Appendix 1

BAPC Detailed Emissions Inventory

Western 102

AP4911-2189.01
(Renewal)
January 2013

Western 102 Barrick Goldstrike - AP4911-2189 - RENEWAL - August 2012

EMISSIONS INVENTORY FOR SYS 02

BAPC CALCULATIONS USING AP-42

System #	Source #	Source Description	Fuel INPUT MMBtu/hr	Operating Hours hr/yr	Emission Factor from AP 42 Table 3.3-1 Uncontrolled lb/MMbtu PM/PM10	PM2.5	SO2	NOx	CO	VOC	CALCULATED EMISSIONS WITH CONTROLS LB/HR PM/PM10	PM2.5	SO2	NOx	CO	VOC	CALCULATED EMISSIONS WITH CONTROLS TPY PM/PM10	PM2.5	SO2	NOx	CO	VOC	SCC Code
02	Emergency Diesel Generator																						
	S2.015	Diesel Gen	1.51	500	0.310	0.310	0.290	4.410	0.950	0.360	0.47	0.47	0.44	6.65	1.43	0.54	0.117	0.117	0.109	1.661	0.358	0.136	2-02-001-02
	REQUESTING ==>		1.53	500	0.310		0.290	4.410	0.950	0.360	0.47		0.44	6.75	1.45	0.55	0.119		0.111	1.687	0.363	0.138	
			FUEL OUTPUT HP/hr		lb/hp-hr PM/PM10	PM2.5	SO2	NOx	CO	VOC	LB/HR PM/PM10	PM2.5	SO2	NOx	CO	VOC	TPY PM/PM10	PM2.5	SO2	NOx	CO	VOC	
			170.0	500	2.20E-03	2.20E-03	2.05E-03	0.031	6.68E-03	2.51E-03	0.37	0.37	0.35	5.27	1.14	0.43	0.094	0.094	0.09	1.318	0.284	0.107	

Note: Using the AP-42 Emission Factors for lb/MMBtu are larger than the lb/(hp-hr) value due to assuming a worst case effiency of 9,000 Btu/(hp-hr).

HAZARDOUS AIR POLLUTANTS CALCULATIONS FOR ONE UNIT SYS 01*					
	lb/MMBtu	lb/hr	lb/start	Control Ef	lb/hr
1,1,2,2-Tetrachloroethane	4.00E-05	3.08E-03	7.70E-04	79%	6.47E-04
1,1,2-Trichloroethane	3.18E-05	2.45E-03	6.12E-04	79%	5.14E-04
1,3-Butadiene	2.67E-04	2.06E-02	5.14E-03	79%	4.32E-03
1,3-Dichloropropene	2.64E-05	2.03E-03	5.08E-04	79%	4.27E-04
2-Methylnaphthalene	3.32E-05	2.56E-03	6.39E-04	79%	5.37E-04
2,2,4-Trimethylpentane	2.50E-04	1.93E-02	4.81E-03	79%	4.04E-03
Acenaphthene	1.25E-06	9.63E-05	2.41E-05	79%	2.02E-05
Acenaphthylene	5.53E-06	4.26E-04	1.06E-04	79%	8.94E-05
Acetaldehyde**	8.36E-03	6.44E-01	1.61E-01	97%	1.93E-02
Acrolein	5.14E-03	3.96E-01	9.89E-02	79%	8.31E-02
Benzene	4.40E-04	3.39E-02	8.47E-03	79%	7.11E-03
Benzo(b)fluoranthene	1.66E-07	1.28E-05	3.20E-06	79%	2.68E-06
Benzo(e)pyrene	4.15E-07	3.20E-05	7.99E-06	79%	6.71E-06
Benzo(g,h,i)perylene	4.14E-07	3.19E-05	7.97E-06	79%	6.69E-06
Biphenyl	2.12E-04	1.63E-02	4.08E-03	79%	3.43E-03
Carbon Tetrachloride	3.67E-05	2.83E-03	7.06E-04	79%	5.93E-04
Chlorobenzene	3.04E-05	2.34E-03	5.85E-04	79%	4.92E-04
Chloroform	2.85E-05	2.19E-03	5.49E-04	79%	4.61E-04
Chrysene	6.93E-07	5.34E-05	1.33E-05	79%	1.12E-05
Ethylbenzene	3.97E-05	3.06E-03	7.64E-04	79%	6.42E-04
Ethylene Dibromide	4.43E-05	3.41E-03	8.53E-04	79%	7.16E-04
Fluoranthene	1.11E-06	8.55E-05	2.14E-05	79%	1.79E-05
Fluorene	5.67E-06	4.37E-04	1.09E-04	79%	9.17E-05
Methanol	2.50E-03	1.93E-01	4.81E-02	79%	4.04E-02
Methylene Chloride	2.00E-05	1.54E-03	3.85E-04	79%	3.23E-04
n-Hexane	1.11E-03	8.55E-02	2.14E-02	79%	1.79E-02
Naphthalene	7.44E-05	5.73E-03	1.43E-03	79%	1.20E-03
PAH	2.69E-05	2.07E-03	5.18E-04	79%	4.35E-04
Phenanthrene	1.04E-05	8.01E-04	2.00E-04	79%	1.68E-04
Phenol	2.40E-05	1.85E-03	4.62E-04	79%	3.88E-04
Pyrene	1.36E-06	1.05E-04	2.62E-05	79%	2.20E-05
Styrene	2.36E-05	1.82E-03	4.54E-04	79%	3.82E-04
Tetrachloroethane	2.48E-06	1.91E-04	4.77E-05	79%	4.01E-05
Toluene	4.08E-04	3.14E-02	7.85E-03	79%	6.60E-03
Vinyl Chloride	1.49E-05	1.15E-03	2.87E-04	79%	2.41E-04
Xylene	1.84E-04	1.42E-02	3.54E-03	79%	2.98E-03
	1.94E-02		3.73E-01		0.198

*Note: AP-42 Table 3.2-2 was used for these calculations. This is only for 1 engine and does not include formaldehyde.

**Note: Barrick is calculating Acetaldehyde with a 97% control efficiency. If 79% control efficiency was used, this still does not have a significant increase to be major for HAPs.

HAPS CALCULATIONS SYS 02*			
	lb/MMBtu	lb/hr	TPY
1,3-Butadiene	3.91E-05	5.87E-05	1.47E-05
Acetaldehyde	7.67E-04	1.15E-03	2.88E-04
Acrolein	9.25E-05	1.39E-04	3.47E-05
Benzene	9.33E-04	1.40E-03	3.50E-04
Formaldehyde	1.18E-03	1.77E-03	4.43E-04
PAH	1.68E-04	2.52E-04	6.30E-05
Propylene	2.58E-03	3.87E-03	9.68E-04
Toluene	4.09E-04	6.14E-04	1.53E-04
Xylenes	2.85E-04	4.28E-04	1.07E-04
		9.68E-03	2.42E-03

*Note: AP-42 Table 3.3-2 was used for the factors.

Table 4.1-1

Western 102 Barrick Goldstrike Mines Inc.

Facility Wide Potential to Emit (Class I Renewal, August 2012)

System	Annual PTE (tons/yr)							
	PM	PM_{10}	SO_2	NO_X	CO	VOC	FORMALD.	TOTAL HAPS
System 01 - Wartsila NG RICE (14 engines)	158.76	158.76	35.56	93.80	152.32	149.52	9.94	22.4
System 02 - Emergency Diesel Generator	0.117	0.117	0.109	1.660	0.360	0.140	4.43E-04	2.00E-03
Total =	**158.88**	**158.88**	**35.67**	**95.46**	**152.68**	**149.66**	**9.94**	**22.40**

Note: The total HAPs are added HAPs including Formaldehyde, Acetaldehyde, Acrolein, Methonal, and N-Hexane. The largest HAP is Formaldehyde which is less than the threshold of 10 tons per year.

SYS 01 (One Natural Gas Engine)

NAC 445B.2203 (*State Only Requirement*) for One NG Engine
Emissions of Particulate Matter (PM_{10}) - Fuel Burning Equipment
For input of heat > 10 MMBtu/hr, but less than 4,000 MMBtu/hr, the allowable emissions are calculated as follows (NAC 445B.2203.1.b.):

Y (lb. PM_{10})/MMBtu = $1.02X^{-0.231}$, where X is the heat input rate in MMBtu/hr.
Y (lb. PM_{10})/MMBtu = $1.02(77)^{-0.231}$ = 0.374 lb. PM_{10}/MMBtu
NAC ER (lb. PM_{10}/hr) = (0.374lb. PM_{10}/MMBtu)*77 MMBtu/hr = **28.8 lb. PM_{10}/hr**
NAC ER (ton PM_{10}/yr) = (28.8 lb/hr)*(8760 hr/yr)*(ton/2,000 lb) = **126.1 ton/yr**

SIP 445.731(1)(b) - (*Federally Enforceable SIP Requirement*) One NG Engine
Emissions of Particulate Matter (PM_{10}) - Fuel Burning Equipment
For input of heat > 10 MMBtu/hr, but less than 4,000 MMBtu/hr, the allowable emissions are calculated using the following equation:

Y (lb. PM_{10})/MMBtu = $1.02X^{-0.231}$, where X is the heat input rate in MMBtu/hr.
Y (lb. PM_{10})/MMBtu = $1.02(77)^{-0.231}$ = 0.374 lb. PM_{10}/MMBtu
SIP ER (lb. PM_{10}/hr) = (0.374 lb. PM_{10}/MMBtu)*77 MMBtu/hr = **28.8 lb. PM_{10}/hr**
SIP ER (ton PM_{10}/yr) = (28.8 lb/hr)*(8760 hr/yr)*(ton/2,000 lb) = **126.1 ton/yr**

NAC 445B.22047 (*State Only Requirement*) for One NG Engine
Sulfur Emissions - Fuel Burning Equipment
Where an emission unit has a total input heat ofless than 250 MMBtu per hour, the allowable emission must be calculated using the following equation:
Y (lb. S/hr) = 0.70X, where X is the maximum heat input rate in MMBtu/hr.
Y (lb. S/hr) = 0.70 (77 MMBtu/hr) = **53.9 lb S/hr**
To calculate the corresponding maximum allowable SO_2 emission rate, assume all sulfur is combusted to SO_2 according to the following equation:

S (32 lb/mol) + O_2 (32 lb/mol) = SO_2 (64 lb/mol)

Therefore, (53.9 lb. S/hr)*(64 lb. SO_2/32 lb. S) = **107.8 lb. SO_2/hr**
(107.8 lb. SO_2/hr)*(8760 hr/yr)*(ton/2,000 lb.) = **472.2 ton SO_2/yr**

One NG Engine Compliance Verification - Maximum Allowables			
	PM	PM_{10}	Sulfur
Permit Limit (lb/hr)	2.59	2.59	0.29
NAC Max. Allowable (lb/hr)	28.8	28.8	53.9
SIP Max. Allowable (lb/hr)	28.8	28.8	53.9

Note: Requested Permit Limits do not exceed NAC or SIP maximum allowable emissions. The permit limit for sulfur is the SO2 limit divided by 2.

SYS 02 (Emergency Diesel Generator)

NAC 445B.22047 (*State Only Requirement*) for Emergency Diesel Generator
Sulfur Emissions - Fuel Burning Equipment
Where an emission unit has a maximum input of heat less than 250 MMBtu per hour, the allowable emission must be calculated using the following equation:
Y (lb. S/hr) = 0.70X, where X is the maximum heat input rate in MMBtu/hr.
Y (lb. S/hr) = 0.70 (1.5 MMBtu/hr) = **1.05 lb S/hr**
To calculate the corresponding maximum allowable SO_2 emission rate, assume all sulfur is combusted to SO_2 according to the following equation:

S (32 lb/mol) + O_2 (32 lb/mol) = SO_2 (64 lb/mol)

Therefore, (1.05 lb. S/hr)*(64 lb. SO_2/32 lb. S) = **2.1 lb. SO_2/hr**
(2.1 lb. SO_2/hr)*(500 hr/yr)*(ton/2,000 lb.) = **0.53 ton SO_2/yr**

Emergency Diesel Generator Compliance Verification - Maximum Allowables			
	PM	PM_{10}	Sulfur
Permit Limit (lb/hr)	N/A	N/A	0.175
NAC Max. Allowable (lb/hr)	N/A	N/A	1.05
SIP Max. Allowable (lb/hr)	N/A	N/A	1.05

Note: Requested Permit Limits do not exceed NAC or SIP maximum allowable emissions. The permit limit for sulfur is the SO2 limit divided by 2.

Western 102 Barrick Goldstrike. - Renewal, Class I

System	ID	Source Description	Process Rate dscf	Operating Hours hr/day	Operating Hours hr/yr	Emissions pounds/hour CO_2	Emissions pounds/hour CH_4	Emissions pounds/hour N_2O	Emissions tons/year CO_2	Emissions tons/year CH_4	Emissions tons/year N_2O	Emission Factor Reference
Wartsilla Natural Gas Engines												
S2.001	Wartsilla Engine #1		23,925.0	24	8,760	9,032.2	4.1	0.0006	39560.9	18.0	0.003	Source Testing for CO2, AP42 Section 3.2-2 CH4. 1% of NOX for N2O.
S2.002	Wartsilla Engine #2		24,932.0	24	8,760	9,583.5	4.3	0.0007	41975.6	18.7	0.003	Source Testing for CO2, AP42 Section 3.2-2 CH4. 1% of NOX for N2O.
S2.003	Wartsilla Engine #3		24,979.0	24	8,760	9,430.1	4.3	0.0007	41303.7	18.8	0.003	Source Testing for CO2, AP42 Section 3.2-2 CH4. 1% of NOX for N2O.
S2.004	Wartsilla Engine #4		24,032.0	24	8,760	9,072.6	4.1	0.0006	39737.8	18.1	0.003	Source Testing for CO2, AP42 Section 3.2-2 CH4. 1% of NOX for N2O.
S2.005	Wartsilla Engine #5		25,146.0	24	8,760	9,493.1	4.3	0.0007	41579.9	18.9	0.003	Source Testing for CO2, AP42 Section 3.2-2 CH4. 1% of NOX for N2O.
S2.006	Wartsilla Engine #6		24,129.0	24	8,760	9,109.2	4.1	0.0006	39898.2	18.1	0.003	Source Testing for CO2, AP42 Section 3.2-2 CH4. 1% of NOX for N2O.
S2.007	Wartsilla Engine #7		24,936.0	24	8,760	9,413.8	4.3	0.0007	41232.6	18.7	0.003	Source Testing for CO2, AP42 Section 3.2-2 CH4. 1% of NOX for N2O.
S2.008	Wartsilla Engine #8		23,557.0	24	8,760	9,054.9	4.0	0.0006	39660.6	17.7	0.003	Source Testing for CO2, AP42 Section 3.2-2 CH4. 1% of NOX for N2O.
S2.009	Wartsilla Engine #9		24,429.0	24	8,760	8,887.1	4.2	0.0006	38925.4	18.4	0.003	Source Testing for CO2, AP42 Section 3.2-2 CH4. 1% of NOX for N2O.
S2.010	Wartsilla Engine #10		24,633.0	24	8,760	9,130.4	4.2	0.0007	39991.0	18.5	0.003	Source Testing for CO2, AP42 Section 3.2-2 CH4. 1% of NOX for N2O.
S2.011	Wartsilla Engine #11		23,796.0	24	8,760	9,146.8	4.1	0.0006	40063.0	17.9	0.003	Source Testing for CO2, AP42 Section 3.2-2 CH4. 1% of NOX for N2O.
S2.012	Wartsilla Engine #12		24,594.0	24	8,760	9,284.7	4.2	0.0007	40667.1	18.5	0.003	Source Testing for CO2, AP42 Section 3.2-2 CH4. 1% of NOX for N2O.
S2.013	Wartsilla Engine #13		23,433.0	24	8,760	8,685.6	4.0	0.0006	38042.8	17.6	0.003	Source Testing for CO2, AP42 Section 3.2-2 CH4. 1% of NOX for N2O.
S2.014	Wartsilla Engine #14		23,854.0	24	8,760	8,841.6	4.1	0.0006	38726.3	17.9	0.003	Source Testing for CO2, AP42 Section 3.2-2 CH4. 1% of NOX for N2O.
					SUM	128,166	58	0.0090	561,365	256	0.040	

System	ID	Source Description	Design Output hp/hr	Operating Hours hr/day	Operating Hours hr/yr	Emission Factor lb/hp-hr CO_2	Emission Factor lb/hp-hr CH_4	Emission Factor lb/hp-hr N_2O	Emissions pounds/hour CO_2	Emissions pounds/hour CH_4	Emissions pounds/hour N_2O	Emissions tons/year CO_2	Emissions tons/year CH_4	Emissions tons/year N_2O	Emission Factor Reference
Diesel Emergency Generator															
S2.015	Emergency Gen		170.0	24	500	1	0.00023	0.000	195.5	0.038	0.05	48.8750	9.62E-03	1.32E-02	AP42 Section 3.3-1 for CO2. 9% of VOC for CH4. 1% of NOX for N2O.

Mass-Based Emissions tons/year			
CO_2	CH_4	N_2O	Combined
561,413.8	255.87	0.05	561,669.8

GHG	GWP	Mass-Based	CO2e-basis
CO_2	1	561,413.8	566,804
CH_4	21	255.87	
N_2O	310	0.05	