APPENDIX 10.II

Regional Air Emission Sources

Air Quality Assessment - NICO Project

Summary of Daily Maximum (Winter) Emissions During the Construction Phase

Description	Source	Type	Emission Rate (kg/day)													
			TSP	PM10	PM2.5	SO2	NOx	CO	VOC	PAH	CO2e	DIOXIN/FURAN	As	Bi	Co	Cu
I -Land Clearing and Debris Removal	I.1 - General land clearing	A - Fugitive Emissions	1.50E+02	4.92E+01	1.58E+01	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		B- Exhaust Emissions	5.06E-01	5.06E-01	4.91E-01	2.20E-02	1.00E+01	3.56E+00	6.02E-01	3.84E-03	2.63E+03	N/A	N/A	N/A	N/A	N/A
	I.2 - Loading of land cleared debris into trucks	A - Fugitive Emissions	1.06E+01	5.49E+00	1.11E+00	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		B- Exhaust Emissions	4.30E-01	4.30E-01	4.17E-01	2.37E-02	9.09E+00	2.98E+00	4.50E-01	4.15E-03	2.83E+03	N/A	N/A	N/A	N/A	N/A
	I.3- Truck transport of debris (unpaved roads)	A - Fugitive Emissions	4.04E+01	8.26E+00	8.26E-01	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		B- Exhaust Emissions	2.26E-01	2.26E-01	2.19E-01	1.03E-02	5.06E+00	1.73E+00	2.37E-01	1.81E-03	1.23E+03	N/A	N/A	N/A	N/A	N/A
	I.4 Dumping material onto overburden stockpile	A - Fugitive Emissions	3.49E-01	1.65E-01	2.50E-02	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	I.5 Wind erosion off of overburden stockpile	A - Fugitive Emissions	8.84E+01	4.42E+01	6.63E+00	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
II - Site Preparation (earth moving)	II.1 - Drilling	A - Fugitive Emissions	1.31E+00	5.82E-01	1.08E-01	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		B- Exhaust Emissions	2.70E-02	2.70E-02	2.62E-02	2.19E-03	8.36E-01	1.77E-01	3.55E-02	3.83E-04	2.61E+02	N/A	N/A	N/A	N/A	N/A
	II.2 - Blasting	A - Fugitive Emissions	5.16E-01	2.68E-01	1.55E-02	4.07E+00	6.93E+01	1.75E+02	N/A	N/A	1.28E+01	N/A	N/A	N/A	N/A	N/A
	II.3 - Bulldozing	A - Fugitive Emissions	1.00E+02	3.28E+01	1.05E+01	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		B- Exhaust Emissions	4.59E-01	4.59E-01	4.45E-01	1.51E-02	8.27E+00	2.41E+00	4.62E-01	2.64E-03	1.80E+03	N/A	N/A	N/A	N/A	N/A
	II.4 - Material handling	A - Fugitive Emissions	1.19E-01	5.62E-02	8.52E-03	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		B- Exhaust Emissions	3.12E-01	3.12E-01	3.03E-01	1.28E-02	5.37E+00	2.80E+00	3.52E-01	2.24E-03	1.53E+03	N/A	N/A	N/A	N/A	N/A
	II.5 - Compacting	A - Fugitive Emissions	1.64E+01	5.37E+00	1.72E+00	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		B- Exhaust Emissions	4.92E-02	4.92E-02	4.77E-02	1.57E-03	7.64E-01	1.73E-01	5.43E-02	2.75E-04	1.88E+02	N/A	N/A	N/A	N/A	N/A
	II.6 - Grading	A - Fugitive Emissions	1.68E+01	4.91E+00	5.20E-01	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		B- Exhaust Emissions	2.75E-02	2.75E-02	2.67E-02	1.26E-03	5.68E-01	1.86E-01	5.33E-02	2.20E-04	1.50E+02	N/A	N/A	N/A	N/A	N/A
	II.7 - Loading of aggregate material into trucks	A - Fugitive Emissions	6.54E+01	3.40E+01	6.87E+00	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		B- Exhaust Emissions	2.79E-01	2.79E-01	2.71E-01	1.54E-02	6.24E+00	2.13E+00	2.93E-01	2.70E-03	1.84E+03	N/A	N/A	N/A	N/A	N/A
	II.8 Hauling material	A - Fugitive Emissions	1.94E+02	3.97E+01	3.97E+00	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		B- Exhaust Emissions	1.32E+00	1.32E+00	1.28E+00	6.02E-02	2.79E+01	9.13E+00	1.38E+00	1.05E-02	7.20E+03	N/A	N/A	N/A	N/A	N/A
	II.9 - Jaw crusher	A - Fugitive Emissions	1.45E+02	5.82E+01	1.08E+00	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	II.10 Material screening	A - Fugitive Emissions	1.82E+02	6.25E+01	3.64E-01	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
III - General Construction	III.1 - Vehicular traffic	A - Fugitive Emissions	3.54E+01	7.25E+00	7.25E-01	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		B- Exhaust Emissions	8.74E+00	8.74E+00	8.48E+00	2.77E-01	1.73E+02	6.69E+01	7.94E+00	4.84E-02	3.31E+04	N/A	N/A	N/A	N/A	N/A
	III.2 - Air transport	A - Fugitive Emissions	4.66E+01	2.33E+01	3.50E+00	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	III.3 -Offsite transport, access road	A - Fugitive Emissions	4.46E+02	9.12E+01	9.12E+00	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		B- Exhaust Emissions	4.30E-02	4.30E-02	3.96E-02	3.57E-03	1.96E+00	8.98E-01	1.83E-01	1.37E-03	9.34E+02	N/A	N/A	N/A	N/A	N/A
	III.4 -Offsite transport, Tilcho road	A - Fugitive Emissions	2.67E+02	5.47E+01	5.47E+00	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		B- Exhaust Emissions	2.58E-02	2.58E-02	2.37E-02	2.14E-03	1.17E+00	5.39E-01	1.10E-01	5.46E-04	3.73E+02	N/A	N/A	N/A	N/A	N/A
	III.5 - Power generation	C - Combustion Emissions	6.66E+01	6.16E+01	6.16E+01	1.63E+00	3.44E+03	9.13E+02	4.46E+00	2.26E-01	1.86E+05	N/A	N/A	N/A	N/A	N/A
	III.6- Incineration	C - Combustion Emissions	7.04E-01	6.42E-01	6.19E-01	1.53E+00	2.07E+01	5.17E+00	1.02E-01	1.26E-03	3.61E+03	8.50E-10	3.99E-05	N/A	6.45E-05	4.40E-03
Total			**1,886.78**	**596.82**	**142.59**	**7.68**	**3,779.43**	**1,187.44**	**16.72**	**0.31**	**243,314.72**	**8.50E-10**	**3.99E-05**	**N/A**	**6.45E-05**	**0.0044**

N/A- No applicable emissions

Description	Emission Rate (kg/day)													
	TSP	PM10	PM2.5	SO2	NOx	CO	VOC	PAH	CO2e	DIOXIN/FURAN	As	Bi	Co	Cu
I -Land Clearing and Debris Removal	290.96	108.45	25.48	0.056	24.16	8.26	1.29	0.010	6,696.13	N/A	N/A	N/A	N/A	N/A
II - Site Preparation (earth moving)	724.33	240.85	27.56	4.18	119.20	192.20	2.63	0.019	12,986.18	N/A	N/A	N/A	N/A	N/A
III - General Construction	871.50	247.52	89.55	3.44	3,636.07	986.98	12.80	0.28	223,632.41	8.50E-10	3.99E-05	N/A	6.45E-05	0.0044
Total	**1,886.78**	**596.82**	**142.59**	**7.68**	**3,779.43**	**1,187.44**	**16.72**	**0.31**	**243,314.72**	**8.50E-10**	**3.99E-05**	**N/A**	**6.45E-05**	**0.0044**

N/A- No applicable emissions

Air Quality Assessment - NICO Project
Calculation of Emissions During the Construction Phase

I -Land Clearing and Debris Removal

I.1 - General land clearing

A - Fugitive Emissions

Dust Control Technique		**No control**

Number of equipment	pc	A	3	(a)
Hours of operation per day - peak	h/day	B	6.0	(b)
Material silt content	(%)	C	56	(c)
Material moisture content	(%)	D	17	(d)
Emission reduction efficiency	(%)	E	0	

Source: (a) Information provided by Fortune in "NICO Mobile Equipment_REVC_without Aker fuel.xlsx"; one skidder, harvester and one dozer was included in land clearing.
(b) Number of work hours per day taken as the maximum construction equipment operation for a tractor/dozer.
(c) Material silt content taken as average silt content of the tall and glacio-lacustrine deposit from Golder FEED document.
(d) Moisture content taken as the maximum overburden moisture content from AP 42 chapter 11.9 Western surface Coal Mine/ Table 11.9-3 (Metric and English Units). Typical Values For Correction Factors Applicable to the Predictive Emission Factor Equations.

			TSP <= 30 um	TSP <= 15 um	PM_{10}	$PM_{2.5}$	
Constant (a)	-	F	2.6	0.45	-	-	(a)
Constant (b)	-	G	1.2	1.5	-	-	(a)
Constant (c)	-	H	1.3	1.4	-	-	(a)
Scaling Factor		I	-	-	0.75	0.105	(a) (b)
Emission rate (uncontrolled)	g/hr	J = F*(C^G)/(D^H)*1000*A	24,946.99	10,893.89	8,170.41	2,619.43	(a) (c)
Emission rate (controlled)	g/hr	K = J*(1-E/100)	24,946.99	10,893.89	8,170.41	2,619.43	
Daily emission rate (uncontrolled)	g/day	L = J*B	150,092.03	65,542.39	49,156.79	15,759.66	
Daily emission rate (controlled)	g/day	M = K*B	150,092.03	65,542.39	49,156.79	15,759.66	
Maximum emission rate (uncontrolled)	g/s	N = L/(B*3600)	6.93	3.03	2.27	0.73	
Maximum emission rate (controlled)	g/s	O = M/(B*3600)	6.93	3.03	2.27	0.73	
Quality rating	-		B	C	D	D	(a)

Source: (a) AP-42 / Section 11.9 - Western Surface Coal Mining (USEPA, October 1998) / Table 11.9-2 (Metric Units) - Emission Factor Equations for Uncontrolled Open Dust Sources at Western Surface Coal Mines (bulldozing overburden). According to recommendations in AP-42 / Section 13.2.3 - Heavy Construction Operations (USEPA, January 1995) / Table 13.2.3-1 - Recommended Emission Factors for Construction Operations (reference to dozer equation (overburden) in Section 11.9 / Table 11.9.2).
(b) Scaling factor to convert TSP <= 30 um to $PM_{2.5}$ and TSP <= 15 um to PM_{10}.
(c) PM_{10} and $PM_{2.5}$ calculated multiplying TSP emission rates by respective scaling factors.

B- Exhaust Emissions

Equipment/Vehicle	Model	Number of Equipment/Vehicle	Daily Use
Skidder	Caterpillar 527; or equivalent	1	3.0
Harvester	Caterpillar 501 HD Track Harvester; or equivalent	1	3.0
Track-dozer	Caterpillar D8T/Komatsu D155AX-6	1	6.0

			SO_2	NO_X	CO	$PM_{2.5}$	PM_{10}	VOC	PAH	CO_2e
Daily emission rate	tonne/day	(refer to Construction combustion)	2.20E-05	0.010	0.0036	4.91E-04	5.06E-04	6.02E-04	3.84E-06	2.63

Air Quality Assessment - NICO Project
Calculation of Emissions During the Construction Phase

I.2 - Loading of land cleared debris into trucks

A - Fugitive Emissions

Dust Control Technique		**No control**	
Hours of operation per day	h/day	A	6.0 (a)
Amount of debris removed per day	tonnes/day	B	586 (b)
Emission reduction efficiency	(%)	C	0

Source: (a) Work will be undertaken by a front end loader; operational hours relate to the front end loader from "NICO Mobile Equipment_REVC_without Aker fuel.xlsx".
(b) Information based Cost Summary Cost Estimate CDF, January 2011; 175,000 m^3 of overburden removed.

			TSP	**PM_{10}**	**$PM_{2.5}$**	
Emission factor (uncontrolled)	kg/tonne	D	0.0180	0.0094	0.0019	(a) (b) (c)
Daily emission rate (controlled)	g/day	E = B*D*1000*(1-C/100)	10,556.74	5,489.51	1,108.46	
Daily emission rate (uncontrolled)	g/day	F = B*D*1000	10,556.74	5,489.51	1,108.46	
Maximum emission rate (controlled)	g/s	G = E/(A*3600)	0.49	0.25	0.051	
Maximum emission rate (uncontrolled)	g/s	H = F/(A*3600)	0.49	0.25	0.051	
Quality rating	-		E	-	-	

Source: (a) TSP emission factor extracted from AP-42 / Section 11.9 - Western Surface Coal Mining (USEPA, October 1998) / Table 11.9.4 - Uncontrolled Particulate Emission Factors for Open Dust Sources at Western Surface Coal Mine (truck loading by power shovel (batch drop) / overburden).

(b) Emission factor for PM_{10} based on the ratio between TSP and PM_{10} emission factors for blasting in AP-42 / Section 11.9 - Western Surface Coal Mining (USEPA, October 1998) / Table 11.9-2 (Metric Units) - Emission Factor Equations for Uncontrolled Open Dust Sources at Western Surface Coal Mines.
(c) Emission factor for $PM_{2.5}$ based on the ratio between TSP and $PM_{2.5}$ emission factors for bulldozing overburden in AP-42 / Section 11.9 - Western Surface Coal Mining (USEPA, October 1998) / Table 11.9-2 (Metric Units) - Emission Factor Equations for Uncontrolled Open Dust Sources at Western Surface Coal Mines.

B- Exhaust Emissions

Equipment/Vehicle	**Model**	**Number of Equipment/Vehicle**	**Daily Use**
Wheeled Front End Loader	Caterpillar 992K/Komatsu WA 900-3	1	6.0

			SO_2	**NO_X**	**CO**	**$PM_{2.5}$**	**PM_{10}**	**VOC**	**PAH**	**CO_2e**
Daily emission rate	tonne/day	(refer to Construction combustion)	2.37E-05	0.0091	0.0030	4.17E-04	4.30E-04	4.50E-04	4.15E-06	2.83

Air Quality Assessment - NICO Project
Calculation of Emissions During the Construction Phase

I.3- Truck transport of debris (unpaved roads)

A - Fugitive Emissions

Dust Control Technique		**Watering twice a day**	(a)

Source: (a) Information provided by Fortune in an email dated Feb. 15, 2011.

Hours of operation per day - peak	h/day	A	2.0	(a)
Surface material silt content	(%)	B	1.6	(b)
Mean vehicle weight	tonnes	C	58	(c)
Vehicle kilometer traveled (VKT)	km/day	D	36	(c)
Number of working days	days/year	E	365	
Number of days with precipitation >= 0.2 mm	days/year	F	58	(d)
Emission reduction efficiency	(%)	G	55	(e)

Source: (a) Information provided by Fortune. Daily operating time assumed to the same as underground haulage construction vehicles.
(b) Roads are assumed to be lined with aggregate and it is expected to have a similar silt content as limestone; data available in AP 42 chapter 13.2.4/table 13.2.4-1.
(c) See Mean Vehicle Weight table below.
(d) Value derived from Fortune 2004-2007 onsite meteorological station (Fortune_2004_2007_MetData(Oct8 04 - Sep27 07)_MD.xls).
(e) Assumed watering based on the use of onsite water trucks. Unpaved Industrial Road Dust Calculator (Environment Canada website, accessed in December 2009).

			PM-30 (TSP)	**PM_{10}**	**$PM_{2.5}$**	
Constant (k)	-	H	4.90	1.50	0.15	(a)
Constant (a)	-	I	0.70	0.90	0.90	(a)
Constant (b)	-	J	0.45	0.45	0.45	(a)
Emission factor (uncontrolled)	lb/VMT	K = H*((B/12)^I)*((C*1.1/3)^J)*[(E-F)/E]	3.97	0.81	0.08	(a)
Emission factor (uncontrolled, metric)	g/VKT	L = K*281.9	1120.08	229.16	22.92	(b)
Emission factor (controlled)	g/VKT	M = K*281.9*(1-G/100)	504.03	103.12	10.31	(b)
Emission factor (uncontrolled, without precipitation correction)	g/VKT	N = H*((B/12)^I)*((C*1.1/3)^J)*281.9	1330.24	272.15	27.22	
Emission factor (controlled, without precipitation correction)	g/VKT	O = N * (1- G/100)	598.61	122.47	12.25	
Daily emission rate (controlled)	g/day	P = M*D	18,167.74	3,716.93	371.69	
Daily emission rate (uncontrolled)	g/day	Q = L*D	40,372.76	8,259.84	825.98	
Daily emission rate (controlled, no precip. correction)	g/day	R= O*D	21,576.66	4,414.35	441.44	
Daily emission rate (uncontrolled, no precip correction)	g/day	S = N*D	47,948.13	9,809.67	980.97	
Maximum emission rate (control)	g/s	T = P/(A*3600)	2.52	0.51	0.051	
Maximum emission rate (uncontrolled)	g/s	U = Q/(A*3600)	5.59	1.14	0.11	
Maximum emission rate (control, no precip. correction)	g/s	V = R/(A*3600)	2.99	0.61	0.061	
Maximum emission rate (uncontrolled, no precip. correction)	g/s	W = S/(A*3600)	6.64	1.36	0.14	
Quality rating	-		B	B	B	

Source: (a) AP-42 / Section 13.2.2 - Unpaved Roads (USEPA, November 2006)/ Equation (1a) - unpaved surfaces at industrial sites and Table 13.2.2-2.
(b) 281.9 constant to convert lb/VMT (pounds per vehicle mile travelled) to g/VKT (grams per vehicle kilometer travelled).

Air Quality Assessment - NICO Project
Calculation of Emissions During the Construction Phase

Mean Vehicle Weight

Equipment			Underground Haulage Units	Total	
Weight - Empty	tonne		32.50		(a)
Weight - Loaded	tonne		82.50		(a)
Mean Weight	tonne		58		
Number of two way trips	number		11.73		(b)
Distance of two way trip	km/day		3.07		(c)
Vehicle kilometer traveled (VKT)	km/day		36.04	36.04	
Percentage of traffic	%		100%		
Mean vehicle weight	tonne		57.50	57.50	

Source: (a) Information provided in "NICO Mobile Equipment_REVC_without Aker fuel.xlsx".
(b) Information based Cost Summary Cost Estimate CDF, January 2011; 175,000 m^3 of overburden removed.
(c) Assumed all land clearing vehicles will travel on the road once a day. Distance travelled will be approximately from plant area to centre of CDF.

B- Exhaust Emissions

Equipment/Vehicle	Model	Number of Equipment/Vehicle	Daily Use
Underground Haulage Unit	Sandvik 50	2	2.0

			SO_2	NO_X	CO	$PM_{2.5}$	PM_{10}	VOC	PAH	CO_2e
Daily emission rate	tonne/day	(refer to Construction combustion)	1.03E-05	0.0051	0.0017	2.19E-04	2.26E-04	2.37E-04	1.81E-06	1.23

I.4 Dumping material onto overburden stockpile

A - Fugitive Emissions

Dust Control Technique		**No control**

Hours of operation per day - maximum	h/day	A	6.0	(a)
Amount of material handled per day	tonnes/day	B	586	(b)
Mean wind speed - maximum daily value	m/s	C	13	(c)
Material moisture content	%	D	17	(d)
Constant (a)	-	E	0.0016	(e)
Constant (b)	-	F	1.3	(e)
Constant (c)	-	G	2.2	(e)
Constant (d)	-	H	1.4	(e)
Constant (e)	-	I	2.0	(e)
Emission reduction efficiency	(%)	J	0	

Source: (a) Based on information provided by Fortune in "NICO Mobile Equipment_REVC_without Aker fuel.xlsx" assumed the same operating time as the haul trucks.
(b) Information based Cost Summary Cost Estimate CDF, January 2011; 175,000 m^3 of overburden removed.
(c) Value derived from Fortune 2004-2007 onsite meteorological station (Fortune_2004_2007_MetData(Oct8 04 - Sep27 07)_MD.xls).
(d) Moisture content taken as the maximum overburden moisture content from AP 42 chapter 11.9 Western surface Coal Mine/ Table 11.9-3 (Metric and English Units). Typical Values For Correction Factors Applicable to the Predictive Emission Factor Equations.
(e) AP-42 / 13.2.4 - Aggregate Handling And Storage Piles (USEPA, November 2006)/ equation 1 - emission factor for drop operation.

			TSP <= 30 um	PM_{10}	$PM_{2.5}$	
Particle size multiplier	-	K	0.74	0.35	0.053	(a)
Emission factor (uncontrolled)	kg/tonne	L = K*E*((C/G)^F)/((D/I)^H)	5.95E-04	2.81E-04	4.26E-05	(a)
Maximum emission rate (controlled)	g/s	M = B*L*(1-J/100)*1000/(A*3600)	0.016	0.0076	0.0012	
Maximum emission rate (uncontrolled)	g/s	N = B*L*1000/(A*3600)	0.016	0.0076	0.0012	
Quality rating	-	-	A	A	A	

Source: (a) AP-42 / 13.2.4 - Aggregate Handling And Storage Piles (USEPA, November 2006)/ equation 1 - emission factor for drop operation.

I.5 Wind erosion off of overburden stockpile

A - Fugitive Emissions

Dust Control Technique		**No Control**

Pile surface area	ha	A	4	(a)
Percentage of time WS >19.3 km/h	%	B	31	(b)
Material silt content	%	C	7.5	(c)
Number of days with precipitation >= 0.2 mm	days/year	D	58	(d)
Constant (a)	-	E	1.9	(e)(f)
Constant (b)	-	F	1.5	(e)
Constant (c)	-	G	365	(e)
Constant (d)	-	H	235	(e)
Constant (e)	-	I	15	(e)
Emission reduction efficiency	(%)	J	0	

Source: (a) Information based Cost Summary Cost Estimate CDF, January 2011; 175,000 m^3 of overburden removed and assuming a 5 m tall stockpiles.
(b) Value derived from Fortune 2004-2007 onsite meteorological station (Fortune_2004_2007_MetData(Oct8 04 - Sep27 07)_MD.xls).
(c) material silt content taken as the mean overburden silt content for Western surface coal mine in AP 42 chapter 13.2.4 Aggregate Handling and Storage Piles/ Table 13.2.4-1 Typical Silt and Moisture Contents of Materials at Various Industries.
(d) Value derived from Fortune 2004-2007 onsite meteorological station (Fortune_2004_2007_MetData(Oct8 04 - Sep27 07)_MD.xls).
(e) Control of Open Fugitive Dust Source (USEPA, September 1988) / Equation (4-9).
(f) Constant of 1.7 lb/year/acre converted to 1.9 lb/day/ha by multiplying by 0.454 kg/lb, 1 acre/0.405 ha and 1 year/365 days. The 1 year/365 days cancels out the 365 day in the equation listed in EPA (1988).

			TSP <= 30 um	**PM_{10}**	**$PM_{2.5}$**	
Scaling factors	-	K	-	0.5	0.075	(a)
Emission factor (uncontrolled)	kg/d/ha	L = E*(C/F)*((G-D)/H)*(B/I)	25.27	12.63	1.89	(b) (c)
Maximum emission rate (controlled)	g/s	M = L*A*1000*(1-J/100)/(24*3600)	1.02	0.51	0.077	
Maximum Emission rate (uncontrolled)	g/s	M' = L*A*1000/(24*3600)	1.02	0.51	0.077	
Maximum emission rate (controlled, removing precipitation correction)	g/s	M"= E*(C/F)*((G-0)/H)*(B/I)*A*1000*(1-J/100)/(24*3600)	1.22	0.61	0.091	
Maximum emission rate (uncontrolled, removing precip correction)	g/s	M"'= E*(C/F)*((G-0)/H)*(B/I)*A*1000/(24*3600)	1.22	0.61	0.091	

Source: (a) AP-42/Section 13.2.5 - Industrial Wind Erosion.
(b) TSP calculated according to Control of Open Fugitive Dust Source (USEPA, September 1988) / Equation (4-9).
(c) PM_{10} and $PM_{2.5}$ calculated by multiplying TSP emission rate by respective scaling factors.

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Calculation of Emissions During the Construction Phase

II - Site Preparation (earth moving)

II.1 - Drilling

A - Fugitive Emissions

Dust Control Technique		**Wet drilling**	(a)

Source: (a) Assume wet drilling.

Hours of operation per day - maximum	h/day	A	1.3	(a)
Material throughput	tonnes/day	B	14,541	(b)
Emission reduction efficiency	(%)	C	0	

Source: (a) Information provided by Fortune in "NICO Mobile Equipment_REVC_without Aker fuel.xlsx/Road Construction Estimate". Operating time taken from Heavy Duty Equipment/blast hole drill for two drills.
(b) Assume same mass of material drilled that is blasted.

			TSP	PM_{10}	$PM_{2.5}$	
Emission factor (controlled - wet drilling)	kg/tonne	D	9.00E-05	4.00E-05	7.41E-06	(a) (b) (c)
Daily emission rate (uncontrolled)	g/day	E = B*D*1000	1308.69	581.64	107.71	
Daily emission rate (controlled)	g/day	F = B*D*1000*(1-C/100)	1308.69	581.64	107.71	
Maximum emission rate (uncontrolled)	g/s	G = E/(A*3600)	0.29	0.13	0.024	
Maximum emission rate (controlled))	g/s	H = F/(A*3600)	0.29	0.13	0.024	
Quality rating	-		C	-	-	

Source: (a) Emission factor for TSP extracted from in AP-42 / 11.19.2 - Crushed Stone Processing and Pulverized Mineral Processing (USEPA, August 2004)/ Table 11.19.2.1 (value for Wet Drilling - Unfragmented Stone).
(b) Emission factor for TSP based on the ratio between TSP and PM_{10} emission factors for tertiary crushing (uncontrolled) in AP-42 / 11.19.2 - Crushed Stone Processing and Pulverized Mineral Processing (USEPA, August 2004)/ Table 11.19.2.1.
(c) Emission factor for PM2.5 based on the ratio between PM10 and $PM_{2.5}$ emission factors for tertiary crushing (controlled) in AP-42 / 11.19.2 - Crushed Stone Processing and Pulverized Mineral Processing (USEPA, August 2004)/ Table 11.19.2.1.

B- Exhaust Emissions

Equipment/Vehicle	Model	Number of Equipment/Vehicle	Daily Use
Self-Propelled Blast Hole Drill	Sandvik D45KS; Atlas Copco DML; or similar	1	1.0
Air Trac Drill	ATD 3100 B, Drifter Attachment PP 123	1	0.3

			SO_2	NO_X	CO	$PM_{2.5}$	PM_{10}	VOC	PAH	CO_2e
Daily emission rate	tonne/day	(refer to Construction combustion)	2.19E-06	8.36E-04	1.77E-04	2.62E-05	2.70E-05	3.55E-05	3.83E-07	0.26

II.2 - Blasting

A - Fugitive Emissions

Dust Control Technique		**No control**

Blasting from ANFO	tonne/year	A	185.88	(a)
Blasting from Emulsion blend	tonne/year	B	185.88	(a)
Number of Blasts per day	blasts/day	C	18.76	(a)

Source: (a) Information provided by Fortune in "NICO estimated blasting quantities.xlsx".

			SO2	**NOx**	**CO**	**CH4**	**H2S**	**CO_2e**	
ANFO constant (a)	kg/Mg	D	1	8	34				(a)
Emulsion blend (b)	kg/Mg	E	1	26	52	0.3	2		(a)(b)
Emission rate	tonne/day	F = (A*D+B*E)/10^3/(365*3/12)	0.0041	0.069	0.18	6.11E-04	0.0041	0.013	

Source: (a) Emission factors taken from AP-42 Section 13.3.
(b) Assumed that Emulsion blend is Dynamite Gelatin within AP-42, chapter 13.

			TSP <= 30 um	**PM_{10}**	**$PM_{2.5}$**	
Constant (a)	-	H	0.00022	-	-	(a)
Constant (b)	-	I	1.5	-	-	(a)
Scaling factor	-	J	-	0.52	0.03	(b)
Emission rate (uncontrolled)	kg/year	K = H*(1250/50)^I*C*(365*3/12)	47.08	24.48	1.41	(c)(d)
Daily emission rate (uncontrolled)	tonne/day	L= K/1000/(365*3/12)	5.16E-04	2.68E-04	1.55E-05	(e)

Source: (a) AP-42 / Section 11.9 - Western Surface Coal Mining (USEPA, October 1998)/ Table 11.9-2 - Emission Factor Equations for Uncontrolled Open Dust Sources at Western Surface Coal Mines (blasting).
(b) Scaling factor to convert TSP <= 30 um to $PM_{2.5}$ and PM_{10}.
(c) PM_{10} and $PM_{2.5}$ calculated multiplying TSP emission rate by respective scaling factors.
(d) Fortune provided that for 50 blasts results in 1250 m^2 of disturbed area in an email dated November 29, 2010.
(e) Fortune has specified that contruction blasting will only last 3 months ("NICO estimated blasting quantities.xlsx").

II.3 - Bulldozing

A - Fugitive Emissions

Dust Control Technique		**No control**

Number of equipment	pc	A	2	(a)
Hours of operation per day - peak	h/day	B	6.0	(b)
Material silt content	(%)	C	56	(c)
Material moisture content	(%)	D	16.8	(d)
Emission reduction efficiency	(%)	E	0	

Source: (a) Information provided by Fortune in "NICO Mobile Equipment_REVC_without Aker fuel.xlsx". Two dozers are assumed to perform this task.
(b) Information provided by Fortune. Daily operating time assumed to be the same as the dozers.
(c) Material silt content taken as average silt content of the till and glacio-lacustrine deposit from Golder FEED document.
(d) Moisture content taken as the maximum overburden moisture content from AP-42 chapter 11.9 Western surface Coal Mine/ Table 11.9-3 (Metric and English Units). Typical Values For Correction Factors Applicable to the Predictive Emission Factor Equations.

			TSP <= 30 um	TSP <= 15 um	PM_{10}	$PM_{2.5}$	
Constant (a)	-	F	2.6	0.45	-	-	(a)
Constant (b)	-	G	1.2	1.5	-	-	(a)
Constant (c)	-	H	1.3	1.4	-	-	(a)
Scaling factor		I	-	-	0.75	0.105	(a) (b)
Emission rate (uncontrolled)	g/hr	J = F*(C^G)/(D^H)*1000*A	16,631.33	7,262.59	5,446.94	1,746.29	(a) (c)
Emission rate (controlled)	g/hr	K = J*(1-E/100)	16,631.33	7,262.59	5,446.94	1,746.29	
Daily emission rate (controlled)	g/day	L = K*B	100,061.36	43,694.93	32,771.20	10,506.44	
Daily emission rate (uncontrolled)	g/day	M = J * B	100,061.36	43,694.93	32,771.20	10,506.44	
Maximum emission rate (controlled)	g/s	N = L/(B*3600)	4.62	2.02	1.51	0.49	
Maximum emission rate (uncontrolled)	g/s	O = M / (B*3600)	4.62	2.02	1.51	0.49	
Quality rating	-		B	C	D	D	

Source: (a) AP-42 / Section 11.9 - Western Surface Coal Mining (USEPA, October 1998) / Table 11.9-2 (Metric Units) - Emission Factor Equations for Uncontrolled Open Dust Sources at Western Surface Coal Mines (bulldozing overburden). According to recommendations in AP-42 / Section 13.2.3 - Heavy Construction Operations (USEPA, January 1995) / Table 13.2.3-1 - Recommended Emission Factors for Construction Operations (reference to dozer equation (overburden) in Section 11.9 / Table 11.9.2).
(b) Scaling factor to convert TSP <= 30 um to $PM_{2.5}$ and TSP <= 15 um to PM_{10}.
(c) PM_{10} and $PM_{2.5}$ calculated multiplying TSP emission rates by respective scaling factors.

B- Exhaust Emissions

Equipment/Vehicle	Model	Number of Equipment/Vehicle	Daily Use
Tracked-Dozer	Caterpillar D4H	1	6.0
Track-dozer	Caterpillar D6T; Aker request; not req if D10 over ice	1	6.0

			SO_2	NO_X	CO	$PM_{2.5}$	PM_{10}	VOC	PAH	CO_2e
Daily emission rate	tonne/day	(refer to Construction combustion)	1.51E-05	0.0083	0.0024	4.45E-04	4.59E-04	4.62E-04	2.64E-06	1.80

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Calculation of Emissions During the Construction Phase

II.4 - Material handling

A - Fugitive Emissions

Dust Control Technique		**No control**

Hours of operation per day - peak	h/day	A	6.0	(a)
Amount of material handled per day	tonnes/day	B	200	(b)
Mean wind speed - maximum daily value	m/s	C	12.82	(c)
Material moisture content	%	D	16.8	(d)
Constant (a)	-	E	0.0016	(e)
Constant (b)	-	F	1.3	(e)
Constant (c)	-	G	2.2	(e)
Constant (d)	-	H	1.4	(e)
Constant (e)	-	I	2	(e)
Emission reduction efficiency	(%)	J	0	

Source: (a) Information provided by Fortune. Daily operating time assumed to the same as construction haulage times.
(b) Assumed that 50 tonne/day of material handled by each piece of equipment (Excavator, backhoe, dump truck and integrated tool carrier).
(c) Value derived from Fortune 2004-2007 onsite meteorological station (Fortune_2004_2007_MetData(Oct8 04 - Sep27 07)_MD.xls).
(d) Moisture content taken as the maximum overburden moisture content from AP 42 chapter 11.9 Western surface Coal Mine/ Table 11.9-3 (Metric and English Units). Typical Values For Correction Factors Applicable to the Predictive Emission Factor Equations.
(e) AP-42 / Section 13.2.4 - Aggregate Handling And Storage Piles (USEPA, November 2006)/ equation 1 - emission factor for drop operation.

			TSP <= 30 um	PM_{10}	$PM_{2.5}$	
Particle size multiplier	-	K	0.74	0.35	0.053	(a)
Emission factor (uncontrolled)	kg/tonne	L = K*E*((C/G)^F)/((D/I)^H)	5.95E-04	2.81E-04	4.26E-05	(a)
Maximum emission rate (controlled)	g/s	M = B*L*(1-J/100)*1000/(A*3600)	0.0055	0.0026	3.93E-04	
Maximum emission rate (uncontrolled)	g/s	N = B*L*1000/(A*3600)	0.0055	0.0026	3.93E-04	
Quality rating	-		A	A	A	

Source: (a) AP-42 / 13.2.4 - Aggregate Handling And Storage Piles (USEPA, November 2006)/ equation 1 - emission factor for drop operation.

B- Exhaust Emissions

Equipment/Vehicle	Model	Number of Equipment/Vehicle	Daily Use
Dump Truck	Western Star 4900 SA; or Equivalent	1	2.0
Excavator	Caterpillar 345 BL	1	2.0
Backhoe	Caterpillar 450E; or Equivalent	1	3.0
Integrated Tool Carrier	Caterpillar IT24F	1	6.0

			SO_2	NO_X	CO	$PM_{2.5}$	PM_{10}	VOC	PAH	CO_2e
Daily emission rate	tonne/day	(refer to Construction combustion)	1.28E-05	0.0054	0.0028	3.03E-04	3.12E-04	3.52E-04	2.24E-06	1.53

II.5 - Compacting

A - Fugitive Emissions

Dust Control Technique		**No control**

Number of equipment	pc	A	2	(a)
Hours of operation per day - peak	h/day	B	1.0	(a)
Material silt content	(%)	C	56	(b)
Material moisture content	(%)	D	16.8	(c)
Emission reduction efficiency	(%)	E	0	

Source: (a) Information provided by Fortune in "NICO Mobile Equipment_REVC_without Aker fuel.xlsx".
(b) Material silt content taken as average silt content of the till and glacio-lacustrine deposit from Golder FEED document.
(c) Moisture content taken as the maximum overburden moisture content from AP-42 chapter 11.9 Western surface Coal Mine/ Table 11.9-3 (Metric and English Units). Typical Values For Correction Factors Applicable to the Predictive Emission Factor Equations.

			TSP <= 30 um	**TSP <= 15 um**	**PM_{10}**	**$PM_{2.5}$**	
Constant (a)	-	F	2.6	0.45	-	-	(a)
Constant (b)	-	G	1.2	1.5	-	-	(a)
Constant (c)	-	H	1.3	1.4	-	-	(a)
Scaling Factor		I	-	-	0.75	0.105	(a) (b)
Emission rate (uncontrolled)	g/hr	J = F*(C^G)/(D^H)*A*1000	16631.33	7262.59	5446.94	1746.29	(a) (c)
Emission rate (controlled)	g/hr	K = J*(1-E/100)	16631.33	7262.59	5446.94	1746.29	
Daily emission rate (uncontrolled)	g/day	L = J * B	16,403.50	7,163.10	5,372.33	1,722.37	
Daily emission rate (controlled)	g/day	M= K*B	16,403.50	7,163.10	5,372.33	1,722.37	
Maximum emission rate (uncontrolled)	g/s	N = L/(B* 3600)	4.62	2.02	1.51	0.49	
Maximum Emission rate (controlled)	g/s	O = M/(B*3600)	4.62	2.02	1.51	0.49	
Quality rating	-		B	C	D	D	

Source: (a) AP-42 / Section 11.9 - Western Surface Coal Mining (USEPA, October 1998) / Table 11.9-2 (Metric Units) - Emission Factor Equations for Uncontrolled Open Dust Sources at Western Surface Coal Mines (bulldozing overburden). According to recommendations in AP-42 / Section 13.2.3 - Heavy Construction Operations (USEPA, January 1995) / Table 13.2.3-1 - Recommended Emission Factors for Construction Operations (reference to dozer equation (overburden) in Section 11.9 / Table 11.9.2).

(b) Scaling factor to convert TSP <= 30 um to $PM_{2.5}$ and TSP <= 15 um to PM_{10}.

(c) PM10 and PM2.5 calculated multiplying TSP emission rates by respective scaling factors.

B- Exhaust Emissions

Equipment/Vehicle	**Model**	**Number of Equipment/Vehicle**	**Daily Use**
Compactor, Sheep Foot	Caterpillar 815F/Komatsu CP76; or equivalent	1	1.0
Compactor, Vibrating Soil	Caterpillar CS-323C; or equivalent	1	1.0

			SO_2	**NO_X**	**CO**	**$PM_{2.5}$**	**PM_{10}**	**VOC**	**PAH**	**CO_2e**
Daily emission rate	tonne/day	(refer to Construction combustion)	1.57E-06	7.64E-04	1.73E-04	4.77E-05	4.92E-05	5.43E-05	2.75E-07	0.19

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II.6 - Grading

A - Fugitive Emissions

Dust Control Technique		**No control**	

Hours of operation per day	hr/day	A	1.0	(a)
Number of graders	number	B	1	(a)
Mean vehicle speed	km/hr	C	11.4	(b)
Vehicle kilometer traveled (VKT)	VKT/day	D = A*B*C	11	
Emission reduction efficiency	(%)	E	0	

Source: (a) Information provided by Fortune in "NICO Mobile Equipment_REVC_without Aker fuel.xlsx".
(b) Calculated assuming an average speed of 11.4 km/h, taken from AP-42 chapter 11.9 Western Surface Coal Mining.

			TSP <= 30 um	**TSP <= 15 um**	**PM_{10}**	**$PM_{2.5}$**	
Constant (a)	-	F	0.0034	0.0056	-	-	(a)
Constant (b)	-	G	2.5	2	-	-	(a)
Scaling Factor		H	-	-	0.60	0.031	(a) (b)
Emission factor (uncontrolled)	kg/VKT	I = F*(C^G)	1.49	0.73	0.44	0.046	(a) (c)
Daily emission rate (uncontrolled)	g/day	J = D* I*1000	16,774.73	8,182.99	4,909.80	520.02	
Daily emission rate (controlled)	g/day	K= D*I*1000*(1-E/100)	16,774.73	8,182.99	4,909.80	520.02	
Maximum emission rate (uncontrolled)	g/s	L = J/(A*3600)	4.72	2.30	1.38	0.15	
Maximum emission rate (controlled)	g/s	M = K/(A*3600)	4.72	2.30	1.38	0.15	
Quality rating	-		C	C	D	D	

Source: (a) AP-42 / Section 11.9 - Western Surface Coal Mining (USEPA, October 1998) / Table 11.9-2 - Emission Factor Equations for Uncontrolled Open Dust Sources at Western Surface Coal Mines (grading). According to recommendations in Section 13.2.3 Heavy Construction Operations (USEPA, January 1995) / Table 13.2.3-1 - Recommended Emission Factors for Construction Operations (reference to grading equation in Table 11.9.2).
(b) Scaling factor to convert TSP <= 30 um to $PM_{2.5}$ and TSP <= 15 um to PM_{10}.
(c) PM_{10} and $PM_{2.5}$ calculated multiplying TSP emission rates by respective scaling factors.

B- Exhaust Emissions

Equipment/Vehicle	**Model**	**Number of Equipment/Vehicle**	**Daily Use**
Grader	Caterpillar 14M/Komatsu GD675-3	1	1.0

			SO_2	**NO_X**	**CO**	**$PM_{2.5}$**	**PM_{10}**	**VOC**	**PAH**	**CO_2e**
Daily emission rate	tonne/day	(refer to Construction combustion)	1.26E-06	5.68E-04	1.86E-04	2.67E-05	2.75E-05	5.33E-05	2.20E-07	0.15

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II.7 - Loading of aggregate material into trucks

A - Fugitive Emissions

Dust Control Technique		**No control**	
Hours of operation per day	h/day	A	6.0 (a)
Amount of debris removed per day	tonnes/day	B	3,635 (b)
Emission reduction efficiency	(%)	C	0

Source: (a) Data provided by Fortune. Numbers of work hours per day taken as the front end loader operational hours.
(b) Information provided by Fortune in "NICO estimated blasting quantities.xlsx".

			TSP	**PM_{10}**	**$PM_{2.5}$**	
Emission factor (uncontrolled)	kg/tonne	D	0.018	0.0094	0.0019	(a) (b) (c)
Daily emission rate (controlled)	g/day	E = B*D*1000*(1-C/100)	65,434.50	34,025.94	6,870.62	
Daily emission rate (uncontrolled)	g/day	F = B*D*1000	65,434.50	34,025.94	6,870.62	
Maxium emission rate (controlled)	g/s	G = E/(A*3600)	3.02	1.57	0.32	
Maximum emission rate (uncontrolled)	g/s	H = F/(A*3600)	3.02	1.57	0.32	
Quality rating	-		E	-	-	

Source: (a) TSP emission factor extracted from AP-42 / Section 11.9 - Western Surface Coal Mining (USEPA, October 1998) / Table 11.9.4 - Uncontrolled Particulate Emission Factors for Open Dust Sources at Western Surface Coal Mine (truck loading by power shovel (batch drop) / overburden).

(b) Emission factor for PM_{10} based on the ratio between TSP and PM10 emission factors for blasting in AP-42 / Section 11.9 - Western Surface Coal Mining (USEPA, October 1998) / Table 11.9-2 (Metric Units) - Emission Factor Equations for Uncontrolled Open Dust Sources at Western Surface Coal Mines.
(c) Emission factor for $PM_{2.5}$ based on the ratio between TSP and PM2.5 emission factors for bulldozing overburden in AP-42 / Section 11.9 - Western Surface Coal Mining (USEPA, October 1998) / Table 11.9-2 (Metric Units) - Emission Factor Equations for Uncontrolled Open Dust Sources at Western Surface Coal Mines.

B- Exhaust Emissions

Equipment/Vehicle	**Model**	**Number of Equipment/Vehicle**	**Daily Use**
Wheeled Front End Loader	Caterpillar 988H/Komatsu WA 600	1	6.0

			SO_2	**NO_X**	**CO**	**$PM_{2.5}$**	**PM_{10}**	**VOC**	**PAH**	**CO_2e**
Daily emission rate	tonne/day	(refer to Construction combustion)	1.54E-05	0.0062	0.0021	2.71E-04	2.79E-04	2.93E-04	2.70E-06	1.84

II.8 Hauling material

A - Fugitive Emissions

Dust Control Technique		**Watering twice a day**	

Source: (a) Information provided by Fortune in an email dated Feb. 15, 2011.

Hours of operation per day - peak	h/day	A	6.0	(a)
Surface material silt content	(%)	B	1.6	(b)
Mean vehicle weight	tonnes	C	118.63	(c)
Vehicle kilometer traveled (VKT)	km/day	D	125.07	(c)
Number of working days	days/year	E	365	
Number of days with precipitation >= 0.2 mm	days/year	F	58	(d)
Emission reduction efficiency	(%)	G	55	(e)

Source: (a) Information provided by Fortune. Daily operating time assumed to the same as construction haulage times.
(b) Roads are assumed to be lined with aggregate and it is expected to have a similar silt content as limestone; data available in AP 42 chapter 13.2.4/Table 13.2.4-1.
(c) See Mean Vehicle Weight table below.
(d) Value derived from Fortune 2004-2007 onsite meteorological station (Fortune_2004_2007_MetData(Oct8 04 - Sep27 07)_MD.xls).
(e) Assumed wet suppression based on the water trucks being present onsite. Unpaved Industrial Road Dust Calculator (Environment Canada website, accessed in December 2009).

			PM-30 (TSP)	**PM_{10}**	**$PM_{2.5}$**	
Constant (k)	-	H	4.9	1.5	0.15	(a)
Constant (a)	-	I	0.7	0.9	0.9	(a)
Constant (b)	-	J	0.45	0.45	0.45	(a)
Emission factor (uncontrolled)	lb/VMT	K = H*((B/12)^I)*((C*1.1/3)^J)*[(E-G)/E]	5.50	1.13	0.11	(a)
Emission factor (metric uncontrolled)	g/VKT	L = K * 281.9	1551.64	317.45	31.74	(b)
Emission factor (controlled)	g/VKT	M = L*281.9*(1-G/100)	698.24	142.85	14.29	(b)
Emission factor (metric uncontrolled, without precip)	g/VKT	N = H*((B/12)^I)*((C*1.1/3)^J)*281.9	1,842.79	377.01	37.70	
Emission factor (controlled, without precip)	g/VKT	O = N * (1-G/100)	829.25	169.66	16.97	
Daily emission rate (uncontrolled)	g/day	P = L *D	194,064.29	39,703.48	3,970.35	
Daily emission rate (controlled)	g/day	Q= M*D	87,328.93	17,866.56	1,786.66	
Daily emission rate (uncontrolled, without precip)	g/day	R = N*D	230,477.65	47,153.26	4,715.33	
Daily emission rate (controlled, without precip)	g/day	S = O*D	103,714.94	21,218.97	2,121.90	
Maximum emission rate (uncontrolled)	g/s	T = P/(A*3600)	8.96	1.83	0.18	
Maximum emission rate (controlled)	g/s	U = Q/(A*3600)	4.03	0.82	0.08	
Maximum emission rate (uncontrolled, without precip)	g/s	V = R/(A*3600)	10.64	2.18	0.22	
Maximum emission rate (controlled, without precip)	g/s	W = S/(A*3600)	4.79	0.98	0.10	
Quality rating	-		B	B	B	

Source: (a) AP-42 / Section 13.2.2 - Unpaved Roads (USEPA, November 2006)/ Equation (1a) - unpaved surfaces at industrial sites and Table 13.2.2-2.
(b) 281.9 constant to convert lb/VMT (pounds per vehicle mile travelled) to g/VKT (grams per vehicle kilometer travelled).

Mean Vehicle Weight

Equipment	-		Haulage Unit	Total	
Weight - Empty	tonne		73.98		(a)
Weight - Loaded	tonne		163.29		(b)
Mean Weight	tonne		119		
Number of two way trips	number		41		(c)
Distance of two way trip	km/day		3.07		(d)
Vehicle kilometer traveled (VKT)	km/day		125.07	125.07	
Percentage of traffic	%		100%		
Mean vehicle weight	tonne		118.63	118.63	

Source: (a) Information provided by Fortune in "NICO Mobile Equipment_REVC_without Aker fuel.xlsx".
(b) Haul truck's loaded weight was taken as the maximum specified load in CAT 777F specification sheet.
(c) Information provided by Fortune in "NICO estimated blasting quantities.xlsx".
(d) Distance taken from Golder Proposed site layout figure 4-1 FEED document.

B- Exhaust Emissions

Equipment/Vehicle	Model	Number of Equipment/Vehicle	Daily Use
Surface rock haulage trucks	Caterpillar 777F/Komatsu HD 785-7	2	6.0

			SO_2	NO_X	CO	$PM_{2.5}$	PM_{10}	VOC	PAH	CO_2e
Daily emission rate	tonne/day	(refer to Construction combustion)	6.02E-05	0.028	0.0091	0.0013	0.0013	0.0014	1.05E-05	7.20

II.9 - Jaw crusher

A - Fugitive Emissions

Dust Control Technique		**No control**

Hours of operation per day - maximum	h/day	A	1.5	(a)(b)
Amount of material processed per day	tonnes/day	B	14,541	(b)
Emission reduction efficiency	(%)	C	0	(c)

Source: (a) Information provided by Fortune in "NICO Mobile Equipment_REVC_without Aker fuel.xlsx". The hours of operation is the average between the jaw crusher and cone crusher.
(b) Assume blasted material is sent to jaw crusher. Information provided by Fortune in "NICO estimated blasting quantities.xlsx".
(c) Assumed no wet suppression.

			TSP	PM_{10}	$PM_{2.5}$	
Emission factor (uncontrolled)	kg/tonne	D	0.01	0.004	0.00007	(a) (b)
Daily emission rate (controlled)	g/day	E = B*D*1000*(1-C/100)	145,410.0	58,164.0	1,077.1	
Maximum emission rate controlled	g/s	F = E/(A*3600)	27.30	10.92	0.20	
Maximum emission rate uncontrolled	g/s	F' = B*D*1000/(A*3600)	27.30	10.92	0.20	
Quality rating	-		C	C	-	(a)

Source: (a) AP-42 / 11.24 - Metallic Minerals Processing (USEPA, August 1982)/ Table 11.24-1 (Metric Units). Emission factors for metallic minerals processing (value for high moisture ore / primary crushing; high moisture ore defined as >= 4% in weight).
(b) Emission factor for $PM_{2.5}$ based on the ratio between PM_{10} and $PM_{2.5}$ emission factors for tertiary crushing (controlled) in AP-42 / 11.19.2 Crushed Stone Processing and Pulverized Mineral Processing (USEPA, August 2004)/ Table 11.19.2.1.

II.10 Material screening

A - Fugitive Emissions

Dust Control Technique		**No control**

Hours of operation per day - maximum	h/day	A	1.0	(a)
Amount of material processed per day	tonnes/day	B	14,541	(b)
Emission reduction efficiency	(%)	C	0	(c)

Source: (a) Information provided by Fortune in "NICO Mobile Equipment_REVC_without Aker fuel.xlsx".
(b) Assume blasted material is sent to jaw crusher. Information provided by Fortune in "NICO estimated blasting quantities.xlsx".
(c) No dust controls methods were assumed.

			TSP	PM_{10}	$PM_{2.5}$	
Emission factor (uncontrolled)	kg/tonne	D	0.0125	0.0043	0.000025	(a) (b)
Daily emission rate (controlled)	g/day	E = B*D*1000*(1-C/100)	181,762.50	62,526.30	363.53	
Daily emission rate (uncontrolled)	g/day	F = B*D*1000	181,762.50	62,526.30	363.53	
Maximum emission rate (controlled)	g/s	G = E/(A*3600)	51.19	17.61	0.10	
Maximum emission rate (uncontrolled)	g/s	H = F/(A*3600)	51.19	17.61	0.10	
Quality rating	-		E	C	-	

Source: (a) AP-42 / 11.19.2 Crushed Stone Processing and Pulverized Mineral Processing (USEPA, August 2004)/ Table 11.19.2-1 (Metric Units) - Emission factors for crushed stone processing operations (value for screening - uncontrolled).
(b) Assumed $PM_{2.5}$ emission factor taken from Screening for wet suppression.

Air Quality Assessment - NICO Project
Calculation of Emissions During the Construction Phase

III - General Construction

III.1 - Vehicular traffic

A - Fugitive Emissions

Dust Control Technique		**Watering twice a day**

Source: (a) Information provided by Fortune in an email dated Feb. 15, 2011.

Hours of operation per day	h/day	A	6.0	(a)
Surface material silt content	(%)	B	1.6	(b)
Mean vehicle weight	(tons)	C	8.83	(c)
Vehicle kilometer traveled (VKT)	km/day	D	76.82	(c)
Number of working days	days/year	E	365	
Number of days with precipitation >= 0.2 mm	days/year	F	58	(d)
Emission reduction efficiency	(%)	G	55	(e)

Source: (a) Based on information provided by Fortune in "NICO Mobile Equipment_REVC_without Aker fuel.xlsx" assumed the same operating time as the haul trucks.
(b) Roads are assumed to be lined with aggregate and it is expected to have a similar silt content as limestone; data available in AP 42 chapter 13.2.4/table 13.2.4-1.
(c) See Mean Vehicle Weight table below.
(d) Value derived from Fortune 2004-2007 onsite meteorological station (Fortune_2004_2007_MetData(Oct8 04 - Sep27 07)_MD.xls).
(e) Unpaved Industrial Road Dust Calculator (Environment Canada website, accessed in December 2009).

			PM-30 (TSP)	**PM_{10}**	**$PM_{2.5}$**	
Constant (k)	-	H	4.9	1.5	0.15	(a)
Constant (a)	-	I	0.7	0.9	0.9	(a)
Constant (b)	-	J	0.45	0.45	0.45	(a)
Emission factor (uncontrolled)	lb/VMT	K = H*((B/12)^I)*((C/3)^J)*[(E-G)/E]	1.64	0.33	0.03	(b)
Emission factor (uncontrolled, metric)	g/VKT	L = K * 281.9	461.45	94.41	9.44	(b)
Emission factor (controlled)	g/VKT	M = L*281.9*(1-G/100)	207.65	42.48	4.25	(b)
Emission factor (uncontrolled, without precipitation)	g/VKT	N=H*((B/12)^I)*((C/3)^J)*281.9	548.03	112.12	11.21	
Emission factor (controlled, without precipitation)	g/VKT	O = N*(1-G/100)	246.61	50.45	5.05	
Daily emission rate (uncontrolled)	g/day	P= L * D	35449.81	7252.65	725.27	
Daily emission rate (controlled)	g/day	Q = M*D	15952.42	3263.69	326.37	
Daily emission rate (uncontrolled, without precipitation)	g/day	R = N * D	42101.46	8613.51	861.35	
Daily emission rate (controlled, without precipitation)	g/day	S = O* D	18945.66	3876.08	387.61	
Maximum emission rate (uncontrolled)	g/s	T = P/(A*3600)	1.64	0.33	0.033	
Maximum emission rate (controlled)	g/s	U = Q/(A*3600)	0.74	0.15	0.015	
Maximum emission rate (uncontrolled, without precipitation)	g/s	V = R/(A*3600)	1.94	0.40	0.040	
Maximum emission rate (controlled, without precipitation)	g/s	W = S/(A*3600)	0.87	0.18	0.018	
Quality rating	-		B	B	B	

Source: (a) AP-42 / Section 13.2.2 - Unpaved Roads (USEPA, November 2006)/ Equation (1a) - unpaved surfaces at industrial sites and Table 13.2.2-2.
(b) 281.9 constant to convert lb/VMT (pounds per vehicle mile travelled) to g/VKT (grams per vehicle kilometer travelled).

Mean Vehicle Weight

Equipment	-		Light Duty Trucks	Heavy Duty Trucks	Concrete Truck	Fuel and Lube Truck	Boom Truck	Total	
Weight - Empty	tonne		4.26	6.58	28.12	27.27	18.01		(a)
Weight - Loaded	tonne		4.26	6.58	28.12	47.27	18.01		(b)
Mean Weight	tonne		4	7	28	37	18	94.24	
Number of two way trips	number		12	10	1	1	1		(c)
Distance of two way trip	km/day		3.07	3.07	3.07	3.07	3.07		(d)
Vehicle kilometer traveled (VKT)	km/day		36.88	30.73	3.07	3.07	3.07	76.82	
Percentage of traffic	%		48%	40%	4%	4%	4%		
Mean vehicle weight	tonne		2.05	2.63	1.12	1.49	0.72	8.01	

Source: (a) Information provided by Fortune in "NICO Mobile Equipment_REVC_without Aker fuel.xlsx".
(b) Assume all vehicles loaded and empty weight are the same except for fuel lube truck where assumed loaded weight is 20 tonnes heavier.
(c) Assume number of all trucks undergo one trip/day, and there are 12 LDT and 10 HDT.
(d) Distance travelled will be approximately from plant area to centre of CDF.

B- Exhaust Emissions

Equipment/Vehicle	Model	Number of Equipment/Vehicle	Daily Use
Concrete Truck	Western Star 4900 SA Mixer	1	2.0
Fuel & Lube Truck	Western Star 4900 SA; or Equivalent	1	2.0
Water Truck	Western Star 4900 SA; or Equivalent	1	2.0
Light Duty Truck, Diesel	Ford F-250 Supercab, or equivalent	1	2.6
Light Duty Truck, Diesel	Ford F-250 Supercab, or equivalent	1	2.6
Light Duty Truck	Ford F-250, or equivalent	4	2.6
Light Duty Truck	Ford F-250, or equivalent	1	2.6
Light Duty Truck	Ford F-250, or equivalent	1	5.3
Light Duty Truck	Ford F-250, or equivalent	1	5.3
Light Duty Truck	Ford F-250 Crewcab, or equivalent	3	5.3
Heavy Duty Truck, Diesel	Ford F-450 Crew Cab Flat Deck; or equivalent	1	5.3
Heavy Duty Truck, Diesel	Ford F-450 Crew Cab Flat Deck; or equivalent	1	5.3
Heavy Duty Truck, Diesel	Ford F-450 Crew Cab Flat Deck; or equivalent	1	5.3
Heavy Duty Truck, Diesel	Ford F-450 Crew Cab Flat Deck; or equivalent	2	5.3
Heavy Duty Truck, Diesel	Ford F-450 Crew Cab Flat Deck; or equivalent	1	5.3
Heavy Duty Truck, Diesel	Ford F-450 Crew Cab Flat Deck; or equivalent	2	5.3
Heavy Duty Truck, Diesel	Ford F-450 Crew Cab Flat Deck; or equivalent	1	5.3
Welding Truck	Ford F-450 Crew Cab Flat Deck; or equivalent	1	5.3
Welding Truck	Ford F-450 Crew Cab Flat Deck; or equivalent	2	5.3
Personnel Carrier	Chevrolet Express 2500 Standard, or equivalent	1	5.3
Mine Ambulance	Chevrolet Express 2500 Standard, or equivalent	1	0.3
Fire Truck	Ford F-450 Crew Cab Flat Deck; or equivalent	1	0.3
Rough Terrain Vehicle	Kubota RTV900; or equivalent	1	0.3
Self Propelled Telescopic Boom	Terex Genie; or Equivalent	1	4.0
Self Propelled Telescopic Boom	Terex Genie; or Equivalent	2	4.0
Rough Terrain Crane; 135 tonnes	Grove RT9150E; or equivalent	1	4.0
Rough Terrain Crane; 36.2 tonnes	Manitowoc (Grove) RT540E type; or Equivalent	1	6.0
Boom Truck (*Alternative* "Hiab Truck")	Western Star 4900 SA; or Equivalent	1	6.0
Telescopic Handler	Caterpillar TL943; or Equivalent	1	5.3
Telescopic Handler	Caterpillar TL943; or Equivalent	1	5.3
Telescopic Handler	Caterpillar TL642	1	5.3
Medium Forklift	Clark, ECX 32	1	0.0
Walkie Straddle Pallet Truck	Clark, CSM 15	1	0.0
Scissor Lift, Rough Terrain	Genie Scissorlift RT 2668; or Equivalent	1	4.0
Scissor Lift, Rough Terrain	Genie Scissorlift RT 2668; or Equivalent	2	4.0
Skid Steer-Loader	Bobcat S150	1	4.0
Skid Steer-Loader	Bobcat S70	1	4.0
Skid Steer-Loader	Bobcat S150	1	4.0
Skid Steer-Loader	Bobcat S150	1	4.0

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			SO_2	NO_X	CO	$PM_{2.5}$	PM_{10}	VOC	PAH	CO_2e
Daily emission rate	tonne/day	(refer to Construction combustion)	2.77E-04	0.17	0.067	0.0085	0.0087	0.0079	4.84E-05	33.10

III.2 - Air transport

A - Fugitive Emissions

Dust Control Technique		**Chemical suppressant (EK35)**	

Pile surface area	ha	A	8.6	(a)
Percentage of time WS >19.3 km/h	%	B	30.5	(b)
Material silt content	%	C	1.6	(c)
Number of days with precipitation >= 0.2 mm	days/year	D	58	(d)
Constant (a)	-	E	1.9	(e)(g)
Constant (b)	-	F	1.5	(e)
Constant (c)	-	G	365	(e)
Constant (d)	-	H	235	(e)
Constant (e)	-	I	15	(e)
Emission reduction efficiency	(%)	J	80	(f)

Source: (a) Surface area estimated from Golder (2010) Proposed site layout. Assumed runway is elevated 2 m off the ground.
(b) Value derived from Fortune 2004-2007 onsite meteorological station (Fortune_2004_2007_MetData(Oct8 04 - Sep27 07)_MD.xls).
(c) The pile is assumed to be lined with limestone. Range of limestone silt content available in AP 42 chapter 13.2.4/table 13.2.4-1.
(d) Value derived from Fortune 2004-2007 onsite meteorological station (Fortune_2004_2007_MetData(Oct8 04 - Sep27 07)_MD.xls).
(e) Control of Open Fugitive Dust Source (USEPA, September 1988) / Equation (4-9).
(f) Emission reduction of 80% from chemical suppressant (EK35) extracted from Unpaved Industrial Road Dust Calculator (Environment Canada website, accessed in December 2010).
(g) Constant of 1.7 lb/year/acre converted to 1.9 lb/day/ha by multiplying by 0.454 kg/lb, 1 acre/0.405 ha and 1 year/365 days. The 1 year/365 days cancels out the 365 day in the equation listed in EPA (1988).
NOTE: Since Air strip will be elevated it is assumed that the strip will behave as a storage pile.

			TSP <= 30 um	**PM_{10}**	**$PM_{2.5}$**	
Scaling factors	-	K	-	0.5	0.075	(a)
Emission factor (uncontrolled)	kg/d/ha	L = E*(C/F)*((G-D)/H)*(B/I)	5.39	2.69	0.40	(b) (c)
Maximum emission rate (controlled)	g/s	M = L*A*1000*(1-J/100)/(24*3600)	0.11	0.054	0.0081	
Maximum emission rate (uncontrolled)	g/s	M' = L*A*1000/(24*3600)	0.54	0.27	0.040	
Maximum emission rate (controlled, removing precip correction)	g/s	N = E*(C/F)*((G-0)/H)*(B/I)*A*1000*(1-J/100)/(24*3600)	0.13	0.064	0.010	
Maximum emission rate (uncontrolled, 24 hour, removing precip correction)	g/s	N' = E*(C/F)*((G-0)/H)*(B/I)*A*1000/(24*3600)	0.64	0.32	0.048	

Source: (a) AP-42/Section 13.2.5 - Industrial Wind Erosion.
(b) TSP calculated according to Control of Open Fugitive Dust Source (USEPA, September 1988) / Equation (4-9).
(c) PM_{10} and $PM_{2.5}$ calculated multiplying TSP emission rate by respective scaling factors.

III.3 -Offsite transport, access road

A - Fugitive Emissions

Dust Control Technique		**Assume no control**	(a)

Source: (a) Information provided by Fortune in an email dated Feb. 15, 2011.

Surface material silt content	(%)	A	1.6	(a)
Mean vehicle weight	tonnes	B	64	(b) (c)
Access Road, Vehicle kilometer traveled (VKT)	km/day	C	381	(b)
Number of working days	days/year	D	365	
Number of days with precipitation >= 0.2 mm	days/year	E	58	(d)
Emission reduction, Access Road	(%)	F	0	

Source: (a) AP-42 / 13.2.4 - Aggregate Handling And Storage Piles (USEPA, November 2006)/ Table 13.2.4-1. Typical silt content of overburden for Western surface
(b) Refer to mean vehicle weight table below.
(c) Conservatively assume trucks return loaded with fuel and supplies.
(d) Value derived from Fortune 2004-2007 onsite meteorological station (Fortune_2004_2007_MetData(Oct8 04 - Sep27 07)_MD.xls).

			PM-30 (TSP)	**PM_{10}**	**$PM_{2.5}$**	
Constant (k)	-	G	4.9	1.5	0.15	(a)
Constant (a)	-	H	0.7	0.9	0.9	(a)
Constant (b)	-	I	0.45	0.45	0.45	(a)
Emission factor (uncontrolled)	lb/VMT	J = G*((A/12)^H)*((B*1.1/3)^I)*((D-E)/D)	4.15	0.85	0.085	(a)
Emission factor (metric uncontrolled)	g/VKT	K = J * 281.9	1,171.24	239.62	23.96	(b)
Daily emission rate (uncontrolled)	g/day	L = K * C	445,879.48	91,222.17	9,122.22	
Quality rating	-		B	B	B	(a)

Source: (a) AP-42 / Section 13.2.2 - Unpaved Roads (USEPA, November 2006)/ Equation (1a) - unpaved surfaces at industrial sites and Table 13.2.2-2.
(b) 281.9 constant to convert lb/VMT (pounds per vehicle mile travelled) to g/VKT (grams per vehicle kilometer travelled).

Mean Vehicle Weight

Equipment	-		**B-train**	**Total**	
Weight - Empty	tonne		63.50		(a)
Weight - Loaded	tonne		63.50		(b)
Mean Weight	tonne		63.50		
Number of loads per day	loads/day		6		
Access Road vehicle kilometer travelled (VKT)	km/day		380.69	380.69	(c)
Access Road Percentage of traffic	%		100%		
Mean vehicle weight	tonne		63.50	63.50	

Source: (a) Assumed B-trains will transport material. B-train weight taken as maximum allowable weight from NWT motor vehicles act Section 36 (f)(ii).
(b) Conservatively assume trucks return loaded with fuel and supplies.
(c) Length of access road taken from EBA report, NICO Mine Access Route Evaluation.

B- Exhaust Emissions

Number of loads	loads/day	A	6	(a)
Vehicle kilometer traveled, Access road (VKT)	km/day	B	381	(b)
Daily fuel consumption	L fuel/day	C	311	(c)

Source: (a) Data provided by Fortune in an email dated November 26, 2010.
(b) Refer to mean vehicle weight above.
(c) Assumed B-train horsepower of 75 hp and vehicles travel at 20 km/h. Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling-- Compression-Ignition (EPA, April 2004).

			SO_2	NO_X	CO	VOC	$PM_{2.5}$	PM_{10}	
Emission factor for HDDV8b (modelled in MOBILE)	g/VMT	D	0.015	8.27	3.80	0.77	0.17	0.18	(a)
Emission factor for HDDV8b (modelled in MOBILE)	g/VKT	E= D/1.609344	0.0094	5.14	2.36	0.48	0.10	0.11	
Access road daily emission rate	g/day	F = E*B	3.57	1956.27	897.94	183.09	39.60	43.00	

Source: (a) Emission rates based on MOBILE simulation saved to Winter_Road_Traffic_Emissions.xls

			PAH	CO2	CH4	N2O	CO2e	
Emission factor	tonne/L	H	4.40E-09	0.0027	1.50E-07	1.10E-06		(a) (b)
Daily emission rate	tonne/day	I = H * C	1.37E-06	0.83	4.66E-05	3.42E-04	9.34E-01	

Source: (a) Technical reference (Golder Associates and Conor Pacific), Table 3-51, p. 94.
(b) Environment Canada, National Inventory Report (1990-2008).

III.4 -Offsite transport, Tilcho road

A - Fugitive Emissions

Dust Control Technique		**Assume no control**	(a)

Source: (a) Information provided by Fortune in an email dated Feb. 15, 2011.

Surface material silt content	(%)	A	1.6	(a)
Mean vehicle weight	tonnes	B	64	(b) (c)
Tilcho road, vehicle kilometer traveled (VKT)	km/day	C	228	(b)
Number of working days	days/year	D	365	
Number of days with precipitation >= 0.2 mm	days/year	E	58	(d)
Emission reduction, Tilcho Road	(%)	F	0	

Source: (a) AP-42 / 13.2.4 - Aggregate Handling And Storage Piles (USEPA, November 2006)/ Table 13.2.4-1. Typical silt content of overburden for Western surface
(b) Refer to mean vehicle weight table below.
(c) Conservatively assume trucks return loaded with fuel and supplies.
(d) Value derived from Fortune 2004-2007 onsite meteorological station (Fortune_2004_2007_MetData(Oct8 04 - Sep27 07)_MD.xls).

			PM-30 (TSP)	**PM_{10}**	**$PM_{2.5}$**	
Constant (k)	-	G	4.9	1.5	0.15	(a)
Constant (a)	-	H	0.7	0.9	0.9	(a)
Constant (b)	-	I	0.45	0.45	0.45	(a)
Emission factor (uncontrolled)	lb/VMT	J =G*((A/12)^H)*((B*1.1/3)^I)*((D-E)/D)	4.15	0.85	0.09	(a)
Emission factor (metric uncontrolled)	g/VKT	K = J * 281.9	1,171.24	239.62	23.96	(b)
Daily emission rate	g/day	L = K * C	267,414.74	54,710.19	5,471.02	
Quality rating	-		B	B	B	(a)

Source: (a) AP-42 / Section 13.2.2 - Unpaved Roads (USEPA, November 2006)/ Equation (1a) - unpaved surfaces at industrial sites and Table 13.2.2-2.
(b) 281.9 constant to convert lb/VMT (pounds per vehicle mile travelled) to g/VKT (grams per vehicle kilometer travelled).

Mean Vehicle Weight

Equipment	-		**B-train**	**Total**	
Weight - Empty	tonne		63.50		(a)
Weight - Loaded	tonne		63.50		(b)
Mean Weight	tonne		63.50		
Number of loads per day	loads/day		6		
All weather road vehicle kilometer travelled (VKT)	km/day		228.32	228.32	(c)
Access Road Percentage of traffic	%		100%		
Mean vehicle weight	tonne		63.50	63.50	

Source: (a) Assumed B-trains will transport material. B-train weight taken as maximum allowable weight from NWT motor vehicles act Section 36 (f)(ii).
(b) Conservatively assume trucks return loaded with fuel and supplies.
(c) Length of Tilcho road taken from EBA report, NICO Mine Access Route Evaluation.

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B- Exhaust Emissions

Number of loads	loads/day	A	6	(a)
Vehicle kilometer traveled, Tilcho road (VKT)	km/day	B	228	(b)
Daily fuel consumption	L fuel/day	C	124.16	(c)

Source: (a) Data provided by Fortune in an email dated November 26, 2010.
(b) Refer to mean vehicle weight above.
(c) Assumed B-train horsepower of 75 hp and vehicle travels tat 30 km/h. Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling-- Compression-Ignition (EPA, April 2004).

			SO_2	NO_X	CO	VOC	$PM_{2.5}$	PM_{10}	
Emission factor for HDDV8b (modelled in MOBILE)	g/VMT	D	0.015	8.27	3.80	0.77	0.17	0.18	(a)
Emission factor for HDDV8b (modelled in MOBILE)	g/VKT	E= D/1.609344	0.0094	5.14	2.36	0.48	0.10	0.11	
Tilcho road daily emission rate	g/day	F = E*B	2.14	1173.27	538.54	109.81	23.75	25.79	

Source: (a) Emission rates based on MOBILE simulation saved to Winter_Road_Traffic_Emissions.xls.

			PAH	CO2	CH4	N2O	CO2e	
Emission factor	tonne/L	H	4.40E-09	0.0027	1.50E-07	1.10E-06		(a) (b)
Daily emission rate	tonne/day	I = H * C	5.46E-07	3.31E-01	1.86E-05	1.37E-04	3.73E-01	

Source: (a) Technical reference (Golder Associates and Conor Pacific), Table 3-51, p. 94.
(b) Environment Canada, National Inventory Report (1990-2008).

III.5 - Power generation

C - Combustion Emissions

Control Technique		**No Control**

Hours of operation per day	h/day	A	24	(a)
Sulphur content in the fuel	%	B	0.0015	(b)
Number of power generators	-	C	8	(c)
Maximum fuel consumption	g/bkW-h	D	200	(c)
Generator power Rating	kW	E	1,450	(c)
Maximum 1 hour power output	KW	F= C*E	11,600	
Diesel heating value	Btu/lb	G	19,300	(d)
Maximum fuel consumption	g/h	H=F*D	2.32E+06	
Power within fuel	GW	I=H/453.5924*G*2.93e-10	0.029	

Source: (a) Assumed continuous operation.
(b)Based on Canada's Sulphur in Diesel Fuel Regulations for off-road diesel Fuel effective from October 1, 2010 (Environmental Canada website last updated December 2, 2010, accessed in December, 2010).
(c) Assumed the same power generation as the operational phase.
(d) AP-42 / 3.4 - Large Stationary Diesel And All Stationary Dual-fuel Engines (USEPA, October 2006).

			TSP (a)	**PM_{10}**	**$PM_{2.5}$ (c)**	**NO_x (d)**	**CO**	**SO_x (e)**	**CO_2**	**VOC**	**PAH**	
Emission factor (uncontrolled)	lb/MMBTU	J	0.062	0.057	0.057	3.20	0.85	0.0015	165.00	0.0042	2.11E-04	(b)
Emission factor (uncontrolled)	g/GW-h	K= J*453.59/0.00029307	95,958.72	88,684.43	88,684.43	4,952,708.34	1,315,563.15	2,344.80	255,374,023.57	6,426.11	326.01	
Maximum emission rate	g/s	L=K*I/3600	0.77	0.71	0.71	39.80	10.57	0.019	2052.23	0.052	0.0026	
Maximum emission rate per boiler	g/s/boiler	M=L/C	0.10	0.089	0.089	4.98	1.32	0.0024	256.53	0.0065	3.27E-04	
Daily emission rate	tonne/day	L' = L*(A*3600)/10^6	0.067	0.062	0.062	3.44	0.91	0.0016	177.31	0.0045	2.26E-04	

Source: (a) TSP is for filterable particulates.
(b) AP-42 / 3.4 - Large Stationary Diesel And All Stationary Dual-fuel Engines (USEPA, October 2006)/ Table 3.4-1 -Table 3.4-4.
(c) Emission factors for PM_{10} and $PM_{2.5}$ are assumed to be the same.
(d) Emission factor for NO_x corresponds to uncontrolled equipment (i.e., without ignition timing retard).
(e) Emission factor for SO_2 calculated based on the equation EF_SO_2 =1.01*S, where S is the fuel sulphur content, according to AP-42 / 3.4 - Large Stationary Diesel And All Stationary Dual-fuel Engines (USEPA, October 2006)/ Table 3.4-1.

			N_2O	**CH_4**	**CO_2e**	
GHG Emission factor for fuel combustion	g/L	N	0.4	0.133		(a)
GHG emissions	g/s	O=H/(7.1*453/3.78)*N/3600	0.30	0.10		(b)
GHG emissions	g/s/boiler	P=O/C	0.038	0.013		
GHG daily emissions	tonne/day	Q = O * (A*3600)/10^6	0.026	0.0087		
Total equivalent daily GHG emissions	tonne/day	R = N20*310 + CH4 * 21 + CO2			185.61	

Source: (a) Emission factors for N_2O and CH_4 taken from Environment Canada, National Inventory Report 1990-2008, Part 2 (2010), Table A8-4.
(b) Diesel fuel density used was 7.1 lb/gallon as specified in AP-42 Chapter 3, table 3.4-1.

III.6- Incineration

C - Combustion Emissions

Control Technique		**No Scrubber**

Waste Generation, Operation	kg/day	A	1030	(a)
Operation hours	hour/day	B	8.0	(a)
Waste Oil Burning	L/hour	C	10	(a)
Sulphur Content of Oil	%	D	1	(b)
Diesel Burning	L/hour	E	45	(a)
Sulphur Content of diesel	%	F	0.0015	(c)
Diesel heating value	Btu/lb	G	19,300	(d)
Diesel density	lb/gallon	H	7.1	(d)

Source: (a) Information provided by Fortune in an email dated November 29, 2010, burns 8 hours every day.
(b) Assumed that the sulphur content was the 1 % as regulated in Ontario.
(c) Based on Canada's Sulphur in Diesel Fuel Regulations for off-road diesel Fuel effective from October 1, 2010 (Environmental Canada website last updated December 2, 2010, accessed in December, 2010).
(d) AP-42 / 3.4 - Large Stationary Diesel And All Stationary Dual-fuel Engines (USEPA, October 2006).

C.1 Incinerator Fuel oil Combustion

			NO_x	**CO**	**SO_2**	**PM**	**PM_{10}**	**$PM_{2.5}$**	**VOC**	**PAH**	**DIOXIN/FURAN**	**P**	**Se**
AP-42 Emission factors for pollutants not included in stack test	g/L	I	6.59	0.60	18.81	1.49	1.05	0.77	0.0040	1.43E-04	3.71E-10	0.0011	8.18E-05
Maximum emission rate	mg/s	J = I*C/3600*1000	18.31	1.66	52.26	4.13	2.93	2.13	0.011	3.96E-04	1.03E-09	0.0031	2.27E-04

Source: (a) NO_x, CO, SO_2, and PM emissions are assumed to be for boilers<100 Million BTU/hour burning Fuel Oil 6.
(b) PM_{10} and $PM_{2.5}$ are assumed to be for utility boiler firing residual oil for fuel oil 6.
(c) For Fuel Oil Combustion VOC included are for Benzene, Ethyl benzene, Formaldehyde, 1,1,1-trichlorethane and o-xylene from AP-42 chapter 1.3/Table 1.3.9.
(d) For Fuel Oil PAH included are Naphthalene, Acenaphthene, Acenaphthylene, Anthracene, Benzo(a)Anthracene, Benzo(b,k)fluoranthene, Benzo(g,h,i)Perylene, Chrysene, Dibenzo(a,h)Anthracene, Fluoranthene, Fluorene, Indeo(1,2,3-cd)Pyrene, Phenanthrene and Pyrene from AP-42 chapter 1.3/Table 1.3.9.
(e) Dioxins/Furans included is octachlorodibenzodioxin from AP-42 chapter 1.3/Table 1.3.9.
(f) For Fuel Oil metal emissions taken from AP-42 chapter 1.3/Table 1.3-11.
(g) Emission factors for CO_2, N_2O and CH_4 taken from Environment Canada, National Inventory Report 1990-2008, Part 2 (2010), Table A8-4, Industrial.

			Sb	**As**	**Ba**	**Be**	**Cd**	**Cr**	**Cr 6**	**Co**	**Cu**	**Pb**	**Mn**
AP-42 Emission factors for pollutants not included in stack test	g/L	K	6.29E-04	1.58E-04	3.08E-04	3.33E-06	4.77E-05	1.01E-04	2.97E-05	7.21E-04	2.11E-04	1.81E-04	3.59E-04
Maximum emission rate	mg/s	L= D*C/3600*1000	0.0017	4.39E-04	8.55E-04	9.25E-06	1.32E-04	2.81E-04	8.25E-05	0.0020	5.86E-04	5.03E-04	9.99E-04

Source: (a) Emission factors taken from AP-42 chapter 1, Table 1.3-11.

C.2 Incinerator Diesel Fuel Combustion

			TSP (a)	PM10	PM2.5 (c)	NOx (d)	CO	SOx (e)	CO2	PAH	VOC	
AP-42 Emission factors for Pollutants	lb/MMBtu (fuel input)	M	0.062	0.057	0.057	3.20	0.85	0.0015	165.00	2.11E-04	0.0042	(b)
Maximum emission Rate	mg/s	N=E*H/3.785*G/10^6*M*453,592.4/3600	12.73	11.76	11.76	656.79	174.46	0.31	33865.87	0.043	0.85	

Source: (a) TSP is for filterable particulates.
(b) AP-42 / 3.4 - Large Stationary Diesel And All Stationary Dual-fuel Engines (USEPA, October 2006)/ Table 3.4-1 -Table 3.4-4.
(c) Emission factors for PM_{10} and $PM_{2.5}$ are assumed to be the same.
(d) Emission factor for NO_x corresponds to uncontrolled equipment (i.e., without ignition timing retard).
(e) Emission factor for SO_2 calculated based on the equation EF_SO_2 = 1.01*S, where S is the fuel sulphur content, according to AP-42 / 3.4 - Large Stationary Diesel And All Stationary Dual-fuel Engines (USEPA, October 2006)/ Table 3.4-1.

			N2O	CH4	
GHG Emission factor for diesel combustion	g/L	O	0.40	0.13	(a)
Maximum GHG emissions	mg/s	P=E*O/3600*1000	5.00	1.66	

Source: (a) Emission factors for N2O and CH4 taken from Environment Canada, National Inventory Report 1990-2008, Part 2 (2010), Table A8-4.

C.3 Incinerator Stack Test Data

			SVOC1	SVOC 2	SVOC 3	Part/M-1	Part/M-2	Part/M-3	
Flow Rate, at stack O2 content, dry, 25'C and 101.325 kPa	m^3/min	Q	71.64	65.73	67.74	66.79	66.72	67.04	(a)
Oxygen Content	% volume of O2	R	13.90	13.90	14.80	15.20	14.70	14.30	(a)

Source: (a) Cianciarelli, D. & C. House. 2003. Characterization of Emissions From the Eco Waste Solutions Thermal Waste Oxidizer Burlington, Ontario. Report ERMD 2002-03. Prepared for Emissions Research and Measurement Division a department of Environment Canada.

			SO_2	NO_x	CO	PM	VOC	HCl	HF	PCDD/PCDF	PAH	CO2	
SVOC1, stack test concentration	mg/m3	S	0.00	33.88	0.00	-	4.03	-	-	7.05E-09	3.86E-05	80,953.51	(a)(b)
SVOC 2, stack test concentration	mg/m3	T	3.70	38.68	2.43	-	1.97	-	-	2.53E-08	3.49E-05	80,953.51	(a)(b)
SVOC 3, stack test concentration	mg/m3	U	0.00	33.71	2.82	-	0.95	-	-	4.37E-08	1.47E-05	66,561.77	(a)(b)
Part/M-1, stack test concentration	mg/m3	V	0.00	39.64	5.93	3.45	-	55.85	1.90	-	-	57,566.94	(a)(b)
Part/M-2, stack test concentration	mg/m3	W	0.00	39.64	4.30	1.82	-	70.77	2.51	-	-	64,762.80	(a)(b)
Part/M-3, stack test concentration	mg/m3	X	0.00	41.81	3.05	15.13	-	174.67	1.13	-	-	80,953.51	(a)(b)
SVOC1, stack test flow rate	mg/s.	Y= Q*S/60	0.00	40.5	0.00	-	4.81	-	-	8.42E-09	4.61E-05	96658.49	
SVOC 2, stack test flow rate	mg/s.	Z = Q*T/60	4.06	42.4	2.66	-	2.15	-	-	2.77E-08	3.82E-05	88684.57	
SVOC 3, stack test flow rate	mg/s.	A' = Q*U/60	0.00	38.1	3.19	-	1.07	-	-	4.94E-08	1.66E-05	75148.24	
Part/M-1, stack test flow rate	mg/s.	B' = Q*V/60	0.00	44.1	6.60	3.85	-	62.17	2.12	-	-	64081.60	
Part/M-2, stack test flow rate	mg/s.	C' = Q*W/60	0.00	44.1	4.78	2.02	-	78.69	2.79	-	-	72016.24	
Part/M-3, stack test flow rate	mg/s.	D' = Q*X/60	0.00	46.7	3.41	16.91	-	195.16	1.27	-	-	90452.05	
Number of samples for each pollutant	number	E'	6	6	6	3	3	3	3	3	3	6	
Average flow rate	mg/s	F'=(Y+Z+A'+B'+C'+D')/E'	0.68	42.63	3.44	7.59	2.68	112.01	2.06	2.85E-08	3.36E-05	81,173.53	
Daily flow rate	tonne/day	G' = E'/10^9*3600*B	1.95E-05	0.0012	9.91E-05	2.19E-04	7.71E-05	0.0032	5.92E-05	8.21E-13	9.69E-10	2.34	

Source: (a) Cianciarelli, D. & C. House. 2003. Characterization of Emissions From the Eco Waste Solutions Thermal Waste Oxidizer Burlington, Ontario. Report ERMD 2002-03. Prepared for Emissions Research and Measurement Division a department of Environment Canada.
(b) Concentrations have been corrected to dry, 25'C, 101.325 kPa and sample O_2 content.

			Hg	Sb	As	Ba	Be	Cd	Cr	Co	Cu	Pb	Mn
Part/M-1, stack test concentration	mg/m3	V	0.0064	0.019	5.18E-04	1.15E-04	0.00	0.012	0.033	1.73E-04	0.079	0.036	0.0067
Part/M-2, stack test concentration	mg/m3	W	0.045	0.058	5.64E-04	0.0020	0.00	0.022	0.031	1.25E-04	0.10	0.10	0.0065
Part/M-3, stack test concentration	mg/m3	X	0.0031	0.061	0.0015	0.0035	0.00	0.20	0.036	3.33E-04	0.23	0.34	0.014
Part/M-1, stack test flow rate	mg/s.	B' = Q*V/60	0.0072	0.021	5.77E-04	1.28E-04	0.00	0.014	0.036	1.92E-04	0.088	0.040	0.0074
Part/M-2, stack test flow rate	mg/s.	C' = Q*W/60	0.050	0.064	6.27E-04	0.0022	0.00	0.025	0.034	1.39E-04	0.11	0.11	0.0072
Part/M-3, stack test flow rate	mg/s.	D' = Q*X/60	0.0035	0.068	0.0016	0.0039	0.00	0.23	0.040	3.72E-04	0.26	0.38	0.016
Number of samples for each pollutant	number	E'	3	3	3	3	3	3	3	3	3	3	3
Average flow rate	mg/s.	F'=(B'+C'+D')/E'	0.020	0.051	9.47E-04	0.0021	0.00	0.088	0.037	2.35E-04	0.15	0.18	0.010
Daily flow rate	tonne/day	G' = E'/10^9*3600*B	5.85E-07	1.47E-06	2.73E-08	6.05E-08	0.00	2.54E-06	1.06E-06	6.76E-09	4.38E-06	5.13E-06	2.91E-07

Source: (a) Cianciarelli, D. & C. House. 2003. Characterization of Emissions From the Eco Waste Solutions Thermal Waste Oxidizer Burlington, Ontario. Report ERMD 2002-03. Prepared for Emissions Research and Measurement Division a department of Environment Canada.
(b) Concentrations have been corrected to dry, 25'C, 101.325 kPa and sample O_2 content.

TOTAL INCINERATOR

			SO_2	NO_X	CO	PM	$PM_{2.5}$	PM_{10}	VOC	HCl	HF	PCDD/PCDF	PAH
Average flow rate mg/s	mg/s	H'=F'+P+N+L+J	53.24	717.73	179.57	24.45	21.48	22.28	3.54	112.01	2.06	2.95E-08	0.044
Daily flow rate	tonne/day	I' = H'/10^9*3600*B	0.0015	0.021	0.0052	7.04E-04	6.19E-04	6.42E-04	1.02E-04	0.0032	5.92E-05	8.50E-13	1.26E-06

			Hg	Sb	As	Ba	Be	Cd	Cr	Co	Cu	Pb	Mn
Average flow rate mg/s	mg/s	H'=F'+P+N+L+J	0.020	0.053	0.0014	0.0030	9.25E-06	0.088	0.037	0.0022	0.15	0.18	0.011
Daily flow rate	tonne/day	I' = H'/10^9*3600*B	5.86E-07	1.52E-06	3.99E-08	8.52E-08	2.66E-10	2.54E-06	1.07E-06	6.45E-08	4.40E-06	5.15E-06	3.20E-07

			Mo	CO_2e
Average flow rate mg/s	mg/s	H'=F'+P+N+L+J	2.62E-04	1.25E+05
Daily flow rate	tonne/day	I' = H'/10^9*3600*B	7.54E-09	3.61

Air Quality Assessment - NICO Project
Calculation of Emissions During the Construction Phase

IV - Access Road Construction

IV.1 - General land clearing

A - Fugitive Emissions

Dust Control Technique		**No control**	
Number of equipment	pc	A	1 (a)
Hours of operation per day - peak	h/day	B	0.9 (b)
Material silt content	(%)	C	56 (c)
Material moisture content	(%)	D	16.8 (d)
Emission reduction efficiency	(%)	E	0

Source: (a) Information provided by Fortune in "NICO Mobile Equipment_REVC_without Aker fuel.xlsx"; assumed only Harvester used.
(b) Numbers of work hours per day taken as the harvester work hours in "NICO Mobile Equipment_REVC_without Aker fuel.xlsx".
(c) Material silt content taken as average silt content of the till and glacio-lacustrine deposit from Golder FEED document.
(d) Moisture content taken as the maximum overburden moisture content from AP 42 chapter 11.9 Western surface Coal Mine/ Table 11.9-3 (Metric and English Units). Typical Values For Correction Factors Applicable to the Predictive Emission Factor Equations.

			TSP <= 30 um	TSP <= 15 um	PM_{10}	$PM_{2.5}$	
Constant (a)	-	F	2.6	0.45	-	-	(a)
Constant (b)	-	G	1.2	1.5	-	-	(a)
Constant (c)	-	H	1.3	1.4	-	-	(a)
Scaling Factor		I	-	-	0.75	0.105	(a) (b)
Emission rate (uncontrolled)	g/hr	J = F*(C^G)/(D^H)*1000*A	8,315.66	3,631.30	2,723.47	873.14	(a) (c)
Emission rate (controlled)	g/hr	K = J*(1-E/100)	8,315.66	3,631.30	2,723.47	873.14	
Daily emission rate (uncontrolled)	g/day	L = J*B	7,654.97	3,342.78	2,507.09	803.77	
Daily emission rate (controlled)	g/day	M = K*B	7,654.97	3,342.78	2,507.09	803.77	
Maximum emission rate (uncontrolled)	g/s	N = L/(B*3600)	2.31	1.01	0.76	0.24	
Maximum emission rate (controlled)	g/s	O = M/(B*3600)	2.31	1.01	0.76	0.24	
Quality rating	-		B	C	D	D	

Source: (a) AP-42 / Section 11.9 - Western Surface Coal Mining (USEPA, October 1998) / Table 11.9-2 (Metric Units) - Emission Factor Equations for Uncontrolled Open Dust Sources at Western Surface Coal Mines (bulldozing overburden). According to recommendations in AP-42 / Section 13.2.3 - Heavy Construction Operations (USEPA, January 1995) / Table 13.2.3-1 - Recommended Emission Factors for Construction Operations (reference to dozer equation (overburden) in Section 11.9 / Table 11.9.2).

(b) Scaling factor to convert TSP <= 30 um to $PM_{2.5}$ and TSP <= 15 um to PM_{10}.

(c) PM10 and PM2.5 calculated multiplying TSP emission rates by respective scaling factors.

B- Exhaust Emissions

Equipment/Vehicle	Model	Number of Equipment/Vehicle	Daily Use
Harvester	Caterpillar 501 HD Track Harvester; or equivalent	1	1.00

			SO_2	NO_X	CO	$PM_{2.5}$	PM_{10}	VOC	PAH	CO_2e
Daily emission rate	tonne/day	(refer to Road_Construction_combustion)	7.74E-07	3.92E-04	6.46E-05	2.14E-05	2.20E-05	2.55E-05	1.35E-07	0.093

Air Quality Assessment - NICO Project
Calculation of Emissions During the Construction Phase

IV.2 - Drilling

A - Fugitive Emissions

Dust Control Technique		**Wet Drilling**	(a)

Source: (a) Assume wet drilling.

Hours of operation per day - maximum	h/day	A	6.0	(a)
Material throughput	tonnes/day	B	337	(b)
Emission reduction efficiency	(%)	C	0	

Source: (a) Information provided by Fortune in "NICO Mobile Equipment_REVC_without Aker fuel.xlsx". Operating time taken from Road Construction Estimate drilling equipment.
(b) Estimated from 0.3 m depth of aggregate used on the road (7.5 m wide) and 31.58 km length (road length taken from EBA, Nico Mine Access Route Evaluation). Assuming the average unit weight of the aggregate material of 17 kN/m ^{3} (FEED document).

			TSP	PM_{10}	$PM_{2.5}$	
Emission factor (controlled - wet drilling)	kg/tonne	D	9.00E-05	4.00E-05	7.41E-06	(a) (b) (c)
Daily emission rate (controlled - wet drilling and retention)	g/day	E = B*D*1000*(1-C/100)	30.36	13.49	2.50	
Daily emission rate (uncontrolled)	g/day	F = B*D*1000	30.36	13.49	2.50	
Maximum emission rate (controlled)	g/s	G = E/(A*3600)	0.0014	6.25E-04	1.16E-04	
Maximum emission rate (uncontrolled)	g/s	H = F/(A*3600)	0.0014	6.25E-04	1.16E-04	
Quality rating	-		-	E	-	

Source: (a) Emission factor for TSP extracted from in AP-42 / 11.19.2 - Crushed Stone Processing and Pulverized Mineral Processing (USEPA, August 2004)/ Table 11.19.2.1 (value for Wet Drilling - Unfragmented Stone).
(b) Emission factor for PM_{10} based on the ratio between TSP and PM10 emission factors for tertiary crushing (uncontrolled) in AP-42 / 11.19.2 - Crushed Stone Processing and Pulverized Mineral Processing (USEPA, August 2004)/ Table 11.19.2.1.
(c) Emission factor for $PM_{2.5}$ based on the ratio between PM10 and PM2.5 emission factors for tertiary crushing (controlled) in AP-42 / 11.19.2 - Crushed Stone Processing and Pulverized Mineral Processing (USEPA, August 2004)/ Table 11.19.2.1.

B- Exhaust Emissions

Equipment/Vehicle	Model	Number of Equipment/Vehicle	Daily Use
Self-Propelled Blast Hole Drill	Atlas Copco Roc D7; or equivalent	2	20.4

			SO_2	NO_X	CO	$PM_{2.5}$	PM_{10}	VOC	PAH	CO_2e
Daily emission rate	tonne/day	(refer to Road_Construction_combustion)	4.52E-05	0.023	0.0033	0.0011	0.0011	0.0014	7.91E-06	5.41

Air Quality Assessment - NICO Project
Calculation of Emissions During the Construction Phase

IV.3 - Bulldozing

A - Fugitive Emissions

Dust Control Technique		**No control**

Number of equipment	pc	A	2	(a)
Hours of operation per day - peak	h/day	B	20.4	(b)
Material silt content	(%)	C	56.0	(c)
Material moisture content	(%)	D	16.8	(d)
Emission reduction efficiency	(%)	E	0	

Source: (a) Information provided by Fortune in "NICO Mobile Equipment_REVC_without Aker fuel.xlsx". Number of vehicles assumed to be for construction dozers only.
(b) Information provided by Fortune. Daily operating time assumed to the same as tracktor bulldozer. Assumed continuous operations.
(c) Material silt content taken as average silt content of the till and glacio-lacustrine deposit from Golder FEED document.
(d) Moisture content taken as the maximum overburden moisture content from AP 42 chapter 11.9 Western surface Coal Mine/ Table 11.9-3 (Metric and English Units). Typical Values For Correction Factors Applicable to the Predictive Emission Factor Equations.

			TSP <= 30 um	TSP <= 15 um	PM_{10}	$PM_{2.5}$	
Constant (a)	-	F	2.6	0.45	-	-	(a)
Constant (b)	-	G	1.2	1.5	-	-	(a)
Constant (c)	-	H	1.3	1.4	-	-	(a)
Scaling Factor		I	-	-	0.75	0.105	(a) (b)
Emission rate (uncontrolled)	g/hr	J = F*(C^G)/(D^H)*1000*A	16,631.33	7,262.59	5,446.94	1,746.29	(a) (c)
Emission rate (controlled)	g/hr	K = J*(1-E/100)	16,631.33	7,262.59	5,446.94	1,746.29	
Daily emission rate (controlled)	g/day	L = K*B	339,279.08	148,156.85	111,117.63	35,624.30	
Daily emission rate (uncontrolled)	g/day	M = J * B	339,279.08	148,156.85	111,117.63	35,624.30	
Maximum emission rate (controlled)	g/s	N = L/(B*3600)	4.62	2.02	1.51	0.49	
Maximum emission rate (uncontrolled)	g/s	O = M / (B*3600)	4.62	2.02	1.51	0.49	
Quality rating	-		B	C	D	D	

Source: (a) AP-42 / Section 11.9 - Western Surface Coal Mining (USEPA, October 1998) / Table 11.9-2 (Metric Units) - Emission Factor Equations for Uncontrolled Open Dust Sources at Western Surface Coal Mines (bulldozing overburden). According to recommendations in AP-42 / Section 13.2.3 - Heavy Construction Operations (USEPA, January 1995) / Table 13.2.3-1 - Recommended Emission Factors for Construction Operations (reference to dozer equation (overburden) in Section 11.9 / Table 11.9.2).
(b) Scaling factor to convert TSP <= 30 um to $PM_{2.5}$ and TSP <= 15 um to PM_{10}.
(c) PM10 and PM2.5 calculated multiplying TSP emission rates by respective scaling factors.

B- Exhaust Emissions

Equipment/Vehicle	Model	Number of Equipment/Vehicle	Daily Use
Tracked-Type tractor, bulldozer	Caterpillar D10T/Komatsu 375A-6	2	20.4

			SO_2	NO_X	CO	$PM_{2.5}$	PM_{10}	VOC	PAH	CO_2e
Daily emission rate	tonne/day	(refer to Road_Construction_combustion)	1.17E-04	0.080	0.030	0.0037	0.0038	0.0033	2.04E-05	13.94

IV.4 - Material handling

A - Fugitive Emissions

Dust Control Technique		**No control**

Hours of operation per day - peak	h/day	A	15.6	(a)
Amount of material handled per day	tonnes/day	B	337	(b)
Mean wind speed - maximum daily value	m/s	C	12.82	(c)
Material moisture content	%	D	16.8	(d)
Constant (a)	-	E	0.0016	(e)
Constant (b)	-	F	1.3	(e)
Constant (c)	-	G	2.2	(e)
Constant (d)	-	H	1.4	(e)
Constant (e)	-	I	2	(e)
Emission reduction efficiency	(%)	J	0	

Source: (a) Information provided by Fortune. Daily operating time assumed to the same as loader times.
(b) Estimated from 0.3 m depth of aggregate used on the road (7.5 m wide) and 31.58 km length. Assuming the average unit weight of the aggregate material of 17 kN/m ^{3}.
(c) Value derived from Fortune 2004-2007 onsite meteorological station (Fortune_2004_2007_MetData(Oct8 04 - Sep27 07)_MD.xls).
(d) Moisture content taken as the maximum overburden moisture content from AP 42 chapter 11.9 Western surface Coal Mine/ Table 11.9-3 (Metric and English Units). Typical Values For Correction Factors Applicable to the Predictive Emission Factor Equations.
(e) AP-42 / Section 13.2.4 - Aggregate Handling And Storage Piles (USEPA, November 2006)/ equation 1 - emission factor for drop operation.

			TSP <= 30 um	PM_{10}	$PM_{2.5}$	
Particle size multiplier	-	K	0.74	0.35	0.053	(a)
Emission factor (uncontrolled)	kg/tonne	L = K*E*((C/G)^F)/((D/I)^H)	5.95E-04	2.81E-04	4.26E-05	(a)
Maximum emission rate (controlled)	g/s	M = B*L*(1-J/100)*1000/(A*3600)	0.0036	0.0017	2.56E-04	
Maximum Emission rate (uncontrolled)	g/s	N = B*L*1000/(A*3600)	0.0036	0.0017	2.56E-04	
Quality rating	-		A	A	A	

Source: (a) AP-42 / 13.2.4 - Aggregate Handling And Storage Piles (USEPA, November 2006)/ equation 1 - emission factor for drop operation.

B- Exhaust Emissions

Equipment/Vehicle	Model	Number of Equipment/Vehicle	Daily Use
Wheeled Front End Loader	Caterpillar 992K/Komatsu WA 900-3	1	20.4
Excavator	Caterpillar 365C L/Komatsu PC650LC-8	1	20.4

			SO_2	NO_X	CO	$PM_{2.5}$	PM_{10}	VOC	PAH	CO_2e
Daily emission rate	tonne/day	(refer to Road_Construction_combustion)	1.21E-04	0.073	0.020	0.0032	0.0033	0.0037	2.12E-05	14.47

IV.5- Compacting

A - Fugitive Emissions

Dust Control Technique		**No control**

Number of equipment	pc	A	1	(a)
Hours of operation per day - peak	h/day	B	6.0	(a)
Material silt content	(%)	C	56	(b)
Material moisture content	(%)	D	16.8	(c)
Emission reduction efficiency	(%)	E	0	

Source: (a) Information provided by Fortune in "NICO Mobile Equipment_REVC_without Aker fuel.xlsx".
(b) Material silt content taken as average silt content of the till and glacio-lacustrine deposit from Golder FEED document.
(c) Moisture content taken as the maximum overburden moisture content from AP 42 chapter 11.9 Western surface Coal Mine/ Table 11.9-3 (Metric and English Units). Typical Values For Correction Factors Applicable to the Predictive Emission Factor Equations.

			TSP <= 30 um	TSP <= 15 um	PM_{10}	$PM_{2.5}$	
Constant (a)	-	F	2.6	0.45	-	-	(a)
Constant (b)	-	G	1.2	1.5	-	-	(a)
Constant (c)	-	H	1.3	1.4	-	-	(a)
Scaling Factor		I	-	-	0.75	0.105	(a) (b)
Emission rate (uncontrolled)	g/hr	J = F*(C^G)/(D^H)*A*1000	8,315.66	3,631.30	2,723.47	873.14	(a) (c)
Emission rate (controlled)	g/hr	K = J*(1-E/100)	8,315.66	3,631.30	2,723.47	873.14	
Daily emission rate (uncontrolled)	g/day	L = J * B	49,893.98	21,787.77	16,340.83	5,238.87	
Daily emission rate (controlled)	g/day	M= K*B	49,893.98	21,787.77	16,340.83	5,238.87	
Maximum emission rate (uncontrolled)	g/s	N = L/(B* 3600)	2.31	1.01	0.76	0.24	
Maximum emission rate (controlled)	g/s	O = M/(B*3600)	2.31	1.01	0.76	0.24	
Quality rating	-		B	C	D	D	

Source: (a) AP-42 / Section 11.9 - Western Surface Coal Mining (USEPA, October 1998) / Table 11.9-2 (Metric Units) - Emission Factor Equations for Uncontrolled Open Dust Sources at Western Surface Coal Mines (bulldozing overburden). According to recommendations in AP-42 / Section 13.2.3 - Heavy Construction Operations (USEPA, January 1995) / Table 13.2.3-1 - Recommended Emission Factors for Construction Operations (reference to dozer equation (overburden) in Section 11.9 / Table 11.9.2).
(b) Scaling factor to convert TSP <= 30 um to $PM_{2.5}$ and TSP <= 15 um to PM_{10}.
(c) PM10 and PM2.5 calculated multiplying TSP emission rates by respective scaling factors.

B- Exhaust Emissions

Equipment/Vehicle	Model	Number of Equipment/Vehicle	Daily Use
Compactor, Sheep Foot	Caterpillar 815F/Komatsu CP76; or equivalent	1	20.4

			SO_2	NO_X	CO	$PM_{2.5}$	PM_{10}	VOC	PAH	CO_2e
Maximum emission rate	tonne/day	(refer to Road_Construction_combustion)	2.33E-05	0.012	0.0017	5.62E-04	5.79E-04	6.99E-04	4.07E-06	2.78

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Calculation of Emissions During the Construction Phase

IV.6 - Grading

A - Fugitive Emissions

Dust Control Technique		**No control**	

Hours of operation per day	hr/day	A	6.0	(a)
Number of graders	number	B	1	(a)
Mean vehicle speed	km/hr	C	11.4	(b)
Vehicle kilometer traveled (VKT)	VKT/day	D = A*B*C	68.4	
Emission reduction efficiency	(%)	E	0	

Source: (a) Information provided by Fortune in "NICO Mobile Equipment_REVC_without Aker fuel.xlsx".
(b) Calculated assuming an average speed of 11.4 km/h, taken from AP-42 chapter 11.9 Western Surface Coal Mining.

			TSP <= 30 um	TSP <= 15 um	PM_{10}	$PM_{2.5}$	
Constant (a)	-	F	0.0034	0.0056	-	-	(a)
Constant (b)	-	G	2.5	2	-	-	(a)
Scaling Factor		H	-	-	0.60	0.031	(a) (b)
Emission factor (uncontrolled)	kg/VKT	I = F*(C^G)	1.49	0.73	0.44	0.05	(a) (c)
Daily emission rate (uncontrolled)	g/day	J = D* I*1000	102,046.27	49,779.88	29,867.93	3,163.43	
Daily emission rate (controlled)	g/day	K= D*I*1000*(1-E/100)	102,046.27	49,779.88	29,867.93	3,163.43	
Maximum emission rate (uncontrolled)	g/s	L = J/(A*3600)	4.72	2.30	1.38	0.15	
Maximum emission rate (controlled)	g/s	M = K/(A*3600)	4.72	858.79	515.28	54.57	
Quality rating	-		C	C	D	D	

Source: (a) AP-42 / Section 11.9 - Western Surface Coal Mining (USEPA, October 1998) / Table 11.9-2 - Emission Factor Equations for Uncontrolled Open Dust Sources at Western Surface Coal Mines (grading). According to recommendations in Section 13.2.3 Heavy Construction Operations (USEPA, January 1995) / Table 13.2.3-1 - Recommended Emission Factors for Construction Operations (reference to grading equation in Table 11.9.2).
(b) Scaling factor to convert TSP <= 30 um to $PM_{2.5}$ and TSP <= 15 um to PM_{10}.
(c) PM10 and PM2.5 calculated multiplying TSP emission rates by respective scaling factors.

B- Exhaust Emissions

Equipment/Vehicle	Model	Number of Equipment/Vehicle	Daily Use
Surface grader	Caterpillar 14M/Komatsu GD675-3	1	20.4

			SO_2	NO_X	CO	$PM_{2.5}$	PM_{10}	VOC	PAH	CO_2e
Daily emission rate	tonne/day	(refer to Road_Construction_combustion)	2.60E-05	0.017	0.0039	0.0011	0.0011	0.0011	4.55E-06	3.11

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Calculation of Emissions During the Construction Phase

IV.7- Loading of aggregate into trucks

A - Fugitive Emissions

Dust Control Technique		**No control**	

Hours of operation per day	h/day	A	15.6	(a)
Amount of debris removed per day	tonnes/day	B	337	(b)
Emission reduction efficiency	(%)	C	0	

Source: (a) Numbers of work hours per day taken as the Loader and Excavator hours of operation.
(b) Estimated from 0.3 m depth of aggregate used on the road (7.5 m wide) and 31.58 km length. Assuming the average unit weight of the aggregate material of 17 kN/m ^{3}.

			TSP	**PM_{10}**	**$PM_{2.5}$**	
Emission factor (uncontrolled)	kg/tonne	D	0.018	0.0094	0.0019	(a) (b) (c)
Daily emission rate (controlled)	g/day	E = B*D*1000*(1-C/100)	6,072.31	3,157.60	637.59	
Daily emission rate (uncontrolled)	g/day	F = B*D*1000	6,072.31	3,157.60	637.59	
Maximum emission rate (controlled)	g/s	G = E/(A*3600)	0.11	0.06	0.011	
Maximum emission rate (uncontrolled)	g/s	H = F/(A*3600)	0.11	0.06	0.011	
Quality rating	-		E	-	-	

Source: (a) TSP emission factor extracted from AP-42 / Section 11.9 - Western Surface Coal Mining (USEPA, October 1998) / Table 11.9.4 - Uncontrolled Particulate Emission Factors for Open Dust Sources at Western Surface Coal Mine (truck loading by power shovel (batch drop) / overburden).

(b) Emission factor for PM_{10} based on the ratio between TSP and PM_{10} emission factors for blasting in AP-42 / Section 11.9 - Western Surface Coal Mining (USEPA, October 1998) / Table 11.9-2 (Metric Units) - Emission Factor Equations for Uncontrolled Open Dust Sources at Western Surface Coal Mines.
(c) Emission factor for $PM_{2.5}$ based on the ratio between TSP and $PM_{2.5}$ emission factors for bulldozing overburden in AP-42 / Section 11.9 - Western Surface Coal Mining (USEPA, October 1998) / Table 11.9-2 (Metric Units) - Emission Factor Equations for Uncontrolled Open Dust Sources at Western Surface Coal Mines.

B- Exhaust Emissions

Equipment/Vehicle	**Model**	**Number of Equipment/Vehicle**	**Daily Use**
Wheeled Front End Loader	Caterpillar 980H/Komatsu WA 500-6	1	20.4

			SO_2	**NO_X**	**CO**	**$PM_{2.5}$**	**PM_{10}**	**VOC**	**PAH**	**CO_2e**
Daily emission rate	tonne/day	(refer to Road_Construction_combustion)	3.50E-05	0.020	0.0075	9.17E-04	9.45E-04	8.09E-04	6.12E-06	4.19

IV.8 Hauling aggregate material along the road

A - Fugitive Emissions

Dust Control Technique		**Assume no control**	(a)

Source: (a) Information provided by Fortune in an email dated Feb. 15, 2011.

Hours of operation per day - peak	h/day	A	20	(a)
Surface material silt content	(%)	B	1.6	(b)
Mean vehicle weight	tonnes	C	56.87	(c)
Vehicle kilometer traveled (VKT)	km/day	D	320.98	(c)
Number of working days	days/year	E	365	
Number of days with precipitation >= 0.2 mm	days/year	F	58	(d)
Emission reduction efficiency	(%)	G	0	

Source: (a) Information provided by Fortune. Daily operating time assumed to the same as construction haulage times. Assumed continuous operations.
(b) Roads are assumed to be lined with aggregate and it is expected to have a similar silt content as limestone; data available in AP 42 chapter 13.2.4/table 13.2.4-1.
(c) See Mean Vehicle Weight table below.
(d) Value derived from Fortune 2004-2007 onsite meteorological station (Fortune_2004_2007_MetData(Oct8 04 - Sep27 07)_MD.xls).

			PM-30 (TSP)	**PM_{10}**	**$PM_{2.5}$**	
Constant (k)	-	H	4.9	1.5	0.15	(a)
Constant (a)	-	I	0.7	0.9	0.9	(a)
Constant (b)	-	J	0.45	0.45	0.45	(a)
Emission factor (uncontrolled)	lb/VMT	K = H*((B/12)^I)*((C*1.1/3)^J)*[(E-G)/E]	3.95	0.81	0.081	(a)
Emission factor (metric uncontrolled)	g/VKT	L = K * 281.9	1,114.51	228.02	22.80	(b)
Emission factor (controlled)	g/VKT	M = L*281.9*(1-G/100)	1,114.51	228.02	22.80	(b)
Emission factor (metric uncontrolled, without precip)	g/VKT	N = H*((B/12)^I)*((C*1.1/3)^J)*281.9	1,323.63	270.80	27.08	
Emission factor (controlled, without precip)	g/VKT	O = N * (1-G/100)	1,323.63	270.80	27.08	
Daily emission rate (uncontrolled)	g/day	P = L *D	357,729.23	73,187.57	7,318.76	
Daily emission rate (controlled)	g/day	Q= M*D	357,729.23	73,187.57	7,318.76	
Daily emission rate (uncontrolled, without precip)	g/day	R = N*D	424,851.96	86,920.17	8,692.02	
Daily emission rate (controlled, without precip)	g/day	S = O*D	424,851.96	86,920.17	8,692.02	
Maximum emission rate (uncontrolled)	g/s	T = P/(A*3600)	4.87	1.00	0.10	
Maximum emission rate (controlled)	g/s	U = Q/(A*3600)	4.87	1.00	0.100	
Maximum emission rate (uncontrolled, without precip)	g/s	V = R/(A*3600)	5.79	1.18	0.12	
Maximum emission rate (controlled, without precip)	g/s	W = S/(A*3600)	5.79	1.18	0.118	
Quality rating	-		B	B	B	

Source: (a) AP-42 / Section 13.2.2 - Unpaved Roads (USEPA, November 2006)/ Equation (1a) - unpaved surfaces at industrial sites and Table 13.2.2-2.
(b) 281.9 constant to convert lb/VMT (pounds per vehicle mile travelled) to g/VKT (grams per vehicle kilometer travelled).

Mean Vehicle Weight

Equipment	-		Articulated Truck	Haulage Unit	Total	
Weight - Empty	tonne		33.10	73.98		(a)
Weight - Loaded	tonne		61.20	163.29		(b)
Mean Weight	tonne		47.15	118.63		
Number of two way trips	number		8	1		(c)
Distance of two way trip	km/day		34.65	34.65		(d)
Vehicle kilometer traveled (VKT)	km/day		277.35	43.63	320.98	
Percentage of traffic	%		86%	14%		
Mean vehicle weight	tonne		40.74	16.13	56.87	

Source: (a) Information provided by Fortune in "NICO Mobile Equipment_REVC_without Aker fuel.xlsx".
(b) Haul trucks the loaded weight was taken as the maximum specified load in CAT 777F specification sheet. Articulated truck haulage capacity detailed in "NICO Mobile Equipment_REVC_without Aker fuel.xlsx".
(c) Estimated from 0.3 m depth of aggregate used on the road (7.5 m wide) and 31.58 km length. Assuming the average unit weight of the aggregate material of 17 kN/m^3.
(d) Assume distance is from centre of CDF to 1/2 way down access road.

B- Exhaust Emissions

Equipment/Vehicle	Model	Number of Equipment/Vehicle	Daily Use
Surface rock haulage trucks	Caterpillar 777F/Komatsu HD 785-7	1	20.4
Articulated Truck	Caterpillar 740	2	20.4

			SO_2	NO_X	CO	$PM_{2.5}$	PM_{10}	VOC	PAH	CO_2e
Daily emission rate	tonne/day	(refer to Road_Construction_combustion)	1.66E-04	0.12	0.032	0.0051	0.0053	0.0058	2.90E-05	19.83

IV.9 - Vehicular traffic

A - Fugitive Emissions

Dust Control Technique		**Assume no control**

Source: (a) Information provided by Fortune in an email dated Feb. 15, 2011.

Hours of operation per day	h/day	A	6	(a)
Surface material silt content	(%)	B	1.6	(b)
Mean vehicle weight	(tons)	C	16.13	(c)
Vehicle kilometer traveled (VKT)	km/day	D	460.80	(c)
Number of working days	days/year	E	365	
Number of days with precipitation >= 0.2 mm	days/year	F	58	(d)
Emission reduction efficiency	(%)	G	0	

Source: (a) Based on information provided by Fortune in "NICO Mobile Equipment_REVC_without Aker fuel.xlsx" assumed the same operating time as the haul trucks.
(b) Roads are assumed to be lined with aggregate and it is expected to have a similar silt content as limestone; data available in AP 42 chapter 13.2.4/table 13.2.4-1.
(c) See Mean Vehicle Weight table below.
(d) Value derived from Fortune 2004-2007 onsite meteorological station (Fortune_2004_2007_MetData(Oct8 04 - Sep27 07)_MD.xls).

			PM-30 (TSP)	**PM_{10}**	**$PM_{2.5}$**	
Constant (k)	-	H	4.9	1.5	0.15	(a)
Constant (a)	-	I	0.7	0.9	0.9	(a)
Constant (b)	-	J	0.45	0.45	0.45	(a)
Emission factor (uncontrolled)	lb/VMT	K = H*((B/12)^I)*((C/3)^J)*[(E-G)/E]	2.15	0.44	0.044	(b)
Emission factor (uncontrolled, metric)	g/VKT	L = K * 281.9	605.10	123.80	12.38	(b)
Emission factor (controlled)	g/VKT	M = L*281.9*(1-G/100)	605.10	123.80	12.38	(b)
Emission factor (uncontrolled, without precipitation)	g/VKT	N=H*((B/12)^I)*((C/3)^J)*281.9	718.64	147.03	14.70	
Emission factor (controlled, without precipitation)	g/VKT	O = N*(1-G/100)	718.64	147.03	14.70	
Daily emission rate (uncontrolled)	g/day	P= L * D	278,832.12	57,046.07	5,704.61	
Daily emission rate (controlled)	g/day	Q = M*D	278,832.12	57,046.07	5,704.61	
Daily emission rate (uncontrolled, without precipitation)	g/day	R = N * D	331,150.95	67,749.94	6,774.99	
Daily emission rate (controlled, without precipitation)	g/day	S = O* D	331,150.95	67,749.94	6,774.99	
Maximum emission rate (uncontrolled)	g/s	T = P/(A*3600)	12.87	2.63	0.26	
Maximum emission rate (controlled)	g/s	U = Q/(A*3600)	12.87	2.63	0.26	
Maximum emission rate (uncontrolled, without precipitation)	g/s	V = R/(A*3600)	15.29	3.13	0.31	
Maximum emission rate (controlled, without precipitation)	g/s	W = S/(A*3600)	15.29	3.13	0.31	
Quality rating	-		B	B	B	

Source: (a) AP-42 / Section 13.2.2 - Unpaved Roads (USEPA, November 2006)/ Equation (1a) - unpaved surfaces at industrial sites and Table 13.2.2-2.
(b) 281.9 constant to convert lb/VMT (pounds per vehicle mile travelled) to g/VKT (grams per vehicle kilometer travelled).

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Mean Vehicle Weight

Equipment	-		Light Duty Truck	Heavy Duty Truck	Road Tractor	Fuel and Lube Truck	Personal Carrier	Total	
Weight - Empty	tonne		4.26	6.59	28.12	28.12	4.13		(a)
Weight - Loaded	tonne		4.26	6.59	28.12	48.12	4.13		(b) (c)
Mean Weight	tonne		4.26	6.59	28.12	38.12	4.13	81.22	
Number of Vehicles	number		2	2	1	1	1		(d)
Distance travelled per day	km/day		38.40	76.80	76.80	76.80	76.80		(e)
Vehicle kilometer traveled (VKT)	km/day		76.80	153.60	76.80	76.80	76.80	460.80	
Percentage of traffic	%		17%	33%	17%	17%	17%		
Mean vehicle weight	tonne		0.71	2.20	4.69	6.35	0.69	14.64	

Source: (a) Information provided by Fortune in "NICO Mobile Equipment_REVC_without Aker fuel.xlsx".
(b) Assumed loaded Fuel truck is 20,000 kg heavier than empty truck.
(c) Assumed loaded tractor is 20,000 kg heavier than empty tractor.
(d) Assumed all vehicles took one trip. For vehicles with 2 trips per day represents that Fortune indicated that there were two of that vehicle type.
(e) Distance travelled per day calculated from vehicle operational times multiplied by an assumed average speed of 20 km/hour.

B- Exhaust Emissions

Equipment/Vehicle	Model	Number of Equipment/Vehicle	Daily Use
Fuel & Lube Truck	Western Star 4900 SA; or Equivalent	1	3.8
Road Tractor	Western Star 4900 SA; or Equivalent	1	3.8
Light Duty Truck	Ford F-250 Crewcab, or equivalent	2	1.9
Personnel Carrier	Chevrolet Express 2500 Standard, or equivalent	1	3.8
Heavy Duty Truck, Diesel	Ford F-450 Crew Cab Flat Deck; or equivalent	1	3.8
Heavy Duty Truck, Diesel	Ford F-450 Crew Cab Flat Deck; or equivalent	1	3.8

			SO_2	NO_X	CO	$PM_{2.5}$	PM_{10}	VOC	PAH	CO_2e
Daily emission rate	tonne/day	(refer to Road_Construction_combustion)	4.44E-05	0.030	0.011	0.0015	0.0015	0.0013	7.77E-06	5.31

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Calculation of Emissions During the Construction Phase

IV.10 - Jaw crusher

A - Fugitive Emissions

Dust Control Technique		**No Control**

Hours of operation per day - maximum	h/day	A	1.2	(a)(b)
Amount of material processed per day	tonnes/day	B	337	(b)
Emission reduction efficiency	(%)	C	0	(c)

Source: (a) Information provided by Fortune in "NICO Mobile Equipment_REVC_without Aker fuel.xlsx".

(b) Estimated from 0.3 m depth of aggregate used on the road (7.5 m wide) and 31.58 km length. Assuming the average unit weight of the aggregate material of 17 kN/m ^{3}.

(c) Assume no Wet Suppression

			TSP	**PM_{10}**	**$PM_{2.5}$**	
Emission factor (uncontrolled)	kg/tonne	D	0.01	0.004	0.00007	(a) (b)
Daily emission rate (controlled)	g/day	E = B*D*1000*(1-C/100)	3373.51	1349.40	24.99	
Maximum emission rate, controlled	g/s	F = E/(A*3600)	0.78	0.31	0.0058	
Maximum emission rate, uncontrolled	g/s	F' = B*D*1000/(A*3600)	0.78	0.31	0.0058	
Quality rating	-		C	C	-	(a)

Source: (a) AP-42 / 11.24 - Metallic Minerals Processing (USEPA, August 1982)/ Table 11.24-1 (Metric Units). Emission factors for metallic minerals processing (value for high moisture ore / primary crushing; high moisture ore defined as >= 4% in weight).

(b) Emission factor for $PM_{2.5}$ based on the ratio between PM_{10} and $PM_{2.5}$ emission factors for tertiary crushing (controlled) in AP-42 / 11.19.2 Crushed Stone Processing and Pulverized Mineral Processing (USEPA, August 2004)/ Table 11.19.2.1.

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IV.11 Material screening

A - Fugitive Emissions

Dust Control Technique		**No control**

Hours of operation per day - maximum	h/day	A	1.2	(a)
Amount of material processed per day	tonnes/day	B	337.4	(b)
Emission reduction efficiency	(%)	C	0	(c)

Source: (a) Assumed same operational hours as the Crusher.
(b) Estimated from 0.3 m depth of aggregate used on the road (7.5 m wide) and 31.58 km length. Assuming the average unit weight of the aggregate material of 17 kN/m ^{3}.
(c) No dust controls methods were assumed.

			TSP	PM_{10}	$PM_{2.5}$	
Emission factor (uncontrolled)	kg/tonne	D	0.0125	0.0043	0.00003	(a) (b)
Daily emission rate (controlled)	g/day	E = B*D*1000*(1-C/100)	4,216.88	1,450.61	8.43	
Daily emission rate (uncontrolled)	g/day	F = B*D*1000	4,216.88	1,450.61	8.43	
Maximum emission rate (controlled)	g/s	G = E/(A*3600)	0.98	0.34	0.0020	
Maximum emission rate (uncontrolled)	g/s	H = F/(A*3600)	0.98	0.34	0.0020	
Quality rating	-		E	C	-	(a)

Source: (a) AP-42 / 11.19.2 Crushed Stone Processing and Pulverized Mineral Processing (USEPA, August 2004)/ Table 11.19.2-1 (Metric Units) - Emission factors for crushed stone processing operations (value for screening - uncontrolled).
(b) Assumed $PM_{2.5}$ emission factor taken from Screening for wet suppression.

IV.12 - Blasting

A - Fugitive Emissions

Dust Control Technique		**No control**	

Blasting from ANFO	tonne/year	A	17	(a)
Blasting from Emulsion blend	tonne/year	B	17	(a)
Number of Blasts per day	blasts/day	C	0.4	(a)

Source: (a) Information provided by Fortune in "NICO estimated blasting quantities.xlsx".

			SO2	**NOx**	**CO**	**CH4**	**H2S**	**CO2e**	
ANFO Constant (a)	kg/Mg	D	1	8	34				(a)
Emulsion blend (b)	kg/Mg	E	1	26	52	0.3	2		(a)(b)
Emission rate	tonne/day	F = (A*D+B*E)/10^3/(365)	9.45E-05	0.0016	0.0041	1.42E-05	9.45E-05	2.98E-04	
Maximum emission rate	g/s	G' = F/(24*3600)*10^6	0.0011	0.019	0.047	1.64E-04	0.0011	0.0034	

Source: (a) Emission factors taken from AP-42 Section 13.3.
(b) Assumed that Emulsion blend is Dynamite Gelatin within AP-42, chapter 13.

			TSP <= 30 um	**PM_{10}**	**$PM_{2.5}$**	
Constant (a)	-	H	0.00022	-	-	(a)
Constant (b)	-	I	1.5	-	-	(a)
Scaling factor		J	-	0.52	0.03	(a)
Annual emission rate (uncontrolled)	kg/year	K = H*(1250/50)^I*C*(365)	4.37	2.27	0.13	(a) (b) (c) (d)
Daily emission rate (uncontrolled)	tonne/day	L= K/1000/(365)	1.20E-05	6.22E-06	3.59E-07	
Maximum emission rate (24 hour)	g/s	N = L/(24*3600)*10^6	1.39E-04	7.20E-05	4.16E-06	

Source: (a) AP-42 / Section 11.9 - Western Surface Coal Mining (USEPA, October 1998)/ Table 11.9-2 - Emission Factor Equations for Uncontrolled Open Dust Sources at Western Surface Coal Mines (blasting).
(b) Scaling factor to convert TSP <= 30 um to $PM_{2.5}$ and PM_{10}.
(c) PM10 and PM2.5 calculated multiplying TSP emission rate by respective scaling factors.
(d) Fortune provided that for 50 blasts results in 1250 m^2 of disturbed area in an email dated November 29, 2010.

Air Quality Assessment - NICO Project
Summary of Daily Maximum (Winter) Emissions During the Road Construction Phase

Description	Source	Type	Emission Rate (kg/day)													
			TSP	PM10	PM2.5	SO2	NOx	CO	VOC	PAH	CO2e	DIOXIN/FURAN	As	Bi	Co	Cu
IV - Access Road Construction	IV.1 - General land clearing	A - Fugitive Emissions	7.65E+00	2.51E+00	8.04E-01	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		B- Exhaust Emissions	2.20E-02	2.20E-02	2.14E-02	7.74E-04	3.92E-01	6.46E-02	2.55E-02	1.35E-04	9.26E+01	N/A	N/A	N/A	N/A	N/A
	IV.2 - Drilling	A - Fugitive Emissions	3.04E-02	1.35E-02	2.50E-03	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		B- Exhaust Emissions	1.12E+00	1.12E+00	1.09E+00	4.52E-02	2.26E+01	3.25E+00	1.36E+00	7.91E-03	5.41E+03	N/A	N/A	N/A	N/A	N/A
	IV.3 - Bulldozing	A - Fugitive Emissions	3.39E+02	1.11E+02	3.56E+01	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		B- Exhaust Emissions	3.81E+00	3.81E+00	3.69E+00	1.17E-01	8.04E+01	3.02E+01	3.25E+00	2.04E-02	1.39E+04	N/A	N/A	N/A	N/A	N/A
	IV.4 - Material handling	A - Fugitive Emissions	2.01E-01	9.49E-02	1.44E-02	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		B- Exhaust Emissions	3.28E+00	3.28E+00	3.18E+00	1.21E-01	7.25E+01	1.97E+01	3.66E+00	2.12E-02	1.45E+04	N/A	N/A	N/A	N/A	N/A
	IV.5- Compacting	A - Fugitive Emissions	4.99E+01	1.63E+01	5.24E+00	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		B- Exhaust Emissions	5.79E-01	5.79E-01	5.62E-01	2.33E-02	1.16E+01	1.67E+00	6.99E-01	4.07E-03	2.78E+03	N/A	N/A	N/A	N/A	N/A
	IV.6 - Grading	A - Fugitive Emissions	1.02E+02	2.99E+01	3.16E+00	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		B- Exhaust Emissions	1.13E+00	1.13E+00	1.10E+00	2.60E-02	1.66E+01	3.86E+00	1.10E+00	4.55E-03	3.11E+03	N/A	N/A	N/A	N/A	N/A
	IV.7- Loading of aggregate into trucks	A - Fugitive Emissions	6.07E+00	3.16E+00	6.38E-01	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		B- Exhaust Emissions	9.45E-01	9.45E-01	9.17E-01	3.50E-02	2.00E+01	7.51E+00	8.09E-01	6.12E-03	4.19E+03	N/A	N/A	N/A	N/A	N/A
	IV.8 Hauling aggregate material along the road	A - Fugitive Emissions	3.58E+02	7.32E+01	7.32E+00	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		B- Exhaust Emissions	5.25E+00	5.25E+00	5.09E+00	1.66E-01	1.16E+02	3.20E+01	5.81E+00	2.90E-02	1.98E+04	N/A	N/A	N/A	N/A	N/A
	IV.9 - Vehicular traffic	A - Fugitive Emissions	2.79E+02	5.70E+01	5.70E+00	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		B- Exhaust Emissions	1.50E+00	1.50E+00	1.46E+00	4.44E-02	3.04E+01	1.10E+01	1.31E+00	7.77E-03	5.31E+03	N/A	N/A	N/A	N/A	N/A
	IV.10 - Jaw crusher	A - Fugitive Emissions	3.37E+00	1.35E+00	2.50E-02	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	IV.11 Material screening	A - Fugitive Emissions	4.22E+00	1.45E+00	8.43E-03	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	IV.12 - Blasting	A - Fugitive Emissions	1.20E-02	6.22E-03	3.59E-04	9.45E-02	1.61E+00	4.06E+00	N/A	N/A	2.98E-01	N/A	N/A	N/A	N/A	N/A
Total			**1,166.98**	**313.78**	**75.65**	**0.67**	**372.12**	**113.40**	**18.02**	**0.10**	**69,130.27**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**

N/A- No applicable emissions

Description	Emission Rate (kg/day)													
	TSP	PM10	PM2.5	SO2	NOx	CO	VOC	PAH	CO2e	DIOXIN/FURAN	As	Bi	Co	Cu
IV - Access Road Construction	1.17E+03	3.14E+02	7.57E+01	6.73E-01	372.12	1.13E+02	1.80E+01	1.01E-01	6.91E+04	N/A	N/A	N/A	N/A	N/A
Total	**1,166.98**	**313.78**	**75.65**	**0.67**	**372.12**	**113.40**	**18.02**	**0.10**	**69,130.27**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**

N/A- No applicable emissions

Air Quality Assessment - NICO Project

Summary of Daily Maximum (Winter) Emissions During the Operation Phase

Description	Source	Type	Emission Rate (kg/day)													
			TSP	PM10	PM2.5	SO2	NOx	CO	VOC	PAH	CO2e	DIOXIN/FURAN	As	Bi	Co	Cu
I - Open Pit Extraction	I.1 - Drilling	A - Fugitive Emissions (PM with Metals)	2.98E+00	1.32E+00	2.45E-01	N/A	N/A	N/A	N/A	N/A	N/A	N/A	8.63E-03	2.02E-03	1.04E-03	4.19E-04
		B- Exhaust Emissions	1.12E+00	1.12E+00	1.08E+00	9.06E-02	3.46E+01	7.33E+00	1.47E+00	1.58E-02	1.08E+04	N/A	N/A	N/A	N/A	N/A
	I.2 - Blasting	A - Fugitive Emissions (PM with Metals)	1.26E+00	6.54E-01	3.77E-02	9.92E+00	1.69E+02	4.26E+02	N/A	N/A	3.12E+01	N/A	3.64E-03	8.53E-04	4.37E-04	1.77E-04
	I.3 - Ore transport (haul truck transport)	A - Fugitive Emissions (PM)	7.74E+02	1.58E+02	1.58E+01	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		B- Exhaust Emissions	3.88E+00	3.88E+00	3.77E+00	1.77E-01	8.25E+01	2.81E+01	3.98E+00	3.09E-02	2.11E+04	N/A	N/A	N/A	N/A	N/A
II - Ore management	II.1 -Transfer (dump) to Stockpile 1	A - Fugitive Emissions (PM with Metals)	5.81E+00	2.75E+00	4.16E-01	N/A	N/A	N/A	N/A	N/A	N/A	N/A	4.69E-02	6.46E-03	5.51E-03	1.05E-03
	II.2 - Transfer to Primary Crusher by Front End Loader/Maintenance, Stockpile 1	A - Fugitive Emissions (PM with Metals)	4.66E+00	3.81E-01	4.90E-01	N/A	N/A	N/A	N/A	N/A	N/A	N/A	3.76E-02	5.18E-03	4.42E-03	8.43E-04
		B- Exhaust Emissions	1.39E-01	1.39E-01	1.35E-01	6.91E-03	2.66E+00	1.01E+00	1.44E-01	1.21E-03	8.26E+02	N/A	N/A	N/A	N/A	N/A
	II.3 Wind Erosion from Stockpile 1	A - Fugitive Emissions (PM with Metals)	1.10E+00	5.52E-01	8.29E-02	N/A	N/A	N/A	N/A	N/A	N/A	N/A	8.92E-03	1.23E-03	1.05E-03	2.00E-04
	II.4 - Transfer (dump) to Stockpile 2	A - Fugitive Emissions (PM with Metals)	5.81E+00	2.75E+00	4.16E-01	N/A	N/A	N/A	N/A	N/A	N/A	N/A	4.69E-02	6.46E-03	5.51E-03	1.05E-03
	II.5 - Transfer to Primary Crusher by Frond End Loader/Maintenance, Stockpile 2	A - Fugitive Emissions (PM with Metals)	4.66E+00	3.81E-01	4.90E-01	N/A	N/A	N/A	N/A	N/A	N/A	N/A	3.76E-02	5.18E-03	4.42E-03	8.43E-04
		B- Exhaust Emissions	1.39E-01	1.39E-01	1.35E-01	6.91E-03	2.66E+00	1.01E+00	1.44E-01	1.21E-03	8.26E+02	N/A	N/A	N/A	N/A	N/A
	II.6 Wind Erosion from Stockpile 2	A - Fugitive Emissions (PM with Metals)	2.03E+00	1.02E+00	1.53E-01	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1.64E-02	2.26E-03	1.93E-03	3.68E-04
III - Ore Processing	III.1 - Ore Drop into Primary Crusher	A - Fugitive Emissions (PM with Metals)	1.24E+01	5.85E+00	8.85E-01	N/A	N/A	N/A	N/A	N/A	N/A	N/A	9.98E-02	1.37E-02	1.17E-02	2.24E-03
	III.2 - Primary Crushing	A - Fugitive Emissions (PM with Metals)	5.50E+01	2.20E+01	4.07E-01	N/A	N/A	N/A	N/A	N/A	N/A	N/A	4.44E-01	6.12E-02	5.22E-02	9.95E-03
	III.3 - Conveyor Transport (1200-CV-003) , exhaust to DC-003 (UTM 513463/7046445)	A - Fugitive Emissions (PM with Metals)	3.62E-03	1.19E-03	3.36E-04	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2.92E-05	4.02E-06	1.99E-04	6.54E-07
	III.4 - Ore Drop into Secondary Crusher, exhaust to DC-003 (UTM 513463/7046445)	A - Fugitive Emissions (PM with Metals)	6.51E-04	3.08E-04	4.66E-05	N/A	N/A	N/A	N/A	N/A	N/A	N/A	5.26E-06	7.24E-07	6.18E-07	1.18E-07
	III.5 - Secondary Crushing, exhaust to DC-003 (UTM 513463/7046445)	A - Fugitive Emissions (PM with Metals)	8.25E-01	3.30E-01	6.11E-03	N/A	N/A	N/A	N/A	N/A	N/A	N/A	6.66E-03	9.17E-04	7.83E-04	1.49E-04
	III.6 - Conveyer Transport (2150-CV-005), exhaust to DC-003 (UTM 513463/7046445)	A - Fugitive Emissions (PM with Metals)	3.62E-03	1.19E-03	3.36E-04	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2.92E-05	4.02E-06	3.43E-06	6.54E-07
	III.7 - Ore Drop in Transfer Tower, exhaust to DC-004 (UTM 513370/7046442)	A - Fugitive Emissions (PM with Metals)	6.51E-04	3.08E-04	4.66E-05	N/A	N/A	N/A	N/A	N/A	N/A	N/A	5.26E-06	7.24E-07	6.18E-07	1.18E-07
	III.8 - Conveyer transport (2150-CV-007), exhaust to DC-003 (UTM 513463/7046445)	A - Fugitive Emissions (PM with Metals)	3.62E-03	1.19E-03	3.36E-04	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2.92E-05	4.02E-06	3.43E-06	6.54E-07
	III.9 - Ore Drop into Material Screen, exhaust to DC-003 (UTM 513463/7046445)	A - Fugitive Emissions (PM with Metals)	6.51E-04	3.08E-04	4.66E-05	N/A	N/A	N/A	N/A	N/A	N/A	N/A	5.26E-06	7.24E-07	6.18E-07	1.18E-07
	III.10 Material Screening, exhaust to DC-003 (UTM 513463/7046445)	A - Fugitive Emissions (PM with Metals)	5.68E-02	1.91E-02	1.29E-03	N/A	N/A	N/A	N/A	N/A	N/A	N/A	4.59E-04	6.32E-05	5.39E-05	1.03E-05
	III.11 - Tertiary Crushing, exhaust to DC-003 (UTM 513463/7046445)	A - Fugitive Emissions (PM with Metals)	8.25E-01	2.75E-01	5.09E-03	N/A	N/A	N/A	N/A	N/A	N/A	N/A	6.66E-03	9.17E-04	7.83E-04	1.49E-04
	III.12 Grinding	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	III.13 Ore Concentration Using Flotation and Recovery	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	III.14 Tailing Slurry Transfer to CDF	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
IV - Co-Disposal Facility (CDF)	IV.1- Waste rock dumping on waste rock pile	A - Fugitive Emissions (PM with Metals)	6.27E+01	2.97E+01	4.49E+00	N/A	N/A	N/A	N/A	N/A	N/A	N/A	7.02E-02	3.32E-02	8.86E-03	7.97E-03
	IV.2 - CDF Management	A - Fugitive Emissions (PM with Metals)	7.68E+02	2.49E+02	8.07E+01	N/A	N/A	N/A	N/A	N/A	N/A	N/A	8.59E-01	4.07E-01	1.08E-01	9.77E-02
		B- Exhaust Emissions	8.05E-01	8.05E-01	7.80E-01	3.67E-02	1.80E+01	6.14E+00	8.43E-01	6.42E-03	4.39E+03	N/A	N/A	N/A	N/A	N/A
	IV.3 - Transport of Rock to CDF	A - Fugitive Emissions (PM)	1.82E+03	3.72E+02	3.72E+01	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		B- Exhaust Emissions	5.77E+00	5.77E+00	5.60E+00	2.64E-01	1.22E+02	3.99E+01	6.04E+00	4.61E-02	3.15E+04	N/A	N/A	N/A	N/A	N/A
V - Concentrate Storage	V.1 - Dumping into fine ore bin assumed to be the same as bagging, exhaust to DC-005 (UTM 513427/7046460)	A - Fugitive Emissions (PM with Metals)	8.31E-05	3.93E-05	5.95E-06	N/A	N/A	N/A	N/A	N/A	N/A	N/A	6.71E-07	9.25E-08	7.89E-08	1.50E-08
	V.2 Concentrate Storage	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
VI - Concentrate Transport	VI.1 - B-Train concentrate, Access Road	A - Fugitive Emissions (PM)	3.06E+02	6.27E+01	6.27E+00	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		B- Exhaust Emissions	3.57E-02	3.57E-02	3.28E-02	2.96E-03	1.62E+00	7.45E-01	1.52E-01	1.13E-03	7.75E+02	N/A	N/A	N/A	N/A	N/A
	VI.2 - B-Train concentrate, Tilcho Road	A - Fugitive Emissions (PM)	1.84E+02	3.76E+01	3.76E+00	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		B- Exhaust Emissions	2.14E-02	2.14E-02	1.97E-02	1.78E-03	9.73E-01	4.47E-01	9.11E-02	4.53E-04	3.10E+02	N/A	N/A	N/A	N/A	N/A
VII - Other Off-site Transport (people, equipment, supplies)	VII.1 - Air transport	A - Fugitive Emissions (PM)	4.66E+01	2.33E+01	3.50E+00	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	VII.2 - Offsite Transport, Access Road	A - Fugitive Emissions (PM)	5.51E+02	1.13E+02	1.13E+01	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		B- Exhaust Emissions	6.42E-02	6.42E-02	5.91E-02	5.33E-03	2.92E+00	1.34E+00	2.73E-01	2.04E-03	1.39E+03	N/A	N/A	N/A	N/A	N/A
	VII.3 - Offsite Transport, Tilcho road	A - Fugitive Emissions (PM)	3.31E+02	6.76E+01	6.76E+00	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		B- Exhaust Emissions	3.85E-02	3.85E-02	3.55E-02	3.20E-03	1.75E+00	8.04E-01	1.64E-01	8.16E-04	5.58E+02	N/A	N/A	N/A	N/A	N/A
VIII - Support Activities	VIII.1 - Power Generation	C - Combustion Emissions	6.66E+01	6.16E+01	6.16E+01	1.63E+00	3.44E+03	9.13E+02	4.46E+00	2.26E-01	1.86E+05	N/A	N/A	N/A	N/A	N/A
	VIII.2 - Incineration	C - Combustion Emissions	7.04E-01	6.42E-01	6.19E-01	1.53E+00	2.07E+01	5.17E+00	1.02E-01	1.26E-03	3.61E+03	8.50E-10	3.99E-05	N/A	6.45E-05	4.40E-03
	VIII.3 - Heating	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	VIII.4 - Other vehicles	B- Exhaust Emissions	2.92E+00	2.92E+00	2.83E+00	1.23E-01	5.88E+01	2.20E+01	3.14E+00	2.15E-02	1.47E+04	N/A	N/A	N/A	N/A	N/A
	VIII.5 - Fuel Storage	N/A														
Total			**5,021.81**	**1,228.81**	**250.09**	**13.80**	**3,956.52**	**1,454.01**	**21.01**	**0.36**	**276,458.75**	**8.50E-10**	**1.69**	**0.55**	**0.21**	**0.13**

N/A- No applicable emission

Description	Emission Rate (kg/day)													
	TSP	PM10	PM2.5	SO2	NOx	CO	VOC	PAH	CO2e	DIOXIN/FURAN	As	Bi	Co	Cu
I - Open Pit Extraction	782.97	165.28	20.96	10.19	285.72	461.96	5.45	0.047	31,997.02	N/A	0.012	0.0029	0.0015	5.97E-04
II - Ore management	24.35	8.10	2.32	0.014	5.31	2.02	0.29	0.0024	1,651.45	N/A	0.19	0.027	0.023	0.0044
III - Ore Processing	69.08	28.47	1.31	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.56	0.077	0.066	0.012
IV - Co-Disposal Facility (CDF)	2,656.51	657.68	128.76	0.30	139.93	46.09	6.89	0.052	35,869.58	N/A	0.93	0.44	0.12	0.11
V - Concentrate Storage	8.31E-05	3.93E-05	5.95E-06	N/A	N/A	N/A	N/A	N/A	N/A	N/A	6.71E-07	9.25E-08	7.89E-08	1.50E-08
VI - Concentrate Transport	490.01	100.30	10.08	0.0047	2.60	1.19	0.24	0.0016	1,084.40	N/A	N/A	N/A	N/A	N/A
VII - Other Off-site Transport (people, equipment, supplies)	928.64	203.84	21.63	0.0085	4.67	2.14	0.44	0.0029	1,951.92	N/A	N/A	N/A	N/A	N/A
VIII - Support Activities	70.25	65.14	65.03	3.28	3,518.29	940.61	7.70	0.25	203,904.38	8.50E-10	3.99E-05	-	6.45E-05	0.0044
TOTAL	**5,021.81**	**1,228.81**	**250.09**	**13.80**	**3,956.52**	**1,454.01**	**21.01**	**0.36**	**276,458.75**	**8.50E-10**	**1.69**	**0.55**	**0.21**	**0.13**

N/A- No applicable emission

Annual Emisison Rate

Description	Source	Type	Emission rate (tonne/year)	Perecent of total
			CO2e	CO2e
I - Open Pit Extraction	I.1 - Drilling	A - Fugitive Emissions (PM with Metals)	N/A	N/A
		B- Exhaust Emissions	3,948.24	4%
	I.2 - Blasting	A - Fugitive Emissions (PM with Metals)	11.40	0%
	I.3 - Ore transport (haul truck transport)	A - Fugitive Emissions	N/A	N/A
		B- Exhaust Emissions	7,719.27	8%
II - Ore management	II.1 -Transfer (dump) to Stockpile 1	A - Fugitive Emissions	N/A	N/A
	II.2 - Transfer to Primary Crusher by Front End Loader/Maintenance, Stockpile 1	A - Fugitive PM Emissions	N/A	N/A
		B- Exhaust Emissions	301.39	0%
	II.3 Wind Erosion from Stockpile 1	A - Fugitive PM Emissions	N/A	N/A
	II.4 - Transfer (dump) to Stockpile 2	A - Fugitive Emissions	N/A	N/A
	II.5 - Transfer to Primary Crusher by Frond End Loader/Maintenance, Stockpile 2	A - Fugitive PM Emissions - Stockpile Working (Dozer)	N/A	N/A
		B- Exhaust Emissions	301.39	0%
	II.6 Wind Erosion from Stockpile 2	A - Fugitive PM Emissions	N/A	N/A
III - Ore Processing	III.1 - Ore Drop into Primary Crusher	A - Fugitive Emissions	N/A	N/A
	III.2 - Primary Crushing	A - Fugitive Emissions	N/A	N/A
	III.3 - Conveyor Transport (1200-CV-003) , exhaust to DC-003 (UTM 513463/7046445)	A - Fugitive Emissions to secondary crusher	N/A	N/A
	III.4 - Ore Drop into Secondary Crusher, exhaust to DC-003 (UTM 513463/7046445)	A - Fugitive Emissions	N/A	N/A
	III.5 - Secondary Crushing, exhaust to DC-003 (UTM 513463/7046445)	A - Fugitive Emissions	N/A	N/A
	III.6 - Conveyer Transport (2150-CV-005), exhaust to DC-003 (UTM 513463/7046445)	A - Fugitive Emissions to transfer tower	N/A	N/A
	III.7 - Ore Drop in Transfer Tower, exhaust to DC-004 (UTM 513370/7046442)	A - Fugitive Emissions	N/A	N/A
	III.8 - Conveyer transport (2150-CV-007), exhaust to DC-003 (UTM 513463/7046445)	A - Fugitive Emissions from transfer tower to tertiary crusher	N/A	N/A
	III.9 - Ore Drop into Material Screen, exhaust to DC-003 (UTM 513463/7046445)	A - Fugitive Emissions	N/A	N/A
	III.10 Material Screening, exhaust to DC-003 (UTM 513463/7046445)	A - Fugitive Emissions	N/A	N/A
	III.11 - Tertiary Crushing, exhaust to DC-003 (UTM 513463/7046445)	A - Fugitive Emissions	N/A	N/A
	III.12 Grinding	N/A	N/A	N/A
	III.13 Ore Concentration Using Flotation and Recovery	N/A	N/A	N/A
	III.14 Tailing Slurry Transfer to CDF	N/A	N/A	N/A
IV - Co-Disposal Facility (CDF)	IV.1- Waste rock dumping on waste rock pile	A - Fugitive Emissions	N/A	N/A
	IV.2 - CDF Management	A - Fugitive PM Emissions - Dozer working in the CDF	N/A	N/A
		B- Exhaust Emissions	1,602.31	2%
	IV.3 - Transport of Rock to CDF	A - Fugitive Emissions	N/A	N/A
		B- Exhaust Emissions	11,490.08	11%
V - Concentrate Storage	V.1 - Dumping into fine ore bin assumed to be the same as bagging, exhaust to DC-005 (UTM 513427/7046460)	A - Fugitive Emissions	N/A	N/A
	V.2 Concentrate Storage	N/A	N/A	N/A
VI - Concentrate Transport	VI.1 - B-Train concentrate, Access Road	A - Fugitive Emissions	N/A	N/A
		B- Exhaust Emissions	282.75	0%
	VI.2 - B-Train concentrate, Tilcho Road	A - Fugitive Emissions	N/A	N/A
		B- Exhaust Emissions	113.05	0%
VII - Other Off-site Transport (people, equipment, supplies)	VII.1 - Air transport	A - Fugitive Emissions	N/A	N/A
	VII.2 - Offsite Transport, Access Road	A - Fugitive Emissions	N/A	N/A
		B- Exhaust Emissions	508.95	1%
	VII.3 - Offsite Transport, Tilcho road	A - Fugitive Emissions	N/A	N/A
		B- Exhaust Emissions	203.50	0%
VIII - Support Activities	VIII.1 - Power Generation	C - Combustion Emissions	67,748.07	68%
	VIII.2 - Incineration	C - Combustion Emissions	658.91	1%
	VIII.3 - Heating	N/A	N/A	N/A
	VIII.4 - Other vehicles	B- Exhaust Emissions	5,359.20	5%
	VIII.5 - Fuel Storage	N/A	N/A	N/A
TOTAL			100,248.53	100%

Air Quality Assessment - NICO Project
Calculation of Emissions During the Operation Phase

I - Open Pit Extraction

I.1 - Drilling

A - Fugitive Emissions

Dust Control Technique		**Wet Drilling**	(a)

Source: (a) Assume wet drilling.

Hours of operation per day - maximum	h/day	A	20.4	(a)
Material throughput (ore extracted)	tonnes/day	B	33,086	(b)
Emission reduction efficiency	(%)	C	0	

Source: (a) Information provided by Fortune in "NICO Mobile Equipment_REVC_without Aker fuel.xlsx". Operating time taken from Open pit mining drilling equipment.
(b) Is the sum of "design daily milling rate" specified in Tailing and Mine Rock Co-disposal Facility FEED Study (Golder, 2010) and the maximum waste rock production from Fortune's "HaulTruckKilometres (2).xlsx"

			TSP	**PM_{10}**	**$PM_{2.5}$**	**As**	**Bi**	**Co**	**Cu**	
Emission factor (controlled - wet drilling)	kg/tonne	D	0.00009	0.00004	7.41E-06					(a) (b) (c)
Daily emission rate (controlled - wet drilling and retention)	g/day	E = B*D*1000*(1-C/100)	2,977.74	1,323.44	245.08					
Maximum Emission rate	g/s	F = E/(A*3600)	0.041	0.018	0.0033					
Elemental component (by mass)	g (element)/g (ore and waste rock)	G				0.0029	6.79E-04	3.48E-04	1.41E-04	(d)
Maximum emission rate	g/s	H = F(TSP)*G				1.17E-04	2.75E-05	1.41E-05	5.71E-06	(e)
Quality rating				E	-					

Source: (a) Emission factor for TSP extracted from in AP-42 / 11.19.2 - Crushed Stone Processing and Pulverized Mineral Processing (USEPA, August 2004)/ Table 11.19.2.1 (value for Wet Drilling - Unfragmented Stone).
(b) Emission factor for TSP based on the ratio between TSP and PM10 emission factors for tertiary crushing (uncontrolled) in AP-42 / 11.19.2 - Crushed Stone Processing and Pulverized Mineral Processing (USEPA, August 2004)/ Table 11.19.2.1.
(c) Emission factor for PM2.5 based on the ratio between PM10 and PM2.5 emission factors for tertiary crushing (controlled) in AP-42 / 11.19.2 - Crushed Stone Processing and Pulverized Mineral Processing (USEPA, August 2004)/ Table 11.19.2.1.
(d) Metal speciation within rock was provided by Fortune in "Appendix IV - results.xlsx". Based on the rock and ore quantities outlined in "Nico Project: Tailings and Mine Rock Co-Disposal Facility FEED study" (Golder 2010) it was assumed that all blasted rock is 26% btw ore and 74% btw waste rock.
(e) Assumed elemental fraction will be calculated from TSP emissions.

B- Exhaust Emissions

Equipment/Vehicle	**Model**	**Number of Equipment/Vehicle**	**Daily Use**
Mining Jumbo	Sandvik D45KS; Atlas Copco DML; or similar	1	20.4
Track Mounted ITH Drill	Sandvik D45KS; Atlas Copco DML; or similar	1	20.4

			SO_2	**NO_x**	**CO**	**$PM_{2.5}$**	**PM_{10}**	**VOC**	**PAH**	**CO_2e**
Daily emission rate	tonne/day	(refer to mine_fleet_operation)	9.06E-05	0.035	0.0073	0.0011	0.0011	0.0015	1.58E-05	10.82

I.2 - Blasting

A - Fugitive Emissions

Dust Control Technique		**No Control**

Blasting from ANFO	tonne/year	A	1,810	(a)
Blasting from Emulsion blend	tonne/year	B	1,810	(a)
Number of Blasts per day	blasts/day	C	46	(b)

Source: (a) Information provided by Fortune in "NICO estimated blasting quantities.xlsx".
(b) Fortune has specified that the blast depth will be 10 m in an email dated November 20, 2010.

			SO2	**NOx**	**CO**	**CH4**	**H2S**	**CO_2e**	
ANFO Constant (a)	kg/Mg	D	1	8	34				(a)
Emulsion blend (b)	kg/Mg	E	1	26	52	0.3	2		(a)(b)
Daily emission rate	tonne/day	F = (A*D+B*E)/10^3/365	0.010	0.17	0.43	0.0015	0.010	0.031	

Source: (a) Emission factors taken from AP-42 Section 13.3.
(b) Assumed that Emulsion blend is Dynamite Gelatin within AP-42, chapter 13.

			TSP <= 30 um	**PM_{10}**	**$PM_{2.5}$**	**As**	**Bi**	**Co**	**Cu**	
Constant (a)	-	G	0.00022	-	-					
Constant (b)	-	H	1.5	-	-					(a)
Scaling Factor	-	I	-	0.52	0.03					(a)
Annual Emission rate (uncontrolled)	kg/year	J = G*(1250/50)^H*C*365	458.78	238.57	13.76					(a) (b)
Daily emission rate (uncontrolled)	tonne/day	K= J/1000/365	0.0013	6.54E-04	3.77E-05					(a) (c) (d)
Elemental component (by mass)	g (element)/g (ore and waste rock)	L				0.0029	6.79E-04	3.48E-04	1.41E-04	(e)
Daily emission rate (24 hour)	tonne/day	M = L*K				3.64E-06	8.53E-07	4.37E-07	1.77E-07	(f)

Source: (a) AP-42 / Section 11.9 - Western Surface Coal Mining (USEPA, October 1998)/ Table 11.9-2 - Emission Factor Equations for Uncontrolled Open Dust Sources at Western Surface Coal Mines (blasting).
(b) Scaling factor to convert TSP <= 30 um to PM2.5 and PM2.5.
(c) PM10 and PM2.5 calculated multiplying TSP emission rate by respective scaling factors.
(d) Fortune mine provided that for 50 blasts results in 1250 m^2 of disturbed area in an email dated November 29, 2010.
(e) Metal speciation within rock was provided by Fortune in "Appendix IV - results.xlsx". Based on the rock and ore quantities outlined in "Nico Project: Tailings and Mine Rock Co-Disposal Facility FEED study" (Golder 2010) it was assumed that all blasted rock is 26% btw ore and 74% btw waste rock.
(f) Assumed elemental fraction will be calculated from TSP emissions.

Air Quality Assessment - NICO Project
Calculation of Emissions During the Operation Phase

I.3 - Ore transport (haul truck transport)

A - Fugitive Emissions from vehicle transport (unpaved roads)

Dust Control Technique		Watering more than twice a day		
Hours of operation per day - maximum	h/day	A	20.5	(a)
Surface material silt content	(%)	B	1.6	(b)
Mean vehicle weight	tonnes	C	28	(c)
Vehicle kilometer traveled (VKT)	km/day	D	957	(c)
Number of working days	days/year	E	365	(d)
Number of days with precipitation >= 0.2 mm	days/year	F	58	(e)
Emission reduction efficiency	(%)	G	70	(f)

Source: (a) Information provided by Fortune in "NICO Mobile Equipment_RevC_without Aker fuel.xlsx". Operating hours based on loaders and haul trucks.
(b) Silt Content of roads. Roads are assumed to be lined with limestone or similar material. Range of limestone silt content available in AP 42 chapter 13.2.4/table 13.2.4-1.
(c) See Mean Vehicle Weight table below.
(d) Assumed continuous operation of mine.
(e) Value derived from Fortune 2004-2007 onsite meteorological station (Fortune_2004_2007_MetData(Oct8 04 - Sep27 07)_MD.xls).
(f) Includes control efficiency of 70% from watering twice a day extracted from Unpaved Industrial Road Dust Calculator (Environment Canada website, accessed in December 2010).

			PM-30 (TSP)	PM_{10}	$PM_{2.5}$	
Constant (k)	lb/VMT	H	4.9	1.5	0.15	(a)
Constant (a)	-	I	0.7	0.9	0.9	(a)
Constant (b)	-	J	0.45	0.45	0.45	(a)
Emission factor (uncontrolled)	lb/VMT	K= H*((B/12)^I)*((C*1.1/3)^J)*(E-F)/E]	2.87	0.59	0.059	(a)
Emission factor (controlled)	g/VKT	L= K*281.9*(1-G/100)	242.63	49.64	4.96	(b)
Emission factor (uncontrolled)	g/VKT	M = K*281.9 [b]	808.77	165.47	16.55	
Daily emission rate (controlled)	g/day	N = L*D	232,121.51	47,489.58	4,748.96	
Daily emission rate (uncontrolled)	g/day	O = M*D	773,738.38	158,298.60	15,829.86	
Maximum emission rate (controlled)	g/s	P = N/(A*3600)	3.15	0.64	0.064	(c)
Maximum emission rate (uncontrolled)	g/s	Q = O/(A*3600)	10.51	2.15	0.21	(c)
Maximum Emission rate (controlled, without adjustment)	g/s	R = P/[(E-F)/E]	3.74	0.77	0.077	
Maximum emission rate (uncontrolled without adjustment)	g/s	S = Q/[(E-F)/E]	12.48	2.55	0.26	
Quality rating	-		B	B	B	

Source: (a) AP-42 / Section 13.2.2 - Unpaved Roads (USEPA, November 2006)/ Equation (1a) - unpaved surfaces at industrial sites and Table 13.2.2-2.
(b) 281.9: constant to convert lb/VMT (pounds per vehicle mile travelled) to g/VKT (grams per vehicle kilometer travelled).
(c) Daily hours is taken as the daily operating hours not 24h/day.
Note: Maximum 1 hour and 24 hours emission rates are assumed to occur in periods without snow cover on roads and without precipitation > 0.254 mm.

Mean Vehicle Weight

Equipment		Water Truck	Wheeled Front End Loader	Surface rock haulage trucks	Surface grader	Explosives Truck	Explosives Truck Trailer	Heavy Duty Truck, Diesel	Personnel Carrier	Light Duty Truck, Diesel	Light Duty Truck	Total	
Weight - Empty	tonnes	28.10	97.30	73.98	21.28	28.12	20.00	6.58	4.13	4.08	4.26		(a)
Weight - Loaded	tonnes	28.10	97.30	163.29	21.28	28.12	40.00	6.58	4.13	4.08	4.26		(b)
Mean Weight	tonnes	28.10	97.30	118.63	21.28	28.12	30.00	6.58	4.13	4.08	4.26		
Number of return trips	number	1	1	65	1	1	1	1	1	1	1		(c)
Distance of return trip	km/return trip	50	2	2	200	2	2	250	100	100	100		(d)
Distance of vehicle travelled (VKT)	km/day	50.00	2.30	149.78	200.00	2.30	2.30	250.00	100.00	100.00	100.00	956.68	
Percentage of traffic	%	5.23%	0.24%	15.66%	20.91%	0.24%	0.24%	26.13%	10.45%	10.45%	10.45%		
Mean vehicle weight	Tonnes	1.47	0.23	18.57	4.45	0.07	0.07	1.72	0.43	0.43	0.45	27.89	

Source: (a) Information provided by Fortune in "NICO Mobile Equipment_REVC_without Aker fuel.xlsx". The explosive truck trailer was assumed to be 20 tonnes empty.
(b) For drills, shovels, dozers, graders, stands, personnel carriers and light duty vehicles it has been assumed that the empty and loaded weight are the same. For haul trucks the loaded weight was taken as the maximum specified load in CAT 777F specification sheet. The explosive trailer's loaded weight is assumed to be twice the empty trailer's weight.
(c) The number of haul truck trips was specified by Fortune in the excel file named "HaulTruckKilometer (2).xlsx". It has been assumed that a 25% addition of trips are added to account for non-capacity travel.
(d) Data provided by client in HaulTruckKilometres (2).xlsx in an email dated December 22, 2010.

B- Exhaust Emissions

Equipment/Vehicle	Model	Number of Equipment/Vehicle	Daily Use (hours)
Wheeled Front End Loader	Caterpillar 992K/Komatsu WA 900-3	1	20.4
Surface rock haulage trucks	Caterpillar 777F/Komatsu HD 785-7	2	2.9
Surface rock haulage trucks	Caterpillar 777F/Komatsu HD 785-7	1	2.9
Surface grader	Caterpillar 14M/Komatsu GD675-3	1	3.8
Explosives Truck	Western Star 4900 SA; or Equivalent	1	3.8
Explosives Truck	Customized Package	1	3.8
Heavy Duty Truck, Diesel	Ford F-450 Crew Cab Flat Deck; or equivalent	1	3.8
Light Duty Truck, Diesel	Ford F-250 Supercab, or equivalent	1	1.9
Light Duty Truck	Ford F-250 Crewcab, or equivalent	1	3.8
Water Truck	Western Star 4900 SA; or Equivalent	1	1.9
Personnel Carrier	Western Star 4900 SA Mixer	1	2.0

			SO_2	NO_x	CO	$PM_{2.5}$	PM_{10}	VOC	PAH	CO_2e
Daily emission rate	tonne/day	(refer to mine_fleet_operation)	1.77E-04	0.083	0.028	0.0038	0.0039	0.0040	3.09E-05	21.15

Air Quality Assessment - NICO Project
Calculation of Emissions During the Operation Phase

II - Ore management

II.1 -Transfer (dump) to Stockpile 1

A - Fugitive Emissions

Dust Control Technique		**Wet Suppression**

Hours of operation per day - maximum	h/day	A	20.5	(a)
Amount of material handled per day	tonnes/day	B	2,584	(b)
Mean wind speed - maximum daily value	m/s	C	12.82	(c)
Material moisture content	%	D	7	(d)
Constant (a)	-	E	0.0016	(e)
Constant (b)	-	F	1.3	(e)
Constant (c)	-	G	2.2	(e)
Constant (d)	-	H	1.4	(e)
Constant (e)	-	I	2	(e)
Emission reduction efficiency	(%)	J	70	(f)

Source: (a) Information provided by Fortune in "NICO Mobile Equipment_RevC_without Aker fuel.xlsx". Operating hours based on loaders and haul trucks.
(b) Estimated as the "design daily milling rate" specified in Tailing and Mine Rock Co-disposal Facility FEED Study (Golder, 2010).
(c) Value derived from Fortune 2004-2007 onsite meteorological station (Fortune_2004_2007_MetData(Oct8 04 - Sep27 07)_MD.xls).
(d) Moisture content of ore supplied by Fortune in an email dated November 26, 2010.
(e) AP-42 / 13.2.4 - Aggregate Handling And Storage Piles (USEPA, November 2006)/ equation 1 - emission factor for drop operation.
(f) Assumed same emission reduction assigned to material dropping as for wetting more than twice a day as unpaved roads (Environment Canada website, accessed in December 2010).

			TSP <= 30 um	**PM_{10}**	**$PM_{2.5}$**	**As**	**Bi**	**Co**	**Cu**	
Particle size multiplier	-	K	0.74	0.35	0.053					(a)
Emission factor (uncontrolled)	kg/tonne	L = K*E*((C/G)**F)/((D/I)**H)	0.0022	0.0011	1.61E-04					(a)
Maximum emission rate (controlled)	g/s	M = B*L*(1-J/100)*1000/(A*3600)	0.024	0.011	0.0017					
Maximum emission rate (uncontrolled)	g/s	M' = B*L*1000/(A*3600)	0.079	0.037	0.0056					
Elemental component (by mass)	g (element)/g (ore)	N				0.0081	0.0011	9.49E-04	1.81E-04	(b)
Maximum emission rate (controlled)	g/s	O = M*N				1.91E-04	2.63E-05	2.24E-05	4.28E-06	(c)
Maximum emission rate (uncontrolled)	g/s	P = M'*N				6.36E-04	8.77E-05	7.48E-05	1.43E-05	(c)
Quality rating	-		A	A	A					

Source: (a) AP-42 / 13.2.4 - Aggregate Handling And Storage Piles (USEPA, November 2006)/ equation 1 - emission factor for drop operation.
(b) Metal speciation within rock was provided by Fortune in "Appendix IV - results.xlsx". Based on the rock and ore quantities outlined in "Nico Project: Tailings and Mine Rock Co-Disposal Facility FEED study" (Golder 2010) it was assumed that all blasted rock is 26% btw ore and 74% btw waste rock.
(c) Assumed elemental fraction will be calculated from TSP emissions.

II.2 - Transfer to Primary Crusher by Front End Loader/Maintenance, Stockpile 1

A - Fugitive PM Emissions - Stockpile Working (Dozer)

Dust Control Technique		**Wetting more than twice a day**	
Number of equipment	pc	A	3 (a)
Hours of operation per day - maximum	h/day	B	20.5 (a)
Material silt content	(%)	C	0.4 (b)
Material moisture content	(%)	D	6.5 (c)
Emission reduction efficiency	(%)	E	70 (d)

Source: (a) Information provided by Fortune in "NICO Mobile Equipment_RevC_ without Aker fuel.xlsx". Number of equipment is for 'Processing plant' and excludes passenger vehicles. Operating hours based on loaders and haul trucks.
(b) AP-42 / 13.2.4 - Aggregate Handling And Storage Piles (USEPA, November 2006)/ Table 13.2.4-1. Typical silt content of materials at various industries (value for limestone).
(c) Moisture content provided by Fortune in an email dated November 26, 2010.
(d) Assumed same emission reduction assigned to material handing for wetting more than twice a day as unpaved roads (Environment Canada website, accessed in December 2010).

			TSP <= 30 um	TSP <= 15 um	PM_{10}	$PM_{2.5}$	As	Bi	Co	Cu	
Constant (a)	-	F	2.6	0.45	-	-					(a)
Constant (b)	-	G	1.2	1.5	-	-					(a)
Constant (c)	-	H	1.3	1.4	-	-					(a)
Scaling Factor	-	I	-	-	0.75	0.105					(a) (b)
Emission rate (uncontrolled)	kg/hr/pc	J = F*(C^G)/(D^H)	0.076	0.008	0.0062	0.0080					(a) (c)
Emission rate (controlled)	g/hr	K = A*J*1000*(1-E/100)	68.38	7.46	5.59	7.18					
Maximum emission rate (uncontrolled)	g/s	L' = A*J*1000/3600	0.063	0.0069	0.0052	0.0066					
Maximum emission rate (controlled)	g/s	L = K/3600	0.019	0.0021	0.0016	0.0020					
Elemental component (by mass)	g (element)/g (ore)	M					0.0081	0.0011	9.49E-04	1.81E-04	(d)
Maximum emission rate (uncontrolled)	g/s	N = L'*M					5.11E-04	7.04E-05	6.01E-05	1.15E-05	(e)
Maximum emission rate (controlled)	g/s	O = L * M					1.53E-04	2.11E-05	1.80E-05	3.44E-06	(e)
Quality rating			B	C	D	D					

Source: (a) AP-42 / Section 11.9 - Western Surface Coal Mining (USEPA, October 1998) / Table 11.9-2 (Metric Units) - Emission Factor Equations for Uncontrolled Open Dust Sources at Western Surface Coal Mines (bulldozing overburden).
(b) Scaling factor to convert TSP <= 30 um to PM2.5 and TSP <= 15 um to PM2.5.
(c) PM10 and PM2.5 calculated multiplying TSP emission rates by respective scaling factors.
(d) Metal speciation within rock was provided by Fortune in "Appendix IV - results.xlsx". Based on the rock and ore quantities outlined in "Nico Project: Tailings and Mine Rock Co-Disposal Facility FEED study" (Golder 2010) it was assumed that all blasted rock is 26% btw ore and 74% btw waste rock.
(e) Assumed elemental fraction will be calculated from TSP emissions.

B- Exhaust Emissions

Equipment/Vehicle	Model	Number of Equipment/Vehicle	Daily Use (hours)
Skid Steer-Loader	Bobcat S150	1	1.9
Skid Steer-Loader	Bobcat S70	1	1.9
Wheeled Front End Loader	Caterpillar 988H/Komatsu WA 600	1	2.4

			SO_2	NO_x	CO	$PM_{2.5}$	PM_{10}	VOC	PAH	CO_2e
Daily emission rate	tonne/day	(refer to mine_fleet_operation)	6.91E-06	0.0027	0.0010	1.35E-04	1.39E-04	1.44E-04	1.21E-06	0.83

II.3 Wind Erosion from Stockpile 1

A - Fugitive PM Emissions

Dust Control Technique		**Material will come out wet and will manage dust with water during water truck season and when required**	
Pile surface area	ha	A	0.8 (a)
Percentage of time WS >19.3 km/h	%	B	31 (b)
Material silt content	%	C	0.4 (c)
Number of days with precipitation >= 0.2 mm	days/year	D	58 (d)
Constant (a)	-	E	1.9 (e)(f)
Constant (b)	-	F	1.5 (e)
Constant (c)	-	G	365 (e)
Constant (d)	-	H	235 (e)
Constant (e)	-	I	15 (e)
Emission reduction efficiency	(%)	J	70 (g)

Source: (a) Surface area Estimated based on Golder (2010) Proposed site layout and a maximum height of 5 m as specified in an email from Fortune dated November 26, 2010.
(b) Value derived from Fortune 2004-2007 onsite meteorological station (Fortune_2004_2007_MetData(Oct8 04 - Sep27 07)_MD.xls).
(c) AP-42 / 13.2.4 - Aggregate Handling And Storage Piles (USEPA, November 2006)/ Table 13.2.4-1. Typical silt content of materials at various industries (value for limestone).
(d) Value derived from Fortune 2004-2007 onsite meteorological station (Fortune_2004_2007_MetData(Oct8 04 - Sep27 07)_MD.xls).
(e) Control of Open Fugitive Dust Source (USEPA, September 1988) / Equation (4-9).
(f) Constant of 1.7 lb/year/acre converted to 1.9 lb/day/ha by multiplying by 0.454 kg/lb, 1acre/0.405 ha and 1 year/365 days. The 1 year/365 days cancels out the 365 day in the equation listed in EPA (1988).
(g) Environment Canada, Pits and Quarries Guidance, last accessed Dec 23, 2010. 70% efficiency relates to application of 3.172 L water/m2 of pile.

			TSP <= 30 um	PM_{10}	$PM_{2.5}$	As	Bi	Co	Cu	
Scaling factors	-	K	-	0.5	0.075					(a)
Emission factor (uncontrolled)	kg/d/ha	L = E*(C/F)*(G-D)/H)*(B/I)	1.35	0.67	0.10					(b) (c)
Maximum emission rate (controlled)	g/s	M = L*A*1000*(1-J/100)/(24*3600)	0.0038	0.0019	2.88E-04					
Maximum emission rate (uncontrolled)	g/s	M'= L*A*1000/(24*3600)	0.013	0.0064	9.59E-04					
Maximum emission rate (controlled, removing precipitation correction)	g/s	M''= E*(C/F)*(G-D)/H)*(B/I)*A*1000*(1-J/100)/(24*3600)	0.0046	0.0023	3.42E-04					
Maximum emission rate (uncontrolled, removing precip correction)	g/s	M'''= E*(C/F)*(G-D)/H)*(B/I)*A*1000/(24*3600)	0.015	0.0076	0.0011					
Elemental component (by mass)	g (element)/g (ore)	N				0.0081	0.0011	9.49E-04	1.81E-04	(d)
Maximum emission rate (controlled)	g/s	O = M * N				3.10E-05	4.27E-06	3.64E-06	6.94E-07	(e)
Maximum emission rate (uncontrolled)	g/s	P = M'*N				1.03E-04	1.42E-05	1.21E-05	2.31E-06	(e)

Source: (a) AP-42/Section 13.2.5 - Industrial Wind Erosion.
(b) TSP calculated according to Control of Open Fugitive Dust Source (USEPA, September 1988) / Equation (4-9).
(c) PM10 and PM2.5 calculated multiplying TSP emission rate by respective scaling factors.
(d) Metal speciation within rock was provided by Fortune in "Appendix IV - results.xlsx". Based on the rock and ore quantities outlined in "Nico Project: Tailings and Mine Rock Co-Disposal Facility FEED study" (Golder 2010) it was assumed that all blasted rock is 26% btw ore and 74% btw waste rock.
(e) Assumed elemental fraction will be calculated from TSP emissions.

II.4 - Transfer (dump) to Stockpile 2

A - Fugitive Emissions

Dust Control Technique		**Wet suppression**	
Hours of operation per day - maximum	h/day	A	20.5 (a)
Amount of material handled per day	tonnes/day	B	2,584 (b)
Mean wind speed - maximum daily value	m/s	C	12.82 (c)
Material moisture content	%	D	7 (d)
Constant (a)	-	E	0.0016 (e)
Constant (b)	-	F	1.3 (e)
Constant (c)	-	G	2.2 (e)
Constant (d)	-	H	1.4 (e)
Constant (e)	-	I	2 (e)
Emission reduction efficiency	(%)	J	70 (f)

Source: (a) Information provided by Fortune in "NICO Mobile Equipment_RevC_ without Aker fuel.xlsx". Operating hours based on loaders and haul trucks.
(b) Estimated as the "design daily milling rate" specified in Tailing and Mine Rock Co-disposal Facility FEED Study (Golder, 2010).
(c) Value derived from Fortune 2004-2007 onsite meteorological station (Fortune_2004_2007_MetData(Oct8 04 - Sep27 07)_MD.xls).
(d) Moisture content of ore supplied by Fortune in an email dated November 26, 2010.
(e) AP-42 / 13.2.4 - Aggregate Handling And Storage Piles (USEPA, November 2006)/ equation 1 - emission factor for drop operation.
(f) Assumed same emission reduction assigned to material dropping as for wetting more than twice a day as unpaved roads (Environment Canada website, accessed in December 2010).

			TSP <= 30 um	PM_{10}	$PM_{2.5}$	As	Bi	Co	Cu	
Particle size multiplier	-	K	0.74	0.35	0.053					(a)
Emission factor (uncontrolled)	kg/tonne	L = K*E*((C/G)^F)/((D/I)^H)	0.0022	0.0011	1.61E-04					(a)
Maximum emission rate (controlled)	g/s	M = B*L*(1-J/100)*1000/(A*3600)	0.024	0.011	0.0017					
Maximum emission rate (uncontrolled)	g/s	M' = B*L*1000/(A*3600)	0.079	0.037	0.0056					
Elemental component (by mass)	g (element)/g (ore)	N				0.0081	0.0011	9.49E-04	1.81E-04	(b)
Maximum emission rate (controlled)	g/s	O = M*N				1.91E-04	2.63E-05	2.24E-05	4.28E-06	(c)
Maximum emission rate (uncontrolled)	g/s	P = M'*N				6.36E-04	8.77E-05	7.48E-05	1.43E-05	(c)
Quality rating			A	A	A					

Source: (a) AP-42 / 13.2.4 - Aggregate Handling And Storage Piles (USEPA, November 2006)/ equation 1 - emission factor for drop operation.
(b) Metal speciation within rock was provided by Fortune in "Appendix IV - results.xlsx". Based on the rock and ore quantities outlined in "Nico Project: Tailings and Mine Rock Co-Disposal Facility FEED study" (Golder 2010) it was assumed that all blasted rock is 26% btw ore and 74% btw waste rock.
(c) Assumed elemental fraction will be calculated from TSP emissions.

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Calculation of Emissions During the Operation Phase

II.5 - Transfer to Primary Crusher by Frond End Loader/Maintenance, Stockpile 2

A - Fugitive PM Emissions - Stockpile Working (Dozer)

Dust Control Technique		**Wetting more than twice a day**	
Number of equipment	pc	A	3 (a)
Hours of operation per day - maximum	h/day	B	20.5 (a)
Material silt content	(%)	C	0.4 (b)
Material moisture content	(%)	D	6.5 (c)
Emission reduction efficiency	(%)	E	70 (d)

Source: (a) Information provided by Fortune in "NICO Mobile Equipment_RevC_ without Aker fuel.xlsx". Number of equipment is for 'Processing plant' and excludes passenger vehicles. Operating hours based on loaders and haul trucks.
(b) AP-42 / 13.2.4 - Aggregate Handling And Storage Piles (USEPA, November 2006)/ Table 13.2.4-1. Typical silt content of materials at various industries (value for limestone).
(c) Moisture content provided by Fortune in an email dated November 26, 2010.
(d) Assumed same emission reduction assigned to material handing for wetting more than twice a day as unpaved roads (Environment Canada website, accessed in December 2010).

			TSP <= 30 um	TSP <= 15 um	PM_{10}	$PM_{2.5}$	As	Bi	Co	Cu	
Constant (a)	-	F	2.6	0.5	-	-					(a)
Constant (b)	-	G	1.2	1.5	-	-					(a)
Constant (c)	-	H	1.3	1.4	-	-					(a)
Scaling Factor	-	I	-	-	0.75	0.105					(a) (b)
Emission rate (uncontrolled)	kg/hr/pc	J = F*(C^G)/(D^H)	0.076	0.0083	0.0062	0.0080					(a) (c)
Emission rate (controlled)	g/hr	K = A*J*1000*(1-E/100)	68.38	7.46	5.59	7.18					
Maximum emission rate (controlled)	g/s	L= K/(3600)	0.019	0.0021	0.0016	0.0020					
Maximum emission rate (uncontrolled)	g/s	L' = A*J*1000/3600	0.063	0.0069	0.0052	0.0066					
Elemental component (by mass)	g (element)/g (ore)	M					0.0081	0.0011	9.49E-04	1.81E-04	(d)
Maximum emission rate (controlled)	g/s	N = M*L					1.53E-04	2.11E-05	1.80E-05	3.44E-06	(e)
Maximum emission rate (uncontrolled)	g/s	O = M*L'					5.11E-04	7.04E-05	6.01E-05	1.15E-05	(e)
Quality rating			B	C	D	D					

Source: (a) AP-42 / Section 11.9 - Western Surface Coal Mining (USEPA, October 1998) / Table 11.9-2 (Metric Units) - Emission Factor Equations for Uncontrolled Open Dust Sources at Western Surface Coal Mines (bulldozing overburden).
(b) Scaling factor to convert TSP <= 30 um to PM2.5 and TSP <= 15 um to PM2.5.
(c) PM10 and PM2.5 calculated multiplying TSP emission rates by respective scaling factors.
(d) Metal speciation within rock was provided by Fortune in "Appendix IV - results.xlsx". Based on the rock and ore quantities outlined in "Nico Project: Tailings and Mine Rock Co-Disposal Facility FEED study" (Golder 2010) it was assumed that all blasted rock is 26% btw ore and 74% btw waste rock.
(e) Assumed elemental fraction will be calculated from TSP emissions.

B- Exhaust Emissions

Equipment/Vehicle	Model	Number of Equipment/Vehicle	Daily Use (hours)
Skid Steer-Loader	Bobcat S150	1	1.9
Skid Steer-Loader	Bobcat S70	1	1.9
Wheeled Front End Loader	Caterpillar 988H/Komatsu WA 600	1	2.4

			SO_2	NO_x	CO	$PM_{2.5}$	PM_{10}	VOC	PAH	CO_2e
Daily emission rate	tonne/day	(refer to mine_fleet_operation)	6.91E-06	0.0027	0.0010	1.35E-04	1.39E-04	1.44E-04	1.21E-06	0.83

II.6 Wind Erosion from Stockpile 2

A - Fugitive PM Emissions

Dust Control Technique		**Material will come out wet and will manage dust with water during water truck season and when required**	
Pile surface area	ha	A	1.5 (a)
Percentage of time WS >19.3 km/h	%	B	31 (b)
Material silt content	%	C	0.4 (c)
Number of days with precipitation >= 0.2 mm	days/year	D	58 (d)
Constant (a)	-	E	1.9 (e)(f)
Constant (b)	-	F	1.5 (e)
Constant (c)	-	G	365 (e)
Constant (d)	-	H	235 (e)
Constant (e)	-	I	15 (e)
Emission reduction efficiency	(%)	J	70 (g)

Source: (a) Estimated based on Golder (2010) Proposed Site Layout. Assumed that height of pile was 5 m as outlined by Fortune in an email dated November 26, 2010.
(b) Value derived from Fortune 2004-2007 onsite meteorological station (Fortune_2004_2007_MetData(Oct8 04 - Sep27 07)_MD.xls).
(c) AP-42 / 13.2.4 - Aggregate Handling And Storage Piles (USEPA, November 2006)/ Table 13.2.4-1. Typical silt content of materials at various industries (value for limestone).
(d) Value derived from Fortune 2004-2007 onsite meteorological station (Fortune_2004_2007_MetData(Oct8 04 - Sep27 07)_MD.xls).
(e) Control of Open Fugitive Dust Source (USEPA, September 1988) / Equation (4-9).
(f) Constant of 1.7 lb/year/acre converted to 1.9 lb/day/ha by multiplying by 0.454 kg/lb, 1acre/0.405 ha and 1 year/365 days. The 1 year/365 days cancels out the 365 day in the equation listed in EPA (1988).
(g) Environment Canada, Pits and Quarries Guidance, last accessed Dec 23, 2010. 70% efficiency relates to application of 3.172 L water/m2 of pile.

			TSP <= 30 um	PM_{10}	$PM_{2.5}$	As	Bi	Co	Cu	
Scaling factors	-	K	-	0.5	0.075					(a)
Emission factor (uncontrolled)	kg/d/ha	L = E*(C/F)*((G-D)/H)*(B/I)	1.35	0.67	0.10					(b) (c)
Maximum emission rate (controlled)	g/s	M = L*A*1000*(1-J/100)/(24*3600)	0.0071	0.0035	5.30E-04					
Maximum emission rate (uncontrolled)	g/s	M' = L*A*1000/(24*3600)	0.024	0.012	0.0018					
Maximum emission rate (controlled, removing precipitation correction)	g/s	M"= E*(C/F)*((G-D)/H)*(B/I)*A*1000*(1-J/100)/(24*3600)	0.0084	0.0042	6.29E-04					
Maximum emission rate (uncontrolled, removing precip correction)	g/s	M"= E*(C/F)*((G-D)/H)*(B/I)*A*1000/(24*3600)	0.028	0.014	0.0021					
Elemental component (by mass)	g (element)/g (ore)	N				0.0081	0.0011	9.49E-04	1.81E-04	(d)
Maximum emission rate (controlled)	g/s	O = M*N				5.70E-05	7.86E-06	6.70E-06	1.28E-06	(e)
Maximum emission rate (uncontrolled)	g/s	P = M"*N				1.90E-04	2.62E-05	2.23E-05	4.26E-06	(e)

Source: (a) AP-42/Section 13.2.5 - Industrial Wind Erosion.
(b) TSP calculated according to Control of Open Fugitive Dust Source (USEPA, September 1988) / Equation (4-9).
(c) PM10 and PM2.5 calculated multiplying TSP emission rate by respective scaling factors.
(d) Metal speciation within rock was provided by Fortune in "Appendix IV - results.xlsx". Based on the rock and ore quantities outlined in "Nico Project: Tailings and Mine Rock Co-Disposal Facility FEED study" (Golder 2010) it was assumed that all blasted rock is 26% btw ore and 74% btw waste rock.
(e) Assumed elemental fraction will be calculated from TSP emissions.

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Calculation of Emissions During the Operation Phase

III - Ore Processing

III.1 - Ore Drop into Primary Crusher

A - Fugitive Emissions

Dust Control Technique		**Wet suppression**		
Hours of operation per day - maximum	h/day	A	10.0	(a)
Amount of material removed per day	tonnes/day	B	5,500	(a)
Mean wind speed - maximum daily value	m/s	C	12.82	(b)
Material moisture content	%	D	7	(c)
Constant (a)	-	E	0.0016	(d)
Constant (b)	-	F	1.3	(d)
Constant (c)	-	G	2.2	(d)
Constant (d)	-	H	1.4	(d)
Constant (e)	-	I	2	(d)
Emission reduction efficiency	(%)	J	70	(e)

Source: (a) Information provided by Fortune in an email dated November 24, 2010. Amount of material based on plants design capacity.
(b) Value derived from Fortune 2004-2007 onsite meteorological station (Fortune_2004_2007_MetData(Oct8 04 - Sep27 07)_MD.xls).
(c) Moisture content of ore supplied by Fortune in an email dated November 23, 2010.
(d) AP-42 / 13.2.4 - Aggregate Handling And Storage Piles (USEPA, November 2006)/ equation 1 - emission factor for drop operation.
(e) Assumed same emission reduction assigned to material dropping as for wetting more than twice a day as unpaved roads (Environment Canada website, accessed in December 2010).

			TSP <= 30 um	**PM_{10}**	**$PM_{2.5}$**	**As**	**Bi**	**Co**	**Cu**	
Particle size multiplier	-	K	0.74	0.35	0.053					(a)
Emission factor (uncontrolled)	kg/tonne	L = K*E*((C/G)^F)/((D/J)^H)	0.0022	0.0011	1.61E-04					(a)
Maximum emission rate (controlled)	g/s	M = B*L*(1-J/100)*1000/(A*3600)	0.10	0.049	0.0074					
Maximum emission rate (uncontrolled)	g/s	M' = B*L*1000/(A*3600)	0.34	0.16	0.025					
Elemental component (by mass)	g (element)/g (ore)	N				0.0081	0.0011	9.49E-04	1.81E-04	(b)
Maximum emission rate (controlled)	g/s	O = M*N				8.31E-04	1.15E-04	9.77E-05	1.86E-05	(c)
Maximum emission rate (uncontrolled)	g/s	P = M'*N				0.0028	3.82E-04	3.26E-04	6.21E-05	(c)
Quality rating			A	A	A					

Source: (a) AP-42 / 13.2.4 - Aggregate Handling And Storage Piles (USEPA, November 2006)/ equation 1 - emission factor for drop operation.
(b) Metal speciation within rock was provided by Fortune in "Appendix IV - results.xlsx". Based on the rock and ore quantities outlined in "Nico Project: Tailings and Mine Rock Co-Disposal Facility FEED study" (Golder 2010) it was assumed that all blasted rock is 26% btw ore and 74% btw waste rock.
(c) Assumed elemental fraction will be calculated from TSP emissions.

III.2 - Primary Crushing

A - Fugitive Emissions

Dust Control Technique		**Wet suppression**		
Hours of operation per day - maximum	h/day	A	10.0	(a)
Amount of material processed per day	tonnes/day	B	5,500	(a)
Emission reduction efficiency	(%)	C	50	(b)

Source: (a) Information provided by Fortune in an email dated November 23, 2010 as the design capacity of the plant.
(b) Emission reduction efficiency calculated from a control factor provided in Environment Canada, Pits and Quarries Guidance, Last Accessed December 23, 2010. Factors for wet material and water spray.

			TSP	**PM_{10}**	**$PM_{2.5}$**	**As**	**Bi**	**Co**	**Cu**	
Emission factor (uncontrolled)	kg/tonne	D	0.01	0.004	0.00007					(a) (b)
Daily emission rate (controlled)	g/day	E = B*D*1000*(1-C/100)	27,500.00	11,000.00	203.70					
Maximum emission rate controlled	g/s	F = E/(A*3600)	0.76	0.31	0.0057					
Maximum emission rate uncontrolled	g/s	F' = B*D*1000/(A*3600)	1.53	0.61	0.011					
Elemental component (by mass)	g (element)/g (ore)	G				0.0081	0.0011	9.49E-04	1.81E-04	(c)
Maximum emission rate (controlled)	g/s	H = G *F				0.0062	8.50E-04	7.25E-04	1.38E-04	(d)
Maximum emission rate (uncontrolled)	g/s	I = G* F'				0.012	0.0017	0.0014	2.76E-04	(d)
Quality rating			C	C	-					(a)

Source: (a) AP-42 / 11.24 - Metallic Minerals Processing (USEPA, August 1982)/ Table 11.24-1 (Metric Units). Emission factors for metallic minerals processing (value for high moisture ore / primary crushing; high moisture ore defined as >= 4% in weight).
(b) Emission factor for PM2.5 based on the ratio between PM10 and PM2.5 emission factors for tertiary crushing (controlled) in AP-42 / 11.19.2 Crushed Stone Processing and Pulverized Mineral Processing (USEPA, August 2004)/ Table 11.19.2.1.
(c) Metal speciation within rock was provided by Fortune in "Appendix IV - results.xlsx". Based on the rock and ore quantities outlined in "Nico Project: Tailings and Mine Rock Co-Disposal Facility FEED study" (Golder 2010) it was assumed that all blasted rock is 26% btw ore and 74% btw waste rock.
(d) Assumed elemental fraction will be calculated from TSP emissions.

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III.3 - Conveyor Transport (1200-CV-003) , exhaust to DC-003 (UTM 513463/7046445)

A - Fugitive Emissions to secondary crusher

Dust Control Technique		**(i) Wet Suppression** **(iii) Bag house**	
Hours of operation per day - maximum	h/day	A	10.0 (a)
Amount of material transferred	tonnes/day	B	5167.0 (a)
Emission reduction efficiency	(%)	C	99 (b)

Source: (a) Assumed same mass of ore going to secondary crusher. Information provided by Fortune in an email dated November 23, 2010, this value is different from the primary crushing value.
(b) Bag filter efficiency based on AP-42 / 11.24 - Metallic Minerals Processing (USEPA, August 1982).

			TSP	PM_{10}	$PM_{2.5}$	As	Bi	Co	Cu	
Emission factor (controlled)	kg/tonne	D	0.00007	0.000023	0.0000065					(a) (b)
Daily emission rate (controlled)	g/day	E = B*D*1000*(1-C/100)	3.6	1.2	0.3					
Maximum emission rate (controlled)	g/s	F = E/(A*3600)	1.00E-04	3.30E-05	9.33E-06					
Elemental component (by mass)	g (element)/g (ore)	G				0.0081	0.0011	0.055	1.81E-04	(c)
Daily emission rate	g/s	H = G*F				8.11E-07	1.12E-07	5.54E-06	1.82E-08	(d)
Quality rating			E	D						

Source: (a) AP-42 / 11.19.2 Crushed Stone Processing and Pulverized Mineral Processing (USEPA, August 2004)/ Table 11.19.2-1 (Metric Units) - Emission factors for crushed stone processing operations (value for conveyor transfer point - controlled). TSP emission has conservatively been taken as PM>100ug.
(b) Emission factors for conveyer transport is for wet suppression.
(c) Metal speciation within rock was provided by Fortune in "Appendix IV - results.xlsx". Based on the rock and ore quantities outlined in "Nico Project: Tailings and Mine Rock Co-Disposal Facility FEED study" (Golder 2010) it was assumed that all blasted rock is 26% btw ore and 74% btw waste rock.
(d) Assumed elemental fraction will be calculated from TSP emissions.

III.4 - Ore Drop into Secondary Crusher, exhaust to DC-003 (UTM 513463/7046445)

A - Fugitive Emissions

Dust Control Technique		**(i) Wet suppression** **(ii) Bag house**		
Hours of operation per day - maximum	h/day	A	10.0	(a)
Amount of material removed per day	tonnes/day	B	5,167	(a)
Mean wind speed	m/s	C	0.6	(b)
Material moisture content	%	D	7	(c)
Constant (a)	-	E	0.0016	(d)
Constant (b)	-	F	1.3	(d)
Constant (c)	-	G	2.2	(d)
Constant (d)	-	H	1.4	(d)
Constant (e)	-	I	2	(d)
Emission reduction efficiency	(%)	J	70	99 (d) (e)

Source: (a) Assumed same mass of ore going to secondary crusher. Information provided by Fortune in an email dated November 23, 2010.
(b) Assumed calmest conditions as allowed by the equation to represent dropping of aggregate material into crusher.
(c) Moisture content of ore supplied by Fortune in an email dated November 26, 2010.
(d) AP-42 / 13.2.4 - Aggregate Handling And Storage Piles (USEPA, November 2006)/ equation 1 - emission factor for drop operation.
(e) Assumed same emission reduction assigned to dropping as for wetting more than twice a day as unpaved roads (Environment Canada website, accessed in December 2010).

			TSP <= 30 um	PM_{10}	$PM_{2.5}$	As	Bi	Co	Cu	
Particle size multiplier	-	K	0.74	0.35	0.053					(a)
Emission factor (uncontrolled)	kg/tonne	L = K*E*((C/G)^F)/((D/J)^H)	4.20E-05	1.99E-05	3.01E-06					(a)
Maximum emission rate (controlled)	g/s	M = B*L*(1-J/100)*1000/(A*3600)	1.81E-05	8.55E-06	1.29E-06					
Elemental component (by mass)	g (element)/g (ore)	N				0.0081	0.0011	9.49E-04	1.81E-04	(b)
Maximum emission rate	g/s	O = N*M				1.46E-07	2.01E-08	1.72E-08	3.27E-09	(c)
Quality rating	-		A	A	A					

Source: (a) AP-42 / 13.2.4 - Aggregate Handling And Storage Piles (USEPA, November 2006)/ equation 1 - emission factor for drop operation.
(b) Metal speciation within rock was provided by Fortune in "Appendix IV - results.xlsx". Based on the rock and ore quantities outlined in "Nico Project: Tailings and Mine Rock Co-Disposal Facility FEED study" (Golder 2010) it was assumed that all blasted rock is 26% btw ore and 74% btw waste rock.
(c) Assumed elemental fraction will be calculated from TSP emissions.

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III.5 - Secondary Crushing, exhaust to DC-003 (UTM 513463/7046445)

A - Fugitive Emissions

Dust Control Technique		(i) Wet suppression (iii) Bag house		
Hours of operation per day - maximum	h/day	A	10.0	(a)
Amount of material processed per day	tonnes/day	B	5,500	(a)(b)
Emission reduction efficiency	(%)	C	50	99 (c) (d)

Source: (a) Information provided by Fortune in an email dated November 23, 2010.
(b) Emission factor for secondary crusher is a function of mass of ore to the primary crusher, that is why the primary crusher mass is entered (AP 42/11.24).
(c) Bag filter efficiency based on AP-42 / 11.24 - Metallic Minerals Processing (USEPA, August 1982).
(d) Emission reduction efficiency calculated from a control factor provided in Environment Canada, Pits and Quarries Guidance, Last Accessed December 23, 2010. Factors for wet material and water spray.

			TSP	PM_{10}	$PM_{2.5}$	As	Bi	Co	Cu	
Emission factor (uncontrolled)	kg/tonne	D	0.03	0.012	0.00022					(a) (b)
Daily emission rate (controlled)	g/day	E = B*D*1000*(1-C/100)	825.00	330.00	6.11					
Maximum emission rate (controlled)	g/s	F = E/(A*3600)	0.023	0.0092	1.70E-04					
Elemental component (by mass)	g (element)/g (ore)	G				0.0081	0.0011	9.49E-04	1.81E-04	(c)
Maximum emission rate (controlled)	g/s	H = G*F				1.85E-04	2.55E-05	2.17E-05	4.15E-06	(d)
Quality rating	-		C	-	-					

Source: (a) AP-42 / 11.24 - Metallic Minerals Processing (USEPA, August 1982)/ Table 11.24-1 (Metric Units). Emission factors for metallic minerals processing (value for high moisture ore / secondary crushing; high moisture ore defined as >= 4% in weight).
(b) Emission factor for PM2.5 based on the ratio between PM10 and PM2.5 emission factors for tertiary crushing (controlled) in AP-42 / 11.19.2 - Crushed Stone Processing and Pulverized Mineral Processing (USEPA, August 2004)/ Table 11.19.2.1.
(c) Metal speciation within rock was provided by Fortune in "Appendix IV - results.xlsx". Based on the rock and ore quantities outlined in "Nico Project: Tailings and Mine Rock Co-Disposal Facility FEED study" (Golder 2010) it was assumed that all blasted rock is 26% btw ore and 74% btw waste rock.
(d) Assumed elemental fraction will be calculated from TSP emissions.

III.6 - Conveyer Transport (2150-CV-005), exhaust to DC-003 (UTM 513463/7046445)

A - Fugitive Emissions to transfer tower

Dust Control Technique		(i) Wet Suppression (ii) Bag house		
Hours of operation per day - maximum	h/day	A	10.0	(a)
Amount of material transferred	tonnes/day	B	5,167	(a)
Emission reduction efficiency	(%)	C	99	(b)

Source: (a) Assumed the same mass of ore processed by secondary crusher. Information provided by Fortune in an email dated November 23, 2010.
(c) Bag filter efficiency based on AP-42 / 11.24 - Metallic Minerals Processing (USEPA, August 1982).

			TSP	PM_{10}	$PM_{2.5}$	As	Bi	Co	Cu	
Emission factor (controlled)	kg/tonne	D	0.00007	2.30E-05	6.50E-06					(a) (b)
Daily emission rate (controlled)	g/day	E = B*D*1000*(1-C/100)	3.6	1.2	0.3					
Maximum emission rate (controlled)	g/s	F = E/(A*3600)	1.00E-04	3.30E-05	9.33E-06					
Elemental component (by mass)	g (element)/g (ore)	G				0.0081	0.0011	9.49E-04	1.81E-04	(c)
Maximum emission rate (controlled)	g/s	H = G*F				8.11E-07	1.12E-07	9.53E-08	1.82E-08	(d)
Quality rating	-		E	D						

Source: (a) AP-42 / 11.19.2 Crushed Stone Processing and Pulverized Mineral Processing (USEPA, August 2004)/ Table 11.19.2-1 (Metric Units) - Emission factors for crushed stone processing operations (value for conveyor transfer point - controlled). TSP emission has conservatively been taken as PM>100 ug.
(b) Emission factors for conveyer transport is for wet suppression.
(c) Metal speciation within rock was provided by Fortune in "Appendix IV - results.xlsx". Based on the rock and ore quantities outlined in "Nico Project: Tailings and Mine Rock Co-Disposal Facility FEED study" (Golder 2010) it was assumed that all blasted rock is 26% btw ore and 74% btw waste rock.
(d) Assumed elemental fraction will be calculated from TSP emissions.

III.7 - Ore Drop in Transfer Tower, exhaust to DC-004 (UTM 513370/7046442)

A - Fugitive Emissions

Dust Control Technique		(i) Wet suppression (iii) Bag house		
Hours of operation per day - maximum	h/day	A	10.0	(a)
Amount of material removed per day	tonnes/day	B	5,167	(a)
Mean wind speed - maximum daily value	m/s	C	0.6	(b)
Material moisture content	%	D	7	(c)
Constant (a)	-	E	0.0016	(d)
Constant (b)	-	F	1.3	(d)
Constant (c)	-	G	2.2	(d)
Constant (d)	-	H	1.4	(d)
Constant (e)	-	I	2	(d)
Emission reduction efficiency	(%)	J	70	99 (e) (f)

Source: (a) Assumed the same mass of ore processed by secondary crusher. Information provided by Fortune in an email dated November 23, 2010.
(b) Assumed calmest conditions as allowed by the equation to represent dumping of aggregate material.
(c) Moisture content of ore supplied by Fortune in an email dated November 26, 2010.
(d) AP-42 / 13.2.4 - Aggregate Handling And Storage Piles (USEPA, November 2006)/ equation 1 - emission factor for drop operation.
(e) Bag filter efficiency based on AP-42 / 11.24 - Metallic Minerals Processing (USEPA, August 1982).
(f) Assumed same emission reduction assigned to material dropping as for wetting more than twice a day as unpaved roads (Environment Canada website, accessed in December 2010).

			TSP <= 30 um	PM_{10}	$PM_{2.5}$	As	Bi	Co	Cu	
Particle size multiplier	-	K	0.74	0.35	0.053					(a)
Emission factor (uncontrolled)	kg/tonne	L = K*E*((C/G)^F)/((D/I)^H)	4.20E-05	1.99E-05	3.01E-06					(a)
Maximum emission rate (controlled)	g/s	M = B*L*(1-J/100)*1000/(A*3600)	1.81E-05	8.55E-06	1.29E-06					
Elemental component (by mass)	g (element)/g (ore)	N				0.0081	0.0011	9.49E-04	1.81E-04	(b)
Maximum emission rate (controlled)	g/s	O = M*N				1.46E-07	2.01E-08	1.72E-08	3.27E-09	(c)
Quality rating	-		A	A	A					

Source: (a) AP-42 / 13.2.4 - Aggregate Handling And Storage Piles (USEPA, November 2006)/ equation 1 - emission factor for drop operation.
(b) Metal speciation within rock was provided by Fortune in "Appendix IV - results.xlsx". Based on the rock and ore quantities outlined in "Nico Project: Tailings and Mine Rock Co-Disposal Facility FEED study" (Golder 2010) it was assumed that all blasted rock is 26% btw ore and 74% btw waste rock.
(c) Assumed elemental fraction will be calculated from TSP emissions.

III.8 - Conveyer transport (2150-CV-007), exhaust to DC-003 (UTM 513463/7046445)

A - Fugitive Emissions from transfer tower to tertiary crusher

Dust Control Technique		**(i) Wet suppression** **(iii) Bag house**	
Hours of operation per day - maximum	h/day	A	10.0 (a)
Amount of material transferred	tonnes/day	B	5,167 (a)
Emission reduction efficiency	(%)	C	99 (b)

Source: (a) Assumed the same mass of ore processed by secondary crusher. Information provided by Fortune in an email dated November 23, 2010.
(c) Bag filter efficiency based on AP-42 / 11.24 - Metallic Minerals Processing (USEPA, August 1982).

			TSP	PM_{10}	$PM_{2.5}$	As	Bi	Co	Cu	
Emission factor (controlled)	kg/tonne	D	0.00007	0.000023	0.0000065					(a) (b)
Daily emission rate (controlled)	g/day	E = B*D*1000*(1-C/100)	3.6	1.2	0.3					
Maximum emission rate (controlled)	g/s	F = E/(A*3600)	1.00E-04	3.30E-05	9.33E-06					
Elemental component (by mass)	g (element)/g (ore)	G				0.0081	0.0011	9.49E-04	1.81E-04	(c)
Maximum emission rate (controlled)	g/s	H = G*F				8.11E-07	1.12E-07	9.53E-08	1.82E-08	(d)
Quality rating	-		E	D						

Source: (a) AP-42 / 11.19.2 Crushed Stone Processing and Pulverized Mineral Processing (USEPA, August 2004)/ Table 11.19.2-1 (Metric Units) - Emission factors for crushed stone processing operations (value for conveyor transfer point - controlled). TSP emission has conservatively been taken as PM>100 ug.
(b) Emission factors for conveyer transport is for wet suppression.
(c) Metal speciation within rock was provided by Fortune in "Appendix IV - results.xlsx". Based on the rock and ore quantities outlined in "Nico Project: Tailings and Mine Rock Co-Disposal Facility FEED study" (Golder 2010) it was assumed that all blasted rock is 26% btw ore and 74% btw waste rock.
(d) Assumed elemental fraction will be calculated from TSP emissions.

III.9 - Ore Drop into Material Screen, exhaust to DC-003 (UTM 513463/7046445)

A - Fugitive Emissions

Dust Control Technique		**Bag house**		
Hours of operation per day - maximum	h/day	A	10.0	(a)
Amount of material removed per day	tonnes/day	B	5,167	(a)
Mean wind speed - maximum daily value	m/s	C	0.6	(b)
Material moisture content	%	D	7	(c)
Constant (a)	-	E	0.0016	(d)
Constant (b)	-	F	1.3	(d)
Constant (c)	-	G	2.2	(d)
Constant (d)	-	H	1.4	(d)
Constant (e)	-	I	2	(d)
Emission reduction efficiency	(%)	J	70 / 99	(e) (f)

Source: (a) Assumed the same mass of ore processed by secondary crusher. Information provided by Fortune in an email dated November 23, 2010.
(b) Assumed calmest conditions as allowed by the equation to represent dumping of aggregate material.
(c) Moisture content of ore supplied by Fortune in an email dated November 26, 2010.
(d) AP-42 / 13.2.4 - Aggregate Handling And Storage Piles (USEPA, November 2006)/ equation 1 - emission factor for drop operation.
(e) Bag filter efficiency based on AP-42 / 11.24 - Metallic Minerals Processing (USEPA, August 1982).
(f) Assumed same emission reduction assigned to material dropping as for wetting more than twice a day as unpaved roads (Environment Canada website, accessed in December 2010).

			TSP <= 30 um	PM_{10}	$PM_{2.5}$	As	Bi	Co	Cu	
Particle size multiplier	-	K	0.74	0.35	0.053					(a)
Emission factor (uncontrolled)	kg/tonne	L = K*E*((C/G)^F)/((D/J)^H)	4.20E-05	1.99E-05	3.01E-06					
Maximum emission rate (controlled)	g/s	M = B*L*(1-J/100)*1000/(A*3600)	1.81E-05	8.55E-06	1.29E-06					
Elemental component (by mass)	g (element)/g (ore)	N				0.0081	0.0011	9.49E-04	1.81E-04	(b)
Maximum emission rate (controlled)	g/s	O = N*M				1.46E-07	2.01E-08	1.72E-08	3.27E-09	(c)
Quality rating	-		A	A	A					

Source: (a) AP-42 / 13.2.4 - Aggregate Handling And Storage Piles (USEPA, November 2006)/ equation 1 - emission factor for drop operation.
(b) Metal speciation within rock was provided by Fortune in "Appendix IV - results.xlsx". Based on the rock and ore quantities outlined in "Nico Project: Tailings and Mine Rock Co-Disposal Facility FEED study" (Golder 2010) it was assumed that all blasted rock is 26% btw ore and 74% btw waste rock.
(c) Assumed elemental fraction will be calculated from TSP emissions.

III.10 Material Screening, exhaust to DC-003 (UTM 513463/7046445)

A - Fugitive Emissions

Dust Control Technique		**(i) Wet suppression** **(ii) Bag house**

Hours of operation per day - maximum	h/day	A	10	(a)
Amount of material processed per day	tonnes/day	B	5,167	(a)
Emission reduction efficiency	(%)	C	0	99 (b) (c)

Source: (a) Assumed the same mass of ore processed by secondary crusher. Information provided by Fortune in an email dated November 23, 2010.
(b) Bag filter efficiency based on AP-42 / 11.24 - Metallic Minerals Processing (USEPA, August 1982).
(c) Emission reduction for wet suppression is 0 since the reduction efficiency from wet suppression is incorporated into the emission factor.

			TSP	PM_{10}	$PM_{2.5}$	As	Bi	Co	Cu	
Emission factor (controlled)	kg/tonne	D	0.0011	0.00037	0.00003					(a) (b)
Daily emission rate (controlled)	g/day	E = B*D*1000*(1-C/100)	56.8	19.1	1.3					
Maximum emission rate (controlled)	g/s	F = E/(A*3600)	0.0016	5.31E-04	3.59E-05					
Elemental component (by mass)	g (element)/g (ore)	G				0.0081	0.0011	9.49E-04	1.81E-04	(c)
Maximum emission rate (controlled)	g/s	H = G*F				1.27E-05	1.76E-06	1.50E-06	2.86E-07	(d)
Quality rating	-		E	C	-					

Source: (a) AP-42 / 11.19.2 Crushed Stone Processing and Pulverized Mineral Processing (USEPA, August 2004)/ Table 11.19.2-1 (Metric Units) - Emission factors for crushed stone processing operations (value for screening - uncontrolled).
(b) Emission factors for wet suppression.
(c) Metal speciation within rock was provided by Fortune in "Appendix IV - results.xlsx". Based on the rock and ore quantities outlined in "Nico Project: Tailings and Mine Rock Co-Disposal Facility FEED study" (Golder 2010) it was assumed that all blasted rock is 26% btw ore and 74% btw waste rock.
(d) Assumed elemental fraction will be calculated from TSP emissions.

III.11 - Tertiary Crushing, exhaust to DC-003 (UTM 513463/7046445)

A - Fugitive Emissions

Dust Control Technique		**(i) Wet suppression** **(ii) Bag house**

Hours of operation per day - maximum	h/day	A	10.0	(a)
Amount of material processed per day	tonnes/day	B	5,500	(a) (b)
Emission reduction efficiency	(%)	C	50	99 (c) (d)

Source: (a) Information provided by Fortune for crushing train in an email dated November 23, 2010.
(b) Emission factor for tertiary crusher is a function of mass of ore to the primary crusher, that is why the primary crusher mass is entered (AP 42/11.24).
(c) Bag filter efficiency based on AP-42 / 11.24 - Metallic Minerals Processing (USEPA, August 1982).
(d) Emission reduction efficiency calculated from a control factor provided in Environment Canada, Pits and Quarries Guidance, Last Accessed December 23, 2010. Factors for wet material and water spray.

			TSP	PM_{10}	$PM_{2.5}$	As	Bi	Co	Cu	
Emission factor (uncontrolled)	kg/tonne	D	0.03	0.01	0.00019					(a) (b)
Daily emission rate (controlled)	g/day	E = B*D*1000*(1-C/100)	825.00	275.00	5.09					
Maximum emission rate (controlled)	g/s	F = E/(A*3600)	0.023	0.0076	0.00014					
Elemental component (by mass)	g (element)/g (ore)	G				0.0081	0.0011	9.49E-04	1.81E-04	(c)
Maximum emission rate (controlled)	g/s	H = G*F				1.85E-04	2.55E-05	2.17E-05	4.15E-06	(d)
Quality rating	-		E	E	-					

Source: (a) AP-42 / 11.24 - Metallic Minerals Processing (USEPA, August 1982)/ Table 11.24-1 (Metric Units). Emission factors for metallic minerals processing (value for high moisture ore / tertiary crushing; high moisture ore defined as >= 4% in weight).
(b) Emission factor for PM2.5 based on the ratio between PM10 and PM2.5 emission factors for tertiary crushing (controlled) in AP-42 / 11.19.2 - Crushed Stone Processing and Pulverized Mineral Processing (USEPA, August 2004)/ Table 11.19.2.1.
(c) Metal speciation within rock was provided by Fortune in "Appendix IV - results.xlsx". Based on the rock and ore quantities outlined in "Nico Project: Tailings and Mine Rock Co-Disposal Facility FEED study" (Golder 2010) it was assumed that all blasted rock is 26% btw ore and 74% btw waste rock.
(d) Assumed elemental fraction will be calculated from TSP emissions.

III.12 Grinding

Fugitive particulate matter emissions: no significant. Wet process

III.13 Ore Concentration Using Flotation and Recovery

Fugitive particulate matter emissions: no significant. Wet process.

III.14 Tailing Slurry Transfer to CDF

Fugitive particulate matter emissions: no significant.

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Calculation of Emissions During the Operation Phase

IV - Co-Disposal Facility (CDF)

IV.1- Waste rock dumping on waste rock pile

A - Fugitive Emissions

Dust Control Technique		**No control**	
Hours of operation per day - maximum	h/day	A	20.4 (a)
Amount of material handled per day	tonnes/day	B	27,919 (b)
Mean wind speed - maximum daily value	m/s	C	12.82 (c)
Material moisture content	%	D	7 (d)
Constant (a)	-	E	0.0016 (e)
Constant (b)	-	F	1.3 (e)
Constant (c)	-	G	2.2 (e)
Constant (d)	-	H	1.4 (e)
Constant (e)	-	I	2 (e)
Emission reduction efficiency	(%)	J	0

Source: (a) Based on information provided by Fortune in "NICO Mobile Equipment_REVC_without Aker fuel.xlsx" assumed the same operating time as the haul trucks.
(b) Maximum daily mine rock disposal as provided by Fortune in "HaulTruckKilometres (2).xlsx".
(c) Value derived from Fortune 2004-2007 onsite meteorological station (Fortune_2004_2007_MetData(Oct8 04 - Sep27 07)_MD.xls).
(d) Assumed same moisture content as ore. Ore moisture content provided by Fortune in November 23, 2010.
(e) AP-42 / 13.2.4 - Aggregate Handling And Storage Piles (USEPA, November 2006)/ equation 1 - emission factor for drop operation.

			TSP <= 30 um	**PM_{10}**	**$PM_{2.5}$**	**As**	**Bi**	**Co**	**Cu**	
Particle size multiplier	-	K	0.74	0.35	0.053					(a)
Emission factor (uncontrolled)	kg/tonne	L = K*E*((C/G)^F)/((D/I)^H)	0.0022	0.0011	1.61E-04					(a)
Maximum emission rate (controlled)	g/s	M = B*L*(1-J/100)*1000/(A*3600)	0.85	0.40	0.061					
Maximum emission rate (uncontrolled)	g/s	N = B*L*1000/(A*3600)	0.85	0.40	0.061					
Elemental component (by mass)	g (element)/g (waste rock)	O				0.0011	5.30E-04	1.41E-04	1.27E-04	(c)
Maximum emission rate (controlled)	g/s	P = O * M				9.55E-04	4.53E-04	1.21E-04	1.09E-04	(d)
Maximum emission rate (uncontrolled)	g/s	Q = O*N				9.55E-04	4.53E-04	1.21E-04	1.09E-04	(d)
Quality rating			A	A	A					

Source: (a) AP-42 / 13.2.4 - Aggregate Handling And Storage Piles (USEPA, November 2006)/ equation 1 - emission factor for drop operation.
(b) Metal speciation within rock was provided by Fortune in "Appendix IV - results.xlsx". Based on the rock and ore quantities outlined in "Nico Project: Tailings and Mine Rock Co-Disposal Facility FEED study" (Golder 2010) it was assumed that all blasted rock is 26% btw ore and 74% btw waste rock.
(c) Assumed elemental fraction will be calculated from TSP emissions.

Air Quality Assessment - NICO Project
Calculation of Emissions During the Operation Phase

IV.2 - CDF Management

A - Fugitive PM Emissions - Dozer working in the CDF

Dust Control Technique		No control	
Number of equipment	pc	A	2 (a)
Hours of operation per day - maximum	h/day	B	20.4 (b)
Material silt content	(%)	C	40 (c)
Material moisture content	(%)	D	6.5 (d)
Emission reduction efficiency	(%)	E	0

Source: (a) 2 Dozers specified for use in the Waste Rock disposal area a CAT D10 and D8 in "NICO Mobile Equipment_REVC_without Aker fuel.xlsx".
(b) Assumed operating time is the same as haul trucks as outlined in "NICO Mobile Equipment_REVC_without Aker fuel.xlsx".
(c) AP-42 / 13.2.4 - Aggregate Handling And Storage Piles (USEPA, November 2006)/ Table 13.2.4-1. Typical silt and moisture contents of materials at various industries (value for limestone).
(d) Assumed same moisture content as ore. Ore moisture content supplied by Fortune in an email dated November 23, 2010.

			TSP <= 30 um	TSP <= 15 um	PM_{10}	$PM_{2.5}$	As	Bi	Co	Cu	
Constant (a)	-	F	2.6	0.45	-	-					(a)
Constant (b)	-	G	1.2	1.5	-	-					(a)
Constant (c)	-	H	1.3	1.4	-	-					(a)
Scaling Factor	-	I	-	-	0.75	0.105					(a) (b)
Emission rate (uncontrolled)	kg/hr/pc	J = F*(C^G)/(D^H)	18.83	8.15	6.11	1.98					(a) (c)
Emission rate (controlled)	g/hr	K = A*J*1000*(1-E/100)	37665.62	16295.79	12221.84	3954.89					
Maximum emission rate (controlled)	g/s	L = K/(3600)	10.46	4.53	3.39	1.10					
Maximum emission rate (uncontrolled)	g/s	M = A*J*1000/3600	10.46	4.53	3.39	1.10					
Elemental component (by mass)	g (element)/g (waste rock)	N					0.0011	5.30E-04	1.41E-04	1.27E-04	(d)
Maximum emission rate (controlled)	g/s	O = N*L					0.012	0.0055	0.0015	0.0013	(e)
Maximum emission rate (uncontrolled)	g/s	P = N*M					0.012	0.0055	0.0015	0.0013	(e)
Quality rating	-		B	C	D	D					

Source: (a) AP-42 / Section 11.9 - Western Surface Coal Mining (USEPA, October 1998) / Table 11.9-2 (Metric Units) - Emission Factor Equations for Uncontrolled Open Dust Sources at Western Surface Coal Mines (bulldozing overburden).
(b) Scaling factor to convert TSP <= 30 um to PM2.5 and TSP <= 15 um to PM2.5.
(c) PM10 and PM2.5 calculated multiplying TSP emission rates by respective scaling factors.
(d) Metal speciation within rock was provided by Fortune in "Appendix IV - results.xlsx". Based on the rock and ore quantities outlined in "Nico Project: Tailings and Mine Rock Co-Disposal Facility FEED study" (Golder 2010) it was assumed that all blasted rock is 26% btw ore and 74% btw waste rock.
(e) Assumed elemental fraction will be calculated from TSP emissions.

B- Exhaust Emissions

Equipment/Vehicle	Model	Number of Equipment/Vehicle	Daily Use (hours)
Track-dozer	Caterpillar D8T/Komatsu D155AX-6	1	3.8
Tracked-Type tractor, bulldozer	Caterpillar D10T/Komatsu 375A-6	1	10.8

			SO_2	NO_x	CO	$PM_{2.5}$	PM_{10}	VOC	PAH	CO_2e
Daily emission rate	tonne/day	(refer to mine_fleet_operation)	3.67E-05	0.018	0.0061	7.80E-04	8.05E-04	8.43E-04	6.42E-06	4.39

IV.3 - Transport of Rock to CDF

A - Fugitive Emissions

Dust Control Technique		Watering more than twice a day	
Hours of operation per day - maximum	h/day	A	20.4 (a)
Surface material silt content	(%)	B	1.6 (b)
Mean vehicle weight	tons	C	130.77 (c)
Vehicle kilometer traveled (VKT)	km/day	D	1,172 (c)
Number of working days	days/year	E	365 (d)
Number of days with precipitation >= 0.2 mm	days/year	F	58 (e)
Emission reduction efficiency	(%)	G	70 (g)

Source: (a) Based on information provided by Fortune in "NICO Mobile Equipment_REVC_without Aker fuel.xlsx" assumed the same operating time as the haul trucks.
(b) Silt Content of roads. Roads are assumed to be lined with limestone. Range of limestone silt content available in AP 42 chapter 13.2.4/table 13.2.4-1.
(c) See Mean Vehicle Weight table below.
(d) Assumed continuous operation.
(e) Value derived from Fortune 2004-2007 onsite meteorological station (Fortune_2004_2007_MetData(Oct8 04 - Sep27 07)_MD.xls).
(f) Snow cover taken from Environment Canada Yellowknife A* (ID 2204100) climate normals.
(g) Includes control efficiency of 70% from watering twice a day extracted from Unpaved Industrial Road Dust Calculator (Environment Canada website, accessed in December 2010).

			PM-30 (TSP)	PM_{10}	$PM_{2.5}$	
Constant (k)	-	H	4.9	1.5	0.15	(a)
Constant (a)	-	I	0.7	0.9	0.9	(a)
Constant (b)	-	J	0.45	0.45	0.45	(a)
Emission factor (uncontrolled)	lb/VMT	K= H*((B/12)*I)^(C/3)^J)*((E-F)/E]	5.50	1.13	0.11	(a)
Emission factor (uncontrolled)	g/VKT	L= K*281.9	1551.64	317.45	31.74	
Emission factor (controlled)	g/VKT	M = K*281.9*(1 - G/100)	465.49	95.23	9.52	(b)
Daily emission rate (uncontrolled)	g/day	N = L*D	1,818,820.65	372,111.25	37,211.13	
Daily emission rate (controlled)	g/day	O = M*D	545,646.20	111,633.38	11,163.34	
Maximum emission rate (uncontrolled)	g/s	P = N/(A*3600)	24.77	5.07	0.51	(c)
Maximum emission rate (controlled)	g/s	Q = O/(A*3600)	7.43	1.52	0.15	(c)
Maximum emission rate (uncontrolled removing precip correction)	g/s	R = P/[(E-F)/E]	29.41	6.02	0.60	
Maximum emission rate (controlled, removing precip correction)	g/s	S = Q/[(E-F)/E]	8.82	1.81	0.18	
Quality rating			B	B	B	

Source: (a) AP-42 / Section 13.2.2 - Unpaved Roads (USEPA, November 2006)/ Equation (1a) - unpaved surfaces at industrial sites and Table 13.2.2-2.
(b) 281.9: constant to convert lb/VMT (pounds per vehicle mile travelled) to g/VKT (grams per vehicle kilometer travelled).
(c) Daily hours of operation is already incorporated into the VKT value.

Mean Vehicle Weight

Equipment	-		Haul Truck	Total	
Weight - Empty	tonne	P	73.98	-	(a)
Weight - Loaded	tonne	Q	163.29	-	(b)
Mean Weight	tonne	R=(P+Q)/2	119	-	
Number of two way trips	number	S = 13,267/(Q-P)	390.73		(c)
Distance of two way trip	km/day	T	3		(d)
Vehicle kilometer traveled (VKT)	km/day	U = S*T	1,172.19	1,172.19	
Percentage of traffic	%		100%	-	
Mean vehicle weight	tonne		118.63	118.63	(e)

Source: (a) Assumed on of the Open Pit haul trucks will be used to take waste rock to CDF, provided by Fortune in "NICO Mobile Equipment_REVC_without Aker fuel.xlsx".
(b) Haul trucks the loaded weight was taken as the maximum specified load in CAT 777F specification sheet.
(c) Number of two way trips is determined by dividing the daily waste rock disposal value (provided in Golder 2010, FEED) by haul truck loaded weight.
(d) Distance of two way trip determined from value provided in HaulTruckKilometers (2).xlsx.
(e) Values weighted according to VKT.

B- Exhaust Emissions

Equipment/Vehicle	Model	Number of Equipment/Vehicle	Daily Use (hours)
Surface rock haulage trucks	Caterpillar 777F/Komatsu HD 785-7	1	17.5
Surface rock haulage trucks	Caterpillar 777F/Komatsu HD 785-7	2	17.5

			SO_2	NO_x	CO	$PM_{2.5}$	PM_{10}	VOC	PAH	CO_2e
Daily emission rate	tonne/day	(refer to mine_fleet_operation)	2.64E-04	0.12	0.040	0.0056	0.0058	0.0060	4.61E-05	31.48

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V - Concentrate Storage

V.1 - Dumping into fine ore bin assumed to be the same as bagging, exhaust to DC-005 (UTM 513427/7046460)

A - Fugitive Emissions

Dust Control Technique		**Bag house**	

Hours of operation per day - maximum	h/day	A	24	(a)
Amount of material handled per day	tonnes/day	B	198.00	(b)
Mean wind speed - maximum daily value	m/s	C	0.60	(c)
Material moisture content	%	D	7	(c)
Constant (a)	-	E	0.0016	(d)
Constant (b)	-	F	1.3	(d)
Constant (c)	-	G	2.2	(d)
Constant (d)	-	H	1.4	(d)
Constant (e)	-	I	2	(d)
Emission reduction efficiency	(%)	J	99	(f)

Source: (a) Operating time of processing plant define by Fortune in an email dated December 23, 2010.
(b) Dry concentrate mass will be approximately 3.6% of incoming ore as detailed in Golder (2010) FEED analysis page 3.
(c) Assumed calmest conditions as allowed by the equation to represent dumping of aggregate material.
(d) Moisture content of ore supplied by Fortune in an email dated November 23, 2010.
(e) AP-42 / 13.2.4 - Aggregate Handling And Storage Piles (USEPA, November 2006)/ equation 1 - emission factor for drop operation.
(f) Bag filter efficiency based on AP-42 / 11.24 - Metallic Minerals Processing (USEPA, August 1982).

			TSP <= 30 um	**PM_{10}**	**$PM_{2.5}$**	**As**	**Bi**	**Co**	**Cu**	
Particle size multiplier	-	K	0.74	0.35	0.053					(a)
Emission factor (uncontrolled)	kg/tonne	L = K*E*((C/G)^F)/((D/I)^H)	4.20E-05	1.99E-05	3.01E-06					
Maximum emission rate (controlled)	g/s	M = B*L*(1-J/100)*1000/(A*3600)	9.62E-07	4.55E-07	6.89E-08					
Elemental component (by mass)	g (element)/g (ore)	N				0.0081	0.0011	9.49E-04	1.81E-04	(b)
Maximum emission rate (controlled)	g/s	O = N*M				7.77E-09	1.07E-09	9.13E-10	1.74E-10	(c)
Quality rating	-		A	A	A					

Source: (a) AP-42 / 13.2.4 - Aggregate Handling And Storage Piles (USEPA, November 2006)/ equation 1 - emission factor for drop operation.
(b) Metal speciation within rock was provided by Fortune in "Appendix IV - results.xlsx". Based on the rock and ore quantities outlined in "Nico Project: Tailings and Mine Rock Co-Disposal Facility FEED study" (Golder 2010) it was assumed that all blasted rock is 26% btw ore and 74% btw waste rock.
(c) Assumed elemental fraction will be calculated from TSP emissions.

V.2 Concentrate Storage

No emissions expected since concentrate will be stored in bags

VI - Concentrate Transport

VI.1 - B-Train concentrate, Access Road

A - Fugitive Emissions

Dust Control Technique		**Assume No Control**	

Surface material silt content	(%)	A	1.6	(a)
Mean vehicle weight	tonnes	B	41.75	(b)
Access Road, Vehicle kilometer traveled (VKT)	km/day	C	316	(b)
Number of working days	days/year	D	365	
Number of days with precipitation >= 0.2 mm	days/year	E	58	(c)
Emission reduction, Access Road	(%)	F	0	

Source: (a) AP-42 / 13.2.4 - Aggregate Handling And Storage Piles (USEPA, November 2006)/ Table 13.2.4-1. Typical silt content of overburden for Western surface coal mine.
(b) Refer to mean vehicle weigth table below.
(c) Value derived from Fortune 2004-2007 onsite meteorological station (Fortune_2004_2007_MetData(Oct8 04 - Sep27 07)_MD.xls).

			PM-30 (TSP)	**PM_{10}**	**$PM_{2.5}$**	
Constant (k)	-	G	4.9	1.5	0.15	(a)
Constant (a)	-	H	0.7	0.9	0.9	(a)
Constant (b)	-	I	0.45	0.45	0.45	(a)
Emission factor (uncontrolled)	lb/VMT	J = G*((A/12)^H)*((B*1.1/3)^I)*((D-E)/D)	3.44	0.70	0.070	(a)
Emission factor (metric uncontrolled)	g/VKT	K = J * 281.9	969.82	198.42	19.84	(b)
Daily emission rate (uncontrolled)	g/day	L = K*C	306,270.32	62,659.63	6,265.96	
Quality rating	-		B	B	B	(a)

Source: (a) AP-42 / Section 13.2.2 - Unpaved Roads (USEPA, November 2006)/ Equation (1a) - unpaved surfaces at industrial sites and Table 13.2.2-2.
(b) 281.9: constant to convert lb/VMT (pounds per vehicle mile travelled) to g/VKT (grams per vehicle kilometer travelled).
(c) Assumed average speed of 30km/hr, continuous operation.

Mean Vehicle Weight

			B-train	**Total**	
Equipment	-				
Weight - Empty	tonne		63.5		(a)
Weight - Loaded	tonne		20.0		(b)
Mean Weight	tonne		41.8		
Number of loads per day	loads/day		5		(c)
Access Road vehicle kilometer travelled (VKT)	km/day		315.80	315.80	(d)
Access Road Percentage of traffic	%		100%		
Mean vehicle weight	tonne		41.75	41.75	

Source: (a) Assumed B-trains will transport material. B-train weight taken as maximum allowable weight from NWT motor vehicles act Section 36 (f)(ii).
(b) Assume empty weight of B train is 20 tonnes.
(c) Information provided by Fortune in an email dated Nov. 26, 2010.
(d) Length of access road taken from EBA report, NICO Mine Access Route Evaluation.

B- Exhaust Emissions

Number of loads	loads/day	A	5	(a)
Vehicle kilometer traveled, Access road (VKT)	km/day	B	316	(b)
Daily fuel consumption	L fuel/day	C	258	(c)

Source: (a) Data provided by Fortune in an email dated November 26, 2010.
(b) Refer to mean vehicle weight table above.
(c) Assumed B-train horsepower at 75 hp and speed of 20 km/h. Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling-- Compression-Ignition (EPA, April 2004).

			SO_2	**NO_x**	**CO**	**VOC**	**$PM_{2.5}$**	**PM_{10}**	
Emission Factor for HDDV8b (modelled in MOBILE)	g/VMT	D	0.0151	8.270	3.796	0.774	0.1674	0.1818	(a)
Emission Factor for HDDV8b (modelled in MOBILE)	g/VKT	E= D/1.609344	0.0094	5.14	2.36	0.48	0.10	0.11	
Access Road Daily Emission Rate	g/day	F = E*B	2.96	1622.81	744.89	151.88	32.85	35.67	

Source: (a) Emission rates based on MOBILE simulation saved to "Winter_Road_Traffic_Emissions.xls".

			PAH	**CO2**	**CH4**	**N2O**	**CO2e**	
Emission Factor	tonne/L	H	4.40E-09	0.0027	1.50E-07	1.10E-06		(a) (b)
Daily emission rate	tonne/day	I = H * C	1.13E-06	0.69	3.86E-05	2.83E-04	7.75E-01	

Source: (a) Technical reference (Golder Associates and Conor Pacific), Table 3-51, p. 94.
(b) Environment Canada, National Inventory Report (1990-2008).

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VI.2 - B-Train concentrate, Tilcho Road

A - Fugitive Emissions

Dust Control Technique		Assume No Control		
Surface material silt content	(%)	A	1.6	(a)
Mean vehicle weight	tonnes	B	41.75	(b)
Tilcho Road, Vehicle kilometer traveled (VKT)	km/day	C	189	(b)
Number of working days	days/year	D	365	
Number of days with precipitation >= 0.2 mm	days/year	E	58	(c)
Emission reduction, Tilcho Road	(%)	F	0	

Source: (a) AP-42 / 13.2.4 - Aggregate Handling And Storage Piles (USEPA, November 2006)/ Table 13.2.4-1. Typical silt content of overburden for Western surface coal mine.
(b) Refer to mean vehicle weight table below.
(c) Value derived from Fortune 2004-2007 onsite meteorological station (Fortune_2004_2007_MetData(Oct8 04 - Sep27 07)_MD.xls).

			PM-30 (TSP)	PM_{10}	$PM_{2.5}$	
Constant (k)	-	G	4.9	1.5	0.15	(a)
Constant (a)	-	H	0.7	0.9	0.9	(a)
Constant (b)	-	I	0.45	0.45	0.45	(a)
Emission factor (uncontrolled)	lb/VMT	J =G*((A/12)^H)*((B*1.1/3)^I)*(D-E)/D)	3.44	0.70	0.07	(a)
Emission factor (metric uncontrolled)	g/VKT	K = J * 281.9	969.82	198.42	19.84	(b)
Daily emission rate	g/day	L = K*C	183,684.61	37,579.91	3,757.99	
Quality rating	-		B	B	B	(a)

Source: (a) AP-42 / Section 13.2.2 - Unpaved Roads (USEPA, November 2006)/ Equation (1a) - unpaved surfaces at industrial sites and Table 13.2.2-2.
(b) 281.9: constant to convert lb/VMT (pounds per vehicle mile travelled) to g/VKT (grams per vehicle kilometer travelled).

Mean Vehicle Weight

Equipment	-		B-train	Total	
Weight - Empty	tonne		63.5		(a)
Weight - Loaded	tonne		20.0		(b)
Mean Weight	tonne		41.8		
Number of loads per day	loads/day		5		(c)
All weather road vehicle kilometer travelled (VKT)	km/day		189.40	189.40	(d)
Access Road Percentage of traffic	%		100%		
Mean vehicle weight	tonne		41.75	41.75	

Source: (a) Assumed B-trains will transport material. B-train weight taken as maximum allowable weight from NWT motor vehicles act Section 36 (f)(ii).
(b) Assume empty weight of B train is 20 tonnes.
(c) Information provided by Fortune in an email dated Nov. 26, 2010.
(d) Length of all weather road taken from EBA report, NICO Mine Access Route Evaluation.

B- Exhaust Emissions

Number of loads	loads/day	A	5	(a)
Vehicle kilometer traveled, Tilcho road (VKT)	km/day	B	189	(b)
Daily fuel consumption	L fuel/day	C	103.00	(c)

Source: (a) Data provided by Fortune in an email dated November 26, 2010.
(b) Refer to mean vehicle weight table above.
(c) Assumed B-train horsepower at 75 hp and speed of 30 km/h. Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling-- Compression-Ignition (EPA, April 2004).

			SO_2	NO_x	CO	VOC	$PM_{2.5}$	PM_{10}	
Emission Factor for HDDV8b (modelled in MOBILE)	g/VMT	D	0.0151	8.270	3.796	0.774	0.1674	0.1818	(a)
Emission Factor for HDDV8b (modelled in MOBILE)	g/VKT	E= D/1.609344	0.0094	5.14	2.36	0.48	0.10	0.11	
Tilcho road Daily Emission rate	g/day	F = E*B	1.78	973.28	446.74	91.09	19.70	21.40	

Source: (a) Emission rates based on MOBILE simulation saved to "Winter_Road_Traffic_Emissions.xls".

			PAH	CO2	CH4	N2O	CO2e	
Emission Factor	tonne/L	H	4.40E-09	0.0027	1.50E-07	1.10E-06		(a) (b)
Daily emission rate	tonne/day	I = H * C	4.53E-07	2.74E-01	1.54E-05	1.13E-04	3.10E-01	

Source: (a) Technical reference (Golder Associates and Conor Pacific), Table 3-51, p. 94.
(b) Environment Canada, National Inventory Report (1990-2008).

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VII - Other Off-site Transport (people, equipment, supplies)

VII.1 - Air transport

A - Fugitive Emissions

Dust Control Technique		**Chemical suppressant (EK35)**		
Pile surface area	ha	A	8.6	(a)
Percentage of time WS >19.3 km/h	%	B	31	(b)
Material silt content	%	C	1.6	(c)
Number of days with precipitation >= 0.2 mm	days/year	D	58	(d)
Constant (a)	-	E	1.9	(e)(g)
Constant (b)	-	F	1.5	(e)
Constant (c)	-	G	365	(e)
Constant (d)	-	H	235	(e)
Constant (e)	-	I	15	(e)
Emission reduction efficiency	(%)	J	80	(f)

Source: (a) Surface area estimated from Golder (2010) Proposed site layout. Assumed runway is elevated 2 m off the ground.
(b) Value derived from Fortune 2004-2007 onsite meteorological station (Fortune_2004_2007_MetData(Oct8 04 - Sep27 07)_MD.xls).
(c) The pile is assumed to be lined with limestone. Range of limestone silt content available in AP 42 chapter 13.2.4/table 13.2.4-1. Limestone will not actually be used but rather crushed rock.
(d) Value derived from Fortune 2004-2007 onsite meteorological station (Fortune_2004_2007_MetData(Oct8 04 - Sep27 07)_MD.xls).
(e) Control of Open Fugitive Dust Source (USEPA, September 1988) / Equation (4-9).
(f) Emission reduction of 80% from chemical suppressant (EK35) extracted from Unpaved Industrial Road Dust Calculator (Environment Canada website, accessed in December 2010).
(g) Constant of 1.7 lb/year/acre converted to 1.9 lb/day/ha by multiplying by 0.454 kg/lb, 1acre/0.405 ha and 1 year/365 days. The 1 year/365 days cancels out the 365 day in the equation listed in EPA (1988).
NOTE: Since Air strip will be elevated it is assumed that the strip will behave as a storage pile.

			TSP <= 30 um	**PM_{10}**	**$PM_{2.5}$**	
Scaling factors	-	K	-	0.5	0.075	(a)
Emission factor (uncontrolled)	kg/d/ha	L = E*(C/F)*((G-D)/H)*(B/I)	5.39	2.69	0.40	(b) (c)
Maximum emission rate (controlled)	g/s	M = L*A*1000*(1-J/100)/(24*3600)	0.11	0.054	0.0081	
Maximum emission rate (controlled, removing precip correction)	g/s	N = E*(C/F)*((G-0)/H)*(B/I)*A*1000*(1-J/100))/(24*3600)	0.13	0.064	0.0096	
Maximum emission rate (uncontrolled)	g/s	O = L*A*1000/(24*3600)	0.54	0.27	0.040	
Maximum emission rate (uncontrolled, removing precip correction)	g/s	P = E*(C/F)*((G-0)/H)*(B/I)*A*1000/(24*3600)	0.64	0.32	0.048	(c)

Source: (a) AP-42/Section 13.2.5 - Industrial Wind Erosion.
(b) TSP calculated according to Control of Open Fugitive Dust Source (USEPA, September 1988) / Equation (4-9).
(c) PM10 and PM2.5 calculated multiplying TSP emission rate by respective scaling factors.

VII.2 - Offsite Transport, Access Road

A - Fugitive Emissions

Dust Control Technique		**Assume no control**		
Surface material silt content	(%)	A	1.6	(a)
Mean vehicle weight	tonnes	B	41.8	(b)
Access Road, Vehicle kilometer traveled (VKT)	km/day	C	568	(b)
Number of working days	days/year	D	365	
Number of days with precipitation >= 0.2 mm	days/year	E	58	(c)
Emission reduction, Access Road	(%)	F	0	

Source: (a) AP-42 / 13.2.4 - Aggregate Handling And Storage Piles (USEPA, November 2006)/ Table 13.2.4-1. Typical silt content of overburden for Western surface coal mine.
(b) Refer to mean vehicle weight table below.
(c) Value derived from Fortune 2004-2007 onsite meteorological station (Fortune_2004_2007_MetData(Oct8 04 - Sep27 07)_MD.xls).

			PM-30 (TSP)	**PM_{10}**	**$PM_{2.5}$**	
Constant (k)	-	G	4.9	1.5	0.15	(a)
Constant (a)	-	H	0.7	0.9	0.9	(a)
Constant (b)		I	0.45	0.45	0.45	(a)
Emission factor (uncontrolled)	lb/VMT	J =G*((A/12)^H)*((B*1.1/3)^I)*(D-E)/D)	3.44	0.70	0.070	(a)
Emission factor (metric uncontrolled)	g/VKT	K = J * 281.9	969.82	198.42	19.84	(b)
Daily Emission rate (uncontrolled)	g/day	L = K*C	551,286.58	112,787.34	11,278.73	
Quality rating	-		B	B	B	(a)

Source: (a) AP-42 / Section 13.2.2 - Unpaved Roads (USEPA, November 2006)/ Equation (1a) - unpaved surfaces at industrial sites and Table 13.2.2-2.
(b) 281.9 constant to convert lb/VMT (pounds per vehicle mile travelled) to g/VKT (grams per vehicle kilometer travelled).

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Mean Vehicle Weight

Equipment	-		B-train	Total	
Weight - Empty	tonne		63.50		(a)
Weight - Loaded	tonne		20.00		(b)
Mean Weight	tonne		41.75		
Number of loads per day	loads/day		9		(c)
Access Road vehicle kilometer travelled (VKT)	km/day		568.44	568.44	(d)
Access Road Percentage of traffic	%		100%		
Mean vehicle weight	tonne		41.75	41.75	

Source: (a) Assumed B-trains will transport material. B-train weight taken as maximum allowable weight from NWT motor vehicles act Section 36 (f)(ii).
(b) Assume empty weight of B train is 20 tonnes.
(c) Information provided by Fortune in an email dated Nov. 26, 2010.
(d) Length of access road and all weather road taken from EBA report, NICO Mine Access Route Evaluation.

B- Exhaust Emissions

Number of loads	loads/year	A	9	(a)
Vehicle kilometer traveled, Access road (VKT)	km/day	B	568	(b)
B-Train, average fuel consumption	L fuel/day	C	463.69	(c)

Source: (a) Data provided by Fortune in an email dated November 26, 2010.
(b) Refer to mean vehicle weight in section A.
(c) Assumed B-train horsepower at 75 hp, and speed of 20 km/h. Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling-- Compression-Ignition (EPA, April 2004).

			SO_2	NO_x	CO	VOC	$PM_{2.5}$	PM_{10}	
Emission Factor for HDDV8b (modelled in MOBILE)	g/VMT	D	0.0151	8.270	3.796	0.774	0.1674	0.1818	(a)
Emission Factor for HDDV8b (modelled in MOBILE)	g/VKT	E= D/1.609344	0.0094	5.14	2.36	0.48	0.10	0.11	
Access Road Daily Emission Rate	g/day	F = E*B	5.33	2,921.07	1,340.79	273.39	59.13	64.21	

Source: (a) Emission rates based on MOBILE simulation saved to "Winter_Road_Traffic_Emissions.xls".

			PAH	CO2	CH4	N2O	CO2e	
Emission Factor	tonne/L	H	4.40E-09	0.0027	1.50E-07	1.10E-06		(a) (b)
Daily emission rate	tonne/day	I = H * C	2.04E-06	1.23	6.96E-05	5.10E-04	1.39E+00	

Source: (a) Technical reference (Golder Associates and Conor Pacific), Table 3-51, p. 94.
(b) Environment Canada, National Inventory Report (1990-2008).

VII.3 - Offsite Transport, Tilcho road

A - Fugitive Emissions

Dust Control Technique		**Assume no control**

Surface material silt content	(%)	A	1.6	(a)
Mean vehicle weight	tonnes	B	41.8	(b)
Tilcho Road, Vehicle kilometer traveled (VKT)	km/day	C	341	(b)
Number of working days	days/year	D	365	
Number of days with precipitation >= 0.2 mm	days/year	E	58	(c)
Emission reduction, Tilcho Road	(%)	F	0	

Source: (a) AP-42 / 13.2.4 - Aggregate Handling And Storage Piles (USEPA, November 2006)/ Table 13.2.4-1. Typical silt content of overburden for Western surface coal mine.
(b) Refer to mean vehicle weight table below.
(c) Value derived from Fortune 2004-2007 onsite meteorological station (Fortune_2004_2007_MetData(Oct8 04 - Sep27 07)_MD.xls).

			PM-30 (TSP)	PM_{10}	$PM_{2.5}$	
Constant (k)	-	G	4.9	1.5	0.15	(a)
Constant (a)	-	H	0.7	0.9	0.9	(a)
Constant (b)	-	I	0.45	0.45	0.45	(a)
Emission factor (uncontrolled)	lb/VMT	J =G*((A/12)^H)*((B*1.1/3)^I)*(D-E)/D	3.44	0.70	0.07	(a)
Emission factor (metric uncontrolled)	g/VKT	K = J * 281.9	969.82	198.42	19.84	(b)
Daily emission rate	g/day	L = K * C	330,632.29	67,643.83	6,764.38	
Quality rating	-		B	B	B	(a)

Source: (a) AP-42 / Section 13.2.2 - Unpaved Roads (USEPA, November 2006)/ Equation (1a) - unpaved surfaces at industrial sites and Table 13.2.2-2.
(b) 281.9 constant to convert lb/VMT (pounds per vehicle mile travelled) to g/VKT (grams per vehicle kilometer travelled).

Mean Vehicle Weight

Equipment	-		B-train	Total	
Weight - Empty	tonne		63.50		(a)
Weight - Loaded	tonne		20.00		(b)
Mean Weight	tonne		41.75		
Number of loads per day	loads/day		9		(c)
All weather road vehicle kilometer travelled (VKT)	km/day		340.92	340.92	(d)
Access Road Percentage of traffic	%		100%		
Mean vehicle weight	tonne		41.75	41.75	

Source: (a) Assumed B-trains will transport material. B-train weight taken as maximum allowable weight from NWT motor vehicles act Section 36 (f)(ii).
(b) Assume empty weight of B train is 20 tonnes.
(c) Information provided by Fortune in an email dated Nov. 26, 2010.
(d) Length of access road and all weather road taken from EBA report, NICO Mine Access Route Evaluation.

B- Exhaust Emissions

Number of loads	loads/year	A	9	(a)
Vehicle kilometer traveled, Tilcho road (VKT)	km/day	B	341	(b)
B-Train, average fuel consumption	L fuel/day	C	185.40	(c)

Source: (a) Data provided by Fortune in an email dated November 26, 2010.
(b) Refer to mean vehicle weight in section A.
(c) Assumed B-train horsepower at 75 hp, and speed of 30 km/h. Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling-- Compression-Ignition (EPA, April 2004).

			SO_2	NO_x	CO	VOC	$PM_{2.5}$	PM_{10}	
Emission Factor for HDDV8b (modelled in MOBILE)	g/VMT	D	0.0151	8.270	3.796	0.774	0.1674	0.1818	(a)
Emission Factor for HDDV8b (modelled in MOBILE)	g/VKT	E= D/1.609344	0.0094	5.14	2.36	0.48	0.10	0.11	
Tilcho road Daily Emission rate	g/day	F = E*B	3.20	1,751.90	804.14	163.96	35.46	38.51	

Source: (a) Emission rates based on MOBILE simulation saved to "Winter_Road_Traffic_Emissions.xls".

			PAH	CO2	CH4	N2O	CO2e	
Emission Factor	tonne/L	H	4.40E-09	0.0027	1.50E-07	1.10E-06		(a) (b)
Daily emission rate	tonne/day	I = H * C	8.16E-07	4.94E-01	2.78E-05	2.04E-04	5.58E-01	

Source: (a) Technical reference (Golder Associates and Conor Pacific), Table 3-51, p. 94.
(b) Environment Canada, National Inventory Report (1990-2008).

Air Quality Assessment - NICO Project
Calculation of Emissions During the Operation Phase

VIII - Support Activities

VIII.1 - Power Generation

C - Combustion Emissions

Control Technique		**No Control**

Hours of operation per day	h/day	A	24	(a)
Sulphur content in the fuel	%	B	0.0015	(b)
Number of power generators	-	C	8	(c)
Maximum fuel consumption	g/bkW-h	D	200	(c)
Generator power Rating	kW	E	1,450	(c)
Maximum power output	KW	F= C*E	11,600	
Diesel heating value	Btu/lb	G	19,300	(d)
Maximum fuel consumption	g/h	H=F*D	2.32E+06	
Power within fuel	GW	I=H/453.5924*G*2.93e-10	0.029	

Source: (a) Assumed continuous operation.
(b)Based on Canada's Sulphur in Diesel Fuel Regulations for off-road diesel Fuel effective from October 1, 2010 (Environmental Canada website last updated December 2, 2010, accessed in December, 2010).
(c) Information provided by Fortune in "Fortune Minerals NICO Project Aker Solutions Specification 1832-M-193 Finning Modular Power Station".
(d) AP-42 / 3.4 - Large Stationary Diesel And All Stationary Dual-fuel Engines (USEPA, October 2006).

			TSP (a)	**PM10**	**PM2.5 (c)**	**NOx (d)**	**CO**	**SOx (e)**	**CO2**	**VOC**	**PAH**	
Emission factor (uncontrolled)	lb/MMBTU	J	0.062	0.0573	5.73E-02	3.2	0.85	0.001515	165	0.0042	2.11E-04	(b)
Emission factor (uncontrolled)	g/GW-h	K= J*453.59/0.00029307	95,958.72	88,684.43	88,684.43	4,952,708.34	1,315,563.15	2,344.80	255,374,021.57	6,426.11	326.01	
Maximum Emission rate (uncontrolled)	g/s	L=K*I/3600	0.77	0.71	0.71	39.80	10.57	0.019	2052.23	0.052	0.0026	
Maximum Emission rate per boiler	g/s/boiler	M=L/C	0.096	0.089	0.089	4.98	1.32	0.0024	256.53	0.0065	3.27E-04	

Source: (a) TSP is for filterable particulates.
(b) AP-42 / 3.4 - Large Stationary Diesel And All Stationary Dual-fuel Engines (USEPA, October 2006)/ Table 3.4-1 -Table 3.4-4.
(c) Emission factors for PM10 and PM2.5 are assumed to be the same.
(d) Emission factor for NOx corresponds to uncontrolled equipment (i.e., without ignition timing retard).
(e) Emission factor for SO2 calculated based on the equation EF_SO2 =1.01*S, where S is the fuel sulphur content, according to AP-42 / 3.4 - Large Stationary Diesel And All Stationary Dual-fuel Engines (USEPA, October 2006)/ Table 3.4-1.

			N2O	**CH4**	**CO_2e**	
GHG Emission factor for fuel combustion	g/L	N	0.4	0.133		(a)
Maximum GHG emissions	g/s	O=H/(7.1*453/3.78)*N/3600	0.30	0.10	2148.28	(b)
GHG emissions	g/s/boiler	P=O/C	0.038	0.013	268.53	

Source: (a) Emission factors for N2O and CH4 taken from Environment Canada, National Inventory Report 1990-2008, Part 2 (2010), Table A8-4.
(b) Diesel fuel density used was 7.1 lb/gallon as specified in AP-42 Chapter 3, table 3.4-1.

VIII.2 - Incineration

C - Combustion Emissions

Control Technique		No Scrubber

Waste Generation, Operation	kg/day	A	470 (a)
Operation hours	hour/day	B	8 (a)
Waste Oil Burning	L/hour	C	10 (a)
Sulphur Content of Oil	%	D	1 (b)
Diesel Burning	L/hour	E	45 (a)
Sulphur Content of diesel	%	F	0.0015 (c)
Diesel heating value	Btu/lb	G	19,300 (d)
Diesel density	lb/gallon	H	7.1 (d)

Source: (a) Information provided by Fortune in an email dated November 29, 2010, burns 8 hours every 2 days.
(b) Assumed that the sulphur content was the 1 % as regulated in Ontario.
(c) Based on Canada's Sulphur in Diesel Fuel Regulations for off-road diesel Fuel effective from October 1, 2010 (Environmental Canada website last updated December 2, 2010, accessed in December, 2010).
(d) AP-42 / 3.4 - Large Stationary Diesel And All Stationary Dual-fuel Engines (USEPA, October 2006).

C.1 Incinerator Fuel oil Combustion

			NOx	CO	SO2	PM	PM10	PM2.5	VOC	PAH	DIOXIN/FURAN	P	Se	V	Zn	CO2	N2O	CH4	
AP-42 Emission factors for pollutants not included in stack test	g/L	I	6.59	0.60	18.81	1.49	1.05	0.77	0.0040	1.43E-04	3.71E-10	0.0011	8.18E-05	0.0038	0.0035	3124.00	0.064	0.12	(a) through (g)
Maximum emission rate	mg/s	J = I*C/3600*1000	18.31	1.66	52.26	4.13	2.93	2.13	0.011	3.96E-04	1.03E-09	0.0031	2.27E-04	0.011	0.0097	8677.78	0.18	0.33	

Source: (a) NOx, CO, SO2, and PM emissions are assumed to be for boilers<100 Million BTU/hour burning Fuel Oil 6.
(b) PM10 and PM2.5 are assumed to be fur utility boiler firing residual oil for fuel oil 6.
(c) For Fuel Oil Combustion VOC included are for Benzene, Ethylbenzene, Formaldehyde, 1,1,1-trichlorethane and o-xylene from AP-42 chapter 1.3/Table 1.3.9.
(d) For Fuel Oil PAH included are Naphthalene, Acenaphthene, Acenaphthylene, Anthracene, Benzo(a)Anthracene, Benzo(b,k)fluoranthene, Benzo(g,h,i)Perylene, Chrysene, Dibenzo(a,h)Anthracene, Fluoranthene, Fluorene, Indeo(1,2,3-cd)Pyrene, Phenanthrene and Pyrene from AP-42 chapter 1.3/Table 1.3.9.
(e) Dioxins/furans included is octachlorodibenzodioxin from AP-42 chapter 1.3/Table 1.3.9.
(f) For Fuel Oil metal emissions taken from AP-42 chapter 1.3/Table 1.3-11.
(g) Emission factors for N2O and CH4 taken from Environment Canada, National Inventory Report 1990-2008, Part 2 (2010), Table A8-4, Industrial.

			Sb	As	Ba	Be	Cd	Cr	Cr 6	Co	Cu	Pb	Mn	Hg	Mo	Ni
AP-42 Emission factors for pollutants not included in stack test	g/L	K	6.29E-04	1.58E-04	3.08E-04	3.33E-06	4.77E-05	1.01E-04	2.97E-05	7.21E-04	2.11E-04	1.81E-04	3.59E-04	1.35E-05	9.43E-05	0.010
Maximum emission rate	mg/s	L= D*C/3600*1000	0.0017	4.39E-04	8.55E-04	9.25E-06	1.32E-04	2.81E-04	8.25E-05	0.0020	5.86E-04	5.03E-04	9.99E-04	3.76E-05	2.62E-04	0.028

Source: (a) Emission factors taken from AP-42 chapter 1, Table 1.3-11.

C.2 Incinerator Diesel Fuel Combustion

			TSP (a)	PM10	PM2.5 (c)	NOx (d)	CO	SOx (e)	CO2	PAH	VOC	
AP-42 Emission factors for Pollutants	lb/MMBtu (fuel input)	M	0.062	0.057	0.057	3.20	0.85	0.0015	165.00	2.11E-04	0.0042	(b)
Maximum emission Rate	mg/s	N=E*H/3.785*G/10^6*M*453,592.4/3600	12.73	11.76	11.76	656.79	174.46	0.31	3.39E+04	0.043	0.85	

Source: (a) TSP is for filterable particulates.
(b) AP-42 / 3.4 - Large Stationary Diesel And All Stationary Dual-fuel Engines (USEPA, October 2006)/ Table 3.4-1 -Table 3.4-4.
(c) Emission factors for PM10 and PM2.5 are assumed to be the same.
(d) Emission factor for NOx corresponds to uncontrolled equipment (i.e., without ignition timing retard).
(e) Emission factor for SO2 calculated based on the equation EF_SO2 = 1.01*S, where S is the fuel sulphur content, according to AP-42 / 3.4 - Large Stationary Diesel And All Stationary Dual-fuel Engines (USEPA, October 2006)/ Table 3.4-1.

			N2O	CH4	
GHG Emission factor for diesel combustion	g/L	O	0.4	0.133	(a)
Maximum GHG emissions	mg/s	P=E*O/3600*1000	5.00	1.66	

Source: (a) Emission factors for N2O and CH4 taken from Environment Canada, National Inventory Report 1990-2008, Part 2 (2010), Table A8-4.

C.3 Incinerator Stack Test Data

			SVOC1	SVOC 2	SVOC 3	Part/M-1	Part/M-2	Part/M-3	
Flow Rate, at stack O2 content, dry, 25'C and 101.325 kPa	m3/min	Q	71.64	65.73	67.74	66.79	66.72	67.04	(a)
Oxygen Content	% volume of O2	R	13.90	13.90	14.80	15.20	14.70	14.30	(a)

Source: (a) Cianciarelli, D. & C. House. 2003. Characterization of Emissions From the Eco Waste Solutions Thermal Waste Oxidizer Burlington, Ontario. Report ERMD 2002-03. Prepared for Emissions Research and Measurement Division a department of Environment Canada.

			SO_2	NO_x	CO	PM	VOC	HCl	HF	PCDD/PCDF	PAH	CO2	
SVOC1, stack test concentration	mg/m3	S	0.00	33.88	0.00	-	4.03	-	-	7.04949E-09	3.86E-05	80,953.51	(a)(b)
SVOC 2, stack test concentration	mg/m3	T	3.70	38.68	2.43	-	1.97	-	-	2.52707E-08	3.49E-05	80,953.51	(a)(b)
SVOC 3, stack test concentration	mg/m3	U	0.00	33.71	2.82	-	0.95	-	-	4.3729E-08	1.47E-05	66,561.77	(a)(b)
Part/M-1, stack test concentration	mg/m3	V	0.00	39.64	5.93	3.45	-	55.85	1.90	-	-	57,566.94	(a)(b)
Part/M-2, stack test concentration	mg/m3	W	0.00	39.64	4.30	1.82	-	70.77	2.51	-	-	64,762.80	(a)(b)
Part/M-3, stack test concentration	mg/m3	X	0.00	41.81	3.05	15.13	-	174.67	1.13	-	-	80,953.51	(a)(b)
SVOC1, stack test flow rate	mg/s.	Y= Q*S/60	0.00	40.45	0	-	4.81	-	-	8.4171E-09	4.6E-05	96,658.49	
SVOC 2, stack test flow rate	mg/s.	Z = Q*T/60	4.06	42.37	2.66	-	2.15	-	-	2.76841E-08	3.8E-05	88,684.57	
SVOC 3, stack test flow rate	mg/s.	A' = Q*U/60	0.00	38.05	3.19	-	1.07	-	-	4.937E-08	1.7E-05	75,148.24	
Part/M-1, stack test flow rate	mg/s.	B' = Q*V/60	0.00	44.13	6.60	3.85	-	62.17	2.12	-	-	64,081.60	
Part/M-2, stack test flow rate	mg/s.	C' = Q*W/60	0.00	44.07	4.78	2.02	-	78.69	2.79	-	-	72,016.24	
Part/M-3, stack test flow rate	mg/s.	D' = Q*X/60	0.00	46.72	3.41	16.91	-	195.16	1.27	-	-	90,452.05	
Number of Samples for each pollutant	number	E'	6	6	6	3	3	3	3	3	3	6	
Average flow rate	mg/s	F'=(Y+Z+A'+B'+C'+D')/E'	0.68	42.63	3.44	7.59	2.68	112.01	2.06	2.85E-08	3.36E-05	81,173.53	
Daily flow rate	tonne/day	G' = E'/10^9*3600*B	1.95E-05	0.0012	9.91E-05	2.19E-04	7.71E-05	0.0032	5.92E-05	8.21E-13	9.69E-10	2.34	

Source: (a) Cianciarelli, D. & C. House. 2003. Characterization of Emissions From the Eco Waste Solutions Thermal Waste Oxidizer Burlington, Ontario. Report ERMD 2002-03. Prepared for Emissions Research and Measurement Division a department of Environment Canada.
(b) Concentrations have been corrected to dry, 25'C, 101.325 kPa and sample O2 content.

			Hg	Sb	As	Ba	Be	Cd	Cr	Co	Cu	Pb	Mn	Ni	Se	Ag	Tl	Zn	
Part/M-1, stack test concentration	mg/m3	V	0.0064	0.019	5.18E-04	1.15E-04	0.00	0.012	0.033	1.73E-04	0.079	0.036	0.0067	0.0017	0.0012	0.0019	0.00	0.033	(a)(b)
Part/M-2, stack test concentration	mg/m3	W	0.045	0.058	5.64E-04	0.0020	0.00	0.022	0.031	1.25E-04	0.10	0.10	0.0065	0.0017	0.0017	0.0022	0.00	0.055	(a)(b)
Part/M-3, stack test concentration	mg/m3	X	0.0031	0.061	0.0015	0.0035	0.00	0.20	0.036	3.33E-04	0.23	0.34	0.014	0.0068	0.0024	0.0029	0.00	0.18	(a)(b)
Part/M-1, stack test flow rate	mg/s.	B' = Q*V/60	0.0072	0.021	5.77E-04	1.28E-04	0.00	0.014	0.036	1.92E-04	0.088	0.040	0.0074	0.0019	0.0013	0.0021	0.00	0.037	(a)(b)
Part/M-2, stack test flow rate	mg/s.	C' = Q*W/60	0.050	0.064	6.27E-04	0.0022	0.00	0.025	0.034	1.39E-04	0.11	0.11	0.0072	0.0019	0.0019	0.0024	0.00	0.061	
Part/M-3, stack test flow rate	mg/s.	D' = Q*X/60	0.0035	0.068	0.0016	0.0039	0.00	0.23	0.040	3.72E-04	0.26	0.38	0.016	0.0076	0.0027	0.0032	0.00	0.20	
Number of Samples for each pollutant	number	E'	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	
Average flow rate	mg/s.	F'=(B'+C'+D')/E'	0.020	0.051	9.47E-04	0.0021	0.00	0.088	0.037	2.35E-04	0.15	0.18	0.010	0.0038	0.0020	0.0026	0.00	0.10	
Daily flow rate	tonne/day	G' = E'/10^9*3600*B	5.85E-07	1.47E-06	2.73E-08	6.05E-08	0.00	2.54E-06	1.06E-06	6.76E-09	4.38E-06	5.13E-06	2.91E-07	1.09E-07	5.67E-08	7.45E-08	0.00	2.90E-06	

Source: (a) Cianciarelli, D. & C. House. 2003. Characterization of Emissions From the Eco Waste Solutions Thermal Waste Oxidizer Burlington, Ontario. Report ERMD 2002-03. Prepared for Emissions Research and Measurement Division a department of Environment Canada.
(b) Concentrations have been corrected to dry, 25'C, 101.325 kPa and sample O2 content.

TOTAL INCINERATOR

			SO_2	NO_x	CO	PM	PM2.5	PM10	VOC	HCl	HF	PCDD/PCDF	PAH	CO2	N2O	CH4	P
Average flow rate mg/s	mg/s	H'=F'+P+N+L+J	53.24	717.73	179.57	24.45	21.48	22.28	3.54	112.01	2.06	2.95E-08	0.044	123,717.18	5.18	2.00	0.0031
Daily flow rate	tonne/day	I' = H'/10^9*3600*8	0.0015	0.021	0.0052	7.04E-04	6.19E-04	6.42E-04	1.02E-04	0.0032	5.92E-05	8.50E-13	1.26E-06	3.56	1.49E-04	5.75E-05	9.07E-08

			Hg	Sb	As	Ba	Be	Cd	Cr	Co	Cu	Pb	Mn	Ni	Se	Ag	Tl	Zn	V
Average flow rate mg/s	mg/s	H'=F'+P+N+L+J	0.020	0.053	0.0014	0.0030	9.25E-06	0.088	0.037	0.0022	0.15	0.18	0.011	0.032	0.0022	0.0026	0.00	0.11	0.011
Daily flow rate	tonne/day	I' = H'/10^9*3600*8	5.86E-07	1.52E-06	3.99E-08	8.52E-08	2.66E-10	2.54E-06	1.07E-06	6.45E-08	4.40E-06	5.15E-06	3.20E-07	9.19E-07	6.33E-08	7.45E-08	0.00	3.18E-06	3.05E-07

			Mo	CO_2e
Average flow rate mg/s	mg/s	H'=F'+P+N+L+J	2.62E-04	125,364.20
Daily flow rate	tonne/day	I' = H'/10^9*3600*8	7.54E-09	3.61

VIII.3 - Heating

A glycol-based heat recovery system connected to the power generation units will be used to provide heated ventilation when necessary. Therefore, no direct emissions from the mine and building heating system are expected.

VIII.4 - Other vehicles

B- Exhaust Emissions

Equipment/Vehicle	Model	Number of Equipment/Vehicle	Daily Use (hours)
Portable Light Stands	Boss Hawg 8MHP104MH-40FT, Perkins Genset	2	12.0
Personnel Carrier	Chevrolet Express 2500 Standard, or equivalent	1	1.9
Light Duty Truck	Ford F-250, or equivalent	1	3.8
Light Duty Truck	Ford F-250, or equivalent	1	3.8
Light Duty Truck	Ford F-250, or equivalent	1	3.8
Portable Light Stands	Boss Hawg 8MHP104MH-40FT, Perkins Genset	1	12.0
Rough Terrain Crane; 36.2 tonnes	Manitowoc (Grove) RT540E type; or Equivalent	1	1.2
Integrated Tool Carrier	Caterpillar IT24F	1	3.8
Fuel & Lube Truck	Western Star 4900 SA; or Equivalent	1	3.8
Boom Truck (Alternative "Hiab Truck")	Western Star 4900 SA; or Equivalent	1	1.9
Welding Truck	Ford F-450 Crew Cab Flat Deck; or equivalent	1	3.8
Light Duty Truck	Ford F-250 Crewcab, or equivalent	1	1.9
Light Duty Truck	Ford F-250, or equivalent	1	1.9
Mine Ambulance	Chevrolet Express 2500 Standard, or equivalent	1	0.2
Fire Truck	Ford F-450 Crew Cab Flat Deck; or equivalent	1	0.2
Fire Truck, Pumps/Foam Package	Fire Truck, Pumps/Foam Package	1	0.2
Light Duty Truck, Diesel	Ford F-250 Supercab, or equivalent	1	1.9
Light Duty Truck	Ford F-250 Crewcab, or equivalent	1	1.9
Light Duty Truck	Ford F-250, or equivalent	1	1.9
Light Duty Truck	Ford F-250, or equivalent	2	1.9
Community Bus	Girardin Minibus Inc; 300D	1	3.8
Light Duty Truck	Ford F-250 Crewcab, or equivalent	1	1.9
Telescopic Handler	Caterpillar TL943; or Equivalent	1	1.9
Self Propelled Telescopic Boom	Terex Genie; or Equivalent	1	1.9
Scissor Lift, Rough Terrain	Genie Scissor lift RT 2668; or Equivalent	1	3.8
Scissor Lift, Rough Terrain	Genie Scissorlift RT 2668; or Equivalent	2	4.0
Light Duty Truck	Ford F-250 Crewcab, or equivalent	1	12.0
Portable Pipe Fusion Machine	McElroy Rolling 250/TracStar 250	1	1.2
Tracked Mobile Jaw Crusher	Sandvik QJ340; or equivalent	1	1.2
Tracked Mobile Cone Crusher	Sandvik QH 440; or equivalent	1	1.2
Tracked Mobile Screening Plant	Sandvik QA 450; or equivalent	1	1.2
Excavator	Caterpillar 345 BL	1	1.2
Backhoe	Caterpillar 450E; or Equivalent	1	1.2
Self Propelled Telescopic Boom	Terex Genie; or Equivalent	2	4.0

			SO_2	NO_x	CO	$PM_{2.5}$	PM_{10}	VOC	PAH	CO_2e
Daily emission rate	tonne/day	(refer to mine_fleet_operation)	1.23E-04	0.059	0.022	0.0028	0.0029	0.0031	2.15E-05	14.68

A - Fugitive Emissions

Air Quality Assessment - NICO Project

Summary of Daily Maximum (Winter) Emissions During the Closure Phase

Description	Source	Type	Emission Rate (kg/day)													
			TSP	PM10	PM2.5	SO2	NOx	CO	VOC	PAH	CO2e	DIOXIN/FURAN	As	Bi	Co	Cu
I - Land Clearing and Debris Removal	I.1 - General land clearing	A - Fugitive Emissions	1.50E+02	4.92E+01	1.58E+01	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		B- Exhaust Emissions	5.06E-01	5.06E-01	4.91E-01	2.20E-02	1.00E+01	3.56E+00	6.02E-01	3.84E-03	2.63E+03	N/A	N/A	N/A	N/A	N/A
	I.2 - Loading of land clear debris	A - Fugitive Emissions	1.06E+01	5.49E+00	1.11E+00	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		B- Exhaust Emissions	4.30E-01	4.30E-01	4.17E-01	2.37E-02	9.09E+00	2.98E+00	4.50E-01	4.15E-03	2.83E+03	N/A	N/A	N/A	N/A	N/A
II - CDF Cover	II.1 - Bulldozer	A - Fugitive Emissions	5.00E+01	1.64E+01	5.25E+00	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		B- Exhaust Emissions	2.01E-01	2.01E-01	1.95E-01	9.18E-03	4.49E+00	1.53E+00	2.11E-01	1.60E-03	1.10E+03	N/A	N/A	N/A	N/A	N/A
	II.2 - Material Handling (burrows)	A - Fugitive Emissions	3.88E-01	1.84E-01	2.78E-02	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		B- Exhaust Emissions	2.39E-01	2.39E-01	2.31E-01	9.12E-03	3.72E+00	2.23E+00	2.75E-01	1.59E-03	1.09E+03	N/A	N/A	N/A	N/A	N/A
	II.3- Loading of material onto trucks	A - Fugitive Emissions	1.18E+01	6.11E+00	1.23E+00	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		B- Exhaust Emissions	2.79E-01	2.79E-01	2.71E-01	1.54E-02	6.24E+00	2.13E+00	2.93E-01	2.70E-03	1.84E+03	N/A	N/A	N/A	N/A	N/A
	II.4 Hauling material from burrows to CDF	A - Fugitive Emissions	4.20E+02	1.75E+02	1.75E+01	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		B- Exhaust Emissions	1.55E+00	1.55E+00	1.50E+00	7.06E-02	3.29E+01	1.09E+01	1.62E+00	1.23E-02	8.43E+03	N/A	N/A	N/A	N/A	N/A
	II.5 - Material Handling (CDF)	A - Fugitive Emissions	3.88E-01	1.84E-01	2.78E-02	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		B- Exhaust Emissions	7.38E-02	7.38E-02	7.16E-02	3.69E-03	1.65E+00	5.63E-01	7.73E-02	6.45E-04	4.40E+02	N/A	N/A	N/A	N/A	N/A
III - General Closure	III.1 - Vehicular traffic	A - Fugitive Emissions	3.63E+02	1.51E+02	1.51E+01	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		B- Exhaust Emissions	8.29E+00	8.29E+00	8.04E+00	2.67E-01	1.68E+02	6.39E+01	7.55E+00	4.67E-02	3.19E+04	N/A	N/A	N/A	N/A	N/A
Total			**1,017.15**	**415.00**	**67.22**	**0.42**	**236.14**	**87.75**	**11.08**	**0.074**	**50,289.02**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**

N/A- No applicable emission

Description	Emission Rate (kg/day)													
	TSP	PM10	PM2.5	SO2	NOx	CO	VOC	PAH	CO2e	DIOXIN/FURAN	As	Bi	Co	Cu
I - Land Clearing and Debris Removal	161.58	55.58	17.78	0.046	19.11	6.53	1.05	0.0080	5,461.82	N/A	N/A	N/A	N/A	N/A
II - CDF Cover	484.70	200.08	26.30	0.11	49.04	17.32	2.47	0.019	12,900.33	N/A	N/A	N/A	N/A	N/A
III - General Closure	370.87	159.33	23.15	0.27	167.99	63.89	7.55	0.047	31,926.88	N/A	N/A	N/A	N/A	N/A
Total	**1,017.15**	**415.00**	**67.22**	**0.42**	**236.14**	**87.75**	**11.08**	**0.074**	**50,289.02**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**

N/A- No applicable emission

Air Quality Assessment - NICO Project
Calculation of Emissions During the Closure Phase

I - Land Clearing and Debris Removal

I.1 - General land clearing

A - Fugitive Emissions

Dust Control Technique		**No control**

Number of equipment	pc	A	3	(a)
Hours of operation per day - peak	h/day	B	6.0	(b)
Material silt content	(%)	C	56	(c)
Material moisture content	(%)	D	16.8	(d)
Emission reduction efficiency	(%)	E	0	

Source: (a) Assumed similar vehicles as in the construction phase. Information provided by Fortune in "NICO Mobile Equipment_REVC_without Aker fuel.xlsx"; it was assumed that a skidder, harvester and dozer was used.
(b) Numbers of work hours per day taken as the maximum construction equipment operation for a tractor/dozer.
(c) Material silt content taken as average silt content of the till and glacio-lacustrine deposit from Golder FEED document.
(d) Moisture content taken as the maximum overburden moisture content from AP 42 chapter 11.9 Western surface Coal Mine/ Table 11.9-3 (Metric and English Units). Typical Values For Correction Factors Applicable to the Predictive Emission Factor Equations.

			TSP <= 30 um	**TSP <= 15 um**	**PM_{10}**	**$PM_{2.5}$**	
Constant (a)	-	F	2.6	0.45	-	-	(a)
Constant (b)	-	G	1.2	1.5	-	-	(a)
Constant (c)	-	H	1.3	1.4	-	-	(a)
Scaling factor		I	-	-	0.75	0.105	(a) (b)
Emission rate (uncontrolled)	g/hr	J = F*(C^G)/(D^H)*1000*A	24,946.99	10,893.89	8,170.41	2,619.43	(a) (c)
Emission rate (controlled)	g/hr	K = J*(1-E/100)	24,946.99	10,893.89	8,170.41	2,619.43	
Daily emission rate (uncontrolled)	g/day	L = J*B	150,092.03	65,542.39	49,156.79	15,759.66	
Daily emission rate (controlled)	g/day	M = K*B	150,092.03	65,542.39	49,156.79	15,759.66	
Maximum emission rate (uncontrolled)	g/s	N = L/(B*3600)	6.93	3.03	2.27	0.73	
Maximum emission rate (controlled)	g/s	O = M/(B*3600)	6.93	3.03	2.27	0.73	
Quality rating	-		B	C	D	D	

Source: (a) AP-42 / Section 11.9 - Western Surface Coal Mining (USEPA, October 1998) / Table 11.9-2 (Metric Units) - Emission Factor Equations for Uncontrolled Open Dust Sources at Western Surface Coal Mines (bulldozing overburden). According to recommendations in AP-42 / Section 13.2.3 - Heavy Construction Operations (USEPA, January 1995) / Table 13.2.3-1 - Recommended Emission Factors for Construction Operations (reference to dozer equation (overburden) in Section 11.9 / Table 11.9.2).
(b) Scaling factor to convert TSP <= 30 um to $PM_{2.5}$ and TSP <= 15 um to PM_{10}.
(c) PM10 and PM2.5 calculated multiplying TSP emission rates by respective scaling factors.

B- Exhaust Emissions

Equipment/Vehicle	**Model**	**Number of Equipment/Vehicle**	**Daily Use**
Skidder	Caterpillar 527; or equivalent	1	3.0
Harvester	Caterpillar 501 HD Track Harvester; or equivalent	1	3.0
Track-dozer	Caterpillar D8T/Komatsu D155AX-6	1	6.0

			SO_2	**NO_X**	**CO**	**$PM_{2.5}$**	**PM_{10}**	**VOC**	**PAH**	**CO_2e**
Daily emission rate	tonne/day	(refer to Construction combustion)	2.20E-05	0.010	0.0036	4.91E-04	5.06E-04	6.02E-04	3.84E-06	2.63

I.2 - Loading of land clear debris

A - Fugitive Emissions

Dust Control Technique		**No control**

Hours of operation per day	h/day	A	6.0	(a)
Amount of debris removed per day	tonnes/day	B	586.5	(b)
Emission reduction efficiency	(%)	C	0	

Source: (a) Assume similar equipment as in construction phase. Numbers of work hours per day taken as the maximum construction equipment operation for a wheeled front end loading.

(b) Information based on construction specifications (GOLDER), 175,000 m^3 of topsoil removed.

			TSP	**PM_{10}**	**$PM_{2.5}$**	
Emission factor (uncontrolled)	kg/tonne	D	0.018	0.0094	0.0019	(a) (b) (c)
Daily emission rate (controlled)	g/day	E = B*D*1000*(1-C/100)	10,556.74	5,489.51	1,108.46	
Daily emission rate (uncontrolled)	g/day	F = B*D*1000	10,556.74	5,489.51	1,108.46	
Maximum emission rate (controlled)	g/s	G = E/(A*3600)	0.49	0.25	0.051	
Maximum emission rate (uncontrolled)	g/s	H = F/(A*3600)	0.49	0.25	0.051	
Quality rating	-		E	-	-	

Source: (a) TSP emission factor extracted from AP-42 / Section 11.9 - Western Surface Coal Mining (USEPA, October 1998) / Table 11.9.4 - Uncontrolled Particulate Emission Factors for Open Dust Sources at Western Surface Coal Mine (truck loading by power shovel (batch drop) / overburden).

(b) Emission factor for PM_{10} based on the ratio between TSP and PM_{10} emission factors for blasting in AP-42 / Section 11.9 - Western Surface Coal Mining (USEPA, October 1998) / Table 11.9-2 (Metric Units) - Emission Factor Equations for Uncontrolled Open Dust Sources at Western Surface Coal Mines.

(c) Emission factor for $PM_{2.5}$ based on the ratio between TSP and $PM_{2.5}$ emission factors for bulldozing overburden in AP-42 / Section 11.9 - Western Surface Coal Mining (USEPA, October 1998) / Table 11.9-2 (Metric Units) - Emission Factor Equations for Uncontrolled Open Dust Sources at Western Surface Coal Mines.

B- Exhaust Emissions

Equipment/Vehicle	**Model**	**Number of Equipment/Vehicle**	**Daily Use**
Wheeled Front End Loader	Caterpillar 992K/Komatsu WA 900-3	1	6.0

			SO_2	**NO_X**	**CO**	**$PM_{2.5}$**	**PM_{10}**	**VOC**	**PAH**	**CO_2e**
Daily emission rate	tonne/day	(refer to Construction combustion)	2.37E-05	0.0091	0.0030	4.17E-04	4.30E-04	4.50E-04	4.15E-06	2.83

Air Quality Assessment - NICO Project
Calculation of Emissions During the Closure Phase

II - CDF Cover

II.1 - Bulldozer

A - Fugitive Emissions

Dust Control Technique		**No control**

Number of equipment	pc	A	1	(a)
Hours of operation per day - peak	h/day	B	6.0	(b)
Material silt content	(%)	C	56	(c)
Material moisture content	(%)	D	16.8	(d)
Emission reduction efficiency	(%)	E	0	

Source: (a) Assume 1 bulldozer used.
(b) Information provided by Fortune. Daily operating time assumed to the same as bulldozer.
(c) Material silt content taken as average silt content of the till and glacio-lacustrine deposit from Golder FEED document.
(d) Moisture content taken as the maximum overburden moisture content from AP 42 chapter 11.9 Western surface Coal Mine/ Table 11.9-3 (Metric and English Units). Typical Values For Correction Factors Applicable to the Predictive Emission Factor Equations.

			TSP <= 30 um	TSP <= 15 um	PM_{10}	$PM_{2.5}$	
Constant (a)	-	F	2.6	0.45	-	-	(a)
Constant (b)	-	G	1.2	1.5	-	-	(a)
Constant (c)	-	H	1.3	1.4	-	-	(a)
Scaling factor		I	-	-	0.75	0.105	(a) (b)
Emission rate (uncontrolled)	g/hr	J = F*(C^G)/(D^H)*1000*A	8,315.66	3,631.30	2,723.47	873.14	(a) (c)
Emission rate (controlled)	g/hr	K = J*(1-E/100)	8,315.66	3,631.30	2,723.47	873.14	
Daily emission rate (controlled)	g/day	L = K*B	50,030.68	21,847.46	16,385.60	5,253.22	
Daily emission rate (uncontrolled)	g/day	M = J * B	50,030.68	21,847.46	16,385.60	5,253.22	
Maximum emission rate (controlled)	g/s	N = L/(B*3600)	2.31	1.01	0.76	0.24	
Maximum emission rate (uncontrolled)	g/s	O = M / (B*3600)	2.31	1.01	0.76	0.24	
Quality rating	-		B	C	D	D	

Source: (a) AP-42 / Section 11.9 - Western Surface Coal Mining (USEPA, October 1998) / Table 11.9-2 (Metric Units) - Emission Factor Equations for Uncontrolled Open Dust Sources at Western Surface Coal Mines (bulldozing overburden). According to recommendations in AP-42 / Section 13.2.3 - Heavy Construction Operations (USEPA, January 1995) / Table 13.2.3-1 - Recommended Emission Factors for Construction Operations (reference to dozer equation (overburden) in Section 11.9 / Table 11.9.2).
(b) Scaling factor to convert TSP <= 30 um to $PM_{2.5}$ and TSP <= 15 um to PM_{10}.
(c) PM_{10} and $PM_{2.5}$ calculated multiplying TSP emission rates by respective scaling factors.

B- Exhaust Emissions

Equipment/Vehicle	Model	Number of Equipment/Vehicle	Daily Use
Tracked-Dozer	Caterpillar D4H	1	6.0

			SO_2	NO_X	CO	$PM_{2.5}$	PM_{10}	VOC	PAH	CO_2e
Daily emission rate	tonne/day	(refer to Construction combustion)	9.18E-06	0.0045	0.0015	1.95E-04	2.01E-04	2.11E-04	1.60E-06	1.10

Air Quality Assessment - NICO Project
Calculation of Emissions During the Closure Phase

II.2 - Material Handling (burrows)

A - Fugitive Emissions

Dust Control Technique		**No control**

Hours of operation per day - peak	h/day	A	6	(a)
Amount of material handled per day	tonnes/day	B	652.8	(b)
Mean wind speed - maximum daily value	m/s	C	12.82	(c)
Material moisture content	%	D	16.8	(d)
Constant (a)	-	E	0.0016	(e)
Constant (b)	-	F	1.3	(e)
Constant (c)	-	G	2.2	(e)
Constant (d)	-	H	1.4	(e)
Constant (e)	-	I	2	(e)
Emission reduction efficiency	(%)	J	0	

Source: (a) Assumed similar vehicles as in construction. Information provided by Fortune. Daily operating time assumed to the same as the integrated tool carrier.
(b) Information based on Cost Estimate, Golder January 2011, 275,000 m^3 of material to cover the CDF from burrowed area over two years. 17 kN/m^3 of density from FEED Report.
(c) Value derived from Fortune 2004-2007 onsite meteorological station (Fortune_2004_2007_MetData(Oct8 04 - Sep27 07)_MD.xls).
(d) Moisture content taken as the maximum overburden moisture content from AP 42 chapter 11.9 Western surface Coal Mine/ Table 11.9-3 (Metric and English Units). Typical Values For Correction Factors Applicable to the Predictive Emission Factor Equations.
(e) AP-42 / Section 13.2.4 - Aggregate Handling And Storage Piles (USEPA, November 2006)/ equation 1 - emission factor for drop operation.

			TSP <= 30 um	**PM_{10}**	**$PM_{2.5}$**	
Particle size multiplier	-	K	0.74	0.35	0.053	(a)
Emission factor (uncontrolled)	kg/tonne	L = K*E*((C/G)^F)/((D/I)^H)	5.95E-04	2.81E-04	4.26E-05	(a)
Maximum emission rate (controlled)	g/s	M = B*L*(1-J/100)*1000/(A*3600)	0.018	0.0085	0.0013	
Maximum emission rate (uncontrolled)	g/s	N = B*L*1000/(A*3600)	0.018	0.0085	0.0013	
Quality rating	-		A	A	A	

Source: (a) AP-42 / 13.2.4 - Aggregate Handling And Storage Piles (USEPA, November 2006)/ equation 1 - emission factor for drop operation.

B- Exhaust Emissions

Equipment/Vehicle	**Model**	**Number of Equipment/Vehicle**	**Daily Use**
Dump Truck	Western Star 4900 SA; or Equivalent	1	2.0
Backhoe	Caterpillar 450E; or Equivalent	1	3.0
Integrated Tool Carrier	Caterpillar IT24F	1	6.0

			SO_2	**NO_X**	**CO**	**$PM_{2.5}$**	**PM_{10}**	**VOC**	**PAH**	**CO_2e**
Daily emission rate	tonne/day	(refer to Construction combustion)	9.12E-06	0.0037	0.0022	2.31E-04	2.39E-04	2.75E-04	1.59E-06	1.09

II.3- Loading of material onto trucks

A - Fugitive Emissions

Dust Control Technique		**No control**

Hours of operation per day	h/day	A	6.0	(a)
Amount of debris removed per day	tonnes/day	B	652.8	(b)
Emission reduction efficiency	(%)	C	0	

Source: (a) Assume similar equipment as in construction phase. Numbers of work hours per day taken as the maximum construction equipment operation for a tractor/dozer.
(b) Information based in Golder construction calculations of 1,105,000 m^3 of material to cover the CDF from burrowed area. Assuming 1 year of closure and 17 kN/m^3 of density.

			TSP	**PM_{10}**	**$PM_{2.5}$**	
Emission factor (uncontrolled)	kg/tonne	D	0.018	0.0094	0.0019	(a) (b) (c)
Daily emission rate (controlled)	g/day	E = B*D*1000*(1-C/100)	11,750.66	6,110.34	1,233.82	
Daily emission rate (uncontrolled)	g/day	F = B*D*1000	11,750.66	6,110.34	1,233.82	
Maximum emission rate (controlled)	g/s	G = E/(A*3600)	0.54	0.28	0.057	
Maximum emission rate (uncontrolled)	g/s	H = F/(A*3600)	0.54	0.28	0.057	
Quality rating	-		E	-	-	

Source: (a) TSP emission factor extracted from AP-42 / Section 11.9 - Western Surface Coal Mining (USEPA, October 1998) / Table 11.9.4 - Uncontrolled Particulate Emission Factors for Open Dust Sources at Western Surface Coal Mine (truck loading by power shovel (batch drop) / overburden).
(b) Emission factor for PM_{10} based on the ratio between TSP and PM_{10} emission factors for blasting in AP-42 / Section 11.9 - Western Surface Coal Mining (USEPA, October 1998) / Table 11.9-2 (Metric Units) - Emission Factor Equations for Uncontrolled Open Dust Sources at Western Surface Coal Mines.
(c) Emission factor for $PM_{2.5}$ based on the ratio between TSP and $PM_{2.5}$ emission factors for bulldozing overburden in AP-42 / Section 11.9 - Western Surface Coal Mining (USEPA, October 1998) / Table 11.9-2 (Metric Units) - Emission Factor Equations for Uncontrolled Open Dust Sources at Western Surface Coal Mines.

B- Exhaust Emissions

Equipment/Vehicle	**Model**	**Number of Equipment/Vehicle**	**Daily Use**
Wheeled Front End Loader	Caterpillar 988H/Komatsu WA 600	1	6.0

			SO_2	**NO_X**	**CO**	**$PM_{2.5}$**	**PM_{10}**	**VOC**	**PAH**	**CO_2e**
Daily emission rate	tonne/day	(refer to Construction combustion)	1.54E-05	0.0062	0.0021	2.71E-04	2.79E-04	2.93E-04	2.70E-06	1.84

Air Quality Assessment - NICO Project
Calculation of Emissions During the Closure Phase

II.4 Hauling material from burrows to CDF

A - Fugitive Emissions

Dust Control Technique		**Watering twice a day**	(a)

Source: (a) Information provided by Fortune in an email dated Feb. 15, 2011.

Hours of operation per day - peak	h/day	A	6	(a)
Surface material silt content	(%)	B	56.0	(b)
Mean vehicle weight	tonnes	C	118.63	(c)
Vehicle kilometer traveled (VKT)	km/day	D	22.46	(c)
Number of working days	days/year	E	365	(a)
Number of days with precipitation >= 0.2 mm	days/year	F	58	(d)
Emission reduction efficiency	(%)	G	55	(e)

Source: (a) Assume the same vehicles as used in construction phase. Information provided by Fortune. Daily operating time assumed to the same as construction haulage times.
(b) Material silt content taken as average silt content of the till and glacio-lacustrine deposit from Golder FEED document.
(c) See Mean Vehicle Weight table below.
(d) Value derived from Fortune 2004-2007 onsite meteorological station (Fortune_2004_2007_MetData(Oct8 04 - Sep27 07)_MD.xls).
(e) Assumed wet suppression. Unpaved Industrial Road Dust Calculator (Environment Canada website, accessed in December 2009).

			PM-30 (TSP)	**PM_{10}**	**$PM_{2.5}$**	
Constant (k)	-	H	4.9	1.5	0.15	(a)
Constant (a)	-	I	0.7	0.9	0.9	(a)
Constant (b)	-	J	0.45	0.45	0.45	(a)
Emission factor (uncontrolled)	lb/VMT	K = H*((B/12)^I)*((C*1.1/3)^J)*[(E-G)/E]	66.30	27.62	2.76	(a)
Emission factor (metric uncontrolled)	g/VKT	L = K * 281.9	18,691.32	7,786.40	778.64	(b)
Emission factor (controlled)	g/VKT	M = L*281.9*(1-G/100)	8,411.09	3,503.88	350.39	(b)
Emission factor (metric uncontrolled, without precip)	g/VKT	N = H*((B/12)^I)*((C*1.1/3)^J)*281.9	22,198.48	9,247.40	924.74	
Emission factor (controlled, without precip)	g/VKT	O = N * (1-G/100)	9,989.31	4,161.33	416.13	
Daily emission rate (uncontrolled)	g/day	P = L *D	419,806.07	174,882.06	17,488.21	
Daily emission rate (controlled)	g/day	Q= M*D	188,912.73	78,696.92	7,869.69	
Daily emission rate (uncontrolled, without precip)	g/day	R = N*D	498,576.62	207,696.15	20,769.62	
Daily emission rate (controlled, without precip)	g/day	S = O*D	224,359.48	93,463.27	9,346.33	
Maximum emission rate (uncontrolled)	g/s	T = P/(A*3600)	19.38	8.07	0.81	
Maximum emission rate (controlled)	g/s	U = Q/(A*3600)	8.72	3.63	0.36	
Maximum emission rate (uncontrolled, without precip)	g/s	V = R/(A*3600)	23.02	9.59	0.96	
Maximum emission rate (controlled, without precip)	g/s	W = S/(A*3600)	10.36	4.32	0.43	
Quality rating	-		B	B	B	

Source: (a) AP-42 / Section 13.2.2 - Unpaved Roads (USEPA, November 2006)/ Equation (1a) - unpaved surfaces at industrial sites and Table 13.2.2-2.
(b) 281.9 constant to convert lb/VMT (pounds per vehicle mile travelled) to g/VKT (grams per vehicle kilometer travelled).

Mean Vehicle Weight

Equipment	-		**Haulage Unit**	**Total**	
Weight - Empty	tonne		73.98		(a)
Weight - Loaded	tonne		163.29		(b)
Mean Weight	tonne		118.63		
Number of two way trips	number		7		(c)
Distance of two way trip	km/day		3.07		(d)
Vehicle kilometer traveled (VKT)	km/day		22.46	22.46	
Percentage of traffic	%		100%		
Mean vehicle weight	tonne		118.63	118.63	

Source: (a) Information provided by Fortune in "NICO Mobile Equipment_REVC_without Aker fuel.xlsx".
(b) Haul trucks the loaded weight was taken as the maximum specified load in CAT 777F specification sheet.
(c) Information based on Cost Estimate, Golder January 2011, 275,000 m^3 of material to cover the CDF from burrowed area over two years. 17 kN/m^3 of density from FEED Report.
(d) Assume that the distance is the same as the distance from the CDF to the topsoil stock piles.

B- Exhaust Emissions

Equipment/Vehicle	**Model**	**Number of Equipment/Vehicle**	**Daily Use**
Surface rock haulage trucks	Caterpillar 777F/Komatsu HD 785-7	2	6.0
Underground Haulage Unit	Sandvik 50	2	2.0

			SO_2	**NO_X**	**CO**	**$PM_{2.5}$**	**PM_{10}**	**VOC**	**PAH**	**CO_2e**
Daily emission rate	tonne/day	(refer to Construction combustion)	7.06E-05	0.033	0.011	0.0015	0.0015	0.0016	1.23E-05	8.43

II.5 - Material Handling (CDF)

A - Fugitive Emissions

Dust Control Technique		**No control**

Hours of operation per day - peak	h/day	A	2	(a)
Amount of material handled per day	tonnes/day	B	652.8	(b)
Mean wind speed - maximum daily value	m/s	C	12.82	(c)
Material moisture content	%	D	16.8	(d)
Constant (a)	-	E	0.0016	(e)
Constant (b)	-	F	1.3	(e)
Constant (c)	-	G	2.2	(e)
Constant (d)	-	H	1.4	(e)
Constant (e)	-	I	2	(e)
Emission reduction efficiency	(%)	J	0	

Source: (a) Assumed similar vehicles as in construction. Information provided by Fortune. Daily operating time assumed to the same as the ecavator time.
(b) Information based on Cost Estimate, Golder January 2011, 275,000 m^3 of material to cover the CDF from burrowed area over two years. 17 kN/m^3 of density from FEED Report.
(c) Value derived from Fortune 2004-2007 onsite meteorological station (Fortune_2004_2007_MetData(Oct8 04 - Sep27 07)_MD.xls).
(d) Moisture content taken as the maximum overburden moisture content from AP 42 chapter 11.9 Western surface Coal Mine/ Table 11.9-3 (Metric and English Units). Typical Values For Correction Factors Applicable to the Predictive Emission Factor Equations.
(e) AP-42 / Section 13.2.4 - Aggregate Handling And Storage Piles (USEPA, November 2006)/ equation 1 - emission factor for drop operation.

			TSP <= 30 um	**PM_{10}**	**$PM_{2.5}$**	
Particle size multiplier	-	K	0.74	0.35	0.053	(a)
Emission factor (uncontrolled)	kg/tonne	L = K*E*((C/G)^F)/((D/I)^H)	5.95E-04	2.81E-04	4.26E-05	(a)
Maximum emission rate (controlled)	g/s	M = B*L*(1-J/100)*1000/(A*3600)	0.055	0.0259	0.0039	
Maximum emission rate (uncontrolled)	g/s	N = B*L*1000/(A*3600)	0.055	0.0259	0.0039	
Quality rating	-		A	A	A	

Source: (a) AP-42 / 13.2.4 - Aggregate Handling And Storage Piles (USEPA, November 2006)/ equation 1 - emission factor for drop operation.

B- Exhaust Emissions

Equipment/Vehicle	**Model**	**Number of Equipment/Vehicle**	**Daily Use**
Excavator	Caterpillar 345 BL	1	2.0

			SO_2	**NO_X**	**CO**	**$PM_{2.5}$**	**PM_{10}**	**VOC**	**PAH**	**CO_2e**
Daily emission rate	tonne/day	(refer to Construction combustion)	3.69E-06	0.0016	5.63E-04	7.16E-05	7.38E-05	7.73E-05	6.45E-07	0.44

Air Quality Assessment - NICO Project
Calculation of Emissions During the Closure Phase

III - General Closure

III.1 - Vehicular traffic

A - Fugitive Emissions

Dust Control Technique		**Watering twice a day**	(a)

Source: (a) Information provided by Fortune in an email dated Feb. 15, 2011.

Hours of operation per day	h/day	A	5.3	(a)
Surface material silt content	(%)	B	56	(b)
Mean vehicle weight	(tons)	C	7.39	(c)
Vehicle kilometer traveled (VKT)	km/day	D	70.68	(c)
Number of working days	days/year	E	365	
Number of days with precipitation >= 0.2 mm	days/year	F	58	(d)
Emission reduction efficiency	(%)	G	55	(e)

Source: (a) Assumed 10 light day truck, 12 heavy duty trucks and one Fuel and Lube truck. Assume operating time same as Heavey duty truck.
(b) Material silt content taken as average silt content of the till and glacio-lacustrine deposit from Golder FEED document.
(c) See Mean Vehicle Weight table below.
(d) Value derived from Fortune 2004-2007 onsite meteorological station (Fortune_2004_2007_MetData(Oct8 04 - Sep27 07)_MD.xls).
(e) Unpaved Industrial Road Dust Calculator (Environment Canada website, accessed in December 2009).

			PM-30 (TSP)	**PM_{10}**	**$PM_{2.5}$**	
Constant (k)	-	H	4.9	1.5	0.15	(a)
Constant (a)	-	I	0.7	0.9	0.9	(a)
Constant (b)	-	J	0.45	0.45	0.45	(a)
Emission factor (uncontrolled)	lb/VMT	K = H*((B/12)^I)*((C/3)^J)*[(E-G)/E]	18.20	7.58	0.76	
Emission factor (uncontrolled, metric)	g/VKT	L = K * 281.9	5,130.02	2,137.06	213.71	(b)
Emission factor (controlled)	g/VKT	M = L*281.9*(1-G/100)	2,308.51	961.68	96.17	(b)
Emission factor (uncontrolled, without precipitation)	g/VKT	N=H*((B/12)^I)*((C/3)^J)*281.9	6,092.60	2,538.04	253.80	
Emission factor (controlled, without precipitation)	g/VKT	O = N*(1-G/100)	2,741.67	1,142.12	114.21	
Daily emission rate (uncontrolled)	g/day	P= L * D	362,577.09	151,041.71	15,104.17	
Daily emission rate (controlled)	g/day	Q = M*D	163,159.69	67,968.77	6,796.88	
Daily emission rate (uncontrolled, without precipitation)	g/day	R = N * D	430,609.45	179,382.51	17,938.25	
Daily emission rate (controlled, without precipitation)	g/day	S = O* D	193,774.25	80,722.13	8,072.21	
Maximum emission rate (uncontrolled)	g/s	T = P/(A*3600)	19.15	7.98	0.80	
Maximum emission rate (controlled)	g/s	U = Q/(A*3600)	8.62	3.59	0.36	
Maximum emission rate (uncontrolled, without precipitation)	g/s	V = R/(A*3600)	22.74	9.47	0.95	
Maximum emission rate (controlled, without precipitation)	g/s	W = S/(A*3600)	10.23	4.26	0.43	
Quality rating	-		B	B	B	

Source: (a) AP-42 / Section 13.2.2 - Unpaved Roads (USEPA, November 2006)/ Equation (1a) - unpaved surfaces at industrial sites and Table 13.2.2-2.
(b) 281.9 constant to convert lb/VMT (pounds per vehicle mile travelled) to g/VKT (grams per vehicle kilometer travelled).

Mean Vehicle Weight

Equipment	-		Light Duty Trucks	Heavy Duty Trucks	Fuel and Lube Truck	Total	
Weight - Empty	tonne		4.26	6.58	27.27		(a)
Weight - Loaded	tonne		4.26	6.58	47.27		(b)
Mean Weight	tonne		4.26	6.58	37.27	48.11	
Number of two way trips	number		12	10	1		(c)
Distance of two way trip	km/day		3.07	3.07	3.07		
Vehicle kilometer traveled (VKT)	km/day		36.88	30.73	3.07	70.68	
Percentage of traffic	%		52%	43%	4%		
Mean vehicle weight	tonne		2.22	2.86	1.62	6.70	

Source: (a) Information provided by Fortune in "NICO Mobile Equipment_REVC_without Aker fuel.xlsx".
(b) Assumed full fuel and Lube truck is 20 tonnes heavier when loaded.
(c) Assume each vehicle takes one trip per day.

Air Quality Assessment - NICO Project
Calculation of Emissions During the Closure Phase

B- Exhaust Emissions

Equipment/Vehicle	Model	Number of Equipment/Vehicle	Daily Use
Fuel & Lube Truck	Western Star 4900 SA; or Equivalent	1	2.0
Water Truck	Western Star 4900 SA; or Equivalent	1	2.0
Light Duty Truck, Diesel	Ford F-250 Supercab, or equivalent	1	2.6
Light Duty Truck, Diesel	Ford F-250 Supercab, or equivalent	1	2.6
Light Duty Truck	Ford F-250, or equivalent	4	2.6
Light Duty Truck	Ford F-250, or equivalent	1	2.6
Light Duty Truck	Ford F-250, or equivalent	1	5.3
Light Duty Truck	Ford F-250, or equivalent	1	5.3
Light Duty Truck	Ford F-250 Crewcab, or equivalent	3	5.3
Heavy Duty Truck, Diesel	Ford F-450 Crew Cab Flat Deck; or equivalent	1	5.3
Heavy Duty Truck, Diesel	Ford F-450 Crew Cab Flat Deck; or equivalent	1	5.3
Heavy Duty Truck, Diesel	Ford F-450 Crew Cab Flat Deck; or equivalent	1	5.3
Heavy Duty Truck, Diesel	Ford F-450 Crew Cab Flat Deck; or equivalent	2	5.3
Heavy Duty Truck, Diesel	Ford F-450 Crew Cab Flat Deck; or equivalent	1	5.3
Heavy Duty Truck, Diesel	Ford F-450 Crew Cab Flat Deck; or equivalent	2	5.3
Heavy Duty Truck, Diesel	Ford F-450 Crew Cab Flat Deck; or equivalent	1	5.3
Welding Truck	Ford F-450 Crew Cab Flat Deck; or equivalent	1	5.3
Welding Truck	Ford F-450 Crew Cab Flat Deck; or equivalent	2	5.3
Personnel Carrier	Chevrolet Express 2500 Standard, or equivalent	1	5.3
Mine Ambulance	Chevrolet Express 2500 Standard, or equivalent	1	0.3
Fire Truck	Ford F-450 Crew Cab Flat Deck; or equivalent	1	0.3
Rough Terrain Vehicle	Kubota RTV900; or equivalent	1	0.3
Rough Terrain Crane; 135 tonnes	Grove RT9150E; or equivalent	1	4.0
Boom Truck (*Alternative* "Hiab Truck")	Western Star 4900 SA; or Equivalent	1	6.0
Telescopic Handler	Caterpillar TL943; or Equivalent	1	5.3
Medium Forklift	Clark, ECX 32	1	0.0
Scissor Lift, Rough Terrain	Genie Scissorlift RT 2668; or Equivalent	1	4.0
Skid Steer-Loader	Bobcat S150	1	4.0
Skid Steer-Loader	Bobcat S70	1	4.0
Skid Steer-Loader	Bobcat S150	1	4.0
Skid Steer-Loader	Bobcat S150	1	4.0
Rough Terrain Crane; 36.2 tonnes	Manitowoc (Grove) RT540E type; or Equivalent	1	6.0
Telescopic Handler	Caterpillar TL943; or Equivalent	1	5.3
Telescopic Handler	Caterpillar TL642	1	5.3
Walkie Straddle Pallet Truck	Clark, CSM 15	1	0.0
Scissor Lift, Rough Terrain	Genie Scissorlift RT 2668; or Equivalent	2	4.0

			SO_2	NO_X	CO	$PM_{2.5}$	PM_{10}	VOC	PAH	CO_2e
Daily emission rate	tonne/day	(refer to Construction combustion)	2.67E-04	0.17	0.064	0.008	0.0083	0.0076	4.67E-05	31.93

Model	Type of Equipment	Number of Equipment/ Vehicle	Annual hours of Operation	Engine Horse Power (hp)	Fuel Type	Equipment Category	Engine Technology Category	Load Factor	Fuel Sulphur (% weight)	PM Adjustment Factor	In use fuel consumption (lb/hp-hr)	Annual Fuel Consumption (L)
A	B	C	D	E	F	G	H	I	J	K	L	M
Construction												
Caterpillar 527; or equivalent	Skidder	1	1,098	166	Diesel	Main	Tier 2	0.23	0.0015	0.05	0.37	35,726
Caterpillar 501 HD Track Harvester; or equivalent	Harvester	1	1,098	157	Diesel	Main	Tier 2	0.58	0.0015	0.05	0.37	33,709
Caterpillar 777F/Komatsu HD 785-7	Surface rock haulage trucks	2	2,196	1016	Diesel	Main	Tier 2	0.58	0.0015	0.05	0.37	873,550
Sandvik 50	Underground Haulage Unit	2	732	523	Diesel	Main	Tier 2	0.58	0.0015	0.05	0.37	149,817
Western Star 4900 SA; or Equivalent	Dump Truck	1	732	450	Diesel	Main	Tier 2	0.58	0.0015	0.05	0.37	64,444
Caterpillar 992K/Komatsu WA 900-3	Wheeled Front End Loader	1	2,196	801	Diesel	Main	Tier 2	0.48	0.0015	0.05	0.37	344,003
Caterpillar 988H/Komatsu WA 600	Wheeled Front End Loader	1	2,196	520	Diesel	Main	Tier 2	0.48	0.0015	0.05	0.37	223,573
Caterpillar IT24F	Integrated Tool Carrier	1	2,196	95	Diesel	Main	Tier 2	0.48	0.0015	0.06	0.41	45,482
Caterpillar D8T/Komatsu D155AX-6	Track-dozer	1	2,196	581	Diesel	Main	Tier 2	0.58	0.0015	0.05	0.37	249,503
Caterpillar D4H	Tracked-Dozer	1	2,196	310	Diesel	Main	Tier 2	0.58	0.0015	0.05	0.37	133,107
Caterpillar D6T; Aker request; not req if D10 over ice	Track-dozer	1	2,196	200	Diesel	Support	Tier 1	0.58	0.0015	0.09	0.37	85,857
Caterpillar 345 BL	Excavator	1	720	380	Diesel	Main	Tier 2	0.53	0.0015	0.05	0.37	53,466
Caterpillar 450E; or Equivalent	Backhoe	1	1,080	95	Diesel	Main	Tier 2	0.21	0.0015	0.06	0.41	22,368
Caterpillar 14M/Komatsu GD675-3	Surface grader	1	360	259	Diesel	Main	Tier 2	0.58	0.0015	0.05	0.37	18,231
Caterpillar 815F/Komatsu CP76; or equivalent	Compactor, Sheep Foot	1	360	232	Diesel	Support	Tier 1	0.43	0.0015	0.09	0.37	16,342
Caterpillar CS-323C; or equivalent	Compactor, Vibrating Soil	1	360	83	Diesel	Support	Tier 1	0.43	0.0015	0.10	0.41	6,511
Sandvik D45KS; Atlas Copco DML; or similar	Self-Propelled Blast Hole Drill	1	360	451	Diesel	Main	Tier 2	0.43	0.0015	0.05	0.37	31,739
ATD 3100 B, Drifter Attachment PP 123	Air Trac Drill	1	100	0	Diesel	Main	Tier 2	0.43	0.0015	0.06	0.41	-
Grove RT9150E; or equivalent	Rough Terrain Crane; 135 tonnes	1	1,464	300	Diesel	Support	Tier 1	0.43	0.0015	0.09	0.37	86,049
Manitowoc (Grove) RT540E type; or Equivalent	Rough Terrain Crane; 36.2 tonnes	1	2,196	160	Diesel	Main	Tier 2	0.43	0.0015	0.05	0.37	68,741
Western Star 4900 SA; or Equivalent	Boom Truck (*Alternative* "Hiab Truck")	1	2,196	450	Diesel	Main	Tier 2	0.58	0.0015	0.05	0.37	193,333
Caterpillar TL943; or Equivalent	Telescopic Handler	1	1,952	100	Diesel	Main	Tier 2	0.48	0.0015	0.06	0.41	42,422
Caterpillar TL943; or Equivalent	Telescopic Handler	1	1,952	100	Diesel	Support	Tier 1	0.48	0.0015	0.10	0.41	42,422
Caterpillar TL642	Telescopic Handler	1	1,952	100	Diesel	Support	Tier 1	0.48	0.0015	0.10	0.41	42,422
Clark, ECX 32	Medium Forklift	1	0	0	Diesel	Main	Tier 2	0.48	0.0015	0.06	0.41	-
Clark, CSM 15	Walkie Straddle Pallet Truck	1	0	0	Diesel	Main	Tier 2	0.48	0.0015	0.06	0.41	-
Terex Genie; or Equivalent	Self Propelled Telescopic Boom	1	1,464	83	Diesel	Main	Tier 2	0.48	0.0015	0.06	0.41	26,478
Terex Genie; or Equivalent	Self Propelled Telescopic Boom	2	1,464	83	Diesel	Support	Tier 1	0.48	0.0015	0.10	0.41	52,956
Genie Scissorlift RT 2668; or Equivalent	Scissor Lift, Rough Terrain	1	1,464	25	Diesel	Main	Tier 2	0.48	0.0015	0.06	0.41	7,943
Genie Scissorlift RT 2668; or Equivalent	Scissor Lift, Rough Terrain	2	1,464	25	Diesel	Support	Tier 1	0.48	0.0015	0.10	0.41	15,887
Bobcat S150	Skid Steer-Loader	1	1,464	49	Diesel	Main	Tier 2	0.23	0.0015	0.06	0.41	15,588
Bobcat S70	Skid Steer-Loader	1	1,464	23	Diesel	Main	Tier 2	0.23	0.0015	0.06	0.41	7,474
Bobcat S150	Skid Steer-Loader	1	1,464	49	Diesel	Support	Tier 1	0.23	0.0015	0.10	0.41	15,588
Bobcat S150	Skid Steer-Loader	1	1,464	49	Diesel	Support	Tier 1	0.23	0.0015	0.10	0.41	15,588
Western Star 4900 SA Mixer	Concrete Truck	1	720	450	Diesel	Support	Tier 1	0.58	0.0015	0.09	0.37	63,388
Western Star 4900 SA; or Equivalent	Fuel & Lube Truck	1	720	450	Diesel	Main	Tier 2	0.58	0.0015	0.05	0.37	63,388
Western Star 4900 SA; or Equivalent	Water Truck	1	720	450	Diesel	Main	Tier 2	0.58	0.0015	0.05	0.37	63,388
Ford F-250 Supercab, or equivalent	Light Duty Truck, Diesel	1	960	400	Diesel	Main	Tier 2	0.58	0.0015	0.05	0.37	75,066
Ford F-250 Supercab, or equivalent	Light Duty Truck, Diesel	1	960	401	Diesel	Support	Tier 1	0.58	0.0015	0.09	0.37	75,318
Ford F-250, or equivalent	Light Duty Truck	4	960	400	Diesel	Support	Tier 1	0.58	0.0015	0.09	0.37	300,264
Ford F-250, or equivalent	Light Duty Truck	1	960	400	Diesel	Support	Tier 1	0.58	0.0015	0.09	0.37	75,066
Ford F-250, or equivalent	Light Duty Truck	1	1,920	400	Diesel	Support	Tier 1	0.58	0.0015	0.09	0.37	150,132
Ford F-250, or equivalent	Light Duty Truck	1	1,920	400	Diesel	Support	Tier 1	0.58	0.0015	0.09	0.37	150,132
Ford F-250 Crewcab, or equivalent	Light Duty Truck	3	1,920	400	Diesel	Support	Tier 1	0.58	0.0015	0.09	0.37	450,396
Ford F-450 Crew Cab Flat Deck; or equivalent	Heavy Duty Truck, Diesel	1	1,920	400	Diesel	Support	Tier 1	0.58	0.0015	0.09	0.37	150,132
Ford F-450 Crew Cab Flat Deck; or equivalent	Heavy Duty Truck, Diesel	1	1,920	400	Diesel	Support	Tier 1	0.58	0.0015	0.09	0.37	150,132
Ford F-450 Crew Cab Flat Deck; or equivalent	Heavy Duty Truck, Diesel	1	1,920	400	Diesel	Support	Tier 1	0.58	0.0015	0.09	0.37	150,132
Ford F-450 Crew Cab Flat Deck; or equivalent	Heavy Duty Truck, Diesel	2	1,920	400	Diesel	Support	Tier 1	0.58	0.0015	0.09	0.37	300,264
Ford F-450 Crew Cab Flat Deck; or equivalent	Heavy Duty Truck, Diesel	1	1,920	400	Diesel	Support	Tier 1	0.58	0.0015	0.09	0.37	150,132
Ford F-450 Crew Cab Flat Deck; or equivalent	Heavy Duty Truck, Diesel	2	1,920	400	Diesel	Support	Tier 1	0.58	0.0015	0.09	0.37	300,264
Ford F-450 Crew Cab Flat Deck; or equivalent	Heavy Duty Truck, Diesel	1	1,920	400	Diesel	Support	Tier 1	0.58	0.0015	0.09	0.37	150,132
Ford F-450 Crew Cab Flat Deck; or equivalent	Welding Truck	1	1,920	400	Diesel	Main	Tier 2	0.58	0.0015	0.05	0.37	150,132
Ford F-450 Crew Cab Flat Deck; or equivalent	Welding Truck	2	1,920	400	Diesel	Support	Tier 1	0.58	0.0015	0.09	0.37	300,264
Chevrolet Express 2500 Standard, or equivalent	Personnel Carrier	1	1,920	250	Diesel	Main	Tier 2	0.58	0.0015	0.05	0.37	93,908
Chevrolet Express 2500 Standard, or equivalent	Mine Ambulance	1	100	250	Diesel	Main	Tier 2	0.58	0.0015	0.05	0.37	4,891
Ford F-450 Crew Cab Flat Deck; or equivalent	Fire Truck	1	100	400	Diesel	Main	Tier 2	0.58	0.0015	0.05	0.37	7,819
Kubota RTV900; or equivalent	Rough Terrain Vehicle	1	120	443	Diesel	Support	Tier 1	0.43	0.0015	0.09	0.37	10,391
Caterpillar 777F/Komatsu HD 785-7	Surface rock haulage trucks	1	7,446	1016	Diesel	Support	Tier 1	0.58	0.0015	0.09	0.37	1,480,977
Caterpillar 740	Articulated Truck	2	7,446	318	Diesel	Support	Tier 1	0.58	0.0015	0.09	0.37	926,099
Caterpillar 992K/Komatsu WA 900-3	Wheeled Front End Loader	1	7,446	801	Diesel	Support	Tier 1	0.48	0.0015	0.09	0.37	1,166,416
Caterpillar 980H/Komatsu WA 500-6	Wheeled Front End Loader	1	7,446	349	Diesel	Support	Tier 1	0.48	0.0015	0.09	0.37	507,987
Caterpillar 365C L/Komatsu PC650LC-8	Excavator	1	7,446	405	Diesel	Support	Tier 1	0.53	0.0015	0.09	0.37	590,046
Caterpillar 14M/Komatsu GD675-3	Surface grader	1	7,446	259	Diesel	Support	Tier 1	0.58	0.0015	0.09	0.37	377,083
Caterpillar D10T/Komatsu 375A-6	Tracked-Type tractor, bulldozer	2	7,446	581	Diesel	Support	Tier 1	0.58	0.0015	0.09	0.37	1,691,987
Atlas Copco Roc D7; or equivalent	Self-Propelled Blast Hole Drill	2	7,446	225	Diesel	Support	Tier 1	0.43	0.0015	0.09	0.37	656,475
Caterpillar 815F/Komatsu CP76; or equivalent	Compactor, Sheep Foot	1	7,446	232	Diesel	Support	Tier 1	0.43	0.0015	0.09	0.37	338,007
Caterpillar 501 HD Track Harvester; or equivalent	Harvester	1	366	157	Diesel	Support	Tier 1	0.43	0.0015	0.09	0.37	11,236
Western Star 4900 SA; or Equivalent	Fuel & Lube Truck	1	1,402	450	Diesel	Support	Tier 1	0.58	0.0015	0.09	0.37	123,395
Western Star 4900 SA; or Equivalent	Road Tractor	1	1,402	450	Diesel	Support	Tier 1	0.58	0.0015	0.09	0.37	123,395
Ford F-250 Crewcab, or equivalent	Light Duty Truck	2	701	400	Diesel	Support	Tier 1	0.58	0.0015	0.09	0.37	109,596
Chevrolet Express 2500 Standard, or equivalent	Personnel Carrier	1	1,402	250	Diesel	Support	Tier 1	0.58	0.0015	0.09	0.37	68,553
Ford F-450 Crew Cab Flat Deck; or equivalent	Heavy Duty Truck, Diesel	1	1,402	400	Diesel	Support	Tier 1	0.58	0.0015	0.09	0.37	109,596
Ford F-450 Crew Cab Flat Deck; or equivalent	Heavy Duty Truck, Diesel	1	1,402	401	Diesel	Support	Tier 1	0.58	0.0015	0.09	0.37	109,964
TOTAL												

Model	Zero hour emission factor (g/hp-hr)				Deterioration Factor				Transient Adjustment Factor				Emission factor based on fuel consumption g/L				Exhaust emission rate (tonne/day)							
	NOx	CO	PM10	VOC	NOx	CO	PM10	VOC	NOx	CO	PM10	VOC	PAH	N2O	CH4	CO2	Nox	CO	PM10	PM2.5	VOC	SO2	PAH	CO2e
A	N1	N2	N3	N4	O1	O2	O3	O4	P1	P2	P3	P4	Q1	Q2	Q3	Q4	R1	R2	R3	R4	R5	R6	R7	R8
Construction																								
Caterpillar 527; or equivalent	4.1	0.8667	0.18	0.356674	1.009	1.101	1.473	1.034	1.1	2.57	1.97	2.29	0.0044	1.1	0.15	2663	5.24E-04	2.82E-04	5.41E-05	5.24E-05	9.91E-05	2.46E-06	4.31E-07	2.94E-01
Caterpillar 501 HD Track Harvester; or equivalent	4.1	0.8667	0.18	0.356674	1.009	1.101	1.473	1.034	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	1.08E-03	4.00E-04	7.49E-05	7.27E-05	1.08E-04	2.32E-06	4.06E-07	2.78E-01
Caterpillar 777F/Komatsu HD 785-7	4.1	0.7642	0.1316	0.175913	1.009	1.101	1.473	1.034	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	2.79E-02	9.13E-03	1.32E-03	1.28E-03	1.38E-03	6.02E-05	1.05E-05	7.20E+00
Sandvik 50	4.3351	0.8425	0.1316	0.175913	1.009	1.101	1.473	1.034	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	5.06E-03	1.73E-03	2.26E-04	2.19E-04	2.37E-04	1.03E-05	1.81E-06	1.23E+00
Western Star 4900 SA; or Equivalent	4.3351	0.8425	0.1316	0.175913	1.009	1.101	1.473	1.034	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	2.17E-03	7.43E-04	9.73E-05	9.44E-05	1.02E-04	4.44E-06	7.77E-07	5.31E-01
Caterpillar 992K/Komatsu WA 900-3	4.1	0.7642	0.1316	0.175913	1.009	1.101	1.473	1.034	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	9.09E-03	2.98E-03	4.30E-04	4.17E-04	4.50E-04	2.37E-05	4.15E-06	2.83E+00
Caterpillar 988H/Komatsu WA 600	4.3351	0.8425	0.1316	0.175913	1.009	1.101	1.473	1.034	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	6.24E-03	2.13E-03	2.79E-04	2.71E-04	2.93E-04	1.54E-05	2.70E-06	1.84E+00
Caterpillar IT24F	4.7	2.3655	0.24	0.387029	1.009	1.101	1.473	1.034	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	1.24E-03	1.10E-03	1.04E-04	1.00E-04	1.18E-04	3.13E-06	5.48E-07	3.75E-01
Caterpillar D8T/Komatsu D155AX-6	4.3351	0.8425	0.1316	0.175913	1.009	1.101	1.473	1.034	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	8.42E-03	2.88E-03	3.77E-04	3.65E-04	3.95E-04	1.72E-05	3.01E-06	2.06E+00
Caterpillar D4H	4.3351	0.8425	0.1316	0.175913	1.009	1.101	1.473	1.034	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	4.49E-03	1.53E-03	2.01E-04	1.95E-04	2.11E-04	9.18E-06	1.60E-06	1.10E+00
Caterpillar D6T; Aker request; not req if D10 over ice	5.5772	0.7475	0.2521	0.325159	1.024	1.101	1.473	1.036	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	3.78E-03	8.78E-04	2.58E-04	2.50E-04	2.52E-04	5.92E-06	1.03E-06	7.07E-01
Caterpillar 345 BL	4.3351	0.8425	0.1316	0.175913	1.009	1.101	1.473	1.034	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	1.65E-03	5.63E-04	7.38E-05	7.16E-05	7.73E-05	3.69E-06	6.45E-07	4.40E-01
Caterpillar 450E; or Equivalent	4.7	2.3655	0.24	0.387029	1.009	1.101	1.473	1.034	1.1	2.57	1.97	2.29	0.0044	1.1	0.15	2663	3.09E-04	3.96E-04	3.77E-05	3.66E-05	5.53E-05	1.54E-06	2.70E-07	1.84E-01
Caterpillar 14M/Komatsu GD675-3	4	0.7475	0.1316	0.325159	1.009	1.101	1.473	1.034	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	5.68E-04	1.86E-04	2.75E-05	2.67E-05	5.33E-05	1.26E-06	2.20E-07	1.50E-01
Caterpillar 815F/Komatsu CP76; or equivalent	5.5772	0.7475	0.2521	0.325159	1.024	1.101	1.473	1.036	1	1.00	1.00	1.00	0.0044	1.1	0.15	2663	5.62E-04	8.10E-05	2.80E-05	2.71E-05	3.38E-05	1.13E-06	1.97E-07	1.35E-01
Caterpillar CS-323C; or equivalent	5.5988	2.3655	0.473	0.54945	1.024	1.101	1.473	1.036	1	1.00	1.00	1.00	0.0044	1.1	0.15	2663	2.02E-04	9.18E-05	2.12E-05	2.05E-05	2.05E-05	4.48E-07	7.85E-08	5.36E-02
Sandvik D45KS; Atlas Copco DML; or similar	4.3351	0.8425	0.1316	0.175913	1.009	1.101	1.473	1.034	1	1.00	1.00	1.00	0.0044	1.1	0.15	2663	8.36E-04	1.77E-04	2.70E-05	2.62E-05	3.55E-05	2.19E-06	3.83E-07	2.61E-01
ATD 3100 B, Drifter Attachment PP 123	4.3	4.1127	0.5	0.580543	1.009	1.101	1.473	1.034	1	1.00	1.00	1.00	0.0044	1.1	0.15	2663	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Grove RT9150E; or equivalent	6.0153	1.306	0.2008	0.213435	1.024	1.101	1.473	1.036	1	1.00	1.00	1.00	0.0044	1.1	0.15	2663	3.19E-03	7.45E-04	1.08E-04	1.05E-04	1.17E-04	5.93E-06	1.04E-06	7.09E-01
Manitowoc (Grove) RT540E type; or Equivalent	4.1	0.8667	0.18	0.356674	1.009	1.101	1.473	1.034	1	1.00	1.00	1.00	0.0044	1.1	0.15	2663	1.71E-03	3.95E-04	8.80E-05	8.54E-05	1.56E-04	4.74E-06	8.29E-07	5.66E-01
Western Star 4900 SA; or Equivalent	4.3351	0.8425	0.1316	0.175913	1.009	1.101	1.473	1.034	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	6.52E-03	2.23E-03	2.92E-04	2.83E-04	3.06E-04	1.33E-05	2.33E-06	1.59E+00
Caterpillar TL943; or Equivalent	4.7	2.3655	0.24	0.387029	1.009	1.101	1.473	1.034	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	1.16E-03	1.02E-03	9.65E-05	9.37E-05	1.10E-04	2.92E-06	5.11E-07	3.50E-01
Caterpillar TL943; or Equivalent	5.5988	2.3655	0.473	0.54945	1.024	1.101	1.473	1.036	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	1.40E-03	1.02E-03	1.95E-04	1.89E-04	1.56E-04	2.92E-06	5.11E-07	3.50E-01
Caterpillar TL642	5.5988	2.3655	0.473	0.54945	1.024	1.101	1.473	1.036	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	1.40E-03	1.02E-03	1.95E-04	1.89E-04	1.56E-04	2.92E-06	5.11E-07	3.50E-01
Clark, ECX 32	4.3	4.1127	0.5	0.580543	1.009	1.101	1.473	1.034	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Clark, CSM 15	4.3	4.1127	0.5	0.580543	1.009	1.101	1.473	1.034	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Terex Genie; or Equivalent	4.7	2.3655	0.24	0.387029	1.009	1.101	1.473	1.034	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	7.21E-04	6.38E-04	6.03E-05	5.85E-05	6.86E-05	1.82E-06	3.19E-07	2.18E-01
Terex Genie; or Equivalent	5.5988	2.3655	0.473	0.54945	1.024	1.101	1.473	1.036	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	1.74E-03	1.28E-03	2.43E-04	2.36E-04	1.95E-04	3.65E-06	6.38E-07	4.36E-01
Genie Scissorlift RT 2668; or Equivalent	4.4399	2.161	0.2665	0.461652	1.009	1.101	1.473	1.034	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	2.04E-04	1.75E-04	2.04E-05	1.98E-05	2.46E-05	5.47E-07	9.58E-08	6.54E-02
Genie Scissorlift RT 2668; or Equivalent	4.4399	2.161	0.2665	0.461652	1.024	1.101	1.473	1.036	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	4.15E-04	3.50E-04	3.71E-05	3.60E-05	4.92E-05	1.09E-06	1.92E-07	1.31E-01
Bobcat S150	4.7279	1.5323	0.3389	0.293961	1.009	1.101	1.473	1.034	1.1	2.57	1.97	2.29	0.0044	1.1	0.15	2663	2.37E-04	1.96E-04	4.18E-05	4.05E-05	3.21E-05	1.07E-06	1.88E-07	1.28E-01
Bobcat S70	4.4399	2.161	0.2665	0.461652	1.009	1.101	1.473	1.034	1.1	2.57	1.97	2.29	0.0044	1.1	0.15	2663	1.07E-04	1.32E-04	1.55E-05	1.50E-05	2.41E-05	5.15E-07	9.01E-08	6.16E-02
Bobcat S150	4.7279	1.5323	0.3389	0.293961	1.024	1.101	1.473	1.036	1.1	2.57	1.97	2.29	0.0044	1.1	0.15	2663	2.40E-04	1.96E-04	4.00E-05	3.88E-05	3.21E-05	1.07E-06	1.88E-07	1.28E-01
Bobcat S150	4.7279	1.5323	0.3389	0.293961	1.024	1.101	1.473	1.036	1.1	2.57	1.97	2.29	0.0044	1.1	0.15	2663	2.40E-04	1.96E-04	4.00E-05	3.88E-05	3.21E-05	1.07E-06	1.88E-07	1.28E-01
Western Star 4900 SA Mixer	6.0153	1.306	0.2008	0.213435	1.024	1.101	1.473	1.036	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	3.01E-03	1.13E-03	1.43E-04	1.38E-04	1.22E-04	4.37E-06	7.64E-07	5.22E-01
Western Star 4900 SA; or Equivalent	4.3351	0.8425	0.1316	0.175913	1.009	1.101	1.473	1.034	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	2.14E-03	7.31E-04	9.57E-05	9.28E-05	1.00E-04	4.37E-06	7.64E-07	5.22E-01
Western Star 4900 SA; or Equivalent	4.3351	0.8425	0.1316	0.175913	1.009	1.101	1.473	1.034	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	2.14E-03	7.31E-04	9.57E-05	9.28E-05	1.00E-04	4.37E-06	7.64E-07	5.22E-01
Ford F-250 Supercab, or equivalent	4.3351	0.8425	0.1316	0.175913	1.009	1.101	1.473	1.034	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	2.53E-03	8.65E-04	1.13E-04	1.10E-04	1.19E-04	5.18E-06	9.05E-07	6.18E-01
Ford F-250 Supercab, or equivalent	6.0153	1.306	0.2008	0.213435	1.024	1.101	1.473	1.036	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	3.58E-03	1.35E-03	1.69E-04	1.64E-04	1.45E-04	5.19E-06	9.08E-07	6.21E-01
Ford F-250, or equivalent	6.0153	1.306	0.2008	0.213435	1.024	1.101	1.473	1.036	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	1.43E-02	5.36E-03	6.75E-04	6.55E-04	5.77E-04	2.07E-05	3.62E-06	2.47E+00
Ford F-250, or equivalent	6.0153	1.306	0.2008	0.213435	1.024	1.101	1.473	1.036	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	3.57E-03	1.34E-03	1.69E-04	1.64E-04	1.44E-04	5.18E-06	9.05E-07	6.18E-01
Ford F-250, or equivalent	6.0153	1.306	0.2008	0.213435	1.024	1.101	1.473	1.036	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	7.13E-03	2.68E-03	3.38E-04	3.28E-04	2.89E-04	1.04E-05	1.81E-06	1.24E+00
Ford F-250, or equivalent	6.0153	1.306	0.2008	0.213435	1.024	1.101	1.473	1.036	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	7.13E-03	2.68E-03	3.38E-04	3.28E-04	2.89E-04	1.04E-05	1.81E-06	1.24E+00
Ford F-250 Crewcab, or equivalent	6.0153	1.306	0.2008	0.213435	1.024	1.101	1.473	1.036	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	2.14E-02	8.05E-03	1.01E-03	9.83E-04	8.66E-04	3.11E-05	5.43E-06	3.71E+00
Ford F-450 Crew Cab Flat Deck; or equivalent	6.0153	1.306	0.2008	0.213435	1.024	1.101	1.473	1.036	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	7.13E-03	2.68E-03	3.38E-04	3.28E-04	2.89E-04	1.04E-05	1.81E-06	1.24E+00
Ford F-450 Crew Cab Flat Deck; or equivalent	6.0153	1.306	0.2008	0.213435	1.024	1.101	1.473	1.036	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	7.13E-03	2.68E-03	3.38E-04	3.28E-04	2.89E-04	1.04E-05	1.81E-06	1.24E+00
Ford F-450 Crew Cab Flat Deck; or equivalent	6.0153	1.306	0.2008	0.213435	1.024	1.101	1.473	1.036	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	7.13E-03	2.68E-03	3.38E-04	3.28E-04	2.89E-04	1.04E-05	1.81E-06	1.24E+00
Ford F-450 Crew Cab Flat Deck; or equivalent	6.0153	1.306	0.2008	0.213435	1.024	1.101	1.473	1.036	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	1.43E-02	5.36E-03	6.75E-04	6.55E-04	5.77E-04	2.07E-05	3.62E-06	2.47E+00
Ford F-450 Crew Cab Flat Deck; or equivalent	6.0153	1.306	0.2008	0.213435	1.024	1.101	1.473	1.036	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	7.13E-03	2.68E-03	3.38E-04	3.28E-04	2.89E-04	1.04E-05	1.81E-06	1.24E+00
Ford F-450 Crew Cab Flat Deck; or equivalent	6.0153	1.306	0.2008	0.213435	1.024	1.101	1.473	1.036	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	1.43E-02	5.36E-03	6.75E-04	6.55E-04	5.77E-04	2.07E-05	3.62E-06	2.47E+00
Ford F-450 Crew Cab Flat Deck; or equivalent	6.0153	1.306	0.2008	0.213435	1.024	1.101	1.473	1.036	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	7.13E-03	2.68E-03	3.38E-04	3.28E-04	2.89E-04	1.04E-05	1.81E-06	1.24E+00
Ford F-450 Crew Cab Flat Deck; or equivalent	4.3351	0.8425	0.1316	0.175913	1.009	1.101	1.473	1.034	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	5.07E-03	1.73E-03	2.27E-04	2.20E-04	2.38E-04	1.04E-05	1.81E-06	1.24E+00
Ford F-450 Crew Cab Flat Deck; or equivalent	6.0153	1.306	0.2008	0.213435	1.024	1.101	1.473	1.036	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	1.43E-02	5.36E-03	6.75E-04	6.55E-04	5.77E-04	2.07E-05	3.62E-06	2.47E+00
Chevrolet Express 2500 Standard, or equivalent	4	0.7475	0.1316	0.325159	1.009	1.101	1.473	1.034	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	2.92E-03	9.60E-04	1.42E-04	1.38E-04	2.75E-04	6.47E-06	1.13E-06	7.74E-01
Chevrolet Express 2500 Standard, or equivalent	4	0.7475	0.1316	0.325159	1.009	1.101	1.473	1.034	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	1.52E-04	5.00E-05	7.39E-06	7.16E-06	1.43E-05	3.37E-07	5.90E-08	4.03E-02
Ford F-450 Crew Cab Flat Deck; or equivalent	4.3351	0.8425	0.1316	0.175913	1.009	1.101	1.473	1.034	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	2.64E-04	9.01E-05	1.18E-05	1.15E-05	1.24E-05	5.39E-07	9.43E-08	6.44E-02
Kubota RTV900; or equivalent	6.0153	1.306	0.2008	0.213435	1.024	1.101	1.473	1.036	1	1.00	1.00	1.00	0.0044	1.1	0.15	2663	3.85E-04	9.00E-05	1.31E-05	1.27E-05	1.41E-05	7.16E-07	1.25E-07	8.56E-02
Caterpillar 777F/Komatsu HD 785-7	6.1525	0.7642	0.1934	0.301549	1.024	1.101	1.473	1.036	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	7.20E-02	1.55E-02	3.17E-03	3.07E-03	4.02E-03	1.02E-04	1.79E-05	1.22E+01
Caterpillar 740	6.0153	1.306	0.2008	0.213435	1.024	1.101	1.473	1.036	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	4.40E-02	1.65E-02	2.08E-03	2.02E-03	1.78E-03	6.39E-05	1.12E-05	7.63E+00
Caterpillar 992K/Komatsu WA 900-3	6.1525	0.7642	0.1934	0.301549	1.024	1.101	1.473	1.036	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	4.69E-02	1.01E-02	2.07E-03	2.00E-03	2.62E-03	8.04E-05	1.41E-05	9.61E+00
Caterpillar 980H/Komatsu WA 500-6	6.0153	1.306	0.2008	0.213435	1.024	1.101	1.473	1.036	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	2.00E-02	7.51E-03	9.45E-04	9.17E-04	8.09E-04	3.50E-05	6.12E-06	4.19E+00
Caterpillar 365C L/Komatsu PC650LC-8	6.0153	1.306	0.2008	0.213435	1.024	1.101	1.473	1.036	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	2.56E-02	9.63E-03	1.21E-03	1.18E-03	1.04E-03	4.07E-05	7.11E-06	4.86E+00
Caterpillar 14M/Komatsu GD675-3	5.5772	0.7475	0.2521	0.325159	1.024	1.101	1.473	1.036	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	1.66E-02	3.86E-03	1.13E-03	1.10E-03	1.10E-03	2.60E-05	4.55E-06	3.11E+00
Caterpillar D10T/Komatsu 375A-6	6.0153	1.306	0.2008	0.213435	1.024	1.101	1.473	1.036	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	8.04E-02	3.02E-02	3.81E-03	3.69E-03	3.25E-03	1.17E-04	2.04E-05	1.39E+01
Atlas Copco Roc D7; or equivalent	5.5772	0.7475	0.2521	0.325159	1.024	1.101	1.473	1.036	1	1.00	1.00	1.00	0.0044	1.1	0.15	2663	2.26E-02	3.25E-03	1.12E-03	1.09E-03	1.36E-03	4.52E-05	7.91E-06	5.41E+00
Caterpillar 815F/Komatsu CP76; or equivalent	5.5772	0.7475	0.2521	0.325159	1.024	1.101	1.473	1.036	1	1.00	1.00	1.00	0.0044	1.1	0.15	2663	1.16E-02	1.67E-03	5.79E-04	5.62E-04	6.99E-04	2.33E-05	4.07E-06	2.78E+00
Caterpillar 501 HD Track Harvester; or equivalent	5.6523	0.8667	0.2799	0.356674	1.024	1.101	1.473	1.036	1	1.00	1.00	1.00	0.0044	1.1	0.15	2663	3.92E-04	6.46E-05	2.20E-05	2.14E-05	2.55E-05	7.74E-07	1.35E-07	9.26E-02
Western Star 4900 SA; or Equivalent	6.0153	1.306	0.2008	0.213435	1.024	1.101	1.473	1.036	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	5.86E-03	2.20E-03	2.78E-04	2.69E-04	2.37E-04	8.51E-06	1.49E-06	1.02E+00
Western Star 4900 SA; or Equivalent	6.0153	1.306	0.2008	0.213435	1.024	1.101	1.473	1.036	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	5.86E-03	2.20E-03	2.78E-04	2.69E-04	2.37E-04	8.51E-06	1.49E-06	1.02E+00
Ford F-250 Crewcab, or equivalent	6.0153	1.306	0.2008	0.213435	1.024	1.101	1.473	1.036	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	5.21E-03	1.96E-03	2.46E-04	2.39E-04	2.11E-04	7.56E-06	1.32E-06	9.03E-01
Chevrolet Express 2500 Standard, or equivalent	5.5772	0.7475	0.2521	0.325159	1.024	1.101	1.473	1.036	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	3.02E-03	7.01E-04	2.06E-04	2.00E-04	2.01E-04	4.72E-06	8.26E-07	5.65E-01
Ford F-450 Crew Cab Flat Deck; or equivalent	6.0153	1.306	0.2008	0.213435	1.024	1.101	1.473	1.036	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	5.21E-03	1.96E-03	2.46E-04	2.39E-04	2.11E-04	7.56E-06	1.32E-06	9.03E-01
Ford F-450 Crew Cab Flat Deck; or equivalent	6.0153	1.306	0.2008	0.213435	1.024	1.101	1.473	1.036	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	5.23E-03	1.96E-03	2.47E-04	2.40E-04	2.11E-04	7.58E-06	1.33E-06	9.06E-01
TOTAL																	6.18E-01	2.02E-01	3.00E-02	2.91E-02	2.99E-02	1.02E-03	1.78E-04	1.22E+02
																	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE

Model	Type of Equipment	Number of Equipment/ Vehicle	Annual hours of Operation	Engine Horse Power (hp)	Fuel Type	Equipment Category	Engine Technology Category	Load Factor	Fuel Sulphur (% weight)	PM Adjustment Factor	In use fuel consumption (lb/hp-hr)	Annual Fuel Consumption (L)	Zero hour emission factor (g/hp-hr)				Deterioration Factor				Transient Adjustment Factor				Emission factor based on fuel consumption g/L				Exhaust emission rate (tonne/day)							
													NOx	CO	PM10	VOC	NOx	CO	PM10	VOC	NOx	CO	PM10	VOC	PAH	N2O	CH4	CO2	Nox	CO	PM10	PM2.5	VOC	SO2	PAH	CO2e
A	B	C	D	E	F	G	H	I	J	K	L	M	N1	N2	N3	N4	O1	O2	O3	O4	P1	P2	P3	P4	Q1	Q2	Q3	Q4	R1	R2	R3	R4	R5	R6	R7	R8
Operation																																				
Sandvik D45KS; Atlas Copco DML; or similar	Self-Propelled Blast Hole Drill	1	7,446	451	Diesel	Main	Tier 2	0.43	0.0015	0.052495504	0.367	656,475	4.3351	0.8425	0.1316	0.175913	1.009	1.101	1.473	1.034	1.00	1.00	1.00	1.00	0.0044	1.1	0.15	2663	1.73E-02	3.67E-03	5.59E-04	5.42E-04	7.33E-04	4.53E-05	7.91E-06	5.41E+00
Sandvik D45KS; Atlas Copco DML; or similar	Self-Propelled Blast Hole Drill	1	7,446	451	Diesel	Main	Tier 2	0.43	0.0015	0.052495504	0.367	656,475	4.3351	0.8425	0.1316	0.175913	1.009	1.101	1.473	1.034	1.00	1.00	1.00	1.00	0.0044	1.1	0.15	2663	1.73E-02	3.67E-03	5.59E-04	5.42E-04	7.33E-04	4.53E-05	7.91E-06	5.41E+00
Caterpillar 992K/Komatsu WA 900-3	Wheeled Front End Loader	1	7,446	801	Diesel	Main	Tier 2	0.48	0.0015	0.052495504	0.367	1,166,416	4.1	0.7642	0.1316	0.175913	1.009	1.101	1.473	1.034	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	3.08E-02	1.01E-02	1.46E-03	1.41E-03	1.53E-03	8.04E-05	1.41E-05	9.61E+00
Caterpillar 777F/Komatsu HD 785-7	Surface rock haulage trucks	2	7,446	1016	Diesel	Main	Tier 2	0.58	0.0015	0.052495504	0.367	2,961,954	4.1	0.7642	0.1316	0.175913	1.009	1.101	1.473	1.034	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	9.45E-02	3.10E-02	4.47E-03	4.34E-03	4.69E-03	2.04E-04	3.57E-05	2.44E+01
Caterpillar 777F/Komatsu HD 785-7	Surface rock haulage trucks	1	7,446	1016	Diesel	Main	Tier 2	0.58	0.0015	0.052495504	0.367	1,480,977	4.1	0.7642	0.1316	0.175913	1.009	1.101	1.473	1.034	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	4.73E-02	1.55E-02	2.24E-03	2.17E-03	2.34E-03	1.02E-04	1.79E-05	1.22E+01
Caterpillar D10T/Komatsu 375A-6	Tracked-Type tractor, bulldozer	1	3,942	581	Diesel	Main	Tier 2	0.58	0.0015	0.052495504	0.367	447,879	4.3351	0.8425	0.1316	0.175913	1.009	1.101	1.473	1.034	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	1.51E-02	5.16E-03	6.76E-04	6.56E-04	7.09E-04	3.09E-05	5.40E-06	3.69E+00
Caterpillar 14M/Komatsu GD675-3	Surface grader	1	1,402	259	Diesel	Main	Tier 2	0.58	0.0015	0.052495504	0.367	70,980	4	0.7475	0.1316	0.325159	1.009	1.101	1.473	1.034	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	2.21E-03	7.26E-04	1.07E-04	1.04E-04	2.08E-04	4.89E-06	8.56E-07	5.85E-01
Western Star 4900 SA; or Equivalent	Explosives Truck	1	1,402	450	Diesel	Support	Tier 1	0.58	0.0015	0.086875431	0.367	123,395	6.0153	1.306	0.2008	0.213435	1.024	1.101	1.473	1.036	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	5.86E-03	2.20E-03	2.78E-04	2.69E-04	2.37E-04	8.51E-06	1.49E-06	1.02E+00
Customized Package	Explosives Truck	1	1,402	450	Diesel	Support	Tier 1	0.58	0.0015	0.086875431	0.367	123,395	6.0153	1.306	0.2008	0.213435	1.024	1.101	1.473	1.036	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	5.86E-03	2.20E-03	2.78E-04	2.69E-04	2.37E-04	8.51E-06	1.49E-06	1.02E+00
Ford F-450 Crew Cab Flat Deck; or equivalent	Heavy Duty Truck, Diesel	1	1,402	400	Diesel	Support	Tier 1	0.58	0.0015	0.086875431	0.367	109,596	6.0153	1.306	0.2008	0.213435	1.024	1.101	1.473	1.036	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	5.21E-03	1.96E-03	2.46E-04	2.39E-04	2.11E-04	7.56E-06	1.32E-06	9.03E-01
Boss Hawg BMHP104MH-40FT, Perkins Genset	Portable Light Stands	2	4,380	13	Diesel	Main	Tier 2	0.43	0.0015	0.058360124	0.408	25,554	4.4399	2.161	0.2665	0.461652	1.009	1.101	1.473	1.034	1.00	1.00	1.00	1.00	0.0044	1.1	0.15	2663	6.20E-04	3.29E-04	4.63E-05	4.49E-05	6.74E-05	1.76E-06	3.08E-07	2.11E-01
Chevrolet Express 2500 Standard, or equivalent	Personnel Carrier	1	701	250	Diesel	Main	Tier 2	0.58	0.0015	0.052495504	0.367	34,276	4	0.7475	0.1316	0.325159	1.009	1.101	1.473	1.034	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	1.07E-03	3.51E-04	5.18E-05	5.02E-05	1.00E-04	2.36E-06	4.13E-07	2.82E-01
Ford F-250 Supercab, or equivalent	Light Duty Truck, Diesel	1	701	400	Diesel	Main	Tier 2	0.58	0.0015	0.052495504	0.367	54,798	4.3351	0.8425	0.1316	0.175913	1.009	1.101	1.473	1.034	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	1.85E-03	6.32E-04	8.27E-05	8.03E-05	8.67E-05	3.78E-06	6.61E-07	4.51E-01
Ford F-250 Crewcab, or equivalent	Light Duty Truck	1	1,402	400	Diesel	Main	Tier 2	0.58	0.0015	0.052495504	0.367	109,596	4.3351	0.8425	0.1316	0.175913	1.009	1.101	1.473	1.034	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	3.70E-03	1.26E-03	1.65E-04	1.61E-04	1.73E-04	7.56E-06	1.32E-06	9.03E-01
Ford F-250, or equivalent	Light Duty Truck	1	1,402	400	Diesel	Main	Tier 2	0.58	0.0015	0.052495504	0.367	109,596	4.3351	0.8425	0.1316	0.175913	1.009	1.101	1.473	1.034	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	3.70E-03	1.26E-03	1.65E-04	1.61E-04	1.73E-04	7.56E-06	1.32E-06	9.03E-01
Ford F-250, or equivalent	Light Duty Truck	1	1,402	400	Diesel	Main	Tier 2	0.58	0.0015	0.052495504	0.367	109,596	4.3351	0.8425	0.1316	0.175913	1.009	1.101	1.473	1.034	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	3.70E-03	1.26E-03	1.65E-04	1.61E-04	1.73E-04	7.56E-06	1.32E-06	9.03E-01
Ford F-250, or equivalent	Light Duty Truck	1	1,402	400	Diesel	Main	Tier 2	0.58	0.0015	0.052495504	0.367	109,596	4.3351	0.8425	0.1316	0.175913	1.009	1.101	1.473	1.034	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	3.70E-03	1.26E-03	1.65E-04	1.61E-04	1.73E-04	7.56E-06	1.32E-06	9.03E-01
Bobcat S150	Skid Steer-Loader	1	1,402	49	Diesel	Main	Tier 2	0.23	0.0015	0.058360124	0.408	14,923	4.7279	1.5323	0.3389	0.293961	1.009	1.101	1.473	1.034	1.10	2.57	1.97	2.29	0.0044	1.1	0.15	2663	2.27E-04	1.87E-04	4.00E-05	3.88E-05	3.07E-05	1.03E-06	1.80E-07	1.23E-01
Bobcat S70	Skid Steer-Loader	1	1,402	23	Diesel	Main	Tier 2	0.23	0.0015	0.058360124	0.408	7,155	4.4399	2.161	0.2665	0.461652	1.009	1.101	1.473	1.034	1.10	2.57	1.97	2.29	0.0044	1.1	0.15	2663	1.02E-04	1.27E-04	1.48E-05	1.44E-05	2.31E-05	4.93E-07	8.63E-08	5.89E-02
Ford F-250 Crewcab, or equivalent	Light Duty Truck	1	701	400	Diesel	Main	Tier 2	0.58	0.0015	0.052495504	0.367	54,798	4.3351	0.8425	0.1316	0.175913	1.009	1.101	1.473	1.034	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	1.85E-03	6.32E-04	8.27E-05	8.03E-05	8.67E-05	3.78E-06	6.61E-07	4.51E-01
Caterpillar 988H/Komatsu WA 600	Wheeled Front End Loader	1	1,752	520	Diesel	Main	Tier 2	0.48	0.0015	0.052495504	0.367	178,370	4.3351	0.8425	0.1316	0.175913	1.009	1.101	1.473	1.034	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	4.98E-03	1.70E-03	2.23E-04	2.16E-04	2.34E-04	1.23E-05	2.15E-06	1.47E+00
Ford F-250 Crewcab, or equivalent	Light Duty Truck	1	4,380	400	Diesel	Main	Tier 2	0.58	0.0015	0.052495504	0.367	342,489	4.3351	0.8425	0.1316	0.175913	1.009	1.101	1.473	1.034	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	1.16E-02	3.95E-03	5.17E-04	5.02E-04	5.42E-04	2.36E-05	4.13E-06	2.82E+00
Caterpillar D8T/Komatsu D155AX-6	Track-dozer	1	1,402	310	Diesel	Main	Tier 2	0.58	0.0015	0.052495504	0.367	84,956	4.3351	0.8425	0.1316	0.175913	1.009	1.101	1.473	1.034	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	2.87E-03	9.79E-04	1.28E-04	1.24E-04	1.34E-04	5.86E-06	1.02E-06	7.00E-01
Boss Hawg BMHP104MH-40FT, Perkins Genset	Portable Light Stands	1	4,380	13	Diesel	Main	Tier 2	0.43	0.0015	0.058360124	0.408	12,777	4.4399	2.161	0.2665	0.461652	1.009	1.101	1.473	1.034	1.00	1.00	1.00	1.00	0.0044	1.1	0.15	2663	3.10E-04	1.65E-04	2.31E-05	2.24E-05	3.37E-05	8.80E-07	1.54E-07	1.05E-01
McElroy Rolling 250/TracStar 250	Portable Pipe Fusion Machine	1	438	11	Diesel	Main	Tier 2	0.43	0.0015	0.058360124	0.408	1,048	4.3	4.1127	0.5	0.580543	1.009	1.101	1.473	1.034	1.00	1.00	1.00	1.00	0.0044	1.1	0.15	2663	2.46E-05	2.57E-05	3.85E-06	3.73E-06	3.47E-06	7.21E-08	1.26E-08	8.63E-03
Sandvik QJ340; or equivalent	Tracked Mobile Jaw Crusher	1	438	350	Diesel	Main	Tier 2	0.43	0.0015	0.052495504	0.367	29,997	4.3351	0.8425	0.1316	0.175913	1.009	1.101	1.473	1.034	1.00	1.00	1.00	1.00	0.0044	1.1	0.15	2663	7.90E-04	1.68E-04	2.55E-05	2.48E-05	3.35E-05	2.07E-06	3.62E-07	2.47E-01
Sandvik QH 440; or equivalent	Tracked Mobile Cone Crusher	1	438	443	Diesel	Support	Tier 1	0.43	0.0015	0.086875431	0.367	37,927	6.0153	1.306	0.2008	0.213435	1.024	1.101	1.473	1.036	1.00	1.00	1.00	1.00	0.0044	1.1	0.15	2663	1.41E-03	3.28E-04	4.77E-05	4.63E-05	5.15E-05	2.62E-06	4.57E-07	3.12E-01
Sandvik QA 450; or equivalent	Tracked Mobile Screening Plant	1	438	101	Diesel	Support	Tier 1	0.43	0.0015	0.086875431	0.367	8,620	5.6523	0.8667	0.2799	0.356674	1.024	1.101	1.473	1.036	1.00	1.00	1.00	1.00	0.0044	1.1	0.15	2663	3.00E-04	4.95E-05	1.69E-05	1.64E-05	1.96E-05	5.94E-07	1.04E-07	7.10E-02
Manitowoc (Grove) RT540E type; or Equivalent	Rough Terrain Crane; 36.2 tonnes	1	438	160	Diesel	Main	Tier 2	0.43	0.0015	0.052495504	0.367	13,711	4.1	0.8667	0.18	0.356674	1.009	1.101	1.473	1.034	1.00	1.00	1.00	1.00	0.0044	1.1	0.15	2663	3.41E-04	7.88E-05	1.76E-05	1.70E-05	3.11E-05	9.45E-07	1.65E-07	1.13E-01
Caterpillar 345 BL	Excavator	1	438	380	Diesel	Main	Tier 2	0.53	0.0015	0.052495504	0.367	32,525	4.3351	0.8425	0.1316	0.175913	1.009	1.101	1.473	1.034	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	1.00E-03	3.43E-04	4.49E-05	4.35E-05	4.70E-05	2.24E-06	3.92E-07	2.68E-01
Caterpillar 450E; or Equivalent	Backhoe	1	438	95	Diesel	Main	Tier 2	0.21	0.0015	0.058360124	0.408	9,072	4.7	2.3655	0.24	0.387029	1.009	1.101	1.473	1.034	1.10	2.57	1.97	2.29	0.0044	1.1	0.15	2663	1.25E-04	1.61E-04	1.53E-05	1.49E-05	2.24E-05	6.25E-07	1.09E-07	7.47E-02
Caterpillar TL943; or Equivalent	Surface grader	1	701	100	Diesel	Main	Tier 2	0.48	0.0015	0.058360124	0.408	15,230	4.7	2.3655	0.24	0.387029	1.009	1.101	1.473	1.034	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	4.15E-04	3.67E-04	3.47E-05	3.36E-05	3.95E-05	1.05E-06	1.84E-07	1.25E-01
Terex Genie; or Equivalent	Telescopic Handler	1	701	83	Diesel	Main	Tier 2	0.58	0.0015	0.058360124	0.408	12,675	4.7	2.3655	0.24	0.387029	1.009	1.101	1.473	1.034	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	4.17E-04	3.69E-04	3.49E-05	3.38E-05	3.97E-05	8.73E-07	1.53E-07	1.04E-01
Caterpillar IT24F	Integrated Tool Carrier	1	1,402	95	Diesel	Main	Tier 2	0.58	0.0015	0.058360124	0.408	29,029	4.7	2.3655	0.24	0.387029	1.009	1.101	1.473	1.034	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	9.55E-04	8.45E-04	7.98E-05	7.74E-05	9.09E-05	2.00E-06	3.50E-07	2.39E-01
Genie Scissor lift RT 2668; or Equivalent	Scissor Lift, Rough Terrain	1	1,402	25	Diesel	Main	Tier 2	0.48	0.0015	0.058360124	0.408	7,605	4.4399	2.161	0.2665	0.461652	1.009	1.101	1.473	1.034	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	1.96E-04	1.67E-04	1.95E-05	1.89E-05	2.35E-05	5.24E-07	9.17E-08	6.27E-02
Western Star 4900 SA; or Equivalent	Fuel & Lube Truck	1	1,402	450	Diesel	Main	Tier 2	0.58	0.0015	0.052495504	0.367	123,395	4.3351	0.8425	0.1316	0.175913	1.009	1.101	1.473	1.034	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	4.16E-03	1.42E-03	1.86E-04	1.81E-04	1.95E-04	8.51E-06	1.49E-06	1.02E+00
Western Star 4900 SA; or Equivalent	Boom Truck (*Alternative* "Hiab Truck")	1	701	450	Diesel	Main	Tier 2	0.58	0.0015	0.052495504	0.367	61,698	4.3351	0.8425	0.1316	0.175913	1.009	1.101	1.473	1.034	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	2.08E-03	7.11E-04	9.32E-05	9.04E-05	9.76E-05	4.26E-06	7.44E-07	5.08E-01
Western Star 4900 SA; or Equivalent	Water Truck	1	701	450	Diesel	Main	Tier 2	0.58	0.0015	0.052495504	0.367	61,698	4.3351	0.8425	0.1316	0.175913	1.009	1.101	1.473	1.034	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	2.08E-03	7.11E-04	9.32E-05	9.04E-05	9.76E-05	4.26E-06	7.44E-07	5.08E-01
Ford F-450 Crew Cab Flat Deck; or equivalent	Welding Truck	1	1,402	400	Diesel	Main	Tier 2	0.58	0.0015	0.052495504	0.367	109,596	4.3351	0.8425	0.1316	0.175913	1.009	1.101	1.473	1.034	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	3.70E-03	1.26E-03	1.65E-04	1.61E-04	1.73E-04	7.56E-06	1.32E-06	9.03E-01
Ford F-250 Crewcab, or equivalent	Light Duty Truck	1	701	400	Diesel	Main	Tier 2	0.58	0.0015	0.052495504	0.367	54,798	4.3351	0.8425	0.1316	0.175913	1.009	1.101	1.473	1.034	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	1.85E-03	6.32E-04	8.27E-05	8.03E-05	8.67E-05	3.78E-06	6.61E-07	4.51E-01
Ford F-250, or equivalent	Light Duty Truck	1	701	400	Diesel	Main	Tier 2	0.58	0.0015	0.052495504	0.367	54,798	4.3351	0.8425	0.1316	0.175913	1.009	1.101	1.473	1.034	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	1.85E-03	6.32E-04	8.27E-05	8.03E-05	8.67E-05	3.78E-06	6.61E-07	4.51E-01
Chevrolet Express 2500 Standard, or equivalent	Mine Ambulance	1	88	250	Diesel	Main	Tier 2	0.58	0.0015	0.052495504	0.367	4,285	4	0.7475	0.1316	0.325159	1.009	1.101	1.473	1.034	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	1.33E-04	4.38E-05	6.47E-06	6.28E-06	1.25E-05	2.95E-07	5.16E-08	3.53E-02
Ford F-450 Crew Cab Flat Deck; or equivalent	Fire Truck	1	88	400	Diesel	Main	Tier 2	0.58	0.0015	0.052495504	0.367	6,850	4.3351	0.8425	0.1316	0.175913	1.009	1.101	1.473	1.034	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	2.31E-04	7.89E-05	1.03E-05	1.00E-05	1.08E-05	4.72E-07	8.26E-08	5.64E-02
Fire Truck, Pumps/Foam Package	Fire Truck, Pumps/Foam Package	1	88	25	Diesel	Main	Tier 2	0.58	0.0015	0.058360124	0.408	475	4.4399	2.161	0.2665	0.461652	1.009	1.101	1.473	1.034	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	1.48E-05	1.26E-05	1.47E-06	1.43E-06	1.78E-06	3.27E-08	5.73E-09	3.92E-03
Ford F-250 Supercab, or equivalent	Light Duty Truck, Diesel	1	701	400	Diesel	Main	Tier 2	0.58	0.0015	0.052495504	0.367	54,798	4.3351	0.8425	0.1316	0.175913	1.009	1.101	1.473	1.034	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	1.85E-03	6.32E-04	8.27E-05	8.03E-05	8.67E-05	3.78E-06	6.61E-07	4.51E-01
Ford F-250 Crewcab, or equivalent	Light Duty Truck	1	701	400	Diesel	Main	Tier 2	0.58	0.0015	0.052495504	0.367	54,798	4.3351	0.8425	0.1316	0.175913	1.009	1.101	1.473	1.034	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	1.85E-03	6.32E-04	8.27E-05	8.03E-05	8.67E-05	3.78E-06	6.61E-07	4.51E-01
Ford F-250, or equivalent	Light Duty Truck	1	701	400	Diesel	Main	Tier 2	0.58	0.0015	0.052495504	0.367	54,798	4.3351	0.8425	0.1316	0.175913	1.009	1.101	1.473	1.034	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	1.85E-03	6.32E-04	8.27E-05	8.03E-05	8.67E-05	3.78E-06	6.61E-07	4.51E-01
Ford F-250, or equivalent	Light Duty Truck	2	701	400	Diesel	Main	Tier 2	0.58	0.0015	0.052495504	0.367	109,596	4.3351	0.8425	0.1316	0.175913	1.009	1.101	1.473	1.034	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	3.70E-03	1.26E-03	1.65E-04	1.61E-04	1.73E-04	7.56E-06	1.32E-06	9.03E-01
Girardin Minibus Inc; 300D	Community Bus	1	1,402	325	Diesel	Main	Tier 2	0.58	0.0015	0.052495504	0.367	89,001	4.3351	0.8425	0.1316	0.175913	1.009	1.101	1.473	1.034	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	3.00E-03	1.03E-03	1.34E-04	1.30E-04	1.41E-04	6.14E-06	1.07E-06	7.33E-01
Terex Genie; or Equivalent	Personnel Carrier	2	1,464	83	Diesel	Support	Tier 1	0.48	0.0015	0.09658086	0.408	52,956	5.5988	2.3655	0.473	0.54945	1.024	1.101	1.473	1.036	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	1.74E-03	1.28E-03	2.43E-04	2.36E-04	1.95E-04	3.65E-06	6.38E-07	4.36E-01
Genie Scissorlift RT 2668; or Equivalent	Scissor Lift, Rough Terrain	2	1,464	25	Diesel	Support	Tier 1	0.48	0.0015	0.09658086	0.408	15,887	4.4399	2.161	0.2665	0.461652	1.024	1.101	1.473	1.036	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	4.15E-04	3.50E-04	3.71E-05	3.60E-05	4.92E-05	1.09E-06	1.92E-07	1.31E-01
Western Star 4900 SA Mixer	Concrete Truck	1	720	450	Diesel	Support	Tier 1	0.58	0.0015	0.086875431	0.367	63,388	6.0153	1.306	0.2008	0.213435	1.024	1.101	1.473	1.036	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	3.01E-03	1.13E-03	1.43E-04	1.38E-04	1.22E-04	4.37E-06	7.64E-07	5.22E-01
TOTAL																													3.21E-01	1.06E-01	1.48E-02	1.43E-02	1.58E-02	7.05E-04	1.23E-04	8.42E+01

Model	Type of Equipment	Number of Equipment/ Vehicle	Annual hours of Operation	Engine Horse Power (hp)	Fuel Type	Equipment Category	Engine Technology Category	Load Factor	Fuel Sulphur (% weight)	PM Adjustment Factor	In use fuel consumption (lb/hp-hr)	Annual Fuel Consumption (L)	Zero hour emission factor (g/hp-hr)				Deterioration Factor				Transient Adjustment Factor				Emission factor based on fuel consumption g/L				Exhaust emission rate (tonne/day)							
													NOx	CO	PM10	VOC	NOx	CO	PM10	VOC	NOx	CO	PM10	VOC	PAH	N2O	CH4	CO2	Nox	CO	PM10	PM2.5	VOC	SO2	PAH	CO2e
A	B	C	D	E	F	G	H	I	J	K	L	M	N1	N2	N3	N4	O1	O2	O3	O4	P1	P2	P3	P4	Q1	Q2	Q3	Q4	R1	R2	R3	R4	R5	R6	R7	R8
Closure																																				
Caterpillar 527; or equivalent	Skidder	1	1098	166.286487	Diesel	Main	Tier 2	0.23	0.0015	0.052495504	0.367	35725.65252	4.1	0.8667	0.18	0.356674	1.009	1.101	1.473	1.034	1.1	2.57	1.97	2.29	0.0044	1.1	0.15	2663	5.24E-04	2.82E-04	5.41E-05	5.24E-05	9.91E-05	2.46E-06	4.31E-07	2.94E-01
Caterpillar 501 HD Track Harvester; or equivalent	Harvester	1	1098	156.899347	Diesel	Main	Tier 2	0.58	0.0015	0.052495504	0.367	33708.88182	4.1	0.8667	0.18	0.356674	1.009	1.101	1.473	1.034	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	1.08E-03	4.00E-04	7.49E-05	7.27E-05	1.08E-04	2.32E-06	4.06E-07	2.78E-01
Caterpillar 777F/Komatsu HD 785-7	Surface rock haulage trucks	2	2196	1016.49321	Diesel	Main	Tier 2	0.58	0.0015	0.052495504	0.367	873549.8262	4.1	0.7642	0.1316	0.175913	1.009	1.101	1.473	1.034	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	2.79E-02	9.13E-03	1.32E-03	1.28E-03	1.38E-03	6.02E-05	1.05E-05	7.20E+00
Sandvik 50	Underground Haulage Unit	2	732	522.997824	Diesel	Main	Tier 2	0.58	0.0015	0.052495504	0.367	149817.2525	4.3351	0.8425	0.1316	0.175913	1.009	1.101	1.473	1.034	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	5.06E-03	1.73E-03	2.26E-04	2.19E-04	2.37E-04	1.03E-05	1.81E-06	1.23E+00
Western Star 4900 SA; or Equivalent	Dump Truck	1	732	449.939051	Diesel	Main	Tier 2	0.58	0.0015	0.052495504	0.367	64444.46739	4.3351	0.8425	0.1316	0.175913	1.009	1.101	1.473	1.034	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	2.17E-03	7.43E-04	9.73E-05	9.44E-05	1.02E-04	4.44E-06	7.77E-07	5.31E-01
Caterpillar 992K/Komatsu WA 900-3	Wheeled Front End Loader	1	2196	800.588976	Diesel	Main	Tier 2	0.48	0.0015	0.052495504	0.367	344003.4606	4.1	0.7642	0.1316	0.175913	1.009	1.101	1.473	1.034	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	9.09E-03	2.98E-03	4.30E-04	4.17E-04	4.50E-04	2.37E-05	4.15E-06	2.83E+00
Caterpillar 988H/Komatsu WA 600	Wheeled Front End Loader	1	2196	520.315783	Diesel	Main	Tier 2	0.48	0.0015	0.052495504	0.367	223573.4384	4.3351	0.8425	0.1316	0.175913	1.009	1.101	1.473	1.034	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	6.24E-03	2.13E-03	2.79E-04	2.71E-04	2.93E-04	1.54E-05	2.70E-06	1.84E+00
Caterpillar IT24F	Integrated Tool Carrier	1	2196	95.2124243	Diesel	Main	Tier 2	0.48	0.0015	0.058360124	0.408	45482.1439	4.7	2.3655	0.24	0.387029	1.009	1.101	1.473	1.034	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	1.24E-03	1.10E-03	1.04E-04	1.00E-04	1.18E-04	3.13E-06	5.48E-07	3.75E-01
Caterpillar D8T/Komatsu D155AX-6	Track-dozer	1	2196	580.661686	Diesel	Main	Tier 2	0.58	0.0015	0.052495504	0.367	249503.3475	4.3351	0.8425	0.1316	0.175913	1.009	1.101	1.473	1.034	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	8.42E-03	2.88E-03	3.77E-04	3.65E-04	3.95E-04	1.72E-05	3.01E-06	2.06E+00
Caterpillar D4H	Tracked-Dozer	1	2196	309.775634	Diesel	Main	Tier 2	0.58	0.0015	0.052495504	0.367	133106.8667	4.3351	0.8425	0.1316	0.175913	1.009	1.101	1.473	1.034	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	4.49E-03	1.53E-03	2.01E-04	1.95E-04	2.11E-04	9.18E-06	1.60E-06	1.10E+00
Caterpillar D6T; Aker request; not req if D10 over ice	Track-dozer	1	2196	199.811989	Diesel	Support	Tier 1	0.58	0.0015	0.086875431	0.367	85856.8101	5.5772	0.7475	0.2521	0.325159	1.024	1.101	1.473	1.036	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	3.78E-03	8.78E-04	2.58E-04	2.50E-04	2.52E-04	5.92E-06	1.03E-06	7.07E-01
Caterpillar 345 BL	Excavator	1	720	379.508677	Diesel	Main	Tier 2	0.53	0.0015	0.052495504	0.367	53465.67776	4.3351	0.8425	0.1316	0.175913	1.009	1.101	1.473	1.034	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	1.65E-03	5.63E-04	7.38E-05	7.16E-05	7.73E-05	3.69E-06	6.45E-07	4.40E-01
Caterpillar 450E; or Equivalent	Backhoe	1	1080	95.2124243	Diesel	Main	Tier 2	0.21	0.0015	0.058360124	0.408	22368.26749	4.7	2.3655	0.24	0.387029	1.009	1.101	1.473	1.034	1.1	2.57	1.97	2.29	0.0044	1.1	0.15	2663	3.09E-04	3.96E-04	3.77E-05	3.66E-05	5.53E-05	1.54E-06	2.70E-07	1.84E-01
Grove RT9150E; or equivalent	Rough Terrain Crane; 135 tonnes	1	1464	300.388494	Diesel	Support	Tier 1	0.43	0.0015	0.086875431	0.367	86048.8835	6.0153	1.306	0.2008	0.213435	1.024	1.101	1.473	1.036	1	1	1	1	0.0044	1.1	0.15	2663	3.19E-03	7.45E-04	1.08E-04	1.05E-04	1.17E-04	5.93E-06	1.04E-06	7.09E-01
Manitowoc (Grove) RT540E type; or Equivalent	Rough Terrain Crane; 36.2 tonnes	1	2196	159.978329	Diesel	Main	Tier 2	0.43	0.0015	0.052495504	0.367	68740.76522	4.1	0.8667	0.18	0.356674	1.009	1.101	1.473	1.034	1	1	1	1	0.0044	1.1	0.15	2663	1.71E-03	3.95E-04	8.80E-05	8.54E-05	1.56E-04	4.74E-06	8.29E-07	5.66E-01
Western Star 4900 SA; or Equivalent	Boom Truck (*Alternative* "Hiab Truck")	1	2196	449.939051	Diesel	Main	Tier 2	0.58	0.0015	0.052495504	0.367	193333.4022	4.3351	0.8425	0.1316	0.175913	1.009	1.101	1.473	1.034	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	6.52E-03	2.23E-03	2.92E-04	2.83E-04	3.06E-04	1.33E-05	2.33E-06	1.59E+00
Caterpillar TL943; or Equivalent	Telescopic Handler	1	1952	99.9059945	Diesel	Main	Tier 2	0.48	0.0015	0.058360124	0.408	42421.53015	4.7	2.3655	0.24	0.387029	1.009	1.101	1.473	1.034	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	1.16E-03	1.02E-03	9.65E-05	9.37E-05	1.10E-04	2.92E-06	5.11E-07	3.50E-01
Caterpillar TL943; or Equivalent	Telescopic Handler	1	1952	99.9059945	Diesel	Support	Tier 1	0.48	0.0015	0.09658086	0.408	42421.53015	5.5988	2.3655	0.473	0.54945	1.024	1.101	1.473	1.036	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	1.40E-03	1.02E-03	1.95E-04	1.89E-04	1.56E-04	2.92E-06	5.11E-07	3.50E-01
Caterpillar TL642	Telescopic Handler	1	1952	99.9059945	Diesel	Support	Tier 1	0.48	0.0015	0.09658086	0.408	42421.53015	5.5988	2.3655	0.473	0.54945	1.024	1.101	1.473	1.036	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	1.40E-03	1.02E-03	1.95E-04	1.89E-04	1.56E-04	2.92E-06	5.11E-07	3.50E-01
Clark, ECX 32	Medium Forklift	1	0	0	Diesel	Main	Tier 2	0.48	0.0015	0.058360124	0.408	0	4.3	4.1127	0.5	0.580543	1.009	1.101	1.473	1.034	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Clark, CSM 15	Walkie Straddle Pallet Truck	1	0	0	Diesel	Main	Tier 2	0.48	0.0015	0.058360124	0.408	0	4.3	4.1127	0.5	0.580543	1.009	1.101	1.473	1.034	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Genie Scissorlift RT 2668; or Equivalent	Scissor Lift, Rough Terrain	1	1464	24.9429731	Diesel	Main	Tier 2	0.48	0.0015	0.058360124	0.408	7943.360343	4.4399	2.161	0.2665	0.461652	1.009	1.101	1.473	1.034	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	2.04E-04	1.75E-04	2.04E-05	1.98E-05	2.46E-05	5.47E-07	9.58E-08	6.54E-02
Genie Scissorlift RT 2668; or Equivalent	Scissor Lift, Rough Terrain	2	1464	24.9429731	Diesel	Support	Tier 1	0.48	0.0015	0.09658086	0.408	15886.72069	4.4399	2.161	0.2665	0.461652	1.024	1.101	1.473	1.036	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	4.15E-04	3.50E-04	3.71E-05	3.60E-05	4.92E-05	1.09E-06	1.92E-07	1.31E-01
Bobcat S150	Skid Steer-Loader	1	1464	48.9472322	Diesel	Main	Tier 2	0.23	0.0015	0.058360124	0.408	15587.77702	4.7279	1.5323	0.3389	0.293961	1.009	1.101	1.473	1.034	1.1	2.57	1.97	2.29	0.0044	1.1	0.15	2663	2.37E-04	1.96E-04	4.18E-05	4.05E-05	3.21E-05	1.07E-06	1.88E-07	1.28E-01
Bobcat S70	Skid Steer-Loader	1	1464	23.4678511	Diesel	Main	Tier 2	0.23	0.0015	0.058360124	0.408	7473.591721	4.4399	2.161	0.2665	0.461652	1.009	1.101	1.473	1.034	1.1	2.57	1.97	2.29	0.0044	1.1	0.15	2663	1.07E-04	1.32E-04	1.55E-05	1.50E-05	2.41E-05	5.15E-07	9.01E-08	6.16E-02
Bobcat S150	Skid Steer-Loader	1	1464	48.9472322	Diesel	Support	Tier 1	0.23	0.0015	0.09658086	0.408	15587.77702	4.7279	1.5323	0.3389	0.293961	1.024	1.101	1.473	1.036	1.1	2.57	1.97	2.29	0.0044	1.1	0.15	2663	2.40E-04	1.96E-04	4.00E-05	3.88E-05	3.21E-05	1.07E-06	1.88E-07	1.28E-01
Bobcat S150	Skid Steer-Loader	1	1464	48.9472322	Diesel	Support	Tier 1	0.23	0.0015	0.09658086	0.408	15587.77702	4.7279	1.5323	0.3389	0.293961	1.024	1.101	1.473	1.036	1.1	2.57	1.97	2.29	0.0044	1.1	0.15	2663	2.40E-04	1.96E-04	4.00E-05	3.88E-05	3.21E-05	1.07E-06	1.88E-07	1.28E-01
Western Star 4900 SA; or Equivalent	Fuel & Lube Truck	1	720	449.939051	Diesel	Main	Tier 2	0.58	0.0015	0.052495504	0.367	63388.00071	4.3351	0.8425	0.1316	0.175913	1.009	1.101	1.473	1.034	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	2.14E-03	7.31E-04	9.57E-05	9.28E-05	1.00E-04	4.37E-06	7.64E-07	5.22E-01
Western Star 4900 SA; or Equivalent	Water Truck	1	720	449.939051	Diesel	Main	Tier 2	0.58	0.0015	0.052495504	0.367	63388.00071	4.3351	0.8425	0.1316	0.175913	1.009	1.101	1.473	1.034	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	2.14E-03	7.31E-04	9.57E-05	9.28E-05	1.00E-04	4.37E-06	7.64E-07	5.22E-01
Ford F-250 Supercab, or equivalent	Light Duty Truck, Diesel	1	960	399.623978	Diesel	Main	Tier 2	0.58	0.0015	0.052495504	0.367	75066.06347	4.3351	0.8425	0.1316	0.175913	1.009	1.101	1.473	1.034	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	2.53E-03	8.65E-04	1.13E-04	1.10E-04	1.19E-04	5.18E-06	9.05E-07	6.18E-01
Ford F-250 Supercab, or equivalent	Light Duty Truck, Diesel	1	960	400.964998	Diesel	Support	Tier 1	0.58	0.0015	0.086875431	0.367	75317.96301	6.0153	1.306	0.2008	0.213435	1.024	1.101	1.473	1.036	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	3.58E-03	1.35E-03	1.69E-04	1.64E-04	1.45E-04	5.19E-06	9.08E-07	6.21E-01
Ford F-250, or equivalent	Light Duty Truck	4	960	399.623978	Diesel	Support	Tier 1	0.58	0.0015	0.086875431	0.367	300264.2539	6.0153	1.306	0.2008	0.213435	1.024	1.101	1.473	1.036	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	1.43E-02	5.36E-03	6.75E-04	6.55E-04	5.77E-04	2.07E-05	3.62E-06	2.47E+00
Ford F-250, or equivalent	Light Duty Truck	1	960	399.623978	Diesel	Support	Tier 1	0.58	0.0015	0.086875431	0.367	75066.06347	6.0153	1.306	0.2008	0.213435	1.024	1.101	1.473	1.036	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	3.57E-03	1.34E-03	1.69E-04	1.64E-04	1.44E-04	5.18E-06	9.05E-07	6.18E-01
Ford F-250, or equivalent	Light Duty Truck	1	1920	399.623978	Diesel	Support	Tier 1	0.58	0.0015	0.086875431	0.367	150132.1269	6.0153	1.306	0.2008	0.213435	1.024	1.101	1.473	1.036	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	7.13E-03	2.68E-03	3.38E-04	3.28E-04	2.89E-04	1.04E-05	1.81E-06	1.24E+00
Ford F-250, or equivalent	Light Duty Truck	1	1920	399.623978	Diesel	Support	Tier 1	0.58	0.0015	0.086875431	0.367	150132.1269	6.0153	1.306	0.2008	0.213435	1.024	1.101	1.473	1.036	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	7.13E-03	2.68E-03	3.38E-04	3.28E-04	2.89E-04	1.04E-05	1.81E-06	1.24E+00
Ford F-250 Crewcab, or equivalent	Light Duty Truck	3	1920	399.623978	Diesel	Support	Tier 1	0.58	0.0015	0.086875431	0.367	450396.3808	6.0153	1.306	0.2008	0.213435	1.024	1.101	1.473	1.036	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	2.14E-02	8.05E-03	1.01E-03	9.83E-04	8.66E-04	3.11E-05	5.43E-06	3.71E+00
Ford F-450 Crew Cab Flat Deck; or equivalent	Heavy Duty Truck, Diesel	1	1920	399.623978	Diesel	Support	Tier 1	0.58	0.0015	0.086875431	0.367	150132.1269	6.0153	1.306	0.2008	0.213435	1.024	1.101	1.473	1.036	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	7.13E-03	2.68E-03	3.38E-04	3.28E-04	2.89E-04	1.04E-05	1.81E-06	1.24E+00
Ford F-450 Crew Cab Flat Deck; or equivalent	Heavy Duty Truck, Diesel	1	1920	399.623978	Diesel	Support	Tier 1	0.58	0.0015	0.086875431	0.367	150132.1269	6.0153	1.306	0.2008	0.213435	1.024	1.101	1.473	1.036	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	7.13E-03	2.68E-03	3.38E-04	3.28E-04	2.89E-04	1.04E-05	1.81E-06	1.24E+00
Ford F-450 Crew Cab Flat Deck; or equivalent	Heavy Duty Truck, Diesel	1	1920	399.623978	Diesel	Support	Tier 1	0.58	0.0015	0.086875431	0.367	150132.1269	6.0153	1.306	0.2008	0.213435	1.024	1.101	1.473	1.036	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	7.13E-03	2.68E-03	3.38E-04	3.28E-04	2.89E-04	1.04E-05	1.81E-06	1.24E+00
Ford F-450 Crew Cab Flat Deck; or equivalent	Heavy Duty Truck, Diesel	2	1920	399.623978	Diesel	Support	Tier 1	0.58	0.0015	0.086875431	0.367	300264.2539	6.0153	1.306	0.2008	0.213435	1.024	1.101	1.473	1.036	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	1.43E-02	5.36E-03	6.75E-04	6.55E-04	5.77E-04	2.07E-05	3.62E-06	2.47E+00
Ford F-450 Crew Cab Flat Deck; or equivalent	Heavy Duty Truck, Diesel	1	1920	399.623978	Diesel	Support	Tier 1	0.58	0.0015	0.086875431	0.367	150132.1269	6.0153	1.306	0.2008	0.213435	1.024	1.101	1.473	1.036	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	7.13E-03	2.68E-03	3.38E-04	3.28E-04	2.89E-04	1.04E-05	1.81E-06	1.24E+00
Ford F-450 Crew Cab Flat Deck; or equivalent	Heavy Duty Truck, Diesel	2	1920	399.623978	Diesel	Support	Tier 1	0.58	0.0015	0.086875431	0.367	300264.2539	6.0153	1.306	0.2008	0.213435	1.024	1.101	1.473	1.036	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	1.43E-02	5.36E-03	6.75E-04	6.55E-04	5.77E-04	2.07E-05	3.62E-06	2.47E+00
Ford F-450 Crew Cab Flat Deck; or equivalent	Heavy Duty Truck, Diesel	1	1920	399.623978	Diesel	Support	Tier 1	0.58	0.0015	0.086875431	0.367	150132.1269	6.0153	1.306	0.2008	0.213435	1.024	1.101	1.473	1.036	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	7.13E-03	2.68E-03	3.38E-04	3.28E-04	2.89E-04	1.04E-05	1.81E-06	1.24E+00
Ford F-450 Crew Cab Flat Deck; or equivalent	Welding Truck	1	1920	399.623978	Diesel	Main	Tier 2	0.58	0.0015	0.052495504	0.367	150132.1269	4.3351	0.8425	0.1316	0.175913	1.009	1.101	1.473	1.034	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	5.07E-03	1.73E-03	2.27E-04	2.20E-04	2.38E-04	1.04E-05	1.81E-06	1.24E+00
Ford F-450 Crew Cab Flat Deck; or equivalent	Welding Truck	2	1920	399.623978	Diesel	Support	Tier 1	0.58	0.0015	0.086875431	0.367	300264.2539	6.0153	1.306	0.2008	0.213435	1.024	1.101	1.473	1.036	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	1.43E-02	5.36E-03	6.75E-04	6.55E-04	5.77E-04	2.07E-05	3.62E-06	2.47E+00
Chevrolet Express 2500 Standard, or equivalent	Personnel Carrier	1	1920	249.966139	Diesel	Main	Tier 2	0.58	0.0015	0.052495504	0.367	93908.1492	4	0.7475	0.1316	0.325159	1.009	1.101	1.473	1.034	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	2.92E-03	9.60E-04	1.42E-04	1.38E-04	2.75E-04	6.47E-06	1.13E-06	7.74E-01
Chevrolet Express 2500 Standard, or equivalent	Mine Ambulance	1	100	249.966139	Diesel	Main	Tier 2	0.58	0.0015	0.052495504	0.367	4891.049438	4	0.7475	0.1316	0.325159	1.009	1.101	1.473	1.034	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	1.52E-04	5.00E-05	7.39E-06	7.16E-06	1.43E-05	3.37E-07	5.90E-08	4.03E-02
Ford F-450 Crew Cab Flat Deck; or equivalent	Fire Truck	1	100	399.623978	Diesel	Main	Tier 2	0.58	0.0015	0.052495504	0.367	7819.381612	4.3351	0.8425	0.1316	0.175913	1.009	1.101	1.473	1.034	0.95	1.53	1.23	1.05	0.0044	1.1	0.15	2663	2.64E-04	9.01E-05	1.18E-05	1.15E-05	1.24E-05	5.39E-07	9.43E-08	6.44E-02
Kubota RTV900; or equivalent	Rough Terrain Vehicle	1	120	442.53662	Diesel	Support	Tier 1	0.43	0.0015	0.086875431	0.367	10390.8561	6.0153	1.306	0.2008	0.213435	1.024	1.101	1.473	1.036	1	1	1	1	0.0044	1.1	0.15	2663	3.85E-04	9.00E-05	1.31E-05	1.27E-05	1.41E-05	7.16E-07	1.25E-07	8.56E-02
TOTAL																													2.40E-01	8.86E-02	1.18E-02	1.15E-02	1.13E-02	4.27E-04	7.46E-05	5.10E+01

Air Quality Assessment - NICO Project

Description of the Calculation of Exhaust Emissions During the Construction, Operation and Closure Phases

A	Vehicle model provided by NICO within "NICO Mobile Equipment_REVC_without Aker fuel.xlsx".
B	Vehicle description of equipment provided by NICO in "NICO Mobile Equipment_REVC_without Aker fuel.xlsx".
C	Number of vehicles/mobile equipment provided by NICO in "NICO Mobile Equipment_REVC_without Aker fuel.xlsx"
D	Annual operations hours provided by NICO in "NICO Mobile Equipment_REVC_without Aker fuel.xlsx"
E	Engine horsepower provided by NICO in "NICO Mobile Equipment_REVC_without Aker fuel.xlsx"
F	Vehicle/equipment fuel type provided by NICO in "NICO Mobile Equipment_REVC_without Aker fuel.xlsx"
G	NICO provided whether the vehicle/equipment would be owned by NICO or owned by a sub-contractor within "NICO Mobile Equipment_REVC_without Aker fuel.xlsx". It was assumed that for all vehiles owned by NICO would be new and thus have a higher tiered emission control technology than those vehicles/equipment that would be owned by a subcontractor. Equipment owned by NICO was labeled as "MAIN" and equipment owned by the subcontractor was flagged as "SUPPORT"
H	See "G" description. It was assumed any vehicles owned by NICO would have a higher tiered emission control (TIER 2) and those vehicles owned by the subcontractors would have lower tiered emission control technology (TIER 1)
I	Input. Estimated based on information provided by Canadian Zinc.
J	Fuel sulphur fuel content as spcifed in Canada's Sulphur in Diesel Fuel Regulations (http://www.ec.gc.ca/energie-energy/default.asp?lang=En&n=7A8F92ED-1)
K	Sulfur Adjustment for PM emissions to account for variation in fuel sulphur content in comparison to default values. SPM adj = BSFC * 453.6 * 7.0 * soxcnv * 0.01 * (soxbas - soxdsl) [Equation 5] SPM adj = PM sulfur adjustment (g/hp-hr) BSFC = in-use adjusted brake-specific fuel consumption (lb fuel/hp-hr) (value L) 453.6 = conversion from lb to grams 7.0 = grams PM sulfate/grams PM sulfur soxcnv = grams PM sulfur/grams fuel sulfur consumed (extracted from: Exhaust and Crankcase Emission Factors for Nonroad Engine Modelling – Compression Ignition – Report No. NR-009C, page 20 & Appendix C) 0.01= conversion from percent to fraction soxbas = default certification fuel sulfur weight percent (extracted from: Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling - Compression-Ignition (EPA, April 2004) / Table A4 - Deterioration Factors for Nonroad Diesel Engines) soxdsl = episodic fuel sulfur weight percent (specified by the user) Source: Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling-- Compression-Ignition (EPA, April 2004).
L	Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling-Compression-Ignition (EPA, 2004) / Table A2. Zero-Hour, Steady-State Emission Factors for Nonroad CI Engines.
M	Fuel Consumption = EFss * Hp / diesel_density * 3.785412 * Op_Hours * Nu_Equip EFss = zero-hour, steady-state emission factor (lb/hp-hr) (Value L) Hp = equipment/vehicle power rating (hp) (value E) diesel_density = density of diesel taken as 7.1 lb/US gallon 3.785412 is the conversion from 1 gallon to Litre Op_hours = Vehicle operation hours/year (value D) Nu_Equip= Number of quipment (value C) Source: Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling-- Compression-Ignition (EPA, April 2004).
N1; N2; N3; N4	Extracted from: Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling-Compression-Ignition (EPA, 2004) / Table A2. Zero-Hour, Steady-State Emission Factors for Nonroad CI Engines.
O1; O2; O3; O4	DF = 1 + A * (Age Factor)^b [Equation 4] Age Factor = fraction of median life expended A = constant for a given pollutant/technology type (extracted from: Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling - Compression-Ignition (EPA, April 2004) / Table A4 - Deterioration Factors for Nonroad Diesel Engines) b = constant for a given pollutant/technology type (b = 1 for diesel nonroad engines) Source: Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling-- Compression-Ignition (EPA, April 2004).
P1; P2; P3; P4	Extracted from: Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling-- Compression-Ignition (EPA, April 2004) / Table A3 - Transient Adjustment Factors by Equipment Type for Nonroad CI Equipment.
Q1	PAH emission factor taken from (Golder Associates and Conor Pacific), Table 3-51, p: 94
Q2; Q3; Q4	GHG emission factors taken from Environment Canada, National Inventory Report (1990-2008)
R1; R2; R5	Emission = (EFss × TAF × DF) *Pop * Power * A * LF Emission = Annual Emission rate EFss = zero-hour, steady-state emission factor (g/hp-hr) (Values N1, N2, and N4) TAF = transient adjustment factor (unitless) (Values P1, P2 and P4) DF = deterioration factor (unitless) (Values O1, O2, O4) Pop = Engine population (value C) Power = Average power (hp) (Value E) A = Activity (hours/year) (Value D)
R3	Emission = (EFss × TAF × DF − SPMadj) *Pop * Power * A * LF Emission = Annual Emission rate EFss = zero-hour, steady-state emission factor (g/hp-hr) (value N3) TAF = transient adjustment factor (unitless) (Value P3) DF = deterioration factor (unitless) (Value O3) SPM adj = adjustment to PM emission factor to account for variations in fuel sulfur content (g/hp-hr) (Value M) Pop = Engine population (value C) Power = Average power (hp) (Value E) A = Activity (hours/year) (Value D) LF = Load facotor (Value I) Source: Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling-- Compression-Ignition (EPA, April 2004).
R4	Assumed that PM2.5 is 97% of PM10 mass emissions. Emission = Emission_PM10 * 0.97 Emission = Annual Emission rate Emission_PM10 = annual PM10 emiisison rate (tonne/year) (value R3) 0.97= fraction of PM2.5 emissions
R6	SO2 = [(BSFC * 453.6* (1 - soxcnv) - HC) * 0.01 * soxdsl * 2] * Pop * Power * A * LF SO2 = Annual Emission rate (tonne/year) BSFC is the in-use adjusted fuel consumption in lb/hp-hr (Value L) 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 soxdsl is the episodic weight percent of sulfur in nonroad diesel fuel 2 is the grams of SO2 formed from a gram of sulfur Pop = Engine population (value C) Power = Average power (hp) (Value E) A = Activity (hours/year) (Value D) LF = Load facotor (Value I) Source: Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling-- Compression-Ignition (EPA, April 2004).
R7	PAH = EF * FUEL/10^6 PAH= Annual emission rate (tonne/year) EF = PAH emission factor (g/L) (Value Q3) FUEL = Annual fuel use (L) (Value M)
R8	CO2e =(Q2*310 + Q3*21 + Q4)*FUEL/10^6 CO2e= Annual GHG emission (tonne/year) Q2 = Emission factor for N2O (g/L) (value Q2) 310 = carbon dioxide equivalent value for N20 Q3 = Emission factor for CH4 (g/L) (value Q3) 21 = carbon dioxide equivalent value for CH4 Q4 = Carbon dioxide emission factor (g/L) (value Q4) FUEL = Annual engine fuel consumption (L) (value M) 10^6 = conversion from g to tonne