

**HUNTS POINT WPCP  
FINAL ENVIRONMENTAL IMPACT STATEMENT (FEIS)**

Appendix 17.E  
Construction Air Quality

## **Appendix 17E: Hunts Point Air Quality Analysis for On-Site Construction**

Provided in this attachment is the methodology for an analysis of air quality impacts from on-site construction activities associated with work to be performed at the Hunts Point WPCP in the Bronx, New York.

An analysis of the potential for air quality impacts from on-site construction equipment is presented below. The focus of the analysis presented below is for the peak annual period beginning with the 3rd quarter of 2011 and ending with the 2nd quarter of 2012, which is expected to be the most conservative (using peak PM<sub>2.5</sub> construction emissions as an indicator for potential adverse impacts) time period for the entire construction program. For the peak short-term period (i.e., daily), maximum impacts are expected to occur in the 3rd quarter of 2011. Although the 3rd quarter of 2011 had slightly lower peak emissions than the 4th quarter of 2011 and 1st quarter of 2012, the 3rd quarter of 2011 was analyzed as the worst-case scenario, because the area of activity would be more concentrated and closer to Barretto Point Park.

### **A. HUNTS POINT CONSTRUCTION EQUIPMENT**

During construction at the Hunts Point facility various types of fuel burning construction equipment will be used at different locations throughout the site. The release of airborne pollutants from the combustion of fuel and fugitive dust created by heavy vehicles traveling and operating in work areas are the two main sources of air emissions. The equipment was assumed to operate a full 8 hours per day (continuous operation) during the primary work shift (i.e., 7 AM to 3 PM). Some of the equipment is mobile and will operate in specified areas while some will remain stationary on-site at distinct locations. Presented in Table 1 is a list of the construction equipment expected to be on-site during the peak construction periods discussed above. The peak short-term and annual periods were determined based on construction equipment resource schedules and activities occurring on-site.

**Table 1**  
**On-Site Construction Equipment for Peak Month and Year**

<b>Equipment Type</b>	<b>Analysis Period</b>	<b>Mobile or Stationary</b>
Backhoes	Short-term/Annual	Mobile
Excavators	Short-term/Annual	Mobile
Loaders	Short-term/Annual	Mobile
Dozers	Short-term/Annual	Mobile
Cranes	Short-term/Annual	Stationary
Pile Drivers	Short-term/Annual	Stationary
Concrete Pumps	Annual Only	Stationary
Compressors	Short-term/Annual	Stationary
Generators	Short-term/Annual	Stationary
Water Pumps	Short-term/Annual	Stationary
Graders	Annual Only	Mobile

Pavers	Annual Only	Mobile
Rollers	Annual Only	Mobile
Heavy Trucks	Short-term/Annual	Mobile

Stationary emission sources were considered to be point sources and were placed at fixed locations. The placement of each individual source is an estimate of where they may be located during the construction period. Mobile source equipment was considered to be volume sources. Volume source emissions were distributed evenly across the construction site.

## **B. HUNTS POINT SOURCE EMISSION CALCULATIONS**

### **FUEL COMBUSTION**

The emission factors for combustion of fuel for on-site construction equipment (excluding heavy duty diesel trucks) were developed using the USEPA NONROAD Emissions Model for the inventory year 2006 with diesel particulate filters (DPF's) applied to all equipment over 50 horsepower. The model is based on source inventory data accumulated for specific categories of off road equipment. Data provided in the output files from the NONROAD model were used to derive (i.e., back-calculated from regional emission estimates) these emission factors for each type of equipment that is expected to be present on-site during construction activities.

Because the contracts have not been let, the exact size of construction equipment has to be estimated. Since the model provides the "percent of population" at specified levels of horsepower for each equipment type, data provided in the NONROAD Model were used as guidance to estimate the size of equipment. All estimated equipment sizes were within the horsepower range of the most common sizes presented in the NONROAD model. The model derived emission factors used for fuel combustion emission rate calculations are provided in Table 2.

Emission rates of NO<sub>x</sub>, PM, SO<sub>2</sub> and CO from combustion of fuel for on-site heavy duty diesel trucks were developed using the USEPA MOBILE6.2 emissions model (a modeling year of 2011 was used for the analysis). This model provides emission factors in grams per vehicle-mile for NO<sub>x</sub> and CO and grams per hour for PM and SO<sub>2</sub>. For this analysis, truck emissions were conservatively estimated using only idle engine emission factors.

### *ESTIMATED EMISSION RATES FROM COMBUSTION SOURCES*

Based on the fuel combustion emission factors described above, emission rates have been calculated for each type of equipment expected to be on-site. These emission rates with sample calculations are provided in Table 3.

### **FUGITIVE DUST EMISSIONS**

On-site construction equipment have the potential to generate fugitive dust (PM<sub>10</sub> for this analysis) due to heavy vehicles (i.e., dump trucks) traveling on paved and unpaved portions of the construction site. Emission rates for these activities were developed using equations presented in USEPA's AP-42 "A Compilation of Air Pollution Emission Factors." Emission factors for particulate matter generated by these sources are provided in grams per vehicle-mile. For this analysis it is presumed that vehicle speeds will be restricted to 5 miles per hour or less. The maximum distance traveled on-site in any one hour on paved roads is estimated to be 1,150 feet per vehicle for the 16 cubic yard (cy) heavy trucks. The maximum distance traveled on-site in any one hour on unpaved roads is estimated to be 400 feet per vehicle for the 16 cubic yard (cy) heavy trucks. The travel distances are an approximation of the maximum distance that most

trucks would travel during soil transfer operations round trip between the site entrance/exit and the excavation area.

During construction activities the contractor will be required to implement a water spray control program for the control of fugitive dust. It is assumed that this control method will provide at least a 50 percent reduction in PM<sub>10</sub> emissions.

Particulate matter emissions would be generated by heavy equipment performing operational activities such as loading and drop (soil transfer) operations, site grading, rock drilling and rock removal. Estimates of air emissions from these activities were developed using USEPA's AP-42. The travel distance used for grading operations was a conservative approximation of the maximum distance a unit might travel during repetitive motions back and forth during the course of an hour while grading soil at a specific locality on-site.

#### *ESTIMATED EMISSION RATES FROM FUGITIVE SOURCES*

PM<sub>10</sub> emission rates from on-site mobile sources are provided in Table 4A for heavy trucks operating on paved roads. Table 4B provides the PM<sub>10</sub> emission rates for heavy trucks operating on unpaved roads. Both tables include sample calculations of emission factors and short-term emission rates for PM<sub>10</sub> (NYCDEP policy states that PM<sub>2.5</sub> does not need to be computed when vehicles speeds are restricted to 5 mph or less). Key parameters in the AP-42 calculations included silt loading/silt content and vehicle weights. The values selected for silt loading and silt content for paved and unpaved roads were conservative estimates taken from AP-42 tables.

The PM<sub>10</sub> and PM<sub>2.5</sub> emission rates for soil transfer activities are provided in Tables 5A and 5B for excavation and sheeting operations, respectively. The PM<sub>10</sub> and PM<sub>2.5</sub> emission rates for soil grading activities are provided in Tables 6A and 6B, respectively. Table 7 contains emission rates for rock removal.

#### **OPERATIONAL PARAMETERS**

The short-term and annual impacts from construction activities were predicted using the most conservative short-term and annual overall emissions generated by onsite activities. Resource schedules provided by URS indicated the peak annual period beginning with the 3rd quarter of 2011 and ending with the 2nd quarter of 2012 would have the highest localized emissions. For the peak short-term period (i.e., daily), maximum impacts are expected to occur in the 3rd quarter of 2011. The hours of operation for each piece of equipment are presented in Table 8 and a description of operational activities is provided in Table 9. A summary of criteria pollutant emission rates used in the dispersion modeling analysis are presented in Tables 10 through 14.

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**TABLE 3**  
**Estimated Peak-Hour Short-Term Emission Rates**  
**Fuel Combustion Sources**

Construction Equipment <sup>1</sup>	Site Equip Rated HP <sup>2</sup>	Emission Rates in g/sec (per unit)					Emission Rates in lb/hr (per unit)				
		NO <sub>x</sub>	CO	SO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	NO <sub>x</sub>	CO	SO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>
Backhoes	87.17	3.7E-02	4.2E-02	3.2E-05	9.8E-04	9.5E-04	2.9E-01	3.3E-01	2.6E-04	7.8E-03	7.6E-03
Excavators	137.6	1.1E-01	3.5E-02	1.1E-04	1.1E-03	1.0E-03	8.7E-01	2.8E-01	8.8E-04	8.4E-03	8.1E-03
Loaders	87.17	3.7E-02	4.2E-02	3.2E-05	9.8E-04	9.5E-04	2.9E-01	3.3E-01	2.6E-04	7.8E-03	7.6E-03
Dozers	136.1	1.1E-01	3.7E-02	1.1E-04	1.1E-03	1.0E-03	8.9E-01	2.9E-01	8.7E-04	8.5E-03	8.3E-03
Cranes	237.7	1.5E-01	3.0E-02	1.4E-04	9.8E-04	9.5E-04	1.2E+00	2.4E-01	1.1E-03	7.8E-03	7.5E-03
Compressors	83.9	5.9E-02	3.0E-02	5.4E-05	8.6E-04	8.4E-04	4.7E-01	2.4E-01	4.3E-04	6.8E-03	6.6E-03
Pile Driver	237.7	1.5E-01	3.0E-02	1.4E-04	9.8E-04	9.5E-04	1.2E+00	2.4E-01	1.1E-03	7.8E-03	7.5E-03
Concrete Pumps	137.7	1.3E-01	5.4E-02	1.1E-04	1.3E-03	1.3E-03	1.0E+00	4.3E-01	8.8E-04	1.1E-02	1.0E-02
Water Pumps	8.5	6.2E-03	4.8E-03	5.5E-06	6.7E-04	6.5E-04	4.9E-02	3.8E-02	4.4E-05	5.3E-03	5.1E-03
Generators	33.4	2.2E-02	1.1E-02	2.2E-05	2.0E-03	2.0E-03	1.7E-01	8.9E-02	1.7E-04	1.6E-02	1.6E-02
Graders	231.2	1.3E-01	4.6E-02	1.9E-04	1.2E-03	1.2E-03	1.0E+00	3.7E-01	1.5E-03	9.9E-03	9.6E-03
Pavers	134.6	1.1E-01	3.9E-02	1.1E-04	1.1E-03	1.1E-03	9.1E-01	3.1E-01	8.6E-04	8.7E-03	8.5E-03
Rollers	84.7	7.5E-02	6.0E-02	7.6E-05	1.4E-03	1.3E-03	6.0E-01	4.8E-01	6.0E-04	1.1E-02	1.1E-02
Trucks											
Heavy Trucks <sup>3</sup>	419.9	7.3E-03	5.1E-03	N/A*	3.0E-04	2.8E-04	5.8E-02	4.0E-02	N/A*	2.4E-03	2.2E-03

**Notes:**

- Construction equipment emission factors were derived from the USEPA NONROAD model. These factors, presented in grams per horsepower-hour (g/hp-hr), are provided in Table HP-2.
- Based on average size of equipment presented in the NONROAD model, this is the rated horsepower used for each equipment type present on-site.
- Heavy Duty Diesel Vehicle emissions were derived from the USEPA MOBILE6.2 model. Since travel time is a very small percentage of time spent on-site, it was conservatively assumed that emission rates for all time spent on-site were the result of idling vehicles. Idle vehicle emission factors were generated using a vehicle speed of 2.5 mph. MOBILE6.2 Emission Factors for trucks in the year 2011 are provided below:  
 NO<sub>x</sub>: 10.49 grams per vehicle mile traveled (gVMT) at 2.5 miles per hour  
 CO: 7.32 g/VMT  
 PM<sub>10</sub>: 1.08 g/hr  
 PM<sub>2.5</sub>: 0.992 g/hr
- Emission rates for heavy trucks (in g/sec) were calculated by multiplying the emission factor in gVMT by 2.5 miles per hour and then dividing by 3,600 seconds per hour.  
 Due to the use of ultra-low sulfur diesel in 2011, SO<sub>2</sub> emissions are negligible.

**Sample Emission Calculation for NO<sub>x</sub> (backhoe):**

$$E_R = (E_i \text{ NONROAD} * \text{Eqpmt HP}) / 60 \text{ (min/hr)} / 60 \text{ (s/min)}$$

where:

E<sub>R</sub> = Pollutant specific emission rate in grams per second (g/sec)

E<sub>i</sub> NONROAD = the NONROAD model derived emission factor in g/hp-hr

Actual HP = the rated horsepower for the actual equipment expected on-site

$$E_R \text{ NO}_x = (1.515 * 87.17) / 60 / 60$$

$$E_R \text{ NO}_x = 0.037 \text{ g/sec}$$

**TABLE 4A**  
**Estimated Peak-Hour Emission Rates**  
**Fugitive Dust Sources - PM<sub>10</sub>**  
**Mobile Equipment Operating on Paved Roads**

Analysis Period	Surface Type	Avg. Length of Road/Path (feet)	Type of Vehicles <sup>c</sup>	Average Weight (tons)	Round Trip Length of Road/Path		Total Distance Traveled Miles	PM <sub>10</sub> Emission Factor lb/VMT	Controlled PM <sub>10</sub> Emission Rate g/s
					feet	miles			
1st Qtr 2011	Paved	575	2, 3	20.5	1,150	0.2178	1.340	0.322	2.72E-02
Annual 2011 <sup>b</sup>	Paved	575	1, 2, 3	23.6	1,150	0.2178	0.751	0.398	1.35E-02

Notes: a. Road dust emissions were not calculated on a per vehicle basis but rather on a fleet-wide basis. Excavators, loaders, and backhoes move about in small incremental steps as the excavation progresses (i.e., minimal distances) and would therefore generate negligible amounts of fugitive dust.

b. Annual emissions were multiplied by 5/7 to account for a five day work week.

c. Listed below are the vehicle types, their average weight and travel frequency in truck trips per hour (round trips).

	Truck trips per hour			
	Short-Term	Annual	Weight	
1. Concrete Trucks =	0	0.85	30 tons	
2. Dump Trucks =	3.5	1.6	30 tons	
3. Heavy Trucks =	2.65	1.0	8 tons	

**Paved Road Emission Factor - Sample Calculation (1st Qtr 2011):**

$$E_f = k * (sL/2)^{0.65} * (W/3)^{1.5} \quad \text{Equation 1 from Section 13.2.1 of USEPA's AP-42}$$

where:

$E_f$  = size specific emission factor in pounds per vehicle mile traveled (lb/VMT)

$k$  = an empirical constant selected from AP-42 Table 13.2.1-1 for PM<sub>10</sub>

$sL$  = road surface silt loading in grams per square meter selected from AP-42 Table 13.2.1-3 for conditions with a low average daily traffic (ADT) classification.

$W$  = mean vehicle weight in tons

$$E_f = 0.016 * (2.4/2)^{0.65} * (20.5/3)^{1.5}$$

$$E_f = 0.322 \text{ lb/VMT}$$

**Sample Emission Rate Calculation (1st Qtr 2011):**

$$E_R = (E_f \text{ paved} * \text{VMT}) * 453.59 \text{ (g/lb)} / 60 \text{ (min/hr)} / 60 \text{ (s/min)} * 0.5$$

where:

$E_R$  = PM<sub>10</sub> emission rate in grams per second

$E_f$  paved = paved road emission factor in lb/VMT

VMT = vehicle miles traveled

0.5 = 50% control for watering program

$$E_R = (0.322 * 1.34) * 453.59 \text{ (g/lb)} / 60 \text{ (min/hr)} / 60 \text{ (s/min)} * 0.5$$

$$E_R = 2.72 \text{ E-02 g/sec}$$

**TABLE 4B**  
**Estimated Peak-Hour Emission Rates**  
**Fugitive Dust Sources - PM<sub>10</sub>**  
**Mobile Equipment Operating on Unpaved Roads**

Analysis Period	Surface Type	Avg. Length of Road/Path (feet)	Type of Vehicles <sup>c</sup>	Average Weight (tons)	Round Trip Length of Road/Path		Total Distance Traveled Miles	PM <sub>10</sub> Emission Factor lb/VMT	Controlled PM <sub>10</sub> Emission Rate g/s
					feet	miles			
1st Qtr 2011	Unpaved	200	2, 3	20.5	400	0.0758	0.466	2.61	7.67E-02
Annual 2011 <sup>b</sup>	Unpaved	200	1, 2, 3	23.6	400	0.0758	0.261	2.78	3.27E-02

Notes: a. Road dust emissions were not calculated on a per vehicle basis but rather on a fleet-wide basis. Excavators, loaders, and backhoes move about in small incremental steps as the excavation progresses (i.e., minimal distances) and would therefore generate negligible amounts of fugitive dust.

b. Annual emissions were multiplied by 5/7 to account for a five day work week.

c. Listed below are the vehicle types, their average weight and travel frequency in truck trips per hour (round trips).

	Truck trips per hour			
	Short-Term	Annual	Weight	
1. Concrete Trucks =	0	0.85	30 tons	
2. Dump Trucks =	3.5	1.6	30 tons	
3. Heavy Trucks =	2.65	1.0	8 tons	

**Unpaved Road Emission Factor - Sample Calculation (1st Qtr 2011):**

$$E_f = k * (s/12)^a * (W/3)^b$$

Equation 1a from Section 13.2.2 of USEPA's AP-42

where:

$E_f$  = size specific emission factor in pounds per vehicle mile traveled (lb/VMT)

$k$  = an empirical constant selected from AP-42 Table 13.2.2-2 for PM<sub>10</sub>

$s$  = surface material silt content in percent silt selected from AP-42 Table 13.2.2-1 (for a construction site)

$a$  = an empirical constant selected from AP-42 Table 13.2.2-2 for PM<sub>10</sub>

$W$  = mean vehicle weight in tons

$b$  = an empirical constant selected from AP-42 Table 13.2.2-2 for PM<sub>10</sub>

$$E_f = 1.5 * (8.5/12)^{0.9} * (20.5/3)^{0.45}$$

$$E_f = 2.61 \text{ lb/VMT}$$

**Sample Emission Rate Calculation (1st Qtr 2011):**

$$E_R = (E_f \text{ unpaved} * \text{VMT}) * 453.59 \text{ (g/lb)} / 60 \text{ (min/hr)} / 60 \text{ (s/min)} * 0.5$$

where:

$E_R$  = PM<sub>10</sub> emission rate in grams per second

$E_f \text{ unpaved}$  = unpaved road emission factor in lb/VMT

VMT = vehicle miles traveled

0.5 = 50% control for watering program

$$E_R = (2.61 * 0.466) * 453.59 \text{ (g/lb)} / 60 \text{ (min/hr)} / 60 \text{ (s/min)} * 0.5$$

$$E_R = 7.67 \text{ E-02 g/sec}$$

**Table 5A**  
**Estimated Peak-Hour Short-Term Emission Rates**  
**Fugitive Dust Sources - PM<sub>10</sub> and PM<sub>2.5</sub>**  
**Transfer Operations - Excavation**

Equipment	Activity	Volume Removed Hourly cubic yards <sup>1</sup>	Default Soil Density lbs/cubic yard	Tons Removed Hourly	Emission Factor <sup>2</sup> lb/ton	PM <sub>10</sub> Emission Rate lb/hr	PM <sub>10</sub> Emission Rate g/s	PM <sub>2.5</sub> Emission Rate lb/hr	PM <sub>2.5</sub> Emission Rate g/s
Excavator #1	Excavates/Transfers to 16 cy Truck	9.0	2,600	12	5.39E-04	0.006	7.9E-04	2.0E-03	2.5E-04
Backhoe #1	Excavates/Transfers to 16 cy Truck	9.0	2,600	12	5.39E-04	0.006	7.9E-04	2.0E-03	2.5E-04
Backhoe #2	Excavates/Transfers to 16 cy Truck	9.0	2,600	12	5.39E-04	0.006	7.9E-04	2.0E-03	2.5E-04
Loader #1	Excavates/Transfers to 16 cy Truck	9.0	2,600	12	5.39E-04	0.006	7.9E-04	2.0E-03	2.5E-04
Loader #2	Excavates/Transfers to 16 cy Truck	9.0	2,600	12	5.39E-04	0.006	7.9E-04	2.0E-03	2.5E-04

**Notes:**

1. A total of 30,450 cubic yards (cy) of soil will be excavated during the excavation/sheeting phase (120 work days). A maximum "excavation" transfer rate of 360 cubic yards for a single day and a maximum of 45 cubic yards per hour (or 9 cy per equipment) has been conservatively assumed as the peak activity since it is assumed that the soil will be removed in the first 80 of the 120 work days.
2. Emission factors for soil transfer operations are based on Equation 1 from Section 13.2.4 of AP-42. Emission factor calculations are provided below.

**Transfer/Drop Operation Emission Factor - Sample Calculation for PM<sub>10</sub>:**

$$E_f = k * (0.0032) * (U/5)^{1.3} / (M/2)^{1.4}$$

where:

E<sub>f</sub> = size specific emission factor in pounds per ton (lb/ton)

k = an empirical constant selected from AP-42 (0.35 for PM<sub>10</sub> and 0.11 for PM<sub>2.5</sub>)

U = mean wind speed in miles per hour (mph)

M = material moisture content in percent moisture (%) conservatively assumed to be 7.9%

$$E_f = 0.35 * (0.0032) * (12.5/5)^{1.3} / (7.9/2)^{1.4}$$

$$E_f = 5.39 \text{ E-04 lb/ton}$$

**Sample Emission Rate Calculation for PM<sub>10</sub> (loader):**

$$E_R = E_f \cdot PM_{10} * (\text{soil volume} * \text{soil density} / 2,000 \text{ lbs/ton}) * 453.59 / 60 / 60$$

where:

E<sub>R</sub> = PM<sub>10</sub> emission rate in grams per second

E<sub>f</sub> PM<sub>10</sub> = PM<sub>10</sub> emission factor in lb/ton

soil volume = volume of soil handled in cubic yards per hour

soil density = 2,600 lbs/YD<sup>3</sup>

$$E_R = 5.39 \text{ E-04} * (9 * 2,600 / 2,000) * 453.59 / 60 / 60$$

$$E_R = 7.9 \text{ E-04 g/s}$$



**Table 5B**  
**Estimated Peak-Hour Short-Term Emission Rates**  
**Fugitive Dust Sources - PM<sub>10</sub> and PM<sub>2.5</sub>**  
**Transfer Operations - Sheetting**

Equipment	Activity	Volume Removed Hourly cubic yards <sup>3</sup>	Default Soil Density lbs/cubic yard	Tons Removed Hourly	Emission Factor <sup>2</sup> lb/ton	PM <sub>10</sub> Emission Rate lb/hr	PM <sub>10</sub> Emission Rate g/s	PM <sub>2.5</sub> Emission Rate lb/hr	PM <sub>2.5</sub> Emission Rate g/s
Backhoe #3	Excavates/Transfers to 16 cy Truck	2.5	2,600	3	5.39E-04	1.8E-03	2.2E-04	5.5E-04	6.9E-05
Loader #3	Excavates/Transfers to 16 cy Truck	2.5	2,600	3	5.39E-04	1.8E-03	2.2E-04	5.5E-04	6.9E-05

- Notes:
1. A total of 30,450 cubic yards (cy) of soil will be excavated during the excavation/sheetting phase (120 work days). A maximum "sheetting" transfer rate of 40 cubic yards for a single day and a maximum of 5 cubic yards per hour (or 2.5 cy per equipment) has been conservatively assumed as the peak activity since it is assumed that the soil will be removed in the first 80 of the 120 work days.
  2. Emission factors for soil transfer operations are based on Equation 1 from Section 13.2.4 of AP-42. Emission factor calculations are provided below.

**Transfer/Drop Operation Emission Factor - Sample Calculation for PM<sub>10</sub>:**

$$E_f = k * (U/5)^3 / (M/2)^{1.4}$$

where:

E<sub>f</sub> = size specific emission factor in pounds per ton (lb/ton)

k = an empirical constant selected from AP-42 (0.35 for PM<sub>10</sub> and 0.11 for PM<sub>2.5</sub>)

U = mean wind speed in miles per hour (mph)

M = material moisture content in percent moisture (%) conservatively assumed to be 7.9%

$$E_f = 0.35 * (0.0032) * (12.5/5)^3 / (7.9/2)^{1.4}$$

$$E_f = 5.39 \text{ E-04 lb/ton}$$

**Sample Emission Rate Calculation for PM<sub>10</sub> (loader):**

$$E_R = E_f \text{ PM}_{10} * (\text{soil volume} * \text{soil density} / 2,000 \text{ lbs/ton}) * 453.59 / 60 / 60$$

where:

E<sub>R</sub> = PM<sub>10</sub> emission rate in grams per second

E<sub>f</sub> PM<sub>10</sub> = PM<sub>10</sub> emission factor in lb/ton

soil volume = volume of soil handled in cubic yards per hour

soil density = 2,600 lbs/Y<sup>3</sup>

$$E_R = 5.39 \text{ E-04} * (2.5 * 2,600 / 2,000) * 453.59 / 60 / 60$$

$$E_R = 2.2 \text{ E-04 g/s}$$

wind spd 12.5  
 moist % 7.9

**TABLE 6A**  
**Estimated Peak-Hour Short-Term Emission Rates**  
**Fugitive Dust Sources - PM<sub>10</sub>**  
**Grading Operations**

Construction Equipment	Miles Traveled per Vehicle max per hr <sup>1</sup>	PM <sub>10</sub> Factor lb/VMT	Uncontrolled Emissions <sup>2</sup>	
			PM <sub>10</sub> Emissions lb/hr per veh	PM <sub>10</sub> Emissions g/sec per veh
Dozer #1	0.0947	0.0306	2.9E-03	3.7E-04
Dozer #2	0.0947	0.0306	2.9E-03	3.7E-04
Dozer #3	0.0947	0.0306	2.9E-03	3.7E-04
Backhoe #5	0.0947	0.0306	2.9E-03	3.7E-04
Loader #5	0.0947	0.0306	2.9E-03	3.7E-04
Loader #6	0.0947	0.0306	2.9E-03	3.7E-04
Grader #1	0.5	0.0306	0.015	1.9E-03

Notes:

1. 0.0947 miles is equal to 500 feet.
2. Emission factors for grading operations are based on equations presented in Table 11.9-1 of AP-42. Emission Factor calculations are provided below.

**Grading Operation Emission Factor - Sample Calculation for PM<sub>10</sub>:**

$$E_f = 0.051 * (S)^{2.0} * PM_{10} \text{ scaling factor}$$

where:

$E_f$  = size specific emission factor in pounds per vehicle mile traveled (lb/VMT)

$S$  = mean vehicle speed in miles per hour (mph)

PM<sub>10</sub> scaling factor = an empirical constant selected from AP-42 for PM<sub>10</sub>

$$E_f = 0.051 * (1.0)^{2.0} * 0.60$$

$$E_f = 0.0306 \text{ lb/VMT}$$

**Sample Emission Rate Calculation for PM<sub>10</sub> (Dozer):**

$$E_R = E_f PM_{10} * \text{miles traveled} * 453.59 / 60 / 60$$

where:

$E_R$  = PM<sub>10</sub> emission rate in grams per second

$E_f PM_{10}$  = PM<sub>10</sub> emission factor in lb/VMT

$$E_R = 0.0306 * 0.0947 * 453.59 / 60 / 60$$

$$E_R = 3.7E-04 \text{ g/s}$$

**TABLE 6B**  
**Estimated Peak-Hour Short-Term Emission Rates**  
**Fugitive Dust Sources - PM<sub>2.5</sub>**  
**Grading Operations**

Construction Equipment	Miles Traveled per Vehicle max per hr <sup>1</sup>	Paved PM <sub>2.5</sub> Factor lb/VMT	Uncontrolled Emissions	
			PM <sub>2.5</sub> Emissions lb/hr per veh	PM <sub>2.5</sub> Emissions g/sec per veh
Dozer #1	0.0947	0.00124	1.2E-04	1.5E-05
Dozer #2	0.0947	0.00124	1.2E-04	1.5E-05
Dozer #3	0.0947	0.00124	1.2E-04	1.5E-05
Backhoe #5	0.0947	0.00124	1.2E-04	1.5E-05
Loader #5	0.0947	0.00124	1.2E-04	1.5E-05
Loader #6	0.0947	0.00124	1.2E-04	1.5E-05
Grader #1	0.5	0.00124	6.2E-04	7.8E-05

Notes:

1. 0.0947 miles is equal to 500 feet.
2. Emission factors for grading operations are based on equations presented in Table 11.9-1 of AP-42. Emission Factor calculations are provided below.

**Grading Operation Emission Factor - Sample Calculation for PM<sub>2.5</sub>:**

$$E_f = 0.040 * (S)^{2.5} * PM_{2.5} \text{ scaling factor}$$

where:

$E_f$  = size specific emission factor in pounds per vehicle mile traveled (lb/VMT)

S = mean vehicle speed in miles per hour (mph)

PM<sub>2.5</sub> scaling factor = an empirical constant selected from AP-42 for PM<sub>2.5</sub>

$$E_f = 0.040 * (1.0)^{2.5} * 0.031$$

$$E_f = 0.00124 \text{ lb/VMT}$$

**Sample Emission Rate Calculation for PM<sub>2.5</sub> (Dozer):**

$$E_R = E_f PM_{2.5} * \text{miles traveled} * 453.59 / 60 / 60$$

where:

$E_R$  = PM<sub>2.5</sub> emission rate in grams per second

$E_f PM_{2.5}$  = PM<sub>2.5</sub> emission factor in lb/VMT

$$E_R = 0.00124 * 0.0947 * 453.59 / 60 / 60$$

$$E_R = 1.5E-05 \text{ g/s}$$

**TABLE 7**  
**Estimated Peak-Hour Short-Term Emission Rates**  
**Fugitive Dust Sources - PM<sub>10</sub> and PM<sub>2.5</sub>**  
**Rock Removal Operations**

Construction Equipment	Rock Removed cubic yards/hr <sup>1</sup>	PM <sub>10</sub> Factor lb/ton	PM <sub>2.5</sub> Factor lb/ton	Uncontrolled Emissions <sup>2</sup>		Uncontrolled Emissions <sup>2</sup>	
				PM <sub>10</sub> Emissions lb/hr per eqpmt	PM <sub>10</sub> Emissions g/sec per eqpmt	PM <sub>2.5</sub> Emissions lb/hr per eqpmt	PM <sub>2.5</sub> Emissions g/sec per eqpmt
Loader #4	20	1.60E-05	4.69E-07	4.2E-04	5.2E-05	1.2E-05	1.5E-06

**Notes:**

1. A total of 12,250 cubic yards (cy) of rock will be excavated during the excavation/sheeting phase (120 work days). A maximum "rock removal" transfer rate of 160 cubic yards for a single day and a maximum of 20 cubic yards per hour has been assumed as the peak activity since it is assumed that the rock will be removed in the first 80 of the 120 work days.
2. Emission factors for rock removal operations are based on equations presented in Table 11.19.2-2 of AP-42 (fragmented stone loading). Emission factor calculations are provided below.

**Rock Removal Operation Emission Factor - Sample Calculation for PM<sub>10</sub> and PM<sub>2.5</sub>:**

$$E_f = 1.60E-05 \text{ lb/ton for PM}_{10}$$

where:

$E_f$  = size specific emission factor in pounds per ton of material (lb/ton)

(Note: PM<sub>2.5</sub> scaling factor would be "(1/0.75)\* 0.022" based on PM<sub>10</sub>/PM<sub>2.5</sub> scaling factor ratios presented in AP-42

Table 11.9-1).

$$E_f = 4.69E-07 \text{ lb/ton PM}_{2.5}$$

**Sample Emission Rate Calculation for PM<sub>10</sub>:**

$$E_R = E_f \text{ PM}_{10} \text{ (lb/ton)} * \text{amount of rock material moved (cy)} * 2,600 \text{ lb/cy} * (1 \text{ ton}/2000 \text{ lbs}) * (453.59 \text{ g} / 1 \text{ lb}) / 60 / 60$$

where:

$E_R$  = PM<sub>10</sub> emission rate in gram per second

$E_f \text{ PM}_{10}$  = PM<sub>10</sub> emission factor in lb/ton

$$E_R = 1.6 \times 10^{-5} * 20 \text{ cy} * 2,600 \text{ lb/cy} * (1 \text{ ton} / 2,000 \text{ lbs}) * 453.59 / 60 / 60$$

$$E_R = 5.2 \times 10^{-5} \text{ g/s}$$

**Table 8  
Construction Equipment Details  
Operational Parameters**

Construction Equipment	Engine HP	Peak Daily Avg hrs/day	Annual Average hrs/day
Excavator #1	137.6	8.00	4.00
Excavator #2	137.6	N/A	2.00
Backhoe #1	87.17	8.00	4.00
Backhoe #2	87.17	8.00	4.00
Backhoe #3	87.17	8.00	1.00
Backhoe #4	87.17	8.00	6.00
Backhoe #5	87.17	N/A	2.00
Loader #1	87.17	8.00	4.00
Loader #2	87.17	8.00	4.00
Loader #3	87.17	8.00	1.00
Loader #4	87.17	N/A	2.00
Loader #5	87.17	N/A	2.00
Loader #6	87.17	N/A	2.00
Dozer #1	136.1	8.00	4.00
Dozer #2	136.1	N/A	2.00
Dozer #3	136.1	N/A	2.00
Crane #1	237.7	8.00	7.00
Compressor #1	83.9	N/A	2.00
Concrete Pump #1	137.7	N/A	4.00
Water Pump #1	8.5	8.00	8.00
Water Pump #2	8.5	8.00	6.00
Generator #1	33.4	8.00	7.00
Pile Driver #1	237.7	8.00	1.00
Grader #1	231.2	N/A	2.00
Paver #1	134.6	N/A	2.00
Roller #1	84.7	N/A	2.00
Roller #2	84.7	N/A	2.00
16 cy Dump Truck #1	419.9	8.00	8.00
16 cy Dump Truck #2	419.9	8.00	8.00
16 cy Dump Truck #3	419.9	8.00	8.00

**Table 9  
Construction Equipment Details  
Modeling Activities**

Construction Equipment	Source Type Point/Volume	Description of Operational Activities
Excavator #1	Volume Source	Soil removal during excavation
Excavator #2	Volume Source	Rock drilling with hoe ram
Backhoe #1	Volume Source	Soil removal during excavation
Backhoe #2	Volume Source	Soil removal during excavation
Backhoe #3	Volume Source	Soil removal during sheeting
Backhoe #4	Volume Source	Lifting materials during electrical inst.
Backhoe #5	Volume Source	Landscaping
Loader #1	Volume Source	Soil removal during excavation
Loader #2	Volume Source	Soil removal during excavation
Loader #3	Volume Source	Soil removal during sheeting
Loader #4	Volume Source	Rock removal during rock drilling
Loader #5	Volume Source	Constructing roadways/move materials
Loader #6	Volume Source	Landscaping
Dozer #1	Volume Source	Grading during excavation
Dozer #2	Volume Source	Grading for constructing roadways
Dozer #3	Volume Source	Landscaping
Crane #1	Point Source	Lifting materials
Compressor #1	Point Source	Pneumatic equipment
Concrete Pump #1	Point Source	Concrete foundation
Water Pump #1	Point Source	Dewatering
Water Pump #2	Point Source	Dewatering
Generator #1	Point Source	Electricity
Pile Driver #1	Point Source	Pile Driving
Grader #1	Volume Source	Grading for constructing roadways
Paver #1	Volume Source	Constructing roadways
Roller #1	Volume Source	Constructing roadways
Roller #2	Volume Source	Constructing roadways
16 cy Dump Truck #1	Volume Source	Soil/rock removal, deliveries
16 cy Dump Truck #2	Volume Source	Soil/rock removal, deliveries
16 cy Dump Truck #3	Volume Source	Soil/rock removal, deliveries

**Table 10**  
**Modelling Parameters**  
**PM<sub>2.5</sub> Emission Rates**

Construction Equipment	Peak Hourly Engine Emission Rate (g/sec)	Peak Hourly Fugitive Emission Rate (g/sec)	Peak Hourly Total Emission Rate (g/sec)	Short-Term Average <sup>b</sup> Emission Rate (g/sec)	Annual Average <sup>d</sup> Emission Rate (g/sec)
Excavator #1	1.0E-03	2.5E-04	1.3E-03	1.3E-03	4.5E-04
Excavator #2	1.0E-03	N/A <sup>a</sup>	1.0E-03	1.0E-03	1.8E-04
Backhoe #1	9.5E-04	2.5E-04	1.2E-03	1.2E-03	4.3E-04
Backhoe #2	9.5E-04	2.5E-04	1.2E-03	1.2E-03	4.3E-04
Backhoe #3	9.5E-04	6.9E-05	1.0E-03	1.0E-03	9.1E-05
Backhoe #4	9.5E-04	N/A <sup>a</sup>	9.5E-04	9.5E-04	5.1E-04
Backhoe #5	9.5E-04	1.5E-05	9.7E-04	N/A <sup>c</sup>	1.7E-04
Loader #1	9.5E-04	2.5E-04	1.2E-03	1.2E-03	4.3E-04
Loader #2	9.5E-04	2.5E-04	1.2E-03	1.2E-03	4.3E-04
Loader #3	9.5E-04	6.9E-05	1.0E-03	1.0E-03	9.1E-05
Loader #4	9.5E-04	1.5E-06	9.6E-04	9.6E-04	1.7E-04
Loader #5	9.5E-04	1.5E-05	9.7E-04	N/A <sup>c</sup>	1.7E-04
Loader #6	9.5E-04	1.5E-05	9.7E-04	N/A <sup>c</sup>	1.7E-04
Dozer #1	1.0E-03	1.5E-05	1.1E-03	1.1E-03	3.8E-04
Dozer #2	1.0E-03	1.5E-05	1.1E-03	N/A <sup>c</sup>	1.9E-04
Dozer #3	1.0E-03	1.5E-05	1.1E-03	N/A <sup>c</sup>	1.9E-04
Crane #1 <sup>1</sup>	9.5E-04	N/A <sup>a</sup>	9.5E-04	9.5E-04	5.9E-04
Compressor #1 <sup>1</sup>	8.4E-04	N/A <sup>a</sup>	8.4E-04	8.4E-04	1.5E-04
Concrete Pump #1 <sup>1</sup>	1.3E-03	N/A <sup>a</sup>	1.3E-03	N/A <sup>c</sup>	4.6E-04
Water Pump #1 <sup>1</sup>	6.5E-04	N/A <sup>a</sup>	6.5E-04	6.5E-04	4.6E-04
Water Pump #2 <sup>1</sup>	6.5E-04	N/A <sup>a</sup>	6.5E-04	6.5E-04	3.5E-04
Generator #1 <sup>1</sup>	2.0E-03	N/A <sup>a</sup>	2.0E-03	2.0E-03	1.2E-03
Pile Driver #1 <sup>1</sup>	9.5E-04	N/A <sup>a</sup>	9.5E-04	9.5E-04	8.5E-05
Grader #1	1.2E-03	7.8E-05	1.3E-03	N/A <sup>c</sup>	2.3E-04
Paver #1	1.1E-03	N/A <sup>a</sup>	1.1E-03	N/A <sup>c</sup>	1.9E-04
Roller #1	1.3E-03	N/A <sup>a</sup>	1.3E-03	N/A <sup>c</sup>	2.4E-04
Roller #2	1.3E-03	N/A <sup>a</sup>	1.3E-03	N/A <sup>c</sup>	2.4E-04
Concrete trucks <sup>1</sup>	2.8E-04	N/A <sup>g</sup>	2.8E-04	N/A <sup>c</sup>	1.7E-04
Excavation dump trucks <sup>9</sup>	2.8E-04	N/A <sup>g</sup>	2.8E-04	4.8E-05	1.6E-05
Other trucks <sup>9</sup>	2.8E-04	N/A <sup>g</sup>	2.8E-04	3.7E-05	9.8E-06
Total Emission Rate (in g/sec) for all Volume Sources in Digester Area				0.012	3.9E-03
Average Emission Rate (in g/sec) per Volume Source (total 24 vol. sources) in Digester Area				5.1E-04	1.6E-04
Total Emission Rate (in g/sec) for all Volume Sources in Other Areas				N/A	1.7E-03
Average Emission Rate (in g/sec) per Volume Source (total 39 vol. sources) in Other Areas					4.4E-05

Notes:

- These equipment produce negligible fugitive dust emissions or are not involved in construction activities that generate fugitive dust emissions.
- No scaling factors were applied to the 8-hour and 24-hour average emission rates because all equipment is assumed to operate 8 hours per day.
- These equipment do not operate during the "worst case" quarter in 2011.
- The annual average hours per day was used to generate annual emissions and was scaled accordingly.
- PM<sub>2.5</sub> emissions are not included for vehicles traveling at 5 mph or less. This is in accordance with NYCDEP guidance.
- Concrete trucks are not subject to idling laws and will operate in a continuous manner.
- These trucks are subject to idling laws and are assumed to run a total of 3 minutes in any one hour.
- These equipment were modeled as point sources, all other equipment were grouped together as volume sources.

**Table 11**  
**Modelling Parameters**  
**PM<sub>10</sub> Emission Rates**

Construction Equipment	Peak Hourly Engine Emission Rate (g/sec)	Peak Hourly Fugitive Emission Rate (g/sec)	Peak Hourly Total Emission Rate (g/sec)	Short-Term Average <sup>b</sup> Emission Rate (g/sec)	Annual Average <sup>d</sup> Emission Rate (g/sec)
Excavator #1	1.1E-03	7.9E-04	1.8E-03	1.8E-03	6.6E-04
Excavator #2	1.1E-03	N/A <sup>a</sup>	1.1E-03	1.1E-03	1.9E-04
Backhoe #1	9.8E-04	7.9E-04	1.8E-03	1.8E-03	6.3E-04
Backhoe #2	9.8E-04	7.9E-04	1.8E-03	1.8E-03	6.3E-04
Backhoe #3	9.8E-04	2.2E-04	1.2E-03	1.2E-03	1.1E-04
Backhoe #4	9.8E-04	N/A <sup>a</sup>	9.8E-04	9.8E-04	5.3E-04
Backhoe #5	9.8E-04	3.7E-04	1.3E-03	N/A <sup>c</sup>	2.4E-04
Loader #1	9.8E-04	7.9E-04	1.8E-03	1.8E-03	6.3E-04
Loader #2	9.8E-04	7.9E-04	1.8E-03	1.8E-03	6.3E-04
Loader #3	9.8E-04	2.2E-04	1.2E-03	1.2E-03	1.1E-04
Loader #4	9.8E-04	5.2E-05	1.0E-03	1.0E-03	1.9E-04
Loader #5	9.8E-04	3.7E-04	1.3E-03	N/A <sup>c</sup>	2.4E-04
Loader #6	9.8E-04	3.7E-04	1.3E-03	N/A <sup>c</sup>	2.4E-04
Dozer #1	1.1E-03	3.7E-04	1.4E-03	1.4E-03	5.1E-04
Dozer #2	1.1E-03	3.7E-04	1.4E-03	N/A <sup>c</sup>	2.6E-04
Dozer #3	1.1E-03	3.7E-04	1.4E-03	N/A <sup>c</sup>	2.6E-04
Crane #1 <sup>1</sup>	9.8E-04	N/A <sup>a</sup>	9.8E-04	9.8E-04	6.1E-04
Compressor #1 <sup>1</sup>	8.6E-04	N/A <sup>a</sup>	8.6E-04	8.6E-04	1.5E-04
Concrete Pump #1 <sup>1</sup>	1.3E-03	N/A <sup>a</sup>	1.3E-03	N/A <sup>c</sup>	4.8E-04
Water Pump #1 <sup>1</sup>	6.7E-04	N/A <sup>a</sup>	6.7E-04	6.7E-04	4.8E-04
Water Pump #2 <sup>1</sup>	6.7E-04	N/A <sup>a</sup>	6.7E-04	6.7E-04	3.6E-04
Generator #1 <sup>1</sup>	2.0E-03	N/A <sup>a</sup>	2.0E-03	2.0E-03	1.3E-03
Pile Driver #1 <sup>1</sup>	9.8E-04	N/A <sup>a</sup>	9.8E-04	9.8E-04	8.7E-05
Grader #1	1.2E-03	1.9E-03	3.2E-03	N/A <sup>c</sup>	5.7E-04
Paver #1	1.1E-03	N/A <sup>a</sup>	1.1E-03	N/A <sup>c</sup>	2.0E-04
Roller #1	1.4E-03	N/A <sup>a</sup>	1.4E-03	N/A <sup>c</sup>	2.5E-04
Roller #2	1.4E-03	N/A <sup>a</sup>	1.4E-03	N/A <sup>c</sup>	2.5E-04
Concrete trucks <sup>f</sup>	3.0E-04	N/A <sup>e</sup>	3.0E-04	N/A <sup>c</sup>	1.8E-04
Excavation dump trucks <sup>g</sup>	3.0E-04	N/A <sup>e</sup>	3.0E-04	5.3E-05	1.7E-05
Other trucks <sup>g</sup>	3.0E-04	N/A <sup>e</sup>	3.0E-04	4.0E-05	1.1E-05
Fugitive Road Dust	---	---	---	1.0E-01	4.6E-02
Total Emission Rate (in g/sec) for all Volume Sources in Digester Area				0.12	0.051
Average Emission Rate (in g/sec) per Volume Source (total 24 vol. sources) in Digester Area				0.005	0.002
Total Emission Rate (in g/sec) for all Volume Sources in Other Areas				N/A	2.3E-03
Average Emission Rate (in g/sec) per Volume Source (total 39 vol. sources) in Other Areas					5.8E-05

Notes:

- These equipment produce negligible fugitive dust emissions or are not involved in construction activities that generate fugitive dust emissions.
- No scaling factors were applied to the 8-hour and 24-hour average emission rates because all equipment is assumed to operate 8 hours per day.
- These equipment do not operate during the "worst case" quarter in 2011.
- The annual average hours per day was used to generate annual emissions and was scaled accordingly
- Fugitive road dust was quantified on a fleet basis in accordance with AP-42 (see bottom row).
- Concrete trucks are not subject to idling laws and will operate in a continuous manner.
- These trucks are subject to idling laws and are assumed to run a total of 3 minutes in any one hour.
- These equipment were modeled as point sources, all other equipment were grouped together as volume sources.



**Table 12**  
**Modeling Parameters**  
**NO<sub>x</sub> Emission Rates**

Construction Equipment	Peak Hourly Engine Emission Rate (g/sec)	Annual Average <sup>a</sup> Emission Rate (g/sec)
Excavator #1	0.110	0.039
Excavator #2	0.110	0.020
Backhoe #1	0.037	0.013
Backhoe #2	0.037	0.013
Backhoe #3	0.037	3.3E-03
Backhoe #4	0.037	2.0E-02
Backhoe #5	0.037	6.6E-03
Loader #1	0.037	0.013
Loader #2	0.037	0.013
Loader #3	0.037	3.3E-03
Loader #4	0.037	6.6E-03
Loader #5	0.037	6.6E-03
Loader #6	0.037	6.6E-03
Dozer #1	0.112	0.040
Dozer #2	0.112	0.020
Dozer #3	0.112	0.020
Crane #1 <sup>d</sup>	0.15	0.095
Compressor #1 <sup>d</sup>	0.059	1.1E-02
Concrete Pump #1 <sup>d</sup>	0.13	0.047
Water Pump #1 <sup>d</sup>	6.2E-03	4.4E-03
Water Pump #2 <sup>d</sup>	6.2E-03	3.3E-03
Generator #1 <sup>d</sup>	0.022	1.4E-02
Pile Driver #1 <sup>d</sup>	0.15	0.014
Grader #1	0.13	0.023
Paver #1	0.114	0.020
Roller #1	0.075	0.013
Roller #2	0.075	0.013
Concrete trucks <sup>b</sup>	0.007	4.4E-03
Excavation dump trucks <sup>c</sup>	0.007	4.2E-04
Other trucks <sup>c</sup>	0.007	2.6E-04
Total Emission Rate (in g/sec) for all Volume Sources in Digester Area		0.207
Average Emission Rate (in g/sec) per Volume Source (total 24 vol. sources) in Digester Area		0.009
Total Emission Rate (in g/sec) for all Volume Sources in Other Areas		0.11
Average Emission Rate (in g/sec) per Volume Source (total 39 vol. sources) in Other Areas		2.9E-03

Notes:

- a. The annual average hours per day was used to generate annual emissions and was scaled accordingly.
- b. Concrete trucks are not subject to idling laws and will operate in a continuous manner.
- c. These trucks are subject to idling laws and are assumed to run a total of 3 minutes in any one hour.
- d. These equipment were modeled as point sources, all other equipment were grouped together as volume sources.

**Table 13  
Modeling Parameters  
SO<sub>2</sub> Emission Rates**

Construction Equipment	Peak Hourly Engine Emission Rate (g/sec)	Short-Term Average <sup>a</sup> Emission Rate (g/sec)	Annual Average <sup>b</sup> Emission Rate (g/sec)
Excavator #1	1.1E-04	1.1E-04	4.0E-05
Excavator #2	1.1E-04	1.1E-04	2.0E-05
Backhoe #1	3.2E-05	3.2E-05	1.2E-05
Backhoe #2	3.2E-05	3.2E-05	1.2E-05
Backhoe #3	3.2E-05	3.2E-05	2.9E-06
Backhoe #4	3.2E-05	3.2E-05	1.7E-05
Backhoe #5	3.2E-05	N/A <sup>c</sup>	5.8E-06
Loader #1	3.2E-05	3.2E-05	1.2E-05
Loader #2	3.2E-05	3.2E-05	1.2E-05
Loader #3	3.2E-05	3.2E-05	2.9E-06
Loader #4	3.2E-05	3.2E-05	5.8E-06
Loader #5	3.2E-05	N/A <sup>c</sup>	5.8E-06
Loader #6	3.2E-05	N/A <sup>c</sup>	5.8E-06
Dozer #1	1.1E-04	1.1E-04	3.9E-05
Dozer #2	1.1E-04	N/A <sup>c</sup>	2.0E-05
Dozer #3	1.1E-04	N/A <sup>c</sup>	2.0E-05
Crane #1 <sup>f</sup>	1.4E-04	1.4E-04	8.6E-05
Compressor #1 <sup>f</sup>	5.4E-05	5.4E-05	9.7E-06
Concrete Pump #1 <sup>f</sup>	1.1E-04	N/A <sup>c</sup>	4.0E-05
Water Pump #1 <sup>f</sup>	5.5E-06	5.5E-06	3.9E-06
Water Pump #2 <sup>f</sup>	5.5E-06	5.5E-06	2.9E-06
Generator #1 <sup>f</sup>	2.2E-05	2.2E-05	1.3E-05
Pile Driver #1 <sup>f</sup>	1.4E-04	1.4E-04	1.2E-05
Grader #1	1.9E-04	N/A <sup>c</sup>	3.4E-05
Paver #1	1.1E-04	N/A <sup>c</sup>	1.9E-05
Roller #1	7.6E-05	N/A <sup>c</sup>	1.4E-05
Roller #2	7.6E-05	N/A <sup>c</sup>	1.4E-05
Concrete trucks <sup>d</sup>	---	N/A <sup>c</sup>	N/A <sup>g</sup>
Excavation dump trucks <sup>e</sup>	---	N/A <sup>g</sup>	N/A <sup>g</sup>
Other trucks <sup>e</sup>	---	N/A <sup>g</sup>	N/A <sup>g</sup>
Total Emission Rate (in g/sec) for all Volume Sources in Digester Area		5.9E-04	2.0E-04
Average Emission Rate (in g/sec) per Volume Source (total 24 vol. sources) in Digester Area		2.5E-05	8.1E-06
Total Emission Rate (in g/sec) for all Volume Sources in Other Areas		N/A	1.2E-04
Average Emission Rate (in g/sec) per Volume Source (total 39 vol. sources) in Other Areas			3.0E-06

Notes:

- No scaling factors were applied to the 8-hour and 24-hour average emission rates because all equipment is assumed to operate 8 hours per day.
- The annual average hours per day was used to generate annual emissions and was scaled accordingly.
- These equipment do not operate during the "worst case" quarter in 2011.
- Concrete trucks are not subject to idling laws and will operate in a continuous manner.
- These trucks are subject to idling laws and are assumed to run a total of 3 minutes in any one hour.
- These equipment were modeled as point sources, all other equipment were grouped together as volume sources.

**Table 14  
Modelling Parameters  
CO Emission Rates**

Construction Equipment	Peak Hourly Engine Emission Rate (g/sec)	Short-Term Average <sup>a</sup> Emission Rate (g/sec)
Excavator #1	0.035	0.035
Excavator #2	0.035	0.035
Backhoe #1	0.042	0.042
Backhoe #2	0.042	0.042
Backhoe #3	0.042	0.042
Backhoe #4	0.042	0.042
Backhoe #5	0.042	N/A <sup>b</sup>
Loader #1	0.042	0.042
Loader #2	0.042	0.042
Loader #3	0.042	0.042
Loader #4	0.042	0.042
Loader #5	0.042	N/A <sup>b</sup>
Loader #6	0.042	N/A <sup>b</sup>
Dozer #1	0.037	0.037
Dozer #2	0.037	N/A <sup>b</sup>
Dozer #3	0.037	N/A <sup>b</sup>
Crane #1 <sup>e</sup>	0.030	0.030
Compressor #1 <sup>e</sup>	0.030	0.030
Concrete Pump #1 <sup>e</sup>	0.054	N/A <sup>b</sup>
Water Pump #1 <sup>e</sup>	4.8E-03	4.8E-03
Water Pump #2 <sup>e</sup>	4.8E-03	4.8E-03
Generator #1 <sup>e</sup>	0.011	0.011
Pile Driver #1 <sup>e</sup>	0.030	0.030
Grader #1	0.046	N/A <sup>b</sup>
Paver #1	0.039	N/A <sup>b</sup>
Roller #1	0.060	N/A <sup>b</sup>
Roller #2	0.060	N/A <sup>b</sup>
Concrete trucks <sup>c</sup>	5.1E-03	N/A <sup>b</sup>
Excavation dump trucks <sup>d</sup>	5.1E-03	8.9E-04
Other trucks <sup>d</sup>	5.1E-03	6.7E-04
Total Emission Rate (in g/sec) for all Volume Sources in Digester Area		0.44
Average Emission Rate (in g/sec) per Volume Source (total 24 vol. sources) in Digester Area		0.018

Notes:

- a. No scaling factors were applied to the 8-hour and 24-hour average emission rates because all equipment is assumed to operate 8 hours per day.
- b. These equipment do not operate during the "worst case" quarter in 2011.
- c. Concrete trucks are not subject to idling laws and will operate in a continuous manner.
- d. These trucks are subject to idling laws and are assumed to run a total of 3 minutes in any one hour.
- e. These equipment were modeled as point sources, all other equipment were grouped together as volume sources.