

APPENDIX 10.7.5

AIR EMISSIONS

TABLE 10.7.5-1
EMISSION CALCULATIONS FOR OFF-SITE FILL DELIVERY AND PLACEMENT

Paved Roads (on-propert yd ³ (from AP1000 specifications)				
E = k (sL/2)^{0.65} (W/3)^{1.5} -C	PM	PM₁₀	PM_{2.5}	Sources and Data:
k	0.082	0.016	0.0024	AP-42, Section 13.2.1
sL (silt loading; g/m ²)	1	1	1	Silt loading from Golder 2001 (BBTT).
W (average weight)	25.5	25.5	25.5	38.5 tons loaded 12.5 tons unloaded
C (1980s emission factor)	0.00047	0.00047	0.00036	AP-42, Section 13.2.1
Emission Factor (lb/VMT)	1.2945	0.2522	0.0375	
Amount (tons)	13,850,000	13,850,000	13,850,000	Offsite fill requirements
Trips (20 cubic yards-26 tons)	532,692	532,692	532,692	Hauling Distance on FPL Property:
Miles	11.11	11.11	11.11	(Estimated from construction traffic analysis)
Rainfall (1-P/4/365); P = precipitation	0.91	0.91	0.91	29320 ft linear (maximum distance on FPL property)
Emissions (lb)	6953099.38	1354670.47	201645.64	11.11 miles roundtrip 5,916,113 miles traveled
Additional Control:	0.95	0.95	0.95	Precip. = 134.5 # days of precipitation ≥ 0.01 inch; NOAA, 2006.
Emissions (lb)	347654.97	67733.52	10082.28	Watering and sweeping as necessary.
Emissions (tons)	173.83	33.87	5.04	
Unloading Fill				
Batch Drop				
E = k (0.0032) (U/5)^{1.3} /(M/2)^{1.4}	PM	PM₁₀	PM_{2.5}	Optimum moisture for Limerock bearing ratio.
k	0.74	0.35	0.053	
U (wind speed; mph)	8.7	8.7	8.7	Miami International Airport (24-year average) NOAA 2006
M (moisture; %)	8	8	8	Estimated
Emission Factor (lb/ton)	0.000698573	0.000330406	5.00329E-05	
Tons	13,850,000	13,850,000	13,850,000	
Emissions (lb; uncontrolled)	9675.23	4576.12	692.96	
Emissions (tons)	4.84	2.29	0.35	

Sources:
USEPA, 2006a; AP-42, Section 13.2.1 Paved Roads.
USEPA, 2006c; AP-42, Section 13.2.4 for Aggregate Handling and Storage Piles.

TABLE 10.7.5-2
EMISSION CALCULATIONS FOR ON-SITE FILL DELIVERY AND PLACEMENT

Unpaved Roads (onsite unpaved roads placing fill):				
	PM	PM ₁₀	PM _{2.5}	Sources and Data:
E=k x (s/12) ^a x (w/3) ^b ; where a = 0.7 and b= 0.45, k = 4.9 for TSP k	4.9	1.5	0.15	AP-42, Section 13.2.2; w = average tons; s = silt content
where a = 0.9 and b= 0.45, k = 1.5 for PM ₁₀ s	5	5	5	Estimated
where a = 0.9 and b= 0.45, k = 0.15 for PM _{2.5} w	25.5	25.5	25.5	38.5 tons loaded 12.5 tons unloaded
Emission Factor (lb/VMT)	6.95	1.79	0.18	
Amount (tons)	130,000	130,000	130,000	On-Site fill available
Trips (20 cubic yards- 26 tons)	5000	5000	5000	Hauling Distance:
Miles	0.68	0.68	0.68	(Estimated from plot plan)
Rainfall (365-P)/365 (P = # days of precipitation ≥ 0.01 inch)	0.63	0.63	0.63	1800 ft linear
Emissions (lb)	14,973	3,847	385	0.6818182 miles roundtrip 3,409 miles travelled
				Precip. = 134.5 # days precipitation; NOAA, 2006
Additional Control:	0.60	0.60	0.60	Watering as necessary.
Emissions (lb)	5989.12	1538.92	153.89	
Emissions (tons)	2.99	0.77	0.08	
Unloading Fill				
Batch Drop				
E = k (0.0032) (U/5) ^{1.3} /(M/2) ^{1.4}	PM	PM ₁₀	PM _{2.5}	Optimum moisture for Limerock bearing ratio.
k	0.74	0.35	0.053	
U (wind speed; mph)	8.7	8.7	8.7	Miami International Airport (24-year average) NOAA 2006
M (moisture; %)	8	8	8	Estimated
Emission Factor (lb/ton)	0.00069857	0.0003304	5.003E-05	
Tons (loading and unloading)	260,000	260,000	260,000	Loading and unloading trucks
Emissions (lb; uncontrolled)	181.63	85.91	13.01	
Emissions (tons)	0.09	0.04	0.01	

Sources:
USEPA, 2006b; AP-42, Section 13.2.2 Unpaved Roads.
USEPA, 2006c; AP-42, Section 13.2.4 for Aggregate Handling and Storage Piles.

TABLE 10.7.5-3
EMISSION CALCULATIONS FOR ON-SITE MUCK REMOVAL, PLACEMENT, AND SITE GRADING

Unpaved Roads (onsite unpaved roads removing and placing muck):				
	PM	PM₁₀	PM_{2.5}	Sources and Data:
E=k x (s/12) ^a x (w/3) ^b ; where a = 0.7 and b= 0.45, k = 4.9 for TSP k	4.9	1.5	0.15	AP-42, Section 13.2.2
where a = 0.9 and b= 0.45, k = 1.5 for PM ₁₀ s	4.8	4.8	4.8	Silt loading from Table 13.2.2-1 Sand and Gravel
where a = 0.9 and b= 0.45, k = 0.15 for PM _{2.5} w	25.5	25.5	25.5	38.5 tons loaded 12.5 tons unloaded
Emission Factor (lb/VMT)	6.76	1.72	0.17	
Amount (tons)	2,840,000	2,840,000	2,840,000	Muck removal
Trips (20 cubic yards- 26 tons)	109,231	109,231	109,231	Hauling Distance:
Miles	8.00	8.00	8.00	Estimated from plot plan
Rainfall (365-P)/365 (P = # days of precipitation ≥ 0.01 inch)	0.63	0.63	0.63	21120 ft linear
Emissions (lb)	3,729,835	950,598	95,060	8 miles roundtrip 873,846 miles travelled VMT
Additional Control:	90%	90%	90%	Precip. = 134.5 NOAA, 2006
Emissions (lb)	372,984	95,060	9,506	Chemical dust suppressant (EPA, 1992) or equivalent
Emissions (tons)	186.49	47.53	4.75	
Unpaved Roads (site preparation and grading):				
	PM	PM₁₀	PM_{2.5}	Sources and Data:
E=k x (s/12) ^a x (w/3) ^b ; where a = 0.7 and b= 0.45, k = 4.9 for TSP k	4.9	1.5	0.15	Optimum moisture for Limerock bearing ratio.
where a = 0.9 and b= 0.45, k = 1.5 for PM ₁₀ s	4.8	4.8	4.8	
where a = 0.9 and b= 0.45, k = 0.15 for PM _{2.5} w	20.73	20.73	20.73	20.73 tons of grader Caperpillar 14H Grader
Emission Factor (lb/VMT)	6.16	1.57	0.16	
Amount (cubic yards)	10,760,000	10,760,000	10,760,000	
Grading Compacting Amount per Movement (cubic yards)	1.04	1.04	1.04	14 ft blade; 2 feet high and 1 foot wide at base (28 ft ³)
Movements	10,375,714	10,375,714	10,375,714	
Distance per movement (ft/movement)	100.00	100.00	100.00	
Distance (miles traveled; VMT)	196,510	196,510	196,510	
Rainfall (365-P)/365	0.63	0.63	0.63	
Emissions (lb)	764,168	194,758	19,476	lb/VMT x VMT x rainfall factor
Additional Control:	90%	90%	90%	Chemical dust suppressant (EPA, 1992)
Emissions (lb)	76,417	19,476	1,948	
Emissions (tons)	38.21	9.74	0.97	
Loading and Unloading Fill				
Batch Drop				
E = k (0.0032) (U/5) ^{1.3} /(M/2) ^{1.4}	PM	PM₁₀	PM_{2.5}	Sources and Data:
k	0.74	0.35	0.053	AP-42, Section 13.2.4
U (wind speed; mph)	8.7	8.7	8.7	Miami International Airport (24-year average) NOAA 2006
M (moisture; %)	12	12	12	Conservative assumption.
Emission Factor (lb/ton)	0.00039599	0.00018729	2.8361E-05	
Tons (loading and unloading)	5,680,000	5,680,000	5,680,000	Loading on trucks and placement on cooling canal berms.
Emissions (lb; uncontrolled)	2249.22191	1063.82118	161.092921	
Emissions (tons)	1.1246	0.5319	0.0805	

Sources:
USEPA, 2006b; AP-42, Section 13.2.2 Unpaved Roads.
USEPA, 2006c; AP-42, Section 13.2.4 for Aggregate Handling and Storage Piles.

TABLE 10.7.5-4
EMISSION CALCULATIONS FOR DIESEL ENGINES DURING SITE PREPARATION

Assumptions: Earthmoving Equipment (Cat 14H)			
Assumption: limestone loading equipment: Cat 988H 501 hp 8.5 yd ³ capacity			
Assumption: muck loading equipment: Cat 637 G 500 hp 43 yd ³ capacity			
Limestone	10.76 million yd ³	of material from makeup water reservior	
	1,265,882	movements	
	15	pieces of equipment	
	20	movements per hour	
	15	gallons/hr Caterpillar Performance Handbook	
	949,412	gallons	
Muck	2.19 million yd ³		
	50,930	movements	
	4	pieces of equipment	
	20	movements per hour	
	23	gallons/hr Caterpillar Performance Handbook	
	58,570	gallons	
	1007981.5	gallons	
	138123.71	mmBtu	
	7156668.9	lb	
Based on EPA Tier 3 Non-Road Engine Standards			
	Maximum Units	Emission Rate Calculation:	
	510 hp	380.307 kW	9728.4825
	27.00 gal/hr	3.70 MMBtu/hr	
NO _x	2.70 gr/hp-hr	(NO _x assumed to be 90% of NO ₊ + HC Tier III standard)	
	3.04 lb/hr	0.82 lb/MMBtu	
CO	2.60 gr/hp-hr		
	2.92 lb/hr	0.79 lb/MMBtu	
PM ₁₀	0.15 gr/hp-hr		
	0.17 lb/hr	0.05 lb/MMBtu	
VOC	0.30 gr/hp-hr	(VOC assumed to be 10% of NOx + HC Tier III standard)	
	0.34 lb/hr	0.09 lb/MMBtu	
NO _x	113,331.26 lb		
	56.67 tons		
CO	109,133.80 lb		
	54.57 tons		
SO ₂	214.70 lb (0.0015%S diesel)		
	0.11 tons		
PM ₁₀	6,296.18 lb		
	3.15 tons		
VOC	12,592.36 lb		
	6.30 tons		

Sources:
USEPA, 2008; 40 CFR Part 89 Control of Emissions of New and In-use Compression Engines.

TABLE 10.7.5-5
EMISSION CALCULATIONS FOR WIND EROSION DURING SITE PREPARATION

Wind Erosion	
E = k 1.7 (s/1.5) (365-p)/235 (f/15) (lb/day/acre)	Sources and Data
k (PM ₁₀)	0.5 AP-42, 13.2.5
s (silt content)	5 Silt content from Borrow Material Report, MACTEC 2008
p (# days of precipitation >= 0.01 inch)	134.5 NOAA, 2006
f (frequency > 12 mph)	20 NOAA, 2006
Emission Factor	2.39 lb/acre/day
Acres	100 acres of open area assumed at any one time
Emissions (uncontrolled)	238.56925 lb/day
Control	90% high moisture content surface, watering as necessary
Controlled Emissions	23.86 lb/day
	8,707.78 lb/year
	4.35 tons/year

Source: USEPA, 2006e; AP-42, Section 13.2.5 Industrial Wind Erosion.

TABLE 10.7.5-6
EMISSION CALCULATIONS FOR CONSTRUCTION WORKERS TRAVELING ON FPL PROPERTY

Paved Roads (Workers to Construction Parking Area on FPL Property):				
E = k (sL/2) ^{0.65} (W/3) ^{1.5} -C	PM	PM ₁₀	PM _{2.5}	Sources and Data:
k	0.082	0.016	0.0024	AP-42, Section 13.2.1
sL (silt loading)	1	1	1	Silt loading from Golder 2001 (BBTT).
W (tons; average weight)	2	2	2	
C (1980s emission factor)	0.00047	0.00047	0.00036	AP-42, Section 13.2.1
Emission Factor (lb/VMT)	0.0279751	0.00508026	0.00047254	
Workers Average	2,430	2,430	2,430	ER Table 3.10-2
Roundtrip Distance	11.11	11.11	11.11	Hauling Distance on FPL Property:
Miles/Day	26987.73	26987.73	26987.73	(Estimated from construction traffic analysis)
Rainfall (1-P/4/365)	0.91	0.91	0.91	29320 ft linear (maximum distance on FPL property)
Emissions (lb/day)	685.43	124.47	11.58	11.11 miles roundtrip
				Precip. = 134.5 # days of precipitation ≥ 0.01 inch; NOAA, 2006.
Additional Control:	0.90	0.90	0.90	Watering and sweeping (as necessary)
Emissions (lb/year)	17821.25	3236.33	301.03	260 days/year
Emissions (tons)	8.91	1.62	0.15	7,016,809 vehicle miles/yr

Source: USEPA, 2006a; AP-42, Section 13.2.1 Paved Roads. Golder, 2001.

TABLE 10.7.5-7
EMISSION CALCULATIONS FOR CONCRETE BATCH PLANT AND CONCRETE PLACEMENT

AP1000 Concrete requirements:				
154,400 yd ³ (from AP1000 specifications)				
2.012 tons/yd ³ based on AP-42 Table 11.12-2				310652.8 tons of concrete required for two units
AP-42 Table 11.12-2				
1865 lbs aggregate				
1428 lbs sand				
491 lbs cement				
73 lbs cement supplement				
167 lbs water		20 gallons of water		
4024 lbs cement/yd ³				
Total for Project:				
143,978 tons aggregate				
110,242 tons sand				
37,905 tons cement				
5,636 tons cement supplement				
310,653 tons concrete				
Unloading Aggregate and Sand				
Batch Drop				
E = k (0.0032) (U/5) ^{1.3} /(M/2) ^{1.4}	PM	PM ₁₀	PM _{2.5}	Sources and Data:
k	0.74	0.35	0.053	AP-42, Section 13.2.4 0.12 Ratio of PM _{2.5} to PM ₁₀
U (wind speed; mph)	8.7	8.7	8.7	Miami International Airport (24-year average) NOAA 2006
M (moisture; %)	8	8	8	Optimum moisture for Limerock bearing ratio.
Emission Factor (lb/ton)	0.000698573	0.00033041	5.0033E-05	
Tons (loading and unloading)	254,220	254,220	254,220	
Emissions (lb; uncontrolled)	177.59	84.00	12.72	
Emissions (tons)	0.0888	0.0420	0.0064	
Table 11.12-2 used as generalized factors.				
Aggregate Loading (lb/ton)	0.0069	0.0033	0.00049971	uncontrolled
Sand Loading (lb/ton)	0.0021	0.00099	0.00014991	uncontrolled
Cement Loading (lb/ton)	0.00099	0.00034	5.1486E-05	controlled
Cement Supplement Loading (lb/ton)	0.0089	0.0049	0.000742	controlled
Concrete Loading (lb/ton)	0.0173	0.0048	0.00072686	controlled
Truck Unloading (lb/ton)	0.0568	0.016	0.00242286	controlled
Aggregate Loading (lb)	993.45	475.13	55.45	PM _{2.5} based on the ratio of PM ₁₀ to PM _{2.5} in Table 11.12-3
Sand Loading (lb)	231.51	109.14	12.74	
Cement Loading (lb)	37.53	12.89	1.50	
Cement Supplement Loading (lb)	50.16	27.61	3.22	
Concrete Loading (lb)	5,374.29	1,491.13	174.02	
Truck Unloading (lb)	17,645.08	4,970.44	580.05	
Total for Concrete batching (lb)	24,509.60	7,170.34	839.70	
Total for Concrete batching (tons)	12.25	3.59	0.42	
Unpaved Roads (Concrete Trucks):				
	PM	PM ₁₀	PM _{2.5}	Sources and Data:
E=k x (s/12) ^a x (w/3) ^b ; where a = 0.7 and b= 0.45, k = 4.9 for TSF	4.9	1.5	0.15	(for k) AP-42, Section 13.2.2
where a = 0.9 and b= 0.45, k = 1.5 for PM ₁₀	4.8	4.8	4.8	(for s) Silt loading from Table 13.2.2-1 Sand and Gravel
where a = 0.9 and b= 0.45, k = 0.15 for PM _{2.5}	22.5	22.5	22.5	(for w) 32.5 tons loaded 12.5 tons unloaded
Emission Factor (lb/VMT)	6.39	1.63	0.16	
Trips	15440	15440	15440	10 yd ³ /truck 15440 trips
Roundtrip miles	0.68	0.68	0.68	20.12 tons 9750.4658 miles travelled
Rainfall (365-P)/365 (P = # days of precipitation ≥ 0.01 inch)	0.63	0.63	0.63	Precip. = 134.5 NOAA, 2006.
Emissions (lb)	42,472.67	10,824.72	1,082.47	
Additional Control:	0.60	0.60	0.60	Watering as necessary.
Emissions (lb)	16,989.07	4,329.89	432.99	
Emissions (tons)	8.49	2.16	0.22	

Source: USEPA, 2006d; AP-42, Section 11.12 Concrete Batching.

TABLE 10.7.5-8
EMISSION CALCULATIONS FOR DIESEL ENGINES ASSOCIATED WITH CONSTRUCTION ACTIVITIES

Assumptions:					
Small (Compressors)	20		2 gallons/hr average usage	320 gal/day	
Large (Cranes and Forklifts)	30		10 gallons/hr average usage	2400 gal/day	
	2400 gallons/day		320 gallons/day		
	624000 gallons/yr		83200 gallons/yr		
	85506.72 mmBtu/yr		11400.896 mmBtu/yr		
	4430400 lb/yr		590720 lb/yr		
Based on EPA Tier 3 Non-Road Engine Standards					
	Maximum Units	Emission Rate Calculation:		Maximum Units	Emission Rate Calculation:
Large Engine	510 hp	380.307 kW	Small Engine	65 hp	48.4705 kW
	27.00 gal/hr	3.70 MMBtu/hr		3.36 gal/hr	0.46 MMBtu/hr
NO _x	2.70 gr/hp-hr			3.15 gr/hp-hr	
	3.04 lb/hr	0.82 lb/MMBtu		0.45 lb/hr	0.12 lb/MMBtu
CO	2.60 gr/hp-hr			3.70 gr/hp-hr	
	2.92 lb/hr	0.79 lb/MMBtu		0.53 lb/hr	0.14 lb/MMBtu
PM ₁₀	0.15 gr/hp-hr			0.30 gr/hp-hr	
	0.17 lb/hr	0.05 lb/MMBtu		0.04 lb/hr	0.01 lb/MMBtu
VOC	0.30 gr/hp-hr			0.35 gr/hp-hr	
	0.34 lb/hr	0.09 lb/MMBtu		0.05 lb/hr	0.01 lb/MMBtu
NO _x	70,158.73 lb			5,249.21 lb	
	35.08 tons			2.62 tons	
CO	67,560.26 lb			1,633.81 lb	
	33.78 tons			0.82 tons	
SO ₂	132.91 lb (0.0015%S diesel)			17.72 lb (0.0015%S diesel)	
	0.07 tons			0.01 tons	
PM ₁₀	3,897.71 lb			132.47 lb	
	1.95 tons			0.07 tons	
VOC	7,795.41 lb			154.55 lb	
	3.90 tons			0.08 tons	

Notes: NO_x assumed to be 90% of NO_x + HC Tier III standard; remainder assumed to be VOC.
Sources: USEPA, 2008; 40 CFR Part 89 Control of Emissions of New and In-use Compression Engines.
Caterpillar Handbook

TABLE 10.7.5-9
ESTIMATED EMISSIONS DATA FOR THE TWO TEMPORARY CONSTRUCTION BOILERS

Pollutant	No. of Units	Maximum Heat Input Rate/Unit (MMBtu/hr)	Hourly Fuel Usage ^a (10 ³ gal/hr)	Annual Operating Hours (hrs/yr)	Annual Fuel Usage ^a (10 ³ gal/yr)	AP-42 Emissions Factor ^b	Emission Rate	
							Hourly (lb/hr)	Annual (TPY)
<u>Propane Combustion</u>								
PM/PM ₁₀	2	110.0	2.404	2,500	6,010.9	0.7 lb/10 ³ gal	1.68	2.10
SO ₂	2	110.0	2.404	2,500	6,010.9	0.1 *S lb/10 ³ gal ^c	0.05	0.06
NO _x	2	110.0	2.404	2,500	6,010.9	13.0 lb/10 ³ gal	31.26	39.1
CO	2	110.0	2.404	2,500	6,010.9	7.5 lb/10 ³ gal	18.03	22.5
VOC ^d	2	110.0	2.404	2,500	6,010.9	0.8 lb/10 ³ gal	1.92	2.40
<u>Ultra Low-Sulfur Diesel Combustion</u>								
PM/PM ₁₀	2	110.0	1.628	2,500	4071.1	3.3 lb/10 ³ gal	5.37	6.72
SO ₂	2	110.0	1.628	2,500	4071.1	157 *S lb/10 ³ gal ^e	0.38	0.48
NO _x	2	110.0	1.628	2,500	4071.1	10.0 lb/10 ³ gal	16.28	20.4
CO	2	110.0	1.628	2,500	4071.1	5.0 lb/10 ³ gal	8.14	10.2
VOC ^d	2	110.0	1.628	2,500	4071.1	0.2 lb/10 ³ gal	0.33	0.41

Footnotes:

^a Based on the propane heat content of 91,500 Btu/gal and ultra low-sulfur diesel heat content of 131,500 Btu/gal.

^b Propane combustion emission factors are based on Table 1.5-1, AP-42, Section 1.5, July 2008. Ultra Low-Sulfur diesel combustion emission factors are based on Tables 1.3-1, 1.3-2, and 1.3-3, AP-42, Section 1.3, September, 1998.

^c "S" is sulfur content of propane gas vapor. A sulfur content of 0.2 gr/100 ft³ of gas vapor used in the calculation.

^d Non-methane total organic compounds.

^e "S" is weight percent of sulfur in oil. A sulfur content of 0.0015% by weight used in the calculation.