

Appendix F

Construction Emissions Estimates

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 Construction Emission Calculations
 Summary - Criteria Pollutants

Description	Emissions (tons)							
	Criteria Pollutants					HAPs		
	NOx	CO	VOC	SO ₂	PM ₁₀	PM _{2.5}	Formaldehyde	Total HAP
Off-Road Engine Emissions	8.75	1.79	0.48	4.13E-03	0.29	0.29	0.00	0.00
Unpaved Roads	--	--	--	--	0.45	0.05	--	--
Earthmoving	--	--	--	--	10.79	1.14	--	--
TOTAL	8.75	1.79	0.48	4.13E-03	11.53	1.47	5.63E-04	9.35E-04

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Construction Emission Calculations
Emission Factors for Construction Engines

Equipment	Quantity ^a	Hours per Day	Number of Days	Total Hours Used	Max Power (HP)	Load Factor ^b	Loaded Power (HP)	Emission Factors ^{c,d} (g/hp-hr)								
								VOC	CO	NOx	PM ₁₀	PM _{2.5}	SO ₂	CO ₂	CH ₄	N ₂ O
Bulldozer	2	10	49	972	250	1	250	0.309	0.748	4.000	0.132	0.132	0.002	188.26	0.008	0.002
Compactor	1	10	122	1,215	300	1	300	0.167	0.843	4.335	0.132	0.132	0.002	188.26	0.008	0.002
Fork Lift	1	10	365	4,010	120	1	120	0.167	0.843	4.335	0.132	0.132	0.002	188.26	0.008	0.002
Dump Truck	1	10	49	486	325	0.8	260	0.338	0.867	4.100	0.180	0.180	0.002	188.26	0.008	0.002
Excavator	2	10	61	1,215	138	1	138	0.309	0.748	4.000	0.132	0.132	0.002	188.26	0.008	0.002
Front End Loader	1	10	49	486	196	1	196	0.309	0.748	4.000	0.132	0.132	0.002	188.26	0.008	0.002
Pickup Truck	3	10	340	8,845	150	0.25	38	0.167	0.843	4.335	0.132	0.132	0.002	188.26	0.008	0.002
Water truck	1	10	97	972	100	0.5	50	0.637	2.366	4.700	0.240	0.240	0.002	188.26	0.008	0.002
Grader	1	10	49	486	35	0.8	28	0.438	2.161	4.44	0.267	0.259	0.002	188.26	0.008	0.002
Large Crane	2	10	24	486	15	0.21	3	0.438	2.161	4.44	0.267	0.259	0.002	188.26	0.008	0.002

^a Equipment counts based on assumptions from a similar projects.

^b Load Factors from Appendix A of EPA 420_P-04-005, Median Life, Annual Activity, and Load Factor Values for Nonroad Engine Emissions Modeling, USEPA, April 2004.

^c EPA 420-P-04-009, Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling - Compression Ignition, USEPA, April 2004 - Tier 2 Engines.

^d GHG emission factors from Title 40 Subchapter C Part 98 Subpart C Table C-1 and C-2 to Subpart C.

Assumption:

393.5 hp-hr/MMBtu

453.6 g/lb

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Construction Emission Calculations
Emission Estimates from Construction Engines

Equipment	Potential Emissions (tons)									
	VOC	CO	NOx	PM ₁₀	PM _{2.5}	SO ₂	CO ₂	CH ₄	N ₂ O	CO ₂ e
Bulldozer	8.26E-02	0.200	1.071	0.035	0.035	0.001	50.43	2.0E-03	4.1E-04	50.59
Compactor	6.71E-02	0.339	1.742	0.053	0.053	0.001	75.64	3.1E-03	6.1E-04	75.89
Fork Lift	8.85E-02	0.447	2.299	0.070	0.070	0.001	99.85	4.0E-03	8.1E-04	100.18
Dump Truck	4.71E-02	0.121	0.571	0.025	0.025	0.000	26.22	1.1E-03	2.1E-04	26.31
Excavator	5.70E-02	0.138	0.739	0.024	0.024	0.000	34.80	1.4E-03	2.8E-04	34.91
Front End Loader	3.24E-02	0.078	0.420	0.014	0.014	0.000	19.77	8.0E-04	1.6E-04	19.83
Pickup Truck	6.10E-02	0.308	1.585	0.048	0.048	0.001	68.83	2.8E-03	5.6E-04	69.06
Water truck	3.41E-02	0.127	0.252	0.013	0.013	0.000	10.09	4.1E-04	8.2E-05	10.12
Grader	6.57E-03	0.032	0.067	0.004	0.004	0.000	2.82	1.1E-04	2.3E-05	2.83
Large Crane	7.39E-04	0.004	0.007	0.000	0.000	0.000	0.32	1.3E-05	2.6E-06	0.32
TOTAL	0.48	1.79	8.75	0.29	0.29	0.00	388.77	1.6E-02	3.2E-03	390.04

Global Warming Potentials		
CO ₂	CH ₄	N ₂ O
1	28	265

Source: EPA's 2024 GHG Emission Factor Hub

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Construction Emission Calculations
Fugitive Dust Emissions from Unpaved Roads

Equipment	Quantity ^a	Total Days Used	VMT ^b	W	Emission Factor (lb/VMT) ^c		Emissions (ton/yr)	
					PM ₁₀	PM _{2.5}	PM ₁₀	PM _{2.5}
Bulldozer	2	49	24	20	1.73	0.17	0.02	0.00
Fork Lift	1	365	182	20	1.73	0.17	0.16	0.02
Dump Truck	1	49	24	21	1.77	0.18	0.02	0.00
Excavator	2	61	30	22	1.81	0.18	0.03	0.00
Front End Loader	1	49	24	23	1.85	0.18	0.02	0.00
Pickup Truck	3	340	170	24	1.88	0.19	0.16	0.02
Water truck	1	97	49	20	1.73	0.17	0.04	0.00
TOTAL	--	--	--	--	--	--	0.45	0.05

^a Equipment counts are estimated based current construction plan.

^b Each vehicle is assumed to travel 0.5 mile per day on site.

^c AP-42 Section 13.2.2 Unpaved Roads, dated November 2006, Equations 1a and 2 TOTALS 11.19 1.12 Surface Silt content based on Table 13.2.2-1 - construction sites.

Eq 1a: $E = k * (s/12)^a * (W/3)^b$

Eq 2: $E_{ext} = E * [(365-P)/365]$

where:

VMT = Vehicle Miles Traveled

W = Mean Vehicle Weight, tons

S = Mean Vehicle Speed, mph

P = 120 days with at least 0.01 inches rain, EPA's AP-42 Figure 13.2.2-1

s = 8.5 surface material silt content (%) for construction sites, EPA's AP-42 Table 13.2.2-1

E = size-specific emission factor, lb/ VMT

E_{ext} = annual size-specific emission factor extrapolated for natural migration, lb/VMT

Constants	PM	PM ₁₀	PM _{2.5}
k (lb/VMT)	4.9	1.5	0.15
a	0.7	0.9	0.9
b	0.45	0.45	0.45

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Construction Emission Calculations
Fugitive Dust Emissions from Earthmoving Activities

Summary of Fugitive Dust Emissions From Earthmoving Activities							
Construction Activity	Daily Material Handling		Average Exposed Area (acres)	Emission Factors ^{b-f} (lb/ton)		Emissions (ton/yr)	
	Construction Rate ^a (ton/day)	Handling Time (days)		PM ₁₀	PM _{2.5}	PM ₁₀	PM _{2.5}
Topsoil removed by scraper ^g	434.1	360	---	0.058	0.0061	4.53	0.48
Pipe trench and project excavation and loading to storage piles	2.1	360	---	0.037	0.0039	0.01	0.00
Backfilling pipe trench and well	2.1	360	---	0.012	0.0013	0.00	0.00
Topsoil replacement	434.1	360	---	0.012	0.0013	0.94	0.10
Wind erosion of exposed areas	--	360	77.50	0.38	0.03999	5.30	0.56
TOTAL						10.79	1.14

Notes and Assumptions:

^a Soil density: 1.25 tons per yard

^b Trench excavation and loading to storage piles emission factor: AP-42 Section 11.9 Western Surface Coal Mining, Table 11.9-4, July 1998, truck loading by batch dump

^c Backfilling trench and topsoil replacement emission factor: AP-42 Section 11.9 Western Surface Coal Mining, Table 11.9-4, July 1998, overburden replacement

^d As worst case, PM₁₀ is set equal to Total Particulate Matter. PM_{2.5} is set to 0.105 times PM₁₀ per Table 11.9-1

^e Emission factor: AP-42 Section 11.9 Western Surface Coal Mining, Table 11.9-4, July 1998, topsoil removal by scraper

^f Wind Erosion Exposed Areas emission factor: AP-42 Section 11.9 Western Surface Coal Mining, Table 11.9-4, July 1998, wind erosion of exposed areas (ton/yr/acre)

^g Assumes the entire workspace is cleared to 1 foot deep, 1.25 tons per cubic yard.

Construction Schedule		
Work Hours:	12	7 am - 7 pm
Work Days	6	Monday through Saturday
Hours per week	72	
Crews:	1	
Total Days:	360	

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 Construction Emission Calculations
 Fugitive Dust Emissions from Earthmoving Activities

Topsoil Removed by Scraper^a				
County/Facility	Total (Acres)	Soil Volume (yd³)	Soil Weight (ton)	Daily Material Handling Rate (ton/day)
Land Control Area	77.5	125,033	156,292	434
TOTAL	77.5	125,033	156,292	434

^a Acreages from SPA

Cable Trench and Project Excavation and Loading to Storage Piles						
Project Segment	Length^a (ft)	Depth (ft)	Total Volume^b (ft³)	Total Volume (yd³)	Soil Weight (ton)	Daily Material Handling Rate (ton/day)
Cable Trench (at 2 feet wide)	2,000	4	16,000	593	741	2.1
TOTAL			16,000	593	741	2.1

^a Assumes length of buried cable is approximately 4x that of the BESS length

^b assumes trench is 2 feet wide

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 Construction Emission Calculations
 Summary

Greenhouse Gas Emissions From Construction Engines				
Description	CO₂	CH₄	N₂O	CO₂e^a
Off-Road Engine Emissions	388.77	0.02	0.00	390.04
Commuters and Delivery Vehicles	838.87	0.00	0.00	838.87
TOTAL	1227.63	0.02	0.00	1,228.91

^a CO₂e = carbon dioxide equivalent. Includes global warming potentials from 40 CFR 98 Table A-1.

Global Warming Potentials		
CO₂	CH₄	N₂O
1	28	265

Source: EPA's 2024 GHG Emission Factor Hub

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 Construction Emission Calculations
 Greenhouse Gas Emissions from On Road Construction Traffic

On-Road Vehicles					
	Vehicles per day	Miles per vehicle	Number of Days	Fuel Used (gallons)	CO₂ Emissions^a (tons)
Commuter Vehicles - Gasoline ^{b,c}	60	60	365	54,750	536
Delivery Trucks - Diesel ^d	8	60	365	26,954	303

^a Assumes 1 gallon of gasoline = 8,887 grams CO₂ and 1 gallon of diesel = 10,180 g CO₂, per US EPA's "Greenhouse Gas Emissions from a Typical Passenger Vehicle," available online at:
<https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P100U8YT.pdf>

^b Assumes commuters travel 30 miles each way (60 miles round trip) per day, with a fuel economy of 24 miles per gallon, per US EPA and US Department of Energy Fuel Economy data for combined city and highway driving in 2023, available online at:
<https://www.fueleconomy.gov/feg/download.shtml>.

^c Assumes commuters will travel for 365 days

^d Assumes delivery trucks travel 30 miles each way (60 miles round trip) per day, with a fuel economy of 6.5 miles per gallon, industry average.

^e Assumes concrete mixer trucks travel 30 miles each way (60 miles round trip) per day, with a fuel economy of 3.4 miles per gallon, industry average.
<http://ascpro0.ascweb.org/archives/cd/2012/paper/CPRT221002012.pdf#:~:text=The%20National%20Ready%20Mix%20Concrete%20Association%20%28NRMCA%29%20in,average%203.4%20miles%20per%20gallon%20of%20diesel%20fuel.>

1 short ton = 907,185 grams
 1 gal gasoline = 8,887 g CO₂
 1 gal diesel = 10,182 g CO₂

Commuter Vehicle MPG= 24
 Delivery Trucks (Diesel) MPG= 6.5
 Concrete Mixer Truck MPG= 3.4