

APPENDIX F – EMISSIONS DATA

**Table F-2
PARTICULATE MATTER EMISSION ESTIMATION FUGITIVE EMISSIONS FROM
AREA III – COAL MINE EQUIPMENT AND OPERATIONS - PREFERRED ALTERNATIVE**

Tons Coal Produced 4347000 Cubic Yds Overburden + Interburden 7029099

Quarry Operations	Maximum Transfer Rate or Emissions Basis		Emission Factor Units	Emission Factor			Representative Uncontrolled Hourly Emission Rate (lb/hr)			Operating Schedule		Annual Emission Rate without Controls (ton per year)			Control Efficiency %	Controlled Emission Rates (No Hourly Average for Blasting)					
				PM	PM ₁₀	PM _{2.5}	PM	PM ₁₀	PM _{2.5}	Hours/Week	Weeks/Year	PM	PM ₁₀	PM _{2.5}		PM ₁₀ (Typ. lb/hr)	PM (tpy)	PM ₁₀ (Typ. lb/hr)	PM ₁₀ (tpy)	PM _{2.5} (Typ. lb/hr)	PM _{2.5} (tpy)
Drilling - Overburden + Interburden ¹	10,003	Holes/yr		1.3	0.676	0.195	2.050	1.066	0.307	122	52	6.50	3.38	0.98	50.0%	1.02	3.25	0.533	1.69	0.154	0.488
Drilling - Coal ¹	74,910	Holes/yr		0.22	0.114	0.033	31.173	16.210	4.863	122	52	8.24	4.28	1.24	50.0%	15.59	4.12	8.10	2.14	2.43	0.618
Overburden Blasting ²	10	blast/yr		9.7	5.04	1.51	N/A	N/A	N/A	N/A		0.05	0.03	0.01	0.00%	N/A	0.05	N/A	0.03	N/A	0.008
Coal Blasting ²	129	blast/yr		9.7	5.04	1.51	N/A	N/A	N/A	N/A		0.63	0.33	0.10	0.00%	N/A	0.63	N/A	0.33	N/A	0.098
Overburden Dragline ³	7.03E+06	cu.yds/yr		0.048	0.0092	8.09E-04	56.96	10.96	0.97	113	52	167.35	32.20	2.85	0.00%	56.96	167.35	10.96	32.20	0.97	2.845
Overburden Dozers ⁴	1675	hrs/month	lb/hr/dozer (12 dozers/hr)	3.00	0.54	6.60E-02	36.02	6.43	0.79	175	52	30.17	5.38	0.66	60.00%	14.41	12.07	2.57	2.15	0.32	0.265
Dozers - Maint and Replace ⁴	2530	hrs/month	lb/hr/dozer (12 dozers/hr)	41.29	9.96	0.91	495.47	119.57	10.90	1330	52	626.77	151.26	13.79	60.00%	198.2	250.7	47.8	60.5	4.36	5.52
Truck Loading Coal with Payloader ⁵	4.35E+06	tons/yr	lb/ton (7 Loaders)	0.05	0.0089	0.0010	6.246	1.037	0.119	715	52	116.11	19.28	2.21	50.00%	3.12	58.06	0.52	9.642	0.156	2.89
Scrapers ⁶	335	hrs/month	lb/VMT (3 Scrapers)	2.26E-01	1.22E-01	7.01E-03	0.473	0.256	0.015	74	52	0.91	0.49	0.03	50.00%	0.24	0.45	0.13	0.246	0.0073	0.014
Road Graders ⁶	1,654	hrs/month	lb/VMT (4 Graders)	2.26E-01	1.22E-01	7.01E-03	2.334	1.263	0.072	74	52	4.49	2.43	0.14	50.00%	1.17	2.25	0.63	1.215	0.0362	0.070
Coal Processing Plant ⁷	4,347,000	tons/yr	lb/ton coal	7.40E-01	3.50E-01	5.30E-02	9.91	4.63	1.36			43.38	20.30	5.92	65.00%	3.47	15.18	1.62	7.10	0.48	2.07
CATEGORY SUBTOTAL: Overburden Drill/Blast																	3.30		1.72		0.50
CATEGORY SUBTOTAL: Coal Drill/Blast																	4.75		2.47		0.72
CATEGORY SUBTOTAL: Mine Extraction Oper.																	490.9		106.0		11.6
TOTAL																	514.1		117.2		14.9

NOTES:

- Emission factor is for uncontrolled drilling for either overburden or coal from AP-42, Western Surface Coal Mining, Table 11.1-4 (7/98). Holes per cu.yd. overburden = 702; holes per ton coal = 58; PM10 = 0.52, PM2.5 = 0.15 x PM (Company data)
- The emission factor for overburden/coal seam blasting is in units of lb/blast. Calculation is based on surface area per blast, which is estimated as follows:
 Blasted material /yr = 29,449,000 cu. Yds/133 blasts/yr * 27 cu.ft. / 1 cu.yd. = 5,978,000 cu.ft./blast
 Area = 5,978,000 cu.ft./blast / 400 ft avg. depth = 149,460 sq.ft./blast
 Emission Factor PM (lb/blast) = Area^{1.5} x 0.000014 = (5,978,000)^{1.5} x 0.000014 = 9.7 lb/blast; AP-42, Table 11.9-1, PM₁₀ is 52% of the PM Emission Factor
- Overburden dragline removal factor (TSP) = 0.0021 * D^{1.1} / M^{0.3}; (< 15 micron PM) = 0.0021 * D^{0.7} / M^{0.3}; Scaling factors: PM10 = 0.75 x EF (< 15 micron); PM2.5 = 0.017 x EF (TSP) From facility data: Drop Height (D) = 30 ft; M = 7.9% moisture
- Coal Bulldozing factor (TSP) = 78.4 * s^{1.2} / M^{1.3}; (< 15 micron PM) = 18.6 * s^{1.5} / M^{1.4}; Scaling factors: PM10 = 0.75 x EF (< 15 micron); PM2.5 = 0.017 x EF (TSP) From facility data: s = 5.5% Silt; M = 7.9% moisture
- Truck loading of coal with Front-End Loaders (TSP) = 1.16 / M^{1.2}; (< 15 micron) = 0.119 / M^{0.9} Scaling factors: PM10 = 0.75 x EF (< 15 micron); PM2.5 = 0.017 x EF (TSP) From facility data: M = 7.9% moisture
- Emission factor for scrapers and graders from Document AP-42, Western Surface Coal Mining, Section 11.9, Table 11.9-1 (7/99), EF(grading, TSP) = 0.4 S²; EF(PM10) = 0.051 S² 2.0 Veh. Avg working speed (S) = 2 mph for emission factor correlation.
- Coal Processing plant located in Area III, emissions are the contribution due to Area III production only. Table entry is a composite of all fugitive sources (belts, drop points, transfer points) in the plant. Emission factors primarily from AP-42 13.2.4 (Moisture = 8%, Wind Speed = 9.5) mph

**Table F-3
PARTICULATE MATTER EMISSION ESTIMATION - FUGITIVE EMISSIONS FROM
AREA IV NORTH - COAL MINE AND PLANT VEHICLES - PREFERRED ALTERNATIVE**

Total Coal 4153000 tons/yr

Mine and Plant Vehicles	Gross Vehicle Weight ⁴	Emission factor ¹ (lb/VMT)			Avg. Speed (MPH)	Oper. Hours/Month ²	Annual VMT ³ (miles/yr)	Max. Uncontrolled Emission Rate (tpy)			Control Measure	Control Efficiency ⁴ (%)	Controlled Emission Rate			
	tons	PM	PM ₁₀	PM _{2.5}				PM	PM ₁₀	PM _{2.5}			PM (tpy)	PM ₁₀ (tpy)	PM _{2.5} (tpy)	
Coal Haulage, Stockpile and Roadway Maintenance																
Coal Haul Trucks (240-ton capacity)	280	24.36	6.93	0.69	35	3244	113,537	1382.79	393.22	39.32	Chem. Suppressant and Water Application	65.00%	483.98	137.63	13.76	
Water Trucks	62	12.36	3.51	0.35	10	505	30,300	187.25	53.25	5.32		65.00%	65.54	18.64	1.86	
Scrapers (Travel Mode)	62	12.36	3.51	0.35	15	290	26,100	161.29	45.87	4.59		65.00%	56.45	16.05	1.61	
End Dump Trucks						None Used										
Light/Medium Veh (e.g., Pick-ups)	3	3.16	0.90	0.09	25	640	96,000	151.84	43.18	4.32		65.00%	53.14	15.11	1.51	
Total Plant Vehicle travel													175.13	49.80	4.98	

- NOTES:
- Emission Factors for the coal haul road from AP-42, Section 13.2.2 Equation 1a, with constants from Table 13.2.2-2 - See results below
 *Assumed quarry surface silt content = 8.3% (Mean value for stone quarrying and processing, AP-42 Table 13.2.2-1) *Assumed days per year with > 0.01 inch moisture = 60, Figure 13.2.2-1
 - Total vehicle category hours per month based on facility estimates for Area IV North development and operations.
 - Total Vehicle Miles Traveled (VMT) estimated by the capacity of coal haul trucks, distance to/from Lowe stockpile (16,600 ft. one way). For other categories, VMT estimated from average speed and hours per month
 - Control efficiency for BNCC control measures estimated from guidance in AP-42, Section 13.2 for unpaved industrial roads

For Unpaved Roads within Area IV North:

AP-42 13.2.2, Eqns 1a (11/06) $EF = k (s/12)^a (W/3)^b$
 EF = Size specific emission factor (lb/VMT)
 k = particle size multiplier = 4.9 for PM and 1.5 for PM₁₀, Table 13.2.2-2
 S = road surface silt content = 8.3% (obtained from facility data)
 W = fleet average vehicle weight for given service (tons) as listed for each category in table above
 a = empirical constant, 0.7 for PM and 0.9 for PM₁₀, Table 13.2.2-2
 b = empirical constant, 0.45 for PM, PM₁₀ and PM_{2.5}, Table 13.2.2-2
 p = ave. days per year with precipitation greater than 0.01 inches, obtained from Figure 13.2.2-1

Table F-4
PARTICULATE MATTER EMISSION ESTIMATION - FUGITIVE EMISSIONS FROM
AREA III -COAL MINE AND PLANT VEHICLES - PREFERRED ALTERNATIVE

Total Coal 4347000 tons/yr

Mine and Plant Vehicles	Gross Vehicle Weight ⁴	Emission factor ¹ (lb/VMT)			Avg. Speed (MPH)	Oper. Hours/Month ²	Annual VMT ³ (miles/yr)	Max. Uncontrolled Emission Rate (tpy)			Control Measure	Control Efficiency ⁴ (%)	Controlled Emission Rate		
	tons	PM	PM ₁₀	PM _{2.5}				PM	PM ₁₀	PM _{2.5}			PM (tpy)	PM ₁₀ (tpy)	PM _{2.5} (tpy)
Coal Haulage, Stockpile and Roadway Maintenance															
Coal Haul Trucks (240-ton capacity)	280	24.36	6.93	0.69	35	3273	114,545	1395.07	396.71	39.67	Chem. Suppressant and Water Application	65.00%	488.27	138.85	13.88
Water Trucks	62	12.36	3.51	0.35	10	505	30,300	187.25	53.25	5.32		65.00%	65.54	18.64	1.86
Scrapers (Travel Mode)	62	12.36	3.51	0.35	15	320	28,800	177.98	50.61	5.06		65.00%	62.29	17.71	1.77
End Dump Trucks	175	19.71	5.61	0.56	18.5	730	81,000	798.45	227.05	22.71		65.00%	279.46	79.47	7.95
Light/Medium Veh (e.g., Pick-ups)	3	3.16	0.90	0.09	25	640	96,000	151.84	43.18	4.32		65.00%	53.14	15.11	1.51
Total Plant Vehicle travel												460.43	130.93	13.09	

- NOTES:
- Emission Factors for the coal haul road from AP-42, Section 13.2.2 Equation 1a, with constants from Table 13.2.2-2 - See results below
 *Assumed quarry surface silt content = 8.3% (Mean value for stone quarrying and processing, AP-42 Table 13.2.2-1) *Assumed days per year with > 0.01 inch moisture = 60, Figure 13.2.2-1
 - Total vehicle category hours per month based on facility estimates for Area III continuing operations, concurrent with Area IV North production.
 - Total Vehicle Miles Traveled (VMT) estimated by the capacity of coal haul trucks, distance to/from Lowe stockpile (16,000 ft. one way). For other categories, VMT estimated from average speed and hours per month
 - Control efficiency for BNCC control measures estimated from guidance in AP-42, Section 13.2 for unpaved industrial roads

For Unpaved Roads within Area III North:

AP-42 13.2.2, Eqns 1a (11/06) $EF = k (s/12)^a (W/3)^b$
 EF = Size specific emission factor (lb/VMT)
 k = particle size multiplier = 4.9 for PM and 1.5 for PM₁₀, Table 13.2.2-2
 S = road surface silt content = 8.3% (obtained from facility data)
 W = fleet average vehicle weight for given service (tons) as listed for each category in table above
 a = empirical constant, 0.7 for PM and 0.9 for PM₁₀, Table 13.2.2-2
 b = empirical constant, 0.45 for PM, PM₁₀ and PM_{2.5}, Table 13.2.2-2
 p = ave. days per year with precipitation greater than 0.01 inches, obtained from Figure 13.2.2-1

Table F-5

VEHICLE TAILPIPE EMISSION ESTIMATION

AREA IV NORTH - COAL MINE AND PLANT VEHICLES -PREFERRED ALTERNATIVE

Mine Vehicle Emission Sources	Nominal Size or Capacity ²	Equipment Hours per Month ³	NOX Emission Factor ⁴	Controlled NOX Emissions ⁵	Controlled NOX Emissions	CO Emission Factor ⁴	Controlled CO Emissions ⁵	Controlled CO Emissions	VOC Emission Factor ⁴	Controlled VOC Emissions ⁵	Controlled VOC Emissions
Description (No. of Units) ¹	hp	h/month	lb/hr/unit	Avg. lb/day	Ton/yr	lb/hr/unit	Avg. lb/day	Ton/month	lb/hr/unit	Avg. lb/day	Ton/month
Mine Operation Equipment Emission Sources											
Large Front-End Loaders (7)	500	1250	3.425	164.66	25.69	1.5182	72.99	11.39	0.365	17.55	2.738
Rubber-Tire Bulldozer (1)	330	1250	3.425	164.66	25.69	1.5182	72.99	11.39	0.365	17.55	2.738
Small Front-End Loaders (3)	354	450	3.2071	55.51	8.66	1.7411	30.13	4.70	0.3621	6.27	0.978
Large Bulldozers (12)	498	450	3.2071	55.51	8.66	1.7411	30.13	4.70	0.3621	6.27	0.978
Scrapers (3)	265	350	1.8284	24.61	3.84	0.929	12.51	1.95	0.2391	3.22	0.502
Water Trucks (3)	320	450	1.5016	25.99	4.05	0.3676	6.36	0.99	0.14	2.42	0.378
End Dump Trucks (8)	410	250	2.0882	20.08	3.13	0.7785	7.49	1.17	0.1987	1.91	0.298
Graders (4)	275	125	1.5357	7.38	1.15	0.421	2.02	0.32	0.1493	0.72	0.112
Mine Extraction Operations					73.68			34.44			8.04
Other On-Site Mobile Sources											
Maintenance Truck (35)	300	250	1.615	15.53	2.42	0.4301	4.14	0.65	0.1639	1.58	0.246
Light Duty Pick-up (60)	230	350	1.615	21.74	3.39	0.4301	5.79	0.90	0.1639	2.21	0.344
Flatbed Truck (10)	385	250	2.3188	22.30	3.48	0.7542	7.25	1.13	0.2492	2.40	0.374
Plant Vehicle travel					16.48			4.84			1.64

NOTES:

- 1 - Number present of each mine operation vehicle obtained from facility projections for Area IV North, some equipment will be from operations displaced from other Navajo Mine areas.
- 2 - Representative horsepower rating for category. The emission factors are defined by the SCAQMD reference for vehicle categories and broad ranges of engine horsepower.
- 3 - Estimated average hours per month across the period of the Preferred Alternative (2012 - 2016) obtained from facility projections for Area IV North, some equipment will be from operations displaced from other Navajo Mine areas.
- 4 - Controlled emission factors for recent model year (2010) for diesel engines to reflect roster of new and existing equipment at Area IV North, SCAQMD 1993 Handbook, Off-road Mobile Source Emission Factors, A9-8 Tables.
- 5 - Hourly average emission rates estimated from the equipment hours per month, divided equally over scheduled average of 26 operating days per month.

Table F-6

VEHICLE TAILPIPE EMISSION ESTIMATION

AREA III COAL MINE AND PLANT VEHICLES PER YEAR - PREFERRED ALTERNATIVE

Coal Production Area III ¹	4.35E+06
Coal Production Area IVN	4153000

Mine Vehicle Emission Sources		Nominal Size or Capacity ²	Equipment Hours per Month ³	NOX Emission Factor ⁴	Controlled NOX Emissions ⁵	Controlled NOX Emissions	CO Emission Factor ⁴	Controlled CO Emissions ⁵	Controlled CO Emissions	VOC Emission Factor ⁴	Controlled VOC Emissions ⁵	Controlled VOC Emissions
	Description (No. of Units) ¹	hp	h/month	lb/hr/unit	Avg. lb/day	Ton/yr	lb/hr/unit	Avg. lb/day	Ton/month	lb/hr/unit	Avg. lb/day	Ton/month
Mine Operation Equipment Emission Sources												
	Large Front-End Loaders (7)	500	1308	3.425	172.36	26.89	1.5182	76.40	11.92	0.365	18.37	2.865
	Rubber-Tire Bulldozer (1)	330	1308	3.425	172.36	26.89	1.5182	76.40	11.92	0.365	18.37	2.865
	Small Front-End Loaders (3)	354	0	3.2071	0.00	0.00	1.7411	0.00	0.00	0.3621	0.00	0.000
	Large Bulldozers (12)	498	471	3.2071	58.10	9.06	1.7411	31.54	4.92	0.3621	6.56	1.023
	Scrapers (3)	265	366	1.8284	25.76	4.02	0.929	13.09	2.04	0.2391	3.37	0.526
	Water Trucks	320	471	1.5016	27.20	4.24	0.3676	6.66	1.04	0.14	2.54	0.396
	End Dump Trucks	410	262	2.0882	21.02	3.28	0.7785	7.84	1.22	0.1987	2.00	0.312
	Graders	275	131	1.5357	7.73	1.21	0.421	2.12	0.33	0.1493	0.75	0.117
Mine Extraction Operations						68.06			31.13			7.40
Other On-Site Mobile Sources												
	Maintenance Truck	300	262	1.615	16.25	2.54	0.4301	4.33	0.68	0.1639	1.65	0.257
	Light Duty Pick-up	230	366	1.615	22.76	3.55	0.4301	6.06	0.95	0.1639	2.31	0.360
	Flatbed Truck	385	262	2.3188	23.34	3.64	0.7542	7.59	1.18	0.2492	2.51	0.391
Plant Vehicle travel						17.25			5.07			1.72

NOTES:

1 - Vehicle operating hours per month for Area III is scaled from detailed data for each vehicle category in Area IV North, in proportion to annual coal production rates. Some equipment will be from operations displaced from other Navajo Mine areas.

2 - Representative horsepower rating for category. The emission factors are defined by the SCAQMD reference for vehicle categories and broad ranges of engine horsepower.

3 - Estimated average hours per month in Area III across the period of the Preferred Alternative (2012 - 2016) obtained by scaling facility projections for Area IV North, in proportion to annual coal production rates.

4 - Controlled emission factors for recent model year (2010) for diesel engines to reflect roster of new and existing equipment at Area III, SCAQMD 1993 Handbook, Off-road Mobile Source Emission Factors, A9-8 Tables.

5 - Hourly average emission rates estimated from the equipment hours per month, divided equally over scheduled average of 26 operating days per month.

Table F-7

TAILPIPE POLLUTANT EMISSION ESTIMATION - COAL HAUL TRUCKS - PREFERRED ALTERNATIVE

		2013 - 2016
Coal Rate Area IV N(tpy)		4153000
Coal Rate Area III (tpy)		4.35E+06

Fraction of Equipment in Operation

1

Coal Haul Truck Emissions		Nominal Size or Capacity ²	Equipment Hours per Month ³	NOX Emission Factor ⁴		Controlled NOX Emissions	CO Emission Factor ⁴		Controlled CO Emissions	VOC Emission Factor ⁴		Controlled VOC Emissions
Description and (Est. Number of Units) ¹		hp	h/month	lb/hr/unit		Ton/yr	lb/hr/unit		Ton/yr	lb/hr/unit		Ton/yr
Coal Haul Truck Tailpipe Emissions - Area IV North - Preferred Alternative												
Coal Haul Trucks (5) -2014		580	3244	3.2071		62.42	1.7411		33.89	0.3621		7.048
Coal Haul Truck Tailpipe Emissions - Area III - Preferred Alternative												
Coal Haul Trucks (5) -2014		580	3273	3.2071		62.98	1.7411		34.19	0.3621		7.110

NOTES:

- 1 - Number of coal haul trucks used from projected Area IV North and Area III information.
- 2 - Horsepower of trucks from facility information, representative of existing vehicle fleet.
- 3 - Unit count of equipment hours from the typical operation required for movement of material during the 5 years of the Preferred Action
- 4 - Controlled emission factors reflect operating year 2010 for diesel engines, SCAQMD 1993 Handbook, Off-road Mobile Source Emission Factors, A9-8 Tables.
- 5 - Hourly maximum emission rates calculated 100% of all equipment present on site is operating simultaneously.

Table F-8
CRITERIA POLLUTANT EMISSION ESTIMATION - COAL AND OVERBURDEN BLASTING - PREFERRED ALTERNATIVE

SOURCE ID:		BNCC Area 4 North 2012 - 2016 Annual use of ANFO = 7,810,650 lbs/yr for 133 blasts/200 lb/ton = 29.36 ton ANFO/blast Annual number of blasts = 133 coal and overburden combined (Facility Estimate) for Area IV North 2012 - 16					
		Type of Source: Explosives Detonation - ANFO (Mine Usage)					
		Coal Blasting (123 Avg. Blasts/yr)			Overburden Blasting (10 Avg. Blasts/yr)		
Pollutant		Carbon Monoxide (CO)	Nitrogen Oxides (NO _x)	Sulfur Dioxide (SO ₂)	Carbon Monoxide (CO)	Nitrogen Oxides (NO _x)	Sulfur Dioxide (SO ₂)
Throughput or Other Emission Basis		29.36 ton ANFO/blast	29.36 ton ANFO/blast	29.36 ton ANFO/blast	29.36 ton ANFO/blast	29.36 ton ANFO/blast	29.36 ton ANFO/blast
Number of Identical Emission Sources		1	1	1	1	1	1
Emission Factor (Reference)		67 lb/ton ANFO <small>AP-42, Tbl. 13.3-1, 1/95</small>	17 lb/ton ANFO <small>AP-42, Tbl. 13.3-1, 1/95</small>	2 lb/ton ANFO <small>AP-42, Tbl. 13.3-1, 1/95</small>	67 lb/ton ANFO <small>AP-42, Tbl. 13.3-1, 1/95</small>	17 lb/ton ANFO <small>AP-42, Tbl. 13.3-1, 1/95</small>	2 lb/ton ANFO <small>AP-42, Tbl. 13.3-1, 1/95</small>
Max. Emission Rate		1967.12 lb/blast	499.12 lb/blast	58.72 lb/blast	1967.12 lb/blast	499.12 lb/blast	58.72 lb/blast
Control Device or System		No Add-on Control	No Add-on Control	No Add-on Control	No Add-on Control	No Add-on Control	No Add-on Control
Capture and Control Efficiency		0.00	0.00	0.00	0.00	0.00	0.00
BACT Measure(s)		Limit the number of blasts	Limit the number of blasts	Limit the number of blasts	Limit the number of blasts	Limit the number of blasts	Limit the number of blasts
Controlled Max. Emission Rate		1967.12 lb/blast	499.12 lb/blast	58.72 lb/blast	1967.12 lb/blast	499.12 lb/blast	58.72 lb/blast
Maximum Daily Blasts		1 blast/day	1 blast/day	1 blast/day	1 blast/day	1 blast/day	1 blast/day
Maximum Annual Blasts		123 blasts/year	123 blasts/year	123 blasts/year	10 blasts/year	10 blasts/year	10 blasts/year
Max. Average Emissions per Blast Event (lb/hr)		81.96	20.80	2.45	81.96	20.80	2.45
Max. Daily Emissions (lb/day)		1967.12	499.12	58.72	1967.12	499.12	58.72
Est. Annual Emissions (tpy)		120.98	30.70	3.61	9.84	2.50	0.29

Table F-9
CRITERIA POLLUTANT EMISSION ESTIMATION - COAL AND OVERBURDEN BLASTING - PREFERRED ALTERNATIVE

SOURCE ID:		BNCC Area III 2012 - 2016 Annual use of ANFO = 8,232,240 lbs/yr for 140 blasts/200 lb/ton = 29.36 ton ANFO/blast Annual number of blasts = 140 coal and overburden combined (scaled from Area IV North) for Area IV North 2012 - 16					
		Type of Source: Explosives Detonation - ANFO (Mine Usage)					
		Coal Blasting (128 Avg. Blasts/yr)			Overburden Blasting (12 Avg. Blasts/yr)		
Pollutant		Carbon Monoxide (CO)	Nitrogen Oxides (NO _x)	Sulfur Dioxide (SO ₂)	Carbon Monoxide (CO)	Nitrogen Oxides (NO _x)	Sulfur Dioxide (SO ₂)
Throughput or Other Emission Basis		29.36 ton ANFO/blast	29.36 ton ANFO/blast	29.36 ton ANFO/blast	29.36 ton ANFO/blast	29.36 ton ANFO/blast	29.36 ton ANFO/blast
Number of Identical Emission Sources		1	1	1	1	1	1
Emission Factor (Reference)		67 lb/ton ANFO <small>AP-42, Tbl. 13.3-1, 1/95</small>	17 lb/ton ANFO <small>AP-42, Tbl. 13.3-1, 1/95</small>	2 lb/ton ANFO <small>AP-42, Tbl. 13.3-1, 1/95</small>	67 lb/ton ANFO <small>AP-42, Tbl. 13.3-1, 1/95</small>	17 lb/ton ANFO <small>AP-42, Tbl. 13.3-1, 1/95</small>	2 lb/ton ANFO <small>AP-42, Tbl. 13.3-1, 1/95</small>
Max. Emission Rate		1967.12 lb/blast	499.12 lb/blast	58.72 lb/blast	1967.12 lb/blast	499.12 lb/blast	58.72 lb/blast
Control Device or System		No Add-on Control	No Add-on Control	No Add-on Control	No Add-on Control	No Add-on Control	No Add-on Control
Capture and Control Efficiency		0.00	0.00	0.00	0.00	0.00	0.00
BACT Measure(s)		Limit the number of blasts	Limit the number of blasts	Limit the number of blasts	Limit the number of blasts	Limit the number of blasts	Limit the number of blasts
Controlled Max. Emission Rate		1967.12 lb/blast	499.12 lb/blast	58.72 lb/blast	1967.12 lb/blast	499.12 lb/blast	58.72 lb/blast
Maximum Daily Blasts		1 blast/day	1 blast/day	1 blast/day	1 blast/day	1 blast/day	1 blast/day
Maximum Annual Blasts		128 blasts/year	128 blasts/year	128 blasts/year	12 blasts/year	12 blasts/year	12 blasts/year
Max. Average Emissions per Blast Event (lb/hr)		81.96	20.80	2.45	81.96	20.80	2.45
Max. Daily Emissions (lb/day)		1967.12	499.12	58.72	1967.12	499.12	58.72
Est. Annual Emissions (tpy)		125.90	31.94	3.76	11.80	2.99	0.35

Table F-10
PARTICULATE MATTER EMISSION ESTIMATION - FUGITIVE EMISSIONS FROM
COAL ADDITION TO STOCKPILES AND RAILCAR LOADING OPERATIONS – PREFERRED ALTERNATIVE

Tons Coal/Yr Area III	Area IVN	Area III
	4153000	4347000

Fugitive Emission ID Number	Quarry Operations	Maximum Transfer Rate or Emissions Basis		Emission Factor ¹ (lb/ton)			Max. Hourly Emission Rate (lb/hr)			Max. Annual Emission Rate (ton per year)			Control Efficiency ³ %	Controlled Emission Rates					
				PM	PM ₁₀	PM _{2.5}	PM	PM ₁₀	PM _{2.5}	PM	PM ₁₀	PM _{2.5}		PM (max. lb/hr)	PM (tpy)	PM ₁₀ (max. lb/hr)	PM ₁₀ (tpy)	PM _{2.5} (max. lb/hr)	PM _{2.5} (tpy)
Area IVN	Coal Addition to Stockpile ⁴	8,500	Max.tons/hr ²	3.54E-04	1.67E-04	5.26E-05	3.01	1.42	0.447	0.735	0.348	0.109	0.50	1.50	0.368	0.712	0.17	0.224	0.055
	Train Loading from Stockpile ⁵	8,500	Max.tons/hr ²	3.54E-04	1.67E-04	5.26E-05	3.01	1.42	0.447	0.735	0.348	0.109	0.50	1.50	0.368	0.712	0.17	0.224	0.055
Area III	Coal Addition to Stockpile ⁴	8,500	Max.tons/hr ²	3.54E-04	1.67E-04	5.26E-05	3.01	1.42	0.447	0.769	0.364	0.114	0.50	1.50	0.385	0.712	0.18	0.224	0.057
	Train Loading from Stockpile ⁵	8,500	Max.tons/hr ²	3.54E-04	1.67E-04	5.26E-05	3.01	1.42	0.447	0.769	0.364	0.114	0.50	1.50	0.385	0.712	0.18	0.224	0.057

NOTES:

1 - Emission factors for excavation from AP-42, from batch drop equation AP-42, Aggregate Handling and Storage Piles (Sect. 13.2), Equation 13.2-4 (11/06), as calculated below with parameters estimated from samples at mine site.

2 - The mine haul and load operations are estimated to be capable of 8,500 tons per hour, and this value used to set maximum hourly emission rate.

3 - Control efficiency based on water sprays at transfer points, as required, due to high moisture in mined coal.

4 - Coal haul to Lowe Stockpile will be accomplished by 240 ton capacity, end-dump coal haul trucks. The addition to Stockpile emissions are based on Batch Drop equation for unloading of the end dump truck. Emission factor from AP-42 Equation 13.2-4 is

5 - Railcar loading from the Lowe Stockpile assumed to match the coal addition rate (8,500 tons/hr). Emission factors from batch drop correlation used for addition to stockpiles.

Coal Addition to Stockpile and Railcar Coal Loading	E (PM₁₀) =	1.67E-04
	E (PM) =	3.54E-04
	E (PM_{2.5}) =	5.26E-05

U for coal railcar load and exposed stockpile loading areas = 8.7 mph, facility data for 1-hour averages per day.
 Moisture (M) is taken as as-mined average of 13% based on sampling at the mine site.

Table F-11

PARTICULATE MATTER EMISSION ESTIMATION - WIND EROSION OF STOCKPILES AND UNRECLAIMED OPEN AREAS - PREFERRED ALTERNATIVE

Total Stockpile Areas (Acres)		Area IV N	Area III	Coal Prod.	Area IV N	Area III	Total Unrecl Area	Area IV N	Area III
Overburden		120	126	TPY	4153000	4347000	(Acres/yr)	108	114
Coal		50	53						

Construction Emission Sources		Particulate Control	Nominal Surface Areas ²		Controlled Emission Factor ³ (ton/yr/Area Unit)			Additional Control Efficiency ⁴	Controlled Emission Rates (ton/yr) ⁵		
Description ¹			Value	Units	PM	PM10	PM2.5	%	PM	PM10	PM2.5
Area IVN	Soil/Overburden Stockpiles	Contour and Compact	490.44	10 ³ m2	0.059	0.0296	0.0119	Incl in Emiss. Fct	28.9	14.5	5.8
	Coal Stockpiles	Contour and Compact	204.35	10 ³ m2	0.0438	0.022	0.0088	Incl in Emiss. Fct	9.0	4.5	1.8
	Coal Prep Plant Stockpiles	Contour and Compact	28.34	10 ³ m2	0.356	0.177	0.0266	Incl in Emiss. Fct	10.1	5.0	0.75
	Unreclaimed Open Area	Water/Stabilize	108	acres	0.1718	0.0859	0.0344	50%	9.3	4.6	1.9
	Total Wind Erosion									57.3	28.7
Area III	Soil/Overburden Stockpiles	Contour and Compact	514.962	10 ³ m2	0.059	0.0296	0.0119	Incl in Emiss. Fct	30.4	15.2	6.1
	Coal Stockpiles	Contour and Compact	216.611	10 ³ m2	0.0438	0.022	0.0088	Incl in Emiss. Fct	9.5	4.8	1.9
	Coal Prep Plant Stockpiles	Contour and Compact	29.66	10 ³ m2	0.356	0.177	0.0266	Incl in Emiss. Fct	10.6	5.3	0.79
	Unreclaimed Open Area	Water/Stabilize	114	acres	0.1718	0.0859	0.0344	50%	9.8	4.9	2.0
	Total Wind Erosion									60.2	30.2

1 - Sources are for windblown dust from idle areas of stockpiles and from disturbed mine areas prior to reclaim activities

2 - Areas estimated for stockpiles and unreclaimed areas are only for Area IV North operations. Some of these areas will offset reductions in stockpile and disturbed areas in other Navajo Mine areas. Stockpiles converted to square meters by conversion 4

3 - Controlled emission factor reflect windblown emissions model from AP-42 as determined by facility emissions for existing Navajo Mine stockpiles of known surface areas. Emissions factors for stockpiles include indicated control measure - no additional

4 - Controls for the Area IV North stockpiles that represent additional measures for those areas.

5 - Controlled emissions from assumed annual areas for total stockpile and unreclaimed areas during each operating year. Ratio of PM2.5 to PM10 obtained from AP-42 model for windblown friction velocity correlation.

6 - Coal Processing plant located in Area III, emissions are the contribution due to separate area production levels. Table entry is a composite 10 stockpiles, erosion from AP-42 model, Albuquerque fasted mile of wind (Moisture = 8%, Wind Speed = 9.5) mp

Table F-12
PARTICULATE MATTER EMISSION ESTIMATION - CONSTRUCTION VEHICLES AND EARTHMOVING
FOR RECLAMATION OF MINED AREAS - PREFERRED ALTERNATIVE

Construction Emission Sources		Particulate Control	Nominal Area or Material ²		PM ₁₀ Uncontrolled Emission Factor ³		PM Control Efficiency ⁴	Controlled PM10 Emission Rates ⁵	Ratio: PM2.5 to PM10 ⁶	Controlled PM2.5 Emission Rates
	Description ¹		Value	Units	Value	Units	%	PM10 (ton/yr)	Frac of PM10	PM2.5 (ton/yr)
Area IVN	General Construction - Contouring	Watering, Veh. Speeds	145	acres	0.19	ton PM10/acre-month	50%	13.8	0.2	2.8
	Overburden Replacement	Watering, Veh. Speeds	1.50E+07	Tons	0.012	lb PM/ton	50%	45.0	0.2	9.00
	Total Reclamation Emissions - Area IV N								58.8	
Area III	General Construction - Contouring	Watering, Veh. Speeds	155	acres	0.19	ton PM10/acre-month	50%	14.7	0.2	2.9
	Overburden Replacement	Watering, Veh. Speeds	1.70E+07	Tons	0.012	lb PM/ton	50%	51.0	0.2	10.20
	Total Reclamation Emissions - Area III								65.7	

NOTES:

- 1 - Sources are for construction operations involved in reclaim of mined areas in Area IV N and Area III during representative year of Preferred Action. These emission source categories include earthmoving, surface shaping, soil handling and vehicle operation.
- 2 - Areas and overburden quantity estimated for unreclaimed areas for Area IV North operations and scaled for Area III.
Stockpiles converted to square meters by conversion 4,088 m² = 1 acre
- 3 - Controlled emission factors from various studies. General Construction factor more recent than latest AP-42 section on Heavy Construction (MRI 1996, EPA 2001, EPA 2006.) Overburden replacement from factor given in Western Surface Coal Mining, AP-42 Section 11.9.
- 4 - Controls for the Area IV North and Area III reclaim activities represent range of control measures utilized for current Mining Permit in other Navajo Mine areas.
- 5 - Controlled emissions from assumed annual reclaim areas and overburden replacement for each operating year of the Preferred Action.
- 6 - Ratio of PM2.5 to PM10 conservatively set for the range of construction operations. For geologic dusts, typical ratio in AP-42 is 20% of PM10 is PM2.5.

Table F-13

GREENHOUSE GAS EMISSION ESTIMATION - AVERAGE ANNUAL BASIS, AREA IV NORTH and AREA III OPERATIONS - PREFERRED ALTERNATIVE

	Avg. Operation Sched ²	Fuel Consump ³	CO2 Emission Factor ⁴	CO2 Emissions ⁵	CO2 Emissions ⁶	CH4 Emission Factor ⁴	CH4 Emissions ⁵	CO2e Emissions ⁶	N2O Emission Factor ⁴	N2O Emissions ⁵	CO2e Emissions ⁶
Description (and Number) ¹	Hours/Month	Gal/hr	kg CO2/gal	Avg. MT/Yr	MT CO2e/year	g CH4/gal	Avg. MT/Yr	MT CO2e/year	g N2O/gal	Avg. MT/Yr	MT CO2e/year
Non-Road Mine Vehicles (Diesel Engines)											
Large Bulldozers (18)	3275	4	10.15	1595.58	1595.58	0.58	0.0912	1.91	0.26	0.0409	12.67
Rubber-Tire Bulldozer (3)	8190	2	10.15	1995.08	1995.08	0.58	0.1140	2.39	0.26	0.0511	15.84
Large Front-End Loaders (12)	3244	4	10.15	1580.48	1580.48	0.58	0.0903	1.90	0.26	0.0405	12.55
Small Front-End Loaders (6)	532	3	10.15	194.39	194.39	0.58	0.0111	0.23	0.26	0.0050	1.54
Graders (7)	3234	4	10.15	1575.60	1575.60	0.58	0.0900	1.89	0.26	0.0404	12.51
Scrapers (6)	1265	4	10.15	616.31	616.31	0.58	0.0352	0.74	0.26	0.0158	4.89
TOTAL EMISSIONS: Mine Extraction /Loading Equipment				7557.45	7557.45		5.18	108.83		2.32	720.15
Coal Haul Trucks - Based on average monthly operating hours during Preferred Alternative years											
Coal Haul Trucks (10)	3300	5	10.15	2009.70	2009.70	0.58	0.1148	2.41	0.26	0.0515	15.96
Plant Vehicles - Based on average monthly operating hours on plant roads											
Diesel Engine Vehicles											
End Dump Trucks (8)	532	4	10.15	259.19	259.19	0.58	0.0148	0.31	0.26	0.0066	2.06
Water Trucks (3)	1010	4	10.15	492.07	492.07	0.58	0.0281	0.59	0.26	0.0126	3.91
Gasoline Engine Vehicles											
								Assume	12	MPG	
Emission Factor Units			kg CO2/gal			g/mile			g/mile		
Light Duty Pick-up (60)	1280	1	8.81	135.32	135.32	0.033	0.0061	0.13	0.0134	0.0025	0.77
Flatbed Truck (10)	2400	2	8.81	507.46	507.46	0.033	0.0228	0.48	0.0134	0.0093	2.87
Maintenance Truck (35)	3500	2	8.81	740.04	740.04	0.033	0.0333	0.70	0.0134	0.0135	4.19
TOTAL EMISSIONS: Plant Vehicles				2134.08	2134.08		0.11	2.21		0.044	13.79
Coal Mine Methane - Based on GHG Reporting Rule Emission Factor for Surface Coal Mining											
	Ton Coal/yr					lb CH4/ton coal ⁷	MT/yr CH4	CO2e Emissions ⁶			
Preferred Alt.- Representative Annual	8,500,000					0.711	2747.0	57688			

1 - Categories of large, non-road plant maintenance equipment and maintenance personnel vehicles. Numbers of vehicles estimated by facility for projected Area IV North plus Area III operations.

2 - Average monthly hours of operation per each vehicle category, as estimated by facility for typical operation during Preferred Alternative years in Area IV North and Area III. In actuality, units will operate on varying monthly and annual schedules.

3 - Estimated fuel consumption rate for category of vehicles, actual consumption will vary for all vehicles in a category.

4 - Default U.S. EPA Emission factors for diesel and gasoline fueled construction vehicles, compiled in Climate Registry, 2008. Tables 13.1, 13.3, and 13.6

5 - Annual metric tons (MT = 2,200 lbs) emissions based on assumed hours per month average operation, for all combined units in vehicle category

6 - Carbon equivalent emissions calculated with relative global warming potential: CO2 = 1, CH4 = 21, N2O = 310

7 - Emission factors for San Juan Basin surface coal mine methane (Support Documents - GHG Mandatory Reporting Rule 2010): Coal Extraction = 14.6 ft3 CH4/short ton of coal; Post-mining preparation = 2.4 ft3 CH4/short ton of coal.

Converted to mass basis emission factor by density of methane at standard conditions: (14.6 + 2.4 ft3 CH4/ton) x 0.418 lb CH4/ft3 = 0.711 lb CH4/ton coal

**Table F-14
PARTICULATE MATTER EMISSION ESTIMATION FUGITIVE EMISSIONS FROM
COAL MINE EQUIPMENT AND OPERATIONS -Baseline Year 2009**

Tons Coal Produced

850000

Cubic Yds Overburden + Interburden

13744500

Quarry Operations	Maximum Transfer Rate or Emissions Basis		Emission Factor Units	Emission Factor			Representative Uncontrolled Hourly Emission Rate (lb/hr)			Operating Schedule		Annual Emission Rate without Controls (ton per year)			Control Efficiency %	Controlled Emission Rates (No Hourly Average for Blasting)					
	PM	PM ₁₀		PM _{2.5}	PM	PM ₁₀	PM _{2.5}	Hours/Week	Weeks/Year	PM	PM ₁₀	PM _{2.5}	PM (Typ. lb/hr)	PM (tpy)		PM ₁₀ (Typ. lb/hr)	PM ₁₀ (tpy)	PM _{2.5} (Typ. lb/hr)	PM _{2.5} (tpy)		
Drilling - Overburden + Interburden ¹	19,560	Holes/yr		1.3	0.676	0.195	4.008	2.084	0.601	122	52	12.71	6.61	1.91	50.0%	2.00	6.36	1.042	3.31	0.301	0.954
Drilling - Coal ¹	146,476	Holes/yr		0.22	0.114	0.033	60.955	31.696	9.509	122	52	16.11	8.38	2.42	50.0%	30.48	8.06	15.85	4.19	4.75	1.208
Overburden Blasting ²	10	blast/yr		9.7	5.04	1.51	N/A	N/A	N/A	N/A		0.05	0.03	0.01	0.00%	N/A	0.05	N/A	0.03	N/A	0.008
Coal Blasting ²	252	blast/yr		9.7	5.04	1.51	N/A	N/A	N/A	N/A		1.22	0.64	0.19	0.00%	N/A	1.22	N/A	0.64	N/A	0.191
Overburden Dragline ³	1.37E+07	cu.yds/yr		0.048	0.0092	8.09E-04	111.38	21.43	1.89	113	52	327.24	62.96	5.56	0.00%	111.38	327.24	21.43	62.96	1.89	5.563
Overburden Dozers ⁴	3275	hrs/month	lb/hr/dozer (12 dozers/hr)	3.00	0.54	6.60E-02	36.02	6.43	0.79	175	52	58.99	10.53	1.30	60.00%	14.41	23.59	2.57	4.21	0.32	0.519
Dozers - Maint and Replace ⁴	8187	hrs/month	lb/hr/dozer (12 dozers/hr)	24.95	5.94	0.55	299.39	71.26	6.59	1330	52	1225.56	291.69	26.96	60.00%	119.8	490.2	28.5	116.7	2.63	10.78
Truck Loading Coal with Payloader ⁵	8.50E+06	tons/yr	lb/ton (7 Loaders)	0.05	0.0089	0.0010	12.213	2.028	0.232	715	52	227.05	37.71	4.31	50.00%	6.11	113.52	1.01	18.855	0.304	5.66
Scrapers ⁶	655	hrs/month	lb/VMT (3 Scapers)	2.26E-01	1.22E-01	7.01E-03	0.924	0.500	0.029	74	52	1.78	0.96	0.06	50.00%	0.46	0.89	0.25	0.481	0.0143	0.028
Road Graders ⁶	3,234	hrs/month	lb/VMT (4 Graders)	2.26E-01	1.22E-01	7.01E-03	4.564	2.469	0.141	74	52	8.78	4.75	0.27	50.00%	2.28	4.39	1.23	2.375	0.0707	0.136
Coal Processing Plant ⁷	8,500,000	tons/yr	lb/ton coal	7.40E-01	3.50E-01	5.30E-02	19.37	9.06	2.66			84.83	39.69	11.57	65.00%	6.78	29.69	3.17	13.89	0.93	4.05
CATEGORY SUBTOTAL: Overburden Drill/Blast																	6.41		3.33		0.96
CATEGORY SUBTOTAL: Coal Drill/Blast																	9.28		4.82		1.40
CATEGORY SUBTOTAL: Mine Extraction Oper.																	989.6		219.4		26.7
TOTAL																	1005.2		227.6		29.1

NOTES:

1 - Emission factor is for uncontrolled drilling for either overburden or coal from AP-42, Western Surface Coal Mining, Table 11.1-4 (7/98). Holes per cu.yd. overburden = 702; holes per ton coal = 58; PM₁₀ = 0.52, PM_{2.5} = 0.15 x PM (Company data)

2 - The emission factor for overburden/coal seam blasting is in units of lb/blast. Calculation is based on surface area per blast, which is estimated as follows:

Blasted material /yr = 29,449,000 cu. Yds/133 blasts/yr * 27 cu.ft / 1 cu.yd. = 5,978,000 cu.ft./blast

Area = 5,978,000 cu.ft./blast / 400 ft avg. depth = 149,460 sq.ft./blast

Emission Factor PM (lb/blast) = Area*1.5 x 0.000014 = (5,978,000)*1.5 x 0.000014 = 9.7 lb/blast; AP-42, Table 11.9-1, PM₁₀ is 52% of the PM Emission Factor

3 - Overburden dragline removal factor (TSP) = 0.0021 * D ^ 1.1 / M ^ 0.3 ; (< 15 micron PM) = 0.0021 * D ^ 0.7 / M ^ 0.3; Scaling factors: PM₁₀ = 0.75 x EF (< 15 micron); PM_{2.5} = 0.017 x EF (TSP)

From facility data: Drop Height (D) = 30 ft; M = 7.9% moisture

4 - Coal Bulldozing factor (TSP) = 78.4 * s ^ 1.2 / M ^ 1.3 ; (< 15 micron PM) = 18.6 * s ^ 1.5 / M ^ 1.4; Scaling factors: PM₁₀ = 0.75 x EF (< 15 micron); PM_{2.5} = 0.017 x EF (TSP)

From facility data: s = 5.5 % Silt; M = 7.9% moisture

5 - Truck loading of coal with Front-End Loaders (TSP) = 1.16 / M ^ 1.2 ; (< 15 micron) = 0.119 / M ^ 0.9 Scaling factors: PM₁₀ = 0.75 x EF (< 15 micron); PM_{2.5} = 0.017 x EF (TSP)

From facility data: M = 7.9% moisture

6 - Emission factor for scrapers and graders from Document AP-42, Western Surface Coal Mining, Section 11.9, Table 11.9-1 (7/98). EF(grading, TSP) = 0.4 S ^ 2.5; EF(PM₁₀) = 0.051 S ^ 2.0 Veh. Avg working speed (S) = 2 mph for emission factor correlation.

Table F-16
VEHICLE TAILPIPE EMISSION ESTIMATION
COAL MINE AND PLANT VEHICLES PER YEAR -Baseline Year 2009

Coal Production 2009 tons	8.50E+06
----------------------------------	-----------------

Mine Vehicle Emission Sources	Nominal Size or Capacity ²	Equipment Hours per Month ³	NOX Emission Factor ⁴	Controlled NOX Emissions ⁵	Controlled NOX Emissions	CO Emission Factor ⁴	Controlled CO Emissions ⁵	Controlled CO Emissions	VOC Emission Factor ⁴	Controlled VOC Emissions ⁵	Controlled VOC Emissions	
Description (No. of Units) ¹	hp	h/month	lb/hr/unit	Avg. lb/day	Ton/yr	lb/hr/unit	Avg. lb/day	Ton/month	lb/hr/unit	Avg. lb/day	Ton/month	
Mine Operation Equipment Emission Sources												
Large Front-End Loaders (7)	500	2558	3.425	336.97	52.57	1.5182	149.37	23.30	0.365	35.91	5.602	
Rubber-Tire Bulldozer (1)	330	2558	3.425	336.97	52.57	1.5182	149.37	23.30	0.365	35.91	5.602	
Small Front-End Loaders (3)	354	0	3.2071	0.00	0.00	1.7411	0.00	0.00	0.3621	0.00	0.000	
Large Bulldozers (12)	498	921	3.2071	113.61	17.72	1.7411	61.68	9.62	0.3621	12.83	2.001	
Scrapers (3)	265	716	1.8284	50.35	7.85	0.929	25.58	3.99	0.2391	6.58	1.027	
Water Trucks	320	921	1.5016	53.19	8.30	0.3676	13.02	2.03	0.14	4.96	0.774	
End Dump Trucks	410	512	2.0882	41.12	6.41	0.7785	15.33	2.39	0.1987	3.91	0.610	
Graders	275	256	1.5357	15.12	2.36	0.421	4.15	0.65	0.1493	1.47	0.229	
Mine Extraction Operations					133.07			60.86			14.46	
Other On-Site Mobile Sources												
Maintenance Truck	300	512	1.615	31.80	4.96	0.4301	8.47	1.32	0.1639	3.23	0.504	
Light Duty Pick-up	230	921	1.615	57.21	8.92	0.4301	15.24	2.38	0.1639	5.81	0.906	
Flatbed Truck	385	512	2.3188	45.66	7.12	0.7542	14.85	2.32	0.2492	4.91	0.766	
Plant Vehicle travel					35.72			10.44			3.56	

- NOTES:
- 1 - Vehicle operating hours per month scaled from detailed data for each vehicle category in Area IV North, to represent equivalent production for 2009 Baseline year, in proportion to annual coal production rates.
 - 2 - Representative horsepower rating for category. The emission factors are defined by the SCAQMD reference for vehicle categories and broad ranges of engine horsepower.
 - 3 - Estimated average hours per month in operating BNCC areas across the 2009 Baseline year at 8,500,000 coal production level obtained by scaling facility projections for Area IV North, in proportion to annual coal production rates.
 - 4 - Controlled emission factors for recent model year (2010) for diesel engines to reflect roster of new and existing equipment at Area III, SCAQMD 1993 Handbook, Off-road Mobile Source Emission Factors, A9-8 Tables.
 - 5 - Hourly average emission rates estimated from the equipment hours per month, divided equally over scheduled average of 26 operating days per month.

Table F-17

TAILPIPE POLLUTANT EMISSION ESTIMATION - COAL HAUL TRUCKS -Baseline Year 2009

	2009
Coal Rate 2009 (tons)	8500000

Fraction of Equipment in Operation 1

Coal Haul Truck Emissions		Nominal Size or Capacity ²	Equipment Hours per Month ³	NOX Emission Factor ⁴		Controlled NOX Emissions	CO Emission Factor ⁴		Controlled CO Emissions	VOC Emission Factor ⁴		Controlled VOC Emissions
Description and (Est. Number of Units) ¹		hp	h/month	lb/hr/unit		Ton/yr	lb/hr/unit		Ton/yr	lb/hr/unit		Ton/yr
Coal Haul Truck Tailpipe Emissions - BNCC Operaitng Areas 2009 Baseline year												
Coal Haul Trucks (5)		580	6524	3.2071		125.54	1.7411		68.15	0.3621		14.174

NOTES:

- 1 - Number of coal haul trucks used from representative 2009 Baseline year operation and 8,500,000 ton/yr total coal production.
- 2 - Horsepower of trucks from facility information, based on existing vehicle fleet.
- 3 - Unit count of equipment hours from the typical operation required for movement of material during the 2009 Baseline year, at 8,500,000 ton/year production.
- 4 - Controlled emission factors reflect operating year 2010 for diesel engines, SCAQMD 1993 Handbook, Off-road Mobile Source Emission Factors, A9-8 Tables.
- 5 - Hourly maximum emission rates calculated 100% of all equipment present on site is operating simultaneously.

Table F-18

CRITERIA POLLUTANT EMISSION ESTIMATION - COAL AND OVERBURDEN BLASTING – Baseline Year 2009

SOURCE ID:	Baseline Year 2009 Annual use of ANFO = 8,232,240 lbs/yr for 140 blasts/2000 lb/ton = 29.36 ton ANFO/blast Annual number of blasts = 140 coal and overburden combined					
	Type of Source: Explosives Detonation - ANFO (Mine Usage)					
	Coal Blasting (128 Avg. Blasts/yr)			Overburden Blasting (12 Avg. Blasts/yr)		
Pollutant	Carbon Monoxide (CO)	Nitrogen Oxides (NO _x)	Sulfur Dioxide (SO ₂)	Carbon Monoxide (CO)	Nitrogen Oxides (NO _x)	Sulfur Dioxide (SO ₂)
Throughput or Other Emission Basis	29.36 ton ANFO/blast	29.36 ton ANFO/blast	29.36 ton ANFO/blast	29.36 ton ANFO/blast	29.36 ton ANFO/blast	29.36 ton ANFO/blast
Number of Identical Emission Sources	1	1	1	1	1	1
Emission Factor (Reference)	67 lb/ton ANFO AP-42, Tbl. 13.3-1, 1/95	17 lb/ton ANFO AP-42, Tbl. 13.3-1, 1/95	2 lb/ton ANFO AP-42, Tbl. 13.3-1, 1/95	67 lb/ton ANFO AP-42, Tbl. 13.3-1, 1/95	17 lb/ton ANFO AP-42, Tbl. 13.3-1, 1/95	2 lb/ton ANFO AP-42, Tbl. 13.3-1, 1/95
Max. Emission Rate	1967.12 lb/blast	499.12 lb/blast	58.72 lb/blast	1967.12 lb/blast	499.12 lb/blast	58.72 lb/blast
Control Device or System	No Add-on Control	No Add-on Control	No Add-on Control	No Add-on Control	No Add-on Control	No Add-on Control
Capture and Control Efficiency	0.00	0.00	0.00	0.00	0.00	0.00
BACT Measure(s)	Limit the number of blasts	Limit the number of blasts	Limit the number of blasts	Limit the number of blasts	Limit the number of blasts	Limit the number of blasts
Controlled Max. Emission Rate	1967.12 lb/blast	499.12 lb/blast	58.72 lb/blast	1967.12 lb/blast	499.12 lb/blast	58.72 lb/blast
Maximum Daily Blasts	1 blast/day	1 blast/day	1 blast/day	1 blast/day	1 blast/day	1 blast/day
Maximum Annual Blasts	251 blasts/year	251 blasts/year	251 blasts/year	22 blasts/year	22 blasts/year	22 blasts/year
Max. Average Emissions per Blast Event (lb/hr)	81.96	20.80	2.45	81.96	20.80	2.45
Max. Daily Emissions (lb/day)	1967.12	499.12	58.72	1967.12	499.12	58.72
Est. Annual Emissions (tpy)	246.87	62.64	7.37	21.64	5.49	0.65

Table F-19

PARTICULATE MATTER EMISSION ESTIMATION - WIND EROSION OF STOCKPILES AND UNRECLAIMED OPEN AREAS -Baseline Year 2009

Construction Emission Sources		Particulate Control	Nominal Surface Areas ²		Controlled Emission Factor ³ (ton/Area Unit)			Additional Control Efficiency ⁴	Controlled Emission Rates (ton/yr) ⁵		
Description ¹	Value		Units	PM	PM10	PM2.5	%	PM	PM10	PM2.5	
2009	Soil/Overburden Stockpiles	Contour and Compact	1258.796	10 ³ m2	0.059	0.0296	0.0119	Incl in Emiss. Fct	74.3	37.3	15.0
	Coal Stockpiles	Contour and Compact	420.961	10 ³ m2	0.0438	0.022	0.0088	Incl in Emiss. Fct	18.4	9.3	3.7
	Coal Prep Plant Stockpiles	Contour and Compact	58.00	10 ³ m2	0.356	0.177	0.0266	Incl in Emiss. Fct	20.6	10.3	1.54
	Unreclaimed Open Area	Water/Stabilize	300	acres	0.1718	0.0859	0.0344	50%	25.8	12.9	5.2
	Total Wind Erosion									139.1	69.7

1 - Sources are for windblown dust from idle areas of stockpiles and from disturbed mine areas prior to reclaim activities

2 - Areas estimated for stockpiles and unreclaimed areas are only for Area IV North operations. Some of these areas will offset reductions in stockpile and disturbed areas in other Navajo Mine areas.

Stockpiles converted to square meters by conversion 4,088 m2 = 1 acre

3 - Controlled emission factor reflect windblown emissions model from AP-42 as determined by facility emissions for existing Navajo Mine stockpiles of known surface areas.

Emissions factors for stockpiles include indicated control measure - no additional controls.

4 - Controls for the Area IV North stockpiles that represent additional measures for those areas.

5 - Controlled emissions from assumed annual areas for total stockpile and unreclaimed areas during each operating year. Ratio of PM2.5 to PM10 obtained from AP-42 model for windblown friction velocity correlation.

Table F-20

**PARTICULATE MATTER EMISSION ESTIMATION - CONSTRUCTION VEHICLES AND EARTHMOVING
FOR RECLAMATION OF MINED AREAS – Baseline Year 2009**

Construction Emission Sources		Particulate Control	Nominal Area or Material ²		PM ₁₀ Uncontrolled Emission Factor ³		PM Control Efficiency ⁴	Controlled PM10 Emission Rates ⁵	Ratio: PM2.5 to PM10 ⁶	Controlled PM2.5 Emission Rates
	Description ¹		Value	Units	Value	Units	%	PM10 (ton/yr)	Frac of PM10	PM2.5 (ton/yr)
Baseline Year 2009	General Construction - Contouring	Watering, Veh. Speeds	303	acres	0.19	ton PM10/acre-month	50%	28.8	0.2	5.8
	Overburden Replacement	Watering, Veh. Speeds	3.32E+07	Tons	0.012	lb PM/ton	50%	99.7	0.2	19.94
	Total Reclamation Emissions – 2009								128.5	

NOTES:

- 1 - Sources are for construction operations involved in reclaim of mined areas. These emission source categories include earthmoving, surface shaping, soil handling and vehicle operation.
- 2 - Areas and overburden quantity estimated for unreclaimed areas in ongoing operations in current Navajo Mine active areas during 2009 Baseline year..
Stockpiles converted to square meters by conversion 4,088 m² = 1 acre
- 3 - Controlled emission factors from various studies. General Construction factor more recent than latest AP-42 section on Heavy Construction (MRI 1996, EPA 2001, EPA 2006.) Overburden replacement from factor given in Western Surface Coal Mining, AP-42 Section 11.9.
- 4 - Controls for the reclaim operations in Baseline 2009 year represent range of control measures utilized for current Mining Permit in other Navajo Mine areas
- 5 - Controlled emissions from reclaim areas and overburden replacement representative of the 2009 Baseline year, scaled to coal production rate of 8,500,000 tons/yr
- 6 - Ratio of PM2.5 to PM10 conservatively set for the range of construction operations. For geologic dusts, typical ratio in AP-42 is 20% of PM10 is PM2.5.

Summary - 2009

Emission Source Category	Baseline Year 2009		
	PM10	PM2.5	NOX
Overburden Drilling and Blasting	3.33	0.96	5.49
Coal Seam Drilling and Blasting	4.82	1.40	62.64
Overburden Dragline Stripping	62.96	5.56	
Mine Extraction Operations and Loading	142.60	17.12	133.07
Coal Haul Truck to Stockpiles	265.2	26.52	125.54
Plant Vehicle Travel	214.6	21.46	35.72
Unloading at Stockpiles and Railcar Loading	0.71	0.11	
Reclamation	128.5	25.70	
Coal Prep Plant (Ex. Stockpiles)	13.89	4.05	
Wind Erosion (Coal and Spoils piles)	69.67	25.39	
TOTALS	906.3	128.3	362.5

Summary - 2009

09	
CO	VOC
21.64	
246.9	
60.86	14.46
68.15	14.17
10.44	3.56
408.0	32.2