Appendix 4-2-C Project Air Emissions Inventory

C.1 Introduction

For the purposes of estimating effects on air quality associated with the Project, air emissions were estimated based on information provided by the Taseko Mines engineering design team regarding the type, quantity, and operating time of equipment. This information formed the basis of the air emissions calculations, in combination with literature documenting emission rates for various types of equipment and vehicles.

Project air emissions were quantified for the following three main development phases:

- construction and commissioning (site clearing, open-pit mine development, and construction of ore processing and mill ancillary facilities)
- operation (ore extraction, transport, crushing, stockpiling, truck loading, and hauling)
- closure (decommissioning, infrastructure removal, water reclamation, and active site management)

Air emissions associated with the closure phase of the Project were assumed to be similar to those associated with the construction phase but to a much lesser degree. Air emissions from post-closure (the point after which reclamation work is complete and reclamation end objectives have been achieved) activities will be minimal.

Emissions of criteria air contaminants (CACs) associated with the Project were calculated for various types of combustion sources, including open burning, construction equipment (dozers, graders, backhoes, loaders, forklifts etc.), rock moving equipment (drills, haul trucks, cranes, etc.), diesel generators, and motor vehicles. Air emissions of PM specifically were calculated for activities such as blasting, truck loading and unloading, rock drilling, primary ore crushing, and materials hauling within the mine pit and along the Project haul road. These latter emissions are characterized as “Fugitive Emissions” as they do not originate from a specific point (e.g., a stack or motor vehicle exhaust system). All CAC emission calculations were based on peak mine operation and production levels for each development phase.

The following sections highlight the emissions estimation methodology for CACs that was applied for each of the three Project development phases, including an overview of key assumptions, emission factors, and calculation methods applied.

C.2 Construction and Commissioning

Air emissions associated with activities during the construction and commissioning phase of the Project will originate primarily from the following major sources, including:

- site clearing activities
- exhaust from mine fleet heavy equipment
- four diesel generator sets (used to supply the site with power)
- fugitive emissions from blasting, drilling, and overburden hauling

The construction phase of the Project is anticipated to be completed over a period of 22 months. The methodologies applied in the calculation of CAC air emissions from each of these sources are discussed in more detail within the following sections.

C.2.1 Site Clearing Activities

Emissions of CACs from the site clearing and grubbing, and subsequent burning of vegetative debris were calculated based on the projected area to be cleared (estimated to be approximately 744 ha) and an estimated 35 tonne/ha fuel loading at the site (Bell-Irving 2007, pers. comm.). Emission factors were applied based on United States Environmental Protection Agency (U.S. EPA) AP-42 factors for wildfires and prescribed burning (U.S. EPA 1996, Internet Site). A summary of the emission rates from site burning is presented in Table C–1.

Table C–1 Summary of Total Emissions from Project Site Clearing

Substance	Average Emission Rate [a, b] (t/y)
$PM_{2.5}$	497
PM_{10}	511
TPM	767
CO	4,787

NOTES:
[a] Based on a total of 744 ha and a fuel loading of 35 tonnes/ha, and emission factors from U.S. EPA (1996, internet site).
[b] Assumes that site clearing will occur over the course of the 22-month construction phase period.

C.2.2 Mine Fleet Equipment

Project-related CAC emissions from mine fleet combustion sources were quantified based on information regarding the type, quantity, and maximum operating time of equipment, as well as literature documenting emission rates for various types of equipment, vehicles, and ore mining processes.

For new diesel-fired combustion equipment, emission factors were applied based on U.S. EPA/Canada Environmental Protection Act (CEPA) Tier 3 Emission Limits for Off-Road Heavy Duty Diesel Engines (Environment Canada 2006). For diesel-fired combustion equipment that will be purchased used (i.e., large sanding/watering trucks), emission factors were applied based on U.S. EPA/Canada Environmental Protection Act (CEPA) Tier 2 Emission Limits for Off-Road Heavy Duty Diesel Engines (Environment Canada 2006). To comply with sulphur regulations for off-road diesel which come into effect in 2010 (Environment Canada 2003, Internet Site), a fuel sulphur content of 15 ppm in diesel was assumed for all SO_2 emission calculations.

For gasoline driven vehicles, U.S. EPA (2000) Tier 1 emission standards for light-duty vehicles and trucks were applied. A maximum concentration of sulphur in gasoline for on-road vehicles was assumed to be 30 mg/kg, based on Department of Justice (2007, Internet Site).

Details regarding the type and quantity of heavy mine fleet equipment used in the construction and commissioning phase of the Project are summarized in Table C–2. Table C–3 summarizes the maximum hourly, daily, and annual emission rates associated

with heavy mine fleet equipment during the construction and commissioning phase of the Project. These emissions are expected to occur over the 22 month construction period.

C.3 Diesel Generators

Four generators will be used on a continuous basis to supply power to the site during the construction and commissioning phase of the Project. The fuel source for the generator sets is diesel. Each 2250 kilowatt (KW) generator was assumed to operate continuously at 75% load. Emission rates were calculated based on manufacturer's specifications (Caterpillar 2006). A summary of emission rates and source parameters for the diesel generators, as applied in dispersion modelling, is presented in Table C–4.

C.4 Fugitive Emissions

Air emissions of PM associated with Project construction and commissioning will be primarily related to fugitive PM generated from blasting, drilling, ground disturbance, and materials handling.

Emissions from blasting were based on U.S. EPA AP-42 Western Surface Coal Mining emission factors (U.S. EPA 1998, Internet Site). It was assumed that each blast would impact an area of approximately 2500 m^2 and that up to five blasting events could occur during a one week period.

Fugitive emissions from drilling, truck loading in the mine pit, and truck un-loading at the truck dump were based on a mine production rate of 126,000 tonnes/day and U.S. EPA emission factors for Crushed Stone Processing (U.S. EPA 2004, Internet Site).

Fugitive emissions from haul roads were estimated based on U.S. EPA emission factors for unpaved roads (U.S. EPA 2006, Internet Site). A silt loading of 8.3% was applied (based upon quarry and stone mining haul roads), as recommended by the U.S. EPA (1995). A haul distance of 4310 km/day was applied for the construction and commissioning phase, based on information provided by the Taseko Mines engineering design team. It was assumed that a dust control program (i.e. applying water to control dust emissions) would be applied and would control fugitive dust emissions from haul roads by approximately 75%.

A summary of emission rates associated with fugitive PM emission sources for the construction and commissioning phase is presented in Table C–5.

Table C–2 Summary of Mine Fleet Equipment for Construction and Commissioning

Type	Description	Maximum Units Required	Unit Operating Time (hours/year)	Engine Type	Engine Size (HP)
Taseko Lake Logging Road (76 km)					
Pick-up Truck	4 x 4	2	131	Gasoline	150
Track Dozer	D9R	2	295	Diesel	474
Grader	16G	1	131	Diesel	265
Backhoe Loader	Cat-430E	2	295	Diesel	97
Tandem Dump Truck	Western Star 4900FA	5	295	Diesel	300
Wheel Loader	966	1	196	Diesel	220
Mobile Crusher	BR380JG-1	1	196	Diesel	190
4500 Haul Road (19 km)					
Pick-up Truck	4 x 4	2	196	Gasoline	150
Track Dozer	D9R	1	442	Diesel	474
Grader	16G	1	196	Diesel	265
Backhoe Loader	Cat-430E	1	442	Diesel	97
Tandem Dump Truck	Western Star 4900FA	5	295	Diesel	300
Compactor	CS-573E	1	442	Diesel	150
Haul Truck	MT 3700	5	442	Diesel	2500
Wheel Loader	966	1	295	Diesel	220
Mobile Crusher	BR380JG-1	1	295	Diesel	190
Site Access Road					
Pick-up Truck	4 x 4	2	131	Gasoline	150
Feller/Buncher	541	1	295	Diesel	305
Log Skidder	324D-FM	1	295	Diesel	200
HIAB Flat Bed Utility Truck (Articulated)	2 x 6, 2t	2	295	Diesel	300
Grader	16G	1	196	Diesel	265
Track Dozer	D9R	2	295	Diesel	474
Backhoe Loader	Cat-430E	1	295	Diesel	97
Tandem Dump Truck	Western Star 4900FA	5	295	Diesel	300
Wheel Loader	966	1	295	Diesel	220
Mobile Crusher	BR380JG-1	1	295	Diesel	190

Table C–2 Summary of Mine Fleet Equipment for Construction and Commissioning (cont'd)

Type	Description	Maximum Units Required	Unit Operating Time (hours/year)	Engine Type	Engine Size (HP)
Mill Site Construction					
Pick-up Truck	4 x 4	1	524	Gasoline	150
Feller/Buncher	541	1	1178	Diesel	305
Log Skidder	324D-FM	1	1178	Diesel	200
HIAB Flat Bed Utility Truck (Articulated)	2 x 6, 2t	3	1178	Diesel	300
Track Dozer	D9R	3	1178	Diesel	474
Grader	16G	1	196	Diesel	265
Backhoe Loader	Cat-430E	1	1178	Diesel	97
Wheel Tractor Scraper	637G	6	1364	Diesel	500
Tandem Dump Truck	Western Star 4900FA	5	295	Diesel	300
Mobile Crusher	BR380JG-1	1	295	Diesel	190
Wheel Loader	966	1	196	Diesel	220
Fork Lift	17,500 lb	1	524	Diesel	50
Fork Lift	52,000 lb	1	524	Diesel	100
Concrete Mixing Trucks	Western Star 4900FA	5	818	Diesel	300
Mobile Crane	130 t	1	524	Diesel	500
Mobile Crane	50 t	1	524	Diesel	370
Mine Fleet Pre-Production & Construction					
Hydraulic Drill	GD	1	1050	Diesel	500
Wheel Loader	L1850	1	5900	Diesel	2000
Haul Truck	MT 3700	5	5900	Diesel	1800
Track Dozer	D9R	2	5000	Diesel	474
Grader	16G	2	3700	Diesel	265
Wheel Tractor Scraper	637G	6	2500	Diesel	500
Water Truck	100t	1	2500	Diesel	1000
Site Drainage & Tailings Dam Construction					
Wheel Loader	988	1	5000	Diesel	220
Track Dozer	D9R	2	5000	Diesel	474
Excavator	325	2	2500	Diesel	1000

Table C –2 Summary of Mine Fleet Equipment for Construction and Commissioning (cont'd)

Type	Description	Maximum Units Required	Unit Operating Time (hours/year)	Engine Type	Engine Size (HP)
Articulating Haul Truck	Cat725	6	5000	Diesel	300
Compactor	CS-573E	1	1600	Diesel	150
Grader	18G	1	3700	Diesel	265
Lighting Plant	-	1	1400	Diesel	25
Support Equipment					
Blasthole Stemmer	-	1	500	Diesel	100
Wheel Loader	966	1	500	Diesel	220
Wheel Loader	988	1	500	Diesel	220
Tow Truck	-	1	250	Diesel	200
Excavator	325	2	500	Diesel	1000
Low Bed	90t	1	500	Diesel	960
Tire Manipulator	980G	1	500	Diesel	325
Lighting Plant	-	2	1400	Diesel	25
Sport Utility Truck	4x4	1	1400	Gasoline	150
Engineering Pickup	4x4	2	1400	Gasoline	150
Pit Services Pickup	4x4	4	1400	Gasoline	150
Pit Services Bus	12 man	2	1400	Diesel	150
Shovel Crew Flat Deck	3t	2	1400	Diesel	300
Shovel Crew HIAB	5t	1	1400	Diesel	300
Surface Crew HIAB	10t	1	1400	Diesel	300
Surface Crew Stinger	-	1	1400	Diesel	300
Fuel and Lube Truck	-	2	1400	Diesel	300
Blasting Truck	-	1	1400	Diesel	300
Light Repair Truck	-	1	1400	Diesel	300

Table C –3 Summary of Mine Fleet Equipment Emission Rates for Construction and Commissioning

Type	Maximum One-hour Emission Rate (g/s)					Maximum 24-hour Emission Rate (g/s)					Annual Averaging Period Emission Rate (g/s)				
	SO_2	NO_x	CO	$PM_{2.5}$	VOC	SO_2	NO_x	CO	$PM_{2.5}$	VOC	SO_2	NO_x	CO	$PM_{2.5}$	VOC
Taseko Lake Logging Road (76 km)															
Pick-up Truck	4.24E-07	3.36E-05	1.90E-04	3.46E-06	2.77E-05	1.59E-07	1.26E-05	7.13E-05	1.30E-06	1.04E-05	6.34E-09	5.01E-07	2.84E-06	5.17E-08	4.14E-07
Track Dozer	1.01E-03	0.404	0.404	0.023	0.062	3.78E-04	0.151	0.151	0.009	0.023	3.39E-05	0.014	0.014	0.001	0.002
Grader	3.78E-04	0.113	0.113	0.007	0.017	1.42E-04	0.042	0.042	0.002	0.007	5.65E-06	0.002	0.002	0.000	0.000
Backhoe Loader	1.66E-04	0.083	0.083	0.005	0.013	6.24E-05	0.031	0.031	0.002	0.005	5.59E-06	0.003	0.003	0.000	0.000
Tandem Dump Truck	1.26E-03	0.639	0.639	0.037	0.098	4.73E-04	0.240	0.240	0.014	0.037	4.24E-05	0.021	0.021	0.001	0.003
Wheel Loader	1.89E-04	0.094	0.094	0.005	0.014	7.09E-05	0.035	0.035	0.002	0.005	4.24E-06	0.002	0.002	0.000	0.000
Mobile Crusher	1.51E-04	0.081	0.081	0.005	0.012	5.67E-05	0.030	0.030	0.002	0.005	3.39E-06	0.002	0.002	0.000	0.000
4500 Haul Road (19 km)															
Pick-up Truck	4.24E-07	3.36E-05	1.90E-04	3.46E-06	2.77E-05	1.59E-07	1.26E-05	7.13E-05	1.30E-06	1.04E-05	6.34E-09	7.52E-07	4.26E-06	7.75E-08	6.20E-07
Track Dozer	5.04E-04	0.202	0.202	0.012	0.031	1.89E-04	0.076	0.076	0.004	0.012	2.54E-05	0.010	0.010	0.001	0.002
Grader	3.78E-04	0.113	0.113	0.007	0.017	1.42E-04	0.042	0.042	0.002	0.007	8.48E-06	0.003	0.003	0.000	0.000
Backhoe Loader	8.32E-05	0.041	0.041	0.002	0.006	3.12E-05	0.015	0.015	0.001	0.002	4.20E-06	0.002	0.002	0.000	0.000
Tandem Dump Truck	1.26E-03	0.639	0.639	0.037	0.098	4.73E-04	0.240	0.240	0.014	0.037	4.24E-05	0.021	0.021	0.001	0.003
Compactor	1.26E-04	0.064	0.064	0.004	0.010	4.73E-05	0.024	0.024	0.001	0.004	6.36E-06	0.003	0.003	0.000	0.000
Haul Truck	7.16E-03	8.604	5.326	0.307	1.229	2.68E-03	3.227	1.997	0.115	0.461	3.61E-04	0.434	0.269	0.015	0.062
Wheel Loader	1.89E-04	0.094	0.094	0.005	0.014	7.09E-05	0.035	0.035	0.002	0.005	6.36E-06	0.003	0.003	0.000	0.000
Mobile Crusher	1.51E-04	0.081	0.081	0.005	0.012	5.67E-05	0.030	0.030	0.002	0.005	5.09E-06	0.003	0.003	0.000	0.000
Site Access Road															
Pick-up Truck	4.24E-07	3.36E-05	1.90E-04	3.46E-06	2.77E-05	1.59E-07	1.26E-05	7.13E-05	1.30E-06	1.04E-05	6.34E-09	5.01E-07	2.84E-06	5.17E-08	4.14E-07
Feller/Buncher	2.52E-04	0.130	0.130	0.007	0.020	9.45E-05	0.049	0.049	0.003	0.007	8.48E-06	0.004	0.004	0.000	0.001
Log Skidder	1.64E-04	0.085	0.085	0.005	0.013	6.14E-05	0.032	0.032	0.002	0.005	5.51E-06	0.003	0.003	0.000	0.000
HIAB Flat Bed Utility Truck (Articulated)	5.04E-05	0.256	0.256	0.015	0.039	1.89E-05	0.096	0.096	0.006	0.015	1.70E-06	0.009	0.009	0.000	0.001
Grader	3.78E-04	0.113	0.113	0.007	0.017	1.42E-04	0.042	0.042	0.002	0.007	8.48E-06	0.003	0.003	0.000	0.000
Track Dozer	1.01E-03	0.404	0.404	0.023	0.062	3.78E-04	0.151	0.151	0.009	0.023	3.39E-05	0.014	0.014	0.001	0.002
Backhoe Loader	8.32E-05	0.041	0.041	0.002	0.006	3.12E-05	0.015	0.015	0.001	0.002	2.80E-06	0.001	0.001	0.000	0.000
Tandem Dump Truck	1.26E-03	0.639	0.639	0.037	0.098	4.73E-04	0.240	0.240	0.014	0.037	4.24E-05	0.021	0.021	0.001	0.003
Wheel Loader	1.89E-04	0.094	0.094	0.005	0.014	7.09E-05	0.035	0.035	0.002	0.005	6.36E-06	0.003	0.003	0.000	0.000
Mobile Crusher	1.51E-04	0.081	0.081	0.005	0.012	5.67E-05	0.030	0.030	0.002	0.005	5.09E-06	0.003	0.003	0.000	0.000
Mill Site Construction															
Pick-up Truck	2.12E-07	1.68E-05	9.51E-05	1.73E-06	1.38E-05	2.12E-07	1.68E-05	9.51E-05	1.73E-06	1.38E-05	3.17E-09	1.00E-06	5.69E-06	1.03E-07	8.27E-07
Feller/Buncher	2.52E-04	0.130	0.130	0.007	0.020	2.52E-04	0.049	0.049	0.003	0.007	3.39E-05	0.017	0.017	0.001	0.003
Log Skidder	1.64E-04	0.085	0.085	0.005	0.013	1.64E-04	0.032	0.032	0.002	0.005	2.20E-05	0.011	0.011	0.001	0.002
HIAB Flat Bed Utility Truck (Articulated)	7.56E-05	0.384	0.384	0.022	0.059	7.56E-05	0.144	0.144	0.008	0.022	1.02E-05	0.052	0.052	0.003	0.008
Track Dozer	1.51E-03	0.606	0.606	0.035	0.093	1.51E-03	0.227	0.227	0.013	0.035	2.03E-04	0.081	0.081	0.005	0.013
Grader	3.78E-04	0.113	0.113	0.007	0.017	3.78E-04	0.042	0.042	0.002	0.007	8.48E-06	0.003	0.003	0.000	0.000
Backhoe Loader	8.32E-05	0.041	0.041	0.002	0.006	8.32E-05	0.015	0.015	0.001	0.002	1.12E-05	0.006	0.006	0.000	0.001
Wheel Tractor Scraper	3.03E-03	1.278	1.278	0.074	0.197	3.03E-03	0.479	0.479	0.028	0.074	4.71E-04	0.199	0.199	0.011	0.031
Tandem Dump Truck	1.26E-03	0.639	0.639	0.037	0.098	1.26E-03	0.240	0.240	0.014	0.037	4.24E-05	0.021	0.021	0.001	0.003
Mobile Crusher	1.51E-04	0.081	0.081	0.005	0.012	1.51E-04	0.030	0.030	0.002	0.005	5.09E-06	0.003	0.003	0.000	0.000
Wheel Loader	1.89E-04	0.094	0.094	0.005	0.014	1.89E-04	0.035	0.035	0.002	0.005	4.24E-06	0.002	0.002	0.000	0.000
Fork Lift	2.52E-05	0.021	0.021	0.001	0.003	2.52E-05	0.008	0.008	0.000	0.001	1.51E-06	0.001	0.001	0.000	0.000
Fork Lift	2.52E-05	0.043	0.043	0.002	0.007	2.52E-05	0.016	0.016	0.001	0.002	1.51E-06	0.003	0.003	0.000	0.000
Concrete Mixing Trucks	1.26E-03	0.639	0.639	0.037	0.098	1.26E-03	0.240	0.240	0.014	0.037	1.18E-04	0.060	0.060	0.003	0.009
Mobile Crane	2.52E-04	0.213	0.213	0.012	0.033	2.52E-04	0.080	0.080	0.005	0.012	1.51E-05	0.013	0.013	0.001	0.002

Table C –3 Summary of Mine Fleet Equipment Emission Rates for Construction and Commissioning (cont'd)

Type	Maximum One-hour Emission Rate (g/s)					Maximum 24-hour Emission Rate (g/s)					Annual Averaging Period Emission Rate (g/s)				
	SO_2	NO_x	CO	$PM_{2.5}$	VOC	SO_2	NO_x	CO	$PM_{2.5}$	VOC	SO_2	NO_x	CO	$PM_{2.5}$	VOC
Concrete Mixing Trucks	1.26E-03	0.639	0.639	0.037	0.098	1.26E-03	0.240	0.240	0.014	0.037	1.18E-04	0.060	0.060	0.003	0.009
Mobile Crane	2.52E-04	0.213	0.213	0.012	0.033	2.52E-04	0.080	0.080	0.005	0.012	1.51E-05	0.013	0.013	0.001	0.002
Mobile Crane	1.26E-04	0.158	0.158	0.009	0.024	1.26E-04	0.059	0.059	0.003	0.009	7.53E-06	0.009	0.009	0.001	0.001
Mine Fleet Pre-Production & Construction															
Hydraulic Drill	5.04E-04	0.213	0.213	0.012	0.033	5.04E-04	0.213	0.213	0.012	0.033	6.04E-05	0.026	0.026	0.001	0.004
Wheel Loader	1.27E-03	1.377	0.852	0.049	0.197	1.27E-03	1.377	0.852	0.049	0.197	8.52E-04	0.927	0.574	0.033	0.132
Haul Truck	7.16E-03	6.195	3.835	0.221	0.885	7.16E-03	6.195	3.835	0.221	0.885	4.82E-03	4.172	2.583	0.149	0.596
Track Dozer	1.01E-03	0.404	0.404	0.023	0.062	1.01E-03	0.404	0.404	0.023	0.062	5.76E-04	0.231	0.231	0.013	0.035
Grader	7.56E-04	0.226	0.226	0.013	0.035	7.56E-04	0.226	0.226	0.013	0.035	3.19E-04	0.095	0.095	0.006	0.015
Wheel Tractor Scraper	3.03E-03	1.278	1.278	0.074	0.197	3.03E-03	1.278	1.278	0.074	0.197	8.63E-04	0.365	0.365	0.021	0.056
Water Truck	6.30E-04	0.688	0.426	0.025	0.098	6.30E-04	0.688	0.426	0.025	0.098	1.80E-04	0.196	0.122	0.007	0.028
Site Drainage & Tailings Dam Construction															
Wheel Loader	1.89E-04	0.094	0.094	0.005	0.014	7.09E-05	0.035	0.035	0.002	0.005	1.08E-04	0.054	0.054	0.003	0.008
Track Dozer	1.01E-03	0.404	0.404	0.023	0.062	3.78E-04	0.151	0.151	0.009	0.023	5.76E-04	0.231	0.231	0.013	0.035
Excavator	1.01E-03	1.377	0.852	0.049	0.197	3.78E-04	0.516	0.320	0.018	0.074	2.88E-04	0.393	0.243	0.014	0.056
Articulating Haul Truck	1.51E-03	0.767	0.767	0.044	0.118	5.67E-04	0.288	0.288	0.017	0.044	8.63E-04	0.438	0.438	0.025	0.067
Compactor	1.26E-04	0.064	0.064	0.004	0.010	4.73E-05	0.024	0.024	0.001	0.004	2.30E-05	0.012	0.012	0.001	0.002
Grader	3.78E-04	0.113	0.113	0.007	0.017	1.42E-04	0.042	0.042	0.002	0.007	1.60E-04	0.048	0.048	0.003	0.007
Lighting Plant	1.26E-05	0.011	0.011	0.001	0.002	4.73E-06	0.004	0.004	0.000	0.001	2.01E-06	0.002	0.002	0.000	0.000
Support Equipment															
Blasthole Stemmer	1.26E-04	0.043	0.043	0.002	0.007	4.73E-05	0.016	0.016	0.001	0.002	7.19E-06	0.002	0.002	0.000	0.000
Wheel Loader	1.89E-04	0.094	0.094	0.005	0.014	7.09E-05	0.035	0.035	0.002	0.005	1.08E-05	0.005	0.005	0.000	0.001
Wheel Loader	1.89E-04	0.094	0.094	0.005	0.014	7.09E-05	0.035	0.035	0.002	0.005	1.08E-05	0.005	0.005	0.000	0.001
Tow Truck	4.29E-05	0.085	0.085	0.005	0.013	1.61E-05	0.032	0.032	0.002	0.005	1.22E-06	0.002	0.002	0.000	0.000
Excavator	1.01E-03	1.377	0.852	0.049	0.197	3.78E-04	0.516	0.320	0.018	0.074	5.75E-05	0.079	0.049	0.003	0.011
Low Bed	6.30E-04	0.661	0.409	0.024	0.094	2.36E-04	0.248	0.153	0.009	0.035	3.59E-05	0.038	0.023	0.001	0.005
Tire Manipulator	4.29E-05	0.138	0.138	0.008	0.021	1.61E-05	0.052	0.052	0.003	0.008	2.44E-06	0.008	0.008	0.000	0.001
Lighting Plant	2.52E-05	0.021	0.021	0.001	0.003	9.45E-06	0.008	0.008	0.000	0.001	4.03E-06	0.003	0.003	0.000	0.001
Sport Utility Truck	2.12E-07	1.68E-05	9.51E-05	1.73E-06	1.38E-05	7.96E-08	6.29E-06	3.57E-05	6.49E-07	5.19E-06	3.17E-09	2.68E-06	1.52E-05	2.76E-07	2.21E-06
Engineering Pickup	4.24E-07	3.36E-05	1.90E-04	3.46E-06	2.77E-05	1.59E-07	1.26E-05	7.13E-05	1.30E-06	1.04E-05	6.34E-09	5.36E-06	3.04E-05	5.53E-07	4.42E-06
Pit Services Pickup	8.49E-07	6.71E-05	3.81E-04	6.92E-06	5.53E-05	3.18E-07	2.52E-05	1.43E-04	2.59E-06	2.08E-05	1.27E-08	1.07E-05	6.08E-05	1.11E-06	8.84E-06
Pit Services Bus	8.57E-05	0.098	0.762	0.005	0.025	0.00E+00	0.037	0.286	0.002	0.009	1.37E-05	0.016	0.122	0.001	0.004
Shovel Crew Flat Deck	8.57E-05	0.256	0.256	0.015	0.039	3.21E-05	0.096	0.096	0.006	0.015	1.37E-05	0.041	0.041	0.002	0.006
Shovel Crew HIAB	4.29E-05	0.128	0.128	0.007	0.020	1.61E-05	0.048	0.048	0.003	0.007	6.85E-06	0.020	0.020	0.001	0.003
Surface Crew HIAB	4.29E-05	0.128	0.128	0.007	0.020	1.61E-05	0.048	0.048	0.003	0.007	6.85E-06	0.020	0.020	0.001	0.003
Surface Crew Stinger	4.29E-05	0.128	0.128	0.007	0.020	1.61E-05	0.048	0.048	0.003	0.007	6.85E-06	0.020	0.020	0.001	0.003
Fuel and Lube Truck	8.57E-05	0.256	0.256	0.015	0.039	3.21E-05	0.096	0.096	0.006	0.015	1.37E-05	0.041	0.041	0.002	0.006
Blasting Truck	4.29E-05	0.128	0.128	0.007	0.020	1.61E-05	0.048	0.048	0.003	0.007	6.85E-06	0.020	0.020	0.001	0.003
Light Repair Truck	4.29E-05	0.128	0.128	0.007	0.020	1.61E-05	0.048	0.048	0.003	0.007	6.85E-06	0.020	0.020	0.001	0.003

Table C–4 Summary of Diesel Generator Emission Rates for Construction and Commissioning

Parameter		Generator 1	Generator 2	Generator 3	Generator 4
Power Rating (kW)		2250	2250	2250	2250
UTM Coordinates	km E	459.388	459.398	459.407	459.416
	km N	5700.753	5700.749	5700.744	5700.74
Stack Height (m)		10	10	10	10
Stack Diameter (m)		0.59	0.59	0.59	0.59
Base Elevation (m)		1575	1575	1575	1575
Exit Temperature	°C	491	491	491	491
	K	764	764	764	764
Exit Velocity (m/s)		22.5	22.5	22.5	22.5
Emission Rates (g/s)	SO_2	3.03E-03	3.03E-03	3.03E-03	3.03E-03
	NO_x	4.76	4.76	4.76	4.76
	CO	4.53E-01	4.53E-01	4.53E-01	4.53E-01
	PM	3.39E-02	3.39E-02	3.39E-02	3.39E-02
	VOC	2.51E-02	2.51E-02	2.51E-02	2.51E-02

Table C–5 Summary of Fugitive PM Emission Sources for Construction and Commissioning

Source of Fugitive Dust	Location of Emission	Emission Rate (t/d)		
		TPM	PM_{10}	$PM_{2.5}$
Blasting	Mine Pit	0.028	0.014	0.001
Truck Loading	Mine Pit	0.006	0.001	0.000
Drilling	Mine Pit	0.050	0.005	0.001
Truck Unloading	Overburden	0.010	0.001	0.001
Dust from Overburden Hauling	Mine Pit/Overburden	4.71	1.34	0.13
Total (t/y)		**1754**	**497**	**50**

NOTES:
1. Assuming a silt loading of 8.3% (U.S. EPA 1995).
2. Assuming an average weight of 260 tonnes for 240 tonne class haul trucks.
3. Assuming an effective dust suppression program will be implemented resulting in at least control of 75% of dust relative to dry/arid/uncontrolled emission levels from overburden haul roads.
4. Assuming an average of 126,000 tonnes/day of total material handled and loaded onto haul trucks.
5. Based upon Project drawings, distances for the inpit roads were estimated to be approximately 4.5 km while distances for haul roads outside of the mine pit were estimated to be approximately 1.8 km.
6. Assuming there are approximately 567 haul truck round trips per day (based upon 126,000 tonnes/day of total material and 222 tonnes of material hauled per truck).

C.5 Model Input Summary

The emission rates presented in Tables C–3 to C–5 for the construction and commissioning phases of the Project were included in dispersion modelling as various area and point sources. A summary of the emission rates and source parameters, as applied in dispersion modelling for the construction and commissioning phase are presented in Table C–6.

Table C–6 Summary of Emission Rates for Construction and Commissioning

Source Name	Source ID	UTM Coordinates of SW Corner		Release Height (m)	Base Elevation (m)	Maximum One-hour Emission Rate ($g/m^2/s$)												
		kmE	kmN			SO_2	SO_4	NO	NO_2	HNO_3	NO_3	NO_x	VOC	CO	TPM	PM_{10}	$PM_{2.5}$	$DEPM_{2.5}$
Mine Pit Area	MINE	455.505	5701.697	0.0	1525.0	9.79E-09	0.00E+00	6.61E-06	7.34E-07	0.00E+00	0.00E+00	7.34E-06	1.07E-06	5.27E-06	2.05E-05	5.81E-06	5.80E-07	2.98E-07
Overburden Pile	OBPILE	456.255	5700.497	5.0	1510.0	3.63E-09	0.00E+00	2.95E-06	3.28E-07	0.00E+00	0.00E+00	3.28E-06	4.83E-07	2.66E-06	5.01E-05	1.42E-05	1.44E-06	1.39E-07
Waste Rock Pile	WRPILE	456.955	5700.497	5.0	1490.0	2.03E-09	0.00E+00	1.37E-06	1.52E-07	0.00E+00	0.00E+00	1.52E-06	2.27E-07	1.29E-06	0.00E+00	0.00E+00	0.00E+00	7.11E-08
Road between mine and plant	MPROAD	456.855	5701.097	5.0	1500.0	5.36E-10	0.00E+00	6.65E-07	7.39E-08	0.00E+00	0.00E+00	7.39E-07	1.11E-07	7.17E-07	0.00E+00	0.00E+00	0.00E+00	3.37E-08
Plant site	PLANT	459.105	5701.047	5.0	1570.0	2.21E-08	0.00E+00	1.13E-05	1.25E-06	0.00E+00	0.00E+00	1.25E-05	1.92E-06	1.25E-05	0.00E+00	0.00E+00	0.00E+00	7.01E-07
Project Access Road	ACROAD	457.855	5703.247	5.0	1590.0	3.48E-09	0.00E+00	1.63E-06	1.81E-07	0.00E+00	0.00E+00	1.81E-06	2.79E-07	1.81E-06	0.00E+00	0.00E+00	0.00E+00	1.05E-07
Truck Dump	TDUMP	457.055	5701.297	5.0	1480.0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Maximum 24-hour Emission Rate ($g/m^2/s$)																		
Mine Pit Area	MINE	455.505	5701.697	0.0	1525.0	9.54E-09	0.00E+00	6.30E-06	7.00E-07	0.00E+00	0.00E+00	7.00E-06	1.02E-06	4.93E-06	2.05E-05	5.81E-06	5.80E-07	2.83E-07
Overburden Pile	OBPILE	456.255	5700.497	5.0	1510.0	2.99E-09	0.00E+00	2.18E-06	2.42E-07	0.00E+00	0.00E+00	2.42E-06	3.53E-07	1.83E-06	5.01E-05	1.42E-05	1.44E-06	1.00E-07
Waste Rock Pile	WRPILE	456.955	5700.497	5.0	1490.0	7.60E-10	0.00E+00	5.14E-07	5.71E-08	0.00E+00	0.00E+00	5.71E-07	8.51E-08	4.84E-07	0.00E+00	0.00E+00	0.00E+00	2.67E-08
Road between mine and plant	MPROAD	456.855	5701.097	5.0	1500.0	1.95E-10	0.00E+00	2.50E-07	2.77E-08	0.00E+00	0.00E+00	2.77E-07	4.17E-08	2.69E-07	0.00E+00	0.00E+00	0.00E+00	1.26E-08
Plant site	PLANT	459.105	5701.047	5.0	1570.0	2.13E-08	0.00E+00	4.23E-06	4.70E-07	0.00E+00	0.00E+00	4.70E-06	7.21E-07	4.68E-06	0.00E+00	0.00E+00	0.00E+00	2.63E-07
Project Access Road	ACROAD	457.855	5703.247	5.0	1590.0	1.31E-09	0.00E+00	6.12E-07	6.80E-08	0.00E+00	0.00E+00	6.80E-07	1.05E-07	6.80E-07	0.00E+00	0.00E+00	0.00E+00	3.92E-08
Truck Dump	TDUMP	457.055	5701.297	5.0	1480.0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Annual Average Emission Rate ($g/m^2/s$)																		
Mine Pit Area	MINE	455.505	5701.697	0.0	1525.0	9.26E-09	0.00E+00	6.58E-06	7.31E-07	0.00E+00	0.00E+00	7.31E-06	1.05E-06	4.90E-06	2.05E-05	5.81E-06	5.80E-07	2.81E-07
Overburden Pile	OBPILE	456.255	5700.497	5.0	1510.0	2.71E-09	0.00E+00	2.02E-06	2.25E-07	0.00E+00	0.00E+00	2.25E-06	3.26E-07	1.61E-06	5.01E-05	1.42E-05	1.44E-06	8.88E-08
Waste Rock Pile	WRPILE	456.955	5700.497	5.0	1490.0	1.61E-09	0.00E+00	8.73E-07	9.70E-08	0.00E+00	0.00E+00	9.70E-07	1.46E-07	8.63E-07	0.00E+00	0.00E+00	0.00E+00	4.88E-08
Road between mine and plant	MPROAD	456.855	5701.097	5.0	1500.0	7.45E-11	0.00E+00	1.11E-07	1.23E-08	0.00E+00	0.00E+00	1.23E-07	1.91E-08	1.46E-07	0.00E+00	0.00E+00	0.00E+00	6.16E-09
Plant site	PLANT	459.105	5701.047	5.0	1570.0	4.34E-09	0.00E+00	2.15E-06	2.39E-07	0.00E+00	0.00E+00	2.39E-06	3.68E-07	2.45E-06	0.00E+00	0.00E+00	0.00E+00	1.36E-07
Project Access Road	ACROAD	457.855	5703.247	5.0	1590.0	2.08E-10	0.00E+00	9.86E-08	1.10E-08	0.00E+00	0.00E+00	1.10E-07	1.68E-08	1.10E-07	0.00E+00	0.00E+00	0.00E+00	6.32E-09
Truck Dump	TDUMP	457.055	5701.297	5.0	1480.0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Maximum Emission Rate (g/s)																		
Generator 1	2250gen1	-	-	-	1575.0	3.03E-03	0.00E+00	4.76E-01	0.00E+00	0.00E+00	4.76E+00	2.51E-02	4.53E-01	0.00E+00	0.00E+00	0.00E+00	3.39E-02	3.03E-03
Generator 2	2250gen2	-	-	-	1575.0	3.03E-03	0.00E+00	4.76E-01	0.00E+00	0.00E+00	4.76E+00	2.51E-02	4.53E-01	0.00E+00	0.00E+00	0.00E+00	3.39E-02	3.03E-03
Generator 3	2250gen3	-	-	-	1575.0	3.03E-03	0.00E+00	4.76E-01	0.00E+00	0.00E+00	4.76E+00	2.51E-02	4.53E-01	0.00E+00	0.00E+00	0.00E+00	3.39E-02	3.03E-03
Generator 4	2250gen4	-	-	-	1575.0	3.03E-03	0.00E+00	4.76E-01	0.00E+00	0.00E+00	4.76E+00	2.51E-02	4.53E-01	0.00E+00	0.00E+00	0.00E+00	3.39E-02	3.03E-03

C.6 Operations

Air emissions associated with activities during the construction and commissioning phase of the Project will originate primarily from the following major sources, including:

- exhaust from mine fleet heavy equipment
- fugitive emissions from blasting, drilling, material hauling, and material crushing

During the operations phase, power will be supplied to the Project site by the 240 kV transmission line so two of the four diesel generators used during the construction and commissioning phase will be removed from the site and the remaining two diesel generators will be used to supply power only in the event of an emergency. Hence emissions from these two standby generators has been excluded from this assessment.

The operations phase of the Project is anticipated to be completed over a period of 20 years. The methodologies applied in the calculation of CAC air emissions from these sources are discussed in more detail within the following sections.

C.7 Mine Fleet Equipment

Project-related CAC emissions from mine fleet combustion sources were quantified based on information regarding the type, quantity, and maximum operating time of equipment, as well as literature documenting emission rates for various types of equipment, vehicles, and ore mining processes.

Similar to the approach for mine fleet equipment associated with the construction and commissioning phase, emission factors were applied based on U.S. EPA/CEPA Tier 3 Emission Limits for Off-Road Heavy Duty Diesel Engines for new diesel-fired combustion equipment (Environment Canada 2006). For diesel-fired combustion equipment that will be purchased used (i.e., large sanding/watering trucks), emission factors were applied based on U.S. EPA/Canada Environmental Protection Act (CEPA) Tier 2 Emission Limits for Off-Road Heavy Duty Diesel Engines (Environment Canada 2006). A fuel sulphur content of 15 ppm in diesel was assumed for all SO_2 emission calculations (Environment Canada 2003, Internet Site).

Similar to the approach for mine fleet equipment associated with the construction and commissioning phase, U.S. EPA (2000) Tier 1 emission standards for light-duty vehicles and trucks were applied for gasoline driven vehicles. A maximum concentration of sulphur in gasoline for on-road vehicles was assumed to be 30 mg/kg (Department of Justice 2007, Internet Site).

Details regarding the type and quantity of heavy mine fleet equipment used in the operations phase of the Project are summarized in Table C–7. Table C–8 summarizes the maximum hourly, daily, and annual emission rates associated with heavy mine fleet equipment during the operations phase. These emissions are expected to occur over the 20-year operations period.

Table C–7 Summary of Mine Fleet Equipment for Operations

Type	Description	Maximum Units Required	Unit Operating Time (hours/year)	Engine Type	Engine Size (HP)
Major Equipment					
Blasthole Drill	GD 100	4	4100	Electric	-
Hydraulic Drill	GD	1	1050	Diesel	500
Cable Shovel	P&H 4100	3	4200	Electric	-
Wheel Loader	L1850	1	1000	Diesel	2000
Haul Truck	MT 4400	31	5900	Diesel	2500
Track Dozer	D9R	7	5000	Diesel	474
Wheel Dozer	834	2	3000	Diesel	554
Grader	16G	3	3700	Diesel	265
Water Truck	100 t	2	2500	Diesel	1000
Wheel Tractor Scraper	637G	3	2500	Diesel	500
Support Equipment					
Blasthole Stemmer	-	2	1400	Diesel	100
Cable Reeler	980G	1	1000	Diesel	275
Wheel Loader	966	1	2500	Diesel	220
Wheel Loader	988	1	2500	Diesel	220
Tow Truck	-	1	250	Diesel	200
Excavator	325	1	2500	Diesel	1000
Low Bed	90 t	1	1400	Diesel	960
Tire Manipulator	980G	1	1400	Diesel	325
Lighting Plant	-	4	1400	Diesel	25
Engineering Pickup	4 x 4	4	1400	Gasoline	150
Engineering Pickup	4 x 2	8	1400	Gasoline	150
Pit Services Pickup	4 x 4	16	1400	Gasoline	150
Pit Services Pickup	4 x 2	4	1400	Gasoline	150
Pit Services Bus	12 man	2	1400	Diesel	300
Pit Services Bus	20 man	1	1400	Diesel	300
Shovel Crew Flat Deck	3 t	2	1400	Diesel	300
Shovel Crew HIAB	5 t	1	1400	Diesel	300
Surface Crew HIAB	10 t	1	1400	Diesel	300
Surface Crew Stinger	Western Star 4900FA	1	1400	Diesel	300

Table C–7 Summary of Mine Fleet Equipment for Operations (cont'd)

Type	Description	Maximum Units Required	Unit Operating Time (hours/year)	Engine Type	Engine Size (HP)
Fuel & Lube Truck	Western Star 4900FA	3	1400	Diesel	300
Blasting Truck	-	2	1400	Diesel	300
Light Repair Truck	-	1	1400	Diesel	300
Ancillary Equipment					
Mobile Crane	130 t	1	1400	Diesel	500
Mobile Crane	50 t	1	1400	Diesel	370
Integrated Tool Carrier	-	1	1400	Diesel	300
Road Grader	-	1	3700	Diesel	300
Front End Loader	-	1	4000	Diesel	80
Road Sanding / Snow Removal Truck	Western Star 4900FA	1	2500	Diesel	300
Bob Cat Loader	-	1	2500	Diesel	50
Excavator	-	1	1400	Diesel	1000
Spill Abatement Equipment Trailer	-	1	250	Diesel	50
Backhoe Loader	-	1	1400	Diesel	97
Fork Lift	10,000 lb	2	1400	Diesel	30
Fork Lift	17,500 lb	1	1400	Diesel	50
Sport Utility Truck	4 x 4	1	1400	Gasoline	150
Pick-up Truck	4 x 4	14	1400	Gasoline	150
Pole Cat Digger Derrick Truck	-	1	1400	Diesel	300
Tipper Rubbish Collection Truck	-	1	1400	Diesel	300
Cherry Picker Life Truck	-	1	1400	Diesel	150
Fork Lift	52,000 lb	1	1400	Diesel	100
Electrical Service Truck	4 x 4	1	1400	Diesel	150
Mechanical Service Truck	4 x 4	1	1400	Diesel	150
Machine Shop Service Truck	4 x 4	1	1400	Diesel	150
HIAB Flat Bed Utility Truck	2 x 6, 2t	3	1400	Diesel	300
Other Equipment					
Concentrate Highway Trucks	on-road heavy-duty diesel	18	5900	Diesel	300

Table C–8 Summary of Mine Fleet Equipment Emission Rates for Operations

Type	Maximum One-hour Emission Rate (g/s)					Maximum 24-hour Emission Rate (g/s)					Annual Averaging Period Emission Rate (g/s)				
	SO_2	NO_x	CO	$PM_{2.5}$	VOC	SO_2	NO_x	CO	$PM_{2.5}$	VOC	SO_2	NO_x	CO	$PM_{2.5}$	VOC
Major Equipment															
Blasthole Drill	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hydraulic Drill	5.042E-04	2.458E-02	2.131E-01	1.229E-03	1.147E-02	5.042E-04	2.458E-02	2.131E-01	1.229E-03	1.147E-02	6.043E-05	2.947E-03	2.554E-02	1.473E-04	1.375E-03
Cable Shovel	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wheel Loader	1.266E-03	1.377E+00	8.522E-01	4.917E-02	1.967E-01	1.266E-03	1.377E+00	8.522E-01	4.917E-02	1.967E-01	1.445E-04	1.572E-01	9.729E-02	5.613E-03	2.245E-02
Haul Truck	4.439E-02	5.335E+01	3.302E+01	1.905E+00	7.621E+00	4.439E-02	5.335E+01	3.302E+01	1.905E+00	7.621E+00	2.990E-02	3.593E+01	2.224E+01	1.283E+00	5.133E+00
Track Dozer	3.529E-03	1.414E+00	1.414E+00	8.157E-02	2.175E-01	3.529E-03	1.414E+00	1.414E+00	8.157E-02	2.175E-01	2.014E-03	8.070E-01	8.070E-01	4.656E-02	1.242E-01
Wheel Dozer	1.008E-03	4.721E-01	4.721E-01	2.724E-02	7.264E-02	1.008E-03	4.721E-01	4.721E-01	2.724E-02	7.264E-02	3.453E-04	1.617E-01	1.617E-01	9.328E-03	2.488E-02
Grader	1.134E-03	3.388E-01	3.388E-01	1.954E-02	5.212E-02	1.134E-03	3.388E-01	3.388E-01	1.954E-02	5.212E-02	4.792E-04	1.431E-01	1.431E-01	8.255E-03	2.201E-02
Water Truck	1.260E-03	1.377E+00	8.522E-01	4.917E-02	1.967E-01	1.260E-03	1.377E+00	8.522E-01	4.917E-02	1.967E-01	3.597E-04	3.929E-01	2.432E-01	1.403E-02	5.613E-02
Wheel Tractor Scraper	1.513E-03	6.392E-01	6.392E-01	3.688E-02	9.833E-02	1.513E-03	6.392E-01	6.392E-01	3.688E-02	9.833E-02	4.317E-04	1.824E-01	1.824E-01	1.052E-02	2.806E-02
Support Equipment															
Blasthole Stemmer	2.521E-04	8.522E-02	8.522E-02	4.917E-03	1.311E-02	9.454E-05	8.522E-02	8.522E-02	4.917E-03	1.311E-02	4.029E-05	1.362E-02	1.362E-02	7.858E-04	2.095E-03
Cable Reeler	2.521E-04	1.172E-01	1.172E-01	6.760E-03	1.803E-02	9.454E-05	1.172E-01	1.172E-01	6.760E-03	1.803E-02	2.878E-05	1.338E-02	1.338E-02	7.717E-04	2.058E-03
Wheel Loader	1.891E-04	9.374E-02	9.374E-02	5.408E-03	1.442E-02	7.090E-05	9.374E-02	9.374E-02	5.408E-03	1.442E-02	5.396E-05	2.675E-02	2.675E-02	1.543E-03	4.116E-03
Wheel Loader	1.891E-04	9.374E-02	9.374E-02	5.408E-03	1.442E-02	7.090E-05	9.374E-02	9.374E-02	5.408E-03	1.442E-02	5.396E-05	2.675E-02	2.675E-02	1.543E-03	4.116E-03
Tow Truck	4.286E-05	8.522E-02	8.522E-02	4.917E-03	1.311E-02	1.607E-05	8.522E-02	8.522E-02	4.917E-03	1.311E-02	1.223E-06	2.432E-03	2.432E-03	1.403E-04	3.742E-04
Excavator	5.042E-04	6.883E-01	4.261E-01	2.458E-02	9.833E-02	1.891E-04	6.883E-01	4.261E-01	2.458E-02	9.833E-02	1.439E-04	1.964E-01	1.216E-01	7.016E-03	2.806E-02
Low Bed	6.302E-04	6.608E-01	4.091E-01	2.360E-02	9.440E-02	2.363E-04	6.608E-01	4.091E-01	2.360E-02	9.440E-02	1.007E-04	1.056E-01	6.538E-02	3.772E-03	1.509E-02
Tire Manipulator	4.286E-05	1.385E-01	1.385E-01	7.990E-03	2.131E-02	1.607E-05	1.385E-01	1.385E-01	7.990E-03	2.131E-02	6.849E-06	2.213E-02	2.213E-02	1.277E-03	3.405E-03
Lighting Plant	5.042E-05	4.261E-02	4.261E-02	2.458E-03	6.556E-03	1.891E-05	4.261E-02	4.261E-02	2.458E-03	6.556E-03	8.058E-06	6.810E-03	6.810E-03	3.929E-04	1.048E-03
Engineering Pickup	9.079E-06	7.177E-04	4.069E-03	7.399E-05	5.919E-04	3.405E-06	2.691E-04	1.526E-03	2.775E-05	2.220E-04	1.451E-06	1.147E-04	6.504E-04	1.182E-05	9.460E-05
Engineering Pickup	1.816E-05	1.435E-03	8.139E-03	1.480E-04	1.184E-03	6.809E-06	5.383E-04	3.052E-03	5.549E-05	4.439E-04	2.902E-06	2.294E-04	1.301E-03	2.365E-05	1.892E-04
Pit Services Pickup	3.632E-05	2.871E-03	1.628E-02	2.960E-04	2.368E-03	1.362E-05	1.077E-03	6.104E-03	1.110E-04	8.879E-04	5.804E-06	4.588E-04	2.601E-03	4.730E-05	3.784E-04
Pit Services Pickup	9.079E-06	7.177E-04	4.069E-03	7.399E-05	5.919E-04	3.405E-06	2.691E-04	1.526E-03	2.775E-05	2.220E-04	1.451E-06	1.147E-04	6.504E-04	1.182E-05	9.460E-05
Pit Services Bus	8.571E-05	1.967E-01	1.524E+00	9.833E-03	4.917E-02	3.214E-05	7.375E-02	5.716E-01	3.688E-03	1.844E-02	1.370E-05	3.143E-02	2.436E-01	1.572E-03	7.858E-03
Pit Services Bus	4.286E-05	9.833E-02	7.621E-01	4.917E-03	2.458E-02	1.607E-05	3.688E-02	2.858E-01	1.844E-03	9.219E-03	6.849E-06	1.572E-02	1.218E-01	7.858E-04	3.929E-03
Shovel Crew Flat Deck	8.571E-05	2.557E-01	2.557E-01	1.475E-02	3.933E-02	3.214E-05	2.557E-01	2.557E-01	1.475E-02	3.933E-02	1.370E-05	4.086E-02	4.086E-02	2.357E-03	6.286E-03
Shovel Crew HIAB	4.286E-05	1.278E-01	1.278E-01	7.375E-03	1.967E-02	1.607E-05	1.278E-01	1.278E-01	7.375E-03	1.967E-02	6.849E-06	2.043E-02	2.043E-02	1.179E-03	3.143E-03
Surface Crew HIAB	4.286E-05	1.278E-01	1.278E-01	7.375E-03	1.967E-02	1.607E-05	1.278E-01	1.278E-01	7.375E-03	1.967E-02	6.849E-06	2.043E-02	2.043E-02	1.179E-03	3.143E-03
Surface Crew Stinger	4.286E-05	1.278E-01	1.278E-01	7.375E-03	1.967E-02	1.607E-05	1.278E-01	1.278E-01	7.375E-03	1.967E-02	6.849E-06	2.043E-02	2.043E-02	1.179E-03	3.143E-03
Fuel & Lube Truck	1.286E-04	3.835E-01	3.835E-01	2.213E-02	5.900E-02	4.821E-05	3.835E-01	3.835E-01	2.213E-02	5.900E-02	2.055E-05	6.129E-02	6.129E-02	3.536E-03	9.429E-03
Blasting Truck	8.571E-05	2.557E-01	2.557E-01	1.475E-02	3.933E-02	3.214E-05	2.557E-01	2.557E-01	1.475E-02	3.933E-02	1.370E-05	4.086E-02	4.086E-02	2.357E-03	6.286E-03
Light Repair Truck	4.286E-05	1.278E-01	1.278E-01	7.375E-03	1.967E-02	1.607E-05	1.278E-01	1.278E-01	7.375E-03	1.967E-02	6.849E-06	2.043E-02	2.043E-02	1.179E-03	3.143E-03
Ancillary Equipment															
Mobile Crane	2.521E-04	2.131E-01	2.131E-01	1.229E-02	3.278E-02	9.454E-05	2.131E-01	2.131E-01	1.229E-02	3.278E-02	4.029E-05	3.405E-02	3.405E-02	1.964E-03	5.238E-03
Mobile Crane	1.260E-04	1.577E-01	1.577E-01	9.096E-03	2.426E-02	4.727E-05	1.577E-01	1.577E-01	9.096E-03	2.426E-02	2.014E-05	2.520E-02	2.520E-02	1.454E-03	3.876E-03
Integrated Tool Carrier	5.042E-05	1.278E-01	1.278E-01	7.375E-03	1.967E-02	1.891E-05	1.278E-01	1.278E-01	7.375E-03	1.967E-02	8.058E-06	2.043E-02	2.043E-02	1.179E-03	3.143E-03
Road Grader	5.042E-05	1.278E-01	1.278E-01	7.375E-03	1.967E-02	1.891E-05	1.278E-01	1.278E-01	7.375E-03	1.967E-02	2.130E-05	5.399E-02	5.399E-02	3.115E-03	8.307E-03
Front End Loader	2.521E-05	3.409E-02	3.409E-02	1.967E-03	5.244E-03	9.454E-06	3.409E-02	3.409E-02	1.967E-03	5.244E-03	1.151E-05	1.557E-02	1.557E-02	8.980E-04	2.395E-03
Road Sanding / Snow Removal Truck	7.563E-05	1.278E-01	1.278E-01	7.375E-03	1.967E-02	2.836E-05	1.278E-01	1.278E-01	7.375E-03	1.967E-02	2.158E-05	3.648E-02	3.648E-02	2.105E-03	5.613E-03
Bob Cat Loader	5.042E-05	2.131E-02	2.131E-02	1.229E-03	3.278E-03	1.891E-05	2.131E-02	2.131E-02	1.229E-03	3.278E-03	1.439E-05	6.080E-03	6.080E-03	3.508E-04	9.354E-04
Excavator	5.042E-04	6.883E-01	4.261E-01	2.458E-02	9.833E-02	1.891E-04	6.883E-01	4.261E-01	2.458E-02	9.833E-02	8.058E-05	1.100E-01	6.810E-02	3.929E-03	1.572E-02
Spill Abatement Equipment Trailer	2.521E-05	2.131E-02	2.131E-02	1.229E-03	3.278E-03	9.454E-06	2.131E-02	2.131E-02	1.229E-03	3.278E-03	7.195E-07	6.080E-04	6.080E-04	3.508E-05	9.354E-05
Backhoe Loader	8.319E-05	4.133E-02	4.133E-02	2.385E-03	6.359E-03	3.120E-05	4.133E-02	4.133E-02	2.385E-03	6.359E-03	1.330E-05	6.606E-03	6.606E-03	3.811E-04	1.016E-03

Table C–8 Summary of Mine Fleet Equipment Emission Rates for Operations (cont'd)

Type	Maximum One-hour Emission Rate (g/s)					Maximum 24-hour Emission Rate (g/s)					Annual Averaging Period Emission Rate (g/s)				
	SO_2	NO_x	CO	$PM_{2.5}$	VOC	SO_2	NO_x	CO	$PM_{2.5}$	VOC	SO_2	NO_x	CO	$PM_{2.5}$	VOC
Fork Lift	2.521E-05	2.557E-02	2.557E-02	1.475E-03	3.933E-03	9.454E-06	2.557E-02	2.557E-02	1.475E-03	3.933E-03	4.029E-06	4.086E-03	4.086E-03	2.357E-04	6.286E-04
Fork Lift	2.521E-05	2.131E-02	2.131E-02	1.229E-03	3.278E-03	9.454E-06	2.131E-02	2.131E-02	1.229E-03	3.278E-03	4.029E-06	3.405E-03	3.405E-03	1.964E-04	5.238E-04
Sport Utility Truck	2.270E-06	1.794E-04	1.017E-03	1.850E-05	1.480E-04	8.511E-07	6.728E-05	3.815E-04	6.937E-06	5.549E-05	3.627E-07	2.868E-05	1.626E-04	2.956E-06	2.365E-05
Pick-up Truck	3.178E-05	2.512E-03	1.424E-02	2.590E-04	2.072E-03	1.192E-05	9.420E-04	5.341E-03	9.711E-05	7.769E-04	5.078E-06	4.015E-04	2.276E-03	4.139E-05	3.311E-04
Pole Cat Digger Derrick Truck	2.521E-05	1.278E-01	1.278E-01	7.375E-03	1.967E-02	9.454E-06	1.278E-01	1.278E-01	7.375E-03	1.967E-02	4.029E-06	2.043E-02	2.043E-02	1.179E-03	3.143E-03
Tipper Rubbish Collection Truck	2.521E-05	1.278E-01	1.278E-01	7.375E-03	1.967E-02	9.454E-06	1.278E-01	1.278E-01	7.375E-03	1.967E-02	4.029E-06	2.043E-02	2.043E-02	1.179E-03	3.143E-03
Cherry Picker Life Truck	2.521E-05	6.392E-02	6.392E-02	3.688E-03	9.833E-03	9.454E-06	6.392E-02	6.392E-02	3.688E-03	9.833E-03	4.029E-06	1.021E-02	1.021E-02	5.893E-04	1.572E-03
Fork Lift	2.521E-05	4.261E-02	4.261E-02	2.458E-03	6.556E-03	9.454E-06	4.261E-02	4.261E-02	2.458E-03	6.556E-03	4.029E-06	6.810E-03	6.810E-03	3.929E-04	1.048E-03
Electrical Service Truck	2.521E-05	4.917E-02	3.810E-01	2.458E-03	1.229E-02	9.454E-06	1.844E-02	1.429E-01	9.219E-04	4.609E-03	4.029E-06	7.858E-03	6.090E-02	3.929E-04	1.964E-03
Mechanical Service Truck	2.521E-05	4.917E-02	3.810E-01	2.458E-03	1.229E-02	9.454E-06	1.844E-02	1.429E-01	9.219E-04	4.609E-03	4.029E-06	7.858E-03	6.090E-02	3.929E-04	1.964E-03
Machine Shop Service Truck	2.521E-05	4.917E-02	3.810E-01	2.458E-03	1.229E-02	9.454E-06	1.844E-02	1.429E-01	9.219E-04	4.609E-03	4.029E-06	7.858E-03	6.090E-02	3.929E-04	1.964E-03
HIAB Flat Bed Utility Truck	7.563E-05	2.950E-01	2.286E+00	1.475E-02	7.375E-02	2.836E-05	1.106E-01	8.573E-01	5.531E-03	2.766E-02	1.209E-05	4.715E-02	3.654E-01	2.357E-03	1.179E-02
Other Equipment															
Concentrate Highway Trucks	3.781E-05	1.844E-02	1.429E-01	9.219E-04	4.609E-03	3.781E-05	1.844E-02	1.429E-01	9.219E-04	4.609E-03	3.781E-05	1.844E-02	1.429E-01	9.219E-04	4.609E-03

C.8 Fugitive Emissions

Air emissions of PM associated with Project operations will be primarily related to primary crushing and materials handling and transfer at the plant. There will also be sources of PM from blasting, drilling, ground disturbance, and materials hauling.

Emissions from blasting were based on U.S. EPA AP-42 Western Surface Coal Mining emission factors (U.S. EPA 1998, Internet Site). It was assumed that each blast would impact an area of approximately 2500 m^2 and that up to five blasting events could occur during a one week period.

Fugitive emissions from drilling, truck loading in the mine pit, and truck un-loading at the truck dump were based on a mine production rate of 126,000 tonnes/day and U.S. EPA emission factors for Crushed Stone Processing (U.S. EPA 2004, Internet Site).

Fugitive emissions from haul roads were estimated based on U.S. EPA emission factors for unpaved roads (U.S. EPA 2006, Internet Site). A silt loading of 8.3% was applied (based upon quarry and stone mining haul roads), as recommended by the U.S. EPA (1995). It was assumed that a dust control program (i.e. applying water to control dust emissions) would be applied and would control fugitive dust emissions from haul roads by approximately 75%. It was assumed that the haul truck route for the operations phase consists of roadway from the center of the mine pit, up the mine portal road, and along the haul road to the truck dump. Based upon Project drawings, distances for the inpit roads were estimated to be approximately 4.5 km while distances for haul roads outside of the mine pit were estimated to be approximately 1.8 km.

Emissions associated with primary crushing and materials handling and transfer at the plant were based on a processing rate of 70,000 tonnes/day and U.S. EPA emission factors for Metallic Minerals Processing (U.S. EPA 1982, Internet Site). A 4% (by weight) ore moisture content was applied, classifying the ore as “high moisture” by the U.S. EPA. Hence, U.S. EPA AP-42 emission factors were used based on high moisture ore. Emission rates were calculated assuming that emission control design will achieve at least 75 percent control of dust associated with primary crushing and materials hauling. There will be no secondary or tertiary crushing associated with the Project, and the re-grind system will use wet processes and was therefore assumed to be negligible in terms of its contribution to PM emissions.

A summary of emission rates associated with fugitive PM emission sources for the operations phase is presented in Table C–9.

C.9 Model Input Summary

The emission rates presented in Tables C–8 and C–9 for the operations phase of the Project were included in dispersion modelling as various area sources. A summary of the emission rates and source parameters, as applied in dispersion modelling for the operations phase, are presented in Table C–10.

Table C–9 Summary of Fugitive PM Emission Sources for Operations

Source of Fugitive Dust	Location of Emission	Emission Rate (t/d)		
		TPM	PM_{10}	$PM_{2.5}$
Blasting	Mine Pit	0.028	0.014	0.001
Truck Loading	Mine Pit	0.006	0.001	0.000
Drilling	Mine Pit	0.050	0.005	0.001
Truck Unloading	Truck Dump	0.010	0.001	0.001
Primary Crushing	Truck Dump	0.175	0.070	0.014
Re-Grinding	Processing Plant	0.000	0.000	0.000
Material Handling/Transfer	Processing Plant	0.350	0.140	0.028
Dust from Materials Hauling	Mine Pit	10.60	3.01	0.30
Dust from Materials Hauling	Haul Road	4.24	1.21	0.12
Total (t/y)		**5633**	**1619**	**170**

NOTES:

1. Assuming an average of 126,000 tonnes/day of total material mined, handled and loaded onto haul trucks.
2. Assuming an average 70,000 tonnes/day of material is fed to primary crusher. Assuming that emission control design will achieve at least 75% control of dust relative to no controls.
3. Assume no secondary or tertiary crushing.
4. Assuming that re-grinding is using a wet process. Emissions for wet process are assumed to be negligible.
5. Assume moisture content of ore is greater than 4% (by weight). This classifies the ore as “high moisture”.
6. Assuming that the haul truck route consists of roadway from the center of the mine pit, up the mine portal road, and along the haul road to the truck dump. Based upon Project drawings, distances for the inpit roads were estimated to be approximately 4.5 km while distances for haul roads outside of the mine pit were estimated to be approximately 1.8 km.
7. Assuming a silt loading of 8.3% (U.S. EPA 1995).
8. Assuming that vehicle dust is generated mainly by large mine vehicles (haul trucks) and hence, dust from other vehicles are not included.
9. Assuming an average weight of 260 tonnes for 240 tonne class haul trucks.
10. Assuming that there are approximately 567 haul truck round trips per day (based upon 126,000 tonne/day of total material and 222 tonnes of material hauled per truck).
11. Assuming an effective dust suppression program will be implemented resulting in at least control of 75% of dust relative to dry/arid/uncontrolled emission levels from overburden haul roads.
12. Assuming no emissions are produced from concentrate handling and concentrate loading.
13. Materials include all material being handled, including overburden, ore, and waste rock.

Table C–10 Summary of Emission Rates for Operations

Source Name	Source ID	UTM Coordinates of SW Corner		Release Height (m)	Base Elevation (m)	Maximum One-hour Emission Rate (g/m^2/s)												
		kmE	kmN			SO_2	SO_4	NO	NO_2	HNO_3	NO_3	NO_x	VOC	CO	TPM	PM_{10}	$PM_{2.5}$	$DEPM_{2.5}$
Mine Pit Area	MINE	455.505	5701.697	0.0	1525.0	3.61E-08	0.00E+00	3.49E-05	3.87E-06	0.00E+00	0.00E+00	3.87E-05	5.56E-06	2.49E-05	8.99E-05	2.55E-05	2.55E-06	1.43E-06
Overburden Pile	OBPILE	456.255	5700.497	5.0	1510.0	1.79E-09	0.00E+00	2.44E-06	2.71E-07	0.00E+00	0.00E+00	2.71E-06	4.42E-07	4.65E-06	0.00E+00	0.00E+00	0.00E+00	1.34E-07
Waste Rock Pile	WRPILE	456.955	5700.497	5.0	1490.0	4.15E-10	0.00E+00	5.67E-07	6.30E-08	0.00E+00	0.00E+00	6.30E-07	1.03E-07	1.08E-06	0.00E+00	0.00E+00	0.00E+00	3.10E-08
Road between mine and plant	MPROAD	456.855	5701.097	5.0	1500.0	9.58E-10	0.00E+00	1.31E-06	1.46E-07	0.00E+00	0.00E+00	1.46E-06	2.37E-07	2.50E-06	0.00E+00	0.00E+00	0.00E+00	7.17E-08
Plant site	PLANT	459.105	5701.047	5.0	1570.0	2.31E-09	0.00E+00	3.16E-06	3.52E-07	0.00E+00	0.00E+00	3.52E-06	5.73E-07	6.03E-06	9.62E-06	3.85E-06	7.69E-07	1.73E-07
Project Access Road	ACROAD	457.855	5703.247	5.0	1590.0	3.72E-11	0.00E+00	1.63E-08	1.81E-09	0.00E+00	0.00E+00	1.81E-08	4.54E-09	1.41E-07	0.00E+00	0.00E+00	0.00E+00	9.07E-10
Truck Dump	TDUMP	457.055	5701.297	5.0	1480.0	3.53E-08	0.00E+00	3.41E-05	3.79E-06	0.00E+00	0.00E+00	3.79E-05	5.44E-06	2.43E-05	3.28E-04	9.46E-05	1.00E-05	1.40E-06
Maximum 24-hour Emission Rate (g/m^2/s)																		
Mine Pit Area	MINE	455.505	5701.697	0.0	1525.0	3.59E-08	0.00E+00	3.49E-05	3.87E-06	0.00E+00	0.00E+00	3.87E-05	5.56E-06	2.49E-05	8.99E-05	2.55E-05	2.55E-06	1.43E-06
Overburden Pile	OBPILE	456.255	5700.497	5.0	1510.0	6.69E-10	0.00E+00	2.25E-06	2.50E-07	0.00E+00	0.00E+00	2.50E-06	3.87E-07	3.00E-06	0.00E+00	0.00E+00	0.00E+00	1.23E-07
Waste Rock Pile	WRPILE	456.955	5700.497	5.0	1490.0	1.56E-10	0.00E+00	5.22E-07	5.80E-08	0.00E+00	0.00E+00	5.80E-07	9.00E-08	6.98E-07	0.00E+00	0.00E+00	0.00E+00	2.85E-08
Road between mine and plant	MPROAD	456.855	5701.097	5.0	1500.0	3.59E-10	0.00E+00	1.21E-06	1.34E-07	0.00E+00	0.00E+00	1.34E-06	2.08E-07	1.61E-06	0.00E+00	0.00E+00	0.00E+00	6.59E-08
Plant site	PLANT	459.105	5701.047	5.0	1570.0	8.68E-10	0.00E+00	2.92E-06	3.24E-07	0.00E+00	0.00E+00	3.24E-06	5.02E-07	3.90E-06	9.62E-06	3.85E-06	7.69E-07	1.59E-07
Project Access Road	ACROAD	457.855	5703.247	5.0	1590.0	3.72E-11	0.00E+00	1.63E-08	1.81E-09	0.00E+00	0.00E+00	1.81E-08	4.54E-09	1.41E-07	0.00E+00	0.00E+00	0.00E+00	9.07E-10
Truck Dump	TDUMP	457.055	5701.297	5.0	1480.0	3.51E-08	0.00E+00	3.41E-05	3.79E-06	0.00E+00	0.00E+00	3.79E-05	5.44E-06	2.43E-05	3.28E-04	9.46E-05	1.00E-05	1.40E-06
Annual Average Emission Rate (g/m^2/s)																		
Mine Pit Area	MINE	455.505	5701.697	0.0	1525.0	2.21E-08	0.00E+00	2.23E-05	2.47E-06	0.00E+00	0.00E+00	2.47E-05	3.54E-06	1.57E-05	8.99E-05	2.55E-05	2.55E-06	9.03E-07
Overburden Pile	OBPILE	456.255	5700.497	5.0	1510.0	3.49E-10	0.00E+00	4.55E-07	5.06E-08	0.00E+00	0.00E+00	5.06E-07	8.14E-08	8.01E-07	0.00E+00	0.00E+00	0.00E+00	2.47E-08
Waste Rock Pile	WRPILE	456.955	5700.497	5.0	1490.0	8.10E-11	0.00E+00	1.06E-07	1.18E-08	0.00E+00	0.00E+00	1.18E-07	1.89E-08	1.86E-07	0.00E+00	0.00E+00	0.00E+00	5.73E-09
Road between mine and plant	MPROAD	456.855	5701.097	5.0	1500.0	1.87E-10	0.00E+00	2.44E-07	2.72E-08	0.00E+00	0.00E+00	2.72E-07	4.37E-08	4.30E-07	0.00E+00	0.00E+00	0.00E+00	1.32E-08
Plant site	PLANT	459.105	5701.047	5.0	1570.0	4.52E-10	0.00E+00	5.90E-07	6.56E-08	0.00E+00	0.00E+00	6.56E-07	1.05E-07	1.04E-06	9.62E-06	3.85E-06	7.69E-07	3.20E-08
Project Access Road	ACROAD	457.855	5703.247	5.0	1590.0	3.72E-11	0.00E+00	1.63E-08	1.81E-09	0.00E+00	0.00E+00	1.81E-08	4.54E-09	1.41E-07	0.00E+00	0.00E+00	0.00E+00	9.07E-10
Truck Dump	TDUMP	457.055	5701.297	5.0	1480.0	2.16E-08	0.00E+00	2.18E-05	2.42E-06	0.00E+00	0.00E+00	2.42E-05	3.47E-06	1.53E-05	3.28E-04	9.46E-05	1.00E-05	8.83E-07

C.10 Closure

Air Emissions associated with activities during the closure phase of the Project will originate primarily from the following major sources, including:

- heavy equipment exhaust
- two diesel generators
- fugitive emissions from truck loading, truck unloading and materials hauling

These sources will be associated with decommissioning activities during Project closure and are anticipated to be completed over a period of 12 months. The methodologies applied in the calculation of CAC air emissions from each of these sources are discussed in more detail within the following sections.

C.11 Mine Fleet Equipment

Project-related CAC emissions from mine fleet combustion sources were quantified based on information regarding the type, quantity, and maximum operating time of equipment, as well as literature documenting emission rates for various types of equipment, vehicles, and ore mining processes.

Similar emission factors as applied for the construction and commissioning, and operations phases were applied for new and used diesel-fired combustion equipment and gasoline driven vehicles (refer to Sections C.2.1 and C.3.1).

Details regarding the type and quantity of heavy mine fleet equipment used in the construction and commissioning phase of the Project are summarized in Table C–11. Table C–12 summarizes the maximum hourly, daily, and annual emission rates associated with heavy mine fleet equipment during the closure phase of the Project. These emissions are expected to occur over the 12 month closure period.

C.12 Diesel Generators

Two diesel generators will be used on a continuous basis to supply power to the site during the closure phase of the Project. Each 2250 kilowatt (KW) generator was assumed to operate continuously at 75% load. Emission rates were calculated based on manufacturer's specifications (Caterpillar 2006). A summary of emission rates and source parameters for the diesel generators, as applied in dispersion modelling, is presented in Table C–13.

C.13 Fugitive Emissions

Air emissions of PM associated with Project closure will be primarily related to materials hauling and ground disturbance.

Fugitive emissions from truck loading and truck un-loading were based on a mine production rate of 12,600 tonnes/day (10% of construction levels) and U.S. EPA emission factors for Crushed Stone Processing (U.S. EPA 2004, Internet Site).

Fugitive emissions from haul roads were estimated based on U.S. EPA emission factors for unpaved roads (U.S. EPA 2006, Internet Site). A silt loading of 8.3% was applied (based upon quarry and stone mining haul roads), as recommended by the U.S. EPA

(1995). It was assumed that a dust control program (i.e. applying water to control dust emissions) would be applied and would control fugitive dust emissions from haul roads by approximately 75%.

A summary of emission rates associated with fugitive PM emission sources for the closure phase is presented in Table C–14.

Table C–11 Summary of Mine Fleet Equipment for Closure

Type	Description	Maximum Units Required	Unit Operating Time (hours/year)	Engine Type	Engine Size (HP)
Mill Site Closure					
Track Dozer	D9R	3	1620	Diesel	474
Mobile Crane	130 t	1	720	Diesel	500
Mobile Crane	50 t	1	720	Diesel	370
Backhoe Loader	Cat-430E	1	1620	Diesel	97
Wheel Loader	988	1	1080	Diesel	220
Fork Lift	17,500 lb	1	720	Diesel	50
Fork Lift	52,000 lb	1	720	Diesel	100
Pick-up Truck	4 x 4	2	720	Gasoline	150
HIAB Flat Bed Utility Truck (Articulated)	2 x 6, 2t	3	1620	Diesel	300
Mine Fleet Reclamation					
Wheel Loader	L1850	1	1000	Diesel	2000
Haul Truck	MT4400	5	5900	Diesel	2500
Track Dozer	D9R	2	5000	Diesel	474
Grader	16G	2	3700	Diesel	265
Wheel Tractor Scraper	637G	3	5000	Diesel	500
Excavator	325	2	2500	Diesel	1000
Low Bed	90t	1	1400	Diesel	960
Tire Manipulator	980G	1	1400	Diesel	325
Lighting Plant	-	4	1400	Diesel	25
Sport Utility Truck	4x4	1	1400	Gasoline	150
Engineering Pickup	4x4	1	1400	Gasoline	150
Pit Services Pickup	4x4	4	1400	Gasoline	150
Pit Services Bus	12 man	2	1400	Diesel	300
Surface Crew HIAB	10t	1	1400	Diesel	300
Surface Crew Stinger	Western Star 4900FA	1	1400	Diesel	300
Fuel and Lube Truck	Western Star 4900FA	2	1400	Diesel	300
Light Repair Truck	-	1	1400	Diesel	300
Sand Truck	100t	1	2500	Diesel	1000
Water Truck	100t	1	2500	Diesel	1000

Table C–12 Summary of Mine Fleet Equipment Emission Rates for Closure

Type	Maximum One-hour Emission Rate (g/s)					Maximum 24-hour Emission Rate (g/s)					Annual Averaging Period Emission Rate (g/s)				
	SO_2	NO_x	CO	$PM_{2.5}$	VOC	SO_2	NO_x	CO	$PM_{2.5}$	VOC	SO_2	NO_x	CO	$PM_{2.5}$	VOC
Mill Site Closure															
Track Dozer	1.513E-03	6.059E-01	6.059E-01	3.496E-02	9.322E-02	1.513E-03	6.059E-01	6.059E-01	3.496E-02	9.322E-02	2.797E-04	1.121E-01	1.121E-01	6.465E-03	1.724E-02
Mobile Crane	2.521E-04	2.131E-01	2.131E-01	1.229E-02	3.278E-02	2.521E-04	2.131E-01	2.131E-01	1.229E-02	3.278E-02	2.072E-05	1.751E-02	1.751E-02	1.010E-03	2.694E-03
Mobile Crane	1.260E-04	1.577E-01	1.577E-01	9.096E-03	2.426E-02	1.260E-04	1.577E-01	1.577E-01	9.096E-03	2.426E-02	1.036E-05	1.296E-02	1.296E-02	7.476E-04	1.994E-03
Backhoe Loader	8.319E-05	4.133E-02	4.133E-02	2.385E-03	6.359E-03	8.319E-05	4.133E-02	4.133E-02	2.385E-03	6.359E-03	1.538E-05	7.644E-03	7.644E-03	4.410E-04	1.176E-03
Wheel Loader	1.891E-04	9.374E-02	9.374E-02	5.408E-03	1.442E-02	1.891E-04	9.374E-02	9.374E-02	5.408E-03	1.442E-02	2.331E-05	1.156E-02	1.156E-02	6.668E-04	1.778E-03
Fork Lift	2.521E-05	2.131E-02	2.131E-02	1.229E-03	3.278E-03	2.521E-05	2.131E-02	2.131E-02	1.229E-03	3.278E-03	2.072E-06	1.751E-03	1.751E-03	1.010E-04	2.694E-04
Fork Lift	2.521E-05	4.261E-02	4.261E-02	2.458E-03	6.556E-03	2.521E-05	4.261E-02	4.261E-02	2.458E-03	6.556E-03	2.072E-06	3.502E-03	3.502E-03	2.021E-04	5.388E-04
Pick-up Truck	2.335E-06	1.846E-04	1.046E-03	1.903E-05	1.522E-04	2.335E-06	1.846E-04	1.046E-03	1.903E-05	1.522E-04	1.919E-07	1.517E-05	8.601E-05	1.564E-06	1.251E-05
HIAB Flat Bed Utility Truck (Articulated)	7.563E-05	3.835E-01	3.835E-01	2.213E-02	5.900E-02	7.563E-05	3.835E-01	3.835E-01	2.213E-02	5.900E-02	1.399E-05	7.092E-02	7.092E-02	4.092E-03	1.091E-02
Mine Fleet Reclamation															
Wheel Loader	1.266E-03	1.377E+00	8.522E-01	4.917E-02	1.967E-01	1.266E-03	1.377E+00	8.522E-01	4.917E-02	1.967E-01	1.445E-04	1.572E-01	9.729E-02	5.613E-03	2.245E-02
Haul Truck	7.160E-03	8.604E+00	5.326E+00	3.073E-01	1.229E+00	7.160E-03	8.604E+00	5.326E+00	3.073E-01	1.229E+00	4.822E-03	5.795E+00	3.587E+00	2.070E-01	8.279E-01
Track Dozer	1.008E-03	4.040E-01	4.040E-01	2.331E-02	6.215E-02	1.008E-03	4.040E-01	4.040E-01	2.331E-02	6.215E-02	5.756E-04	2.306E-01	2.306E-01	1.330E-02	3.547E-02
Grader	7.563E-04	2.258E-01	2.258E-01	1.303E-02	3.474E-02	7.563E-04	2.258E-01	2.258E-01	1.303E-02	3.474E-02	3.194E-04	9.539E-02	9.539E-02	5.503E-03	1.468E-02
Wheel Tractor Scraper	1.513E-03	6.392E-01	6.392E-01	3.688E-02	9.833E-02	1.513E-03	6.392E-01	6.392E-01	3.688E-02	9.833E-02	8.633E-04	3.648E-01	3.648E-01	2.105E-02	5.613E-02
Excavator	1.008E-03	1.377E+00	8.522E-01	4.917E-02	1.967E-01	1.008E-03	1.377E+00	8.522E-01	4.917E-02	1.967E-01	2.878E-04	3.929E-01	2.432E-01	1.403E-02	5.613E-02
Low Bed	6.302E-04	6.608E-01	4.091E-01	2.360E-02	9.440E-02	6.302E-04	6.608E-01	4.091E-01	2.360E-02	9.440E-02	1.007E-04	1.056E-01	6.538E-02	3.772E-03	1.509E-02
Tire Manipulator	4.286E-05	1.385E-01	1.385E-01	7.990E-03	2.131E-02	4.286E-05	1.385E-01	1.385E-01	7.990E-03	2.131E-02	6.849E-06	2.213E-02	2.213E-02	1.277E-03	3.405E-03
Lighting Plant	5.042E-05	4.261E-02	4.261E-02	2.458E-03	6.556E-03	5.042E-05	4.261E-02	4.261E-02	2.458E-03	6.556E-03	8.058E-06	6.810E-03	6.810E-03	3.929E-04	1.048E-03
Sport Utility Truck	1.167E-06	9.228E-05	5.232E-04	9.513E-06	7.610E-05	4.377E-07	9.228E-05	5.232E-04	9.513E-06	7.610E-05	1.866E-07	1.475E-05	8.362E-05	1.520E-06	1.216E-05
Engineering Pickup	1.167E-06	9.228E-05	5.232E-04	9.513E-06	7.610E-05	4.377E-07	9.228E-05	5.232E-04	9.513E-06	7.610E-05	1.866E-07	1.475E-05	8.362E-05	1.520E-06	1.216E-05
Pit Services Pickup	4.669E-06	3.691E-04	2.093E-03	3.805E-05	3.044E-04	1.751E-06	3.691E-04	2.093E-03	3.805E-05	3.044E-04	7.462E-07	5.899E-05	3.345E-04	6.081E-06	4.865E-05
Pit Services Bus	8.571E-05	1.967E-02	1.416E+00	9.833E-04	1.377E-02	8.571E-05	1.967E-02	1.416E+00	9.833E-04	1.377E-02	1.370E-05	3.143E-03	2.263E-01	1.572E-04	2.200E-03
Surface Crew HIAB	4.286E-05	1.278E-01	1.278E-01	7.375E-03	1.967E-02	4.286E-05	1.278E-01	1.278E-01	7.375E-03	1.967E-02	6.849E-06	2.043E-02	2.043E-02	1.179E-03	3.143E-03
Surface Crew Stinger	4.286E-05	1.278E-01	1.278E-01	7.375E-03	1.967E-02	4.286E-05	1.278E-01	1.278E-01	7.375E-03	1.967E-02	6.849E-06	2.043E-02	2.043E-02	1.179E-03	3.143E-03
Fuel and Lube Truck	8.571E-05	2.557E-01	2.557E-01	1.475E-02	3.933E-02	8.571E-05	2.557E-01	2.557E-01	1.475E-02	3.933E-02	1.370E-05	4.086E-02	4.086E-02	2.357E-03	6.286E-03
Light Repair Truck	4.286E-05	1.278E-01	1.278E-01	7.375E-03	1.967E-02	4.286E-05	1.278E-01	1.278E-01	7.375E-03	1.967E-02	6.849E-06	2.043E-02	2.043E-02	1.179E-03	3.143E-03
Sand Truck	6.302E-04	6.883E-01	4.261E-01	2.458E-02	9.833E-02	6.302E-04	6.883E-01	4.261E-01	2.458E-02	9.833E-02	1.799E-04	1.964E-01	1.216E-01	7.016E-03	2.806E-02
Water Truck	6.302E-04	6.883E-01	4.261E-01	2.458E-02	9.833E-02	6.302E-04	6.883E-01	4.261E-01	2.458E-02	9.833E-02	1.799E-04	1.964E-01	1.216E-01	7.016E-03	2.806E-02

Table C–13 Summary of Diesel Generator Emission Rates for Closure

Parameter		Generator 1	Generator 2
Power Rating (kW)		2250	2250
UTM Coordinates	km E	459.388	459.398
	km N	5700.753	5700.749
Stack Height (m)		10	10
Stack Diameter (m)		0.59	0.59
Base Elevation (m)		1575	1575
Exit Temperature	°C	491	491
	K	764	764
Exit Velocity (m/s)		22.5	22.5
Emission Rates (g/s)	SO_2	3.03E-03	3.03E-03
	NO_x	4.76	4.76
	CO	4.53E-01	4.53E-01
	PM	3.39E-02	3.39E-02
	VOC	2.51E-02	2.51E-02

Table C–14 Summary of Fugitive PM Emission Sources for Closure

Source of Fugitive Dust	Location of Emission	Emission Rate (t/d)		
		TPM	PM_{10}	$PM_{2.5}$
Truck Loading	Mine Pit	0.001	0.000	0.000
Truck Unloading	Mine Pit	0.001	0.000	0.000
Dust from Materials Hauling	Mine Pit	1.06	0.30	0.03
Total (t/y)		**388**	**110**	**11**

NOTES:
1. Assuming a silt loading of 8.3% (U.S. EPA 1995).
2. Assuming an average weight of 260 tonnes for 240 tonne class haul trucks.
3. Assuming an effective dust suppression program will be implemented resulting in at least control of 75% of dust relative to dry/arid/uncontrolled emission levels from overburden haul roads.
4. Assuming an average of 12,600 tonnes/day of total material handled and loaded onto haul trucks (10% of construction).
5. Based upon Project drawings, distances for the inpit roads were estimated to be approximately 4.5 km while distances for haul roads outside of the mine pit were estimated to be approximately 1.8 km.
6. Assuming there are approximately 57 haul truck round trips per day (based upon 12,600 tonnes/day of total material and 222 tonnes of material hauled per truck).

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