUG	5-4, 6a-4, 8	Line Volume	3	12.09	3.16	20.00	4.00	see AERMOD input file for coordinates of each volume source	NOx	10102-44-0	1.15E-01	—
									SPM	N/A	5.61E-01	—
									PM10	N/A	1.52E-01	—
									PM2.5	N/A	2.21E-02	—
									SO2	7446-09-5	6.07E-04	—
									CO	630-08-0	4.33E-02	—
									Crystalline silica	14808-60-7	9.49E-03	—
EXTLOAD	7b	Volume	1	0.93	0.77	4.00	3.33	see AERMOD input file for coordinates of each volume source	SPM	N/A	see AERMOD Input file for hourly variable emissions	—
									PM10	N/A		—
									PM2.5	N/A		—
									Crystalline silica	14808-60-7		—

**Table A2-Sc3 - Operating Scenario 3
Dispersion Modelling Source Summary Table**

Modelling ID	Source ID(s)	Source Type	Modelling Source Data						Emissions Data			
			Length [m]	Width [m]	Initial Vertical Dimension	Area	Release Height [m]	Source Coordinates (x,y) [m]	Contaminant	CAS No.	Maximum Emission Rate [g/s-m ²]	
											1-hour	24-hour
CRSHWIND	3-1	Area	88.5	37.44	2.09	3313.44	4.50	644332.76, 4751898.15	SPM	N/A	3.10E-06	—
									PM10	N/A	1.55E-06	—
									PM2.5	N/A	2.33E-07	—
									Crystalline silica	14808-60-7	1.02E-07	—
WASHWIND	3-2	Area	162.02	93.94	2.09	15220.2	4.50	644384.50, 4751778.34	SPM	N/A	2.94E-06	—
									PM10	N/A	1.47E-06	—
									PM2.5	N/A	2.20E-07	—
									Crystalline silica	14808-60-7	9.65E-08	—
WESTWIND	3-3	Area	184.8	104.81	2.09	19368.9	4.50	644507.67, 4751950.96	SPM	N/A	3.46E-06	—
									PM10	N/A	1.73E-06	—
									PM2.5	N/A	2.59E-07	—
									Crystalline silica	14808-60-7	1.14E-07	—
BLAST	9, 10	Areapoly	N/A	N/A	N/A	12509.1	1.00	645882.29, 4751356.10	NOx	10102-44-0	3.47E-04	7.39E-05
									SPM	N/A	1.35E-05	—
									PM10	N/A	7.02E-06	—
									PM2.5	N/A	4.05E-07	—
									SO2	7446-09-5	2.46E-06	4.10E-07
									CO	630-08-0	3.02E-03	—
									Crystalline silica	14808-60-7	4.61E-07	—
Modelling ID	Source ID(s)	Source Type	Number of Volume Sources	Initial Lateral Dimension	Initial Vertical Dimension	Length of Side [m]	Release Height [m]	Source Coordinates (x,y) [m]	Contaminant	CAS No.	Maximum Emission Rate [g/s]	
											1-hour	24-hour
CRUSH	1a	Volume	1	10.33	1.86	44.44	2.00	644286.30, 4751955.64	SPM	N/A	5.84E-01	—
									PM10	N/A	2.05E-01	—
									PM2.5	N/A	3.12E-02	—
									Crystalline silica	14808-60-7	1.35E-02	—
CRSHDRP	1b	Volume	1	10.33	1.86	44.44	2.00	644286.30, 4751955.64	SPM	N/A	see AERMOD Input file for hourly variable emissions	—
									PM10	N/A		—
									PM2.5	N/A		—
									Crystalline silica	14808-60-7		—
SHPTRCK	7a	Volume	1	0.47	0.40	2.00	2.60	644368.96, 4751851.28	SPM	N/A	see AERMOD Input file for hourly variable emissions	—
									PM10	N/A		—
									PM2.5	N/A		—
									Crystalline silica	14808-60-7		—

**Table A2-Sc3 - Operating Scenario 3
Dispersion Modelling Source Summary Table**

Modelling ID	Source ID(s)	Source Type	Number of Volume Sources	Initial Lateral Dimension	Initial Vertical Dimension	Length of Side [m]	Release Height [m]	Source Coordinates (x,y) [m]	Contaminant	CAS No.	Maximum Emission Rate [g/s]	
											1-hour	24-hour
PSHIP	4-5, 6b-7	Line Volume	10	12.09	2.74	20.00	2.95	see AERMOD input file for coordinates of each volume source	NOx	10102-44-0	1.73E-02	—
									SPM	N/A	5.80E-02	—
									PM10	N/A	1.18E-02	—
									PM2.5	N/A	3.49E-03	—
									SO2	7446-09-5	7.14E-04	—
									CO	630-08-0	1.34E+00	—
									Crystalline silica	14808-60-7	7.21E-04	—
HAULROAD	5-3, 6a-3,6b-6	Line Volume	69	7.57	3.51	N/A	4.44	see AERMOD input file for coordinates of each volume source	NOx	10102-44-0	1.05E+00	—
									SPM	N/A	4.70E+00	—
									PM10	N/A	1.28E+00	—
									PM2.5	N/A	2.23E-01	—
									SO2	7446-09-5	2.26E-03	—
									CO	630-08-0	8.90E-01	—
									Crystalline silica	14808-60-7	7.70E-02	—
SHIPROAD	5-5, 6b-8	Line Volume	51	9.77	2.74	N/A	2.95	see AERMOD input file for coordinates of each volume source	NOx	10102-44-0	1.73E-02	—
									SPM	N/A	7.84E-01	—
									PM10	N/A	2.01E-01	—
									PM2.5	N/A	2.08E-02	—
									SO2	7446-09-5	7.14E-04	—
									CO	630-08-0	1.34E+00	—
									Crystalline silica	14808-60-7	1.31E-02	—
PUMP3	6a-6	Volume	1	0.23	0.70	1.00	0.75	645895.82, 4751318.93	NOx	10102-44-0	4.21E-02	—
									SPM	N/A	4.55E-03	—
									PM10	N/A	4.55E-03	—
									PM2.5	N/A	4.41E-03	—
									SO2	7446-09-5	8.15E-05	—
									CO	630-08-0	1.67E-02	—
CRSHLOAD	5-1a, 6a-1	Line Volume	7	12.09	2.82	20.00	3.57	see AERMOD input file for coordinates of each volume source	NOx	10102-44-0	1.42E-01	—
									SPM	N/A	4.67E-01	—
									PM10	N/A	1.30E-01	—
									PM2.5	N/A	2.58E-02	—
									SO2	7446-09-5	2.66E-04	—
									CO	630-08-0	8.02E-02	—
									Crystalline silica	14808-60-7	7.58E-03	—
WASHLOAD	5-1b, 6a-2	Line Volume	9	12.09	2.82	20.00	3.57	see AERMOD input file for coordinates of each volume source	NOx	10102-44-0	1.62E-01	—
									SPM	N/A	4.63E-01	—
									PM10	N/A	1.31E-01	—
									PM2.5	N/A	2.77E-02	—
									SO2	7446-09-5	3.04E-04	—
									CO	630-08-0	9.17E-02	—
									Crystalline silica	14808-60-7	7.48E-03	—

**Table A2-Sc3 - Operating Scenario 3
Dispersion Modelling Source Summary Table**

Modelling ID	Source ID(s)	Source Type	Number of Volume Sources	Initial Lateral Dimension	Initial Vertical Dimension	Length of Side [m]	Release Height [m]	Source Coordinates (x,y) [m]	Contaminant	CAS No.	Maximum Emission Rate [g/s]	
											1-hour	24-hour
EXTFUG	5-4, 6a-4, 8	Line Volume	8	12.09	3.16	20.00	4.00	see AERMOD input file for coordinates of each volume source	NOx	10102-44-0	1.15E-01	—
									SPM	N/A	5.61E-01	—
									PM10	N/A	1.52E-01	—
									PM2.5	N/A	2.21E-02	—
									SO2	7446-09-5	6.07E-04	—
									CO	630-08-0	4.33E-02	—
EXTLOAD	7b	Volume	1	0.93	0.77	4.00	3.33	see AERMOD input file for coordinates of each volume source	Crystalline silica	14808-60-7	9.49E-03	—
									SPM	N/A	—	—
									PM10	N/A	—	—
									PM2.5	N/A	—	—
									Crystalline silica	14808-60-7	—	—

**Table A2-Sc4 - Operating Scenario 4
Dispersion Modelling Source Summary Table**

Modelling ID	Source ID(s)	Source Type	Modelling Source Data						Emissions Data			
			Length [m]	Width [m]	Initial Vertical Dimension	Area	Release Height [m]	Source Coordinates (x,y) [m]	Contaminant	CAS No.	Maximum Emission Rate [g/s-m ²]	
											1-hour	24-hour
CRSHWIND	3-1	Area	88.5	37.44	2.09	3313.44	4.50	644332.76, 4751898.15	SPM	N/A	3.10E-06	—
									PM10	N/A	1.55E-06	—
									PM2.5	N/A	2.33E-07	—
									Crystalline silica	14808-60-7	1.02E-07	—
WASHWIND	3-2	Area	162.02	93.94	2.09	15220.2	4.50	644384.50, 4751778.34	SPM	N/A	2.94E-06	—
									PM10	N/A	1.47E-06	—
									PM2.5	N/A	2.20E-07	—
									Crystalline silica	14808-60-7	9.65E-08	—
WESTWIND	3-3	Area	184.8	104.81	2.09	19368.9	4.50	644507.67, 4751950.96	SPM	N/A	3.46E-06	—
									PM10	N/A	1.73E-06	—
									PM2.5	N/A	2.59E-07	—
									Crystalline silica	14808-60-7	1.14E-07	—
BLAST	9, 10	Areapoly	N/A	N/A	N/A	3897.8	1.00	645882.29, 4751356.10	NOx	10102-44-0	1.12E-03	0.00024
									SPM	N/A	4.33E-05	—
									PM10	N/A	2.25E-05	—
									PM2.5	N/A	1.30E-06	—
									SO2	7446-09-5	7.90E-06	1.32E-06
									CO	630-08-0	9.70E-03	—
									Crystalline silica	14808-60-7	1.48E-06	—
Modelling ID	Source ID(s)	Source Type	Number of Volume Sources	Initial Lateral Dimension	Initial Vertical Dimension	Length of Side [m]	Release Height [m]	Source Coordinates (x,y) [m]	Contaminant	CAS No.	Maximum Emission Rate [g/s]	
											1-hour	24-hour
CRUSH	1a	Volume	1	10.33	1.86	44.44	2.00	644286.30, 4751955.64	SPM	N/A	5.84E-01	—
									PM10	N/A	2.05E-01	—
									PM2.5	N/A	3.12E-02	—
									Crystalline silica	14808-60-7	1.35E-02	—
CRSHDRP	1b	Volume	1	10.33	1.86	44.44	2.00	644286.30, 4751955.64	SPM	N/A	see AERMOD Input file for hourly variable emissions	—
									PM10	N/A		—
									PM2.5	N/A		—
									Crystalline silica	14808-60-7		—
SHPTRCK	7a	Volume	1	0.47	0.40	2.00	2.60	644368.96, 4751851.28	SPM	N/A	see AERMOD Input file for hourly variable emissions	—
									PM10	N/A		—
									PM2.5	N/A		—
									Crystalline silica	14808-60-7		—

**Table A2-Sc4 - Operating Scenario 4
Dispersion Modelling Source Summary Table**

Modelling ID	Source ID(s)	Source Type	Number of Volume Sources	Initial Lateral Dimension	Initial Vertical Dimension	Length of Side [m]	Release Height [m]	Source Coordinates (x,y) [m]	Contaminant	CAS No.	Maximum Emission Rate [g/s]	
											1-hour	24-hour
PSHIP	4-5, 6b-7	Line Volume	10	12.09	2.74	20.00	2.95	see AERMOD input file for coordinates of each volume source	NOx	10102-44-0	1.73E-02	—
									SPM	N/A	5.80E-02	—
									PM10	N/A	1.18E-02	—
									PM2.5	N/A	3.49E-03	—
									SO2	7446-09-5	7.14E-04	—
									CO	630-08-0	1.34E+00	—
HAULROAD	5-3, 6a-3,6b-6	Line Volume	98	7.57	3.51	N/A	4.44	see AERMOD input file for coordinates of each volume source	NOx	10102-44-0	1.05E+00	—
									SPM	N/A	6.64E+00	—
									PM10	N/A	1.78E+00	—
									PM2.5	N/A	2.73E-01	—
									SO2	7446-09-5	2.26E-03	—
									CO	630-08-0	8.90E-01	—
SHIPROAD	5-5, 6b-8	Line Volume	51	9.77	2.74	N/A	2.95	see AERMOD input file for coordinates of each volume source	NOx	10102-44-0	1.73E-02	—
									SPM	N/A	7.84E-01	—
									PM10	N/A	2.01E-01	—
									PM2.5	N/A	2.08E-02	—
									SO2	7446-09-5	7.14E-04	—
									CO	630-08-0	1.34E+00	—
PUMP3	6a-6	Volume	1	0.23	0.70	1.00	0.75	645721.60, 4751690.75	NOx	10102-44-0	4.21E-02	—
									SPM	N/A	4.55E-03	—
									PM10	N/A	4.55E-03	—
									PM2.5	N/A	4.41E-03	—
									SO2	7446-09-5	8.15E-05	—
									CO	630-08-0	1.67E-02	—
CRSHLOAD	5-1a, 6a-1	Line Volume	7	12.09	2.82	20.00	3.57	see AERMOD input file for coordinates of each volume source	NOx	10102-44-0	1.42E-01	—
									SPM	N/A	4.67E-01	—
									PM10	N/A	1.30E-01	—
									PM2.5	N/A	2.58E-02	—
									SO2	7446-09-5	2.66E-04	—
									CO	630-08-0	8.02E-02	—
WASHLOAD	5-1b, 6a-2	Line Volume	9	12.09	2.82	20.00	3.57	see AERMOD input file for coordinates of each volume source	NOx	10102-44-0	1.62E-01	—
									SPM	N/A	4.63E-01	—
									PM10	N/A	1.31E-01	—
									PM2.5	N/A	2.77E-02	—
									SO2	7446-09-5	3.04E-04	—

**Table A2-Sc4 - Operating Scenario 4
Dispersion Modelling Source Summary Table**

Modelling ID	Source ID(s)	Source Type	Number of Volume Sources	Initial Lateral Dimension	Initial Vertical Dimension	Length of Side [m]	Release Height [m]	Source Coordinates (x,y) [m]	Contaminant	CAS No.	Maximum Emission Rate [g/s]	
											1-hour	24-hour
EXTFUG	5-4, 6a-4, 8	Line Volume	2	12.09	3.16	20.00	4.00	see AERMOD input file for coordinates of each volume source	NOx	10102-44-0	1.15E-01	—
									SPM	N/A	5.61E-01	—
									PM10	N/A	1.52E-01	—
									PM2.5	N/A	2.21E-02	—
									SO2	7446-09-5	6.07E-04	—
									CO	630-08-0	4.33E-02	—
									Crystalline silica	14808-60-7	9.49E-03	—
EXTLOAD	7b	Volume	1	0.93	0.77	4.00	3.33	see AERMOD input file for coordinates of each volume source	SPM	N/A	see AERMOD Input file for hourly variable emissions	—
									PM10	N/A		—
									PM2.5	N/A		—
									Crystalline silica	14808-60-7		—

APPENDIX C

Sample Emission Calculations

Source Number 1

Source Name Crushing Plant

Source Description The Facility operates a Crushing Plant which consists of primary, secondary and tertiary crushers, conveyors, and screening of coarse and fine material. The existing Crushing Plant (Scenario 0) has multiple water spray nozzles to apply water to the aggregate before it enters the various crushers and screens. The new Crushing Plant (Scenarios 1 to 4) is anticipated to have 20% more water spray nozzles.

Methodology It is assumed that all equipment is operating at the maximum rated capacity. Emission factors for crushing, screening, conveyor transfers and truck unloading were obtained from U.S. EPA, AP-42 Chapter 11.19.2 Crushed Stone Processing and Pulverized Mineral Processing (08/04). Based on information provided by facility personnel, both the existing and new Crushing Plants have or will have wet suppression systems and therefore, controlled emission factors are used for all handling activities.

Particulate matter emissions due to drop operations at the Crushing plant are estimated using the method described in the U.S. EPA AP-42 Chapter 13.2.4 Aggregate Handling and Storage Piles (11/06). The emission factor has a quality rating of Above-Average and is calculated as per the equation shown below.

Hourly emission rates were calculated to allow the use of variable time-of-day emission factors in the air dispersion modelling.

Sample Calculation

CRUSHING - Source 31 - C140 Metso Jaw Crusher

Hourly SPM Emission Rate = Daily Throughput [Mg/day] × Emission factor [kg/Mg] × Operating hours per day × Conversion Factors

$$\text{Hourly SPM Emission Rate} = \frac{3150 \text{ Mg}}{\text{day}} \times \frac{0.0006 \text{ kg}}{\text{Mg}} \times \frac{1000 \text{ g}}{\text{kg}} \times \frac{1 \text{ day}}{10 \text{ hrs}} \times \frac{1 \text{ hr}}{3600 \text{ s}}$$

Hourly SPM Emission Rate = 5.25E-02 g/s

DROP - Source 227 - 100' x 36" Stacker

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

Parameter	SPM	PM10	PM2.5
k	0.8	0.35	0.053
M [%]	4		
U [m/s]	19.00		

(maximum hourly wind speed obtained from the MECP pre-processed meteorological data (1996 2000) for London region)

Max Hourly SPM Emission Factor = 8.00E-03 kg/Mg (Calculated using the maximum hourly wind speed from the London meteorological data set)

$$\text{Max Hourly SPM Emission Rate} = \frac{1125 \text{ Mg}}{\text{day}} \times \frac{8.00E-03 \text{ kg}}{\text{Mg}} \times \frac{1000 \text{ g}}{\text{kg}} \times \frac{1 \text{ day}}{10 \text{ hrs}} \times \frac{1 \text{ hr}}{3600 \text{ s}}$$

Max Hourly SPM Emission Rate = 2.50E-01 g/s

Crushing Plant Emissions

Source ID	Source Description	Source Type	Transfer From	Transfer To	Maximum Capacity [Mg/day]	SPM			PM10			PM2.5		
						Emission Factor [kg/Mg]	US EPA Rating	Hourly Emission Rate [g/s]	Emission Factor [kg/Mg]	US EPA Rating	Hourly Emission Rate [g/s]	Emission Factor [kg/Mg]	US EPA Rating	Hourly Emission Rate [g/s]
152	5' by 30' Vibrating Grizzly Feeder	Truck Unloading	Haul truck	Grizzly feeder	4500	8.00E-06	E	1.00E-03	8.00E-06	E	1.00E-03	8.00E-06	E	1.00E-03
31	C140 Metso Jaw Crusher	Crushing			3150	6.00E-04	E	5.25E-02	2.70E-04	C	2.36E-02	5.00E-05	E	4.38E-03
153	60' by 60" Conveyor	Conveyor Transfer	153	168	3150	7.00E-05	E	6.13E-03	2.30E-05	D	2.01E-03	6.50E-06	E	5.69E-04
168	190' x 48" Conveyor	Conveyor Transfer	153	168	3150	7.00E-05	E	6.13E-03	2.30E-05	D	2.01E-03	6.50E-06	E	5.69E-04
155 E	6' x 24' Triple Deck Screen	Screening			2250	1.10E-03	E	6.88E-02	3.70E-04	C	2.31E-02	2.50E-05	E	1.56E-03
155 W	6' x 24' Triple Deck Screen	Screening			2250	1.10E-03	E	6.88E-02	3.70E-04	C	2.31E-02	2.50E-05	E	1.56E-03
160	25' x 30" Conveyor	Conveyor Transfer	160	167	2250	7.00E-05	E	4.38E-03	2.30E-05	D	1.44E-03	6.50E-06	E	4.06E-04
167	150' x 36" Conveyor	Conveyor Transfer	160	167	2250	7.00E-05	E	4.38E-03	2.30E-05	D	1.44E-03	6.50E-06	E	4.06E-04
161	30' x 42" Conveyor	Conveyor Transfer	161	166	2250	7.00E-05	E	4.38E-03	2.30E-05	D	1.44E-03	6.50E-06	E	4.06E-04
166	60' x 42" Conveyor	Conveyor Transfer	161	166	2250	7.00E-05	E	4.38E-03	2.30E-05	D	1.44E-03	6.50E-06	E	4.06E-04
166	60' x 42" Conveyor	Conveyor Transfer	166	Crusher 154	2250	7.00E-05	E	4.38E-03	2.30E-05	D	1.44E-03	6.50E-06	E	4.06E-04
154	Number 1 impact crusher	Crushing			675	6.00E-04	E	1.13E-02	2.70E-04	C	5.06E-03	5.00E-05	E	9.38E-04
177	Number 2 impact crusher	Crushing			450	6.00E-04	E	7.50E-03	2.70E-04	C	3.38E-03	5.00E-05	E	6.25E-04
187	Number 3 impact crusher	Crushing			450	6.00E-04	E	7.50E-03	2.70E-04	C	3.38E-03	5.00E-05	E	6.25E-04
181	30' x 42" Conveyor	Conveyor Transfer	181	168	450	7.00E-05	E	8.75E-04	2.30E-05	D	2.88E-04	6.50E-06	E	8.13E-05
168	190' x 48" Conveyor	Conveyor Transfer	181	168	3150	7.00E-05	E	6.13E-03	2.30E-05	D	2.01E-03	6.50E-06	E	5.69E-04
186	60' x 36" Conveyor	Conveyor Transfer	186	168	450	7.00E-05	E	8.75E-04	2.30E-05	D	2.88E-04	6.50E-06	E	8.13E-05
168	190' x 48" Conveyor	Conveyor Transfer	186	168	3150	7.00E-05	E	6.13E-03	2.30E-05	D	2.01E-03	6.50E-06	E	5.69E-04
173	29' x 42" Conveyor	Conveyor Transfer	173	103	4500	7.00E-05	E	8.75E-03	2.30E-05	D	2.88E-03	6.50E-06	E	8.13E-04
103	200' x 36" Radial Conveyor	Conveyor Transfer	103 to 303		4500	7.00E-05	E	8.75E-03	2.30E-05	D	2.88E-03	6.50E-06	E	8.13E-04
174	58' x 36" Conveyor	Conveyor Transfer	174	179	2250	7.00E-05	E	4.38E-03	2.30E-05	D	1.44E-03	6.50E-06	E	4.06E-04
179	131' x 36" Conveyor	Conveyor Transfer	179 to 227		2250	7.00E-05	E	4.38E-03	2.30E-05	D	1.44E-03	6.50E-06	E	4.06E-04
156 E	6' x 24' Triple Deck Screen	Screening	6' x 24' Triple Deck Screen	Upper Screens	900	1.10E-03	E	2.75E-02	3.70E-04	C	9.25E-03	2.50E-05	E	6.25E-04
156 W	6' x 24' Triple Deck Screen	Screening	6' x 24' Triple Deck Screen	Upper Screens	900	1.10E-03	E	2.75E-02	3.70E-04	C	9.25E-03	2.50E-05	E	6.25E-04
155 E	6' x 24' Triple Deck Screen	Fines Screening	Upper Screens	Lower Screens	2250	1.10E-03	E	6.88E-02	3.70E-04	E	2.31E-02	2.50E-05	E	1.56E-03
155 W	6' x 24' Triple Deck Screen	Fines Screening	Upper Screens	Lower Screens	2250	1.10E-03	E	6.88E-02	3.70E-04	E	2.31E-02	2.50E-05	E	1.56E-03
158	48' x 30" Upper Screenings Conveyor	Conveyor Transfer	158	173	2250	7.00E-05	E	4.38E-03	2.30E-05	D	1.44E-03	6.50E-06	E	4.06E-04

Source ID	Source Description	Source Type	Transfer From	Transfer To	Maximum Capacity [Mg/day]	SPM			PM10			PM2.5		
						Emission Factor [kg/Mg]	US EPA Rating	Hourly Emission Rate [g/s]	Emission Factor [kg/Mg]	US EPA Rating	Hourly Emission Rate [g/s]	Emission Factor [kg/Mg]	US EPA Rating	Hourly Emission Rate [g/s]
173	29' x 42" Conveyor	Conveyor Transfer	158	173	4500	7.00E-05	E	8.75E-03	2.30E-05	D	2.88E-03	6.50E-06	E	8.13E-04
162	48' x 30" Upper Screenings Conveyor	Conveyor Transfer	162	173	2250	7.00E-05	E	4.38E-03	2.30E-05	D	1.44E-03	6.50E-06	E	4.06E-04
173	29' x 42" Conveyor	Conveyor Transfer	162	173	4500	7.00E-05	E	8.75E-03	2.30E-05	D	2.88E-03	6.50E-06	E	8.13E-04
169	48' x 30" Conveyor	Conveyor Transfer	169	173	2250	7.00E-05	E	4.38E-03	2.30E-05	D	1.44E-03	6.50E-06	E	4.06E-04
173	29' x 42" Conveyor	Conveyor Transfer	169	173	4500	7.00E-05	E	8.75E-03	2.30E-05	D	2.88E-03	6.50E-06	E	8.13E-04
170	48' x 30" Conveyor	Conveyor Transfer	170	173	3150	7.00E-05	E	6.13E-03	2.30E-05	D	2.01E-03	6.50E-06	E	5.69E-04
173	29' x 42" Conveyor	Conveyor Transfer	170	173	4500	7.00E-05	E	8.75E-03	2.30E-05	D	2.88E-03	6.50E-06	E	8.13E-04
163	25' x 24" Conveyor	Conveyor Transfer	163	179	3150	7.00E-05	E	6.13E-03	2.30E-05	D	2.01E-03	6.50E-06	E	5.69E-04
178	-	Conveyor Transfer	163	179	2250	7.00E-05	E	4.38E-03	2.30E-05	D	1.44E-03	6.50E-06	E	4.06E-04
164	25' x 24" Conveyor	Conveyor Transfer	164	179	2250	7.00E-05	E	4.38E-03	2.30E-05	D	1.44E-03	6.50E-06	E	4.06E-04
179	-	Conveyor Transfer	164	179	2250	7.00E-05	E	4.38E-03	2.30E-05	D	1.44E-03	6.50E-06	E	4.06E-04
165	25' x 24" Conveyor	Conveyor Transfer	165	179	2250	7.00E-05	E	4.38E-03	2.30E-05	D	1.44E-03	6.50E-06	E	4.06E-04
179	-	Conveyor Transfer	165	179	2250	7.00E-05	E	4.38E-03	2.30E-05	D	1.44E-03	6.50E-06	E	4.06E-04
103	200' x 36" Radial Conveyor	Conveyor Transfer	103	303	4500	7.00E-05	E	8.75E-03	2.30E-05	D	2.88E-03	6.50E-06	E	8.13E-04
303	150' x 36" Radial Stacker	Drop	103	303	4500	8.00E-03	A	1.00E+00	3.50E-03	A	4.37E-01	5.30E-04	A	6.62E-02
179	131' x 36" Conveyor	Conveyor Transfer	179	227	2250	7.00E-05	E	4.38E-03	2.30E-05	D	1.44E-03	6.50E-06	E	4.06E-04
227	100' x 36" Stacker	Drop	179	227	1125	8.00E-03	A	2.50E-01	3.50E-03	A	1.09E-01	5.30E-04	A	1.66E-02
229	100' x 36" Radial Stacker	Drop	-	-	3375	8.00E-03	A	7.50E-01	3.50E-03	A	3.28E-01	5.30E-04	A	4.97E-02
178	-	Conveyor Transfer	-	-	2250	7.00E-05	E	4.38E-03	2.30E-05	D	1.44E-03	6.50E-06	E	4.06E-04
-	Sputnik Stacker	Drop	Stacker	229	3375	8.00E-03	A	7.50E-01	3.50E-03	A	3.28E-01	5.30E-04	A	4.97E-02
						TOTAL SPM		3.33E+00	TOTAL PM10		1.41E+00	TOTAL PM2.5		2.13E-01
						Total SPM No Drops		5.84E-01	Total PM10 No Drops		2.05E-01	Total PM2.5 No Drops		3.12E-02
						Total SPM Drops Only		2.75E+00	Total PM10 Drops Only		1.20E+00	Total PM2.5 Drops Only		1.82E-01

Emissions Summary

Source ID	Contaminant	CAS No.	Hourly Emission Rate [g/s]
1a - Crushing Plant	SPM	N/A	5.84E-01
	PM10	N/A	2.05E-01
	PM2.5	N/A	3.12E-02
1b - Crushing Plant Drop Operations	SPM	N/A	2.75E+00
	PM10	N/A	1.20E+00
	PM2.5	N/A	1.82E-01

Source Number 3

Source Name Stockpiles - Wind Erosion

Source Description Material is stored in stockpiles after processing.

Methodology Emission factors from U.S. EPA Control of Open Fugitive Dust Source (EPA-45/3-88-008), September 1988, Page 4-17 used to calculate emissions from the storage piles. The material silt loading value was obtained from U.S. EPA AP-42 Chapter 13.2.4 Aggregate Handling and Storage Piles, Table 13.2.4-1 for stone quarrying and processing.

A number of dust best management practices (BMPs) will be implemented for stockpiles at the site, including stockpile placement (use of natural wind breaks), reduced activity during high winds, watering as needed and progressive rehabilitation. These practices offer varying degrees of control. For example, spraying water as a dust suppressant can afford control efficiencies from 50% (per the Australian NPI Emission Estimation Technique Manual for Concrete Batching, Table 7) to 90% (per the WRAP Fugitive Dust Handbook, page 3, control efficiency for wind erosion when exposed area is watered before high winds); resulting in an average control efficiency of 70%.

Use of wind breaks can afford a control efficiency of 30% (per the Australian NPI Emission Estimation Technique Manual for Concrete Batching, Table 7, PM10 reduction factor for wind erosion from active stockpiles with wind breaks). When a combination of controls is applied, the reduction in emissions is multiplicative and translates to an overall reduction of 79% from the uncontrolled emission rate [i.e. $(1-0.7) \times (1-0.3) = 0.21$, which is a 79% (or 0.79) reduction].

Due to the uncertainty in the exact control efficiency of certain practices, an efficiency of 75% was conservatively applied to the emission estimates instead of the calculated 79%.

Process Specifications/Operating Conditions/Limitations:

$$E = 1.9 \left(\frac{s}{1.5} \right) \left(\frac{f}{15} \right)$$

Where:
 E = Emission Factor [kg/ha/day]
 s = silt loading [%]
 f = % Time Wind Speed > 5.4 m/s = 16.52

Contaminant	SPM	PM10	PM2.5
Scaling Factor	1	0.5	0.075

Control Efficiency = 75% *Assuming dust best management practices for stockpiles*

Sample Calculation Source 3-1: Storage Pile A

$$\text{SPM Emission Factor} = \frac{1.9}{1.5} \times \frac{3.90}{15} = \frac{16.52}{15} = 1.1013$$

SPM Emission Factor = 5.441 kg/ha-day

Hourly SPM Emission Rate = Emission factor [kg/ha/day] x Exposed area x Conversion factors x (1 - control %)

$$\text{Hourly SPM Emission Rate} = \frac{5.441 \text{ kg}}{\text{ha/day}} \times \frac{347 \text{ m}^2}{10000 \text{ m}^2} \times \frac{1 \text{ ha}}{10000 \text{ m}^2} \times \frac{1000 \text{ g}}{\text{kg}} \times \frac{1 \text{ day}}{24 \text{ hrs}} \times \frac{1 \text{ hr}}{3600 \text{ s}} \times 25\%$$

Hourly SPM Emission Rate = 5.45E-04 g/s

Stockpile Emissions

Source ID	Storage Pile ID	Length [m]	Width [m]	Radius [m]	Average Height [m]	Exposed Area [m ²]	Silt Content [%]	Emission Factors			Hourly Emission Rates			Emission Estimating Technique	Emission Factor Quality
								SPM [kg/ha/day]	PM10 [kg/ha/day]	PM2.5 [kg/ha/day]	SPM [g/s]	PM10 [g/s]	PM2.5 [g/s]		
3-1	A	12.0	7.7	—	9	347	3.90	5.441	2.720	0.408	5.45E-04	2.73E-04	4.09E-05	EF	Marginal
	B	28.0	6.4	—	9	595					9.37E-04	4.69E-04	7.03E-05		
	C	—	—	12	9	565					8.90E-04	4.45E-04	6.68E-05		
	D	51.0	31.0	—	9	5,022					7.91E-03	3.95E-03	5.93E-04		
3-2	E	52.0	15.5	—	9	2,558	3.90	5.441	2.720	0.408	4.03E-03	2.01E-03	3.02E-04	EF	Marginal
	F	—	—	10.25	9	439					6.91E-04	3.46E-04	5.19E-05		
	G	30.0	17.0	—	9	1,683					2.65E-03	1.32E-03	1.99E-04		
	H	50.9	37.7	—	9	6,096					9.60E-03	4.80E-03	7.20E-04		
	I	80.0	57.0	—	9	14,193					2.23E-02	1.12E-02	1.68E-03		
	J	57.0	19.0	—	9	3,420					5.38E-03	2.69E-03	4.04E-04		
3-3	K	25.7	22.2	—	9	1,911	3.90	5.441	2.720	0.408	3.01E-03	1.50E-03	2.26E-04	EF	Marginal
	L	35.8	31.3	—	9	3,643					5.74E-03	2.87E-03	4.30E-04		
	M	17.5	14.6	—	9	898					1.41E-03	7.07E-04	1.06E-04		
	N	22.0	14.3	—	9	1,073					1.69E-03	8.44E-04	1.27E-04		
	O	36.5	21.0	—	9	2,489					3.92E-03	1.96E-03	2.94E-04		
	P	35.0	25.4	—	9	2,896					4.56E-03	2.28E-03	3.42E-04		
	Q	59.7	46.3	—	9	8,709					1.37E-02	6.86E-03	1.03E-03		
	R	52.6	25.6	—	9	4,270					6.72E-03	3.36E-03	5.04E-04		
	S	45.1	34.5	—	9	4,978					7.84E-03	3.92E-03	5.88E-04		
	U	52.0	30.0	—	9	4,950					7.79E-03	3.90E-03	5.84E-04		
	V	34.1	19.2	—	9	2,137					3.36E-03	1.68E-03	2.52E-04		
	W	40.4	35.2	—	9	4,583					7.21E-03	3.61E-03	5.41E-04		
	TOTAL											1.22E-01	6.10E-02		

Emissions Summary

Source ID	Source Description	Hourly Emission Rate [g/s]		
		SPM	PM10	PM2.5
3-1	Crusher Stockpiles Wind Erosion	1.03E-02	5.14E-03	7.71E-04
3-2	Wash Plant Stockpiles Wind Erosion	4.47E-02	2.23E-02	3.35E-03
3-3	West Stockpiles Wind Erosion	6.70E-02	3.35E-02	5.02E-03

Source Number 4

Source Name Paved Roads - Fugitive Dust

Source Description Existing (Scenario 0) access roads for the quarry operations are paved. A portion of the future new shipping access road will also be paved (Scenarios 1 through 4). Rankin regularly waters the access roads to control dust track-out, at a rate of > 2 litres/hour. The water truck operates whenever the crushing plant is operating.

Methodology The U.S. EPA AP-42 emission factor equation from Chapter 13.2.1 – Paved Roads (January 2011) was used to calculate the fugitive dust emissions from paved roadways. The equation accounts for control efficiency for the implementation of dust control measures. A control efficiency of 75% from the Australian National Pollutant Inventory Emission Estimation Technique Manual for Mining (Version 3.1, January 2012) was selected to represent the dust suppression activities that will occur (watering at a rate of > 2 litres/m² per hour).

Hourly emission rates were calculated, to allow the use of variable time-of-day emission factors in the air dispersion modelling.

Sample Calculation

Where:

$$E_{ext} = [k (sL)^{0.91} \times (W)^{1.02}]$$

E_{ext} = annual average emission factor in same units as k
 k = particle size multiplier for particle size range and units of interest
 sL = silt loading [g/m²]
 W = Mean Vehicle Weight (tons)

Silt Loading [g/m²] 8.2 *from US EPA AP-42 Section 13.2.1, mean silt loading for paved roads at quarries*
 Dust control (%) 75%
 Average Operating Hours per Day 10 *hours*

Constants for Paved Road Emission Calculation

	SPM	PM10	PM2.5
k (g/VKT):	3.23	0.62	0.15
Emission Factor Quality	Above Average	Above Average	Average

Traffic Data

Vehicle Type	# of Arrival or Empty Vehicle Trips [trips/day]	# of Departure or Full Vehicle Trips [trips/day]	Unloaded Vehicle Weight [tons] ¹	Loaded Vehicle Weight [tons] ¹	Prorated Mean Vehicle Weight ² [tons]
Shipping Trucks	28	28	8.06	37.83	22.94
Passenger vehicles	10	10	5.00	—	5.00

Notes: "Loaded"/"Unloaded" refers to whether the vehicle is hauling a load of aggregate product or is travelling "empty" except for a driver. Passenger vehicles will never be "loaded" with aggregate. "Unloaded" passenger vehicle weight includes the weight of passengers, the car frame and all vehicle components.

"Unloaded" shipping truck weight is the inherent weight of the truck frame, cab, and all vehicle components, and includes the weight of the driver. "Loaded" shipping truck weight adds the aggregate payload to the unloaded truck weight.

1 - US tons to be consistent with requirements of formula obtained from US EP AP42.

Conversion from Mg to short ton:

1.102311

2 - Vehicles are assumed to travel unloaded in one direction and loaded in the other direction, except passenger vehicles.

Emission Parameters Summary:

Scenario	Source ID	Description	Average length of one-way trip [km/trip]	Vehicles travelling on road	Prorated mean vehicle weight on the road segment [tons]	Vehicle kilometers travelled (VKT) [km/day]	Emission Factor (accounting for dust control efficiency) [g/VKT]		
							SPM	PM10	PM2.5
Sc0	4-1	Main Site Access	0.09	Shipping Trucks & Passenger vehicles	18.22	3.5	105.81	20.31	4.91
Sc0	4-2	Main Site Egress	0.10	Shipping Trucks & Passenger vehicles	18.22	3.7	105.81	20.31	4.91
Sc0	4-3	Road to Parking Lot	0.19	Passenger vehicles	5.00	3.9	28.29	5.43	1.31
Sc0	4-4	Paved Entrance to Pit	0.05	Shipping Trucks	22.94	2.92	133.85	25.69	6.22
Sc1, Sc2, Sc3, Sc4	4-5	Shipping Paved Road (Expansion Phases)	0.26	Shipping Trucks & Passenger vehicles	18.22	19.4	105.81	20.31	4.91

$$\text{Hourly SPM Emission Rate (source 4-5)} = \frac{105.81 \text{ g}}{\text{VKT}} \times \frac{19.4 \text{ VKT}}{\text{day}} \times \frac{1 \text{ day}}{10 \text{ hrs}} \times \frac{1 \text{ hr}}{3600 \text{ s}}$$

$$\text{Hourly SPM Emission Rate (source 4-5)} = 5.71\text{E-}02 \text{ g/s}$$

Emissions Summary

Source ID	Description	Contaminant	CAS No.	Hourly Emission Rates [g/s]
4-1	Main Site Access	SPM	N/A	1.04E-02
		PM10	N/A	1.99E-03
		PM2.5	N/A	4.81E-04
4-2	Main Site Egress	SPM	N/A	1.08E-02
		PM10	N/A	2.07E-03
		PM2.5	N/A	5.00E-04
4-3	Road to Parking Lot	SPM	N/A	3.04E-03
		PM10	N/A	5.83E-04
		PM2.5	N/A	1.41E-04
4-4	Paved Entrance to Pit	SPM	N/A	1.09E-02
		PM10	N/A	2.09E-03
		PM2.5	N/A	5.05E-04
4-5	Shipping Paved Road (Expansion Phases)	SPM	N/A	5.71E-02
		PM10	N/A	1.10E-02
		PM2.5	N/A	2.65E-03

Source Number 5

Source Name Unpaved Roads - Fugitive Dust

Source Description Many of the roads within the quarry are unpaved. The majority of traffic travels along the unpaved haul route extending from the edge of the existing extraction area to the processing plant in Pit 1.
Operations at the site are generally from 7 am to 5 pm.

Methodology The predictive equation in U.S. EPA AP-42 Chapter 13.2.2 – Unpaved Roads (November 2006) was used to calculate the fugitive dust emissions from unpaved roadways. The equation accounts for control efficiency for the implementation of dust control measures. A control efficiency of 75% from the Australian National Pollutant Inventory Emission Estimation Technique Manual for Mining (Version 3.1, January 2012) was selected to represent the dust suppression activities that will occur (watering at a rate of > 2 litres/m² per hour during dry periods).

Hourly emission rates were calculated, to allow the use of variable time-of-day emission factors in the air dispersion modelling.

Sample Calculation

Controlled Emission Factor

$$E = k \left(\frac{s}{12} \right)^a \left(\frac{W}{3} \right)^b \times 281 .9$$

Where:

- E = Size Specific Emission Factor (g/VKT)
- k= particle size multiplier for particle size range and units of interest
- s = silt content (%)
- W = Mean Vehicle Weight (tons)

Silt Loading [%] 4.8 *from US EPA AP-42 Section 13.2.2, mean silt loading for plant roads in a sand and gravel processing facility*
 Dust Control Efficiency 75%
 Average Operating Hours per Day 10 hrs

Constants for Unpaved Road Emission Calculation

	SPM	PM10	PM2.5
k (lb/VMT):	4.90	1.50	0.15
a	0.7	0.9	0.9
b	0.45	0.45	0.45

Road Length Data

Scenario	Road	Length [m]
Sc0	Shipping Unpaved Road	451.4
Sc0	Haul Road	2880.4
Sc1		1192.5
Sc2		1482
Sc3		1116.3
Sc4		1588.3
Sc1, Sc2, Sc3, Sc4	Shipping Unpaved Road (Expansion Phases)	1070.1

Traffic Data

Description	Total distance travelled per vehicle per hour [km/hr]	Operating hours per day [hrs/day]	Unloaded Vehicle Weight [tons] ¹	Loaded Vehicle Weight [tons] ¹	Prorated Mean Vehicle Weight ² [tons] ¹	Emission Factor (accounting for dust control efficiency)		
						SPM [g/VKT]	PM10 [g/VKT]	PM2.5 [g/VKT]
Loader (at face)	3	10	43.83	56.29	50.06	645.26	164.45	16.45
Wheel Loader 1	3		29.98	38.25	34.12	543.00	138.39	13.84
Wheel Loader 2	3		28.99	37.26	33.12	535.84	136.57	13.66
Description	# of Arrival or Empty Vehicle Trips [trips/day]	# of Departure or Full Vehicle Trips [trips/day]	Unloaded Vehicle Weight [tons] ¹	Loaded Vehicle Weight [tons] ¹	Prorated Mean Vehicle Weight ² [tons] ¹	Emission Factor (accounting for dust control efficiency)		
Shipping Trucks	28	28	8.06	37.83	22.94	454.23	115.77	11.58
Haul Trucks	95	95	44.86	105.49	75.18	774.83	197.48	19.75
Passenger vehicles	—	—	5.00	—	5.00	228.83	58.32	5.83

Notes: "Loaded"/"Unloaded" refers to whether the vehicle is hauling a load of aggregate product or is travelling "empty" except for a driver. Passenger vehicles will never be "loaded" with aggregate. "Unloaded" passenger vehicle weight includes the weight of passengers, the car frame and all vehicle components.

"Unloaded" shipping truck weight is the inherent weight of the truck frame, cab, and all vehicle components, and includes the weight of the driver. "Loaded" shipping truck weight adds the aggregate payload to the unloaded truck weight.

1 - US tons to be consistent with requirements of formula obtained from US EP AP42.

Conversion from Mg to short ton:

1.102311

2 - Vehicles are assumed to travel unloaded in one direction and loaded in the other direction.

Source 5-4 - Loader (at Face)

$$\text{Hourly SPM Emission Rate} = \frac{645.26 \text{ g}}{\text{VKT}} \times \frac{3.0 \text{ VKT}}{\text{hr}} \times \frac{1}{3600} = \frac{\text{g}}{\text{s}}$$

$$\text{Hourly SPM Emission Rate} = 5.38\text{E-}01 \text{ g/s}$$

Source 5-2 - Shipping trucks

$$\text{Hourly SPM Emission Rate} = \frac{454.23 \text{ g}}{\text{VKT}} \times \frac{25.28 \text{ VKT}}{\text{day}} \times \frac{1}{10} \times \frac{\text{day}}{\text{hrs}} \times \frac{1}{3600} = \frac{\text{g}}{\text{s}}$$

$$\text{Hourly SPM Emission Rate} = 3.19\text{E-}01 \text{ g/s}$$

Emission Summary:

Emission Factor Quality	Above Average
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Loaders

Scenario	Source ID	Description	Vehicle	Number of Units	Vehicle kilometers travelled (VKT) [km/hr]	Hourly Emission Rates [g/s]		
						SPM	PM10	PM2.5
All	5-1a	Stockpile Area 1 Loader Dust	Wheel Loader 1	1	3	4.53E-01	1.15E-01	1.15E-02
All	5-1b	Stockpile Area 2 Loader Dust	Wheel Loader 2	1	3	4.47E-01	1.14E-01	1.14E-02
All	5-4	Extraction Face Loader Road Dust	Loader (at face)	1	3	5.38E-01	1.37E-01	1.37E-02

Other Vehicles

Scenario	Source ID	Description	Vehicle	Total length of one-way trip [km/trip]	Vehicle kilometers travelled (VKT) [km/day]	Hourly Emission Rates [g/s]		
						SPM	PM10	PM2.5
Sc0	5-2	Shipping Unpaved Road	Shipping Trucks	0.45	25.28	3.19E-01	8.13E-02	8.13E-03
			Passenger vehicles	0.45	1.81	1.15E-02	2.93E-03	2.93E-04
Sc0	5-3	Haul Road Dust	Haul Trucks	2.88	547.28	1.18E+01	3.00E+00	3.00E-01
			Passenger vehicles	2.88	11.52	7.32E-02	1.87E-02	1.87E-03
Sc1			Haul Trucks	1.19	226.58	4.88E+00	1.24E+00	1.24E-01
			Passenger vehicles	1.19	4.77	3.03E-02	7.73E-03	7.73E-04
Sc2			Haul Trucks	1.48	281.58	6.06E+00	1.54E+00	1.54E-01
			Passenger vehicles	1.48	5.93	3.77E-02	9.60E-03	9.60E-04
Sc3			Haul Trucks	1.12	212.10	4.56E+00	1.16E+00	1.16E-01
			Passenger vehicles	1.12	4.47	2.84E-02	7.23E-03	7.23E-04
Sc4			Haul Trucks	1.59	301.78	6.50E+00	1.66E+00	1.66E-01
			Passenger vehicles	1.59	6.35	4.04E-02	1.03E-02	1.03E-03
Sc1, Sc2, Sc3, Sc4	5-5	Shipping Unpaved Road (Expansion Phases)	Shipping Trucks	1.07	59.93	7.56E-01	1.93E-01	1.93E-02
			Passenger vehicles	1.07	4.28	2.72E-02	6.93E-03	6.93E-04

Emissions Summary

Scenario	Source ID	Description	1-hour ER [g/s]		
			SPM	PM10	PM2.5
All	5-1a	Stockpile Area 1 Loader Dust	4.53E-01	1.15E-01	1.15E-02
All	5-1b	Stockpile Area 2 Loader Dust	4.47E-01	1.14E-01	1.14E-02
Sc0	5-2	Shipping Unpaved Road	3.30E-01	8.42E-02	8.42E-03
Sc0	5-3	Haul Road Dust	1.19E+01	3.02E+00	3.02E-01
Sc1			4.91E+00	1.25E+00	1.25E-01
Sc2			6.10E+00	1.55E+00	1.55E-01
Sc3			4.59E+00	1.17E+00	1.17E-01
Sc4			6.54E+00	1.67E+00	1.67E-01
All	5-4	Extraction Face Loader Road Dust	5.38E-01	1.37E-01	1.37E-02
Sc1	5-5	Shipping Unpaved Road (Expansion Phases)	7.83E-01	2.00E-01	2.00E-02
Sc2			7.83E-01	2.00E-01	2.00E-02
Sc3			7.83E-01	2.00E-01	2.00E-02
Sc4			7.83E-01	2.00E-01	2.00E-02

Source Number 6a

Source Name Exhaust Emissions - Nonroad Engines

Source Description Offroad (Nonroad) vehicles operate within the quarry and along the haul route. Front end loaders move material at the face and wheel loaders move the material from stockpiles to the shipping trucks. Water trucks drive slowly along the unpaved haul routes and the processing and extraction areas to apply water for dust control.

Operations at the site are generally from 7 am to 5 pm.

Methodology Nonroad CI Engine Emission Standards from Table 1 of the U.S. EPA Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling - Compression-Ignition NR-009d (July 2010) (EPA Report NR-009d) were used to calculate the exhaust emissions from on-site vehicles. All vehicles at the quarry meet Tier 3 emission standards at minimum. The loader operating at the face of the extraction area meets Tier 4 emission standards. Emission standards were not provided for PM10 and PM2.5; therefore, it was assumed that all PM emissions consist of PM10 and that PM2.5 emissions are 97% of PM10 emissions, per the NR-009d document.

Hourly emission rates were calculated to allow the use of variable time-of-day emission factors in the air dispersion modelling.

Sample Calculation

Loader (at face)

Basic SPM emission factor = Zero-hour emission factor [g/hp-hr] × Deterioration Factor × Transient Adjustment Factor - Sulphur Adjustment Factor

$$EF = \frac{0.01 \text{ g}}{\text{hp-hr}} \times 1.473 \times 1.00 - 0.00 \text{ g}}{\text{hp-hr}}$$

$$EF = 1.36E-02 \text{ g/hp-hr}$$

Hourly SPM Emission Rate = Emission Factor [g/hp-hr] × Horsepower × Load factor × Conversion factors × Number of units

$$\text{Hourly SPM Emission Rate} = \frac{0.01 \text{ g}}{\text{hp-hr}} \times 540 \text{ hp} \times 0.59 \times \frac{1 \text{ hr}}{3600 \text{ s}} \times 1 \text{ loader}$$

$$\text{Hourly SPM Emission Rate} = 1.20E-03 \text{ g/s}$$

Per the EPA Report NR-009d, emissions of SO2 are calculated based on brake-specific fuel consumption, sulphur content in the diesel fuel used, and the fraction of fuel sulphur which was converted to direct SPM, using the equation below:

$$SO_2 = (BSFC * 453.6 * (1 - soxcnv) - HC) * 0.01 * soxds1 * 2$$

where

- SO₂ is in g/hp-hr
- BSFC is the in-use adjusted fuel consumption in lb/hp-hr
- 453.6 is the conversion factor from pounds to grams
- soxcnv is the fraction of fuel sulfur converted to direct PM
- HC is the in-use adjusted hydrocarbon emissions in g/hp-hr
- 0.01 is the conversion factor from weight percent to weight fraction
- soxds1 is the episodic weight percent of sulfur in nonroad diesel fuel
- 2 is the grams of SO₂ formed from a gram of sulfur

The following values were assumed in the calculation of SO2 emissions. Vehicles were assumed to meet no higher than Tier 3 emission standards; the SOXCNV value was obtained from page C5 of the EPA Report NR-009d. The fuel sulphur content was assumed to be 15 mg/kg (0.0015%) per Canadian Sulphur in Diesel Fuel Regulations (SOR/2002-254).

	For Engines meeting Base Tier - Tier 3
SOXCNV	0.02247
Sulphur fuel content, ppm	15

Emission Summary:

Emission Factor Quality	Marginal
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Vehicle ID	# of units	hp ¹	Tier Rating	NONROAD model equipment type	Load Factor ²	BSFCs [lb fuel/hp-hr]	BSFC TAF	Fraction of S Converted to PM	Default Fuel Sulphur Level in the US EPA NONROAD (SOXBAS) [ppmw]
Loader (at face)	1	540	4	RTLoader	0.59	0.367	1	0.02247	15
Wheel Loader 1	1	330	3	RTLoader	0.59	0.367	1.01	0.02247	2000
Wheel Loader 2	1	377	3	RTLoader	0.59	0.367	1.01	0.02247	2000
Haul Trucks	3	700	3	Crawler	0.59	0.367	1.01	0.02247	2000
Water Truck	1	350	3	Crawler	0.59	0.367	1.01	0.02247	2000
Drill	1	300	3	None	0.43	0.367	1	0.02247	2000
Water Pump - Pit 2	1	120	3	None	0.43	0.367	1	0.02247	2000
Water Pump - Pit 3	1	140	3	None	0.43	0.367	1	0.02247	2000

Notes:

1 - Horsepower for the equipment was obtained from manufacturer's specifications documents available online based on the make and the model

2 - Load factors were obtained from the document titled Median Life, Annual Activity, and Load Factor Values for Nonroad engine Emissions Modeling – Report No. NR-005d (U.S. EPA, July 2010), Table 9, Table 10, and Appendix A.

Calculations for 1-hour Particulate Matter

PM10 = 100% of PM
 PM2.5 = 97% of PM10

Vehicle ID	# of units	hp ¹	Tier Rating	NONROAD model equipment type	PM Emission Factor [g/hp-hr]	Transient Factor [PM]	Deterioration Factor [PM]	Sulphur Adjustment Factor [g/hp-hr]	Hourly Emission Rates [g/s]		
									SPM	PM10	PM2.5
Loader (at face)	1	540	4	RTLoader	0.0092	1.00	1.473	0.0000	1.20E-03	1.20E-03	1.16E-03
Wheel Loader 1	1	330	3	RTLoader	0.15	1.47	1.473	0.0525	1.47E-02	1.47E-02	1.43E-02
Wheel Loader 2	1	377	3	RTLoader	0.15	1.47	1.473	0.0525	1.68E-02	1.68E-02	1.63E-02
Haul Trucks	3	700	3	Crawler	0.15	1.47	1.473	0.0525	9.37E-02	9.37E-02	9.09E-02
Water Truck	1	350	3	Crawler	0.15	1.47	1.473	0.0525	1.56E-02	1.56E-02	1.52E-02
Drill	1	300	3	None	0.15	1.00	1.473	0.0520	6.05E-03	6.05E-03	5.87E-03
Water Pump - Pit 2	1	120	3	None	0.22	1.00	1.473	0.0520	3.90E-03	3.90E-03	3.78E-03
Water Pump - Pit 3	1	140	3	None	0.22	1.00	1.473	0.0520	4.55E-03	4.55E-03	4.41E-03

Calculations for hourly emission rates of Nitrogen Oxides and Carbon Monoxide

Vehicle ID	# of units	hp ¹	Tier Rating	NONROAD model equipment type	NOx Emission Factor [g/hp-hr]	Transient Factor [NOx]	Deterioration Factor [NOx]	Hourly Emission Rates of NOx [g/s]	CO Emission Factor [g/hp-hr]	Transient Factor [CO]	Deterioration Factor [CO]	Hourly Emission Rate of CO [g/s]
Loader (at face)	1	540	4	RTLoader	0.276	1.00	1.008	2.46E-02	0.084	1.00	1.151	8.56E-03
Wheel Loader 1	1	330	3	RTLoader	2.5	1.04	1.008	1.42E-01	0.8425	1.53	1.151	8.02E-02
Wheel Loader 2	1	377	3	RTLoader	2.5	1.04	1.008	1.62E-01	0.8425	1.53	1.151	9.17E-02
Haul Trucks	3	700	3	Crawler	2.5	1.04	1.008	9.02E-01	1.3272	1.53	1.151	8.04E-01
Water Truck	1	350	3	Crawler	2.5	1.04	1.008	1.50E-01	0.8425	1.53	1.151	8.51E-02
Drill	1	300	3	None	2.5	1.00	1.008	9.03E-02	0.8425	1.00	1.151	3.47E-02
Water Pump - Pit 2	1	120	3	None	2.5	1.00	1.008	3.61E-02	0.8667	1.00	1.151	1.43E-02
Water Pump - Pit 3	1	140	3	None	2.5	1.00	1.008	4.21E-02	0.8667	1.00	1.151	1.67E-02

Calculations for hourly emission rates of Sulphur Dioxide

Vehicle ID	# of units	hp ¹	Tier Rating	NONROAD model equipment type	HC Emission Factor [g/hp-hr]	Transient Factor [HC]	Deterioration Factor [HC]	SO2 Emission Factor [g/hp-hr]	Hourly Emission Rates of SO2 [g/s]
Loader (at face)	1	540.4	4	RTLoader	0.1314	1.00	1.027	4.88E-03	4.32E-04
Wheel Loader 1	1	330	3	RTLoader	0.1669	1.05	1.027	4.93E-03	2.66E-04
Wheel Loader 2	1	377	3	RTLoader	0.1669	1.05	1.027	4.93E-03	3.04E-04
Haul Trucks	3	700	3	Crawler	0.1669	1.05	1.027	4.93E-03	1.70E-03
Water Truck	1	350	3	Crawler	0.1669	1.05	1.027	4.93E-03	2.83E-04
Drill	1	300	3	None	0.1669	1.00	1.027	4.88E-03	1.75E-04
Water Pump - Pit 2	1	120	3	None	0.1836	1.00	1.027	4.88E-03	6.99E-05
Water Pump - Pit 3	1	140	3	None	0.1836	1.00	1.027	4.88E-03	8.15E-05

Source ID	Vehicle ID	Hourly Emission Rates by Location [g/s]					
		SPM	PM10	PM2.5	NOx	SO2	CO
6a-1	Stockpile Area Tailpipe						
	Wheel Loader 1	1.47E-02	1.47E-02	1.43E-02	1.42E-01	2.66E-04	8.02E-02
6a-2	Stockpile Area 2 Tailpipe						
	Wheel Loader 2	1.68E-02	1.68E-02	1.63E-02	1.62E-01	3.04E-04	9.17E-02
6a-3	Haul Road Non-Road Tail Pipe						
	Haul Trucks	9.37E-02	9.37E-02	9.09E-02	9.02E-01	1.70E-03	8.04E-01
	Water Truck	1.56E-02	1.56E-02	1.52E-02	1.50E-01	2.83E-04	8.51E-02
6a-4	Extraction Face Tailpipe						
	Drill	6.05E-03	6.05E-03	5.87E-03	9.03E-02	1.75E-04	3.47E-02
	Loader (at face)	1.20E-03	1.20E-03	1.16E-03	2.46E-02	4.32E-04	8.56E-03
6a-5	Water Pump - Pit 2						
	Water Pump - Pit 2	3.90E-03	3.90E-03	3.78E-03	3.61E-02	6.99E-05	1.43E-02
6a-6	Water Pump - Pit 3						
	Water Pump - Pit 3	4.55E-03	4.55E-03	4.41E-03	4.21E-02	8.15E-05	1.67E-02

Emissions Summary

Source ID	Description	Hourly Emission Rates [g/s]					
		SPM	PM10	PM2.5	NOx	SO2	CO
6a-1	Stockpile Area Tailpipe	1.47E-02	1.47E-02	1.43E-02	1.42E-01	2.66E-04	8.02E-02
6a-2	Stockpile Area 2 Tailpipe	1.68E-02	1.68E-02	1.63E-02	1.62E-01	3.04E-04	9.17E-02
6a-3	Haul Road Non-Road Tail Pipe	1.09E-01	1.09E-01	1.06E-01	1.05E+00	1.98E-03	8.90E-01
6a-4	Extraction Face Tailpipe	7.26E-03	7.26E-03	7.04E-03	1.15E-01	6.07E-04	4.33E-02
6a-5	Water Pump - Pit 2	3.90E-03	3.90E-03	3.78E-03	3.61E-02	6.99E-05	1.43E-02
6a-6	Water Pump - Pit 3	4.55E-03	4.55E-03	4.41E-03	4.21E-02	8.15E-05	1.67E-02

Source Number 6b

Source Name Exhaust Emissions - On-Highway Engines

Source Description Shipping trucks and passenger vehicles (i.e. personal cars or pickup trucks) operate along the Facility's access roads. Passenger vehicles may also travel within the pit or along the surface haul road between pits.
Product shipments are transported off-site during daytime (between 7 am and 5 pm). No equipment is operated at night (neither the crushing plant, wash plant, nor onsite vehicles).

Methodology The U.S. EPA emission standards for light duty vehicle emissions (<https://www.epa.gov/greenvehicles/light-duty-vehicle-emissions#standards>) were used to estimate emissions from the passenger vehicles travelling onsite. The U.S. EPA exhaust emission standards for Heavy-Duty Highway Compression-Ignition Engines and Urban Buses (EPA-420-B-16-018, March 2016) were used to estimate emissions from the shipping trucks. All vehicles at the quarry meet Tier 3 emission standards at minimum. Emission standards were not provided for PM10 and PM2.5; therefore, it was assumed that all PM emissions consist of PM10 and that PM2.5 emissions are 97% of PM10 emissions, per EPA Report NR-009d.

Hourly emission rates were calculated to allow the use of variable time-of-day emission factors in the air dispersion modelling.

Sample Calculation

$$\text{Emission Rate} = \text{Emission Factor (g/bhp-hr)} * \text{Horsepower} * 1 \text{ hr}/3600\text{s}$$

$$\text{1-hour NOx Emission Rate for Shipping Trucks} = \frac{2.00\text{E-}01 \text{ g}}{\text{bhp-hr}} \times \frac{310.69 \text{ bhp}}{1} \times \frac{1 \text{ hr}}{3600 \text{ s}}$$

$$\text{1-hour NOx Emission Rate for Shipping Trucks} = 1.73\text{E-}02 \text{ g/s}$$

$$\text{Emission Rate} = \text{Emission Factor (g/mile)} * \text{Distance travelled (mi/hr)} * 1 \text{ hr}/3600\text{s}$$

$$\text{1-hour NOx Emission Rate for Passenger vehicles} = \frac{1.60\text{E-}01 \text{ g}}{\text{mile}} \times \frac{0.11 \text{ miles}}{\text{hour}} \times \frac{1 \text{ hr}}{3600 \text{ s}}$$

$$\text{1-hour NOx Emission Rate for Passenger vehicles} = 4.99\text{E-}06 \text{ g/s}$$

Sulphur dioxide (SO2) emissions were estimated based on the diesel fuel consumption rate per vehicle and a sulphur content of 15 mg/kg (Ultra Low Sulphur Diesel [ULSD]), based upon the Sulphur in Diesel Fuel Regulations (SOR/2002-254, dated June 2012) promulgated under CEPA (CEPA 1999). The following equation was used to determine the SO2 emission factor:

$$EF = \text{Fuel Density} \times \text{Sulphur Content} \times \frac{MM \text{ SO}_2}{MM \text{ Sulphur}}$$

where: EF = emission factor [g/L]

MM SO ₂ = molar mass SO ₂ [g/mol] =	64
MM Sulphur = molar mass [g/mol] =	32
diesel fuel density [kg/L] =	0.843
sulphur content [mg/kg] =	15

The SO2 emission rate is then calculated from fuel consumption as follows:

$$ER = EF \times \text{Fuel Consumption} \times \frac{\text{Hours of Operation}}{24 \text{ hr}} \times \frac{1 \text{ hr}}{3,600 \text{ s}}$$

Sample Calculation

$$\text{SO}_2 \text{ Emission Factor} = \frac{0.843 \text{ kg}}{\text{L fuel}} \times \frac{15 \text{ mg}}{\text{kg}} \times \frac{64}{32} \times \frac{1}{1000} \frac{\text{g}}{\text{mg}}$$

$$\text{SO}_2 \text{ Emission Factor} = 0.0253 \text{ g/L fuel}$$

$$\text{1-hour SO}_2 \text{ emissions from shipping trucks} = \frac{0.0253 \text{ g SO}_2}{\text{L fuel}} \times \frac{1}{0.843} \frac{\text{L}}{\text{kg fuel}} \times \frac{0.453592 \text{ kg}}{\text{lb fuel}} \times \frac{0.367 \text{ lb fuel}}{\text{hp-hr}} \times \frac{315 \text{ hp}}{1} \times \frac{1 \text{ hr}}{3600 \text{ s}}$$

$$\text{1-hour SO}_2 \text{ emissions from shipping trucks} = 4.37\text{E-}04 \text{ g/s}$$

Emission Summary:

Emission Factor Quality	Marginal
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Operating hours per day 10 hours/day

Vehicle ID	hp ¹	Tier Rating	BSFCs [lb fuel/hp-hr] ²	Conversion to bhp
Shipping Trucks	315	3	0.367	310.69
Passenger vehicles	200	3	0.367	197.26

Notes:

- 1 - Horsepower for the equipment was obtained from manufacturer's specifications documents available online based on the make and the model
- 2 - A brake-specific fuel consumption (required for SO2 estimates) was assumed from the document Exhaust and Crankcase Emission Factors for Nonroad Engine Modelling – Compression Ignition – Report No. NR-009d, Appendix A, Table A4

1 bhp = 1.01387 hp 1 km = 0.6214 miles

Calculations for 1-hour Particulate Matter

PM10 = 100% of PM
 PM2.5 = 97% of PM10

Vehicle ID	hp	Emission Limits						Year or Tier ¹
		PM	Units	NOx	Units	CO	Units	
Shipping Trucks	315	0.01	g/bhp-hr	0.2	g/bhp-hr	15.5	g/bhp-hr	2007+
Passenger vehicles ²	200	0.003	g/mile	0.16	g/mile	4.2	g/mile	Tier 3

Notes:

- 1 - The exhaust emission standards for Heavy-Duty Highway Compression-Ignition Engines and Urban Buses (EPA-420-B-16-018, March 2016) depend on the year of the engine. Tier 3 standards came into effect in 2017, therefore the emission factors for engine year "2007+" from EPA-420-B-16-018 were applied to the shipping trucks.
- 2 - Vehicles are certified based on which of the EPA's smog rating standards (or "bins") the automaker constructs their vehicles to meet. As this information is unknown for the Facility's passenger vehicles, the highest emissions out of the Tier 3 emission limits for the various "bins" was conservatively selected to calculate emissions of each contaminant.

Scenario	Source ID	Road Description	Vehicle ID	Km travelled per hour [km/hr]	Miles travelled per hour [miles/hr]	1-hour NOx Emissions [g/s]	1-hour CO Emissions [g/s]	1-hour SPM Emissions [g/s]	1-hour PM10 Emissions [g/s]	1-hour PM2.5 Emissions [g/s]	1-hour SO2 Emissions [g/s]	
Sc0	6b-1	Shipping Unpaved Road Tailpipe	Passenger Vehicles	0.18	0.11	4.99E-06	1.31E-04	9.35E-08	9.35E-08	9.07E-08	2.77E-04	
			Shipping Trucks	2.53	1.57	1.73E-02	1.34E+00	8.63E-04	8.63E-04	8.37E-04	4.37E-04	
	6b-2	Main Site Access Road Tailpipe	Shipping Trucks	0.35	0.22	1.73E-02	1.34E+00	8.63E-04	8.63E-04	8.37E-04	4.37E-04	
			Passenger Vehicles	0.35	0.22	9.73E-06	2.55E-04	1.82E-07	1.82E-07	1.77E-07	2.77E-04	
	6b-3	Main Site Egress Tailpipe	Shipping Trucks	0.37	0.23	1.73E-02	1.34E+00	8.63E-04	8.63E-04	8.37E-04	4.37E-04	
			Passenger Vehicles	0.37	0.23	1.01E-05	2.66E-04	1.90E-07	1.90E-07	1.84E-07	2.77E-04	
	6b-4	Road to Parking Lot Tailpipe	Passenger Vehicles	0.39	0.24	1.07E-05	2.80E-04	2.00E-07	2.00E-07	1.94E-07	2.77E-04	
	6b-5	Paved Entrance to Pit Tailpipe	Shipping Trucks	0.29	0.18	1.73E-02	1.34E+00	8.63E-04	8.63E-04	8.37E-04	4.37E-04	
	Sc0	6b-6	Haul Road Passenger Tailpipe	Passenger Vehicles	1.15	0.72	3.18E-05	8.35E-04	5.97E-07	5.97E-07	5.79E-07	2.77E-04
	Sc1			Passenger Vehicles	0.48	0.30	1.32E-05	3.46E-04	2.47E-07	2.47E-07	2.40E-07	2.77E-04
Sc2	Passenger Vehicles			0.59	0.37	1.64E-05	4.30E-04	3.07E-07	3.07E-07	2.98E-07	2.77E-04	
Sc3	Passenger Vehicles			0.45	0.28	1.23E-05	3.24E-04	2.31E-07	2.31E-07	2.24E-07	2.77E-04	
Sc4	Passenger Vehicles			0.64	0.39	1.75E-05	4.61E-04	3.29E-07	3.29E-07	3.19E-07	2.77E-04	

Sc1, Sc2, Sc3, Sc4	6b-7	Shipping Paved Road Tailpipe (Expansion Phases)	Shipping Trucks	1.94	1.21	1.73E-02	1.34E+00	8.63E-04	8.63E-04	8.37E-04	4.37E-04
			Passenger vehicles	1.94	1.21	5.36E-05	1.41E-03	1.01E-06	1.01E-06	9.76E-07	2.77E-04
	6b-8	Shipping Unpaved Road Tailpipe (Expansion Phases)	Shipping Trucks	5.99	3.72	1.73E-02	1.34E+00	8.63E-04	8.63E-04	8.37E-04	2.77E-04
			Passenger vehicles	0.43	0.27	1.18E-05	3.10E-04	2.22E-07	2.22E-07	2.15E-07	4.37E-04

Emissions Summary

Scenario	Source ID	Description	1-hour ER [g/s]					
			NOx	CO	SPM	PM10	PM2.5	SO2
Sc0	6b-1	Shipping Unpaved Road Tailpipe	1.73E-02	1.34E+00	8.63E-04	8.63E-04	8.37E-04	7.14E-04
	6b-2	Main Site Access Road Tailpipe	1.73E-02	1.34E+00	8.63E-04	8.63E-04	8.37E-04	7.14E-04
	6b-3	Main Site Egress Tailpipe	1.73E-02	1.34E+00	8.63E-04	8.63E-04	8.37E-04	7.14E-04
	6b-4	Road to Parking Lot Tailpipe	1.07E-05	2.80E-04	2.00E-07	2.00E-07	1.94E-07	2.77E-04
	6b-5	Paved Entrance to Pit Tailpipe	1.73E-02	1.34E+00	8.63E-04	8.63E-04	8.37E-04	4.37E-04
Sc0	6b-6	Haul Road Passenger Tailpipe	3.18E-05	8.35E-04	5.97E-07	5.97E-07	5.79E-07	2.77E-04
Sc1			1.32E-05	3.46E-04	2.47E-07	2.47E-07	2.40E-07	2.77E-04
Sc2			1.64E-05	4.30E-04	3.07E-07	3.07E-07	2.98E-07	2.77E-04
Sc3			1.23E-05	3.24E-04	2.31E-07	2.31E-07	2.24E-07	2.77E-04
Sc4			1.75E-05	4.61E-04	3.29E-07	3.29E-07	3.19E-07	2.77E-04
Sc1	6b-7	Shipping Paved Road Tailpipe (Expansion Phases)	1.73E-02	1.34E+00	8.64E-04	8.64E-04	8.38E-04	7.14E-04
Sc2								
Sc3								
Sc4								
Sc1	6b-8	Shipping Unpaved Road Tailpipe (Expansion Phases)	1.73E-02	1.34E+00	8.63E-04	8.63E-04	8.37E-04	7.14E-04
Sc2								
Sc3								
Sc4								

Source Number 7

Source Name Stockpile Material Handling

Source Description Material can be loaded from stockpiles at an average rate of 756 tonnes per day, while at the extraction face, material can be loaded at a rate of 4500 tonnes per day.

Operating Rate Particulate matter emissions due to material handling are estimated using the method described in the U.S. EPA AP-42 Chapter 13.2.4 Aggregate Handling and Storage Piles (11/06). The emission factor has a quality rating of Above-Average and is calculated as per the equation shown below. A default moisture content was assumed based on Table 13.2.4-1 of Chapter 13.2.4. The table provides a value of 2.1% moisture for 'Various limestone products' and 0.7% for 'Crushed limestone'. The 2.1% moisture content was assumed for material at the extraction face since it is blasted limestone, not crushed limestone.

Sample Calculation

Drop Equation

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

Where:

- M = Moisture content of material [%]
- k = Particle size multiplier, dimensionless
- U = Hourly windspeed obtained from the MECP's regional meteorological dataset for London (Crops)

Parameter	SPM	PM10	PM2.5
k	0.8	0.35	0.053
M [%]	2.1		

(mean limestone product moisture content obtained from Table 13.2.4-1)

Sample calculation for source 7a (SHPTRCK) - Year 1996, Month 1, Day 1, Hour Ending - 8

$$\text{SPM EF} = 0.8 \times (0.0016) \times \frac{\left(\frac{5.7}{2.2}\right)^{1.3}}{\left(\frac{2.10}{2}\right)^{1.4}}$$

$$\text{SPM EF} = \frac{4.12\text{E-}03 \text{ kg}}{\text{Mg}}$$

$$\text{SPM ER} = \frac{756 \text{ Mg}}{\text{day}} \times \frac{4.12\text{E-}03 \text{ kg}}{\text{Mg}} \times \frac{1000 \text{ g}}{\text{kg}} \times \frac{1 \text{ day}}{10 \text{ op hrs}} \times \frac{1 \text{ hr}}{3600 \text{ s}}$$

$$\text{SPM ER} = 8.65\text{E-}02 \text{ g/s}$$

Process Specifications/Operating Conditions/Limitations:

Source ID	Description	Maximum Capacity [Mg/day]
7a	Stockpile Material Handling	756
7b	Extraction Face Material Handling	4500

Source Number 8

Source Name Blast Hole Drilling

Source Description Rock and stone are loosened by drilling and blasting the quarry face. Up to 200 holes are drilled per blast, with a maximum of 10 holes drilled per hour. Emissions are controlled by a vacuum bag dust collection system equipped with a fabric filter that is attached to the drill rig.

Methodology Particulate matter emissions due to blast hole drilling are estimated using the emission factor from Table 11.9-4 of the U.S. EPA AP-42 Section 11.9 - Western Surface Coal Mining (10/98). The emission factor has a quality rating of Average. The U.S. EPA document only has a factor for SPM, therefore for the purpose of this assessment, an emission factor for PM10 was estimated from the SPM factor based on the ratio between the SPM and PM10 emission factors for tertiary crushing (uncontrolled) from U.S. EPA AP-42 Chapter 11.19.2 - Crushed Stone Processing and Pulverized Mineral Processing (8/04). Similarly, an emission factor for PM2.5 was estimated from SPM based on the ratio between the SPM and PM2.5 emission factors for tertiary crushing (controlled) from Chapter 11.19.2.

A 99% control was applied as per the Table 4 of the Australian National Pollutant Inventory Emission Estimation Technique Manual for Mining (Version 3.1, January 2012) for use of fabric filters when drilling.

Hourly emission rates were calculated, to allow the use of variable time-of-day emission factors in the air dispersion modelling.

Sample Calculation Emission Rate [g/s] = Emission Factor [kg/hole] x Activity Rate [holes drilled/hr] x 1000 [g/kg] x (1-Control Factor)

Dust control (%) 99%

Source	Contaminant	CAS No.	Emission Factor (Uncontrolled) [kg/hole]	Emission Factor Quality	
Drilling, Overburden (uncontrolled)	SPM	N/A	5.90E-01	C	Average
	PM10 ¹	N/A	2.62E-01	B	Average
	PM2.5 ²	N/A	4.92E-02	B	Average

1 - Emission factor for PM10 based on the ratio between TSP and PM10 emission factors for tertiary crushing (uncontrolled).

2 - Emission factor for PM2.5 based on the ratio between TSP and PM2.5 emission factors for tertiary crushing (controlled).

$$1\text{-hour Emission Rate [g/s]} = \frac{0.59 \text{ kg}}{\text{hole}} \times \frac{10 \text{ holes}}{\text{hr}} \times \frac{1000 \text{ g}}{\text{kg}} \times \frac{1 \text{ hr}}{3600 \text{ seconds}} \times (1 - 0.99)$$

$$1\text{-hour Emission Rate [g/s]} = 1.64\text{E-}02 \text{ g/s}$$

Emission Summary

Source ID	Source Description	Control Method	1-hour Emission Rates [g/s]		
			SPM	PM10	PM2.5
8	Blast hole drilling	Fabric Filter	1.64E-02	7.28E-03	1.37E-03

Source Number 9

Source Name Blasting - Particulate Matter Emissions

Source Description Rock and stone are loosened by drilling and blasting the quarry face.

Operating Rate Blasting occurs 1-3 times per week during peak production levels. A blast would occur once per day, between 10 am and 4 pm. There is no blasting during the months of December, January or February.

Methodology The predictive equation in Table 11.9-1 of the U.S. EPA AP-42 Section 11.9 Western Surface Coal Mining (10/98) was used to calculate particulate emissions from blasting.

An emission factor is only available for SPM, therefore PM10 and PM2.5 emission factors were estimated using the scaling factors provided in Table 11.9-2.

Process Specifications/Operating Conditions/Limitations:

Maximum Horizontal Area per Blast 650 m²
 Maximum Number of Blasts 1 blast/day
 Window of time within a day when blasts could occur 6 hours during a day (anytime between 10 am and 4 pm)

Sample Calculation Emission Factor [kg/blast] = 0.00022 (A)^{1.5}, where A = horizontal area (m²)

Scaling Factors (from SPM)	0.52 PM10	0.03 PM2.5
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Source	Contaminant	CAS	Emission Factor	Emission Factor Quality	
			[kg/blast]		
Blasting Particulate	SPM	N/A	3.65	C	Average
	PM10	N/A	1.90	D	Marginal
	PM2.5	N/A	0.11	D	Marginal

$$\text{Emission Rate [g/s]} = \frac{3.65 \text{ kg}}{\text{blast}} \times \frac{1 \text{ blast}}{\text{day}} \times \frac{1000 \text{ g}}{\text{kg}} \times \frac{1 \text{ day}}{6 \text{ hrs}} \times \frac{1 \text{ hr}}{3600 \text{ s}}$$

$$\text{Emission Rate [g/s]} = 1.69\text{E-}01 \text{ g/s}$$

Emission Summary

Source	Contaminant	CAS	Emission Rate
			[g/s]
9 - Blasting Particulate	SPM	N/A	1.69E-01
	PM10	N/A	8.78E-02
	PM2.5	N/A	5.06E-03

Source Number 10

Source Name Blasting - Combustion Gases

Source Description Rock and stone are loosened by drilling and blasting the quarry face using an emulsion/ANFO blend of explosives (blend is comprised predominantly of emulsion). No other types of explosive are used at the site. Per PCQ, the maximum amount of explosive used per blast is 6160 kg.

Methodology The compounds associated with blasting explosives include products of combustion (CO, NO_x and SO₂). Emission factors for 70% emulsion and 30% ANFO explosives mix were obtained from Table 7 in Appendix C of the Australian National Pollutant Inventory document Explosives Detonation and Firing Ranges (Version 3.1, August 2016).

Process Specifications/Operating Conditions/Limitations:

Maximum amount of explosive used per blast 6160 kg/blast
 Number of Blasts 1 blast/hour
 Composition of explosive 70% emulsion
 30% ANFO

Sample Calculation Emission rate (g/s) = EF (kg/Mg material processed) × Hourly Throughput (kg of explosives/blast)

Uncontrolled Emission Factor					
Source	Contaminant	CAS	Emission Factor	Units	Emission Factor Quality
Blasting - Combustion Gases	Carbon monoxide	630-08-0	34	kg/Mg ANFO	D
			17	kg/Mg emulsion	D
	Sulphur dioxide	7446-09-5	0.06	kg/Mg ANFO	D
			—	kg/Mg emulsion	D
	Nitrogen oxides	10102-44-0	8	kg/Mg ANFO	D
			0.2	kg/Mg emulsion	D

Nitrogen Oxides 1-Hour Emissions

1-hour Emission Rate [g/s] = ER from ANFO + ER from emulsion

$$1\text{-hour ANFO } ER_{NOx} = \frac{8 \text{ kg}}{\text{Mg explosive}} \times \frac{6,160 \text{ kg}}{\text{blast}} \times \frac{1 \text{ blast}}{\text{hr}} \times \frac{\text{Mg}}{1000 \text{ kg}} \times \frac{1000 \text{ g}}{\text{kg}} \times \frac{1 \text{ hr}}{3600 \text{ s}} \times 30\% \text{ ANFO}$$

$$1\text{-hour ANFO } ER_{NOx} = \frac{4.11E+00 \text{ g}}{\text{s}}$$

$$1\text{-hour Emulsion } ER_{NOx} = \frac{0.2 \text{ kg}}{\text{Mg}} \times \frac{6,160 \text{ kg}}{\text{blast}} \times \frac{1 \text{ blast}}{\text{hr}} \times \frac{\text{Mg}}{1000 \text{ kg}} \times \frac{1000 \text{ g}}{\text{kg}} \times \frac{1 \text{ hr}}{3600 \text{ s}} \times 70\% \text{ emulsion}$$

$$1\text{-hour Emulsion } ER_{NOx} = \frac{2.40E-01 \text{ g}}{\text{s}}$$

$$1\text{-hour Emission Rate [g/s]} = \frac{4.11E+00 \text{ g}}{\text{s}} + \frac{2.40E-01 \text{ g}}{\text{s}}$$

$$1\text{-hour Emission Rate [g/s]} = \frac{4.35E+00 \text{ g}}{\text{s}}$$

Nitrogen Oxides 24-Hour Emissions

$$24\text{-hour ANFO } ER_{NOx} = \frac{8.0 \text{ kg}}{\text{Mg explosive}} \times \frac{6160 \text{ kg explosive}}{\text{blast}} \times \frac{1 \text{ blast}}{1000 \text{ kg}} \times \frac{\text{Mg}}{\text{kg}} \times \frac{1 \text{ blast}}{\text{day}} \times \frac{1 \text{ day}}{6 \text{ hrs}} \times \frac{1000 \text{ g}}{1 \text{ kg}} \times \frac{1 \text{ hr}}{3600 \text{ seconds}} \times 30\% \text{ ANFO}$$

$$24\text{-hour ANFO } ER_{NOx} = \frac{6.84E-01 \text{ g}}{\text{s}}$$

$$24\text{-hour Emulsion } ER_{NOx} = \frac{0.2 \text{ kg}}{\text{Mg}} \times \frac{6,160 \text{ kg}}{\text{blast}} \times \frac{1 \text{ blast}}{\text{hr}} \times \frac{\text{Mg}}{1000 \text{ kg}} \times \frac{1000 \text{ g}}{\text{kg}} \times \frac{1 \text{ hr}}{3600 \text{ s}} \times 70\% \text{ emulsion}$$

$$24\text{-hour Emulsion } ER_{NOx} = \frac{2.40E-01 \text{ g}}{\text{s}}$$

$$24\text{-hour Emission Rate [g/s]} = \frac{6.84E-01 \text{ g}}{\text{s}} + \frac{2.40E-01 \text{ g}}{\text{s}}$$

$$24\text{-hour Emission Rate [g/s]} = \frac{9.24E-01 \text{ g}}{\text{s}}$$

Emission Summary

Source ID	Source Description	Source Type	Control Method	Contaminant	Explosive	1-hour ER [g/s]	Total 1-hr ER [g/s]	24-hour ER [g/s]	Total 24-hr ER [g/s]
10	Blasting - Combustion Gases	Explosive detonation	N/A	Carbon monoxide	ANFO	1.75E+01	3.78E+01	—	—
					Emulsion	2.04E+01			
				Sulphur dioxide	ANFO	3.08E-02	3.08E-02	5.13E-03	5.13E-03
					Emulsion	—			
				Nitrogen oxides	ANFO	4.11E+00	4.35E+00	6.84E-01	9.24E-01
					Emulsion	2.40E-01			

APPENDIX D

Dispersion Modelling Results

Summary of Dispersion Modelling Reesults

Scenario 0

Compound	Averaging Period	Objective / Criteria?	Criteria [$\mu\text{g}/\text{m}^3$]	Existing Concentration [$\mu\text{g}/\text{m}^3$]	Sensitive Receptors			Off-site Receptors		
					Maximum Predicted Concentration [$\mu\text{g}/\text{m}^3$]	Maximum Predicted Cumulative Concentration [$\mu\text{g}/\text{m}^3$]	% Criteria	Maximum Off-Site Concentration [$\mu\text{g}/\text{m}^3$]	Maximum Predicted Cumulative Concentration [$\mu\text{g}/\text{m}^3$]	% Criteria
SPM	24-Hour	AAQC	120	42	77	118	99%	152	194	161%
	Annual	AAQC	60	25	4.8	30	50%	11	36	61%
PM ₁₀	24-Hour	AAQC	50	23	38	61	122%	59	82	165%
PM _{2.5}	24-Hour	AAQC/CAAQS	27	13	6.4	19	70%	10.1	23	84%
	Annual	CAAQS	8.8	6.9	0.3	7.2	82%	0.73	7.7	87%
Crystalline Silica	24-hour	AAQC	5	2.5	2.4	4.9	98%	3.7	6.3	125%
NO ₂	1-Hour	AAQC	400	26	259	286	71%	167	193	48%
		CAAQS	79	26	259	286	362%	167	193	245%
	24-Hour	AAQC	200	22	34	57	28%	41	63	31%
SO ₂	1-Hour	CAAQS	22.6	13	1.8	15	65%	5.6	18	82%
		AAQC	104.8	2.6	12	15	14%	7.6	10	10%
	24-Hour	CAAQS	170.3	2.6	12	15	9%	7.6	10	6%
		CAAQS	150	2.6	0.37	3.0	2%	1.7	4.3	3%
Annual	AAQC/CAAQS	10.5	1.2	0.01	1.2	11%	0.20	1.4	13%	
CO	1-Hour	AAQC	36,200	435	14,686	15,121	42%	14,482	14,917	41%
		NAAQO	15,000	435	14,686	15,121	101%	14,482	14,917	99%
	8-Hour	AAQC	15,700	553	3,488	4,041	26%	4,374	4,927	31%
		NAAQO	6000	553	3,488	4,041	67%	4,374	4,927	82%

Scenario 1

Compound	Averaging Period	Objective / Criteria?	Criteria [$\mu\text{g}/\text{m}^3$]	Existing Concentration [$\mu\text{g}/\text{m}^3$]	Sensitive Receptors			Off-site Receptors		
					Maximum Predicted Concentration [$\mu\text{g}/\text{m}^3$]	Maximum Predicted Cumulative Concentration [$\mu\text{g}/\text{m}^3$]	% Criteria	Maximum Off-Site Concentration [$\mu\text{g}/\text{m}^3$]	Maximum Predicted Cumulative Concentration [$\mu\text{g}/\text{m}^3$]	% Criteria
SPM	24-Hour	AAQC	120	42	66	108	90%	96	138	115%
	Annual	AAQC	60	25	3.5	29	48%	11	36	60%
PM ₁₀	24-Hour	AAQC	50	23	34	57	114%	45	68	136%
PM _{2.5}	24-Hour	AAQC/CAAQS	27	13	6.0	19	69%	7.9	21	76%
	Annual	CAAQS	8.8	6.9	0.26	7.2	82%	0.84	7.8	88%
Crystalline Silica	24-hour	AAQC	5	2.5	2.1	4.6	92%	2.8	5.3	106%
NO ₂	1-Hour	AAQC	400	26	204	230	57%	178	204	51%
		CAAQS	79	26	204	230	291%	178	204	259%
	24-Hour	AAQC	200	22	37	59	30%	40	63	31%
SO ₂	1-Hour	CAAQS	22.6	13	2.1	15	66%	6.4	19	85%
		AAQC	106	2.6	8.29	11	10%	6.5	9.2	9%
	24-Hour	CAAQS	173	2.6	8.29	11	6%	6.5	9.2	5%
		CAAQS	150	2.6	0.19	2.8	2%	0.28	2.9	2%
Annual	AAQC/CAAQS	11	1.2	0.01	1.2	11%	0.031	1.2	11%	
CO	1-Hour	AAQC	36,200	435	10,015	10,450	29%	7,906	8,341	23%
		NAAQO	15,000	435	10,015	10,450	70%	7,906	8,341	56%
	8-Hour	AAQC	15,700	553	3,488	4,041	26%	2,933	3,486	22%
		NAAQO	6000	553	3,488	4,041	67%	2,933	3,486	58%

Scenario 2

Compound	Averaging Period	Objective / Criteria?	Criteria [$\mu\text{g}/\text{m}^3$]	Existing Concentration [$\mu\text{g}/\text{m}^3$]	Sensitive Receptors			Off-site Receptors		
					Maximum Predicted Concentration [$\mu\text{g}/\text{m}^3$]	Maximum Predicted Cumulative Concentration [$\mu\text{g}/\text{m}^3$]	% Criteria	Maximum Off-Site Concentration [$\mu\text{g}/\text{m}^3$]	Maximum Predicted Cumulative Concentration [$\mu\text{g}/\text{m}^3$]	% Criteria
SPM	24-Hour	AAQC	120	41.9	98.6	140.5	117%	265.9	307.8	257%
	Annual	AAQC	60	25.1	7.6	32.7	54%	34.5	59.6	99%
PM ₁₀	24-Hour	AAQC	50	23.3	44.0	67.2	134%	97.8	121.0	242%
PM _{2.5}	24-Hour	AAQC/CAAQS	27	12.6	7.4	20.0	74%	16.6	29.2	108%
	Annual	CAAQS	8.8	6.9	0.53	7.5	85%	2.2	9.2	104%
Crystalline Silica	24-hour	AAQC	5	2.5	2.7	5.3	105%	6.1	8.6	172%
NO ₂	1-Hour	AAQC	400	26.3	385.1	411.4	103%	399.31	425.6	106%
		CAAQS	79	26.3	385.1	411.4	521%	399.31	425.6	539%
	Annual	CAAQS	22.6	12.8	4.9	17.7	78%	9.31	22.1	98%
SO ₂	1-Hour	AAQC	106	2.6	21.0	23.6	22%	22	24.6	23%
		CAAQS	173	2.6	21.0	23.6	14%	22	24.6	14%
	Annual	AAQC/CAAQS	11	1.2	0.023	1.2	11%	0.13	1.3	12%
CO	1-Hour	AAQC	36,200	435.2	25410.2	25845.4	71%	26678.1	27113.3	75%
		NAAQO	15,000	435.2	25410.2	25845.4	172%	26678.1	27113.3	181%
	8-Hour	AAQC	15,700	553.2	5985.7	6538.8	42%	10656.4	11209.6	71%
		NAAQO	6000	553.2	5985.7	6538.8	109%	10656.4	11209.6	187%

Scenario 3

Compound	Averaging Period	Objective / Criteria?	Criteria [$\mu\text{g}/\text{m}^3$]	Existing Concentration [$\mu\text{g}/\text{m}^3$]	Sensitive Receptors			Off-site Receptors		
					Maximum Predicted Concentration [$\mu\text{g}/\text{m}^3$]	Maximum Predicted Cumulative Concentration [$\mu\text{g}/\text{m}^3$]	% Criteria	Maximum Off-Site Concentration [$\mu\text{g}/\text{m}^3$]	Maximum Predicted Cumulative Concentration [$\mu\text{g}/\text{m}^3$]	% Criteria
SPM	24-Hour	AAQC	120	42	32	74	62%	142	184	153%
	Annual	AAQC	60	25	2.2	27	45%	25	50	83%
PM ₁₀	24-Hour	AAQC	50	23	21	45	89%	63	87	173%
PM _{2.5}	24-Hour	AAQC/CAAQS	27	13	3.6	16	60%	11	24	89%
	Annual	CAAQS	8.8	6.9	0.17	7.1	81%	1.8	8.7	99%
Crystalline Silica	24-hour	AAQC	5	2.5	1.3	3.8	77%	4.0	6.5	130%
NO ₂	1-Hour	AAQC	400	26	133	160	40%	231	257	64%
		CAAQS	79	26	133	160	202%	231	257	325%
	Annual	CAAQS	22.6	13	1.0	14	61%	8.5	21	94%
SO ₂	1-Hour	AAQC	106	2.6	3.3	5.9	6%	10	13	12%
		CAAQS	173	2.6	3.3	5.9	3%	10	13	7%
	Annual	AAQC/CAAQS	11	1.2	0.0041	1.2	11%	0.092	1.3	12%
CO	1-Hour	AAQC	36,200	435	4,004	4,439	12%	12,356	12,791	35%
		NAAQO	15,000	435	4,004	4,439	30%	12,356	12,791	85%
	8-Hour	AAQC	15,700	553	749	1,302	8%	5,486	6,040	38%
		NAAQO	6000	553	749	1,302	22%	5,486	6,040	101%

Scenario 4

Compound	Averaging Period	Objective / Criteria?	Criteria [$\mu\text{g}/\text{m}^3$]	Existing Concentration [$\mu\text{g}/\text{m}^3$]	Sensitive Receptors			Off-site Receptors		
					Maximum Predicted Concentration [$\mu\text{g}/\text{m}^3$]	Maximum Predicted Cumulative Concentration [$\mu\text{g}/\text{m}^3$]	% Criteria	Maximum Off-Site Concentration [$\mu\text{g}/\text{m}^3$]	Maximum Predicted Cumulative Concentration [$\mu\text{g}/\text{m}^3$]	% Criteria
SPM	24-Hour	AAQC	120	42	78	120	100%	286	328	274%
	Annual	AAQC	60	25	7.3	32	54%	48	73	121%
PM ₁₀	24-Hour	AAQC	50	23	33	56	112%	101	124	249%
PM _{2.5}	24-Hour	AAQC/CAAQS	27	13	5.4	18	67%	17	30	110%
	Annual	CAAQS	8.8	6.9	0.50	7.4	84%	2.9	10	111%
Crystalline Silica	24-hour	AAQC	5	2.5	2.0	4.5	91%	6.3	8.8	176%
NO ₂	1-Hour	AAQC	400	26	245	272	68%	438	464	116%
		CAAQS	79	26	245	272	344%	438	464	588%
	24-Hour	AAQC	200	22	39	61	31%	56	78	39%
	Annual	CAAQS	22.6	13	4.9	18	79%	9.7	22	100%
SO ₂	1-Hour	AAQC	106	2.6	11	14	13%	24.56	27	26%
		CAAQS	173	2.6	11	14	8%	24.56	27	16%
	24-Hour	CAAQS	150	2.6	0.22	2.8	2%	1.04	3.7	2%
	Annual	AAQC/CAAQS	11	1.2	0.023	1.2	11%	0.15	1.3	12%
CO	1-Hour	AAQC	36,200	435	13,340	13,775	38%	29,725	30,160	83%
		NAAQO	15,000	435	13,340	13,775	92%	29,725	30,160	201%
	8-Hour	AAQC	15,700	553	4,176	4,729	30%	11,698	12,251	78%
		NAAQO	6000	553	4,176	4,729	79%	11,698	12,251	204%