Appendix B – Greenhouse Gas Analysis

NEPA ID EAXX-007-21-001-1736758141

Greenhouse gas (GHG) emissions have been estimated using project planning information developed by the New York District, consisting of anticipated equipment types and estimates of the horsepower and operating hours of the diesel engines powering the equipment. In addition to this planning information, conservative factors have been used to represent the average level of engine load of operating engines (load factors) and the average emissions of typical engines used to power the equipment (emission factors). The basic emission estimating equation is the following:

$$\mathbf{E = hrs \times LF \times EF}$$

Where:

E = Emissions per period of time such as a year or the entire project.
hrs = Number of operating hours in the period of time (e.g., hours per year, hours per project).
LF = Load factor, an estimate of the average percentage of full load an engine is run at in its usual operating mode.
EF = Emission factor, an estimate of the amount of a pollutant (such as CO_2) that an engine emits while performing a defined amount of work.

In these estimates, the emission factors are in units of grams of pollutant per horsepower hour (g/hphr). For each piece of equipment, the number of horsepower hours (hphr) is calculated by multiplying the engine's horsepower by the load factor assigned to the type of equipment and the number of hours that piece of equipment is anticipated to work during the year or during the project. For example, a crane with a 250-horsepower engine would have a load factor of 0.43 (meaning on average the crane's engine operates at 43% of its maximum rated power output). If the crane were anticipated to operate 1,000 hours during the course of the project, the horsepower hours would be calculated by:

$$\mathbf{250\ horsepower \times 0.43 \times 1{,}000\ hours = 107{,}500\ hphr}$$

The emission factors for CO_2, N_2O, and CH_4 used in these calculations are based on locally-specific emissions data related to off-road and on-road diesel engines.[1] In the example of the crane engine, a CO_2 emission factor of 571 g/hphr would be used to estimate emissions from this crane on the project by the following equation:

$$\frac{\mathbf{107{,}500\ hphr \times 571\ g\ CO_2/hphr}}{\mathbf{1{,}000{,}000\ g/metric\ ton}} = \mathbf{61.4\ metric\ tons\ (tonnes)\ of\ NO_x}$$

As noted above, information on the equipment types, horsepower, and hours of operation associated with the project have been obtained from the project's plans and represent current best estimates of the equipment and work that will be required. Load factors have been obtained from various sources depending on the type of equipment. Land-side

[1] https://www.panynj.gov/port/en/our-port/sustainability/air-emissions-inventories-and-related-studies.html

nonroad equipment load factors are from the documentation for EPA's NONROAD emission estimating model, "Median Life, Annual Activity, and Load Factor Values for Nonroad Engine Emissions Modeling, EPA420-P-04-005, April 2004."

The following pages summarize the estimated emissions of CO_2, N_2O, and CH_4 in sum for the project including the anticipated equipment and engine information developed by the New York District, the load factors and emission factors as discussed above, and the estimated emissions from the project. GHG emissions are also presented in terms of CO_2 equivalents, as discussed in the text.

USACE - New York District
Fort Hamilton Child Development Center
Greenhouse Gas Emission Estimates
31 July 2024

Emission estimates	Metric Tons of GHGs			
	CO_2	N_2O	CH_4	CO_2e
CO_2 equivalents	1	265	28	___
Construction emissions, metric tons	76.2	0.005	0.006	77.6

Equipment Type	hp	Count	Load Factor	Operating hours	hphr	CO_2 g/hphr	N_2O g/hphr	CH_4 g/hphr	CO_2 MT	N_2O MT	CH_4 MT	CO_2e MT
Compactor	250	2	0.43	61	6,558	571	0.044	0.048	3.7	0.0003	0.0003	3.8
Compressor	75	2	0.43	117	3,773	571	0.044	0.048	2.2	0.0002	0.0002	2.2
Compressor	100	1	0.43	3	129	571	0.044	0.048	0.1	0.0000	0.0000	0.1
Concrete saw	50	1	0.59	22	649	571	0.044	0.048	0.4	0.0000	0.0000	0.4
Crane	225	3	0.43	31	2,999	571	0.044	0.048	1.7	0.0001	0.0001	1.8
Crane	300	3	0.43	83	10,707	571	0.044	0.048	6.1	0.0005	0.0005	6.3
Dozer	100	1	0.59	0	0	571	0.044	0.048	0.0	0.0000	0.0000	0.0
Dozer	250	1	0.59	0	0	571	0.044	0.048	0.0	0.0000	0.0000	0.0
Dozer	340	1	0.59	0	0	571	0.044	0.048	0.0	0.0000	0.0000	0.0
Excavator	300	2	0.59	52	9,204	571	0.044	0.048	5.3	0.0004	0.0004	5.4
Excavator	325	1	0.59	7	1,342	571	0.044	0.048	0.8	0.0001	0.0001	0.8
Excavator	350	1	0.59	15	3,098	571	0.044	0.048	1.8	0.0001	0.0001	1.8
Excavator	400	1	0.59	4	944	571	0.044	0.048	0.5	0.0000	0.0000	0.6
Generator	10	4	0.43	1133	4,872	571	0.044	0.048	2.8	0.0002	0.0002	2.8
Grader	135	1	0.59	0	0	571	0.044	0.048	0.0	0.0000	0.0000	0.0
Off-road truck	100	2	0.59	34	2,006	571	0.026	0.043	1.1	0.0001	0.0001	1.2
Off-road truck	200	6	0.59	287	33,866	571	0.026	0.043	19.3	0.0009	0.0015	19.6
Off-road truck	250	1	0.59	7	1,033	571	0.026	0.043	0.6	0.0000	0.0000	0.6
Off-road truck	300	1	0.59	15	2,655	571	0.026	0.043	1.5	0.0001	0.0001	1.5
Off-road truck	350	2	0.59	15	3,098	571	0.026	0.043	1.8	0.0001	0.0001	1.8
Off-road truck	400	1	0.59	69	16,284	571	0.026	0.043	9.3	0.0004	0.0007	9.4
Pump	50	2	0.43	117	2,516	571	0.044	0.048	1.4	0.0001	0.0001	1.5
Rubber tired loader	175	6	0.59	223	23,025	571	0.044	0.048	13.1	0.0010	0.0011	13.4
Skid Steer Loader	175	2	0.21	39	1,433	571	0.044	0.048	0.8	0.0001	0.0001	0.8
Other diesel engines	150	2	0.59	36	3,186	571	0.044	0.048	1.8	0.0001	0.0002	1.9
Other diesel engines	200	1	0.59	0	0	571	0.044	0.048	0.0	0.0000	0.0000	0.0
Totals		**51**		**2,370**	**133,375**				**76.2**	**0.005**	**0.006**	**77.6**