Deepwater Port License Application
Blue Marlin Offshore Port (BMOP) Project

Volume IIa – Appendix G

Submitted to:

Maritime Administration
Office of Deepwater Ports and Offshore Activities
1200 New Jersey Avenue SE, W21-309
Washington, DC 20590

United States Coast Guard
Commandant (CG-OES-2)
Stop 7509
2703 Martin Luther King Jr. Ave. SE
Washington, DC 20593-7509

Submitted by:

Blue Marlin Offshore Port LLC
8111 Westchester Drive
Suite 600
Dallas, Texas 75225

September 2020

This page left blank intentionally.

Deepwater Port License Application
Blue Marlin Offshore Port (BMOP) Project

Volume I: General (Public), including Deepwater Port License Application and Appendices
(*under separate cover*)

Volume IIa: Offshore Project Components Environmental Evaluation (Public)
(*herein*)

Volume IIb: Onshore Project Components, Environmental Evaluation (Public)
(*under separate cover*)

Volume III: Technical Information
[*Confidential*]
(*under separate cover*)

Volume IV: Company and Financial Information
[*Confidential*]
(*under separate cover*)

This page left blank intentionally.

APPENDIX G

AIR EMISSIONS CALCULATIONS

This page left blank intentionally.

APPENDIX G-1

EMISSIONS CALCULATIONS FOR OFFSHORE CONSTRUCTION, STATIONARY, AND MOBILE SOURCES

OFFSHORE EMISSIONS CALCULATIONS

Offshore Construction, Stationary, and Mobile Source Air Emissions Calculations

BLUE MARLIN OFFSHORE PORT LLC

Prepared By:

TRINITY CONSULTANTS
1 Galleria Blvd
Suite 1030
Metairie, LA 70001
(504) 828 - 5845

September 2020

Project 191001.0117

TABLE OF CONTENTS

LIST OF TABLES

1. OFFSHORE CONSTRUCTION EMISSIONS

Blue Marlin Offshore Port, LLC (BMOP) estimated construction-related emissions of criteria pollutants, Hazardous Air Pollutants (HAPs), and greenhouse gases (GHGs) for the proposed Deepwater Port (Project). BMOP anticipate the construction to occur in 2022. Air quality impacts associated with construction of the Project will include emissions from the use of equipment powered by gasoline or diesel engines as well as engine emissions from marine vessels. Construction activities will also result in engine emissions from workers commuting. Fugitive dust may also be generated by vehicular traffic on paved roads. The construction emissions will be temporary in nature and will not significantly affect regional air quality. Detailed construction emission calculations along with the methodology, emission factors, and associated references are provided in Appendix A. Table 1-1 provides the summary of construction emissions for the proposed Project.

Table 1-1. Summary of Total Offshore Pipeline Construction Emissions

Construction Activity	CO (tpy)	NO_X (tpy)	PM_{10} (tpy)	$PM_{2.5}$ (tpy)	SO_2 (tpy)	VOC (tpy)	Total HAPs (tpy)	CO_2e (tpy)
2022 Emissions								
Diesel non-road equipment[1]	398.00	2,107.87	69.80	69.33	1.57	46.41	4.83	186,564
Diesel and gas on-road equipment	0.13	0.01	<0.01	<0.01	<0.01	<0.01	0.18	21.22
Fugitive dust from paved roads	--	--	0.02	0.01	--	--	--	--

[1]Include emissions from marine vessels.

Construction equipment and other mobile sources are predicted to be powered by diesel engines, which emit combustion-related emissions, including CO, NO_X, PM_{10}, $PM_{2.5}$, SO_2, VOC, GHGs, and minimal amounts of HAPs. Emission estimates for construction equipment engines are based on the equipment that is expected to be utilized (quantity, type, fuel type, capacity, and operational schedule). The marine vessels (assist tugboats, crew boats, etc.,) associated with construction activities are included under non-road engines. Construction-related equipment that would generate air emissions for the proposed Project includes the following:

- Forty (40) Air Compressors;
- Thirty-Three (33) Cranes;
- One Hundred (100) Generators;
- Nineteen (19) Light Plants;
- Two (2) Diving Equipment Compressors;
- Thirty-Four (34) Winches;
- Six (6) Pumps;
- Eight (8) Gantry Booms;
- Eight (8) Gantry Hoists;
- Eight (8) Gantry Swings;
- Two (2) Line-up Stations;
- Two (2) UT Stations;
- Two (2) Coating Stations; and

- Eighty-four (84) Marine Vessels such as tugboats, crew boats, supply vessels, etc.,

1.1.1 Offshore Construction Activities

The scheduled tasks for the construction-related activities associated with the proposed Project are listed below:

- Isolate Northern Shippers, Flood and Clean Stingray Pipeline;
- Gas Redirection Program;
- WC 509 Complex Modifications;
- WC 148 Platform Conversion;
- Stingray Pipeline Conversion Program;
- Stingray Pipeline to WC 509 Platform Connection;
- Calm Pipelines Installation;
- Calm Buoys Installation; and
- Decommissioning.

The following sections provides a summary of the emissions calculation methodologies, emission factors, and operating parameter assumptions used in estimating the construction-related emissions from the construction equipment utilized for the proposed Project.

1.1.1.1 Marine Vessels for Offshore Construction Activities

BMOP expects to utilize several marine vessels such as tugboats, crew boats, supply vessels for various offshore construction activities as discussed below:

- **Isolate Northern Shippers, Flood and Clean Stingray Pipeline:**
  - Close Valves on 36" Stingray: A diving support vessel with a horsepower rating of 2,250 horsepower (hp) is expected to be used for this activity.
  - Deinventory: Two lift boats with rated engine capacity of 1,500 hp and 1,000 hp, a DP nitrogen boat (3,000 hp), a supply vessel (1,125 hp), and a crew boat (1,000 hp) are expected to be used for this activity.

- **Gas Redirection Program:**
  - WC 509 Redirection to Sea Robin System EC 278: A diving support vessel (3,000 hp), a bow thruster (950 hp), a stern thruster (950 hp), a lift boat (1,500 hp), a supply vessel (1,125 hp), and a crew boat (1,000 hp) are expected to be used for this activity.
  - WC 44 Redirection to Transco WC 61: A diving support vessel (2,250 hp), a supply vessel (1,125 hp), and a crew boat (1,000 hp) are expected to be used for this activity.
  - Abandon WC 144 to WC 148 24" Pipeline, Recover and Scrap to Shore: A diving support vessel (2,250 hp), two anchor handling tugs (900 hp each), a transportation cargo barge tug (1,800 hp), a supply vessel (1,125 hp), and a crew boat (1,000 hp) are expected to be used for this activity.

- **WC 509 Complex Modifications:**
  - WC 509 Complex Demolition: A derrick barge anchor handling tug (1,800 hp), a transportation cargo barge tug (1,800 hp), a supply vessel (1,125 hp), and a crew boat (1,000 hp) are expected to be used for this activity.
  - WC 509 Complex Jacket Remediation: A diving support vessel (2,250 hp), a derrick barge anchor handling tug (1,800 hp), a transportation cargo barge tug (1,800 hp), two supply vessels (1,125 hp each), and two crew boats (1,000 hp each) are expected to be used for this activity.

- Install New WC 509B Deck: A derrick barge anchor handling tug (1,800 hp), a transportation cargo barge tug (1,800 hp), a supply vessel (1,125 hp), and a crew boat (1,000 hp) are expected to be used for this activity.

► **WC 148 Platform Conversion:**
- Convert WC148 and Install a Main Line Valve (MLV): A derrick barge anchor handling tug (1,800 hp), a transportation cargo barge tug (1,800 hp), a supply vessel (1,125 hp), a crew boat (1,000 hp), and two small support vessels (crew boats: 350 hp each) are expected to be used for this activity.

► **Stingray Pipeline Conversion Program:**
- Removal and Spool Replacement of MLV at MP 41.6 (WC276): A diving support vessel (2,250 hp), a supply vessel (1,125 hp), and a crew boat (1,000 hp) are expected to be used for this activity.
- Sidetap Decommissioning at Nine (9) Locations: Two diving support vessels (2,250 hp each), two supply vessels (1,125 hp each), and two crew boats (1,000 hp each) are expected to be used for this activity.
- Hydrotest Station 701 to WC 509: A hydrotest boat (2,250 hp), a supply vessel (1,125 hp), and a crew boat (1,000 hp) are expected to be used for this activity.

► **Stingray Pipeline to WC 509 Platform Connection:**
- WC 509 Tie 36" Stingray into WC 509 Riser: Two laybarge anchor handling tugs (1,800 hp each), a pipehaul tug (1,200 hp), a supply vessel (1,125 hp), and a crew boat (1,000 hp) are expected to be used for this activity.

► **Calm Pipelines Installation:**
- Pipeline and PLEM Installation WC 509: Two laybarge anchor handling tugs (1,800 hp each), two jet barge anchor handling tugs (900 hp each), a pipehaul tug (1,200 hp), two supply vessels (1,125 hp each), and two crew boat (1,000 hp each) are expected to be used for this activity.
- Hydrotest PLEM - Platform Pipeline with DPDSV: A diving support vessel with an engine rating of 3,000 hp, a bow thruster (950 hp), and a stern thruster (950 hp) are expected to be used for this activity.

► **Calm Buoys Installation:**
- Install CALM systems at WC 509: A derrick barge anchor handling tug (1,800 hp), a transportation cargo barge tug (1,800 hp), a supply vessel (1,125 hp), and a crew boat (1,000 hp) are expected to be used for this activity.

► **Decommissioning:**
- Deinventory, Flush Stingray and CALM Pipelines: A lift boat (1,500 hp), a supply vessel (1,125 hp), and a crew boat (1,000 hp) are expected to be used for this activity.
- Abandon and Dispose Structure and CALM Buoys: A derrick barge anchor handling tug (1,800 hp), a transportation cargo barge tug (1,800 hp), a supply vessel (1,125 hp), and a crew boat (1,000 hp) are expected to be used for this activity.
- Trawler Drag Net Through Abandonment Area: A 350 hp small support vessel is expected to be used for this activity.

1.1.1.1.1 Emission Calculation Methodology for Marine Vessels

The emission factors utilized for estimating emissions from the above listed marine vessels and the calculation methodology are discussed below:

- **Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories, ICF International, April 2009 -** Particulate matter (PM_{10}/$PM_{2.5}$), carbon monoxide (CO), oxides of nitrogen (NO_X), sulfur dioxide (SO_2), volatile organic compounds (VOCs), carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O) emission factors are based on Tier 0 engines (Category 1) emission factors from Table 3-8 of US Environmental Protection Agency (USEPA) *Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories* final report. The load factors for different marine vessels are obtained from Table 3-4 of USEPA *Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories* final report. A fuel correction factor of 0.005 was applied to SO_2 emission factors (Ultra Low Sulfur Diesel) per Table 3-9 of USEPA *Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories* final report.

- **AP-42, Section 3.4. Large Stationary Diesel and All Stationary Dual-fuel Engines -** The HAP emission factors for engines greater than 600 hp are based on Tables 3.4-3 and 3.4-4 of AP-42, Section 3.4. Large Stationary Diesel and All Stationary Dual-fuel Engines. An average Brake-specific fuel consumption (BSFC) of 7,000 Btu/hp-hr has been used to convert emission factors from lb/MMBtu to lb/hp-hr.

- **AP-42, Section 3.3. Gasoline and Diesel Industrial Engines -** The HAP emission factors for engines less than 600 hp are based on Table 3.3-2 of AP-42, Section 3.3. Gasoline and Diesel Industrial Engines. An average BSFC of 7,000 Btu/hp-hr has been used to convert emission factors from lb/MMBtu to lb/hp-hr.

1.1.1.1.2 Operating Parameters

The annual emissions from the above listed marine vessels are calculated based on the following operating parameters:

- **Annual Emissions -** The marine vessel total emissions are based on hours of operation data provided by BMOP. The selected emission factors used for these pollutants are shown in the emission calculations included in Appendix A.

1.1.1.2 Pipelay Barge

The pipelay barge contains the equipment listed in Table 1-2. Note that this list represents the construction equipment that may be utilized on the pipelay barge – the marine propulsion engines (marine vessels) are discussed in the previous section.

Engine rating (hp), quantity, fuel type, operating hours are provided by BMOP. The Source Classification Code (SCC) and load factors are based on USEPA's Motor Vehicle Emission Simulator (MOVES) version 2014b. The pipelay barge will be utilized for the following construction activities:

- WC 509 Tie 36" Stingray into WC 509 Riser; and
- Pipeline and PLEM Installation WC 509.

Table 1-2. Pipelay Barge – Equipment List

Equipment Type	Quantity	Fuel Type	SCC	Engine Rating (hp)	Load Factor (%)
Barge Generator	2	Diesel	2270006005	1,400	43%
Weld Generator	2	Diesel	2270006005	550	43%
Anchor Winch	2	Diesel	2270002081	600	59%
Gantry Boom Engine	2	Diesel	2270002081	335	59%
Gantry Hoist Engine	2	Diesel	2270002081	520	59%
Gantry Swing Engine	2	Diesel	2270002081	335	59%
Gantry Generator	2	Diesel	2270006005	260	43%
Deck Crane	2	Diesel	2270002045	335	43%
Air Compressor	2	Diesel	2270006015	180	43%
Line-up Station	2	Diesel	2270002081	120	59%
UT Station	2	Diesel	2270002081	60	59%
Coating Station	2	Diesel	2270002081	60	59%

1.1.1.2.1 Emission Calculation Methodology for Pipelay Barge

The emission factors for the construction equipment listed in Table 1-2 are estimated using USEPA MOVES2014b as discussed below:

- **USEPA MOVES Modeling System, version 2014b -** Emission factors in grams per horsepower hour ("g/hp-hr") for NO_X, CO, PM_{10}, $PM_{2.5}$, SO_2, VOC, CH_4, CO_2, and HAPs for the construction equipment listed in Table 1-2 were obtained using the most recent version of the USEPA MOVES modeling system, version 2014b. The MOVES modeling system will not generate emission factors for N_2O. Therefore, the N_2O emission factors were obtained from the "2020 Climate Registry Default Emission Factors" and apportioned based on CO_2 emissions. Table 1-3 provides the summary of key MOVES inputs utilized for developing the emission factors. The emission factors were generated using the MOVES in-built SQL script "emissionfactors_per_hphr_by_equipment_and_horsepower". This script generates emission factors for each SCC for various engine ratings for all selected pollutants and fuel type in the model.

Table 1-3. Summary of Key MOVES Input for Pipelay Barge Equipment

Moves Input	Description
Scale	Model: Nonroad Domain/Scale: National Calculation Type: Inventory
Time Spans	Calendar Year(s): 2022 Months: All Days: Weekdays/Weekends Hours: All
Geographic Bounds	Region: National
Vehicles/ Equipment	All valid fuel and source use type combinations

Moves Input	Description
Pollutants and Processes	Criteria and HAPs (all processes)
Output - Output Emissions	SCC, HP Class, Fuel Type, and Emission Process.

1.1.1.2.2 Operating Parameters

The annual emissions from the above listed equipment are calculated based on the following operating parameters:

- **Annual Emissions -** The pipeline lay barge total emissions are based on hours of operation data provided by BMOP. The selected emission factors used for these pollutants are shown in the emission calculations included in Appendix A.

1.1.1.3 Generator, Air Compressor, Crane, Light Plant, and Pump Combustion Emissions

Per the information received from BMOP, the generators, air compressors, cranes, light plants, and pumps shown in Table 1-4 are expected to be used for the proposed Project. Engine rating (hp), quantity, fuel type, operating hours are provided by BMOP. The SCC and load factors are based on USEPA's MOVES2014b.

Table 1-4. Generator, Air Compressor, Crane, Light Plant, and Pump - Equipment Data

Equipment Type	Quantity	Fuel Type	SCC	Engine Rating (hp)	Load Factor (%)
Air Compressors	12	Diesel	2270006015	100	43%
Air Compressors	9	Diesel	2270006015	80	43%
Air Compressors	10	Diesel	2270006015	180	43%
Air Compressors	1	Diesel	2270006015	600	43%
Air Compressors	1	Diesel	2270006015	630	43%
Air Compressors	1	Diesel	2270006015	900	43%
Air Compressors	1	Diesel	2270006015	900	43%
Cranes	14	Diesel	2270002045	335	43%
Cranes	2	Diesel	2270002045	285	43%
Cranes	2	Diesel	2270002045	350	43%
Cranes	1	Diesel	2270002045	332	43%
Cranes	1	Diesel	2270002045	150	43%
Cranes	2	Diesel	2270002045	365	43%
Cranes	3	Diesel	2270002045	335	43%
Cranes	2	Diesel	2270002045	335	43%
Generators	8	Diesel	2270006005	200	43%
Generators	3	Diesel	2270006005	375	43%
Generators	1	Diesel	2270006005	200	43%
Generators	17	Diesel	2270006005	180	43%
Generators	17	Diesel	2270006005	80	43%
Generators	2	Diesel	2270006005	250	43%
Generators	1	Diesel	2270006005	425	43%
Generators	19	Diesel	2270006005	120	43%
Generators	5	Diesel	2270006005	1,400	43%
Generators	5	Diesel	2270006005	260	43%
Generators	2	Diesel	2270006005	80	43%
Generators	2	Diesel	2270006005	80	43%
Generators	1	Diesel	2270006005	425	43%
Light Plant	9	Diesel	2270002027	15	43%
Light Plant	5	Diesel	2270002027	60	43%
Pumps	3	Diesel	2270006010	240	43%
Pumps	1	Diesel	2270006010	110	43%
Pumps	1	Diesel	2270006010	1,840	43%

1.1.1.3.1 Emission Calculation Methodology for Generator, Air Compressor, Crane, Light Plant, and Pump

The emission factors for the construction equipment listed in Table 1-4 are estimated using USEPA MOVES2014b as discussed below:

- **USEPA MOVES Modeling System, version 2014b -** Emission factors in "g/hp-hr" for NO_X, CO, PM_{10}, $PM_{2.5}$, SO_2, VOC, CH_4, CO_2, and HAPs for the construction equipment listed in Table 1-4 were obtained using the most recent version of the USEPA MOVES modeling system, version 2014b. The MOVES modeling system will not generate emission factors for N_2O. Therefore, the N_2O emission factors were obtained from the "2020 Climate Registry Default Emission Factors" and apportioned based on CO_2 emissions. Table 1-5 provides the summary of key MOVES inputs utilized for developing the emission factors. The emission factors were generated using the MOVES in-built SQL script "emissionfactors_per_hphr_by_equipment_and_horsepower". This script generates emission factors for each SCC for various engine ratings for all selected pollutants and fuel type in the model.

Table 1-5. Summary of Key MOVES Input for Generator, Air Compressor, Crane, Light Plant, and Pump

Moves Input	Description
Scale	Model: Nonroad Domain/Scale: National Calculation Type: Inventory
Time Spans	Calendar Year(s): 2022 Months: All Days: Weekdays/Weekends Hours: All
Geographic Bounds	Region: National
Vehicles/ Equipment	All valid fuel and source use type combinations
Pollutants and Processes	Criteria and HAPs (all processes)
Output - Output Emissions	SCC, HP Class, Fuel Type, and Emission Process.

1.1.1.3.2 Operating Parameters

The annual emissions from the above listed equipment are calculated based on the following operating parameters:

- **Annual Emissions -** The total emissions from generator, air compressor, crane, light plant, and pump equipment are based on hours of operation data provided by BMOP. The selected emission factors used for these pollutants are shown in the emission calculations included in Appendix A.

1.1.1.4 Miscellaneous Construction Equipment Combustion Emissions

Per the information received from BMOP, several miscellaneous construction equipment, shown in Table 1-6, will be used for the proposed project. Engine rating (hp), quantity, fuel type, operating hours are provided by BMOP. The SCC and load factors are based on USEPA's MOVES2014b.

Table 1-6. Miscellaneous Construction Equipment – Equipment Data

Equipment Type	Quantity	Fuel Type	SCC	Engine Rating (hp)	Load Factor (%)
Diving Equipment Compressors	2	Diesel	2270002081	180	59%
Anchor Winches	1	Diesel	2270002081	240	59%
AHT Winch	19	Diesel	2270002081	120	59%
Anchor Winches	5	Diesel	2270002081	600	59%
Gantry Boom	5	Diesel	2270002081	335	59%
Gantry Hoist	5	Diesel	2270002081	520	59%
Gantry Swing	5	Diesel	2270002081	335	59%
Tug Winch	2	Diesel	2270002081	80	59%
Jet Barge Anchor Winches	1	Diesel	2270002081	240	59%
Jet Barge Sled Winch	1	Diesel	2270002081	240	59%

1.1.1.4.1 Emission Calculation Methodology for Miscellaneous Construction Equipment

The emission factors for the construction equipment listed in Table 1-6 are estimated using USEPA MOVES2014b as discussed below:

- **USEPA MOVES Modeling System, version 2014b -** Emission factors in "g/hp-hr" for NO_X, CO, PM_{10}, $PM_{2.5}$, SO_2, VOC, CH_4, CO_2, and HAPs for the construction equipment listed in Table 1-6 were obtained using the most recent version of the USEPA MOVES modeling system, version 2014b. The MOVES modeling system will not generate emission factors for N_2O. Therefore, the N_2O emission factors were obtained from the "2020 Climate Registry Default Emission Factors," and apportioned based on CO_2 emissions. Table 1-7 provides the summary of key MOVES inputs utilized for developing the emission factors. The emission factors were generated using the MOVES in-built SQL script "emissionfactors_per_hphr_by_equipment_and_horsepower". This script generates emission factors for each SCC for various engine ratings for all selected pollutants and fuel type in the model.

Table 1-7. Summary of Key MOVES Input for Miscellaneous Construction Equipment

Moves Input	Description
Scale	Model: Nonroad Domain/Scale: National Calculation Type: Inventory
Time Spans	Calendar Year(s): 2022 Months: All Days: Weekdays/Weekends Hours: All
Geographic Bounds	Region: National
Vehicles/ Equipment	All valid fuel and source use type combinations
Pollutants and Processes	Criteria and HAPs (all processes)

Moves Input	Description
Output - Output Emissions	SCC, HP Class, Fuel Type, and Emission Process.

1.1.1.4.2 Operating Parameters

The annual emissions from the above listed equipment are calculated based on the following operating parameters:

- **Annual Emissions -** The total emissions from miscellaneous construction equipment are based on hours of operation data provided by BMOP. The selected emission factors used for these pollutants are shown in the emission calculations included in Appendix A.

1.1.1.5 Worker Commuting (Vehicular) Emissions

BMOP expects minimal emissions for the on-road vehicular emissions from worker commuting; however, BMOP estimated the criteria pollutants, HAPs, and GHG emissions from on-road worker commuting during the construction period based on a conservative estimate. Emissions are based on 66 workers commuting a 30-mile round trip and approximately 2,000 trips (both gasoline passenger cars and trucks).

1.1.1.5.1 Emission Calculation Methodology for Miscellaneous Construction Equipment

The emission factors for the on-road vehicular emissions from work commuting listed in Table 1-8 are estimated using USEPA MOVES2014b as discussed below:

- **USEPA MOVES Modeling System, version 2014b -** Emission factors in "g/VMT" for NO_X, CO, PM_{10}, $PM_{2.5}$, SO_2, VOC, CH_4, N_2O, CO_2, and HAPs for the on-road vehicles were obtained using the most recent version of the USEPA MOVES modeling system, version 2014b. Table 1-8 provides the summary of key MOVES inputs utilized for developing the emission factors. The emission factors were generated using the MOVES in-built SQL script "EmissionRates.sql". This script generates emission factors for each source type, selected pollutants, and fuel type in the model.

Table 1-8. Summary of Key MOVES Input for Miscellaneous Construction Equipment

Moves Input	Description
Scale	Model: Onroad Domain/Scale: National Calculation Type: Inventory
Time Spans	Calendar Year(s): 2022 Months: All Days: Weekdays/Weekends Hours: All
Geographic Bounds	Region: National
Vehicles/ Equipment	All valid fuel and source use type combinations
Pollutants and Processes	Criteria and HAPs (all processes)
Output – General Output /Output Emissions Detail	Enabled Activity Outputs for Onroad: Distance Traveled, Population Units: Grams (Mass), Joules (Energy), Miles (Distance) Output Emissions Detail: SCC, Fuel Type, Emission Process, Road Type and Source Use Type

1.1.1.5.2 Operating Parameters

The annual emissions from vehicular worker commuting emissions are calculated based on the following operating parameters:

- **Annual Emissions -** The on-road vehicle worker commuting total emissions are based on the vehicle miles traveled per year (VMT/yr). The selected emission factors used for these pollutants are shown in the emission calculations included in Appendix A.

1.1.1.6 Fugitive Dust – Paved Road Emissions

BMOP conservatively estimated fugitive emissions from paved road based on the VMT/yr utilized to quantify on-road worker commuting vehicular emissions.

1.1.1.6.1 Emission Calculation Methodology for Fugitive Dust – Paved Road

The sources of emission factors used to estimate particulate emissions for this equipment are summarized below:

- **AP-42, Section 13.2.1, Paved Roads** - The particulate emission factors are based on AP-42, Section 13.2.1, Paved Roads, January 2011. For silt loading, no site-specific data is available. Thus, BMOP utilized the value from Table 13.2.1-2 for ubiquitous baseline with average daily traffic (ADT) ranging between 500 to 5,000 vehicles.

1.1.1.6.2 Operating Parameters

The annual emissions are calculated based on the following operating parameters:

- **Annual Emissions -** The fugitive dust total emissions are based on the vehicle miles traveled. The selected emission factors used for these pollutants are shown in the emission calculations included in Appendix A.

1.1.1.7 Decommissioning

The marine vessels associated with the decommissioning activities are provided in Section 1.1.1.1. The construction-related equipment that would be used for decommissioning activities are provided in Table 1-9. BMOP expects minimal emissions for the on-road vehicular emissions from worker commuting; however, BMOP estimated the criteria pollutants, HAPs, and GHG emissions from on-road worker commuting during the construction period based on a conservative estimate. On-road vehicular worker commuting emissions during decommissioning are based on 25% of the work force that was required for construction, resulting in a 30-mile round trip and approximately 500 trips (both gasoline passenger cars and trucks). BMOP conservatively estimated fugitive emissions from paved road based on the VMT/yr utilized to quantify on-road worker commuting vehicular emissions. Table 1-10 shows the emissions during the decommissioning activities.

The emission calculation methodology and operating parameters for the decommissioning activities are consistent with the offshore construction activities as discussed in sections 1.1.1.1 through 1.1.1.6.

Table 1-9. Decommissioning - Equipment Data

Equipment Type	Quantity	Fuel Type	SCC	Engine Rating (hp)	Load Factor (%)
Air Compressors	1	Diesel	2270006015	80	43%
Air Compressors	2	Diesel	2270006015	600	43%
Cranes	1	Diesel	2270002045	335	43%
Cranes	1	Diesel	2270002045	285	43%
Cranes	1	Diesel	2270002045	350	43%
Cranes	1	Diesel	2270002045	335	43%
Generators	2	Diesel	2270006005	200	43%
Generators	2	Diesel	2270006005	200	43%
Generators	1	Diesel	2270006005	180	43%
Generators	1	Diesel	2270006005	80	43%
Generators	1	Diesel	2270006005	1,400	43%
Generators	2	Diesel	2270006005	80	43%
Generators	2	Diesel	2270006005	425	43%
Light Plant	5	Diesel	2270002027	60	43%
AHT Winch	2	Diesel	2270002081	120	59%
Anchor Winches	1	Diesel	2270002081	600	59%
Gantry Boom	1	Diesel	2270002081	335	59%
Gantry Hoist	1	Diesel	2270002081	520	59%
Gantry Swing	1	Diesel	2270002081	335	59%
Pumps	1	Diesel	2270006010	1,840	43%

Table 1-10. Decommissioning Emissions

Construction Activity	CO (tpy)	NO_X (tpy)	PM_{10} (tpy)	$PM_{2.5}$ (tpy)	SO_2 (tpy)	VOC (tpy)	Total HAPs (tpy)	CO_2e (tpy)
Diesel non-road equipment[1,2]	11.00	50.18	1.53	1.51	0.05	0.87	0.32	6,227
Diesel and gas on-road equipment[2]	0.03	<0.01	<0.01	<0.01	<0.01	<0.01	0.18	4.95
Fugitive dust from paved roads	--	--	0.01	<0.01	--	--	--	--
Total	**11.03**	**50.19**	**1.54**	**1.52**	**0.06**	**0.88**	**0.50**	**6,232**

[1] Include emissions from marine vessels.

[2] The actual date for decommissioning is yet to be determined; therefore, BMOP quantified offshore construction emissions associated with decommissioning activities for 2024 using MOVES2014b conservatively.

The emissions from decommissioning activities are expected to be short-term. The impacts associated with decommissioning would be expected to be minimal.

2. OFFSHORE STATIONARY SOURCE EMISSIONS

BMOP has calculated potential air emissions for the following stationary emission sources associated with the offshore portion of the Project.

2.1 WC 509 Stationary Potential Emissions Summary

A summary of the proposed emissions is shown in the table below.

Table 2-1. Offshore WC 509 Stationary Sources Potential Emissions Summary

	NO_X (tpy)	CO (tpy)	VOC (tpy)	SO_2 (tpy)	PM_{10}[1] (tpy)	$PM_{2.5}$ (tpy)	H_2S (tpy)	H_2SO_4 (tpy)	HAPs (tpy)	CO_2e (tpy)
Marine Loading										
Crude Oil Loading	--	--	21,840	--	--	--	9.49	--	1,224	--
Platform A Sources										
Aviation Fuel Tank	--	--	5.12E-4	--	--	--	--	--	7.65E-5	--
Platform B Sources										
Natural Gas Generators (x2)	22.48	44.96	15.74	0.05	0.80	0.80	--	2.34E-3	4.22	12,871
Emergency Diesel Generator	1.06	0.58	1.06	0.07	0.04	0.04	--	2.23E-3	1.11E-3	115.2
Platform B Cranes (x2)	2.05	11.97	0.97	1.48	0.21	0.21	--	0.05	0.06	2,383
Platform B Cranes Diesel Tank #1	--	--	1.93E-3	--	--	--	--	--	2.65E-4	--
Platform B Cranes Diesel Tank #2	--	--	1.93E-3	--	--	--	--	--	2.65E-4	--
Firewater Pump Engine	0.21	0.19	0.21	0.02	0.01	0.01	--	7.22E-4	3.58E-4	37.22
Primary Diesel Tank	--	--	0.01	--	--	--	--	--	1.17E-3	--
Surge Tank #1	--	--	3.73	--	--	--	--	--	0.07	--
Platform C Sources										
Firewater Pump Engine	0.21	0.19	0.21	0.02	0.01	0.01	--	7.22E-4	3.58E-4	37.22
Fugitive Sources										
Total Fugitive Emissions	--	--	18.65	--	--	--	0.005	--	1.91	1,060
Total	26.02	57.88	21,881	1.64	1.07	1.07	9.50	0.05	1,230	16,503

[1] PM_{10} and $PM_{2.5}$ emissions are represented as the sum of filterable PM_{10}/$PM_{2.5}$ and condensable emissions.

2.2 Detailed Emissions Calculations

Potential emissions were calculated for the stationary offshore sources by using the following calculation methodologies.

2.2.1 Marine Loading

VOC emissions from marine loading of crude oil are calculated based on the maximum hourly loading rate (gallons per hour [gal/hr]) and Equations 2 and 3 of U.S. EPA's AP-42, Section 5.2 (07/08), which was developed specifically for loading crude oil into ships and ocean barges.[2] In addition to the explicit direction in AP-42 to utilize Equations 2 and 3 for crude oil loading into ocean-going ships, this methodology is consistent with other marine loading of crude and permitting determinations in Louisiana,[3] which is the nearest onshore state. To align with the nearest state consistent with the DWPA,[4] and based on Louisiana's recent determinations for crude loading into ships, Equations 2 and 3 are most appropriate to estimate emissions for the Project.

The application of Equations 2 and 3 are described below.

$$C_L = C_A + C_G$$

Where:

$C_L = Total\ Loading\ Loss, pounds\ per\ 1000\ gallons\ \left(\frac{lb}{10^3 gal}\right) of\ crude\ oil\ loaded$

$C_A = Arrival\ emission\ factor, contributed\ by\ vapors\ in\ the\ empty\ tank\ compartment\ before\ loading,\ \frac{lb}{10^3 gal}\ of\ crude\ oil\ loaded$

$C_G = Generated\ emission\ factor, contributed\ by\ evaporation\ during\ loading, \frac{lb}{10^3 gal}\ of\ crude\ oil\ loaded$

BMOP conservatively uses the average arrival emission factor for an uncleaned ship/ocean barge tank, as provided in AP-42 Table 5.2-3. The generated emissions factor, C_G is calculated based on Equation 3 of AP-42, Section 5.2, as described below.

$$C_G = 1.84 \times (0.44 \times P - 0.42) \times \frac{MG}{T}$$

Where:

$P = True\ vapor\ pressure\ of\ loaded\ crude\ oil, psia$

$M = Molecular\ weight\ of\ vapors, \frac{lb}{lb - mol}$

$G = Vapor\ growth\ factor, 1.02\ (dimensionless)$

$T = Temperature\ of\ vapors, °R$

[2] U.S. EPA, AP-42 Section 5.2 Transportation and Marketing of Petroleum Liquids, 6/08.

[3] See examples: Part 70 Permit No. 2520-00033-V-14 for International Matex Tank Terminals – IMTT – St. Rose, Louisiana, 8/14/2019, based on crude loading emissions from Eq. 2 and 3 from application for Title V Revision, dated June 3, 2019, and also Part 70 Permit No. 2560-00034-V9 for Sugarland Pipeline Station/Terminal, Shell Pipeline Company, LP, St. James, Louisiana, based on crude loading emissions from Eq. 2 and 3.

[4] 33 USC §1518(b).

BMOP estimates a maximum hourly loading rate of 80,000 barrels per hour (bbl/hr) of crude oil and the annual loading rate is equivalent to continuous (e.g. 8,760 hours per year) loading at the maximum hourly loading rate.[5] To calculate the VOC loading loss rate (in lb/10^3 gal), maximum hourly and annual average crude loading temperatures and crude true vapor pressures are used, based on project design specifications. Because the crude oil will be subsea for approximately 100 statute miles, the long-term temperature representative of the sea floor was used to estimate the loading temperatures.[6] The molecular weight of the crude oil (liquid and vapor) is based on AP-42, Chapter 7, Table 7.1-2 (06/20). A summary of the characteristics used to calculate VOC emissions are provided in the table below.

2.2.1.1 Marine Loading – H_2S Emissions

Emissions of H_2S from marine loading are based on the hourly maximum and annual average H_2S content in the crude oil, and the following mass balance equation.

$$H_2S\ Emission\ Rate\ \left(\frac{lb\ H_2S}{lb\ VOC}\right) = \frac{X}{1x10^6} \times \frac{M_{crude}}{M_{H2S}} \times \frac{M_{H2S}}{M_{Vapor}} \times k$$

Where:

$X = Crude\ H_2S\ Content, parts\ per\ million\ by\ weight\ (ppmw)$

$M_{crude} = Molecular\ weight\ of\ crude\ liquid, \left(\frac{lb}{lb - mol}\right)$

$M_{Vapor} = Molecular\ weight\ of\ crude\ vapor, \left(\frac{lb}{lb - mol}\right)$

$k = Vapor\ to\ liquid\ H_2S\ partition\ factor$[7]

A summary of the characteristics used to calculate H_2S emissions are also provided in the table below.

Table 2-2. Marine Loading Emissions Specifications

	Maximum Hourly	**Annual Average**
Crude Loading Rate (bbl/hr)	80,000	80,000
Arrival Emission Factor	0.86	0.86
Loading Temperature (°R)	550	532
Vapor Molecular Weight (lb/lbmol)	50	50
Liquid Molecular Weight (lb/lbmol)	207	207
True Vapor Pressure (psia)[8]	10.99	9.00
Liquid H_2S Partition	25	21
H_2S Concentration (ppmw)[9]	125	5
H_2S Molecular Weight (lb/lbmol)	34.1	34.1

[5] 80,000 bbl/hr is approximately 3,360,000 gal/hr.

[6] Temperature data from ROMS Texas A&M University Outputs, Location: WC509, Depth 150.672 feet. Long-term average of 72.66°F used for annual average conditions and a maximum of 90°F used for short-term maximum conditions (max of dataset is 85.4°F.

[7] Per the Petroleum Processing Handbook, McGraw-Hill, New York, Figure 12-71, page 12-93.

[8] Maximum short-term and annual average true vapor pressure aligned with the permit limits for the origination of the crude oil for the BMOP Project – the Nederland Terminal. Note that the purpose of the project is to load a variety of both heavy and light crude oils, so using the permit limits is a conservative estimate of potential emissions for the Project.

[9] H_2S concentration aligned with permit limits for the origination of the crude oil for the BMOP Project – the Nederland Terminal. Annual mass H_2S emissions calculated from a conservative assumption of 5 ppmw. The average of all samples from Nederland (>3000 samples) is 1.31 ppmw.

2.2.1.2 Marine Loading – HAP Emissions

Emissions of HAPs are based on an identified maximum crude oil vapor HAP speciation, by individual HAP, provided in weight percent (wt%) of the vapor. These maximum individual HAP concentrations were determined from thirteen samples of various crude types at the Nederland Terminal from May and June 2020 and analyzed per Method D7900, *Standard Test Method for Determination of Light Hydrocarbons in Stabilized Crude Oils by Gas Chromatography*.[10] The analytical results provided an extensive speciation of the crude oil, of which >99.9% was identified as VOCs. From these 13 samples, the average total HAP concentration in the liquid (wt.%) was 3.2%. This identifies the expected average HAP concentration to be less than 5%, by weight, in the liquid.

For preparing potential emissions, the concentration in the vapor phase was calculated. Consistent with AP-42, Chapter 7.1.4 (06/2020), Raoult's Law was followed to determine the HAP content in the vapor phase of the crude oil from the HAP content in the liquid phase. Raoult's Law states that the mole fraction in the liquid of a speciated component, when multiplied by the vapor pressure of that component is equal to the partial pressure of that component, or:

$$P_i = (P)(x_i)$$

Where:

$P_i = partial\ pressure\ of\ component, i, psia$

$P = vapor\ pressure\ of\ pure\ component\ i\ at\ the\ average\ daily\ liquid\ surface\ temperature, psia$

$x_i = liquid\ mole\ fraction, \frac{lb - mole}{lb - mole}$

The vapor pressure of each HAP species was determined using published Antoine Coefficients at the average daily temperature, described above.

The liquid mole fraction was determined from the liquid weight fraction of the component in the samples per:

$$x_i = \left(\frac{Z_{Li} M_L}{M_i}\right)$$

Where:

$x_i = liquid\ mole\ fraction, \frac{lb - mole}{lb - mole}$

$Z_{Li} = weight\ fraction\ of\ component\ i\ in\ the\ liquid, lb/lb$

$M_L = molecular\ weight\ of\ liquid\ stock, \left(\frac{lb}{lb - mol}\right)$

$M_i = molecular\ weight\ of\ component, i, \left(\frac{lb}{lb - mol}\right)$

The vapor mole fraction was determination by:

$$y_i = \frac{P_i}{P_{VA}}$$

[10] 49 CFR § 171.7(h)(45).

Where:

$y_i = vapor\ mole\ fraction\ of\ component\ i, \frac{lb-mole}{lb-mole}$

$P_i = partial\ pressure\ of\ component, i, psia$

$P_{VA} = total\ vapor\ pressure\ of\ liquid\ mixture, psia$

The weight fraction in the vapor phase can then be determined from the mole fractions in the vapor phase.

$$Z_{Vi} = \frac{y_i M_i}{M_V}$$

Where:

$Z_{Vi} = vapor\ weight\ fraction\ of\ component\ i, lb/lb$

$y_i = vapor\ mole\ fraction\ of\ component\ i, \frac{lb-mole}{lb-mole}$

$M_i = molecular\ weight\ of\ component, i, \left(\frac{lb}{lb-mol}\right)$

$M_V = molecular\ weight\ of\ vapor\ stock, \left(\frac{lb}{lb-mol}\right)$

The resulting total HAP in the vapor averaged 2.4% for all 13 samples.

In order to ensure a conservative representation of potential emissions on a short-term basis, the 99% upper prediction limit (UPL) was calculated for each individual HAP identified in the 13 samples. BMOP used the higher of the 99% UPL from the 13 samples, or the Nederland Permit basis for each individual HAP, whichever was greater. The result is a conservative estimate for each individual HAP, and the total HAP (which is the sum of the highest values for each individual HAP).

BMOP has used the following crude oil vapor HAP speciation to estimate emissions.

Table 2-3. Crude Oil Vapor HAP Speciation

HAP	Vapor Weight %
Hexane	4.09
Benzene	0.80
Toluene	0.36
Ethylbenzene	0.05
1,2,4-Trimethylbenzene	0.01
1,3-dimethylbenzene	0.05
1,4-dimethylbenzene	0.03
1,2-dimethylbenzene (Xylene)	0.21
i-propylbenzene (Cumene)	0.01
Biphenyl	0.00002
Cresols	0.001
Naphthalene	0.001
Phenol	0.001
Total HAP	5.60

Hourly and annual VOC emissions are multiplied by each HAP speciation, above, to determine the hourly and annual mass emission rates.

2.2.1.3 Marine Loading – GHG Emissions

None of the 13 samples of varying crude types identified methane or carbon dioxide in the crude. Although produced crude may have some amount of methane, methane is highly volatile and will quickly be released in vapor prior to being loaded into a marine vessel in the BMOP DWP, after many steps of production (which is initially extracted at pressure, then stored in atmospheric tanks where the majority of light ends flash off), processing, storage, and hundreds of miles of transmission. Referred to as "weathering," it is typical for the lightest volatile compounds, including methane and carbon dioxide, to be released well before reaching a storage terminal. This is evident in that none of the 13 samples identified even a small fraction of methane or carbon dioxide in the crude at the Nederland Terminal.

Accordingly, GHG emissions from crude oil loading at the BMOP project are not expected or will be negligible in comparison.

2.2.2 Natural Gas Generators

The Project will operate two (2) natural gas-fired generators. BMOP currently predicts that the make/model of each generator will be equivalent to a Caterpillar G3516C, each rated at approximately 2,000 horsepower (hp). To conservatively estimate emissions from the proposed units, a maximum power of 2,328 hp was used, per the manufacturer's specification sheet at 100% load.

Emissions from NO_X, CO, and VOC are based on the applicable emission standards provided in Table 1 of NSPS Subpart JJJJ, in grams per horsepower-hour (g/hp-hr).[11] Emissions from formaldehyde are limited to 14 ppmvd or less at 15% O_2, based on Table 2a of NESHAP Subpart ZZZZ.[12] Emissions from CO_2 and CH_4 are estimated based on the manufacturer's specifications sheet, in grams per kilowatt hour (g/kW-hr). Emissions from filterable particulate matter (PM) with an aerodynamic diameter less than 10 and 2.5 micrometers (PM_{10} and $PM_{2.5}$, respectively), condensable PM, SO_2, and the remaining HAPs were estimated based on emission factors from EPA's AP-42 Chapter 3, Table 3.2-2 (07/00), *Uncontrolled Emission Factors for 4-Stroke Lean Burn Engines*, in pounds per million British thermal units (lb/MMBtu). Filterable PM emissions are assumed to be equivalent to filterable PM_{10} and $PM_{2.5}$ emissions. H_2SO_4 emissions are assumed to be 5% of SO_2 emissions. The natural gas specific emission factor from 40 CFR 98 Subpart C, Table C-2, *Default CH_4 and N_2O Emission Factors for Various Types of Fuel,* was used to estimate N_2O emissions, in kilograms per MMBtu (kg/MMBtu). The carbon dioxide equivalent (CO_2e) emission rate was calculated based on the CO_2, CH_4, and N_2O emission rates, weighted according to their global warming potentials (GWP) of 1, 25, and 298, respectively.

To calculate emissions for heat rate based emission factors (lb/MMBtu or kg/MMBtu), a natural gas higher heating value (HHV) of 1,020 British thermal units per standard cubic foot (Btu/scf)[13] and average brake-specific fuel consumption rate of 17,820 scf per hour (scf/hr) were used.[14]

Based on current Project designs, only one engine will be operating at any given time, to continuously power the sources of the DWP platform, therefore, potential annual emissions are based on the continuous operation of a single engine at 100% load.

---

[11] For non-emergency spark ignition natural gas engines greater than 500 hp manufacturered after July 1, 2010.

[12] Table 2a of NESHAP Subpart ZZZZ for four-stroke lean burn (4SLB) stationary RICE.

[13] Per footnote b of AP-42, Table 3.2-2.

[14] Per the manufacturer's specification sheet at 100% load.

2.2.3 Emergency Diesel Generator

The Project will operate one (1) emergency, diesel-fired generator. BMOP currently predicts that the make/model of the emergency generator will be equivalent to a Caterpillar G3512C, rated at approximately 1,500 kW (~2,000 hp).

Emissions from filterable PM, NO_X, VOC, and CO are estimated based on the emissions standards provided in 40 CFR 60.4205(b), in g/kW-hr.[15] Filterable PM emissions are assumed to be equivalent to PM_{10} and $PM_{2.5}$ emissions. Condensable PM and HAP emissions were estimated based on emission factors from AP-42 Chapter 3, Table 3.4-1, 2, and 3 (10/96), *Emission Factors for large Stationary Diesel and All Stationary Dual-Fuel Engines,* in lb/MMBtu. SO_2 and H_2SO_4 emissions are based on a diesel fuel sulfur content of 0.1%. It is estimated that 98% of the sulfur is oxidized to SO_2 and the remaining 2% is hydrolyzed to H_2SO_4. GHG emissions of CO_2, CH_4, and N_2O were based on emission factors provided in 40 CFR 98, Subpart C, Tables C-1 and C-2, for distillate fuel Oil No. 2. The CO_2e emission rate was calculated based on the CO_2, CH_4, and N_2O GWP's of 1, 25, and 298, respectively.

To calculate emissions for heat rate based emission factors (lb/MMBtu or kg/MMBtu), a distillate fuel oil HHV of 19,300 British thermal units per pound (Btu/lb) and average brake-specific fuel consumption (BSFC) rate of 7,000 British thermal units per horsepower-hour (Btu/hp-hr) were used. [16]

The emergency diesel-fired generator will only operate during periods where both natural gas generators are unavailable or for maintenance and readiness testing. Therefore, to estimate potential emissions, BMOP conservatively assumes that the emergency generator will not operate more than 100 hours per year, operating at 100% load.

2.2.4 Platform Crane Engines

The Project will operate a number of platform cranes for various types of operation. Based on current design specifications for the Project, the following diesel-fired crane engines will be located at the WC 509 platform complex:

- **Two (2) 354 kW (~475 hp) diesel engines.**

Emissions from filterable PM, NO_X, CO, and VOC are estimated based on the emissions standards provided in 40 CFR 60.4204(b), in g/kW-hr.[17] To conservatively estimate emissions from the crane engines, emissions of PM, NO_X, and VOC are multiplied by the appropriate Not to Exceed (NTE) multiplier provided in 40 CFR 1039.101(e), which, for engines with a NO_X standard less than 2.5 g/kW-hr and PM standard less than 0.07 g/kW-hr is 1.5. Filterable PM emissions are assumed to be equivalent to PM_{10} and $PM_{2.5}$ emissions.

Emissions from HAP were estimated based on emission factors from EPA's AP-42 Chapter 3, Tables 3.3-1 and 2 (10/96), *Emission Factors for Uncontrolled Gasoline And Diesel Industrial Engines*. AP-42 Chapter 3.3 does not provide an emission factor for condensable PM, therefore, the condensable PM emission factor

---

[15] Per 40 CFR 60.4205(b) and 40 CFR 89.112, for 2007 model year or later emergency combustion ignition internal combustion engines less than 3,000 hp with a displacement less than 10 liters per cylinders. It is conservatively assumes that NO_X and VOC emissions are equivalent to the NMHC+NO_X emission limit.

[16] Per footnote e of AP-42 Table 3.4-1.

[17] Per 40 CFR 60.4204(b) and 40 CFR 1039.101, for 2014 model year or later combustion ignition internal combustion engines between 130 kW to 560 kW.

provided in AP-42, Table 3.4-2, *Emission Factors for Large Uncontrolled Stationary Diesel Engines,* was conservatively used. SO_2 and H_2SO_4 emissions are based on a diesel fuel sulfur content of 0.1%. It is estimated that 98% of the sulfur is oxidized to SO_2 and the remaining 2% is hydrolyzed to H_2SO_4. GHG emissions of CO_2, CH_4, and N_2O were based on emission factors provided in 40 CFR 98, Subpart C, Tables C-1 and C-2, for distillate fuel Oil No. 2. The CO_2e emission rate was calculated based on the CO_2, CH_4, and N_2O GWP's of 1, 25, and 298, respectively.

To calculate emissions for heat rate based emission factors (lb/MMBtu or kg/MMBtu), a distillate fuel oil HHV of 19,300 Btu/lb and average BSFC rate of 7,000 Btu/hp-hr were used. [18]

To conservatively estimate emissions from the crane engines, BMOP assumes that each engine will operate continuously at 100% load.

2.2.5 Firewater Pump Engines

The Project will operate two (2) firewater pump engines. Current design specifications for the Project predict that the engines will be rated at approximately 485 kW (~650 hp).

Emissions from filterable PM, NO_X, CO, and VOC are estimated based on the emissions standards provided in Table 4 of NSPS Subpart IIII[19] and 40 CFR 60.4204(b), in g/kW-hr.[20] Filterable PM emissions are assumed to be equivalent to PM_{10} and $PM_{2.5}$ emissions.

Emissions from HAP were estimated based on emission factors from EPA's AP-42 Chapter 3, Tables 3.3-1 and 2 (10/96), *Emission Factors for Uncontrolled Gasoline And Diesel Industrial Engines*. AP-42 Chapter 3.3 does not provide an emission factor for condensable PM, therefore, the condensable PM emission factor provided in AP-42, Table 3.4-2, *Emission Factors for Large Uncontrolled Stationary Diesel Engines,* was conservatively used. SO_2 and H_2SO_4 emissions are based on a diesel fuel sulfur content of 0.1%. It is estimated that 98% of the sulfur is oxidized to SO_2 and the remaining 2% is hydrolyzed to H_2SO_4. GHG emissions of CO_2, CH_4, and N_2O were based on emission factors provided in 40 CFR 98, Subpart C, Tables C-1 and C-2, for distillate fuel Oil No. 2. The CO_2e emission rate was calculated based on the CO_2, CH_4, and N_2O GWP's of 1, 25, and 298, respectively.

To calculate emissions for heat rate based emission factors (lb/MMBtu or kg/MMBtu), a distillate fuel oil HHV of 19,300 Btu/lb and average BSFC rate of 7,000 Btu/hp-hr were used. [21]

The emergency firewater pump engines will only operate during periodic maintenance testing and during emergencies. Therefore, to estimate potential emissions, BMOP conservatively assumes that the firewater pump engines will not operate more than 100 hours per year, operating at 100% load.

[18] Per footnote c of AP-42 Table 3.3-1.

[19] Per 40 CFR 60.4205(c) for firewater pump engines with a displacement of less than 30 liters/cylinder between 225 kW and 450 kW. Conservatively assume that NO_X and VOC emissions are equivalent to the NMHC+NO_X emissions limit.

[20] Per 40 CFR 60.4204(b) and 40 CFR 1039.101, for 2014 model year or later combustion ignition internal combustion engines between 130 kW to 560 kW.

[21] Per footnote c of AP-42 Table 3.3-1.

2.2.6 Storage Tanks

The Project will operate a number of fuel and petroleum liquid storage tanks. Current design specifications for the Project predict that the following storage tanks will be located at each platform:

- **Platform A**
  - One (1) 3,000 gallon aviation fuel (estimated as jet kerosene) tank.
- **Platform B**
  - Two (2) 4,400 gallon diesel storage tanks associated with each platform crane.
  - One (1) 18,000 gallon primary diesel storage tank.
  - One (1) 42,000 gallon crude oil surge tank.

TankESP™ software was utilized to estimate potential annual emissions consistent with the methodology of U.S. EPA's AP-42 Chapter 7.1. using the following dimension and usage assumptions.

Table 2-4. Storage Tank Assumptions

Tank	Tank Dimensions L (ft)	W (ft)	H (ft)	Dia. (ft)	Volume (gal)	Max. Filling Rate (gal/hr)	Annual Throughput (gal/yr)	Orientation
Aviation Fuel Tank	10	5	8	--	3,000	200	13,000	Horizontal
Crane Diesel Storage Tank #1	--	--	30	5	4,400	400	114,400	Vertical
Crane Diesel Storage Tank #2	--	--	30	5	4,400	400	114,400	Vertical
Primary Diesel Storage Tank	16	15	10	--	18,000	400	468,000	Horizontal
Crude Oil Surge Tank	47.5	--	--	12.67	42,000	80,000	42,000	Horizontal

The chemical characteristics for jet kerosene and diesel fuel were based on standard TankESP™ defaults, while the chemical characteristics for crude oil were based on same annual average values as described for loading emissions, provided in Table 2-3 above. All tanks were assumed to operate continuously with fixed roofs.

2.2.7 Fugitive Emissions

Fugitive emissions were calculated based on the synthetic organic chemical manufacturing industry (SOCMI) average emission factor (in pounds per hour [lb/hr])[22], using the following equation.

$$E_{VOC} = F_A \times WF_{VOC} \times N$$

Where:

$E_{VOC} = Emission\ rate\ of\ VOC\ from\ all\ equipment\ in\ the\ stream, \frac{lb}{hr}$

$F_A = SOCMI\ average\ emission\ factor, \frac{lb}{hr}$

$WF_{VOC} = Weight\ fraction\ of\ VOC\ in\ the\ stream, \%$

$N = number\ of\ components\ in\ the\ stream$

[22] As provided in EPA's Protocol for Equipment Leak Emission Estimates, EPA-453/R-95-017 https://www3.epa.gov/ttnchie1/efdocs/equiplks.pdf

This factor was chosen to ensure a conservative representation of the collection of piping components in different service at the WC 509 DWP. It should be noted that no reduction from these average emissions factors has been applied for these estimates, to ensure a conservative representation. Actual emissions will be much lower, as piping components will be monitored and repaired, if found to be leaking, based on the applicable leak detection and monitoring requirements.

The total number of piping components for each applicable stream are based on current design estimates for the Project. The different streams are categorized as gas/vapor or light liquid service based on the contents of the stream. The total number of components are then multiplied by the appropriate SOCMI emission factor. For piping components servicing natural gas streams, it is assumed that the components are in gas/vapor service. For piping components servicing diesel fuel, crude oil, or aviation fuel (assumed to be equivalent to jet kerosene), it is assumed that the components are in light liquid service.

To determine the VOC emission rate, the stream is multiplied by the VOC weight percent (wt%) of the stream. For components in natural gas service, the total VOC composition of the stream is based on an April 13, 2020 sample at the DWP platform. For components in diesel fuel or jet kerosene service, the total VOC composition is consistent with the Tanks ESP defaults. For components in crude oil service, the total VOC composition is based on the maximum vapor wt% used for crude oil loading emissions calculations.

Similar to VOC emissions, HAP emissions for the fugitive components were calculated using the same approach as above. Fugitive emissions also consider H_2S emissions from components in crude oil service and GHG emissions from components in natural gas service, using the same methodology as above. Annual emissions for all fugitive emissions are based on continuous operation (i.e. 8,760 hours of operation).

2.3 WC 148 Stationary Sources Potential Emissions

A summary of the operating emissions from the sources at WC 148 is shown in the table below.

Table 2-5. Offshore WC 148 Stationary Sources Potential Emissions Summary

	NO_X (tpy)	CO (tpy)	VOC (tpy)	SO_2 (tpy)	PM_{10} (tpy)	$PM_{2.5}$ (tpy)	H_2S (tpy)	H_2SO_4 (tpy)	HAPs (tpy)	CO_2e (tpy)
WC 148 Platform Sources										
WC 148 Fugitive Emissions	--	--	0.71	--	--	--	3.1E-4	--	0.04	--
Total	--	--	0.71	--	--	--	3.1E-4	--	0.04	--

The potential emissions calculations presented above for WC 148 follow the same methodology as that described for the similar sources at WC 509.

3. OFFSHORE MOBILE SOURCE EMISSIONS

BMOP has calculated potential air emissions for the following mobile sources associated with the Project.

3.1 Mobile Potential Emissions Summary

A summary of the proposed emissions is shown in the table below.

Table 3-1. Offshore Mobile Sources Potential Emissions Summary

	NO_X (tpy)	CO (tpy)	VOC (tpy)	SO_2 (tpy)	PM_{10}[23] (tpy)	$PM_{2.5}$[23] (tpy)	H_2SO_4 (tpy)	HAPs (tpy)	CO_2e (tpy)
Tugboats/Support									
Main Engines	105.3	24.14	2.82	3.12	1.76	1.71	0.10	0.05	5,026
Generator Set	20.89	4.50	1.66	0.48	1.52	1.52	0.01	0.02	771.8
AHT Winch Engines	1.61	0.35	0.13	0.04	0.12	0.12	1.15E-3	1.41E-3	59.37
4-Point Dive Support									
Main Engines	31.10	7.13	0.83	0.92	0.52	0.50	0.03	0.01	1,484
Generators	1.79	0.38	0.14	0.04	0.13	0.13	1.28E-3	1.56E-3	65.97
Air Compressors	0.59	0.13	0.05	0.01	0.04	0.04	4.20E-4	5.12E-4	21.65
Dive Compressors	0.62	0.13	0.05	0.01	0.05	0.05	4.48E-4	5.47E-4	23.09
Crane Engines	0.75	0.16	0.06	0.02	0.05	0.05	5.36E-4	6.45E-4	27.62
Supply Vessels									
Main Engines	13.82	3.17	0.37	0.41	0.23	0.22	0.01	6.35E-3	659.7
Diesel Generators	1.79	0.38	0.14	0.04	0.13	0.13	1.28E-3	1.56E-3	65.97
Helicopter									
Platform A Helicopter	0.25	0.69	0.52	0.04	0.02	0.26	1.89E-3	0.35	55.15
VLCC									
Main Engines	358.6	82.18	9.59	10.62	5.99	5.82	0.33	0.16	17,112
Diesel Generators	201.2	46.11	5.38	5.96	3.36	3.26	0.19	0.09	9,601
Total	738.3	169.5	21.73	21.71	13.92	13.81	0.68	0.70	34,974

3.2 Detailed Emissions Calculations

Potential emissions were calculated for the mobile offshore sources by using the following calculation methodologies. It is assumed that all mobile sources combust diesel fuel (distillate fuel oil No. 2) as the primary source of fuel.

3.2.1 Large Diesel Engines

BMOP classifies large diesel engines as all engines greater than or equal to 600 hp, in accordance with EPA's AP-42, Chapter 3.4.1. As such, all mobile source engines that are greater than 600 hp use the following approach to estimate potential emissions.

Emissions from filterable PM, condensable PM, NO_X, CO, VOC, and HAP were estimated based on emission factors from EPA's AP-42 Chapter 3, Tables 3.4-1, 2, and 3 (10/96), *Emission Factors for Large Uncontrolled*

[23] PM_{10} and $PM_{2.5}$ emissions are represented as the sum of filterable PM_{10}/$PM_{2.5}$ and condensable emissions.

Stationary Diesel Engines. An average brake-specific fuel consumption (BSFC) of 7,000 Btu/hp-hr was used to convert lb/MMBtu to lb/hp-hr.[24] Filterable PM emissions are assumed to be equivalent to PM_{10} and $PM_{2.5}$ emissions. SO_2 and H_2SO_4 emissions are based on a diesel fuel sulfur content of 0.1%. It is estimated that 98% of the sulfur is oxidized to SO_2 and the remaining 2% is hydrolyzed to H_2SO_4. GHG emissions of CO_2, CH_4, and N_2O were based on emission factors provided in 40 CFR 98, Subpart C, Tables C-1 and C-2, for distillate fuel Oil No. 2. The CO_2e emission rate was calculated based on the CO_2, CH_4, and N_2O GWP's of 1, 25, and 298, respectively.

3.2.2 Small Diesel Engines

BMOP classifies small diesel engines as all engines less than 600 hp, in accordance with EPA's AP-42, Chapter 3.4.1. As such, all mobile source engines that are less than 600 hp use the following approach to estimate potential emissions.

Emissions from filterable PM, NO_X, CO, VOC, and HAP were estimated based on emission factors from EPA's AP-42 Chapter 3, Tables 3.3-1 and 2 (10/96), *Emission Factors for Uncontrolled Gasoline and Diesel Industrial Engines*. AP-42 Chapter 3.3 does not provide an emission factor for condensable PM, therefore, the condensable PM emission factor provided in AP-42, Table 3.4-2, *Emission Factors for Large Uncontrolled Stationary Diesel Engines,* was conservatively used. An average brake-specific fuel consumption (BSFC) of 7,000 Btu/hp-hr was used to convert lb/MMBtu to lb/hp-hr.[25] Filterable PM emissions are assumed to be equivalent to PM_{10} and $PM_{2.5}$ emissions. SO_2 and H_2SO_4 emissions are based on a diesel fuel sulfur content of 0.1%. It is estimated that 98% of the sulfur is oxidized to SO_2 and the remaining 2% is hydrolyzed to H_2SO_4. GHG emissions of CO_2, CH_4, and N_2O were based on emission factors provided in 40 CFR 98, Subpart C, Tables C-1 and C-2, for distillate fuel Oil No. 2. The CO_2e emission rate was calculated based on the CO_2, CH_4, and N_2O GWP's of 1, 25, and 298, respectively.

3.2.3 Platform A Helicopter

Emissions from helicopter operations are based on emissions generated during the takeoff and landing cycle. BMOP currently predicts that the helicopter will operate for an average of 260 hours per year, for an average of 1 hour per day. As such, it is conservatively estimated that a take-off/landing cycle occurred 260 hours per year.

Emissions from filterable PM, condensable PM, NOx, SO2, CO, VOC, CO2, CH4, and N2O emissions are based on Table 6-12 year 2011 Gulf-wide Emissions Inventory Study for a twin engine medium lift helicopter, provided in pounds per landing/take-off (lb/LTO).[26] The CO_2e emission rate was calculated based on the CO_2, CH_4, and N_2O GWP's of 1, 25, and 298, respectively. HAP emissions are based on EPA's Documentation for Aircraft Component of the National Emissions Inventory, provided in tons per LTO (tons/LTO).[27]

---

[24] Per footenote c of AP-42, Table 3.3-1.

[25] Per footenote c of AP-42, Table 3.3-1.

[26] BOEM 014-666

[27] "Documentation for Aircraft Component of the National Emissions Inventory: Inventory Methodology USEPA, Emissions, Monitoring and Analysis Division, Contract No.: EP-D-07-097, April 23, 2010.

3.2.4 Mobile Source Operation

To quantify emissions from mobile sources, BMOP estimated the projected hours of operation, and annual average power level (load) of each source during normal operation. BMOP currently predicts that each mobile source will operate and maintain the following hours of operation and annual average power level, as provided in the table below.

Table 3-2. Mobile Source Operating Assumptions

	Operating Days (days/yr)	Operating Hours (hrs/yr)	Power level (% Load)
Tugboats/Support Vessels			
Main Engines	180	24	10
Generator Set	180	12	25
AHT Winch Engines	180	2	80
4-Point Dive Support Vessels			
Main Engines	30	24	80
Generators	30	12	80
Air Compressors	30	18	70
Dive Compressors	30	12	70
Crane Engines	30	12	20
Supply Vessels			
Main Engines	30	24	80
Diesel Generators	30	12	80
Helicopter			
Platform A Helicopter	260	1	100
VLCC			
Main Engines[28]	365	24	5
Diesel Generators	365	24	60

[28] The VLCC main engine will primarily be operating in a low power mode during the loading of crude oil.

APPENDIX A. DETAILED OFFSHORE CONSTRUCTION EMISSIONS

Table 1 - BMOP - Offshore Construction Emissions

2022 Non-Road Construction Equipment Exhaust Criteria Pollutant Emissions

Equipment Type	Fuel	Source Category[1]	Engine Rating[3] (hp)	Load Factor[1]	Pollutant Emission Factor[2] (g/hp-hr)						No. of Equipment /Day[3]	Engines per Unit[3]	Hours of Operation[3]	Pollutant Emissions (tons/year)					
					CO	NO_x	SO_2	VOC	PM_{10}	$PM_{2.5}$				CO	NO_x	SO_2	VOC	PM_{10}	$PM_{2.5}$
Air Compressors	Diesel	2270006015	100	43%	0.27	1.20	0.004	0.01	0.07	0.07	12	3	8,602	4.02	17.62	0.06	0.12	1.01	0.98
Air Compressors	Diesel	2270006015	80	43%	0.72	1.81	0.004	0.01	0.12	0.12	9	2	1,632	0.80	2.02	4.74E-03	0.01	0.13	0.13
Air Compressors	Diesel	2270006015	180	43%	0.22	0.92	0.004	0.01	0.04	0.04	12	2	6,109	2.72	11.45	0.05	0.09	0.54	0.53
Air Compressors	Diesel	2270006015	600	43%	0.54	1.93	0.004	0.01	0.09	0.08	1	18	408	1.13	4.04	0.01	0.03	0.18	0.17
Air Compressors	Diesel	2270006015	630	43%	0.54	1.93	0.004	0.01	0.09	0.08	1	3	408	0.20	0.71	1.50E-03	4.65E-03	0.03	0.03
Air Compressors	Diesel	2270006015	900	43%	0.54	1.93	0.004	0.01	0.09	0.08	1	2	506	0.23	0.83	1.77E-03	0.01	0.04	0.04
Air Compressors	Diesel	2270006015	900	43%	0.54	1.93	0.004	0.01	0.09	0.08	1	2	616	0.29	1.02	2.15E-03	0.01	0.04	0.04
Cranes	Diesel	2270002045	335	43%	0.31	1.22	0.004	0.01	0.05	0.05	14	2	6,335	8.73	34.25	0.11	0.20	1.37	1.33
Cranes	Diesel	2270002045	285	43%	0.15	0.62	0.004	0.005	0.03	0.03	2	2	1,452	0.12	0.49	2.89E-03	3.64E-03	0.02	0.02
Cranes	Diesel	2270002045	350	43%	0.31	1.22	0.004	0.01	0.05	0.05	2	2	1,452	2.99E-01	1.17	3.71E-03	7.00E-03	4.70E-02	0.05
Cranes	Diesel	2270002045	332	43%	0.31	1.22	0.004	0.01	0.05	0.05	1	2	1,044	0.10	0.40	1.26E-03	2.39E-03	0.02	0.02
Cranes	Diesel	2270002045	150	43%	0.20	0.89	0.004	0.01	0.05	0.05	1	2	1,044	0.03	0.13	5.52E-04	7.91E-04	0.01	0.01
Cranes	Diesel	2270002045	365	43%	0.31	1.22	0.004	0.01	0.05	0.05	2	1	408	0.04	0.17	5.43E-04	1.03E-03	0.01	0.01
Cranes	Diesel	2270002045	335	43%	0.31	1.22	0.004	0.01	0.05	0.05	5	1	2,245	0.55	2.17	0.01	0.01	0.09	0.08
Cranes	Diesel	2270002045	335	43%	0.31	1.22	0.004	0.01	0.05	0.05	2	1	768	0.08	0.30	9.39E-04	1.77E-03	0.01	0.01
Generators	Diesel	2270006005	200	43%	0.67	2.44	0.004	0.02	0.13	0.13	8	2	3,515	3.56	12.99	0.02	0.12	0.71	0.69
Generators	Diesel	2270006005	375	43%	0.74	2.44	0.004	0.02	0.11	0.11	3	2	1,860	1.46	4.84	0.01	0.04	0.22	0.21
Generators	Diesel	2270006005	200	43%	0.67	2.44	0.004	0.02	0.13	0.13	1	2	1,044	0.13	0.48	8.28E-04	4.45E-03	0.03	0.03
Generators	Diesel	2270006005	180	43%	0.67	2.44	0.004	0.02	0.13	0.13	17	3	1,726	5.02	18.30	0.03	0.17	1.00	0.97
Generators	Diesel	2270006005	80	43%	1.53	3.24	0.005	0.03	0.27	0.26	17	2	1,726	3.42	7.21	0.01	0.07	0.59	0.57
Generators	Diesel	2270006005	250	43%	0.67	2.44	0.004	0.02	0.13	0.13	2	2	600	0.19	0.69	1.19E-03	0.01	0.04	0.04
Generators	Diesel	2270006005	425	43%	0.74	2.44	0.004	0.02	0.11	0.11	1	2	276	0.08	0.27	4.65E-04	2.00E-03	0.01	0.01
Generators	Diesel	2270006005	120	43%	0.75	2.75	0.004	0.03	0.16	0.16	19	2	3,889	6.34	23.09	0.04	0.21	1.38	1.34
Generators	Diesel	2270006005	1,400	43%	0.74	2.44	0.004	0.02	0.11	0.11	7	2	3,013	20.57	68.23	0.12	0.50	3.12	3.03
Generators	Diesel	2270006005	260	43%	0.67	2.44	0.004	0.02	0.13	0.13	7	2	2,757	3.18	11.59	0.02	0.11	0.64	0.62
Generators	Diesel	2270006005	80	43%	1.53	3.24	0.005	0.03	0.27	0.26	2	2	120	0.03	0.06	8.50E-05	6.06E-04	4.84E-03	4.69E-03
Generators	Diesel	2270006005	550	43%	0.74	2.44	0.004	0.02	0.11	0.11	2	3	1,024	1.18	3.90	0.01	0.03	0.18	0.17
Generators	Diesel	2270006005	80	43%	1.53	3.24	0.005	0.03	0.27	0.26	2	2	564	0.13	0.28	4.00E-04	2.85E-03	0.02	0.02
Generators	Diesel	2270006005	425	43%	0.74	2.44	0.004	0.02	0.11	0.11	1	2	336	0.10	0.33	5.66E-04	2.43E-03	0.02	0.01
Light Plant	Diesel	2270002027	15	43%	1.56	3.82	0.005	0.04	0.18	0.17	9	1	1,344	0.13	0.33	4.66E-04	3.55E-03	0.02	0.02
Light Plant	Diesel	2270002027	60	43%	1.26	3.74	0.005	0.03	0.22	0.22	5	1	876	0.16	0.47	5.67E-04	3.82E-03	0.03	0.03
Diving Equipment	Diesel	2270002081	180	59%	0.27	0.82	0.004	0.01	0.05	0.05	2	1	1,200	0.07	0.23	1.07E-03	1.87E-03	0.02	0.01
Anchor Winches	Diesel	2270002081	240	59%	0.27	0.82	0.004	0.01	0.05	0.05	1	4	506	0.08	0.26	1.20E-03	2.10E-03	0.02	0.02
AHT Winch	Diesel	2270002081	120	59%	0.34	1.05	0.004	0.01	0.08	0.08	19	1	1,050	0.53	1.63	0.01	0.01	0.13	0.12
Anchor Winches	Diesel	2270002081	600	59%	0.75	1.87	0.004	0.01	0.10	0.10	7	8	956	15.58	39.08	0.08	0.25	2.14	2.08
Gantry Boom	Diesel	2270002081	335	59%	0.75	1.87	0.004	0.01	0.10	0.10	7	1	2,009	2.29	5.73	0.01	0.04	0.31	0.30
Gantry Hoist	Diesel	2270002081	520	59%	0.75	1.87	0.004	0.01	0.10	0.10	7	1	2,009	3.55	8.90	0.02	0.06	0.49	0.47
Gantry Swing	Diesel	2270002081	335	59%	0.75	1.87	0.004	0.01	0.10	0.10	7	2	2,009	4.57	11.46	0.02	0.07	0.63	0.61
Line-up Station	Diesel	2270002081	120	59%	0.34	1.05	0.004	0.01	0.08	0.08	2	1	792	0.04	0.13	4.72E-04	9.17E-04	0.01	0.01
UT Station	Diesel	2270002081	60	59%	0.80	2.90	0.004	0.01	0.10	0.10	2	1	792	0.05	0.18	2.66E-04	8.81E-04	0.01	0.01
Coating Station	Diesel	2270002081	60	59%	0.80	2.90	0.004	0.01	0.10	0.10	2	1	792	0.05	0.18	2.66E-04	8.81E-04	0.01	0.01
Tug Winch	Diesel	2270002081	80	59%	0.89	1.68	0.004	0.01	0.14	0.14	2	1	94	0.01	0.02	4.15E-05	9.32E-05	1.36E-03	1.32E-03
Jet Barge Anchor Winches	Diesel	2270002081	240	59%	0.27	0.82	0.004	0.01	0.05	0.05	1	4	616	0.10	0.32	1.46E-03	2.56E-03	0.02	0.02
Jet Barge Sled Winch	Diesel	2270002081	240	59%	0.27	0.82	0.004	0.01	0.05	0.05	1	1	224	0.01	0.03	1.33E-04	2.32E-04	1.89E-03	1.84E-03
Pumps	Diesel	2270006010	240	43%	0.67	2.44	0.004	0.02	0.14	0.13	3	4	2,016	1.85	6.72	0.01	0.06	0.38	0.37
Pumps	Diesel	2270006010	110	43%	0.76	2.75	0.004	0.03	0.17	0.16	1	3	1,314	0.16	0.57	8.63E-04	0.01	0.03	0.03
Pumps	Diesel	2270006010	1,840	43%	0.74	2.44	0.004	0.02	0.12	0.11	1	2	616	0.80	2.62	4.50E-03	0.02	0.13	0.12

Table 1 - BMOP - Offshore Construction Emissions

2022 Non-Road Construction Equipment Exhaust Criteria Pollutant Emissions

Equipment Type	Fuel	Source Category[1]	Engine Rating[3] (hp)	Load Factor[1]	Pollutant Emission Factor[2] (g/hp-hr)						No. of Equipment /Day[3]	Engines per Unit[3]	Hours of Operation[3]	Pollutant Emissions (tons/year)					
					CO	NO_x	SO_2	VOC	PM_{10}	$PM_{2.5}$				CO	NO_x	SO_2	VOC	PM_{10}	$PM_{2.5}$
Marine Vessels[4,5]																			
Diving Support Vessel	Diesel	-	2,250	43%	0.82	9.84	0.005	0.37	0.54	0.54	8	2	540	7.56	90.70	0.04	3.44	4.95	4.95
Lift Boat	Diesel	-	1,500	43%	0.82	9.84	0.005	0.37	0.54	0.54	2	2	168	0.39	4.70	2.32E-03	0.18	0.26	0.26
Lift Boat	Diesel	-	1,000	43%	1.86	9.69	0.005	0.20	0.22	0.22	1	2	72	0.13	0.66	3.31E-04	0.01	0.02	0.02
DP Nitrogen Boat	Diesel	-	3,000	43%	0.82	9.84	0.005	0.37	0.54	0.54	1	2	408	0.95	11.42	0.01	0.43	0.62	0.62
Supply Vessel	Diesel	-	1,125	43%	1.86	9.69	0.005	0.20	0.22	0.22	17	2	3,279	110.83	576.32	0.29	11.97	13.30	13.30
Crew Boat	Diesel	-	1,000	45%	1.86	9.69	0.005	0.20	0.22	0.22	17	3	3,221	151.91	789.94	0.39	16.41	18.23	18.23
Diving Support Vessel	Diesel	-	3,000	43%	0.82	9.84	0.005	0.37	0.54	0.54	2	2	656	3.06	36.73	0.02	1.39	2.00	2.00
Bow Thruster	Diesel	-	950	31%	1.86	9.69	0.005	0.20	0.22	0.22	2	2	800	1.94	10.07	0.01	0.21	0.23	0.23
Stern Thruster	Diesel	-	950	31%	1.86	9.69	0.005	0.20	0.22	0.22	2	1	800	0.97	5.04	2.52E-03	0.10	0.12	0.12
Jet Barge Anchor Handling Tug	Diesel	-	900	31%	1.86	9.69	0.005	0.20	0.22	0.22	4	2	612	2.81	14.60	7.30E-03	0.30	0.34	0.34
Derrick Barge Anchor Handling Tug	Diesel	-	1,800	31%	0.82	9.84	0.005	0.37	0.54	0.54	15	2	1,376	20.83	249.93	0.12	9.47	13.63	13.63
Crew Boat	Diesel	-	350	45%	1.12	7.46	0.005	0.20	0.22	0.22	2	2	180	0.14	0.93	6.06E-04	0.03	0.03	0.03
Pipehaul Tug	Diesel	-	1,200	31%	1.86	9.69	0.005	0.20	0.22	0.22	2	2	564	1.72	8.97	4.48E-03	0.19	0.21	0.21
Total														**398.00**	**2,107.87**	**1.57**	**46.41**	**69.80**	**69.33**

1. Based on EPA MOVES2014b.
2. EPA MOVES2014b (Region: National).
3. Based on data provided by Blue Marlin Offshore Port, LLC.
4. Load factor from Table 3-4 of Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories, ICF International, April 2009. A fuel correction factor of 0.005 was applied to SO_2 emission factors (Ultra Low Sulfur Diesel) per Table 3-9 of Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories, ICF International, April 2009.
5. Tier 0 emission factors from Tables 3-8 of Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories, ICF International, April 2009.

Table 2 - BMOP - Offshore Construction Emissions

2022 Non-Road Construction Equipment Exhaust Greenhouse Gas Emissions

Equipment Type	Fuel	Source Category[1]	Engine Rating[3] (hp)	Load Factor[1]	Pollutant Emission Factor[2] (g/hp-hr)			No. of Equipment /Day[3]	Engines per Unit[3]	Hours of Operation[3]	Pollutant Emissions (tons/year)			
					CO_2	CH_4	N_2O[6]				CO_2	CH_4	N_2O	CO_2e[7]
Air Compressors	Diesel	2270006015	100	43%	530.84	0.001	0.02	12	3	8,602	7,792	0.01	0.36	7,899
Air Compressors	Diesel	2270006015	80	43%	590.11	0.001	0.03	9	2	1,632	657	8.27E-04	0.03	666
Air Compressors	Diesel	2270006015	180	43%	530.86	0.001	0.02	12	2	6,109	6,641	0.01	0.31	6,732
Air Compressors	Diesel	2270006015	600	43%	530.71	0.001	0.02	1	18	408	1,108	1.68E-03	0.05	1,124
Air Compressors	Diesel	2270006015	630	43%	530.71	0.001	0.02	1	3	408	194	2.95E-04	0.01	197
Air Compressors	Diesel	2270006015	900	43%	530.71	0.001	0.02	1	2	506	229	3.48E-04	0.01	232
Air Compressors	Diesel	2270006015	900	43%	530.71	0.001	0.02	1	2	616	279	4.24E-04	0.01	283
Cranes	Diesel	2270002045	335	43%	530.85	4.86E-04	0.02	14	2	6,335	14,952	0.01	0.69	15,157
Cranes	Diesel	2270002045	285	43%	530.92	4.00E-04	0.02	2	2	1,452	417	3.14E-04	0.02	422
Cranes	Diesel	2270002045	350	43%	530.85	4.86E-04	0.02	2	2	1,452	511	4.68E-04	2.35E-02	519
Cranes	Diesel	2270002045	332	43%	530.85	4.86E-04	0.02	1	2	1,044	174	1.60E-04	0.01	177
Cranes	Diesel	2270002045	150	43%	530.91	4.48E-04	0.02	1	2	1,044	79	6.65E-05	3.62E-03	80
Cranes	Diesel	2270002045	365	43%	530.85	4.86E-04	0.02	2	1	408	75	6.86E-05	3.44E-03	76
Cranes	Diesel	2270002045	335	43%	530.85	4.86E-04	0.02	5	1	2,245	946	8.66E-04	0.04	959
Cranes	Diesel	2270002045	335	43%	530.85	4.86E-04	0.02	2	1	768	129	1.19E-04	0.01	131
Generators	Diesel	2270006005	200	43%	530.46	0.001	0.02	8	2	3,515	2,828	0.01	0.13	2,867
Generators	Diesel	2270006005	375	43%	530.57	0.001	0.02	3	2	1,860	1,052	1.61E-03	0.05	1,067
Generators	Diesel	2270006005	200	43%	530.46	0.001	0.02	1	2	1,044	105	1.96E-04	4.82E-03	106
Generators	Diesel	2270006005	180	43%	530.46	0.001	0.02	17	3	1,726	3,984	0.01	0.18	4,039
Generators	Diesel	2270006005	80	43%	589.50	0.001	0.03	17	2	1,726	1,312	2.85E-03	0.06	1,330
Generators	Diesel	2270006005	250	43%	530.46	0.001	0.02	2	2	600	151	2.81E-04	0.01	153
Generators	Diesel	2270006005	425	43%	530.57	0.001	0.02	1	2	276	59	9.03E-05	2.71E-03	60
Generators	Diesel	2270006005	120	43%	530.39	0.001	0.02	19	2	3,889	4,458	0.01	0.20	4,520
Generators	Diesel	2270006005	1,400	43%	530.57	0.001	0.02	7	2	3,013	14,852	0.02	0.68	15,055
Generators	Diesel	2270006005	260	43%	530.46	0.001	0.02	7	2	2,757	2,523	4.7E-03	0.12	2,558
Generators	Diesel	2270006005	80	43%	589.50	0.001	0.03	2	2	120	11	2.33E-05	4.93E-04	11
Generators	Diesel	2270006005	550	43%	530.57	0.001	0.02	2	3	1,024	850	1.30E-03	0.04	861
Generators	Diesel	2270006005	80	43%	589.50	0.001	0.03	2	2	564	50	1.10E-04	2.32E-03	51
Generators	Diesel	2270006005	425	43%	530.57	0.001	0.02	1	2	336	72	1.10E-04	3.30E-03	73
Light Plant	Diesel	2270002027	15	43%	589.30	0.004	0.03	9	1	1,344	51	3.03E-04	2.33E-03	51
Light Plant	Diesel	2270002027	60	43%	589.57	0.002	0.03	5	1	876	73	1.97E-04	3.37E-03	74
Diving Equipment	Diesel	2270002081	180	59%	536.66	0.001	0.02	2	1	1,200	151	1.42E-04	0.01	153
Anchor Winches	Diesel	2270002081	240	59%	536.66	0.001	0.02	1	4	506	170	1.60E-04	0.01	172
AHT Winch	Diesel	2270002081	120	59%	536.64	0.001	0.02	19	1	1,050	836	8.66E-04	0.04	847
Anchor Winches	Diesel	2270002081	600	59%	536.52	0.001	0.02	7	8	956	11,208	0.01	0.51	11,362
Gantry Boom	Diesel	2270002081	335	59%	536.52	0.001	0.02	7	1	2,009	1,644	1.97E-03	0.08	1,666
Gantry Hoist	Diesel	2270002081	520	59%	536.52	0.001	0.02	7	1	2,009	2,552	3.06E-03	0.12	2,587
Gantry Swing	Diesel	2270002081	335	59%	536.52	0.001	0.02	7	2	2,009	3,288	3.94E-03	0.15	3,333
Line-up Station	Diesel	2270002081	120	59%	536.64	0.001	0.02	2	1	792	66	6.88E-05	3.05E-03	67
UT Station	Diesel	2270002081	60	59%	595.78	0.001	0.03	2	1	792	37	8.81E-05	1.69E-03	37
Coating Station	Diesel	2270002081	60	59%	595.78	0.001	0.03	2	1	792	37	8.81E-05	1.69E-03	37
Tug Winch	Diesel	2270002081	80	59%	595.91	0.001	0.03	2	1	94	6	6.17E-06	2.68E-04	6
Jet Barge Anchor Winches	Diesel	2270002081	240	59%	536.66	0.001	0.02	1	4	616	206	1.94E-04	0.01	209
Jet Barge Sled Winch	Diesel	2270002081	240	59%	536.66	0.001	0.02	1	1	224	19	1.77E-05	8.62E-04	19
Pumps	Diesel	2270006010	240	43%	530.46	0.001	0.02	3	4	2,016	1,460	2.73E-03	0.07	1,480
Pumps	Diesel	2270006010	110	43%	530.39	0.001	0.02	1	3	1,314	109	2.34E-04	0.01	111
Pumps	Diesel	2270006010	1,840	43%	530.57	0.001	0.02	1	2	616	570	8.74E-04	0.03	578

Table 2 - BMOP - Offshore Construction Emissions

2022 Non-Road Construction Equipment Exhaust Greenhouse Gas Emissions

Equipment Type	Fuel	Source Category[1]	Engine Rating[3] (hp)	Load Factor[1]	Pollutant Emission Factor[2] (g/hp-hr)			No. of Equipment /Day[3]	Engines per Unit[3]	Hours of Operation[3]	Pollutant Emissions (tons/year)			
					CO_2	CH_4	N_2O[6]				CO_2	CH_4	N_2O	CO_2e[7]
Marine Vessels[4,5]														
Diving Support Vessel	Diesel	-	2,250	43%	514.54	0.07	0.01	8	2	540	4,741	0.62	0.14	4,798
Lift Boat	Diesel	-	1,500	43%	514.54	0.07	0.01	2	2	168	246	0.03	0.01	249
Lift Boat	Diesel	-	1,000	43%	514.54	0.07	0.01	1	2	72	35	4.58E-03	1.02E-03	36
DP Nitrogen Boat	Diesel	-	3,000	43%	514.54	0.07	0.01	1	2	408	597	0.08	0.02	604
Supply Vessel	Diesel	-	1,125	43%	514.54	0.07	0.01	17	2	3,279	30,589	3.99	0.89	30,953
Crew Boat	Diesel	-	1,000	45%	514.54	0.07	0.01	17	3	3,221	41,927	5.47	1.22	42,426
Diving Support Vessel	Diesel	-	3,000	43%	514.54	0.07	0.01	2	2	656	1,920	0.25	0.06	1,943
Bow Thruster	Diesel	-	950	31%	514.54	0.07	0.01	2	2	800	535	0.07	0.02	541
Stern Thruster	Diesel	-	950	31%	514.54	0.07	0.01	2	1	800	267	0.03	0.01	270
Jet Barge Anchor Handling Tug	Diesel	-	900	31%	514.54	0.07	0.01	4	2	612	775	0.10	0.02	784
Derrick Barge Anchor Handling Tug	Diesel	-	1,800	31%	514.54	0.07	0.01	15	2	1,376	13,065	1.70	0.38	13,220
Crew Boat	Diesel	-	350	45%	514.54	0.07	0.01	2	2	180	64	0.01	1.86E-03	65
Pipehaul Tug	Diesel	-	1,200	31%	514.54	0.07	0.01	2	2	564	476	0.06	0.01	482
Total											**184,210**	**12.54**	**6.85**	**186,564**

1. Based on EPA MOVES2014b.
2. EPA MOVES2014b (Region: National).
3. Based on data provided by Blue Marlin Offshore Port, LLC.
4. Load factor from Table 3-4 of Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories, ICF International, April 2009.
5. Tier 0 emission factors from Tables 3-8 of Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories, ICF International, April 2009.
6. 2020 Climate Registry Default Emission Factors, Released: April 2020, Tables 2.1 and 2.7, ratioed based on CO_2 emission factor from EPA MOVES2014b. https://www.theclimateregistry.org/wp-content/uploads/2020/04/The-Climate-Registry-2020-Default-Emission-Factor-Document.pdf
7. The global warming potentials of CO_2, CH_4, and N_2O are assumed to be 1, 25, and 298, respectively.

Table 3 - BMOP - Offshore Construction Emissions
2022 Non-Road Construction Equipment Exhaust Hazardous Air Pollutant Emissions

Equipment Type	Fuel	Source Category[1]	Engine Rating[3] (hp)	Load Factor[1]	Pollutant Emission Factor[2] (g/hp-hr)				No. of Equipment /Day[3]	Engines per Unit[3]	Hours of Operation[3]	Pollutant Emissions (tons/year)			
					1,3-Butadiene	2,2,4-Trimethylpentane	Acetaldehyde	Acrolein				1,3-Butadiene	2,2,4-Trimethylpentane	Acetaldehyde	Acrolein
Air Compressors	Diesel	2270006015	100	43%	6.44E-05	6.01E-05	3.48E-03	6.37E-04	12	3	8,602	9.45E-04	8.82E-04	0.05	0.01
Air Compressors	Diesel	2270006015	80	43%	8.39E-05	7.74E-05	4.41E-03	8.27E-04	9	2	1,632	9.35E-05	8.62E-05	4.91E-03	9.21E-04
Air Compressors	Diesel	2270006015	180	43%	5.46E-05	5.22E-05	3.00E-03	5.42E-04	12	2	6,109	6.83E-04	6.53E-04	0.04	0.01
Air Compressors	Diesel	2270006015	600	43%	1.04E-04	9.85E-05	5.30E-03	1.19E-03	1	18	408	2.17E-04	2.06E-04	0.01	2.49E-03
Air Compressors	Diesel	2270006015	630	43%	1.04E-04	9.85E-05	5.30E-03	1.19E-03	1	3	408	3.80E-05	3.60E-05	1.94E-03	4.36E-04
Air Compressors	Diesel	2270006015	900	43%	1.04E-04	9.85E-05	5.30E-03	1.19E-03	1	2	506	4.49E-05	4.25E-05	2.29E-03	5.15E-04
Air Compressors	Diesel	2270006015	900	43%	1.04E-04	9.85E-05	5.30E-03	1.19E-03	1	2	616	5.47E-05	5.18E-05	2.79E-03	6.27E-04
Cranes	Diesel	2270002045	335	43%	5.73E-05	5.50E-05	3.02E-03	6.17E-04	14	2	6,335	1.62E-03	1.55E-03	0.09	0.02
Cranes	Diesel	2270002045	285	43%	3.50E-05	3.46E-05	2.00E-03	3.54E-04	2	2	1,452	2.74E-05	2.72E-05	1.57E-03	2.78E-04
Cranes	Diesel	2270002045	350	43%	5.73E-05	5.50E-05	3.02E-03	6.17E-04	2	2	1,452	5.53E-05	5.29E-05	2.91E-03	5.95E-04
Cranes	Diesel	2270002045	332	43%	5.73E-05	5.50E-05	3.02E-03	6.17E-04	1	2	1,044	1.88E-05	1.81E-05	9.92E-04	2.03E-04
Cranes	Diesel	2270002045	150	43%	4.32E-05	4.09E-05	2.39E-03	4.31E-04	1	2	1,044	6.41E-06	6.07E-06	3.55E-04	6.40E-05
Cranes	Diesel	2270002045	365	43%	5.73E-05	5.50E-05	3.02E-03	6.17E-04	2	1	408	8.10E-06	7.76E-06	4.26E-04	8.72E-05
Cranes	Diesel	2270002045	335	43%	5.73E-05	5.50E-05	3.02E-03	6.17E-04	5	1	2,245	1.02E-04	9.79E-05	0.01	1.10E-03
Cranes	Diesel	2270002045	335	43%	5.73E-05	5.50E-05	3.02E-03	6.17E-04	2	1	768	1.40E-05	1.34E-05	7.37E-04	1.51E-04
Generators	Diesel	2270006005	200	43%	1.86E-04	1.73E-04	8.79E-03	2.22E-03	8	2	3,515	9.92E-04	9.25E-04	0.05	0.01
Generators	Diesel	2270006005	375	43%	1.48E-04	1.40E-04	7.04E-03	1.87E-03	3	2	1,860	2.94E-04	2.78E-04	0.01	3.71E-03
Generators	Diesel	2270006005	200	43%	1.86E-04	1.73E-04	8.79E-03	2.22E-03	1	2	1,044	3.68E-05	3.43E-05	1.74E-03	4.39E-04
Generators	Diesel	2270006005	180	43%	1.86E-04	1.73E-04	8.79E-03	2.22E-03	17	3	1,726	1.40E-03	1.30E-03	0.07	0.02
Generators	Diesel	2270006005	80	43%	2.78E-04	2.56E-04	1.28E-02	3.27E-03	17	2	1,726	6.19E-04	5.69E-04	0.03	0.01
Generators	Diesel	2270006005	250	43%	1.86E-04	1.73E-04	8.79E-03	2.22E-03	2	2	600	5.29E-05	4.93E-05	2.50E-03	6.31E-04
Generators	Diesel	2270006005	425	43%	1.48E-04	1.40E-04	7.04E-03	1.87E-03	1	2	276	1.65E-05	1.56E-05	7.82E-04	2.08E-04
Generators	Diesel	2270006005	120	43%	2.09E-04	1.94E-04	9.95E-03	2.48E-03	19	2	3,889	1.76E-03	1.63E-03	0.08	0.02
Generators	Diesel	2270006005	1,400	43%	1.48E-04	1.40E-04	7.04E-03	1.87E-03	7	2	3,013	4.15E-03	3.92E-03	0.20	0.05
Generators	Diesel	2270006005	260	43%	1.86E-04	1.73E-04	8.79E-03	2.22E-03	7	2	2,757	8.85E-04	8.25E-04	0.04	0.01
Generators	Diesel	2270006005	80	43%	2.78E-04	2.56E-04	1.28E-02	3.27E-03	2	2	120	5.06E-06	4.66E-06	2.33E-04	5.96E-05
Generators	Diesel	2270006005	550	43%	1.48E-04	1.40E-04	7.04E-03	1.87E-03	2	3	1,024	2.37E-04	2.24E-04	0.01	3.00E-03
Generators	Diesel	2270006005	80	43%	2.78E-04	2.56E-04	1.28E-02	3.27E-03	2	2	564	2.38E-05	2.19E-05	1.10E-03	2.80E-04
Generators	Diesel	2270006005	425	43%	1.48E-04	1.40E-04	7.04E-03	1.87E-03	1	2	336	2.00E-05	1.90E-05	9.53E-04	2.53E-04
Light Plant	Diesel	2270002027	15	43%	3.46E-04	3.23E-04	1.91E-02	3.50E-03	9	1	1,344	2.97E-05	2.78E-05	1.65E-03	3.01E-04
Light Plant	Diesel	2270002027	60	43%	2.55E-04	2.33E-04	1.20E-02	2.77E-03	5	1	876	3.18E-05	2.90E-05	1.49E-03	3.45E-04
Diving Equipment	Diesel	2270002081	180	59%	5.19E-05	4.97E-05	2.83E-03	5.12E-04	2	1	1,200	1.46E-05	1.40E-05	7.94E-04	1.44E-04
Anchor Winches	Diesel	2270002081	240	59%	5.19E-05	4.97E-05	2.83E-03	5.12E-04	1	4	506	1.64E-05	1.57E-05	8.93E-04	1.62E-04
AHT Winch	Diesel	2270002081	120	59%	6.07E-05	5.65E-05	3.25E-03	5.96E-04	19	1	1,050	9.45E-05	8.80E-05	0.01	9.28E-04
Anchor Winches	Diesel	2270002081	600	59%	9.57E-05	9.05E-05	4.77E-03	1.10E-03	7	8	956	2.00E-03	1.89E-03	0.10	0.02
Gantry Boom	Diesel	2270002081	335	59%	9.57E-05	9.05E-05	4.77E-03	1.10E-03	7	1	2,009	2.93E-04	2.77E-04	0.01	3.38E-03
Gantry Hoist	Diesel	2270002081	520	59%	9.57E-05	9.05E-05	4.77E-03	1.10E-03	7	1	2,009	4.55E-04	4.30E-04	0.02	0.01
Gantry Swing	Diesel	2270002081	335	59%	9.57E-05	9.05E-05	4.77E-03	1.10E-03	7	2	2,009	5.87E-04	5.54E-04	0.03	0.01
Line-up Station	Diesel	2270002081	120	59%	6.07E-05	5.65E-05	3.25E-03	5.96E-04	2	1	792	7.51E-06	6.99E-06	4.02E-04	7.37E-05
UT Station	Diesel	2270002081	60	59%	1.17E-04	1.09E-04	6.22E-03	1.15E-03	2	1	792	7.26E-06	6.76E-06	3.85E-04	7.13E-05
Coating Station	Diesel	2270002081	60	59%	1.17E-04	1.09E-04	6.22E-03	1.15E-03	2	1	792	7.26E-06	6.76E-06	3.85E-04	7.13E-05
Tug Winch	Diesel	2270002081	80	59%	7.88E-05	7.21E-05	4.04E-03	7.64E-04	2	1	94	7.71E-07	7.05E-07	3.95E-05	7.47E-06
Jet Barge Anchor Winches	Diesel	2270002081	240	59%	5.19E-05	4.97E-05	2.83E-03	5.12E-04	1	4	616	2.00E-05	1.91E-05	1.09E-03	1.97E-04
Jet Barge Sled Winch	Diesel	2270002081	240	59%	5.19E-05	4.97E-05	2.83E-03	5.12E-04	1	1	224	1.82E-06	1.74E-06	9.89E-05	1.79E-05
Pumps	Diesel	2270006010	240	43%	1.87E-04	1.74E-04	8.81E-03	2.22E-03	3	4	2,016	5.14E-04	4.79E-04	0.02	0.01
Pumps	Diesel	2270006010	110	43%	2.10E-04	1.95E-04	9.98E-03	2.48E-03	1	3	1,314	4.31E-05	4.00E-05	2.05E-03	5.11E-04
Pumps	Diesel	2270006010	1,840	43%	1.49E-04	1.41E-04	7.06E-03	1.88E-03	1	2	616	1.60E-04	1.51E-04	0.01	2.02E-03

Table 3 - BMOP - Offshore Construction Emissions
2022 Non-Road Construction Equipment Exhaust Hazardous Air Pollutant Emissions

Equipment Type	Fuel	Source Category[1]	Engine Rating[3] (hp)	Load Factor[1]	Pollutant Emission Factor[2] (g/hp-hr)				No. of Equipment /Day[3]	Engines per Unit[3]	Hours of Operation[3]	Pollutant Emissions (tons/year)			
					1,3-Butadiene	2,2,4-Trimethylpentane	Acetaldehyde	Acrolein				1,3-Butadiene	2,2,4-Trimethylpentane	Acetaldehyde	Acrolein
Marine Vessels[4,5]															
Diving Support Vessel	Diesel	-	2,250	43%	-	-	8.00E-05	2.50E-05	8	2	540	-	-	7.37E-04	2.31E-04
Lift Boat	Diesel	-	1,500	43%	-	-	8.00E-05	2.50E-05	2	2	168	-	-	3.82E-05	1.20E-05
Lift Boat	Diesel	-	1,000	43%	-	-	8.00E-05	2.50E-05	1	2	72	-	-	5.46E-06	1.71E-06
DP Nitrogen Boat	Diesel	-	3,000	43%	-	-	8.00E-05	2.50E-05	1	2	408	-	-	9.28E-05	2.90E-05
Supply Vessel	Diesel	-	1,125	43%	-	-	8.00E-05	2.50E-05	17	2	3,279	-	-	4.76E-03	1.49E-03
Crew Boat	Diesel	-	1,000	45%	-	-	8.00E-05	2.50E-05	17	3	3,221	-	-	0.01	2.04E-03
Diving Support Vessel	Diesel	-	3,000	43%	-	-	8.00E-05	2.50E-05	2	2	656	-	-	2.99E-04	9.34E-05
Bow Thruster	Diesel	-	950	31%	-	-	8.00E-05	2.50E-05	2	2	800	-	-	8.31E-05	2.60E-05
Stern Thruster	Diesel	-	950	31%	-	-	8.00E-05	2.50E-05	2	1	800	-	-	4.16E-05	1.30E-05
Jet Barge Anchor Handling Tug	Diesel	-	900	31%	-	-	8.00E-05	2.50E-05	4	2	612	-	-	1.20E-04	3.77E-05
Derrick Barge Anchor Handling Tug	Diesel	-	1,800	31%	-	-	8.00E-05	2.50E-05	15	2	1,376	-	-	2.03E-03	6.35E-04
Crew Boat	Diesel	-	350	45%	1.24E-04	-	2.44E-03	2.94E-04	2	2	180	1.55E-05	-	3.04E-04	3.67E-05
Pipehaul Tug	Diesel	-	1,200	31%	-	-	8.00E-05	2.50E-05	2	2	564	-	-	7.40E-05	2.31E-05
Total												**0.02**	**0.02**	**0.93**	**0.22**

1. Based on EPA MOVES2014b.
2. EPA MOVES2014b (Region: National).
3. Based on data provided by Blue Marlin Offshore Port, LLC.
4. Load factor from Table 3-4 of Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories, ICF International, April 2009.
5. Emission factors for engines greater than 600 hp are based on Section 3.4. Large Stationary Diesel and All Stationary Dual-fuel Engines, Tables 3.4-3 and 3.4-4. For engines less than 600 hp, emission factors are based on AP-42, Section 3.3. Gasoline and Diesel Industrial Engines, Table 3.3-2.

Table 3 - BMOP - Offshore Construction Emissions
2022 Road Construction Equipment Exhaust Hazardous Air Pollutant Emissions

Equipment Type	Fuel	Source Category[1]	Engine Rating[3] (hp)	Load Factor[1]	Pollutant Emission Factor[2] (g/hp-hr)					No. of Equipment /Day[3]	Engines per Unit[3]	Equipment Operating Duration[3]		Pollutant Emissions (tons/year)				
					Benzene	Ethyl Benzene	Formaldehyde	Hexane	Naphthalene			Hours/Day	Days/Year	Benzene	Ethyl Benzene	Formaldehyde	Hexane	Naphthalene
Air Compressors	Diesel	2270006015	100	43%	3.76E-04	3.49E-05	9.73E-03	3.78E-06	1.85E-09	12	3	8,602	1	0.01	5.12E-04	0.14	5.55E-05	2.72E-08
Air Compressors	Diesel	2270006015	80	43%	4.59E-04	4.48E-05	1.24E-02	7.43E-06	0.00E+00	9	2	1,632	1	5.12E-04	4.99E-05	0.01	8.28E-06	-
Air Compressors	Diesel	2270006015	180	43%	3.16E-04	3.26E-05	8.29E-03	3.86E-06	1.04E-08	12	2	6,109	1	3.96E-03	4.08E-04	0.10	4.83E-05	1.30E-07
Air Compressors	Diesel	2270006015	600	43%	5.22E-04	7.26E-05	1.48E-02	1.15E-05	6.95E-09	1	18	408	1	1.09E-03	1.52E-04	0.03	2.41E-05	1.45E-08
Air Compressors	Diesel	2270006015	630	43%	5.22E-04	7.26E-05	1.48E-02	1.15E-05	6.95E-09	1	3	408	1	1.91E-04	2.65E-05	0.01	4.21E-06	2.54E-09
Air Compressors	Diesel	2270006015	900	43%	5.22E-04	7.26E-05	1.48E-02	1.15E-05	6.95E-09	1	2	506	1	2.25E-04	3.13E-05	0.01	4.97E-06	3.00E-09
Air Compressors	Diesel	2270006015	900	43%	5.22E-04	7.26E-05	1.48E-02	1.15E-05	6.95E-09	1	2	616	1	2.74E-04	3.81E-05	0.01	6.06E-06	3.65E-09
Cranes	Diesel	2270002045	335	43%	3.00E-04	3.89E-05	8.33E-03	6.10E-06	1.07E-08	14	2	6,335	1	0.01	1.10E-03	0.23	1.72E-04	3.00E-07
Cranes	Diesel	2270002045	285	43%	2.13E-04	2.34E-05	5.44E-03	1.83E-06	1.25E-08	2	2	1,452	1	1.67E-04	1.83E-05	4.27E-03	1.43E-06	9.83E-09
Cranes	Diesel	2270002045	350	43%	3.00E-04	3.89E-05	8.33E-03	6.10E-06	1.07E-08	2	2	1,452	1	2.89E-04	3.75E-05	8.03E-03	5.88E-06	1.0E-08
Cranes	Diesel	2270002045	332	43%	3.00E-04	3.89E-05	8.33E-03	6.10E-06	1.07E-08	1	2	1,044	1	9.84E-05	1.28E-05	2.74E-03	2.00E-06	3.50E-09
Cranes	Diesel	2270002045	150	43%	2.65E-04	2.43E-05	6.66E-03	1.51E-06	2.23E-09	1	2	1,044	1	3.93E-05	3.60E-06	9.89E-04	2.25E-07	3.31E-10
Cranes	Diesel	2270002045	365	43%	3.00E-04	3.89E-05	8.33E-03	6.10E-06	1.07E-08	2	1	408	1	4.23E-05	5.49E-06	1.18E-03	8.61E-07	1.51E-09
Cranes	Diesel	2270002045	335	43%	3.00E-04	3.89E-05	8.33E-03	6.10E-06	1.07E-08	5	1	2,245	1	5.34E-04	6.93E-05	0.01	1.09E-05	1.90E-08
Cranes	Diesel	2270002045	335	43%	3.00E-04	3.89E-05	8.33E-03	6.10E-06	1.07E-08	2	1	768	1	7.31E-05	9.48E-06	2.03E-03	1.49E-06	2.60E-09
Generators	Diesel	2270006005	200	43%	7.61E-04	1.37E-04	2.46E-02	3.36E-05	5.90E-09	8	2	3,515	1	4.06E-03	7.32E-04	0.13	1.79E-04	3.15E-08
Generators	Diesel	2270006005	375	43%	6.16E-04	1.19E-04	1.96E-02	2.47E-05	5.78E-09	3	2	1,860	1	1.22E-03	2.35E-04	0.04	4.90E-05	1.15E-08
Generators	Diesel	2270006005	200	43%	7.61E-04	1.37E-04	2.46E-02	3.36E-05	5.90E-09	1	2	1,044	1	1.51E-04	2.72E-05	4.87E-03	6.64E-06	1.17E-09
Generators	Diesel	2270006005	180	43%	7.61E-04	1.37E-04	2.46E-02	3.36E-05	5.90E-09	17	3	1,726	1	0.01	1.03E-03	0.18	2.52E-04	4.43E-08
Generators	Diesel	2270006005	80	43%	1.07E-03	2.00E-04	3.60E-02	5.59E-05	0.00E+00	17	2	1,726	1	2.38E-03	4.44E-04	0.08	1.24E-04	-
Generators	Diesel	2270006005	250	43%	7.61E-04	1.37E-04	2.46E-02	3.36E-05	5.90E-09	2	2	600	1	2.16E-04	3.90E-05	0.01	9.55E-06	1.68E-09
Generators	Diesel	2270006005	425	43%	6.16E-04	1.19E-04	1.96E-02	2.47E-05	5.78E-09	1	2	276	1	6.85E-05	1.32E-05	2.18E-03	2.75E-06	6.42E-10
Generators	Diesel	2270006005	120	43%	8.83E-04	1.51E-04	2.79E-02	3.53E-05	1.04E-09	19	2	3,889	1	0.01	1.27E-03	0.23	2.96E-04	8.74E-09
Generators	Diesel	2270006005	1,400	43%	6.16E-04	1.19E-04	1.96E-02	2.47E-05	5.78E-09	7	2	3,013	1	0.02	3.32E-03	0.55	6.91E-04	1.62E-07
Generators	Diesel	2270006005	260	43%	7.61E-04	1.37E-04	2.46E-02	3.36E-05	5.90E-09	7	2	2,757	1	3.62E-03	6.53E-04	0.12	1.60E-04	2.81E-08
Generators	Diesel	2270006005	80	43%	1.07E-03	2.00E-04	3.60E-02	5.59E-05	0.00E+00	2	2	120	1	1.94E-05	3.63E-06	6.55E-04	1.02E-06	-
Generators	Diesel	2270006005	550	43%	6.16E-04	1.19E-04	1.96E-02	2.47E-05	5.78E-09	2	3	1,024	1	9.87E-04	1.90E-04	0.03	3.96E-05	9.25E-09
Generators	Diesel	2270006005	80	43%	1.07E-03	2.00E-04	3.60E-02	5.59E-05	0.00E+00	2	2	564	1	9.13E-05	1.71E-05	3.08E-03	4.78E-06	-
Generators	Diesel	2270006005	425	43%	6.16E-04	1.19E-04	1.96E-02	2.47E-05	5.78E-09	1	2	336	1	8.34E-05	1.61E-05	2.66E-03	3.34E-06	7.82E-10
Light Plant	Diesel	2270002027	15	43%	2.18E-03	1.84E-04	5.37E-02	4.08E-06	0.00E+00	9	1	1,344	1	1.88E-04	1.58E-05	4.62E-03	3.51E-07	-
Light Plant	Diesel	2270002027	60	43%	1.02E-03	1.63E-04	3.38E-02	5.18E-05	0.00E+00	5	1	876	1	1.27E-04	2.03E-05	4.20E-03	6.45E-06	-
Diving Equipment	Diesel	2270002081	180	59%	2.92E-04	3.15E-05	7.79E-03	4.47E-06	1.17E-08	2	1	1,200	1	8.20E-05	8.84E-06	2.19E-03	1.26E-06	3.29E-09
Anchor Winches	Diesel	2270002081	240	59%	2.92E-04	3.15E-05	7.79E-03	4.47E-06	1.17E-08	1	4	506	1	9.22E-05	9.94E-06	2.46E-03	1.41E-06	3.70E-09
AHT Winch	Diesel	2270002081	120	59%	3.44E-04	3.29E-05	9.08E-03	4.46E-06	2.13E-09	19	1	1,050	1	5.36E-04	5.13E-05	0.01	6.94E-06	3.31E-09
Anchor Winches	Diesel	2270002081	600	59%	4.47E-04	6.87E-05	1.33E-02	1.33E-05	8.79E-09	7	8	956	1	0.01	1.43E-03	0.28	2.78E-04	1.84E-07
Gantry Boom	Diesel	2270002081	335	59%	4.47E-04	6.87E-05	1.33E-02	1.33E-05	8.79E-09	7	1	2,009	1	1.37E-03	2.10E-04	0.04	4.07E-05	2.69E-08
Gantry Hoist	Diesel	2270002081	520	59%	4.47E-04	6.87E-05	1.33E-02	1.33E-05	8.79E-09	7	1	2,009	1	2.13E-03	3.27E-04	0.06	6.32E-05	4.18E-08
Gantry Swing	Diesel	2270002081	335	59%	4.47E-04	6.87E-05	1.33E-02	1.33E-05	8.79E-09	7	2	2,009	1	2.74E-03	4.21E-04	0.08	8.15E-05	5.39E-08
Line-up Station	Diesel	2270002081	120	59%	3.44E-04	3.29E-05	9.08E-03	4.46E-06	2.13E-09	2	1	792	1	4.26E-05	4.07E-06	1.12E-03	5.51E-07	2.63E-10
UT Station	Diesel	2270002081	60	59%	6.50E-04	6.22E-05	1.76E-02	1.12E-05	0.00E+00	2	1	792	1	4.02E-05	3.85E-06	1.09E-03	6.95E-07	-
Coating Station	Diesel	2270002081	60	59%	6.50E-04	6.22E-05	1.76E-02	1.12E-05	0.00E+00	2	1	792	1	4.02E-05	3.85E-06	1.09E-03	6.95E-07	-
Tug Winch	Diesel	2270002081	80	59%	4.04E-04	4.15E-05	1.14E-02	9.38E-06	0.00E+00	2	1	94	1	3.95E-06	4.06E-07	1.11E-04	9.18E-08	-
Jet Barge Anchor Winches	Diesel	2270002081	240	59%	2.92E-04	3.15E-05	7.79E-03	4.47E-06	1.17E-08	1	4	616	1	1.12E-04	1.21E-05	3.00E-03	1.72E-06	4.51E-09
Jet Barge Sled Winch	Diesel	2270002081	240	59%	2.92E-04	3.15E-05	7.79E-03	4.47E-06	1.17E-08	1	1	224	1	1.02E-05	1.10E-06	2.73E-04	1.56E-07	4.10E-10
Pumps	Diesel	2270006010	240	43%	7.63E-04	1.38E-04	2.47E-02	3.37E-05	5.97E-09	3	4	2,016	1	2.10E-03	3.79E-04	0.07	9.26E-05	1.64E-08
Pumps	Diesel	2270006010	110	43%	8.86E-04	1.51E-04	2.80E-02	3.54E-05	1.05E-09	1	3	1,314	1	1.82E-04	3.10E-05	0.01	7.27E-06	2.16E-10
Pumps	Diesel	2270006010	1,840	43%	6.18E-04	1.19E-04	1.97E-02	2.48E-05	5.83E-09	1	2	616	1	6.64E-04	1.28E-04	0.02	2.67E-05	6.26E-09

Table 3 - BMOP - Offshore Construction Emissions
2022 Road Construction Equipment Exhaust Hazardous Air Pollutant Emissions

Equipment Type	Fuel	Source Category[1]	Engine Rating[3] (hp)	Load Factor[1]	Pollutant Emission Factor[2] (g/hp-hr)					No. of Equipment /Day[3]	Engines per Unit[3]	Equipment Operating Duration[3]		Pollutant Emissions (tons/year)				
					Benzene	Ethyl Benzene	Formaldehyde	Hexane	Naphthalene			Hours/Day	Days/Year	Benzene	Ethyl Benzene	Formaldehyde	Hexane	Naphthalene
Marine Vessels[4,5]																		
Diving Support Vessel	Diesel	-	2,250	43%	2.46E-03	-	2.51E-04	-	4.13E-04	8	2	540	1	0.02	-	2.31E-03	-	3.80E-03
Lift Boat	Diesel	-	1,500	43%	2.46E-03	-	2.51E-04	-	4.13E-04	2	2	168	1	1.18E-03	-	1.20E-04	-	1.97E-04
Lift Boat	Diesel	-	1,000	43%	2.46E-03	-	2.51E-04	-	4.13E-04	1	2	72	1	1.68E-04	-	1.71E-05	-	2.82E-05
DP Nitrogen Boat	Diesel	-	3,000	43%	2.46E-03	-	2.51E-04	-	4.13E-04	1	2	408	1	2.86E-03	-	2.91E-04	-	4.79E-04
Supply Vessel	Diesel	-	1,125	43%	2.46E-03	-	2.51E-04	-	4.13E-04	17	2	3,279	1	0.15	-	0.01	-	0.02
Crew Boat	Diesel	-	1,000	45%	2.46E-03	-	2.51E-04	-	4.13E-04	17	3	3,221	1	0.20	-	0.02	-	0.03
Diving Support Vessel	Diesel	-	3,000	43%	2.46E-03	-	2.51E-04	-	4.13E-04	2	2	656	1	0.01	-	9.35E-04	-	1.54E-03
Bow Thruster	Diesel	-	950	31%	2.46E-03	-	2.51E-04	-	4.13E-04	2	2	800	1	2.56E-03	-	2.60E-04	-	4.29E-04
Stern Thruster	Diesel	-	950	31%	2.46E-03	-	2.51E-04	-	4.13E-04	2	1	800	1	1.28E-03	-	1.30E-04	-	2.14E-04
Jet Barge Anchor Handling Tug	Diesel	-	900	31%	2.46E-03	-	2.51E-04	-	4.13E-04	4	2	612	1	3.71E-03	-	3.77E-04	-	6.22E-04
Derrick Barge Anchor Handling Tug	Diesel	-	1,800	31%	2.46E-03	-	2.51E-04	-	4.13E-04	15	2	1,376	1	0.06	-	0.01	-	0.01
Crew Boat	Diesel	-	350	45%	2.96E-03	-	3.75E-03	-	2.69E-04	2	2	180	1	3.70E-04	-	4.68E-04	-	3.37E-05
Pipehaul Tug	Diesel	-	1,200	31%	2.46E-03	-	2.51E-04	-	4.13E-04	2	2	564	1	2.28E-03	-	2.32E-04	-	3.82E-04
Total														**0.54**	**0.01**	**2.60**	**<0.01**	**0.08**

1. Based on EPA MOVES2014b.
2. EPA MOVES2014b (Region: National).
3. Based on data provided by Blue Marlin Offshore Port, LLC.
4. Load factor from Table 3-4 of Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories, ICF International, April 2009.
5. Emission factors for engines greater than 600 hp are based on Section 3.4. Large Stationary Diesel and All Stationary Dual-fuel Engines, Tables 3.4-3 and 3.4-4. For engines less than 600 hp, emission factors are based on AP-42, Section 3.3. Gasoline and Diesel Industrial Engines, Table 3.3-2.

Table 3 - BMOP - Offshore Construction Emissions
2022 Non-Road Construction Equipment Exhaust Hazardous Air Pollutant Emissions (Continued)

Equipment Type	Fuel	Source Category[1]	Engine Rating[3] (hp)	Load Factor[1]	Pollutant Emission Factor[2] (g/hp-hr)				No. of Equipment /Day[3]	Engines per Unit[3]	Hours of Operation[3]	Pollutant Emissions (tons/year)			
					PAH	Propionaldehyde	Toluene	Xylenes				PAH	Propionaldehyde	Toluene	Xylenes
Air Compressors	Diesel	2270006015	100	43%	1.73E-04	8.53E-04	2.72E-04	1.08E-04	12	3	8,602	8.47E-04	4.17E-03	1.33E-03	5.27E-04
Air Compressors	Diesel	2270006015	80	43%	2.35E-04	1.16E-03	3.37E-04	1.38E-04	9	2	1,632	1.31E-04	6.49E-04	1.87E-04	7.69E-05
Air Compressors	Diesel	2270006015	180	43%	1.38E-04	7.34E-04	2.36E-04	1.15E-04	12	2	6,109	8.63E-04	4.59E-03	1.47E-03	7.18E-04
Air Compressors	Diesel	2270006015	600	43%	2.84E-04	1.23E-03	3.74E-04	2.09E-04	1	18	408	3.30E-05	1.42E-04	4.34E-05	2.42E-05
Air Compressors	Diesel	2270006015	630	43%	2.84E-04	1.23E-03	3.74E-04	2.09E-04	1	3	408	3.46E-05	1.50E-04	4.56E-05	2.54E-05
Air Compressors	Diesel	2270006015	900	43%	2.84E-04	1.23E-03	3.74E-04	2.09E-04	1	2	506	6.13E-05	2.65E-04	8.07E-05	4.50E-05
Air Compressors	Diesel	2270006015	900	43%	2.84E-04	1.23E-03	3.74E-04	2.09E-04	1	2	616	7.47E-05	3.23E-04	9.83E-05	5.48E-05
Cranes	Diesel	2270002045	335	43%	1.50E-04	7.39E-04	2.23E-04	1.30E-04	14	2	6,335	2.11E-03	0.01	3.14E-03	1.83E-03
Cranes	Diesel	2270002045	285	43%	9.16E-05	4.48E-04	1.60E-04	8.88E-05	2	2	1,452	3.59E-05	1.76E-04	6.27E-05	3.48E-05
Cranes	Diesel	2270002045	350	43%	1.50E-04	7.39E-04	2.23E-04	1.30E-04	2	2	1,452	7.21E-05	3.56E-04	1.07E-04	6.27E-05
Cranes	Diesel	2270002045	332	43%	1.50E-04	7.39E-04	2.23E-04	1.30E-04	1	2	1,044	2.46E-05	1.21E-04	3.66E-05	2.14E-05
Cranes	Diesel	2270002045	150	43%	1.21E-04	5.46E-04	1.91E-04	7.59E-05	1	2	1,044	8.99E-06	4.05E-05	1.42E-05	5.63E-06
Cranes	Diesel	2270002045	365	43%	1.50E-04	7.39E-04	2.23E-04	1.30E-04	2	1	408	2.11E-05	1.04E-04	3.15E-05	1.84E-05
Cranes	Diesel	2270002045	335	43%	1.50E-04	7.39E-04	2.23E-04	1.30E-04	5	1	2,245	2.67E-04	1.32E-03	3.97E-04	2.32E-04
Cranes	Diesel	2270002045	335	43%	1.50E-04	7.39E-04	2.23E-04	1.30E-04	2	1	768	3.65E-05	1.80E-04	5.44E-05	3.17E-05
Generators	Diesel	2270006005	200	43%	4.88E-04	2.32E-03	5.56E-04	3.91E-04	8	2	3,515	1.30E-03	0.01	1.48E-03	1.04E-03
Generators	Diesel	2270006005	375	43%	4.14E-04	1.64E-03	4.37E-04	3.23E-04	3	2	1,860	4.11E-04	1.63E-03	4.34E-04	3.20E-04
Generators	Diesel	2270006005	200	43%	4.88E-04	2.32E-03	5.56E-04	3.91E-04	1	2	1,044	4.83E-05	2.30E-04	5.50E-05	3.87E-05
Generators	Diesel	2270006005	180	43%	4.88E-04	2.32E-03	5.56E-04	3.91E-04	17	3	1,726	1.22E-03	0.01	1.39E-03	9.79E-04
Generators	Diesel	2270006005	80	43%	7.43E-04	3.65E-03	7.90E-04	5.68E-04	17	2	1,726	8.26E-04	4.06E-03	8.78E-04	6.32E-04
Generators	Diesel	2270006005	250	43%	4.88E-04	2.32E-03	5.56E-04	3.91E-04	2	2	600	6.95E-05	3.30E-04	7.91E-05	5.56E-05
Generators	Diesel	2270006005	425	43%	4.14E-04	1.64E-03	4.37E-04	3.23E-04	1	2	276	2.30E-05	9.13E-05	2.43E-05	1.79E-05
Generators	Diesel	2270006005	120	43%	5.58E-04	2.59E-03	6.38E-04	4.18E-04	19	2	3,889	2.34E-03	0.01	2.68E-03	1.76E-03
Generators	Diesel	2270006005	1,400	43%	4.14E-04	1.64E-03	4.37E-04	3.23E-04	7	2	3,013	5.80E-03	0.02	6.12E-03	4.52E-03
Generators	Diesel	2270006005	260	43%	4.88E-04	2.32E-03	5.56E-04	3.91E-04	7	2	2,757	1.16E-03	0.01	1.32E-03	9.30E-04
Generators	Diesel	2270006005	80	43%	7.43E-04	3.65E-03	7.90E-04	5.68E-04	2	2	120	6.76E-06	3.32E-05	7.19E-06	5.17E-06
Generators	Diesel	2270006005	550	43%	4.14E-04	1.64E-03	4.37E-04	3.23E-04	2	3	1,024	2.21E-04	8.77E-04	2.33E-04	1.72E-04
Generators	Diesel	2270006005	80	43%	7.43E-04	3.65E-03	7.90E-04	5.68E-04	2	2	564	3.18E-05	1.56E-04	3.38E-05	2.43E-05
Generators	Diesel	2270006005	425	43%	4.14E-04	1.64E-03	4.37E-04	3.23E-04	1	2	336	2.80E-05	1.11E-04	2.96E-05	2.18E-05
Light Plant	Diesel	2270002027	15	43%	8.85E-04	4.13E-03	1.53E-03	4.91E-04	9	1	1,344	7.61E-05	3.55E-04	1.31E-04	4.22E-05
Light Plant	Diesel	2270002027	60	43%	6.22E-04	3.69E-03	7.81E-04	4.98E-04	5	1	876	7.75E-05	4.60E-04	9.72E-05	6.20E-05
Diving Equipment	Diesel	2270002081	180	59%	1.35E-04	7.21E-04	2.20E-04	1.15E-04	2	1	1,200	3.78E-05	2.03E-04	6.19E-05	3.24E-05
Anchor Winches	Diesel	2270002081	240	59%	1.35E-04	7.21E-04	2.20E-04	1.15E-04	1	4	506	1.06E-05	5.69E-05	1.74E-05	9.10E-06
AHT Winch	Diesel	2270002081	120	59%	1.68E-04	8.30E-04	2.52E-04	1.05E-04	19	1	1,050	2.62E-04	1.29E-03	3.93E-04	1.64E-04
Anchor Winches	Diesel	2270002081	600	59%	2.69E-04	1.18E-03	3.26E-04	2.05E-04	7	8	956	7.02E-04	3.07E-03	8.51E-04	5.36E-04
Gantry Boom	Diesel	2270002081	335	59%	2.69E-04	1.18E-03	3.26E-04	2.05E-04	7	1	2,009	8.24E-04	3.61E-03	9.99E-04	6.29E-04
Gantry Hoist	Diesel	2270002081	520	59%	2.69E-04	1.18E-03	3.26E-04	2.05E-04	7	1	2,009	1.28E-03	0.01	1.55E-03	9.77E-04
Gantry Swing	Diesel	2270002081	335	59%	2.69E-04	1.18E-03	3.26E-04	2.05E-04	7	2	2,009	8.24E-04	3.61E-03	9.99E-04	6.29E-04
Line-up Station	Diesel	2270002081	120	59%	1.68E-04	8.30E-04	2.52E-04	1.05E-04	2	1	792	2.08E-05	1.03E-04	3.12E-05	1.30E-05
UT Station	Diesel	2270002081	60	59%	2.93E-04	1.61E-03	4.80E-04	1.92E-04	2	1	792	1.81E-05	9.94E-05	2.97E-05	1.19E-05
Coating Station	Diesel	2270002081	60	59%	2.93E-04	1.61E-03	4.80E-04	1.92E-04	2	1	792	1.81E-05	9.94E-05	2.97E-05	1.19E-05
Tug Winch	Diesel	2270002081	80	59%	2.24E-04	1.16E-03	3.03E-04	1.35E-04	2	1	94	2.19E-06	1.14E-05	2.96E-06	1.32E-06
Jet Barge Anchor Winches	Diesel	2270002081	240	59%	1.35E-04	7.21E-04	2.20E-04	1.15E-04	1	4	616	1.29E-05	6.93E-05	2.12E-05	1.11E-05
Jet Barge Sled Winch	Diesel	2270002081	240	59%	1.35E-04	7.21E-04	2.20E-04	1.15E-04	1	1	224	4.71E-06	2.52E-05	7.70E-06	4.03E-06
Pumps	Diesel	2270006010	240	43%	4.92E-04	2.33E-03	5.58E-04	3.92E-04	3	4	2,016	3.38E-04	1.60E-03	3.84E-04	2.70E-04
Pumps	Diesel	2270006010	110	43%	5.62E-04	2.60E-03	6.40E-04	4.19E-04	1	3	1,314	3.85E-05	1.78E-04	4.39E-05	2.87E-05
Pumps	Diesel	2270006010	1,840	43%	4.19E-04	1.65E-03	4.38E-04	3.24E-04	1	2	616	2.25E-04	8.85E-04	2.36E-04	1.74E-04

Table 3 - BMOP - Offshore Construction Emissions

2022 Non-Road Construction Equipment Exhaust Hazardous Air Pollutant Emissions (Continued)

Equipment Type	Fuel	Source Category[1]	Engine Rating[3] (hp)	Load Factor[1]	Pollutant Emission Factor[2] (g/hp-hr)				No. of Equipment /Day[3]	Engines per Unit[3]	Hours of Operation[3]	Pollutant Emissions (tons/year)			
					PAH	Propionaldehyde	Toluene	Xylenes				PAH	Propionaldehyde	Toluene	Xylenes
Marine Vessels[4,5]															
Diving Support Vessel	Diesel	-	2,250	43%	6.73E-04	-	8.92E-04	6.13E-04	8	2	540	3.10E-03	-	4.11E-03	2.8E-03
Lift Boat	Diesel	-	1,500	43%	6.73E-04	-	8.92E-04	6.13E-04	2	2	168	1.61E-04	-	2.13E-04	1.5E-04
Lift Boat	Diesel	-	1,000	43%	6.73E-04	-	8.92E-04	6.13E-04	1	2	72	2.30E-05	-	3.04E-05	2.1E-05
DP Nitrogen Boat	Diesel	-	3,000	43%	6.73E-04	-	8.92E-04	6.13E-04	1	2	408	3.91E-04	-	5.18E-04	3.6E-04
Supply Vessel	Diesel	-	1,125	43%	6.73E-04	-	8.92E-04	6.13E-04	17	2	3,279	0.02	-	0.03	0.02
Crew Boat	Diesel	-	1,000	45%	6.73E-04	-	8.92E-04	6.13E-04	17	3	3,221	0.02	-	0.02	0.02
Diving Support Vessel	Diesel	-	3,000	43%	6.73E-04	-	8.92E-04	6.13E-04	2	2	656	1.26E-03	-	1.66E-03	1.1E-03
Bow Thruster	Diesel	-	950	31%	6.73E-04	-	8.92E-04	6.13E-04	2	2	800	3.50E-04	-	4.63E-04	3.2E-04
Stern Thruster	Diesel	-	950	31%	6.73E-04	-	8.92E-04	6.13E-04	2	1	800	3.50E-04	-	4.63E-04	3.2E-04
Jet Barge Anchor Handling Tug	Diesel	-	900	31%	6.73E-04	-	8.92E-04	6.13E-04	4	2	612	5.07E-04	-	6.72E-04	4.6E-04
Derrick Barge Anchor Handling Tug	Diesel	-	1,800	31%	6.73E-04	-	8.92E-04	6.13E-04	15	2	1,376	0.01	-	0.01	0.01
Crew Boat	Diesel	-	350	45%	5.33E-04	-	1.30E-03	9.05E-04	2	2	180	3.33E-05	-	8.12E-05	5.7E-05
Pipehaul Tug	Diesel	-	1,200	31%	6.73E-04	-	8.92E-04	6.13E-04	2	2	564	3.11E-04	-	4.13E-04	2.8E-04
Total												**0.08**	**0.10**	**0.10**	**0.07**

1. Based on EPA MOVES2014b.
2. EPA MOVES2014b (Region: National).
3. Based on data provided by Blue Marlin Offshore Port, LLC.
4. Load factor from Table 3-4 of Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories, ICF International, April 2009.
5. Emission factors for engines greater than 600 hp are based on Section 3.4. Large Stationary Diesel and All Stationary Dual-fuel Engines, Tables 3.4-3 and 3.4-4. For engines less than 600 hp, emission factors are based on AP-42, Section 3.3. Gasoline and Diesel Industrial Engines, Table 3.3-2.

Table 3 - BMOP - Offshore Construction Emissions
2022 Non-Road Construction Equipment Exhaust Hazardous Air Pollutant Emissions (Continued)

Equipment Type	Fuel	Source Category[1]	Engine Rating[3] (hp)	Load Factor[1]	Pollutant Emission Factor[2] (g/hp-hr)					No. of Equipment /Day[3]	Engines per Unit[3]	Equipment Operating Duration[3]		Pollutant Emissions (tons/year)				
					Arsenic	Chromium VI	Manganese	Mercury	Nickel			Hours/Day	Days/Year	Arsenic	Chromium VI	Manganese	Mercury	Nickel
Air Compressors	Diesel	2270006015	100	43%	8.32E-07	3.27E-09	1.36E-06	1.11E-08	2.35E-06	12	3	8,602	1	4.07E-06	1.60E-08	6.65E-06	5.41E-08	1.15E-05
Air Compressors	Diesel	2270006015	80	43%	9.25E-07	3.32E-09	1.28E-06	1.23E-08	2.18E-06	9	2	1,632	1	5.15E-07	1.85E-09	7.12E-07	6.85E-09	1.21E-06
Air Compressors	Diesel	2270006015	180	43%	8.32E-07	2.62E-09	1.05E-06	1.11E-08	1.80E-06	12	2	6,109	1	5.21E-06	1.64E-08	6.54E-06	6.92E-08	1.13E-05
Air Compressors	Diesel	2270006015	600	43%	8.32E-07	3.01E-09	1.25E-06	1.11E-08	2.16E-06	1	18	408	1	9.66E-08	3.49E-10	1.45E-07	1.28E-09	2.51E-07
Air Compressors	Diesel	2270006015	630	43%	8.32E-07	3.01E-09	1.25E-06	1.11E-08	2.16E-06	1	3	408	1	1.01E-07	3.67E-10	1.52E-07	1.35E-09	2.64E-07
Air Compressors	Diesel	2270006015	900	43%	8.32E-07	3.01E-09	1.25E-06	1.11E-08	2.16E-06	1	2	506	1	1.80E-07	6.50E-10	2.69E-07	2.39E-09	4.67E-07
Air Compressors	Diesel	2270006015	900	43%	8.32E-07	3.01E-09	1.25E-06	1.11E-08	2.16E-06	1	2	616	1	2.19E-07	7.91E-10	3.28E-07	2.91E-09	5.69E-07
Cranes	Diesel	2270002045	335	43%	8.32E-07	2.65E-09	1.08E-06	1.11E-08	1.87E-06	14	2	6,335	1	1.17E-05	3.74E-08	1.52E-05	1.56E-07	2.63E-05
Cranes	Diesel	2270002045	285	43%	8.32E-07	2.47E-09	9.74E-07	1.11E-08	1.68E-06	2	2	1,452	1	3.26E-07	9.69E-10	3.82E-07	4.34E-09	6.59E-07
Cranes	Diesel	2270002045	350	43%	8.32E-07	2.65E-09	1.08E-06	1.11E-08	1.87E-06	2	2	1,452	1	4.01E-07	1.28E-09	5.19E-07	5.33E-09	8.99E-07
Cranes	Diesel	2270002045	332	43%	8.32E-07	2.65E-09	1.08E-06	1.11E-08	1.87E-06	1	2	1,044	1	1.37E-07	4.36E-10	1.77E-07	1.82E-09	3.06E-07
Cranes	Diesel	2270002045	150	43%	8.32E-07	3.24E-09	1.35E-06	1.11E-08	2.33E-06	1	2	1,044	1	6.18E-08	2.40E-10	9.99E-08	8.21E-10	1.73E-07
Cranes	Diesel	2270002045	365	43%	8.32E-07	2.65E-09	1.08E-06	1.11E-08	1.87E-06	2	1	408	1	1.17E-07	3.75E-10	1.52E-07	1.56E-09	2.63E-07
Cranes	Diesel	2270002045	335	43%	8.32E-07	2.65E-09	1.08E-06	1.11E-08	1.87E-06	5	1	2,245	1	1.48E-06	4.73E-09	1.92E-06	1.97E-08	3.32E-06
Cranes	Diesel	2270002045	335	43%	8.32E-07	2.65E-09	1.08E-06	1.11E-08	1.87E-06	2	1	768	1	2.03E-07	6.47E-10	2.63E-07	2.70E-09	4.55E-07
Generators	Diesel	2270006005	200	43%	8.32E-07	3.13E-09	1.31E-06	1.11E-08	2.27E-06	8	2	3,515	1	2.22E-06	8.34E-09	3.49E-06	2.95E-08	6.06E-06
Generators	Diesel	2270006005	375	43%	8.32E-07	3.13E-09	1.31E-06	1.11E-08	2.27E-06	3	2	1,860	1	8.25E-07	3.10E-09	1.30E-06	1.10E-08	2.25E-06
Generators	Diesel	2270006005	200	43%	8.32E-07	3.13E-09	1.31E-06	1.11E-08	2.27E-06	1	2	1,044	1	8.24E-08	3.10E-10	1.30E-07	1.09E-09	2.25E-07
Generators	Diesel	2270006005	180	43%	8.32E-07	3.13E-09	1.31E-06	1.11E-08	2.27E-06	17	3	1,726	1	2.08E-06	7.83E-09	3.28E-06	2.77E-08	5.69E-06
Generators	Diesel	2270006005	80	43%	9.25E-07	3.74E-09	1.54E-06	1.23E-08	2.66E-06	17	2	1,726	1	1.03E-06	4.17E-09	1.71E-06	1.37E-08	2.95E-06
Generators	Diesel	2270006005	250	43%	8.32E-07	3.13E-09	1.31E-06	1.11E-08	2.27E-06	2	2	600	1	1.18E-07	4.45E-10	1.86E-07	1.57E-09	3.23E-07
Generators	Diesel	2270006005	425	43%	8.32E-07	3.13E-09	1.31E-06	1.11E-08	2.27E-06	1	2	276	1	4.63E-08	1.74E-10	7.28E-08	6.15E-10	1.26E-07
Generators	Diesel	2270006005	120	43%	8.32E-07	3.52E-09	1.50E-06	1.11E-08	2.60E-06	19	2	3,889	1	3.50E-06	1.48E-08	6.30E-06	4.65E-08	1.09E-05
Generators	Diesel	2270006005	1,400	43%	8.32E-07	3.13E-09	1.31E-06	1.11E-08	2.27E-06	7	2	3,013	1	1.16E-05	4.38E-08	1.83E-05	1.55E-07	3.18E-05
Generators	Diesel	2270006005	260	43%	8.32E-07	3.13E-09	1.31E-06	1.11E-08	2.27E-06	7	2	2,757	1	1.98E-06	7.44E-09	3.12E-06	2.63E-08	5.41E-06
Generators	Diesel	2270006005	80	43%	9.25E-07	3.74E-09	1.54E-06	1.23E-08	2.66E-06	2	2	120	1	8.42E-09	3.41E-11	1.40E-08	1.12E-10	2.42E-08
Generators	Diesel	2270006005	550	43%	8.32E-07	3.13E-09	1.31E-06	1.11E-08	2.27E-06	2	3	1,024	1	4.44E-07	1.67E-09	6.99E-07	5.91E-09	1.21E-06
Generators	Diesel	2270006005	80	43%	9.25E-07	3.74E-09	1.54E-06	1.23E-08	2.66E-06	2	2	564	1	3.96E-08	1.60E-10	6.58E-08	5.26E-10	1.14E-07
Generators	Diesel	2270006005	425	43%	8.32E-07	3.13E-09	1.31E-06	1.11E-08	2.27E-06	1	2	336	1	5.63E-08	2.12E-10	8.87E-08	7.49E-10	1.54E-07
Light Plant	Diesel	2270002027	15	43%	9.25E-07	4.47E-09	1.99E-06	1.23E-08	3.48E-06	9	1	1,344	1	7.96E-08	3.84E-10	1.71E-07	1.06E-09	2.99E-07
Light Plant	Diesel	2270002027	60	43%	9.25E-07	3.77E-09	1.52E-06	1.23E-08	2.62E-06	5	1	876	1	1.15E-07	4.70E-10	1.90E-07	1.53E-09	3.26E-07
Diving Equipment	Diesel	2270002081	180	59%	8.41E-07	2.57E-09	1.03E-06	1.12E-08	1.77E-06	2	1	1,200	1	2.36E-07	7.23E-10	2.89E-07	3.14E-09	4.98E-07
Anchor Winches	Diesel	2270002081	240	59%	8.41E-07	2.57E-09	1.03E-06	1.12E-08	1.77E-06	1	4	506	1	6.64E-08	2.03E-10	8.11E-08	8.83E-10	1.40E-07
AHT Winch	Diesel	2270002081	120	59%	8.41E-07	3.33E-09	1.40E-06	1.12E-08	2.42E-06	19	1	1,050	1	1.31E-06	5.19E-09	2.17E-06	1.74E-08	3.77E-06
Anchor Winches	Diesel	2270002081	600	59%	8.41E-07	2.91E-09	1.21E-06	1.12E-08	2.10E-06	7	8	956	1	2.20E-06	7.61E-09	3.16E-06	2.92E-08	5.49E-06
Gantry Boom	Diesel	2270002081	335	59%	8.41E-07	2.91E-09	1.21E-06	1.12E-08	2.10E-06	7	1	2,009	1	2.58E-06	8.93E-09	3.71E-06	3.43E-08	6.44E-06
Gantry Hoist	Diesel	2270002081	520	59%	8.41E-07	2.91E-09	1.21E-06	1.12E-08	2.10E-06	7	1	2,009	1	4.00E-06	1.39E-08	5.76E-06	5.32E-08	9.99E-06
Gantry Swing	Diesel	2270002081	335	59%	8.41E-07	2.91E-09	1.21E-06	1.12E-08	2.10E-06	7	2	2,009	1	2.58E-06	8.93E-09	3.71E-06	3.43E-08	6.44E-06
Line-up Station	Diesel	2270002081	120	59%	8.41E-07	3.33E-09	1.40E-06	1.12E-08	2.42E-06	2	1	792	1	1.04E-07	4.12E-10	1.73E-07	1.38E-09	2.99E-07
UT Station	Diesel	2270002081	60	59%	9.34E-07	3.55E-09	1.37E-06	1.24E-08	2.33E-06	2	1	792	1	5.77E-08	2.20E-10	8.46E-08	7.68E-10	1.44E-07
Coating Station	Diesel	2270002081	60	59%	9.34E-07	3.55E-09	1.37E-06	1.24E-08	2.33E-06	2	1	792	1	5.77E-08	2.20E-10	8.46E-08	7.68E-10	1.44E-07
Tug Winch	Diesel	2270002081	80	59%	9.34E-07	3.26E-09	1.24E-06	1.24E-08	2.11E-06	2	1	94	1	9.14E-09	3.19E-11	1.21E-08	1.21E-10	2.06E-08
Jet Barge Anchor Winches	Diesel	2270002081	240	59%	8.41E-07	2.57E-09	1.03E-06	1.12E-08	1.77E-06	1	4	616	1	8.09E-08	2.47E-10	9.87E-08	1.08E-09	1.71E-07
Jet Barge Sled Winch	Diesel	2270002081	240	59%	8.41E-07	2.57E-09	1.03E-06	1.12E-08	1.77E-06	1	1	224	1	2.94E-08	9.00E-11	3.59E-08	3.91E-10	6.20E-08
Pumps	Diesel	2270006010	240	43%	8.32E-07	3.13E-09	1.31E-06	1.11E-08	2.27E-06	3	4	2,016	1	5.73E-07	2.15E-09	9.02E-07	7.61E-09	1.56E-06
Pumps	Diesel	2270006010	110	43%	8.32E-07	3.52E-09	1.50E-06	1.11E-08	2.60E-06	1	3	1,314	1	5.70E-08	2.41E-10	1.03E-07	7.58E-10	1.78E-07
Pumps	Diesel	2270006010	1,840	43%	8.32E-07	3.13E-09	1.31E-06	1.11E-08	2.27E-06	1	2	616	1	4.47E-07	1.68E-09	7.04E-07	5.94E-09	1.22E-06

Table 3 - BMOP - Offshore Construction Emissions
2022 Non-Road Construction Equipment Exhaust Hazardous Air Pollutant Emissions (Continued)

Equipment Type	Fuel	Source Category[1]	Engine Rating[3] (hp)	Load Factor[1]	Pollutant Emission Factor[2] (g/hp-hr)					No. of Equipment /Day[3]	Engines per Unit[3]	Equipment Operating Duration[3]		Pollutant Emissions (tons/year)				
					Arsenic	Chromium VI	Manganese	Mercury	Nickel			Hours/Day	Days/Year	Arsenic	Chromium VI	Manganese	Mercury	Nickel
Marine Vessels[4,5]																		
Diving Support Vessel	Diesel	-	2,250	43%	-	-	-	-	-	8	2	540	1	-	-	-	-	-
Lift Boat	Diesel	-	1,500	43%	-	-	-	-	-	2	2	168	1	-	-	-	-	-
Lift Boat	Diesel	-	1,000	43%	-	-	-	-	-	1	2	72	1	-	-	-	-	-
DP Nitrogen Boat	Diesel	-	3,000	43%	-	-	-	-	-	1	2	408	1	-	-	-	-	-
Supply Vessel	Diesel	-	1,125	43%	-	-	-	-	-	17	2	3,279	1	-	-	-	-	-
Crew Boat	Diesel	-	1,000	45%	-	-	-	-	-	17	3	3,221	1	-	-	-	-	-
Diving Support Vessel	Diesel	-	3,000	43%	-	-	-	-	-	2	2	656	1	-	-	-	-	-
Bow Thruster	Diesel	-	950	31%	-	-	-	-	-	2	2	800	1	-	-	-	-	-
Stern Thruster	Diesel	-	950	31%	-	-	-	-	-	2	1	800	1	-	-	-	-	-
Jet Barge Anchor Handling Tug	Diesel	-	900	31%	-	-	-	-	-	4	2	612	1	-	-	-	-	-
Derrick Barge Anchor Handling Tug	Diesel	-	1,800	31%	-	-	-	-	-	15	2	1,376	1	-	-	-	-	-
Crew Boat	Diesel	-	350	45%	-	-	-	-	-	2	2	180	1	-	-	-	-	-
Pipehaul Tug	Diesel	-	1,200	31%	-	-	-	-	-	2	2	564	1	-	-	-	-	-
Total														<0.01	<0.01	<0.01	<0.01	<0.01

1. Based on EPA MOVES2014b.
2. EPA MOVES2014b (Region: National).
3. Based on data provided by Blue Marlin Offshore Port, LLC.
4. Load factor from Table 3-4 of Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories, ICF International, April 2009.
5. Emission factors for engines greater than 600 hp are based on Section 3.4. Large Stationary Diesel and All Stationary Dual-fuel Engines, Tables 3.4-3 and 3.4-4. For engines less than 600 hp, emission factors are based on AP-42, Section 3.3. Gasoline and Diesel Industrial Engines, Table 3.3-2.

Table 4 - BMOP - Offshore Construction Emissions
2024 Non-Road Construction Equipment Exhaust Criteria Pollutant Emissions

Equipment Type	Fuel	Source Category[1]	Engine Rating[3] (hp)	Load Factor[1]	Pollutant Emission Factor[2] (g/hp-hr)						No. of Equipment/ Day[3]	Engines per Unit[3]	Hours of Operation[3]	Pollutant Emissions (tons/year)					
					CO	NO_x	SO_2	VOC	PM_{10}	$PM_{2.5}$				CO	NO_x	SO_2	VOC	PM_{10}	$PM_{2.5}$
Air Compressors	Diesel	2270006015	100	43%	0.20	0.91	0.004	0.01	0.05	0.05	0	0	0	-	-	-	-	-	-
Air Compressors	Diesel	2270006015	80	43%	0.51	1.54	0.004	0.01	0.09	0.09	1	1	990	0.02	0.06	1.55E-04	2.65E-04	3.33E-03	3.23E-03
Air Compressors	Diesel	2270006015	180	43%	0.15	0.66	0.004	0.005	0.03	0.03	0	0	0	-	-	-	-	-	-
Air Compressors	Diesel	2270006015	600	43%	0.41	1.47	0.004	0.01	0.07	0.06	2	2	1,512	0.71	2.53	0.01	0.02	0.11	0.11
Air Compressors	Diesel	2270006015	630	43%	0.41	1.47	0.004	0.01	0.07	0.06	0	0	0	-	-	-	-	-	-
Air Compressors	Diesel	2270006015	900	43%	0.41	1.47	0.004	0.01	0.07	0.06	0	0	0	-	-	-	-	-	-
Air Compressors	Diesel	2270006015	900	43%	0.41	1.47	0.004	0.01	0.07	0.06	0	0	0	-	-	-	-	-	-
Cranes	Diesel	2270002045	335	43%	0.22	0.90	0.004	0.01	0.04	0.03	1	2	660	0.05	0.19	7.86E-04	1.12E-03	0.01	0.01
Cranes	Diesel	2270002045	285	43%	0.10	0.40	0.004	0.003	0.02	0.02	1	2	924	0.02	0.10	9.03E-04	8.06E-04	0.01	0.01
Cranes	Diesel	2270002045	350	43%	0.22	0.90	0.004	0.01	0.04	0.03	1	2	924	6.85E-02	2.77E-01	1.15E-03	1.63E-03	1.10E-02	1.07E-02
Cranes	Diesel	2270002045	332	43%	0.22	0.90	0.004	0.01	0.04	0.03	0	0	0	-	-	-	-	-	-
Cranes	Diesel	2270002045	150	43%	0.15	0.61	0.004	0.004	0.04	0.04	0	0	0	-	-	-	-	-	-
Cranes	Diesel	2270002045	365	43%	0.22	0.90	0.004	0.01	0.04	0.03	0	0	0	-	-	-	-	-	-
Cranes	Diesel	2270002045	335	43%	0.22	0.90	0.004	0.01	0.04	0.03	1	1	588	0.02	0.08	3.50E-04	4.97E-04	3.36E-03	3.26E-03
Cranes	Diesel	2270002045	335	43%	0.22	0.90	0.004	0.01	0.04	0.03	0	0	0	-	-	-	-	-	-
Generators	Diesel	2270006005	200	43%	0.55	2.07	0.004	0.02	0.11	0.11	2	3	317	0.10	0.37	7.38E-04	3.39E-03	0.02	0.02
Generators	Diesel	2270006005	375	43%	0.61	2.06	0.004	0.01	0.09	0.09	0	0	0	-	-	-	-	-	-
Generators	Diesel	2270006005	200	43%	0.55	2.07	0.004	0.02	0.11	0.11	2	2	660	0.14	0.52	1.02E-03	4.70E-03	0.03	0.03
Generators	Diesel	2270006005	180	43%	0.55	2.07	0.004	0.02	0.11	0.11	1	2	588	0.06	0.21	4.11E-04	1.89E-03	0.01	0.01
Generators	Diesel	2270006005	80	43%	1.32	2.89	0.005	0.03	0.23	0.22	1	2	588	0.06	0.13	2.04E-04	1.24E-03	0.01	0.01
Generators	Diesel	2270006005	250	43%	0.55	2.07	0.004	0.02	0.11	0.11	0	0	0	-	-	-	-	-	-
Generators	Diesel	2270006005	425	43%	0.61	2.06	0.004	0.01	0.09	0.09	0	0	0	-	-	-	-	-	-
Generators	Diesel	2270006005	120	43%	0.63	2.36	0.004	0.02	0.14	0.13	0	0	0	-	-	-	-	-	-
Generators	Diesel	2270006005	1,400	43%	0.61	2.06	0.004	0.01	0.09	0.09	1	2	924	0.74	2.53	0.01	0.02	0.11	0.11
Generators	Diesel	2270006005	260	43%	0.55	2.07	0.004	0.02	0.11	0.11	0	0	0	-	-	-	-	-	-
Generators	Diesel	2270006005	80	43%	1.32	2.89	0.005	0.03	0.23	0.22	0	0	0	-	-	-	-	-	-
Generators	Diesel	2270006005	550	43%	0.61	2.06	0.004	0.01	0.09	0.09	0	0	0	-	-	-	-	-	-
Generators	Diesel	2270006005	80	43%	1.32	2.89	0.005	0.03	0.23	0.22	2	2	168	0.03	0.07	1.16E-04	7.08E-04	0.01	0.01
Generators	Diesel	2270006005	425	43%	0.61	2.06	0.004	0.01	0.09	0.09	2	2	317	0.16	0.53	1.05E-03	3.80E-03	0.02	0.02
Light Plant	Diesel	2270002027	15	43%	1.52	3.79	0.005	0.04	0.18	0.17	0	0	0	-	-	-	-	-	-
Light Plant	Diesel	2270002027	60	43%	0.99	3.41	0.004	0.02	0.16	0.16	5	1	660	0.09	0.32	4.12E-04	2.23E-03	0.02	0.01
Diving equipment	Diesel	2270002081	180	59%	0.19	0.60	0.004	0.005	0.04	0.04	0	0	0	-	-	-	-	-	-
Anchor Winches	Diesel	2270002081	240	59%	0.19	0.60	0.004	0.005	0.04	0.04	0	0	0	-	-	-	-	-	-
AHT Winch	Diesel	2270002081	120	59%	0.25	0.80	0.004	0.01	0.06	0.06	2	1	61	2.41E-03	0.01	3.55E-05	5.05E-05	5.82E-04	5.65E-04
Anchor Winches	Diesel	2270002081	600	59%	0.53	1.35	0.004	0.01	0.08	0.07	1	8	49	0.08	0.21	5.98E-04	1.31E-03	0.01	0.01
Gantry Boom	Diesel	2270002081	335	59%	0.53	1.35	0.004	0.01	0.08	0.07	1	1	392	0.05	0.12	3.34E-04	7.32E-04	0.01	0.01
Gantry Hoist	Diesel	2270002081	520	59%	0.53	1.35	0.004	0.01	0.08	0.07	1	1	392	0.07	0.18	5.18E-04	1.14E-03	0.01	0.01
Gantry Swing	Diesel	2270002081	335	59%	0.53	1.35	0.004	0.01	0.08	0.07	1	2	392	0.09	0.23	6.68E-04	1.46E-03	0.01	0.01
Line-up Station	Diesel	2270002081	120	59%	0.25	0.80	0.004	0.01	0.06	0.06	0	0	0	-	-	-	-	-	-
UT Station	Diesel	2270002081	60	59%	0.63	2.79	0.004	0.01	0.08	0.07	0	0	0	-	-	-	-	-	-
Coating Station	Diesel	2270002081	60	59%	0.63	2.79	0.004	0.01	0.08	0.07	0	0	0	-	-	-	-	-	-
Tug Winch	Diesel	2270002081	80	59%	0.64	1.45	0.004	0.01	0.10	0.10	0	0	0	-	-	-	-	-	-
Jet Barge Anchor Winches	Diesel	2270002081	240	59%	0.19	0.60	0.004	0.005	0.04	0.04	0	0	0	-	-	-	-	-	-
Jet Barge Sled Winch	Diesel	2270002081	240	59%	0.19	0.60	0.004	0.005	0.04	0.04	0	0	0	-	-	-	-	-	-
Pumps	Diesel	2270006010	240	43%	0.56	2.07	0.004	0.02	0.11	0.11	0	0	0	-	-	-	-	-	-
Pumps	Diesel	2270006010	110	43%	0.64	2.36	0.004	0.02	0.14	0.14	0	0	0	-	-	-	-	-	-
Pumps	Diesel	2270006010	1,840	43%	0.61	2.06	0.004	0.01	0.10	0.09	1	3	990	1.59	5.35	0.01	0.04	0.25	0.24

Table 4 - BMOP - Offshore Construction Emissions
2024 Non-Road Construction Equipment Exhaust Criteria Pollutant Emissions

Equipment Type	Fuel	Source Category[1]	Engine Rating[3] (hp)	Load Factor[1]	Pollutant Emission Factor[2] (g/hp-hr)						No. of Equipment/ Day[3]	Engines per Unit[3]	Hours of Operation[3]	Pollutant Emissions (tons/year)					
					CO	NO_x	SO_2	VOC	PM_{10}	$PM_{2.5}$				CO	NO_x	SO_2	VOC	PM_{10}	$PM_{2.5}$
Marine Vessels[4,5]																			
Diving Support Vessel	Diesel	-	2,250	43%	0.82	9.84	0.005	0.37	0.54	0.54	0	0	0	-	-	-	-	-	-
Lift Boat	Diesel	-	1,500	43%	0.82	9.84	0.005	0.37	0.54	0.54	1	2	72	0.08	1.01	5.0E-04	0.04	0.05	0.05
Lift Boat	Diesel	-	1,000	43%	1.86	9.69	0.005	0.20	0.22	0.22	0	0	0	-	-	-	-	-	-
DP Nitrogen Boat	Diesel	-	3,000	43%	0.82	9.84	0.005	0.37	0.54	0.54	0	0	0	-	-	-	-	-	-
Supply Vessel	Diesel	-	1,125	43%	1.86	9.69	0.005	0.20	0.22	0.22	2	2	634	2.52	13.11	0.01	0.27	0.30	0.30
Crew Boat	Diesel	-	1,000	45%	1.86	9.69	0.005	0.20	0.22	0.22	2	3	634	3.52	18.29	0.01	0.38	0.42	0.42
Diving Support Vessel	Diesel	-	3,000	43%	0.82	9.84	0.005	0.37	0.54	0.54	0	0	0	-	-	-	-	-	-
Bow Thruster	Diesel	-	950	31%	1.86	9.69	0.005	0.20	0.22	0.22	0	0	0	-	-	-	-	-	-
Stern Thruster	Diesel	-	950	31%	1.86	9.69	0.005	0.20	0.22	0.22	2	2	61	0.15	0.77	3.8E-04	0.02	0.02	0.02
Jet Barge Anchor Handling Tug	Diesel	-	900	31%	1.86	9.69	0.005	0.20	0.22	0.22	2	2	252	0.58	3.01	1.50E-03	0.06	0.07	0.07
Derrick Barge Anchor Handling Tug	Diesel	-	1,800	31%	0.82	9.84	0.005	0.37	0.54	0.54	0	0	0	-	-	-	-	-	-
Crew Boat	Diesel	-	350	45%	1.12	7.46	0.005	0.20	0.22	0.22	0	0	0	-	-	-	-	-	-
Pipehaul Tug	Diesel	-	1,200	31%	1.86	9.69	0.005	0.20	0.22	0.22	0	0	0	-	-	-	-	-	-
Total														**11.00**	**50.18**	**0.05**	**0.87**	**1.53**	**1.51**

1. Based on EPA MOVES2014b.
2. EPA MOVES2014b (Region: National).
3. Based on data provided by Blue Marlin Offshore Port, LLC.
4. Load factor from Table 3-4 of Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories, ICF International, April 2009. A fuel correction factor of 0.005 was applied to SO_2 emission factors (Ultra Low Sulfur Diesel) per Table 3-9 of Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories, ICF International, April 2009.
5. Tier 0 emission factors from Tables 3-8 of Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories, ICF International, April 2009.

Table 5 - BMOP - Offshore Construction Emissions
2024 Non-Road Construction Equipment Exhaust Greenhouse Gas Emissions

Equipment Type	Fuel	Source Category[1]	Engine Rating[3] (hp)	Load Factor[1]	Pollutant Emission Factor[2] (g/hp-hr)			No. of Equipment/Day[3]	Engines per Unit[3]	Hours of Operation[3]	Pollutant Emissions (tons/year)			
					CO_2	CH_4	N_2O[6]				CO_2	CH_4	N_2O	CO_2e[7]
Air Compressors	Diesel	2270006015	100	43%	530.90	4.47E-04	0.02	0	0	0	-	-	-	-
Air Compressors	Diesel	2270006015	80	43%	590.19	0.001	0.03	1	1	990	22	2.05E-05	1.02E-03	22
Air Compressors	Diesel	2270006015	180	43%	530.92	4.04E-04	0.02	0	0	0	-	-	-	-
Air Compressors	Diesel	2270006015	600	43%	530.79	0.001	0.02	2	2	1,512	913	0.001	0.04	926
Air Compressors	Diesel	2270006015	630	43%	530.79	0.001	0.02	0	0	0	-	-	-	-
Air Compressors	Diesel	2270006015	900	43%	530.79	0.001	0.02	0	0	0	-	-	-	-
Air Compressors	Diesel	2270006015	900	43%	530.79	0.001	0.02	0	0	0	-	-	-	-
Cranes	Diesel	2270002045	335	43%	530.90	3.76E-04	0.02	1	2	660	111	7.88E-05	0.01	113
Cranes	Diesel	2270002045	285	43%	530.96	2.60E-04	0.02	1	2	924	133	6.50E-05	0.01	134
Cranes	Diesel	2270002045	350	43%	530.90	3.76E-04	0.02	1	2	924	162.8	1.15E-04	7.48E-03	165
Cranes	Diesel	2270002045	332	43%	530.90	3.76E-04	0.02	0	0	0	-	-	-	-
Cranes	Diesel	2270002045	150	43%	530.95	3.07E-04	0.02	0	0	0	-	-	-	-
Cranes	Diesel	2270002045	365	43%	530.90	3.76E-04	0.02	0	0	0	-	-	-	-
Cranes	Diesel	2270002045	335	43%	530.90	3.76E-04	0.02	1	1	588	50	3.51E-05	2.28E-03	50
Cranes	Diesel	2270002045	335	43%	530.90	3.76E-04	0.02	0	0	0	-	-	-	-
Generators	Diesel	2270006005	200	43%	530.56	0.001	0.02	2	3	317	96	1.62E-04	4.39E-03	97
Generators	Diesel	2270006005	375	43%	530.66	0.001	0.02	0	0	0	-	-	-	-
Generators	Diesel	2270006005	200	43%	530.56	0.001	0.02	2	2	660	133	2.25E-04	0.01	135
Generators	Diesel	2270006005	180	43%	530.56	0.001	0.02	1	2	588	53	9.03E-05	2.45E-03	54
Generators	Diesel	2270006005	80	43%	589.65	0.001	0.03	1	2	588	26	5.21E-05	1.21E-03	27
Generators	Diesel	2270006005	250	43%	530.56	0.001	0.02	0	0	0	-	-	-	-
Generators	Diesel	2270006005	425	43%	530.66	0.001	0.02	0	0	0	-	-	-	-
Generators	Diesel	2270006005	120	43%	530.50	0.001	0.02	0	0	0	-	-	-	-
Generators	Diesel	2270006005	1,400	43%	530.66	0.001	0.02	1	2	924	651	9.08E-04	0.03	660
Generators	Diesel	2270006005	260	43%	530.56	0.001	0.02	0	0	0	-	-	-	-
Generators	Diesel	2270006005	80	43%	589.65	0.001	0.03	0	0	0	-	-	-	-
Generators	Diesel	2270006005	550	43%	530.66	0.001	0.02	0	0	0	-	-	-	-
Generators	Diesel	2270006005	80	43%	589.65	0.001	0.03	2	2	168	15	2.98E-05	6.90E-04	15
Generators	Diesel	2270006005	425	43%	530.66	0.001	0.02	2	2	317	136	1.89E-04	0.01	137
Light Plant	Diesel	2270002027	15	43%	589.33	0.004	0.03	0	0	0	-	-	-	-
Light Plant	Diesel	2270002027	60	43%	589.74	0.002	0.03	5	1	660	55	1.41E-04	2.54E-03	56
Diving equipment	Diesel	2270002081	180	59%	536.71	3.70E-04	0.02	0	0	0	-	-	-	-
Anchor Winches	Diesel	2270002081	240	59%	536.71	3.70E-04	0.02	0	0	0	-	-	-	-
AHT Winch	Diesel	2270002081	120	59%	536.69	4.15E-04	0.02	2	1	61	5	3.95E-06	2.35E-04	5
Anchor Winches	Diesel	2270002081	600	59%	536.61	4.75E-04	0.02	1	8	49	82	7.27E-05	3.77E-03	83
Gantry Boom	Diesel	2270002081	335	59%	536.61	4.75E-04	0.02	1	1	392	46	4.06E-05	2.11E-03	46
Gantry Hoist	Diesel	2270002081	520	59%	536.61	4.75E-04	0.02	1	1	392	71	6.30E-05	3.27E-03	72
Gantry Swing	Diesel	2270002081	335	59%	536.61	4.75E-04	0.02	1	2	392	92	8.12E-05	4.21E-03	93
Line-up Station	Diesel	2270002081	120	59%	536.69	4.15E-04	0.02	0	0	0	-	-	-	-
UT Station	Diesel	2270002081	60	59%	595.85	0.001	0.03	0	0	0	-	-	-	-
Coating Station	Diesel	2270002081	60	59%	595.85	0.001	0.03	0	0	0	-	-	-	-
Tug Winch	Diesel	2270002081	80	59%	595.99	4.76E-04	0.03	0	0	0	-	-	-	-
Jet Barge Anchor Winches	Diesel	2270002081	240	59%	536.71	3.70E-04	0.02	0	0	0	-	-	-	-
Jet Barge Sled Winch	Diesel	2270002081	240	59%	536.71	3.70E-04	0.02	0	0	0	-	-	-	-
Pumps	Diesel	2270006010	240	43%	530.55	0.001	0.02	0	0	0	-	-	-	-
Pumps	Diesel	2270006010	110	43%	530.50	0.001	0.02	0	0	0	-	-	-	-
Pumps	Diesel	2270006010	1,840	43%	530.65	0.001	0.02	1	3	990	1,375	1.92E-03	0.06	1,393

Table 5 - BMOP - Offshore Construction Emissions
2024 Non-Road Construction Equipment Exhaust Greenhouse Gas Emissions

Equipment Type	Fuel	Source Category[1]	Engine Rating[3] (hp)	Load Factor[1]	Pollutant Emission Factor[2] (g/hp-hr)			No. of Equipment/Day[3]	Engines per Unit[3]	Hours of Operation[3]	Pollutant Emissions (tons/year)			
					CO_2	CH_4	N_2O[6]				CO_2	CH_4	N_2O	CO_2e[7]
Marine Vessels[4,5]														
Diving Support Vessel	Diesel	-	2,250	43%	514.54	0.07	0.01	0	0	0	-	-	-	-
Lift Boat	Diesel	-	1,500	43%	514.54	0.07	0.01	1	2	72	53	0.01	1.53E-03	53
Lift Boat	Diesel	-	1,000	43%	514.54	0.07	0.01	0	0	0	-	-	-	-
DP Nitrogen Boat	Diesel	-	3,000	43%	514.54	0.07	0.01	0	0	0	-	-	-	-
Supply Vessel	Diesel	-	1,125	43%	514.54	0.07	0.01	2	2	634	696	0.09	0.02	704
Crew Boat	Diesel	-	1,000	45%	514.54	0.07	0.01	2	3	634	971	0.13	0.03	982
Diving Support Vessel	Diesel	-	3,000	43%	514.54	0.07	0.01	0	0	0	-	-	-	-
Bow Thruster	Diesel	-	950	31%	514.54	0.07	0.01	0	0	0	-	-	-	-
Stern Thruster	Diesel	-	950	31%	514.54	0.07	0.01	2	2	61	41	0.01	1.18E-03	41
Jet Barge Anchor Handling Tug	Diesel	-	900	31%	514.54	0.07	0.01	2	2	252	160	0.02	4.62E-03	161
Derrick Barge Anchor Handling Tug	Diesel	-	1,800	31%	514.54	0.07	0.01	0	0	0	-	-	-	-
Crew Boat	Diesel	-	350	45%	514.54	0.07	0.01	0	0	0	-	-	-	-
Pipehaul Tug	Diesel	-	1,200	31%	514.54	0.07	0.01	0	0	0	-	-	-	-
Total											**6,146**	**0.26**	**0.25**	**6,227**

1. Based on EPA MOVES2014b.
2. EPA MOVES2014b (Region: National).
3. Based on data provided by Blue Marlin Offshore Port, LLC.
4. Load factor from Table 3-4 of Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories, ICF International, April 2009.
5. Tier 0 emission factors from Tables 3-8 of Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories, ICF International, April 2009.
6. 2020 Climate Registry Default Emission Factors, Released: April 2020, Tables 2.1 and 2.7, ratioed based on CO_2 emission factor from EPA MOVES2014b. https://www.theclimateregistry.org/wp-content/uploads/2020/04/The-Climate-Registry-2020-Default-Emission-Factor-Document.pdf
7. The global warming potentials of CO_2, CH_4, and N_2O are assumed to be 1, 25, and 298, respectively.

Table 6 - BMOP - Offshore Construction Emissions
2024 Non-Road Construction Equipment Exhaust Hazardous Air Pollutant Emissions

Equipment Type	Fuel	Source Category[1]	Engine Rating[3] (hp)	Load Factor[1]	Pollutant Emission Factor[2] (g/hp-hr)				No. of Equipment/Day[3]	Engines per Unit[3]	Hours of Operation[3]	Pollutant Emissions (tons/year)			
					1,3-Butadiene	2,2,4-Trimethylpentane	Acetaldehyde	Acrolein				1,3-Butadiene	2,2,4-Trimethylpentane	Acetaldehyde	Acrolein
Air Compressors	Diesel	2270006015	100	43%	4.47E-05	4.22E-05	2.45E-03	4.44E-04	0	0	0	-	-	-	-
Air Compressors	Diesel	2270006015	80	43%	5.82E-05	5.39E-05	3.10E-03	5.69E-04	1	1	990	2.18E-06	2.02E-06	1.17E-04	2.14E-05
Air Compressors	Diesel	2270006015	180	43%	3.69E-05	3.62E-05	2.08E-03	3.71E-04	0	0	0	-	-	-	-
Air Compressors	Diesel	2270006015	600	43%	7.83E-05	7.47E-05	4.07E-03	8.81E-04	2	2	1,512	1.35E-04	1.29E-04	0.01	1.52E-03
Air Compressors	Diesel	2270006015	630	43%	7.83E-05	7.47E-05	4.07E-03	8.81E-04	0	0	0	-	-	-	-
Air Compressors	Diesel	2270006015	900	43%	7.83E-05	7.47E-05	4.07E-03	8.81E-04	0	0	0	-	-	-	-
Air Compressors	Diesel	2270006015	900	43%	7.83E-05	7.47E-05	4.07E-03	8.81E-04	0	0	0	-	-	-	-
Cranes	Diesel	2270002045	335	43%	4.07E-05	3.98E-05	2.21E-03	4.29E-04	1	2	660	8.54E-06	8.33E-06	4.63E-04	8.99E-05
Cranes	Diesel	2270002045	285	43%	2.27E-05	2.35E-05	1.35E-03	2.35E-04	1	2	924	5.67E-06	5.88E-06	3.38E-04	5.88E-05
Cranes	Diesel	2270002045	350	43%	4.07E-05	3.98E-05	2.21E-03	4.29E-04	1	2	924	1.25E-05	1.22E-05	6.77E-04	1.32E-04
Cranes	Diesel	2270002045	332	43%	4.07E-05	3.98E-05	2.21E-03	4.29E-04	0	0	0	-	-	-	-
Cranes	Diesel	2270002045	150	43%	2.84E-05	2.73E-05	1.61E-03	2.87E-04	0	0	0	-	-	-	-
Cranes	Diesel	2270002045	365	43%	4.07E-05	3.98E-05	2.21E-03	4.29E-04	0	0	0	-	-	-	-
Cranes	Diesel	2270002045	335	43%	4.07E-05	3.98E-05	2.21E-03	4.29E-04	1	1	588	3.80E-06	3.71E-06	2.06E-04	4.01E-05
Cranes	Diesel	2270002045	335	43%	4.07E-05	3.98E-05	2.21E-03	4.29E-04	0	0	0	-	-	-	-
Generators	Diesel	2270006005	200	43%	1.55E-04	1.45E-04	7.44E-03	1.81E-03	2	3	317	2.79E-05	2.61E-05	1.34E-03	3.27E-04
Generators	Diesel	2270006005	375	43%	1.22E-04	1.16E-04	5.91E-03	1.51E-03	0	0	0	-	-	-	-
Generators	Diesel	2270006005	200	43%	1.55E-04	1.45E-04	7.44E-03	1.81E-03	2	2	660	3.87E-05	3.62E-05	1.86E-03	4.54E-04
Generators	Diesel	2270006005	180	43%	1.55E-04	1.45E-04	7.44E-03	1.81E-03	1	2	588	1.55E-05	1.45E-05	7.47E-04	1.82E-04
Generators	Diesel	2270006005	80	43%	2.32E-04	2.13E-04	1.08E-02	2.67E-03	1	2	588	1.03E-05	9.50E-06	4.84E-04	1.19E-04
Generators	Diesel	2270006005	250	43%	1.55E-04	1.45E-04	7.44E-03	1.81E-03	0	0	0	-	-	-	-
Generators	Diesel	2270006005	425	43%	1.22E-04	1.16E-04	5.91E-03	1.51E-03	0	0	0	-	-	-	-
Generators	Diesel	2270006005	120	43%	1.75E-04	1.63E-04	8.48E-03	2.04E-03	0	0	0	-	-	-	-
Generators	Diesel	2270006005	1,400	43%	1.22E-04	1.16E-04	5.91E-03	1.51E-03	1	2	924	1.49E-04	1.42E-04	0.01	1.85E-03
Generators	Diesel	2270006005	260	43%	1.55E-04	1.45E-04	7.44E-03	1.81E-03	0	0	0	-	-	-	-
Generators	Diesel	2270006005	80	43%	2.32E-04	2.13E-04	1.08E-02	2.67E-03	0	0	0	-	-	-	-
Generators	Diesel	2270006005	550	43%	1.22E-04	1.16E-04	5.91E-03	1.51E-03	0	0	0	-	-	-	-
Generators	Diesel	2270006005	80	43%	2.32E-04	2.13E-04	1.08E-02	2.67E-03	2	2	168	5.91E-06	5.43E-06	2.76E-04	6.79E-05
Generators	Diesel	2270006005	425	43%	1.22E-04	1.16E-04	5.91E-03	1.51E-03	2	2	317	3.11E-05	2.96E-05	1.51E-03	3.86E-04
Light Plant	Diesel	2270002027	15	43%	3.36E-04	3.15E-04	1.88E-02	3.39E-03	0	0	0	-	-	-	-
Light Plant	Diesel	2270002027	60	43%	1.98E-04	1.82E-04	9.55E-03	2.15E-03	5	1	660	1.86E-05	1.71E-05	8.96E-04	2.02E-04
Diving equipment	Diesel	2270002081	180	59%	3.57E-05	3.51E-05	2.00E-03	3.57E-04	0	0	0	-	-	-	-
Anchor Winches	Diesel	2270002081	240	59%	3.57E-05	3.51E-05	2.00E-03	3.57E-04	0	0	0	-	-	-	-
AHT Winch	Diesel	2270002081	120	59%	4.29E-05	4.04E-05	2.34E-03	4.25E-04	2	1	61	4.09E-07	3.85E-07	2.23E-05	4.04E-06
Anchor Winches	Diesel	2270002081	600	59%	6.83E-05	6.52E-05	3.45E-03	7.82E-04	1	8	49	1.04E-05	9.97E-06	5.27E-04	1.20E-04
Gantry Boom	Diesel	2270002081	335	59%	6.83E-05	6.52E-05	3.45E-03	7.82E-04	1	1	392	5.83E-06	5.57E-06	2.94E-04	6.68E-05
Gantry Hoist	Diesel	2270002081	520	59%	6.83E-05	6.52E-05	3.45E-03	7.82E-04	1	1	392	9.05E-06	8.64E-06	4.57E-04	1.04E-04
Gantry Swing	Diesel	2270002081	335	59%	6.83E-05	6.52E-05	3.45E-03	7.82E-04	1	2	392	1.17E-05	1.11E-05	5.89E-04	1.34E-04
Line-up Station	Diesel	2270002081	120	59%	4.29E-05	4.04E-05	2.34E-03	4.25E-04	0	0	0	-	-	-	-
UT Station	Diesel	2270002081	60	59%	9.50E-05	8.94E-05	5.15E-03	9.37E-04	0	0	0	-	-	-	-
Coating Station	Diesel	2270002081	60	59%	9.50E-05	8.94E-05	5.15E-03	9.37E-04	0	0	0	-	-	-	-
Tug Winch	Diesel	2270002081	80	59%	5.48E-05	5.06E-05	2.87E-03	5.31E-04	0	0	0	-	-	-	-
Jet Barge Anchor Winches	Diesel	2270002081	240	59%	3.57E-05	3.51E-05	2.00E-03	3.57E-04	0	0	0	-	-	-	-
Jet Barge Sled Winch	Diesel	2270002081	240	59%	3.57E-05	3.51E-05	2.00E-03	3.57E-04	0	0	0	-	-	-	-
Pumps	Diesel	2270006010	240	43%	1.55E-04	1.45E-04	7.46E-03	1.82E-03	0	0	0	-	-	-	-
Pumps	Diesel	2270006010	110	43%	1.76E-04	1.63E-04	8.50E-03	2.04E-03	0	0	0	-	-	-	-
Pumps	Diesel	2270006010	1,840	43%	1.22E-04	1.16E-04	5.93E-03	1.52E-03	1	3	990	3.17E-04	3.01E-04	0.02	3.93E-03

Table 6 - BMOP - Offshore Construction Emissions
2024 Non-Road Construction Equipment Exhaust Hazardous Air Pollutant Emissions

Equipment Type	Fuel	Source Category[1]	Engine Rating[3] (hp)	Load Factor[1]	Pollutant Emission Factor[2] (g/hp-hr)				No. of Equipment/Day[3]	Engines per Unit[3]	Hours of Operation[3]	Pollutant Emissions (tons/year)			
					1,3-Butadiene	2,2,4-Trimethylpentane	Acetaldehyde	Acrolein				1,3-Butadiene	2,2,4-Trimethylpentane	Acetaldehyde	Acrolein
Marine Vessels[4,5]															
Diving Support Vessel	Diesel	-	2,250	43%	-	-	8.00E-05	2.50E-05	0	0	0	-	-	-	-
Lift Boat	Diesel	-	1,500	43%	-	-	8.00E-05	2.50E-05	1	2	72	-	-	8.19E-06	2.56E-06
Lift Boat	Diesel	-	1,000	43%	-	-	8.00E-05	2.50E-05	0	0	0	-	-	-	-
DP Nitrogen Boat	Diesel	-	3,000	43%	-	-	8.00E-05	2.50E-05	0	0	0	-	-	-	-
Supply Vessel	Diesel	-	1,125	43%	-	-	8.00E-05	2.50E-05	2	2	634	-	-	1.08E-04	3.38E-05
Crew Boat	Diesel	-	1,000	45%	-	-	8.00E-05	2.50E-05	2	3	634	-	-	1.51E-04	4.72E-05
Diving Support Vessel	Diesel	-	3,000	43%	-	-	8.00E-05	2.50E-05	0	0	0	-	-	-	-
Bow Thruster	Diesel	-	950	31%	-	-	8.00E-05	2.50E-05	0	0	0	-	-	-	-
Stern Thruster	Diesel	-	950	31%	-	-	8.00E-05	2.50E-05	2	2	61	-	-	6.34E-06	1.98E-06
Jet Barge Anchor Handling Tug	Diesel	-	900	31%	-	-	8.00E-05	2.50E-05	2	2	252	-	-	2.48E-05	7.76E-06
Derrick Barge Anchor Handling Tug	Diesel	-	1,800	31%	-	-	8.00E-05	2.50E-05	0	0	0	-	-	-	-
Crew Boat	Diesel	-	350	45%	1.24E-04	-	2.44E-03	2.94E-04	0	0	0	-	-	-	-
Pipehaul Tug	Diesel	-	1,200	31%	-	-	8.00E-05	2.50E-05	0	0	0	-	-	-	-
Total												**<0.01**	**<0.01**	**0.04**	**0.01**

1. Based on EPA MOVES2014b.
2. EPA MOVES2014b (Region: National).
3. Based on data provided by Blue Marlin Offshore Port, LLC.
4. Load factor from Table 3-4 of Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories, ICF International, April 2009.
5. Emission factors for engines greater than 600 hp are based on Section 3.4. Large Stationary Diesel and All Stationary Dual-fuel Engines, Tables 3.4-3 and 3.4-4. For engines less than 600 hp, emission factors are based on AP-42, Section 3.3. Gasoline and Diesel Industrial Engines, Table 3.3-2.

Table 6 - BMOP - Offshore Construction Emissions
2024 Non-Road Construction Equipment Exhaust Hazardous Air Pollutant Emissions

Equipment Type	Fuel	Source Category[1]	Engine Rating[3] (hp)	Load Factor[1]	Pollutant Emission Factor[2] (g/hp-hr)					No. of Equipment/Day[3]	Engines per Unit[3]	Hours of Operation[3]	Pollutant Emissions (tons/year)				
					Benzene	Ethyl Benzene	Formaldehyde	Hexane	Naphthalene				Benzene	Ethyl Benzene	Formaldehyde	Hexane	Naphthalene
Air Compressors	Diesel	2270006015	100	43%	2.67E-04	2.50E-05	6.83E-03	2.21E-06	2.25E-09	0	0	0	-	-	-	-	-
Air Compressors	Diesel	2270006015	80	43%	3.30E-04	3.09E-05	8.70E-03	4.32E-06	0.00E+00	1	1	990	1.24E-05	1.16E-06	3.27E-04	1.62E-07	-
Air Compressors	Diesel	2270006015	180	43%	2.18E-04	2.42E-05	5.67E-03	2.46E-06	1.24E-08	0	0	0	-	-	-	-	-
Air Compressors	Diesel	2270006015	600	43%	4.07E-04	5.43E-05	1.13E-02	7.89E-06	8.83E-09	2	2	1,512	6.99E-04	9.34E-05	0.02	1.36E-05	1.52E-08
Air Compressors	Diesel	2270006015	630	43%	4.07E-04	5.43E-05	1.13E-02	7.89E-06	8.83E-09	0	0	0	-	-	-	-	-
Air Compressors	Diesel	2270006015	900	43%	4.07E-04	5.43E-05	1.13E-02	7.89E-06	8.83E-09	0	0	0	-	-	-	-	-
Air Compressors	Diesel	2270006015	900	43%	4.07E-04	5.43E-05	1.13E-02	7.89E-06	8.83E-09	0	0	0	-	-	-	-	-
Cranes	Diesel	2270002045	335	43%	2.21E-04	2.83E-05	6.04E-03	3.96E-06	1.23E-08	1	2	660	4.64E-05	5.94E-06	1.27E-03	8.29E-07	2.58E-09
Cranes	Diesel	2270002045	285	43%	1.43E-04	1.78E-05	3.60E-03	9.11E-07	1.49E-08	1	2	924	3.57E-05	4.44E-06	9.00E-04	2.27E-07	3.73E-09
Cranes	Diesel	2270002045	350	43%	2.21E-04	2.83E-05	6.04E-03	3.96E-06	1.23E-08	1	2	924	6.78E-05	8.69E-06	1.85E-03	1.21E-06	3.78E-09
Cranes	Diesel	2270002045	332	43%	2.21E-04	2.83E-05	6.04E-03	3.96E-06	1.23E-08	0	0	0	-	-	-	-	-
Cranes	Diesel	2270002045	150	43%	1.79E-04	1.70E-05	4.44E-03	5.96E-07	2.71E-09	0	0	0	-	-	-	-	-
Cranes	Diesel	2270002045	365	43%	2.21E-04	2.83E-05	6.04E-03	3.96E-06	1.23E-08	0	0	0	-	-	-	-	-
Cranes	Diesel	2270002045	335	43%	2.21E-04	2.83E-05	6.04E-03	3.96E-06	1.23E-08	1	1	588	2.07E-05	2.65E-06	5.64E-04	3.69E-07	1.15E-09
Cranes	Diesel	2270002045	335	43%	2.21E-04	2.83E-05	6.04E-03	3.96E-06	1.23E-08	0	0	0	-	-	-	-	-
Generators	Diesel	2270006005	200	43%	6.63E-04	1.12E-04	2.08E-02	2.59E-05	7.14E-09	2	3	317	1.20E-04	2.01E-05	3.75E-03	4.66E-06	1.29E-09
Generators	Diesel	2270006005	375	43%	5.35E-04	9.57E-05	1.65E-02	1.85E-05	6.96E-09	0	0	0	-	-	-	-	-
Generators	Diesel	2270006005	200	43%	6.63E-04	1.12E-04	2.08E-02	2.59E-05	7.14E-09	2	2	660	1.66E-04	2.80E-05	0.01	6.47E-06	1.79E-09
Generators	Diesel	2270006005	180	43%	6.63E-04	1.12E-04	2.08E-02	2.59E-05	7.14E-09	1	2	588	6.65E-05	1.12E-05	2.09E-03	2.60E-06	7.17E-10
Generators	Diesel	2270006005	80	43%	9.30E-04	1.60E-04	3.05E-02	4.41E-05	0.00E+00	1	2	588	4.15E-05	7.15E-06	1.36E-03	1.97E-06	-
Generators	Diesel	2270006005	250	43%	6.63E-04	1.12E-04	2.08E-02	2.59E-05	7.14E-09	0	0	0	-	-	-	-	-
Generators	Diesel	2270006005	425	43%	5.35E-04	9.57E-05	1.65E-02	1.85E-05	6.96E-09	0	0	0	-	-	-	-	-
Generators	Diesel	2270006005	120	43%	7.75E-04	1.23E-04	2.38E-02	2.71E-05	1.28E-09	0	0	0	-	-	-	-	-
Generators	Diesel	2270006005	1,400	43%	5.35E-04	9.57E-05	1.65E-02	1.85E-05	6.96E-09	1	2	924	6.56E-04	1.17E-04	0.02	2.26E-05	8.54E-09
Generators	Diesel	2270006005	260	43%	6.63E-04	1.12E-04	2.08E-02	2.59E-05	7.14E-09	0	0	0	-	-	-	-	-
Generators	Diesel	2270006005	80	43%	9.30E-04	1.60E-04	3.05E-02	4.41E-05	0.00E+00	0	0	0	-	-	-	-	-
Generators	Diesel	2270006005	550	43%	5.35E-04	9.57E-05	1.65E-02	1.85E-05	6.96E-09	0	0	0	-	-	-	-	-
Generators	Diesel	2270006005	80	43%	9.30E-04	1.60E-04	3.05E-02	4.41E-05	0.00E+00	2	2	168	2.37E-05	4.09E-06	7.76E-04	1.12E-06	-
Generators	Diesel	2270006005	425	43%	5.35E-04	9.57E-05	1.65E-02	1.85E-05	6.96E-09	2	2	317	1.37E-04	2.44E-05	4.20E-03	4.72E-06	1.78E-09
Light Plant	Diesel	2270002027	15	43%	2.16E-03	1.77E-04	5.26E-02	1.29E-06	0.00E+00	0	0	0	-	-	-	-	-
Light Plant	Diesel	2270002027	60	43%	8.62E-04	1.26E-04	2.69E-02	3.45E-05	0.00E+00	5	1	660	8.09E-05	1.18E-05	2.52E-03	3.24E-06	-
Diving equipment	Diesel	2270002081	180	59%	2.07E-04	2.38E-05	5.44E-03	2.71E-06	1.35E-08	0	0	0	-	-	-	-	-
Anchor Winches	Diesel	2270002081	240	59%	2.07E-04	2.38E-05	5.44E-03	2.71E-06	1.35E-08	0	0	0	-	-	-	-	-
AHT Winch	Diesel	2270002081	120	59%	2.52E-04	2.41E-05	6.52E-03	2.51E-06	2.48E-09	2	1	61	2.40E-06	2.29E-07	6.20E-05	2.39E-08	2.36E-11
Anchor Winches	Diesel	2270002081	600	59%	3.22E-04	5.02E-05	9.51E-03	9.49E-06	1.09E-08	1	8	49	4.92E-05	7.68E-06	1.46E-03	1.45E-06	1.66E-09
Gantry Boom	Diesel	2270002081	335	59%	3.22E-04	5.02E-05	9.51E-03	9.49E-06	1.09E-08	1	1	392	2.75E-05	4.29E-06	8.13E-04	8.10E-07	9.27E-10
Gantry Hoist	Diesel	2270002081	520	59%	3.22E-04	5.02E-05	9.51E-03	9.49E-06	1.09E-08	1	1	392	4.27E-05	6.65E-06	1.26E-03	1.26E-06	1.44E-09
Gantry Swing	Diesel	2270002081	335	59%	3.22E-04	5.02E-05	9.51E-03	9.49E-06	1.09E-08	1	2	392	5.50E-05	8.57E-06	1.63E-03	1.62E-06	1.85E-09
Line-up Station	Diesel	2270002081	120	59%	2.52E-04	2.41E-05	6.52E-03	2.51E-06	2.48E-09	0	0	0	-	-	-	-	-
UT Station	Diesel	2270002081	60	59%	5.51E-04	5.06E-05	1.45E-02	7.43E-06	0.00E+00	0	0	0	-	-	-	-	-
Coating Station	Diesel	2270002081	60	59%	5.51E-04	5.06E-05	1.45E-02	7.43E-06	0.00E+00	0	0	0	-	-	-	-	-
Tug Winch	Diesel	2270002081	80	59%	2.96E-04	2.90E-05	8.06E-03	5.38E-06	0.00E+00	0	0	0	-	-	-	-	-
Jet Barge Anchor Winches	Diesel	2270002081	240	59%	2.07E-04	2.38E-05	5.44E-03	2.71E-06	1.35E-08	0	0	0	-	-	-	-	-
Jet Barge Sled Winch	Diesel	2270002081	240	59%	2.07E-04	2.38E-05	5.44E-03	2.71E-06	1.35E-08	0	0	0	-	-	-	-	-
Pumps	Diesel	2270006010	240	43%	6.65E-04	1.12E-04	2.08E-02	2.59E-05	7.24E-09	0	0	0	-	-	-	-	-
Pumps	Diesel	2270006010	110	43%	7.78E-04	1.23E-04	2.38E-02	2.72E-05	1.30E-09	0	0	0	-	-	-	-	-
Pumps	Diesel	2270006010	1,840	43%	5.37E-04	9.60E-05	1.65E-02	1.85E-05	7.03E-09	1	3	990	1.39E-03	2.49E-04	0.04	4.80E-05	1.82E-08

Table 6 - BMOP - Offshore Construction Emissions
2024 Non-Road Construction Equipment Exhaust Hazardous Air Pollutant Emissions

Equipment Type	Fuel	Source Category[1]	Engine Rating[3] (hp)	Load Factor[1]	Pollutant Emission Factor[2] (g/hp-hr)					No. of Equipment/Day[3]	Engines per Unit[3]	Hours of Operation[3]	Pollutant Emissions (tons/year)				
					Benzene	Ethyl Benzene	Formaldehyde	Hexane	Naphthalene				Benzene	Ethyl Benzene	Formaldehyde	Hexane	Naphthalene
Marine Vessels[4,5]																	
Diving Support Vessel	Diesel	-	2,250	43%	2.46E-03	-	2.51E-04	-	4.13E-04	0	0	0	-	-	-	-	-
Lift Boat	Diesel	-	1,500	43%	2.46E-03	-	2.51E-04	-	4.13E-04	1	2	72	2.52E-04	-	2.56E-05	-	4.23E-05
Lift Boat	Diesel	-	1,000	43%	2.46E-03	-	2.51E-04	-	4.13E-04	0	0	0	-	-	-	-	-
DP Nitrogen Boat	Diesel	-	3,000	43%	2.46E-03	-	2.51E-04	-	4.13E-04	0	0	0	-	-	-	-	-
Supply Vessel	Diesel	-	1,125	43%	2.46E-03	-	2.51E-04	-	4.13E-04	2	2	634	3.33E-03	-	3.39E-04	-	5.58E-04
Crew Boat	Diesel	-	1,000	45%	2.46E-03	-	2.51E-04	-	4.13E-04	2	3	634	4.65E-03	-	4.73E-04	-	7.79E-04
Diving Support Vessel	Diesel	-	3,000	43%	2.46E-03	-	2.51E-04	-	4.13E-04	0	0	0	-	-	-	-	-
Bow Thruster	Diesel	-	950	31%	2.46E-03	-	2.51E-04	-	4.13E-04	0	0	0	-	-	-	-	-
Stern Thruster	Diesel	-	950	31%	2.46E-03	-	2.51E-04	-	4.13E-04	2	2	61	1.95E-04	-	1.98E-05	-	3.27E-05
Jet Barge Anchor Handling Tug	Diesel	-	900	31%	2.46E-03	-	2.51E-04	-	4.13E-04	2	2	252	7.64E-04	-	7.77E-05	-	1.28E-04
Derrick Barge Anchor Handling Tug	Diesel	-	1,800	31%	2.46E-03	-	2.51E-04	-	4.13E-04	0	0	0	-	-	-	-	-
Crew Boat	Diesel	-	350	45%	2.96E-03	-	3.75E-03	-	2.69E-04	0	0	0	-	-	-	-	-
Pipehaul Tug	Diesel	-	1,200	31%	2.46E-03	-	2.51E-04	-	4.13E-04	0	0	0	-	-	-	-	-
Total													**0.01**	**<0.01**	**0.11**	**<0.01**	**<0.01**

1. Based on EPA MOVES2014b.
2. EPA MOVES2014b (Region: National).
3. Based on data provided by Blue Marlin Offshore Port, LLC.
4. Load factor from Table 3-4 of Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories, ICF International, April 2009.
5. Emission factors for engines greater than 600 hp are based on Section 3.4. Large Stationary Diesel and All Stationary Dual-fuel Engines, Tables 3.4-3 and 3.4-4. For engines less than 600 hp, emission factors are based on AP-42, Section 3.3. Gasoline and Diesel Industrial Engines, Table 3.3-2.

Table 6 - BMOP - Offshore Construction Emissions
2024 Non-Road Construction Equipment Exhaust Hazardous Air Pollutant Emissions (Continued)

Equipment Type	Fuel	Source Category[1]	Engine Rating[3] (hp)	Load Factor[1]	Pollutant Emission Factor[2] (g/hp-hr)				No. of Equipment/ Day[3]	Engines per Unit[3]	Hours of Operation[3]	Pollutant Emissions (tons/year)			
					PAH	Propionaldehyde	Toluene	Xylenes				PAH	Propionaldehyde	Toluene	Xylenes
Air Compressors	Diesel	2270006015	100	43%	1.23E-04	5.83E-04	1.94E-04	7.94E-05	0	0	-	-	-	-	-
Air Compressors	Diesel	2270006015	80	43%	1.66E-04	7.97E-04	2.41E-04	9.68E-05	1	1	990	6.24E-06	2.99E-05	9.05E-06	3.64E-06
Air Compressors	Diesel	2270006015	180	43%	9.50E-05	4.88E-04	1.65E-04	9.26E-05	0	0	-	-	-	-	-
Air Compressors	Diesel	2270006015	600	43%	2.13E-04	9.36E-04	2.94E-04	1.64E-04	2	2	1,512	1.83E-04	8.05E-04	2.53E-04	1.41E-04
Air Compressors	Diesel	2270006015	630	43%	2.13E-04	9.36E-04	2.94E-04	1.64E-04	0	0	-	-	-	-	-
Air Compressors	Diesel	2270006015	900	43%	2.13E-04	9.36E-04	2.94E-04	1.64E-04	0	0	-	-	-	-	-
Air Compressors	Diesel	2270006015	900	43%	2.13E-04	9.36E-04	2.94E-04	1.64E-04	0	0	-	-	-	-	-
Cranes	Diesel	2270002045	335	43%	1.06E-04	5.35E-04	1.68E-04	1.04E-04	1	2	660	1.11E-05	5.60E-05	1.76E-05	1.09E-05
Cranes	Diesel	2270002045	285	43%	6.19E-05	2.83E-04	1.10E-04	7.51E-05	1	2	924	7.73E-06	3.53E-05	1.38E-05	9.38E-06
Cranes	Diesel	2270002045	350	43%	1.06E-04	5.35E-04	1.68E-04	1.04E-04	1	2	924	1.63E-05	8.19E-05	2.57E-05	1.59E-05
Cranes	Diesel	2270002045	332	43%	1.06E-04	5.35E-04	1.68E-04	1.04E-04	0	0	-	-	-	-	-
Cranes	Diesel	2270002045	150	43%	8.31E-05	3.47E-04	1.30E-04	5.59E-05	0	0	-	-	-	-	-
Cranes	Diesel	2270002045	365	43%	1.06E-04	5.35E-04	1.68E-04	1.04E-04	0	0	-	-	-	-	-
Cranes	Diesel	2270002045	335	43%	1.06E-04	5.35E-04	1.68E-04	1.04E-04	1	1	588	9.92E-06	4.99E-05	1.57E-05	9.68E-06
Cranes	Diesel	2270002045	335	43%	1.06E-04	5.35E-04	1.68E-04	1.04E-04	0	0	-	-	-	-	-
Generators	Diesel	2270006005	200	43%	4.04E-04	1.94E-03	4.85E-04	3.24E-04	2	3	317	2.43E-05	1.17E-04	2.92E-05	1.95E-05
Generators	Diesel	2270006005	375	43%	3.40E-04	1.36E-03	3.81E-04	2.65E-04	0	0	-	-	-	-	-
Generators	Diesel	2270006005	200	43%	4.04E-04	1.94E-03	4.85E-04	3.24E-04	2	2	660	5.05E-05	2.43E-04	6.07E-05	4.05E-05
Generators	Diesel	2270006005	180	43%	4.04E-04	1.94E-03	4.85E-04	3.24E-04	1	2	588	2.02E-05	9.75E-05	2.43E-05	1.62E-05
Generators	Diesel	2270006005	80	43%	6.14E-04	3.09E-03	6.89E-04	4.62E-04	1	2	588	1.37E-05	6.90E-05	1.54E-05	1.03E-05
Generators	Diesel	2270006005	250	43%	4.04E-04	1.94E-03	4.85E-04	3.24E-04	0	0	-	-	-	-	-
Generators	Diesel	2270006005	425	43%	3.40E-04	1.36E-03	3.81E-04	2.65E-04	0	0	-	-	-	-	-
Generators	Diesel	2270006005	120	43%	4.66E-04	2.18E-03	5.60E-04	3.43E-04	0	0	-	-	-	-	-
Generators	Diesel	2270006005	1,400	43%	3.40E-04	1.36E-03	3.81E-04	2.65E-04	1	2	924	2.08E-04	8.35E-04	2.33E-04	1.63E-04
Generators	Diesel	2270006005	260	43%	4.04E-04	1.94E-03	4.85E-04	3.24E-04	0	0	-	-	-	-	-
Generators	Diesel	2270006005	80	43%	6.14E-04	3.09E-03	6.89E-04	4.62E-04	0	0	-	-	-	-	-
Generators	Diesel	2270006005	550	43%	3.40E-04	1.36E-03	3.81E-04	2.65E-04	0	0	-	-	-	-	-
Generators	Diesel	2270006005	80	43%	6.14E-04	3.09E-03	6.89E-04	4.62E-04	2	2	168	7.83E-06	3.94E-05	8.78E-06	5.89E-06
Generators	Diesel	2270006005	425	43%	3.40E-04	1.36E-03	3.81E-04	2.65E-04	2	2	317	4.34E-05	1.74E-04	4.86E-05	3.39E-05
Light Plant	Diesel	2270002027	15	43%	8.66E-04	3.99E-03	1.51E-03	4.70E-04	0	0	-	-	-	-	-
Light Plant	Diesel	2270002027	60	43%	4.93E-04	2.72E-03	6.46E-04	3.76E-04	5	1	660	4.63E-05	2.55E-04	6.06E-05	3.53E-05
Diving equipment	Diesel	2270002081	180	59%	9.50E-05	4.82E-04	1.58E-04	9.35E-05	0	0	-	-	-	-	-
Anchor Winches	Diesel	2270002081	240	59%	9.50E-05	4.82E-04	1.58E-04	9.35E-05	0	0	-	-	-	-	-
AHT Winch	Diesel	2270002081	120	59%	1.23E-04	5.70E-04	1.84E-04	7.84E-05	2	1	61	1.17E-06	5.43E-06	1.75E-06	7.47E-07
Anchor Winches	Diesel	2270002081	600	59%	1.91E-04	8.50E-04	2.38E-04	1.59E-04	1	8	49	3.66E-06	1.63E-05	4.56E-06	3.04E-06
Gantry Boom	Diesel	2270002081	335	59%	1.91E-04	8.50E-04	2.38E-04	1.59E-04	1	1	392	1.63E-05	7.26E-05	2.03E-05	1.36E-05
Gantry Hoist	Diesel	2270002081	520	59%	1.91E-04	8.50E-04	2.38E-04	1.59E-04	1	1	392	2.53E-05	1.13E-04	3.16E-05	2.11E-05
Gantry Swing	Diesel	2270002081	335	59%	1.91E-04	8.50E-04	2.38E-04	1.59E-04	1	2	392	1.63E-05	7.26E-05	2.03E-05	1.36E-05
Line-up Station	Diesel	2270002081	120	59%	1.23E-04	5.70E-04	1.84E-04	7.84E-05	0	0	-	-	-	-	-
UT Station	Diesel	2270002081	60	59%	2.39E-04	1.25E-03	4.05E-04	1.55E-04	0	0	-	-	-	-	-
Coating Station	Diesel	2270002081	60	59%	2.39E-04	1.25E-03	4.05E-04	1.55E-04	0	0	-	-	-	-	-
Tug Winch	Diesel	2270002081	80	59%	1.61E-04	7.87E-04	2.20E-04	9.46E-05	0	0	-	-	-	-	-
Jet Barge Anchor Winches	Diesel	2270002081	240	59%	9.50E-05	4.82E-04	1.58E-04	9.35E-05	0	0	-	-	-	-	-
Jet Barge Sled Winch	Diesel	2270002081	240	59%	9.50E-05	4.82E-04	1.58E-04	9.35E-05	0	0	-	-	-	-	-
Pumps	Diesel	2270006010	240	43%	4.06E-04	1.95E-03	4.87E-04	3.25E-04	0	0	-	-	-	-	-
Pumps	Diesel	2270006010	110	43%	4.69E-04	2.19E-03	5.62E-04	3.44E-04	0	0	-	-	-	-	-
Pumps	Diesel	2270006010	1,840	43%	3.44E-04	1.37E-03	3.82E-04	2.66E-04	1	3	990	2.97E-04	1.18E-03	3.30E-04	2.30E-04

Table 6 - BMOP - Offshore Construction Emissions
2024 Non-Road Construction Equipment Exhaust Hazardous Air Pollutant Emissions (Continued)

Equipment Type	Fuel	Source Category[1]	Engine Rating[3] (hp)	Load Factor[1]	Pollutant Emission Factor[2] (g/hp-hr)				No. of Equipment/ Day[3]	Engines per Unit[3]	Hours of Operation[3]	Pollutant Emissions (tons/year)			
					PAH	Propionaldehyde	Toluene	Xylenes				PAH	Propionaldehyde	Toluene	Xylenes
Marine Vessels[4,5]															
Diving Support Vessel	Diesel	-	2,250	43%	6.73E-04	-	8.92E-04	6.13E-04	0	0	-	-	-	-	-
Lift Boat	Diesel	-	1,500	43%	6.73E-04	-	8.92E-04	6.13E-04	1	2	72	3.45E-05	-	4.57E-05	3.14E-05
Lift Boat	Diesel	-	1,000	43%	6.73E-04	-	8.92E-04	6.13E-04	0	0	-	-	-	-	-
DP Nitrogen Boat	Diesel	-	3,000	43%	6.73E-04	-	8.92E-04	6.13E-04	0	0	-	-	-	-	-
Supply Vessel	Diesel	-	1,125	43%	6.73E-04	-	8.92E-04	6.13E-04	2	2	634	4.55E-04	-	6.03E-04	4.14E-04
Crew Boat	Diesel	-	1,000	45%	6.73E-04	-	8.92E-04	6.13E-04	2	3	634	4.23E-04	-	5.61E-04	3.85E-04
Diving Support Vessel	Diesel	-	3,000	43%	6.73E-04	-	8.92E-04	6.13E-04	0	0	-	-	-	-	-
Bow Thruster	Diesel	-	950	31%	6.73E-04	-	8.92E-04	6.13E-04	0	0	-	-	-	-	-
Stern Thruster	Diesel	-	950	31%	6.73E-04	-	8.92E-04	6.13E-04	2	2	61	2.67E-05	-	3.53E-05	2.43E-05
Jet Barge Anchor Handling Tug	Diesel	-	900	31%	6.73E-04	-	8.92E-04	6.13E-04	2	2	252	1.04E-04	-	1.38E-04	9.50E-05
Derrick Barge Anchor Handling Tug	Diesel	-	1,800	31%	6.73E-04	-	8.92E-04	6.13E-04	0	0	-	-	-	-	-
Crew Boat	Diesel	-	350	45%	5.33E-04	-	1.30E-03	9.05E-04	0	0	-	-	-	-	-
Pipehaul Tug	Diesel	-	1,200	31%	6.73E-04	-	8.92E-04	6.13E-04	0	0	-	-	-	-	-
Total												**<0.01**	**<0.01**	**<0.01**	**<0.01**

1. Based on EPA MOVES2014b.
2. EPA MOVES2014b (Region: National).
3. Based on data provided by Blue Marlin Offshore Port, LLC.
4. Load factor from Table 3-4 of Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories, ICF International, April 2009.
5. Emission factors for engines greater than 600 hp are based on Section 3.4. Large Stationary Diesel and All Stationary Dual-fuel Engines, Tables 3.4-3 and 3.4-4. For engines less than 600 hp, emission factors are based on AP-42, Section 3.3. Gasoline and Diesel Industrial Engines, Table 3.3-2.

Table 6 - BMOP - Offshore Construction Emissions
2024 Non-Road Construction Equipment Exhaust Hazardous Air Pollutant Emissions (Continued)

Equipment Type	Fuel	Source Category[1]	Engine Rating[3] (hp)	Load Factor[1]	Pollutant Emission Factor[2] (g/hp-hr)					No. of Equipment/ Day[3]	Engines per Unit[3]	Hours of Operation[3]	Pollutant Emissions (tons/year)				
					Arsenic	Chromium VI	Manganese	Mercury	Nickel				Arsenic	Chromium VI	Manganese	Mercury	Nickel
Air Compressors	Diesel	2270006015	100	43%	8.32E-07	3.23E-09	1.35E-06	1.11E-08	2.33E-06	0	0	-	-	-	-	-	-
Air Compressors	Diesel	2270006015	80	43%	9.25E-07	3.17E-09	1.19E-06	1.23E-08	2.03E-06	1	1	990	3.47E-08	1.19E-10	4.48E-08	4.62E-10	7.61E-08
Air Compressors	Diesel	2270006015	180	43%	8.32E-07	2.47E-09	9.73E-07	1.11E-08	1.68E-06	0	0	-	-	-	-	-	-
Air Compressors	Diesel	2270006015	600	43%	8.32E-07	2.82E-09	1.15E-06	1.11E-08	2.00E-06	2	2	1512	7.16E-07	2.43E-09	9.92E-07	9.51E-09	1.72E-06
Air Compressors	Diesel	2270006015	630	43%	8.32E-07	2.82E-09	1.15E-06	1.11E-08	2.00E-06	0	0	-	-	-	-	-	-
Air Compressors	Diesel	2270006015	900	43%	8.32E-07	2.82E-09	1.15E-06	1.11E-08	2.00E-06	0	0	-	-	-	-	-	-
Air Compressors	Diesel	2270006015	900	43%	8.32E-07	2.82E-09	1.15E-06	1.11E-08	2.00E-06	0	0	-	-	-	-	-	-
Cranes	Diesel	2270002045	335	43%	8.32E-07	2.51E-09	1.01E-06	1.11E-08	1.74E-06	1	2	660	8.72E-08	2.64E-10	1.06E-07	1.16E-09	1.83E-07
Cranes	Diesel	2270002045	285	43%	8.32E-07	2.36E-09	9.35E-07	1.11E-08	1.62E-06	1	2	924	1.04E-07	2.95E-10	1.17E-07	1.38E-09	2.02E-07
Cranes	Diesel	2270002045	350	43%	8.32E-07	2.51E-09	1.01E-06	1.11E-08	1.74E-06	1	2	924	1.28E-07	3.85E-10	1.55E-07	1.70E-09	2.67E-07
Cranes	Diesel	2270002045	332	43%	8.32E-07	2.51E-09	1.01E-06	1.11E-08	1.74E-06	0	0	-	-	-	-	-	-
Cranes	Diesel	2270002045	150	43%	8.32E-07	3.24E-09	1.36E-06	1.11E-08	2.37E-06	0	0	-	-	-	-	-	-
Cranes	Diesel	2270002045	365	43%	8.32E-07	2.51E-09	1.01E-06	1.11E-08	1.74E-06	0	0	-	-	-	-	-	-
Cranes	Diesel	2270002045	335	43%	8.32E-07	2.51E-09	1.01E-06	1.11E-08	1.74E-06	1	1	588	7.77E-08	2.35E-10	9.41E-08	1.03E-09	1.63E-07
Cranes	Diesel	2270002045	335	43%	8.32E-07	2.51E-09	1.01E-06	1.11E-08	1.74E-06	0	0	-	-	-	-	-	-
Generators	Diesel	2270006005	200	43%	8.32E-07	3.00E-09	1.25E-06	1.11E-08	2.16E-06	2	3	317	5.00E-08	1.80E-10	7.49E-08	6.65E-10	1.30E-07
Generators	Diesel	2270006005	375	43%	8.32E-07	3.00E-09	1.25E-06	1.11E-08	2.16E-06	0	0	-	-	-	-	-	-
Generators	Diesel	2270006005	200	43%	8.32E-07	3.00E-09	1.25E-06	1.11E-08	2.16E-06	2	2	660	1.04E-07	3.75E-10	1.56E-07	1.38E-09	2.71E-07
Generators	Diesel	2270006005	180	43%	8.32E-07	3.00E-09	1.25E-06	1.11E-08	2.16E-06	1	2	588	4.18E-08	1.50E-10	6.25E-08	5.55E-10	1.08E-07
Generators	Diesel	2270006005	80	43%	9.25E-07	3.63E-09	1.47E-06	1.23E-08	2.53E-06	1	2	588	2.06E-08	8.09E-11	3.28E-08	2.74E-10	5.64E-08
Generators	Diesel	2270006005	250	43%	8.32E-07	3.00E-09	1.25E-06	1.11E-08	2.16E-06	0	0	-	-	-	-	-	-
Generators	Diesel	2270006005	425	43%	8.32E-07	3.00E-09	1.25E-06	1.11E-08	2.16E-06	0	0	-	-	-	-	-	-
Generators	Diesel	2270006005	120	43%	8.32E-07	3.48E-09	1.48E-06	1.11E-08	2.57E-06	0	0	-	-	-	-	-	-
Generators	Diesel	2270006005	1,400	43%	8.32E-07	3.00E-09	1.25E-06	1.11E-08	2.16E-06	1	2	924	5.10E-07	1.84E-09	7.64E-07	6.78E-09	1.33E-06
Generators	Diesel	2270006005	260	43%	8.32E-07	3.00E-09	1.25E-06	1.11E-08	2.16E-06	0	0	-	-	-	-	-	-
Generators	Diesel	2270006005	80	43%	9.25E-07	3.63E-09	1.47E-06	1.23E-08	2.53E-06	0	0	-	-	-	-	-	-
Generators	Diesel	2270006005	550	43%	8.32E-07	3.00E-09	1.25E-06	1.11E-08	2.16E-06	0	0	-	-	-	-	-	-
Generators	Diesel	2270006005	80	43%	9.25E-07	3.63E-09	1.47E-06	1.23E-08	2.53E-06	2	2	168	1.18E-08	4.62E-11	1.87E-08	1.57E-10	3.22E-08
Generators	Diesel	2270006005	425	43%	8.32E-07	3.00E-09	1.25E-06	1.11E-08	2.16E-06	2	2	317	1.06E-07	3.83E-10	1.59E-07	1.41E-09	2.76E-07
Light Plant	Diesel	2270002027	15	43%	9.25E-07	4.47E-09	1.99E-06	1.23E-08	3.48E-06	0	0	-	-	-	-	-	-
Light Plant	Diesel	2270002027	60	43%	9.25E-07	3.65E-09	1.44E-06	1.23E-08	2.47E-06	5	1	660	8.68E-08	3.42E-10	1.35E-07	1.15E-09	2.32E-07
Diving equipment	Diesel	2270002081	180	59%	8.41E-07	2.45E-09	9.69E-07	1.12E-08	1.67E-06	0	0	-	-	-	-	-	-
Anchor Winches	Diesel	2270002081	240	59%	8.41E-07	2.45E-09	9.69E-07	1.12E-08	1.67E-06	0	0	-	-	-	-	-	-
AHT Winch	Diesel	2270002081	120	59%	8.41E-07	3.30E-09	1.38E-06	1.12E-08	2.40E-06	2	1	61	8.01E-09	3.14E-11	1.32E-08	1.06E-10	2.29E-08
Anchor Winches	Diesel	2270002081	600	59%	8.41E-07	2.70E-09	1.10E-06	1.12E-08	1.91E-06	1	8	49	1.61E-08	5.16E-11	2.11E-08	2.14E-10	3.66E-08
Gantry Boom	Diesel	2270002081	335	59%	8.41E-07	2.70E-09	1.10E-06	1.12E-08	1.91E-06	1	1	392	7.19E-08	2.31E-10	9.42E-08	9.55E-10	1.63E-07
Gantry Hoist	Diesel	2270002081	520	59%	8.41E-07	2.70E-09	1.10E-06	1.12E-08	1.91E-06	1	1	392	1.12E-07	3.58E-10	1.46E-07	1.48E-09	2.54E-07
Gantry Swing	Diesel	2270002081	335	59%	8.41E-07	2.70E-09	1.10E-06	1.12E-08	1.91E-06	1	2	392	7.19E-08	2.31E-10	9.42E-08	9.55E-10	1.63E-07
Line-up Station	Diesel	2270002081	120	59%	8.41E-07	3.30E-09	1.38E-06	1.12E-08	2.40E-06	0	0	-	-	-	-	-	-
UT Station	Diesel	2270002081	60	59%	9.34E-07	3.47E-09	1.31E-06	1.24E-08	2.23E-06	0	0	-	-	-	-	-	-
Coating Station	Diesel	2270002081	60	59%	9.34E-07	3.47E-09	1.31E-06	1.24E-08	2.23E-06	0	0	-	-	-	-	-	-
Tug Winch	Diesel	2270002081	80	59%	9.34E-07	3.14E-09	1.17E-06	1.24E-08	1.98E-06	0	0	-	-	-	-	-	-
Jet Barge Anchor Winches	Diesel	2270002081	240	59%	8.41E-07	2.45E-09	9.69E-07	1.12E-08	1.67E-06	0	0	-	-	-	-	-	-
Jet Barge Sled Winch	Diesel	2270002081	240	59%	8.41E-07	2.45E-09	9.69E-07	1.12E-08	1.67E-06	0	0	-	-	-	-	-	-
Pumps	Diesel	2270006010	240	43%	8.32E-07	3.00E-09	1.25E-06	1.11E-08	2.16E-06	0	0	-	-	-	-	-	-
Pumps	Diesel	2270006010	110	43%	8.32E-07	3.48E-09	1.48E-06	1.11E-08	2.57E-06	0	0	-	-	-	-	-	-
Pumps	Diesel	2270006010	1,840	43%	8.32E-07	3.00E-09	1.25E-06	1.11E-08	2.16E-06	1	3	990	7.19E-07	2.59E-09	1.08E-06	9.55E-09	1.87E-06

Table 6 - BMOP - Offshore Construction Emissions
2024 Non-Road Construction Equipment Exhaust Hazardous Air Pollutant Emissions (Continued)

Equipment Type	Fuel	Source Category[1]	Engine Rating[3] (hp)	Load Factor[1]	Pollutant Emission Factor[2] (g/hp-hr)					No. of Equipment/ Day[3]	Engines per Unit[3]	Hours of Operation[3]	Pollutant Emissions (tons/year)				
					Arsenic	Chromium VI	Manganese	Mercury	Nickel				Arsenic	Chromium VI	Manganese	Mercury	Nickel
Marine Vessels[4,5]																	
Diving Support Vessel	Diesel	-	2,250	43%	-	-	-	-	-	0	0	-	-	-	-	-	-
Lift Boat	Diesel	-	1,500	43%	-	-	-	-	-	1	2	72	-	-	-	-	-
Lift Boat	Diesel	-	1,000	43%	-	-	-	-	-	0	0	-	-	-	-	-	-
DP Nitrogen Boat	Diesel	-	3,000	43%	-	-	-	-	-	0	0	-	-	-	-	-	-
Supply Vessel	Diesel	-	1,125	43%	-	-	-	-	-	2	2	634	-	-	-	-	-
Crew Boat	Diesel	-	1,000	45%	-	-	-	-	-	2	3	634	-	-	-	-	-
Diving Support Vessel	Diesel	-	3,000	43%	-	-	-	-	-	0	0	-	-	-	-	-	-
Bow Thruster	Diesel	-	950	31%	-	-	-	-	-	0	0	-	-	-	-	-	-
Stern Thruster	Diesel	-	950	31%	-	-	-	-	-	2	2	61	-	-	-	-	-
Jet Barge Anchor Handling Tug	Diesel	-	900	31%	-	-	-	-	-	2	2	252	-	-	-	-	-
Derrick Barge Anchor Handling Tug	Diesel	-	1,800	31%	-	-	-	-	-	0	0	-	-	-	-	-	-
Crew Boat	Diesel	-	350	45%	-	-	-	-	-	0	0	-	-	-	-	-	-
Pipehaul Tug	Diesel	-	1,200	31%	-	-	-	-	-	0	0	-	-	-	-	-	-
Total													**<0.01**	**<0.01**	**<0.01**	**<0.01**	**<0.01**

1. Based on EPA MOVES2014b.
2. EPA MOVES2014b (Region: National).
3. Based on data provided by Blue Marlin Offshore Port, LLC.
4. Load factor from Table 3-4 of Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories, ICF International, April 2009.
5. Emission factors for engines greater than 600 hp are based on Section 3.4. Large Stationary Diesel and All Stationary Dual-fuel Engines, Tables 3.4-3 and 3.4-4. For engines less than 600 hp, emission factors are based on AP-42, Section 3.3. Gasoline and Diesel Industrial Engines, Table 3.3-2.

Table 7 - BMOP - Offshore Construction Emissions
On-Road Worker Commuting Criteria and Greenhouse Gas Emission Factors

Vehicle	Emission Factor (g/VMT)[1]									Onsite Travel (miles/vehicle)[2]	No. of Vehicle Trips/Year[2]
	CO	NO_x	SO_2	VOC	PM_{10}	$PM_{2.5}$	CO_2	CH_4	N_2O		
2022											
Gasoline Passenger Cars	1.38	0.08	0.002	0.02	0.004	0.003	258.85	0.002	0.001	30	495
Gasoline Passenger Trucks	2.19	0.18	0.002	0.04	0.005	0.004	345.16	0.003	0.001	30	1,485
2024											
Gasoline Passenger Cars	1.22	0.06	0.002	0.01	0.003	0.003	240.72	0.002	0.001	30	124
Gasoline Passenger Trucks	1.90	0.14	0.002	0.03	0.004	0.004	322.54	0.003	0.001	30	371

1. EPA MOVES2014b (Region: National).
2. BMOP does not expect this many trips to occur during the construction period; however, BMOP quantified emissions based on a conservative estimate.

Table 8 - BMOP - Offshore Construction Emissions
On-Road Worker Commuting Criteria and Greenhouse Gas Emissions

Vehicle	Vehicle Miles Traveled (VMT/year)	Emissions (tons/yr)									
		CO	NO_x	SO_2	VOC	PM_{10}	$PM_{2.5}$	CO_2	CH_4	N_2O	CO_2e[1]
2021											
Gasoline Passenger Cars	14,850	0.02	1.30E-03	2.79E-05	2.61E-04	5.79E-05	5.12E-05	4	3.34E-05	1.49E-05	4
Gasoline Passenger Trucks	44,550	0.11	0.01	1.11E-04	1.73E-03	2.40E-04	2.13E-04	17	1.63E-04	6.99E-05	17
Total		**0.13**	**0.01**	**1.39E-04**	**1.99E-03**	**2.98E-04**	**2.64E-04**	**21**	**1.96E-04**	**8.49E-05**	**21**
2024											
Gasoline Passenger Cars	3,720	0.01	0.00	6.49E-06	0.00	1.27E-05	1.13E-05	1	7.41E-06	3.58E-06	1
Gasoline Passenger Trucks	11,130	0.02	0.00	2.60E-05	0.00	0.00	0.00	4	0.00	1.53E-05	4
Total		**0.03**	**0.00**	**3.25E-05**	**0.00**	**0.00**	**5.91E-05**	**5**	**0.00**	**1.88E-05**	**5**

1. The global warming potentials of CO_2, CH_4, and N_2O are assumed to be 1, 25, and 298, respectively.

Table 9 - BMOP - Offshore Construction Emissions
On-Road Worker Commuting Hazardous Air Pollutant Emission Factors

Vehicle	Emission Factor (g/VMT)[1]						Onsite Travel (miles/vehicle)[2]	No. of Vehicle Trips/Year[2]
	1,3-Butadiene	2,2,4-Trimethylpentane	Acetaldehyde	Acrolein	Benzene	Ethyl Benzene		
2022								
Gasoline Passenger Cars	2.59E-05	3.17E-04	1.19E-04	8.80E-06	5.12E-04	2.79E-04	30	495
Gasoline Passenger Trucks	7.98E-05	6.78E-04	3.06E-04	2.09E-05	1.19E-03	6.30E-04	30	1,485
2024								
Gasoline Passenger Cars	1.15E-05	2.48E-04	8.25E-05	6.99E-06	4.15E-04	2.17E-04	30	124
Gasoline Passenger Trucks	4.49E-05	5.10E-04	2.14E-04	1.60E-05	9.26E-04	4.73E-04	30	371

1. EPA MOVES2014b (Region: National).
2. BMOP does not expect this many trips to occur during the construction period; however, BMOP quantified emissions based on a conservative estimate.

Table 9 - BMOP - Offshore Construction Emissions
On-Road Worker Commuting Hazardous Air Pollutant Emissions
(Continued)

Vehicle	Vehicle Miles Traveled (VMT/year)	Emissions (tons/yr)					
		1,3-Butadiene	2,2,4-Trimethylpentane	Acetaldehyde	Acrolein	Benzene	Ethyl Benzene
2022							
Gasoline Passenger Cars	14,850	4.23E-07	5.19E-06	1.94E-06	1.44E-07	8.38E-06	4.56E-06
Gasoline Passenger Trucks	44,550	3.92E-06	3.33E-05	1.50E-05	1.03E-06	5.85E-05	3.09E-05
Total		**4.34E-06**	**3.85E-05**	**1.70E-05**	**1.17E-06**	**6.68E-05**	**3.55E-05**
2024							
Gasoline Passenger Cars	3,720	4.71E-08	1.02E-06	3.38E-07	2.87E-08	1.70E-06	8.88E-07
Gasoline Passenger Trucks	11,130	5.51E-07	6.25E-06	2.62E-06	1.97E-07	1.14E-05	5.80E-06
Total		**5.98E-07**	**7.27E-06**	**2.96E-06**	**2.25E-07**	**1.31E-05**	**6.69E-06**

Table 9 - BMOP - Offshore Construction Emissions
On-Road Worker Commuting Hazardous Air Pollutant Emission Factors
(Continued)

Vehicle	Emission Factor (g/VMT)[1]								Onsite Travel (miles/vehicle)[2]	No. of Vehicle Trips/Year[2]
	Formaldehyde	Hexane	Naphthalene	PAH	Propionaldehyde	Styrene	Toluene	Xylenes		
2022										
Gasoline Passenger Cars	1.90E-04	3.70E-04	2.34E-07	2.00E-05	8.26E-06	1.40E-05	1.50E-03	1.03E-03	30	495
Gasoline Passenger Trucks	4.53E-04	7.45E-04	3.23E-07	3.73E-05	2.16E-05	3.48E-05	3.19E-03	2.32E-03	30	1,485
2024										
Gasoline Passenger Cars	1.51E-04	3.12E-04	2.05E-07	1.65E-05	5.87E-06	1.08E-05	1.18E-03	7.99E-04	30	124
Gasoline Passenger Trucks	3.46E-04	6.03E-04	2.91E-07	3.02E-05	1.53E-05	2.61E-05	2.43E-03	1.74E-03	30	371

1. EPA MOVES2014b (Region: National).
2. BMOP does not expect this many trips to occur during the construction period; however, BMOP quantified emissions based on a conservative estimate.

Table 9 - BMOP - Offshore Construction Emissions
On-Road Worker Commuting Hazardous Air Pollutant Emissions
(Continued)

Vehicle	Vehicle Miles Traveled (VMT/year)	Emissions (tons/yr)							
		Formaldehyde	Hexane	Naphthalene	PAH	Propionaldehyde	Styrene	Toluene	Xylenes
2022									
Gasoline Passenger Cars	14,850	3.11E-06	6.06E-06	3.82E-09	3.27E-07	1.35E-07	2.30E-07	2.45E-05	1.68E-05
Gasoline Passenger Trucks	44,550	2.23E-05	3.66E-05	1.59E-08	1.83E-06	1.06E-06	1.71E-06	1.57E-04	1.14E-04
Total		**2.54E-05**	**4.26E-05**	**1.97E-08**	**2.16E-06**	**1.20E-06**	**1.94E-06**	**1.81E-04**	**1.31E-04**
2024									
Gasoline Passenger Cars	3,720	6.18E-07	1.28E-06	8.41E-10	6.78E-08	2.41E-08	4.43E-08	4.86E-06	3.28E-06
Gasoline Passenger Trucks	11,130	4.25E-06	7.40E-06	3.58E-09	3.70E-07	1.88E-07	3.20E-07	2.98E-05	2.14E-05
Total		**4.87E-06**	**8.68E-06**	**4.42E-09**	**4.38E-07**	**2.12E-07**	**3.64E-07**	**3.46E-05**	**2.47E-05**

Table 9 - BMOP - Offshore Construction Emissions
On-Road Worker Commuting Hazardous Air Pollutant Emission Factors
(Continued)

Vehicle	Emission Factor (g/VMT)[1]				Onsite Travel (miles/vehicle)[2]	No. of Vehicle Trips/Year[2]
	Arsenic	Chromium VI	Mercury	Nickel		
2022						
Gasoline Passenger Cars	2.30E-06	1.20E-08	1.20E-07	1.50E-06	30	495
Gasoline Passenger Trucks	2.30E-06	1.20E-08	1.20E-07	1.50E-06	30	1,485
2024						
Gasoline Passenger Cars	2.30E-06	1.20E-08	1.20E-07	1.50E-06	30	124
Gasoline Passenger Trucks	2.30E-06	1.20E-08	1.20E-07	1.50E-06	30	371

1. EPA MOVES2014b (Region: National).
2. BMOP does not expect this many trips to occur during the construction period; however, BMOP quantified emissions based on a conservative estimate.

Table 9 - BMOP - Offshore Construction Emissions
On-Road Worker Commuting Hazardous Air Pollutant Emissions
(Continued)

Vehicle	Vehicle Miles Traveled (VMT/year)	Emissions (tons/yr)			
		Arsenic	Chromium VI	Mercury	Nickel
2022					
Gasoline Passenger Cars	14,850	3.76E-08	1.96E-10	1.97E-09	2.46E-08
Gasoline Passenger Trucks	44,550	1.13E-07	5.89E-10	5.91E-09	7.37E-08
Total		**1.51E-07**	**7.86E-10**	**7.88E-09**	**9.82E-08**
2024					
Gasoline Passenger Cars	3,720	9.43E-09	4.92E-11	4.93E-10	6.15E-09
Gasoline Passenger Trucks	11,130	2.82E-08	1.47E-10	1.48E-09	1.84E-08
Total		**3.76E-08**	**1.96E-10**	**1.97E-09**	**2.46E-08**

Table 10 - BMOP - Offshore Construction Emissions
Fugitive Dust from Paved Roads

Paved Road Data[1]

Road surface silt loading[1], g/m^2	0.2	
Particle size multiplier (k)[1]	PM_{10}	0.0022
	$PM_{2.5}$	0.00054

Type of Vehicle	Vehicle Miles Traveled[4], (VMT)/year		Average Vehicle Weight[2], tons	Emission Factor[3], lb/VMT	
	2022	2024		PM_{10}	$PM_{2.5}$
Gasoline Passenger Cars	14,850	3,720	1	7.26E-04	1.78E-04
Gasoline Passenger Trucks	44,550	11,130	1	7.26E-04	1.78E-04

Emissions Summary

Activity Year	Total Emissions, tons/year	
	PM_{10}	$PM_{2.5}$
2022	0.02	0.01
2024	0.01	0.001

1. Based on AP-42, Section 13.2.1, Paved Roads, January 2011. For silt loading, no site-specific data is available. Thus, BMOP utilized the value from Table 13.2.1-2 for ubiquitous baseline with average daily traffic (ADT) ranging between 500 to 5,000 vehicles.
2. Based on Update Heavy-Duty Engine Emission Conversion Factors for MOBILE6: Analysis of BSFCs and Calculation of Heavy-Duty Engine Emission Conversion Factors, EPA420-P-98-015, May 1998.
3. PM emission factors determined by methodology from AP-42, Section 13.2.1, *Paved Roads,* Equation 1 (January, 2011).

$$E = k * (sL)^{0.91} * W^{1.02}$$

E= particulate emission factor, (lb/VMT)
k= Particle size multiplier for particle size range and units of interest from Table 13.2.1-1
sL= road surface silt loading from Table 13.2.1-2, grams per square meter (g/m^2)
W= average weight of the vehicles traveling the road, tons

4. BMOP quantified emissions based on a conservative estimate.

Table 11 - BMOP - Offshore Construction Emissions
Construction Emissions Totals

Nonroad Exhaust Emissions - Hazardous Air Pollutant Emissions										
Annual Emissions (tons)										
Year	**CO**	**NOx**	**SO_2**	**VOC**	**PM_{10}**	**$PM_{2.5}$**	**CO_2**	**CH_4**	**N_2O**	**CO_2e**
2022	398.00	2,107.87	1.57	46.41	69.80	69.33	184,210	12.54	6.85	186,564
2024	11.00	50.18	0.05	0.87	1.53	1.51	6,146	0.26	0.25	6,227
Total	**409.00**	**2,158.05**	**1.62**	**47.27**	**71.33**	**70.83**	**190,356**	**12.80**	**7.10**	**192,791**

Nonroad Exhaust Emissions - Hazardous Air Pollutant Emissions										
Annual Emissions (tons)										
Year	**1,3-Butadiene**	**2,2,4-Trimethylpentane**	**Acetaldehyde**	**Acrolein**	**Benzene**	**Ethyl Benzene**	**Formaldehyde**	**Hexane**	**Naphthalene**	**PAH**
2022	0.02	0.02	0.93	0.22	0.54	0.01	2.60	<0.01	0.08	0.08
2024	<0.01	<0.01	0.04	0.01	0.01	<0.01	0.11	<0.01	<0.01	<0.01
Total	**0.03**	**0.03**	**0.97**	**0.23**	**0.55**	**0.02**	**2.72**	**0.02**	**0.09**	**0.09**

Nonroad Exhaust Emissions - Hazardous Air Pollutant Emissions									
Annual Emissions (tons)									
Year	**Propionaldehyde**	**Toluene**	**Xylenes**	**Arsenic**	**Chromium VI**	**Manganese**	**Mercury**	**Nickel**	**Total HAPs**
2022	0.10	0.10	0.07	<0.01	<0.01	<0.01	<0.01	<0.01	**4.83**
2024	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	**0.32**
Total	**0.11**	**0.11**	**0.08**	**0.02**	**0.02**	**0.02**	**0.02**	**0.02**	**5.15**

On-Road Tailpipe Emissions - Criteria Pollutants and GHG Emissions										
Annual Emissions (tons)										
Year	**CO**	**NOx**	**SO_2**	**VOC**	**PM_{10}**	**$PM_{2.5}$**	**CO_2**	**CH_4**	**N_2O**	**CO_2e**
2022	0.13	0.01	<0.01	<0.01	<0.01	<0.01	21	<0.01	<0.01	21
2024	0.03	<0.01	<0.01	<0.01	<0.01	<0.01	5	<0.01	<0.01	5
Total	**0.16**	**0.02**	**0.02**	**0.02**	**0.02**	**0.02**	**26**	**0.02**	**0.02**	**26**

On-Road Tailpipe Emissions - Hazardous Air Pollutant Emissions										
Annual Emissions (tons)										
Year	**1,3-Butadiene**	**2,2,4-Trimethylpentane**	**Acetaldehyde**	**Acrolein**	**Benzene**	**Ethyl Benzene**	**Formaldehyde**	**Hexane**	**Naphthalene**	**PAH**
2022	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2024	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Total	**0.02**	**0.02**	**0.02**	**0.02**	**0.02**	**0.02**	**0.02**	**0.02**	**0.02**	**0.02**

On-Road Tailpipe Emissions - Hazardous Air Pollutant Emissions										
Annual Emissions (tons)										
Year	**Propionaldehyde**	**Styrene**	**Toluene**	**Xylenes**	**Arsenic**	**Chromium VI**	**Manganese**	**Mercury**	**Nickel**	**Total HAPs**
2022	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	<0.01	<0.01	**0.18**
2024	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	<0.01	<0.01	**0.18**
Total	**0.02**	**0.02**	**0.02**	**0.02**	**0.02**	**0.02**	-	**0.02**	**0.02**	**0.36**

Table 11 - BMOP - Offshore Pipeline Construction Emissions
Construction Emissions Totals
(Continued)

Fugitive Dust										
Annual Emissions (tons)										
Year	CO	NOx	SO_2	VOC	PM_{10}	$PM_{2.5}$	CO_2	CH_4	N_2O	CO_2e
2022	-	-	-	-	0.02	0.01	-	-	-	-
2024	-	-	-	-	0.01	<0.01	-	-	-	-
Total	**-**	**-**	**-**	**-**	**0.03**	**0.01**	**-**	**-**	**-**	**-**

Totals - Criteria and GHG Emissions										
Annual Emissions (tons)										
Year	CO	NOx	SO_2	VOC	PM_{10}	$PM_{2.5}$	CO_2	CH_4	N_2O	CO_2e
2022	398.13	2,107.88	1.58	46.42	69.83	69.34	184,231	12.55	6.86	186,585
2024	11.03	50.19	0.06	0.88	1.54	1.52	6,151	0.27	0.26	6,232
Total	**409.16**	**2,158.07**	**1.64**	**47.29**	**71.37**	**70.86**	**190,382**	**12.82**	**7.12**	**192,817**

Totals - Hazardous Air Pollutant Emissions										
Annual Emissions (tons)										
Year	1,3-Butadiene	2,2,4-Trimethylpentane	Acetaldehyde	Acrolein	Benzene	Ethyl Benzene	Formaldehyde	Hexane	Naphthalene	PAH
2022	0.03	0.03	0.94	0.23	0.55	0.02	2.61	0.02	0.09	0.09
2024	0.02	0.02	0.05	0.02	0.02	0.02	0.12	0.02	0.02	0.02
Total	**0.05**	**0.05**	**0.99**	**0.25**	**0.57**	**0.04**	**2.74**	**0.04**	**0.11**	**0.11**

Totals - Hazardous Air Pollutant Emissions										
Annual Emissions (tons)										
Year	Propionaldehyde	Styrene	Toluene	Xylenes	Arsenic	Chromium VI	Manganese	Mercury	Nickel	Total HAPs
2022	0.11	0.01	0.11	0.08	0.02	0.02	0.01	0.02	0.02	5.01
2024	0.02	0.01	0.02	0.02	0.02	0.02	0.01	0.02	0.02	0.50
Total	**0.13**	**0.02**	**0.13**	**0.10**	**0.04**	**0.04**	**0.02**	**0.04**	**0.04**	**5.51**

APPENDIX B. DETAILED OFFSHORE STATIONARY SOURCE EMISSIONS CALCULATIONS

Normal Operations Emission Calculations
Stationary Summary

	NO_X (tpy)	CO (tpy)	VOC (tpy)	SO_2 (tpy)	PM Filterable (tpy)	PM_{10}[1] (tpy)	$PM_{2.5}$[1] (tpy)	H_2S (tpy)	H_2SO_4 (tpy)	HAPs (tpy)	CO_2e (tpy)
Marine Loading											
Crude Oil Loading	--	--	21,840	--	--	--	--	9.49	--	1,224	--
Platform A Sources											
Aviation Fuel Tank	--	--	5.12E-04	--	--	--	--	--	--	7.65E-05	--
Platform B Sources											
Natural Gas Generators (x2)	22.48	44.96	15.74	0.05	6.14E-03	0.80	0.80	--	2.34E-03	4.22	12,871
Emergency Diesel Generator	1.06	0.58	1.06	0.07	0.03	0.04	0.04	--	2.23E-03	1.11E-03	115.2
Platform B Cranes (x2)	2.05	11.97	0.97	1.48	0.10	0.21	0.21	--	0.05	0.06	2,383
Platform B Cranes Diesel Tank #1	--	--	1.93E-03	--	--	--	--	--	--	2.65E-04	--
Platform B Cranes Diesel Tank #2	--	--	1.93E-03	--	--	--	--	--	--	2.65E-04	--
Firewater Pump Engine	0.21	0.19	0.21	0.02	0.01	0.01	0.01	--	7.22E-04	3.58E-04	37.22
Primary Diesel Tank	--	--	8.51E-03	--	--	--	--	--	--	1.17E-03	--
Surge Tank #1	--	--	3.73	--	--	--	--	--	--	0.07	--
Platform C Sources											
Firewater Pump Engine	0.21	0.19	0.21	0.02	0.01	0.01	0.01	--	7.22E-04	3.58E-04	37.22
Fugitive Sources											
Total Fugitive Emissions	--	--	18.65	--	--	--	--	4.89E-03	--	1.91	1,060
Total	26.02	57.88	21,881	1.64	0.16	1.07	1.07	9.50	0.05	1,230	16,503

[1] PM_{10} and $PM_{2.5}$ emissions are represented as the sum of filterable PM_{10}/$PM_{2.5}$ and condensable emission

Normal Operations Emission Calculations

BMOP - Platform Natural Gas Generators

Engine Rating [1]	=	1,736	kW
	=	2,328	HP
Total Operating Time [1]	=	8,760	hrs/yr
Operating load [1]	=	100%	
Total number Main Engines [1]	=	1 engine at any one time	
Fuel Type [1]	=	Natural Gas, 4-Stroke Lean Burn	
Average Brake-Specific Fuel Consumption [2]	=	17,820	scf/hr
Average Higher Heating Value (HHV) [4]	=	1,020	Btu/scf
Average Heat Input Rate	=	18.18	MMBtu/hr

Criteria Pollutants

Pollutant	Emission Factor Basis		Emission Factor		Hourly Emissions	Annual Emissions
			Value	Units	(lb/hr)	(tons/yr)
$PM_{Filterable}$	AP-42	[4]	7.71E-05	lb/MMBtu	1.40E-03	6.14E-03
$PM_{10, Filterable}$	AP-42	[4]	7.71E-05	lb/MMBtu	1.40E-03	6.14E-03
$PM_{2.5, Filterable}$	AP-42	[4]	7.71E-05	lb/MMBtu	1.40E-03	6.14E-03
$PM_{Condensable}$	AP-42	[4]	9.91E-03	lb/MMBtu	0.18	0.79
NO_x	EPA	[3]	1.00	g/HP-hr	5.13	22.48
SO_2	AP-42	[4]	5.88E-04	lb/MMBtu	0.01	0.05
CO	EPA	[3]	2.00	g/HP-hr	10.26	44.96
VOC	EPA	[3]	0.70	g/HP-hr	3.59	15.74
H_2SO_4	Conversion	[5]	5.00	% of SO_2	5.34E-04	2.34E-03

[1] Based on current project design specifications, provided by BMOP. The BMOP Platform complex will operate 2 engines, however, only one will be operating at any given time.

[2] Per Manufacturer Specification sheet for a Caterpillar G3516C (based on 100% load).

[3] Per Table 1 of NSPS Subpart JJJJ

[4] Emission factors are based on AP-42 Chapter 3, Table 3.2-2, Uncontrolled Emission Factors for 4-Stroke Lean Burn Engines (July 2000). Assume filterable PM = PM_{10} = $PM_{2.5}$.

[5] Assumes 5% of SO_2 emissions are converted to H_2SO_4.

Normal Operations Emission Calculations

BMOP - Platform Natural Gas Generators

Hazardous Air Pollutants

Pollutant	Emission Factor Basis		Emission Factor		Hourly Emissions	Annual Emissions
			Value	Units	(lb/hr)	(tons/yr)
Acenaphthene	AP-42	[6]	1.25E-06	lb/MMBtu	2.27E-05	9.95E-05
Acenaphthylene	AP-42	[6]	5.53E-06	lb/MMBtu	1.01E-04	4.40E-04
Acetaldehyde	AP-42	[6]	8.36E-03	lb/MMBtu	0.15	0.67
Acrolein	AP-42	[6]	5.14E-03	lb/MMBtu	0.09	0.41
Benzene	AP-42	[6]	4.40E-04	lb/MMBtu	8.00E-03	0.04
Benzo(b)fluoranthene	AP-42	[6]	1.66E-07	lb/MMBtu	3.02E-06	1.32E-05
Benzo(e)pyrene	AP-42	[6]	4.15E-07	lb/MMBtu	7.54E-06	3.30E-05
Beno(g,h,i)perylene	AP-42	[6]	4.14E-07	lb/MMBtu	7.53E-06	3.30E-05
Biphenyl	AP-42	[6]	2.12E-04	lb/MMBtu	3.85E-03	0.02
Butadiene (1,3-)	AP-42	[6]	2.67E-04	lb/MMBtu	4.85E-03	0.02
Carbon Tetrachloride	AP-42	[6]	3.67E-05	lb/MMBtu	6.67E-04	2.92E-03
Chlorobenzene	AP-42	[6]	3.04E-05	lb/MMBtu	5.53E-04	2.42E-03
Chloroform	AP-42	[6]	2.85E-05	lb/MMBtu	5.18E-04	2.27E-03
Chrysene	AP-42	[6]	6.93E-07	lb/MMBtu	1.26E-05	5.52E-05
Dichloropropene (1,3-)	AP-42	[6]	2.64E-05	lb/MMBtu	4.80E-04	2.10E-03
Ethylbenzene	AP-42	[6]	3.97E-05	lb/MMBtu	7.22E-04	3.16E-03
Ethylene Dibromide	AP-42	[6]	4.43E-05	lb/MMBtu	8.05E-04	3.53E-03
Fluoranthene	AP-42	[6]	1.11E-06	lb/MMBtu	2.02E-05	8.84E-05
Fluorene	AP-42	[6]	5.67E-06	lb/MMBtu	1.03E-04	4.51E-04
Formaldehyde	ZZZZ	[7]	14	ppmvd	0.61	2.67
Methanol	AP-42	[6]	2.50E-03	lb/MMBtu	0.05	0.20
Methylene Chloride	AP-42	[6]	2.00E-05	lb/MMBtu	3.64E-04	1.59E-03
Methylnaphthalene (2-)	AP-42	[6]	3.32E-05	lb/MMBtu	6.03E-04	2.64E-03
n-Hexane	AP-42	[6]	1.11E-03	lb/MMBtu	0.02	0.09
Naphthalene	AP-42	[6]	7.44E-05	lb/MMBtu	1.35E-03	5.92E-03
PAH	AP-42	[6]	2.69E-05	lb/MMBtu	4.89E-04	2.14E-03
Phenanthrene	AP-42	[6]	1.04E-05	lb/MMBtu	1.89E-04	8.28E-04
Phenol	AP-42	[6]	2.40E-05	lb/MMBtu	4.36E-04	1.91E-03
Pyrene	AP-42	[6]	1.36E-06	lb/MMBtu	2.47E-05	1.08E-04
Styrene	AP-42	[6]	2.36E-05	lb/MMBtu	4.29E-04	1.88E-03
Tetrachloroethane	AP-42	[6]	2.48E-06	lb/MMBtu	4.51E-05	1.97E-04
Toluene	AP-42	[6]	4.08E-04	lb/MMBtu	7.42E-03	0.03
Tetrachloroethane (1,1,2,2-)	AP-42	[6]	4.00E-05	lb/MMBtu	7.27E-04	3.18E-03
Trichloroethane (1,1,2-)	AP-42	[6]	3.18E-05	lb/MMBtu	5.78E-04	2.53E-03
Trimethylpentane (2,2,4-)	AP-42	[6]	2.50E-04	lb/MMBtu	4.54E-03	0.02
Vinyl Chloride	AP-42	[6]	1.49E-05	lb/MMBtu	2.71E-04	1.19E-03
Xylene	AP-42	[6]	1.84E-04	lb/MMBtu	3.34E-03	0.01
Total VOC HAPs					**0.96**	**4.22**

[6] Emission factors are based on AP-42 Chapter 3, Table 3.2-2, Uncontrolled Emission Factors for 4-Stroke Lean Burn Engines (July 2000).

[7] Per Table 2a of 40 CFR 63 Subpart ZZZZ, subject 4SLB engines may comply with 14 ppmvd HCHO at 15% O2.

Greenhouse Gases

Pollutant	Emission Factor Basis		Emission Factor		Hourly Emissions	Annual Emissions
			Value	Units	(lb/hr)	(tons/yr)
CO_2	Manuf. Spec.	[8]	617	g/kW-hr	2,361	10,343
CH_4	Manuf. Spec.	[8]	6.02	g/kW-hr	23.04	100.9
N_2O	EPA	[9]	1.00E-04	kg/MMBtu	4.01E-03	0.02
CO_2e	EPA	[10]	--	--	**2,939**	**12,871**

[8] Per Manufacturer Specification sheet for a Caterpillar G3516C (based on 100% load).

[9] Emission factors based on 40 CFR 98 Subpart C, Table C-2 Default CH_4 and N_2O Emission Factors for Various Types of Fuel. The emission factor for natural gas was used to calculate emissions.

[10] CH_4, CO_2 and N_2O are included in the emissions of CO_2 equivalent (CO_2e), weighted according to their global warming potential (GWP). The GWP was obtained from table A-1 to Subpart A of Part 98.

Normal Operations Emission Calculations

BMOP - Platform Diesel Generators

Engine Rating [1]	=	1,500	kW
	=	2,012	HP
Total Operating Time [1]	=	100	hrs/yr
Operating load [1]	=	100%	
Total number Main Engines [1]	=	1	
Fuel Type [1]	=	Diesel	
Average Brake-Specific Fuel Consumption [2]	=	7,000	Btu/HP-hr
Average Higher Heating Value (HHV) [2]	=	19,300	Btu/lb
Average Heat Input Rate	=	14.08	MMBtu/hr

Criteria Pollutants

Pollutant	Emission Factor Basis		Emission Factor		Hourly Emissions	Annual Emissions
			Value	Units	(lb/hr)	(tons/yr)
PM $_{Filterable}$	EPA	[3]	0.20	g/kW-hr	0.66	0.03
$PM_{10, Filterable}$	EPA	[3]	0.20	g/kW-hr	0.66	0.03
$PM_{2.5, Filterable}$	EPA	[3]	0.20	g/kW-hr	0.66	0.03
PM $_{Condensable}$	AP-42	[2]	5.39E-05	lb/HP-hr	0.11	5.42E-03
NO_x	EPA	[3]	6.40	g/kW-hr	21.17	1.06
SO_2	Fuel S Content	[4]	7.11E-04	lb/HP-hr	1.43	0.07
CO	EPA	[3]	3.50	g/kW-hr	11.58	0.58
VOC	EPA	[3]	6.40	g/kW-hr	21.17	1.06
H_2SO_4	Fuel S Content	[4]	2.22E-05	lb/HP-hr	0.04	2.23E-03

[1] Based on current project design specifications, provided by BMOP.

[2] Emission factors are based on AP-42 Chapter 3, Tables 3.4-1 and 2, Emission Factors for Large Stationary Diesel and all Stationary Dual-fuel Engines (October 1996). An average BSFC of 7,000 Btu/hp-hr was used to convert from lb/MMBtu to lb/hp-hr.

[3] Per 40 CFR 60.4205(b) and Table 1 of 40 CFR 89.112. Conservatively assume that NO_X and VOC emissions are equivalent to the NMHC + NO_X emissions limit. Conservatively assume that filterable $PM=PM_{10}=PM_{2.5}$.

[4] Sulfur content of 0.1 % is used for all diesel combustion sources per IMO 2015 standards. Therefore, emissions have been calculated based on a maximum sulfur content of 1000 ppm in diesel fuel assuming that 98 percent of sulfur in the fuel is oxidized to SO2 (MW=32 g/mol) and 2 percent of sulfur in the fuel is oxidized to H2SO4 (MW=98 g/mol) based on Draft Regulatory Impact Analysis: Control of Emissions from Nonroad Diesel Engines, EPA420-R-03-008, April 2003.

[5] Per footnote f of AP-42 Chapter 3, Table 3.4-1, non methane VOC emission factor has calculated as 91% of TOC emission factor.

Normal Operations Emission Calculations
BMOP - Platform Diesel Generators

Hazardous Air Pollutants

Pollutant	Emission Factor Basis		Emission Factor		Hourly Emissions	Annual Emissions
			Value	Units	(lb/hr)	(tons/yr)
Acetaldehyde	AP-42	[6], [7]	2.52E-05	lb/MMBtu	3.55E-04	1.77E-05
Acrolein	AP-42	[6], [7]	7.88E-06	lb/MMBtu	1.11E-04	5.55E-06
Benzene	AP-42	[6], [7]	7.76E-04	lb/MMBtu	1.09E-02	5.46E-04
Formaldehyde	AP-42	[6], [7]	7.89E-05	lb/MMBtu	1.11E-03	5.56E-05
Toluene	AP-42	[6], [7]	2.81E-04	lb/MMBtu	3.96E-03	1.98E-04
Xylenes	AP-42	[6], [7]	1.93E-04	lb/MMBtu	2.72E-03	1.36E-04
Total PAH	AP-42	[6], [7]	2.12E-04	lb/MMBtu	2.99E-03	1.49E-04
Total VOC HAPs					**2.22E-02**	**1.11E-03**

[6] Emission factors based on AP-42, Chapter 3, Table 3.4-3, Speciated Organic Compound Emission Factors for Large Uncontrolled Stationary Diesel Engines (October 1996).

[7] An average BSFC of 7,000 Btu/hp-hr was used to convert from lb/MMBtu to lb/hp-hr to calculate emissions.

Greenhouse Gases

Pollutant	Emission Factor Basis		Emission Factor		Hourly Emissions	Annual Emissions
			Value	Units	(lb/hr)	(tons/yr)
CO_2	EPA	[8], [11]	73.96	kg/MMBtu	2,296	114.8
CH_4	EPA	[9], [11]	3.00E-03	kg/MMBtu	9.31E-02	0.00
N_2O	EPA	[9], [11]	6.00E-04	kg/MMBtu	1.86E-02	0.00
CO_2e	EPA	[10]	--	--	**2,304**	**115.2**

[8] Emission factor based on 40 CFR 98 Subpart C, Table C-1 Default CO_2 Emission Factors and High Heat Values for Various Types of Fuel. The emission factor for Distillate Fuel Oil No. 2 was used to calculate emissions.

[9] Emission factors based on 40 CFR 98 Subpart C, Table C-2 Default CH_4 and N_2O Emission Factors for Various Types of Fuel. The emission factor for petroleum (All types in table C-1) was used to calculate emissions.

[10] CH_4, CO_2 and N_2O are included in the emissions of CO_2 equivalent (CO_2e), weighted according to their global warming potential (GWP). The GWP was obtained from table A-1 to Subpart A of Part 98.

[11] An average BSFC of 7,000 Btu/hp-hr was used to convert from lb/MMBtu to lb/hp-hr to calculate emissions.

Normal Operations Emission Calculations
BMOP - Platform B Cranes

Engine Rating [1]	=	354	kW
	=	475	HP
Total Operating Time [1]	=	4,380	hrs/yr
Operating load [1]	=	100%	
Total number Gen Sets [1]	=	2	
Fuel Type [1]	=	Diesel	
Average Brake-Specific Fuel Consumption [2]	=	7,000	Btu/HP-hr
Average Higher Heating Value (HHV) [2]	=	19,300	Btu/lb
Average Heat Input Rate	=	3.33	MMBtu/hr

Criteria Pollutants

Pollutant	Emission Factor Basis		Emission Factor Value	Emission Factor Units	Hourly Emissions from 1 Engine (lb/hr)	Annual Emissions from 1 Engine (tons/yr)	Hourly Emissions from All Engines (lb/hr)	Annual Emissions from All Engines (tons/yr)
$PM_{Filterable}$	EPA	[3], [4]	3.00E-02	g/kW-hr	0.02	0.05	0.05	0.10
$PM_{10, Filterable}$	EPA	[3], [4]	3.00E-02	g/kW-hr	0.02	0.05	0.05	0.10
$PM_{2.5, Filterable}$	EPA	[3], [4]	3.00E-02	g/kW-hr	0.02	0.05	0.05	0.10
$PM_{Condensable}$	AP-42	[5]	5.39E-05	lb/HP-hr	2.56E-02	5.61E-02	0.05	0.11
NO_x	EPA	[3]	0.60	g/kW-hr	0.47	1.03	0.94	2.05
SO_2	Fuel S Content	[6]	7.11E-04	lb/HP-hr	0.34	0.74	0.68	1.48
CO	EPA	[3]	3.5	g/kW-hr	2.73	5.99	5.47	11.97
VOC	EPA	[3]	0.285	g/kW-hr	0.22	0.49	0.45	0.97
H_2SO_4	Fuel S Content	[6]	2.22E-05	lb/HP-hr	1.06E-02	2.31E-02	2.11E-02	4.62E-02

[1] Based on current project design specifications, provided by BMOP.

[2] Based on AP-42 Chapter 3, Table 3.3-1, Emission Factors for Uncontrolled Gasoline and Diesel Industrial Engines (October 1996).

[3] Per 40 CFR 60.4204(b) and Table 1 of 40 CFR 1039.101. Per 40 CFR 1039.101(e), emissions of PM, NO_X, and VOC are multiplied by the appropriate NTE multiplier.

[4] Conservatively assumed PM_{10}=$PM_{2.5}$.

[5] Conservatively based on AP-42 Chapter 3, Table 3.4-1, Emission Factors for Large Stationary Diesel and all Stationary Dual-fuel Engines (October 1996).

[6] Sulfur content of 0.1 % is used for all diesel combustion sources per IMO 2015 standards. Therefore, emissions have been calculated based on a maximum sulfur content of 1000 ppm in diesel fuel assuming that 98 percent of sulfur in the fuel is oxidized to SO2 (MW=32 g/mol) and 2 percent of sulfur in the fuel is oxidized to H2SO4 (MW=98 g/mol) based on Draft Regulatory Impact Analysis: Control of Emissions from Nonroad Diesel Engines, EPA420-R-03-008, April 2003.

Normal Operations Emission Calculations
BMOP - Platform B Cranes

Hazardous Air Pollutants

Pollutant	Emission Factor Basis		Emission Factor		Hourly Emissions from 1 Engine	Annual Emissions from 1 Engine	Hourly Emissions from All Engines	Annual Emissions from All Engines
			Value	Units	(lb/hr)	(tons/yr)	(lb/hr)	(tons/yr)
Acetaldehyde	AP-42	[7], [8]	7.67E-04	lb/MMBtu	2.55E-03	5.59E-03	5.10E-03	1.12E-02
Acrolein	AP-42	[7], [8]	9.25E-05	lb/MMBtu	3.08E-04	6.74E-04	6.15E-04	1.35E-03
Benzene	AP-42	[7], [8]	9.33E-04	lb/MMBtu	3.10E-03	6.79E-03	6.20E-03	1.36E-02
1,3-Butadiene	AP-42	[7], [8]	3.91E-05	lb/MMBtu	1.30E-04	2.85E-04	2.60E-04	5.69E-04
Formaldehyde	AP-42	[7], [8]	1.18E-03	lb/MMBtu	3.92E-03	8.59E-03	7.85E-03	1.72E-02
Toluene	AP-42	[7], [8]	4.09E-04	lb/MMBtu	1.36E-03	2.98E-03	2.72E-03	5.96E-03
Xylenes	AP-42	[7], [8]	2.85E-04	lb/MMBtu	9.48E-04	2.08E-03	1.90E-03	4.15E-03
Total PAH	AP-42	[7], [8]	1.68E-04	lb/MMBtu	5.59E-04	1.22E-03	1.12E-03	2.45E-03
Total VOC HAPs					**1.29E-02**	**2.82E-02**	**2.58E-02**	**5.64E-02**

[7] Emission factors based on AP-42, Chapter 3, Table 3.3-2, Speciated Organic Compound Emission Factors for Uncontrolled Stationary Diesel Engines (October 1996).

[8] An average BSFC of 7,000 Btu/hp-hr was used to convert from lb/MMBtu to lb/hp-hr to calculate emissions.

Greenhouse Gases

Pollutant	Emission Factor Basis		Emission Factor		Hourly Emissions from 1 Engine	Annual Emissions from 1 Engine	Hourly Emissions from All Engines	Annual Emissions from All Engines
			Value	Units	(lb/hr)	(tons/yr)	(lb/hr)	(tons/yr)
CO_2	EPA	[9], [12]	73.96	kg/MMBtu	542.2	1,187.3	1,084.3	2,375
CH_4	EPA	[10], [12]	3.00E-03	kg/MMBtu	2.20E-02	4.82E-02	4.40E-02	9.63E-02
N_2O	EPA	[10], [12]	6.00E-04	kg/MMBtu	4.40E-03	9.63E-03	8.80E-03	1.93E-02
CO_2e	EPA	[11]	--	--	**544.0**	**1,191.4**	**1,088.0**	**2,383**

[9] Emission factor based on 40 CFR 98 Subpart C, Table C-1 Default CO_2 Emission Factors and High Heat Values for Various Types of Fuel. The emission factor for Distillate Fuel Oil No. 2 was used to calculate emissions.

[10] Emission factors based on 40 CFR 98 Subpart C, Table C-2 Default CH_4 and N_2O Emission Factors for Various Types of Fuel. The emission factor for petroleum (All types in table C-1) was used to calculate emissions.

[11] CH_4, CO_2 and N_2O are included in the emissions of CO_2 equivalent (CO_2e), weighted according to their global warming potential (GWP). The GWP was obtained from table A-1 to Subpart A of Part 98.

[12] An average BSFC of 7,000 Btu/hp-hr was used to convert from lb/MMBtu to lb/hp-hr to calculate emissions.

Normal Operations Emission Calculations
BMOP - Platform Firewater Pumps

Engine Rating [1]	=	485	kW
	=	650	HP
Total Operating Time [1]	=	100	hrs/yr
Operating load [1]	=	100%	
Total number Main Engines [1]	=	2	
Fuel Type [1]	=	Diesel	
Average Brake-Specific Fuel Consumption [2]	=	7,000	Btu/HP-hr
Average Higher Heating Value (HHV) [2]	=	19,300	Btu/lb
Average Heat Input Rate	=	4.55	MMBtu/hr

Criteria Pollutants

Pollutant	Emission Factor Basis		Emission Factor		Hourly Emissions from 1 Engine	Annual Emissions from 1 Engine	Hourly Emissions from All Engines	Annual Emissions from All Engines
			Value	Units	(lb/hr)	(tons/yr)	(lb/hr)	(tons/yr)
$PM_{Filterable}$	EPA	[3], [4]	0.15	g/HP-hr	0.21	0.01	0.43	0.02
$PM_{10, Filterable}$	EPA	[3], [4]	0.15	g/HP-hr	0.21	0.01	0.43	0.02
$PM_{2.5, Filterable}$	EPA	[3], [4]	0.15	g/HP-hr	0.21	0.01	0.43	0.02
$PM_{Condensable}$	AP-42	[5]	5.39E-05	lb/HP-hr	3.50E-02	1.75E-03	0.07	3.50E-03
NO_x	EPA	[3]	3.00	g/HP-hr	4.30	0.21	8.60	0.43
SO_2	Fuel S Content	[6]	7.11E-04	lb/HP-hr	0.46	0.02	0.92	0.05
CO	EPA	[3]	2.60	g/HP-hr	3.73	0.19	7.45	0.37
VOC	EPA	[3]	3.00	g/HP-hr	4.30	0.21	8.60	0.43
H_2SO_4	Fuel S Content	[6]	2.22E-05	lb/HP-hr	1.44E-02	7.22E-04	2.89E-02	1.44E-03

[1] Based on current project design specifications, provided by BMOP.
[2] Based on AP-42 Chapter 3, Table 3.3-1, Emission Factors for Uncontrolled Gasoline and Diesel Industrial Engines (October 1996).
[3] Per 40 CFR 60.4205(c) and Table 4 of NSPS Subpart IIII. Conservatively assume that NO_X and VOC emissions are equivalent to the NMHC + NO_X emissions limit.
[4] Conservatively assumed PM_{10}=$PM_{2.5}$.
[5] Conservatively based on AP-42 Chapter 3, Table 3.4-1, Emission Factors for Large Stationary Diesel and all Stationary Dual-fuel Engines (October 1996).
[6] Sulfur content of 0.1 % is used for all diesel combustion sources per IMO 2015 standards. Therefore, emissions have been calculated based on a maximum sulfur content of 1000 ppm in diesel fuel assuming that 98 percent of sulfur in the fuel is oxidized to SO2 (MW=32 g/mol) and 2 percent of sulfur in the fuel is oxidized to H2SO4 (MW=98 g/mol) based on Draft Regulatory Impact Analysis: Control of Emissions from Nonroad Diesel Engines, EPA420-R-03-008, April 2003.

Normal Operations Emission Calculations

BMOP - Platform Firewater Pumps

Hazardous Air Pollutants

Pollutant	Emission Factor Basis		Emission Factor		Hourly Emissions from 1 Engine (lb/hr)	Annual Emissions from 1 Engine (tons/yr)	Hourly Emissions from All Engines (lb/hr)	Annual Emissions from All Engines (tons/yr)
			Value	Units				
Acetaldehyde	AP-42	[7], [8]	2.52E-05	lb/MMBtu	1.15E-04	5.73E-06	2.29E-04	1.15E-05
Acrolein	AP-42	[7], [8]	7.88E-06	lb/MMBtu	3.59E-05	1.79E-06	7.17E-05	3.59E-06
Benzene	AP-42	[7], [8]	7.76E-04	lb/MMBtu	3.53E-03	1.77E-04	7.06E-03	3.53E-04
Formaldehyde	AP-42	[7], [8]	7.89E-05	lb/MMBtu	3.59E-04	1.79E-05	7.18E-04	3.59E-05
Toluene	AP-42	[7], [8]	2.81E-04	lb/MMBtu	1.28E-03	6.39E-05	2.56E-03	1.28E-04
Xylenes	AP-42	[7], [8]	1.93E-04	lb/MMBtu	8.78E-04	4.39E-05	1.76E-03	8.78E-05
Total PAH	AP-42	[7], [8]	2.12E-04	lb/MMBtu	9.65E-04	4.82E-05	1.93E-03	9.65E-05
Total VOC HAPs					**7.16E-03**	**3.58E-04**	**1.43E-02**	**7.16E-04**

[7] Emission factors based on AP-42, Chapter 3, Table 3.4-3, Speciated Organic Compound Emission Factors for Large Uncontrolled Stationary Diesel Engines (October 1996).

[8] An average BSFC of 7,000 Btu/hp-hr was used to convert from lb/MMBtu to lb/hp-hr to calculate emissions.

Greenhouse Gases

Pollutant	Emission Factor Basis		Emission Factor		Hourly Emissions from 1 Engine (lb/hr)	Annual Emissions from 1 Engine (tons/yr)	Hourly Emissions from All Engines (lb/hr)	Annual Emissions from All Engines (tons/yr)
			Value	Units				
CO_2	EPA	[9], [12]	73.96	kg/MMBtu	741.9	37.09	1,483.8	74.19
CH_4	EPA	[10], [12]	3.00E-03	kg/MMBtu	3.01E-02	1.50E-03	6.02E-02	3.01E-03
N_2O	EPA	[10], [12]	6.00E-04	kg/MMBtu	6.02E-03	3.01E-04	1.20E-02	6.02E-04
CO_2e	EPA	[11]	--	--	**744.4**	**37.22**	**1,488.88**	**74.44**

[9] Emission factor based on 40 CFR 98 Subpart C, Table C-1 Default CO_2 Emission Factors and High Heat Values for Various Types of Fuel. The emission factor for Distillate Fuel Oil No. 2 was used to calculate emissions.

[10] Emission factors based on 40 CFR 98 Subpart C, Table C-2 Default CH_4 and N_2O Emission Factors for Various Types of Fuel. The emission factor for petroleum (All types in table C-1) was used to calculate emissions.

[11] CH_4, CO_2 and N_2O are included in the emissions of CO_2 equivalent (CO_2e), weighted according to their global warming potential (GWP). The GWP was obtained from table A-1 to Subpart A of Part 98.

[12] An average BSFC of 7,000 Btu/hp-hr was used to convert from lb/MMBtu to lb/hp-hr to calculate emissions.

BMOP - Deepwater Port WC509 platform
Tank Emissions

Platform	Tank ID	Roof Type	Standing Losses (tpy)	Working Losses (tpy)	Total VOC Losses (tpy)	Total HAP Losses (tpy)
WC509	Aviation Fuel Storage[1]	Horizontal Tank	2.90E-04	2.22E-04	5.12E-04	7.65E-05
	Crane Diesel Tank No. 1[2]	FRT (no floating roof)	4.14E-04	1.52E-03	1.93E-03	2.65E-04
	Crane Diesel Tank No. 2[2]	FRT (no floating roof)	4.14E-04	1.52E-03	1.93E-03	2.65E-04
	Primary Diesel Storage Tank[2]	Horizontal Tank	2.23E-03	6.28E-03	0.01	1.17E-03
	Surge Tank	Horizontal Tank	3.57	0.17	3.73	0.07
				Totals:	**3.74**	**0.07**

[1] TankESP default Jet Kerosene is used as a product for this tank.
[2] TankESP default Diesel stock is used as product for this tank.

BMOP - Deepwater Port WC509 platform
Tank Emissions

Platform	Tank ID	HAP Emissions (lb/yr)										
		Benzo(g,h,i)perylene	Biphenyl	Cumene	Cyclohexane	Ethylcyclohexane	Hexanol (1)	Neopentane {dimethylpropane (2,2)}	Pentane (n-)	Toluene diisocyanate	Trimethylbenzene (1,3,5)	Xylene (m-)
WC509	Aviation Fuel Storage[1]	0.0069	2.41E-16	-	-	0.0207	0.0139	3.31E-04	3.58E-14	0.0670	-	0.0442
	Crane Diesel Tank No. 1[2]	0.0077	2.95E-15	-	-	0.0118	0.0016	1.74E-03	6.41E-13	0.0898	0.1876	0.2303
	Crane Diesel Tank No. 2[2]	0.0077	2.95E-15	-	-	0.0118	0.0016	1.74E-03	6.41E-13	0.0898	0.1876	0.2303
	Primary Diesel Storage Tank[2]	0.0339	1.33E-14	-	-	0.0521	0.0068	7.69E-03	2.88E-12	0.3949	0.8273	1.0140
	Surge Tank	3.32E+01	9.34E-15	0.25	39.81	2.13	35.46	0.01	9.94E-12	16.28	0.37	6.53
		33.28	**2.87E-14**			**2.23**	**35.48**	**1.66E-02**	**1.41E-11**	**16.92**	**1.57**	**8.05**

[1] TankESP default Jet Kerosene is used as a product for this tank.
[2] TankESP default Diesel stock is used as product for this tank.

BMOP - Deepwater Port WC509 platform
Fugitive Emissions

					Equipment Counts														
Source	Contents	Representative Contents	Platform	Service	Valves	Flanges/Connectors	Pumps	Vapor/Gas Relief Valves	Compressors	Process Drains	Sampling Connections	Total VOC[1] (lb/hr)	Total VOC[2] (tpy)	Total HAP[3] (lb/hr)	Total HAP[2] (tpy)	Total H_2S[4] (lb/hr)	Total H_2S[2,4] (tpy)	Total CO_2e[5] (lb/hr)	Total CO_2e[2] (tpy)
Gas Inlet Scrubber No. 1	Natural Gas	Natural Gas	509B	Gas/Vapor	21	22	0	2	0	4	0	0.07	0.30	6.74E-03	0.03	0	0	17.51	76.68
Gas Inlet Scrubber No. 2	Natural Gas	Natural Gas	509B	Gas/Vapor	21	22	0	2	0	4	0	0.07	0.30	6.74E-03	0.03	0	0	17.51	76.68
Gas Inlet Scrubber No. 3	Natural Gas	Natural Gas	509B	Gas/Vapor	21	22	0	2	0	4	0	0.07	0.30	6.74E-03	0.03	0	0	17.51	76.68
Gas Inlet Scrubber No. 4	Natural Gas	Natural Gas	509B	Gas/Vapor	21	22	0	2	0	4	0	0.07	0.30	6.74E-03	0.03	0	0	17.51	76.68
Condensate Pump No. 1	Natural Gas	Natural Gas	509B	Gas/Vapor	20	15	1	1	0	2	0	0.05	0.22	4.86E-03	0.02	0	0	12.62	55.28
Condensate Pump No. 2	Natural Gas	Natural Gas	509B	Gas/Vapor	20	15	1	1	0	2	0	0.05	0.22	4.86E-03	0.02	0	0	12.62	55.28
Condensate Pump No. 3	Natural Gas	Natural Gas	509B	Gas/Vapor	20	15	1	1	0	2	0	0.05	0.22	4.86E-03	0.02	0	0	12.62	55.28
Condensate Pump No. 4	Natural Gas	Natural Gas	509B	Gas/Vapor	20	15	1	1	0	2	0	0.05	0.22	4.86E-03	0.02	0	0	12.62	55.28
Pig Launcher (Gas Export)	Natural Gas	Natural Gas	509A	Gas/Vapor	63	126	0	0	0	8	8	0.13	0.58	0.01	0.06	0	0	33.84	148.21
Pig Receiver (Oil Import)	Crude Oil	Crude Oil	509B	Light Liquid	9	17	0	0	0	4	0	0.10	0.45	5.82E-03	0.03	1.34E-03	1.98E-04	0	0
Oil Meter Skid	Crude oil	Crude Oil	509B	Light Liquid	52	105	0	0	0	6	1	0.57	2.50	0.03	0.14	7.39E-03	1.09E-03	0	0
Meter Prover Skid	Crude Oil	Crude Oil	509B	Light Liquid	8	16	0	0	0	1	0	0.08	0.36	4.65E-03	0.02	1.07E-03	1.58E-04	0	0
Pig Launcher No. 1 (Export to VLCC)	Crude Oil	Crude Oil	509B	Light Liquid	18	34	0	0	0	8	0	0.21	0.91	0.01	0.05	2.69E-03	3.95E-04	0	0
Pig Launcher No. 2 (Export to VLCC)	Crude Oil	Crude Oil	509B	Light Liquid	18	34	0	0	0	8	0	0.21	0.91	0.01	0.05	2.69E-03	3.95E-04	0	0
CALM Buoy #1	Crude Oil	Crude Oil	--	Light Liquid	20	50	0	0	0	0	0	0.20	0.89	0.01	0.05	2.63E-03	3.87E-04	0	0
CALM Buoy #2	Crude Oil	Crude Oil	--	Light Liquid	20	50	0	0	0	0	0	0.20	0.89	0.01	0.05	2.63E-03	3.87E-04	0	0
Surge Relief Valve Skid	Crude Oil	Crude Oil	509B	Light Liquid	20	18	0	0	0	2	0	0.19	0.85	0.01	0.05	2.52E-03	3.71E-04	0	0
Surge Tank	Crude Oil	Crude Oil	509B	Light Liquid	12	22	2	0	0	1	0	0.21	0.92	0.01	0.05	2.71E-03	3.99E-04	0	0
Surge Tank Pump No. 1	Crude Oil	Crude Oil	509B	Light Liquid	4	8	0	0	0	1	0	0.04	0.19	2.43E-03	0.01	5.61E-04	8.26E-05	0	0
Surge Tank Pump No. 2	Crude Oil	Crude Oil	509B	Light Liquid	4	8	0	0	0	1	0	0.04	0.19	2.43E-03	0.01	5.61E-04	8.26E-05	0	0
Sump System No. 1	Crude Oil	Crude Oil	509B	Light Liquid	15	32	2	0	0	3	0	0.25	1.09	0.01	0.06	3.22E-03	4.74E-04	0	0
Sump System No. 2	Crude Oil	Crude Oil	509C	Light Liquid	15	32	2	0	0	3	0	0.25	1.09	0.01	0.06	3.22E-03	4.74E-04	0	0
Firewater Pump No. 1	Diesel Fuel	Diesel Fuel	509B	Light Liquid	5	6	0	0	0	1	0	0.05	0.22	7.04E-03	0.03	0	0	0	0
Firewater Pump No. 2	Diesel Fuel	Diesel Fuel	509C	Light Liquid	5	6	0	0	0	1	0	0.05	0.22	7.04E-03	0.03	0	0	0	0
Air Compressor No. 1	Lubricating Oil	Diesel Fuel	509B	Light Liquid	4	8	0	0	0	1	0	0.04	0.19	5.96E-03	0.03	0	0	0	0
Air Compressor No. 2	Lubricating Oil	Diesel Fuel	509B	Light Liquid	4	8	0	0	0	1	0	0.04	0.19	5.96E-03	0.03	0	0	0	0
Platform Crane No. 1	Diesel Fuel	Diesel Fuel	509B	Light Liquid	4	8	0	0	0	1	0	0.04	0.19	5.96E-03	0.03	0	0	0	0
Platform Crane No. 2	Diesel Fuel	Diesel Fuel	509B	Light Liquid	4	8	0	0	0	1	0	0.04	0.19	5.96E-03	0.03	0	0	0	0
Diesel Transfer Skid	Diesel Fuel	Diesel Fuel	509B	Light Liquid	18	30	2	0	0	1	0	0.27	1.17	0.04	0.16	0	0	0	0
Gas Generator No. 1	Natural Gas	Natural Gas	509B	Gas/Vapor	10	11	0	0	0	2	0	0.01	0.07	1.47E-03	6.44E-03	0	0	3.82	16.72
Gas Generator No. 2	Natural Gas	Natural Gas	509B	Gas/Vapor	10	11	0	0	0	2	0	0.01	0.07	1.47E-03	6.44E-03	0	0	3.82	16.72
Emergency Diesel Generator	Diesel Fuel	Diesel Fuel	509B	Gas/Vapor	5	6	0	0	0	1	0	0.09	0.41	0.01	0.06	0	0	0	0
Knockout System	Natural Gas	Natural Gas	509B	Gas/Vapor	30	40	0	2	0	2	0	0.08	0.36	8.20E-03	0.04	0	0	21.30	93.30
Fuel Gas Skid	Natural Gas	Natural Gas	509B	Gas/Vapor	68	81	0	6	0	13	5	0.23	1.00	0.02	0.10	0	0	58.66	256.92
Aviation Refueling	Aviation Fuel	Aviation Fuel	509A	Light Liquid	6	20	1	0	0	1	0	0.11	0.49	0.11	0.49	0	0	0	0
Total												4.26	18.65	0.44	1.91	0.03	4.89E-03	241.95	1059.75

[1] Emission factors based on EPA's Protocol for Equipment Leak Emission Estimates, EPA-453/R-95-017
https://www3.epa.gov/ttnchie1/efdocs/equiplks.pdf
[2] Based on continous operation (e.g. 8,760 hours per year).
[3] HAP emissions are based on the speciation of:
- Natural Gas Composition and Properties based on an April 13, 2020 sample at WC509.
- Diesel fuel HAP content consistent with tank emissions speciation.
- Crude Oil speciation per the maximum mass %, vapor values calculated for crude oil loading emissions.
[4] H2S emissions are calculated based on the mass balance and liquid H2S parition factors from the Petroleum Processing Handbook, McGraw-Hill, New York, Figure 12-71, page 12-93.
Short-term and annual H2S values are based on the values used to calculate crude oil loading emissions.
[5] CO2 and CH4 speciation of natural gas based on an April 13, 2020 sample at WC509.
CH4 and CO2 CO2e, weighted according to their global warming potential (GWP).
The GWP was obtained from table A-1 to Subpart A of Part 98.

Normal Operations Emission Calculations
BMOP - Loading Operations

Maximum Hourly Loading Rate [1]	=	80,000	bbl/hr	
	=	3,360	1,000 gal/hr	
Maximum Annual Loading Rate [1]	=	700,800,000	bbl/yr	
	=	29,433,600	1,000 gal/yr	
Crude Oil Loading Specifications		Maximum	Annual	
Arrival Emission Factor [2]	=	0.86	0.86	
Loading Temperature [1]	=	550	532	°R
Vapor Molecular Weight [1]	=	50	50	lb/lbmol
Crude Oil Liquid Molecular Weight [1]	=	207	207	lb/lbmol
True Vapor Pressure [1]	=	10.99	9.00	psia
Liquid H_2S Partition [3]	=	25	21	
H2S Molecular Weight	=	34.1	34.1	lb/lbmol

Criteria Pollutants

Pollutant	Emission Factor Basis		Hourly Emission Factor		Annual Emission Factor		Hourly Loading Emission	Annual Loading Emission
			Value	Units	Value	Units	(lb/hr)	(tons/yr)
VOC	AP-42	[2]	1.61	lb/1,000 gal	1.48	lb/1,000 gal	5,422	21,840
H_2S	Site Specific	[3], [4]	125	ppmw	5	ppmw	70.15	9.49

[1] Based on current project design specifications, provided by BMOP. Molecular weight referenced from AP-42, Chapter 7, Table 7.1-2.
[2] Per AP-42, Table 5.2-3 for crude oil loading into ships (uncleaned). Total loading loss based on AP-42, Section 5.2 Equations 2 and 3 (06/08).
[3] Mass balance based and liquid H_2S partion factors from the Petroleum Processing Handbook, McGraw-Hill, New York, Figure 12-71, page 12-93. Short-term H2S concentration from Nederland permit basis.
[4] Annual mass H2S emissions calculated from a conservative assumption of 5 ppmw. The average of all samples from Nederland (>3000 samples) is 1.31 ppmw.

Normal Operations Emission Calculations
BMOP - Loading Operations

Hazardous Air Pollutants

Crude Oil HAP Speciation (%)[5]			99% UPL[6]	99% UPL[7]	Nederland Basis[8]	Maximum HAP[9]	Hourly Emissions[10]	Annual Emissions
HAP	**Mass %, liquid**	**Mass %, vapor**	**Mass %, liquid**	**Mass %, vapor**	**Mass %, vapor**	**Mass %, vapor**	**lb/hr**	**tpy**
Hexane	2.07%	3.11%	3.09%	4.09%	3.38%	4.09%	221.8	893.2
Benzene	0.25%	0.19%	0.46%	0.34%	0.80%	0.80%	43.40	174.8
Toluene	0.69%	0.20%	1.10%	0.29%	0.36%	0.36%	19.27	77.61
Ethylbenzene	0.16%	0.01%	0.29%	0.02%	0.05%	0.05%	2.69	10.85
1,2,4-Trimethylbenzene	0.44%	0.007%	0.76%	0.01%		0.01%	0.58	2.33
1,3-dimethylbenzene	0.43%	0.04%	0.79%	0.05%		0.05%	2.58	10.41
1,4-dimethylbenzene	0.31%	0.03%	0.57%	0.03%		0.03%	1.80	7.25
1,2-dimethylbenzene (Xylene)	0.21%	0.01%	0.37%	0.02%	0.21%	0.21%	11.26	45.36
i-propylbenzene (Cumene)	0.04%	0.002%	0.08%	0.003%	0.006%	0.01%	0.32	1.28
Biphenyl[6]					0.00002%	0.00002%	0.001	0.004
Cresols[6]					0.0007%	0.001%	0.04	0.16
Naphthalene[6]					0.0006%	0.001%	0.03	0.14
Phenol[6]					0.001%	0.001%	0.08	0.33
Total HAP	**4.59%**	**3.60%**	**7.50%**	**4.86%**	**4.80%**	**5.60%**	**303.8**	**1,224**

[5] Maximum mass % in liquid of individual HAP from 13 samples of various crude types taken at Nederland from May and June 2020 and analyzed per Method D7900, *Standard Test Method for Determination of Light Hydrocarbons in Stabilized Crude Oils by Gas Chromatography*.
Vapor weight percent calculated assuming annual average temperature.

[6] Calculation of the 99% Upper Prediction Limit (UPL) mass percent in liquid, based on the results of the 13 samples from Nederland, by individual HAP.

[7] Calculation of the 99% Upper Prediction Limit (UPL) mass percent in vapor, based on the calculated vapor speciation using results of the 13 samples from Nederland, by individual HAP.

[8] Speciated VOC components, vapor weight %, from the permit basis for the Nederland Terminal, which references Table 3-1 of API Publication 1673 (May 1998), and factors obtained from Mr. James Durham, EPA Office of Air Quality Planning and Standards.

[9] The maximum of the calculated sample mass %, vapor, the Nederland permit basis, or the 99% UPL of the mass %, vapor, by individual HAP.

[10] Calculated as a percent of VOC emissions, as the crude samples demonstrated >99.9% is VOC.
Note that the "Total HAP" is the sum of all max individual HAP from the 13 samples.

Normal Operations Emission Calculations
WC 148 Platform Summary

	NO_X (tpy)	CO (tpy)	VOC (tpy)	SO_2 (tpy)	PM_{10} (tpy)	$PM_{2.5}$ (tpy)	H_2S (tpy)	H_2SO_4 (tpy)	HAPs (tpy)	CO_2e (tpy)
WC 148 Platform Sources										
WC 148 Fugitive Emissions	--	--	0.71	--	--	--	3.09E-04	--	0.04	--
Total	--	--	0.71	--	--	--	3.09E-04	--	0.04	--

BMOP - Deepwater Port WC148 platform
Fugitive Emissions

Source	Contents	Representative Contents	Platform	Service	Equipment Counts: Valves	Flanges/Connectors	Pumps	Vapor/Gas Relief Valves	Compressors	Process Drains	Sampling Connections	Total VOC[1] (lb/hr)	Total VOC[2] (tpy)	Total HAP[3] (lb/hr)	Total HAP[2] (tpy)	Total H_2S[4] (lb/hr)	Total H_2S[2,4] (tpy)
MLV and Piping	Crude Oil	Crude Oil	148	Light Liquid	15	50	0	0	0	1	0	0.16	0.71	9.09E-03	0.04	2.10E-03	3.09E-04
											Total	0.16	0.71	9.09E-03	0.04	2.10E-03	3.09E-04

[1] Emission factors based on EPA's Protocol for Equipment Leak Emission Estimates, EPA-453/R-95-017 https://www3.epa.gov/ttnchie1/efdocs/equiplks.pdf
[2] Based on continous operation (e.g. 8,760 hours per year).
[3] HAP emissions are based on the speciation of:
- Crude Oil speciation per the maximum mass %, vapor values calculated for crude oil loading emissions.
[4] H_2S emissions are calculated based on the mass balance and liquid H_2S parition factors from the Petroleum Processing Handbook, McGraw-Hill, New York, Figure 12-71, page 12-93.
Short-term and annual H_2S values are based on the values used to calculate crude oil loading emissions.

APPENDIX C. DETAILED OFFSHORE MOBILE SOURCE EMISSIONS CALCULATIONS

Normal Operations Emission Calculations
Mobile Summary

	NO_X (tpy)	CO (tpy)	VOC (tpy)	SO_2 (tpy)	PM Filterable (tpy)	PM_{10} [1] (tpy)	$PM_{2.5}$ [1] (tpy)	H_2SO_4 (tpy)	Total VOC HAPs (tpy)	CO_2e (tpy)
Tugboats/Support										
Main Engines	105.32	24.14	2.82	3.12	1.90	1.76	1.71	0.10	0.05	5,025.84
Generator Set	20.89	4.50	1.66	0.48	1.48	1.52	1.52	0.01	0.02	771.84
AHT Winch Engines	1.61	0.35	0.13	0.04	0.11	0.12	0.12	1.15E-03	1.41E-03	59.37
4-Point Dive Support										
Main Engines	31.10	7.13	0.83	0.92	0.56	0.52	0.50	0.03	0.01	1,484.30
Generators	1.79	0.38	0.14	0.04	0.13	0.13	0.13	1.28E-03	1.56E-03	65.97
Air Compressors	0.59	0.13	0.05	0.01	0.04	0.04	0.04	4.20E-04	5.12E-04	21.65
Dive Compressors	0.62	0.13	0.05	0.01	0.04	0.05	0.05	4.48E-04	5.47E-04	23.09
Crane Engines	0.75	0.16	0.06	0.02	0.05	0.05	0.05	5.36E-04	6.54E-04	27.62
Supply Vessels										
Main Engines	13.82	3.17	0.37	0.41	0.25	0.23	0.22	0.01	6.35E-03	659.69
Diesel Generators	1.79	0.38	0.14	0.04	0.13	0.13	0.13	1.28E-03	1.56E-03	65.97
Helicopter										
Platform A Helicopter	0.25	0.69	0.52	0.04	7.80E-03	0.02	0.26	1.89E-03	0.35	55.15
VLCC										
Main Engines	358.60	82.18	9.59	10.62	6.48	5.99	5.82	0.33	0.16	17,112.38
Diesel Generators	201.20	46.11	5.38	5.96	3.64	3.36	3.26	0.19	0.09	9,601.35
Total	738.32	169.45	21.73	21.71	14.84	13.92	13.81	0.68	0.70	34,974.21

[1] PM_{10} and $PM_{2.5}$ emissions are represented as the sum of filterable PM_{10}/$PM_{2.5}$ and condensable emissions.

Normal Operations Emission Calculations
Tug Boat - Main Engines

Engine Rating [1]	=	2,525	kW
	=	3,386	HP
Total Operating Time [1]	=	4,320	hrs/yr
Operating load [1]	=	10%	
Total number Main Engines [1]	=	6	
Fuel Type [1]	=	Diesel	
Average Brake-Specific Fuel Consumption [2]	=	7,000	Btu/HP-hr
Average Higher Heating Value (HHV) [2]	=	19,300	Btu/lb

Criteria Pollutants

Pollutant	Emission Factor Basis		Emission Factor		Hourly Emissions from 1 Engine	Annual Emissions from 1 Engine	Hourly Emissions from All Engines	Annual Emissions from All Engines
			Value	Units	(lb/hr)	(tons/yr)	(lb/hr)	(tons/yr)
$PM_{Filterable}$	AP-42	[3]	4.34E-04	lb/HP-hr	0.15	0.32	0.88	1.90
$PM_{10, Filterable}$	AP-42	[3]	3.47E-04	lb/HP-hr	0.12	0.25	0.71	1.52
$PM_{2.5, Filterable}$	AP-42	[3]	3.35E-04	lb/HP-hr	0.11	0.25	0.68	1.47
$PM_{Condensable}$	AP-42	[3]	5.39E-05	lb/HP-hr	0.02	0.04	0.11	0.24
NO_x	AP-42	[2]	2.40E-02	lb/HP-hr	8.13	17.55	48.76	105.3
SO_2	Fuel S Content	[4]	7.11E-04	lb/HP-hr	0.24	0.52	1.44	3.12
CO	AP-42	[2]	5.50E-03	lb/HP-hr	1.86	4.02	11.17	24.14
VOC	AP-42	[2], [5]	6.42E-04	lb/HP-hr	0.22	0.47	1.30	2.82
H_2SO_4	Fuel S Content	[4]	2.22E-05	lb/HP-hr	7.52E-03	0.02	0.05	0.10

[1] Based on current project design specifications, provided by BMOP.
[2] Emission factors are based on AP-42 Chapter 3, Table 3.4-1, Emission Factors for Large Stationary Diesel and all Stationary Dual-fuel Engines (October 1996).
[3] PM_{10} and $PM_{2.5}$ emission factors based on AP-42 Chapter 3, Table 3.4-2, Particulate and Particle-sizing Emission Factors for Large Uncontrolled Stationary Diesel Engines (October 1996). An average brake-specific fuel consumption (BSFC) of 7,000 Btu/hp-hr was used to convert from lb/MMBtu to lb/hp-hr. PM < 3um taken as $PM_{2.5}$. Total particulate emissions is the sum of filterable and condensable particulate emissions.
[4] Sulfur content of 0.1 % is used for all diesel combustion sources per IMO 2015 standards. Therefore, emissions have been calculated based on a maximum sulfur content of 1000 ppm in diesel fuel assuming that 98 percent of sulfur in the fuel is oxidized to SO2 (MW=32 g/mol) and 2 percent of sulfur in the fuel is oxidized to H2SO4 (MW=98 g/mol) based on Draft Regulatory Impact Analysis: Control of Emissions from Nonroad Diesel Engines, EPA420-R-03-008, April 2003.
[5] Per footnote f of AP-42 Chapter 3, Table 3.4-1, non methane VOC emission factor has calculated as 91% of TOC emission factor.

Normal Operations Emission Calculations

Tug Boat - Main Engines

Hazardous Air Pollutants

Pollutant	Emission Factor Basis		Emission Factor Value	Emission Factor Units	Hourly Emissions from 1 Engine (lb/hr)	Annual Emissions from 1 Engine (tons/yr)	Hourly Emissions from All Engines (lb/hr)	Annual Emissions from All Engines (tons/yr)
Acetaldehyde	AP-42	[6], [7]	2.52E-05	lb/MMBtu	5.97E-05	1.29E-04	3.58E-04	7.74E-04
Acrolein	AP-42	[6], [7]	7.88E-06	lb/MMBtu	1.87E-05	4.03E-05	1.12E-04	2.42E-04
Benzene	AP-42	[6], [7]	7.76E-04	lb/MMBtu	1.84E-03	3.97E-03	1.10E-02	2.38E-02
Formaldehyde	AP-42	[6], [7]	7.89E-05	lb/MMBtu	1.87E-04	4.04E-04	1.12E-03	2.42E-03
Toluene	AP-42	[6], [7]	2.81E-04	lb/MMBtu	6.66E-04	1.44E-03	4.00E-03	8.63E-03
Xylenes	AP-42	[6], [7]	1.93E-04	lb/MMBtu	4.57E-04	9.88E-04	2.74E-03	5.93E-03
Total PAH	AP-42	[6], [7]	2.12E-04	lb/MMBtu	5.02E-04	1.09E-03	3.01E-03	6.51E-03
Total VOC HAPs					**3.73E-03**	**8.06E-03**	**2.24E-02**	**4.83E-02**

[6] Emission factors based on AP-42, Chapter 3, Table 3.4-3, Speciated Organic Compound Emission Factors for Large Uncontrolled Stationary Diesel Engines (October 1996).
[7] An average BSFC of 7,000 Btu/hp-hr was used to convert from lb/MMBtu to lb/hp-hr to calculate emissions.

Greenhouse Gases

Pollutant	Emission Factor Basis		Emission Factor Value	Emission Factor Units	Hourly Emissions from 1 Engine (lb/hr)	Annual Emissions from 1 Engine (tons/yr)	Hourly Emissions from All Engines (lb/hr)	Annual Emissions from All Engines (tons/yr)
CO_2	EPA	[8], [11]	73.96	kg/MMBtu	386.5	834.8	2,319	5,009
CH_4	EPA	[9], [11]	3.00E-03	kg/MMBtu	1.57E-02	3.39E-02	9.41E-02	0.20
N_2O	EPA	[9], [11]	6.00E-04	kg/MMBtu	3.14E-03	6.77E-03	1.88E-02	0.04
CO_2e	EPA	[10]	--	--	**387.80**	**837.64**	**2,327**	**5,026**

[8] Emission factor based on 40 CFR 98 Subpart C, Table C-1 Default CO_2 Emission Factors and High Heat Values for Various Types of Fuel. The emission factor for Distillate Fuel Oil No. 2 was used to calculate emissions.
[9] Emission factors based on 40 CFR 98 Subpart C, Table C-2 Default CH_4 and N_2O Emission Factors for Various Types of Fuel. The emission factor for petroleum (All types in table C-1) was used to calculate emissions.
[10] CH_4, CO_2 and N_2O are included in the emissions of CO_2 equivalent (CO_2e), weighted according to their global warming potential (GWP). The GWP was obtained from table A-1 to Subpart A of Part 98. This is consistent with TCEQ 2015 guidance: https://www.tceq.texas.gov/assets/public/permitting/air/factsheets/factsheets-psdghg-6291.pdf
[11] An average BSFC of 7,000 Btu/hp-hr was used to convert from lb/MMBtu to lb/hp-hr to calculate emissions.

Normal Operations Emission Calculations

Tug Boat - Generator Set

Engine Rating [1]	=	310	kW
	=	416	HP
Total Operating Time [1]	=	2,160	hrs/yr
Operating load [1]	=	25%	
Total number Gen Sets [1]	=	6	
Fuel Type [1]	=	Diesel	
Average Brake-Specific Fuel Consumption [2]	=	7,000	Btu/HP-hr
Average Higher Heating Value (HHV) [2]	=	19,300	Btu/lb

Criteria Pollutants

Pollutant	Emission Factor Basis		Emission Factor		Hourly Emissions from 1 Engine	Annual Emissions from 1 Engine	Hourly Emissions from All Engines	Annual Emissions from All Engines
			Value	Units	(lb/hr)	(tons/yr)	(lb/hr)	(tons/yr)
$PM_{Filterable}$	AP-42	[3], [4]	2.20E-03	lb/HP-hr	0.23	0.25	1.37	1.48
$PM_{10,\ Filterable}$	AP-42	[3], [4]	2.20E-03	lb/HP-hr	0.23	0.25	1.37	1.48
$PM_{2.5,\ Filterable}$	AP-42	[3], [4]	2.20E-03	lb/HP-hr	0.23	0.25	1.37	1.48
$PM_{Condensable}$	AP-42	[5]	5.39E-05	lb/HP-hr	0.01	0.01	0.03	0.04
NO_x	AP-42	[3]	3.10E-02	lb/HP-hr	3.22	3.48	19.34	20.89
SO_2	Fuel S Content	[6]	7.11E-04	lb/HP-hr	0.07	0.08	0.44	0.48
CO	AP-42	[3]	6.68E-03	lb/HP-hr	0.69	0.75	4.17	4.50
VOC	AP-42	[3]	2.47E-03	lb/HP-hr	0.26	0.28	1.54	1.66
H_2SO_4	Fuel S Content	[6]	2.22E-05	lb/HP-hr	2.31E-03	2.50E-03	1.39E-02	1.50E-02

[1] Based on current project design specifications, provided by BMOP.
[2] Based on AP-42 Chapter 3, Table 3.3-1, Emission Factors for Uncontrolled Gasoline and Diesel Industrial Engines (October 1996).
[3] Emission factors are based on AP-42 Chapter 3, Table 3.3-1, Emission Factors for Uncontrolled Gasoline And Diesel Industrial Engines October 1996).
[4] Conservatively assumed PM_{10}=$PM_{2.5}$.
[5] Conservatively based on AP-42 Chapter 3, Table 3.4-1, Emission Factors for Large Stationary Diesel and all Stationary Dual-fuel Engines (October 1996).
[6] Sulfur content of 0.1 % is used for all diesel combustion sources per IMO 2015 standards. Therefore, emissions have been calculated based on a maximum sulfur content of 1000 ppm in diesel fuel assuming that 98 percent of sulfur in the fuel is oxidized to SO2 (MW=32 g/mol) and 2 percent of sulfur in the fuel is oxidized to H2SO4 (MW=98 g/mol) based on Draft Regulatory Impact Analysis: Control of Emissions from Nonroad Diesel Engines, EPA420-R-03-008, April 2003.

Normal Operations Emission Calculations
Tug Boat - Generator Set
Hazardous Air Pollutants

Pollutant	Emission Factor Basis		Emission Factor		Hourly Emissions from 1 Engine	Annual Emissions from 1 Engine	Hourly Emissions from All Engines	Annual Emissions from All Engines
			Value	Units	(lb/hr)	(tons/yr)	(lb/hr)	(tons/yr)
Acetaldehyde	AP-42	[7], [8]	7.67E-04	lb/MMBtu	5.58E-04	6.03E-04	3.35E-03	3.62E-03
Acrolein	AP-42	[7], [8]	9.25E-05	lb/MMBtu	6.73E-05	7.27E-05	4.04E-04	4.36E-04
Benzene	AP-42	[7], [8]	9.33E-04	lb/MMBtu	6.79E-04	7.34E-04	4.08E-03	4.40E-03
1,3-Butadiene	AP-42	[7], [8]	3.91E-05	lb/MMBtu	2.85E-05	3.07E-05	1.71E-04	1.84E-04
Formaldehyde	AP-42	[7], [8]	1.18E-03	lb/MMBtu	8.59E-04	9.28E-04	5.15E-03	5.57E-03
Toluene	AP-42	[7], [8]	4.09E-04	lb/MMBtu	2.98E-04	3.22E-04	1.79E-03	1.93E-03
Xylenes	AP-42	[7], [8]	2.85E-04	lb/MMBtu	2.07E-04	2.24E-04	1.24E-03	1.34E-03
Total PAH	AP-42	[7], [8]	1.68E-04	lb/MMBtu	1.22E-04	1.32E-04	7.34E-04	7.93E-04
Total VOC HAPs					**2.82E-03**	**3.05E-03**	**1.69E-02**	**1.83E-02**

[7] Emission factors based on AP-42, Chapter 3, Table 3.3-2, Speciated Organic Compound Emission Factors for Uncontrolled Stationary Diesel Engines (October 1996).
[8] An average BSFC of 7,000 Btu/hp-hr was used to convert from lb/MMBtu to lb/hp-hr to calculate emissions.

Greenhouse Gases

Pollutant	Emission Factor Basis		Emission Factor		Hourly Emissions from 1 Engine	Annual Emissions from 1 Engine	Hourly Emissions from All Engines	Annual Emissions from All Engines
			Value	Units	(lb/hr)	(tons/yr)	(lb/hr)	(tons/yr)
CO_2	EPA	[9], [12]	73.96	kg/MMBtu	118.7	128.2	712.2	769.2
CH_4	EPA	[10], [12]	3.00E-03	kg/MMBtu	4.81E-03	5.20E-03	2.89E-02	3.12E-02
N_2O	EPA	[10], [12]	6.00E-04	kg/MMBtu	9.63E-04	1.04E-03	5.78E-03	6.24E-03
CO_2e	EPA	[11]	--	--	**119.1**	**128.6**	**714.7**	**771.8**

[9] Emission factor based on 40 CFR 98 Subpart C, Table C-1 Default CO_2 Emission Factors and High Heat Values for Various Types of Fuel. The emission factor for Distillate Fuel Oil No. 2 was used to calculate emissions.
[10] Emission factors based on 40 CFR 98 Subpart C, Table C-2 Default CH_4 and N_2O Emission Factors for Various Types of Fuel. The emission factor for petroleum (All types in table C-1) was used to calculate emissions.
[11] CH_4, CO_2 and N_2O are included in the emissions of CO_2 equivalent (CO_2e), weighted according to their global warming potential (GWP). The GWP was obtained from table A-1 to Subpart A of Part 98. This is consistent with TCEQ 2015 guidance: https://www.tceq.texas.gov/assets/public/permitting/air/factsheets/factsheets-psdghg-6291.pdf
[12] An average BSFC of 7,000 Btu/hp-hr was used to convert from lb/MMBtu to lb/hp-hr to calculate emissions.

Normal Operations Emission Calculations

Tug Boat - Supply Boat AHT Winch Engine

Engine Rating [1]	=	89	kW
	=	120	HP
Total Operating Time [1]	=	360	hrs/yr
Operating load [1]	=	80%	
Total number AHT Winch Engine [1]	=	3	
Fuel Type [1]	=	Diesel	
Average Brake-Specific Fuel Consumption [2]	=	7,000	Btu/HP-hr
Average Higher Heating Value (HHV) [2]	=	19,300	Btu/lb

Criteria Pollutants

Pollutant	Emission Factor Basis		Emission Factor		Hourly Emissions from 1 Engine	Annual Emissions from 1 Engine	Hourly Emissions from All Engines	Annual Emissions from All Engines
			Value	Units	(lb/hr)	(tons/yr)	(lb/hr)	(tons/yr)
$PM_{Filterable}$	AP-42	[3], [4]	2.20E-03	lb/HP-hr	0.21	0.04	0.63	0.11
$PM_{10,\ Filterable}$	AP-42	[3], [4]	2.20E-03	lb/HP-hr	0.21	3.80E-02	0.63	0.11
$PM_{2.5,\ Filterable}$	AP-42	[3], [4]	2.20E-03	lb/HP-hr	0.21	0.04	0.63	0.11
$PM_{Condensable}$	AP-42	[5]	5.39E-05	lb/HP-hr	0.01	0.00	0.02	2.79E-03
NO_x	AP-42	[3]	3.10E-02	lb/HP-hr	2.98	0.54	8.93	1.61
SO_2	Fuel S Content	[6]	7.11E-04	lb/HP-hr	0.07	0.01	0.20	0.04
CO	AP-42	[3]	6.68E-03	lb/HP-hr	0.64	0.12	1.92	0.35
VOC	AP-42	[3]	2.47E-03	lb/HP-hr	0.24	0.04	0.71	0.13
H_2SO_4	Fuel S Content	[6]	2.22E-05	lb/HP-hr	2.13E-03	3.84E-04	6.40E-03	1.15E-03

[1] Based on current project design specifications, provided by BMOP.

[2] Based on AP-42 Chapter 3, Table 3.3-1, Emission Factors for Uncontrolled Gasoline and Diesel Industrial Engines (October 1996).

[3] Emission factors are based on AP-42 Chapter 3, Table 3.3-1, Emission Factors for Uncontrolled Gasoline And Diesel Industrial Engines October 1996).

[4] Conservatively assumed PM_{10}=$PM_{2.5}$.

[5] Conservatively based on AP-42 Chapter 3, Table 3.4-1, Emission Factors for Large Stationary Diesel and all Stationary Dual-fuel Engines (October 1996).

[6] Sulfur content of 0.1 % is used for all diesel combustion sources per IMO 2015 standards. Therefore, emissions have been calculated based on a maximum sulfur content of 1000 ppm in diesel fuel assuming that 98 percent of sulfur in the fuel is oxidized to SO2 (MW=32 g/mol) and 2 percent of sulfur in the fuel is oxidized to H2SO4 (MW=98 g/mol) based on Draft Regulatory Impact Analysis: Control of Emissions from Nonroad Diesel Engines, EPA420-R-03-008, April 2003.

Normal Operations Emission Calculations
Tug Boat - Supply Boat AHT Winch Engine

Hazardous Air Pollutants

Pollutant	Emission Factor Basis		Emission Factor		Hourly Emissions from 1 Engine	Annual Emissions from 1 Engine	Hourly Emissions from All Engines	Annual Emissions from All Engines
			Value	Units	(lb/hr)	(tons/yr)	(lb/hr)	(tons/yr)
Acetaldehyde	AP-42	[7], [8]	7.67E-04	lb/MMBtu	5.15E-04	9.28E-05	1.55E-03	2.78E-04
Acrolein	AP-42	[7], [8]	9.25E-05	lb/MMBtu	6.22E-05	1.12E-05	1.86E-04	3.36E-05
Benzene	AP-42	[7], [8]	9.33E-04	lb/MMBtu	6.27E-04	1.13E-04	1.88E-03	3.39E-04
1,3-Butadiene	AP-42	[7], [8]	3.91E-05	lb/MMBtu	2.63E-05	4.73E-06	7.88E-05	1.42E-05
Formaldehyde	AP-42	[7], [8]	1.18E-03	lb/MMBtu	7.93E-04	1.43E-04	2.38E-03	4.28E-04
Toluene	AP-42	[7], [8]	4.09E-04	lb/MMBtu	2.75E-04	4.95E-05	8.25E-04	1.48E-04
Xylenes	AP-42	[7], [8]	2.85E-04	lb/MMBtu	1.92E-04	3.45E-05	5.75E-04	1.03E-04
Total PAH	AP-42	[7], [8]	1.68E-04	lb/MMBtu	1.13E-04	2.03E-05	3.39E-04	6.10E-05
Total VOC HAPs					**2.60E-03**	**4.69E-04**	**7.81E-03**	**1.41E-03**

[7] Emission factors based on AP-42, Chapter 3, Table 3.3-2, Speciated Organic Compound Emission Factors for Uncontrolled Stationary Diesel Engines (October 1996).

[8] An average BSFC of 7,000 Btu/hp-hr was used to convert from lb/MMBtu to lb/hp-hr to calculate emissions.

Greenhouse Gases

Pollutant	Emission Factor Basis		Emission Factor		Hourly Emissions from 1 Engine	Annual Emissions from 1 Engine	Hourly Emissions from All Engines	Annual Emissions from All Engines
			Value	Units	(lb/hr)	(tons/yr)	(lb/hr)	(tons/yr)
CO_2	EPA	[9], [12]	73.96	kg/MMBtu	109.6	19.72	328.7	59.17
CH_4	EPA	[10], [12]	3.00E-03	kg/MMBtu	4.44E-03	8.00E-04	1.33E-02	2.40E-03
N_2O	EPA	[10], [12]	6.00E-04	kg/MMBtu	8.89E-04	1.60E-04	2.67E-03	4.80E-04
CO_2e	EPA	[11]	--	--	**109.95**	**19.79**	**329.84**	**59.37**

[9] Emission factor based on 40 CFR 98 Subpart C, Table C-1 Default CO_2 Emission Factors and High Heat Values for Various Types of Fuel. The emission factor for Distillate Fuel Oil No. 2 was used to calculate emissions.

[10] Emission factors based on 40 CFR 98 Subpart C, Table C-2 Default CH_4 and N_2O Emission Factors for Various Types of Fuel. The emission factor for petroleum (All types in table C-1) was used to calculate emissions.

[11] CH_4, CO_2 and N_2O are included in the emissions of CO_2 equivalent (CO_2e), weighted according to their global warming potential (GWP). The GWP was obtained from table A-1 to Subpart A of Part 98. This is consistent with TCEQ 2015 guidance: https://www.tceq.texas.gov/assets/public/permitting/air/factsheets/factsheets-psdghg-6291.pdf

[12] An average BSFC of 7,000 Btu/hp-hr was used to convert from lb/MMBtu to lb/hp-hr to calculate emissions.

Normal Operations Emission Calculations

4-point Dive Support Vessel - Main Engines

Engine Rating [1]	=	1,678	kW
	=	2,250	HP
Total Operating Time [1]	=	720	hrs/yr
Operating load [1]	=	80%	
Total number Main Engines [1]	=	2	
Fuel Type [1]	=	Diesel	
Average Brake-Specific Fuel Consumption [2]	=	7,000	Btu/HP-hr
Average Higher Heating Value (HHV) [2]	=	19,300	Btu/lb

Criteria Pollutants

Pollutant	Emission Factor Basis		Emission Factor		Hourly Emissions from 1 Engine	Annual Emissions from 1 Engine	Hourly Emissions from All Engines	Annual Emissions from All Engines
			Value	Units	(lb/hr)	(tons/yr)	(lb/hr)	(tons/yr)
$PM_{Filterable}$	AP-42	[3]	4.34E-04	lb/HP-hr	0.78	0.28	1.56	0.56
$PM_{10, Filterable}$	AP-42	[3]	3.47E-04	lb/HP-hr	0.62	0.22	1.25	0.45
$PM_{2.5, Filterable}$	AP-42	[3]	3.35E-04	lb/HP-hr	0.60	0.22	1.21	0.43
$PM_{Condensable}$	AP-42	[3]	5.39E-05	lb/HP-hr	0.10	0.03	0.19	0.07
NO_x	AP-42	[2]	2.40E-02	lb/HP-hr	43.20	15.55	86.40	31.10
SO_2	Fuel S Content	[4]	7.11E-04	lb/HP-hr	1.28	0.46	2.56	0.92
CO	AP-42	[2]	5.50E-03	lb/HP-hr	9.90	3.56	19.80	7.13
VOC	AP-42	[2],[5]	6.42E-04	lb/HP-hr	1.15	0.42	2.31	0.83
H_2SO_4	Fuel S Content	[4]	2.22E-05	lb/HP-hr	4.00E-02	0.01	0.08	0.03

[1] Based on current project design specifications, provided by BMOP.

[2] Emission factors are based on AP-42 Chapter 3, Table 3.4-1, Emission Factors for Large Stationary Diesel and all Stationary Dual-fuel Engines (October 1996).

[3] PM_{10} and $PM_{2.5}$ emission factors based on AP-42 Chapter 3, Table 3.4-2, Particulate and Particle-sizing Emission Factors for Large Uncontrolled Stationary Diesel Engines (October 1996). An average brake-specific fuel consumption (BSFC) of 7,000 Btu/hp-hr was used to convert from lb/MMBtu to lb/hp-hr. PM < 3um taken as $PM_{2.5}$. Total particulate emissions is the sum of filterable and condensable particulate emissions.

[4] Sulfur content of 0.1 % is used for all diesel combustion sources per IMO 2015 standards. Therefore, emissions have been calculated based on a maximum sulfur content of 1000 ppm in diesel fuel assuming that 98 percent of sulfur in the fuel is oxidized to SO2 (MW=32 g/mol) and 2 percent of sulfur in the fuel is oxidized to H2SO4 (MW=98 g/mol) based on Draft Regulatory Impact Analysis: Control of Emissions from Nonroad Diesel Engines, EPA420-R-03-008, April 2003.

[5] Per footnote f of AP-42 Chapter 3, Table 3.4-1, non methane VOC emission factor has calculated as 91% of TOC emission factor.

Normal Operations Emission Calculations
4-point Dive Support Vessel - Main Engines

Hazardous Air Pollutants

Pollutant	Emission Factor Basis		Emission Factor		Hourly Emissions from 1 Engine	Annual Emissions from 1 Engine	Hourly Emissions from All Engines	Annual Emissions from All Engines
			Value	Units	(lb/hr)	(tons/yr)	(lb/hr)	(tons/yr)
Acetaldehyde	AP-42	[6], [7]	2.52E-05	lb/MMBtu	3.18E-04	1.14E-04	6.35E-04	2.29E-04
Acrolein	AP-42	[6], [7]	7.88E-06	lb/MMBtu	9.93E-05	3.57E-05	1.99E-04	7.15E-05
Benzene	AP-42	[6], [7]	7.76E-04	lb/MMBtu	9.78E-03	3.52E-03	1.96E-02	7.04E-03
Formaldehyde	AP-42	[6], [7]	7.89E-05	lb/MMBtu	9.94E-04	3.58E-04	1.99E-03	7.16E-04
Toluene	AP-42	[6], [7]	2.81E-04	lb/MMBtu	3.54E-03	1.27E-03	7.08E-03	2.55E-03
Xylenes	AP-42	[6], [7]	1.93E-04	lb/MMBtu	2.43E-03	8.75E-04	4.86E-03	1.75E-03
Total PAH	AP-42	[6], [7]	2.12E-04	lb/MMBtu	2.67E-03	9.62E-04	5.34E-03	1.92E-03
Total VOC HAPs					**1.98E-02**	**7.14E-03**	**3.97E-02**	**1.43E-02**

[6] Emission factors based on AP-42, Chapter 3, Table 3.4-3, Speciated Organic Compound Emission Factors for Large Uncontrolled Stationary Diesel Engines (October 1996).
[7] An average BSFC of 7,000 Btu/hp-hr was used to convert from lb/MMBtu to lb/hp-hr to calculate emissions.

Greenhouse Gases

Pollutant	Emission Factor Basis		Emission Factor		Hourly Emissions from 1 Engine	Annual Emissions from 1 Engine	Hourly Emissions from All Engines	Annual Emissions from All Engines
			Value	Units	(lb/hr)	(tons/yr)	(lb/hr)	(tons/yr)
CO_2	EPA	[8], [11]	73.96	kg/MMBtu	2,054	739.6	4,109	1,479
CH_4	EPA	[9], [11]	3.00E-03	kg/MMBtu	8.33E-02	3.00E-02	1.67E-01	0.06
N_2O	EPA	[9], [11]	6.00E-04	kg/MMBtu	1.67E-02	6.00E-03	3.33E-02	0.01
CO_2e	EPA	[10]	--	--	**2,062**	**742.1**	**4,123**	**1,484**

[8] Emission factor based on 40 CFR 98 Subpart C, Table C-1 Default CO_2 Emission Factors and High Heat Values for Various Types of Fuel. The emission factor for Distillate Fuel Oil No. 2 was used to calculate emissions.
[9] Emission factors based on 40 CFR 98 Subpart C, Table C-2 Default CH_4 and N_2O Emission Factors for Various Types of Fuel. The emission factor for petroleum (All types in table C-1) was used to calculate emissions.
[10] CH_4, CO_2 and N_2O are included in the emissions of CO_2 equivalent (CO_2e), weighted according to their global warming potential (GWP). The GWP was obtained from table A-1 to Subpart A of Part 98. This is consistent with TCEQ 2015 guidance: https://www.tceq.texas.gov/assets/public/permitting/air/factsheets/factsheets-psdghg-6291.pdf
[11] An average BSFC of 7,000 Btu/hp-hr was used to convert from lb/MMBtu to lb/hp-hr to calculate emissions.

Normal Operations Emission Calculations

4-point Dive Support Vessel - Generators

Engine Rating [1]	=	149	kW
	=	200	HP
Total Operating Time [1]	=	360	hrs/yr
Operating load [1]	=	80%	
Total number Main Engines [1]	=	2	
Fuel Type [1]	=	Diesel	
Average Brake-Specific Fuel Consumption [2]	=	7,000	Btu/HP-hr
Average Higher Heating Value (HHV) [2]	=	19,300	Btu/lb

Criteria Pollutants

Pollutant	Emission Factor Basis		Emission Factor		Hourly Emissions from 1 Engine	Annual Emissions from 1 Engine	Hourly Emissions from All Engines	Annual Emissions from All Engines
			Value	Units	(lb/hr)	(tons/yr)	(lb/hr)	(tons/yr)
$PM_{Filterable}$	AP-42	[3], [4]	2.20E-03	lb/HP-hr	0.35	0.06	0.70	1.27E-01
$PM_{10, Filterable}$	AP-42	[3], [4]	2.20E-03	lb/HP-hr	3.52E-01	6.34E-02	0.70	1.27E-01
$PM_{2.5, Filterable}$	AP-42	[3], [4]	2.20E-03	lb/HP-hr	0.35	0.06	0.70	0.13
$PM_{Condensable}$	AP-42	[5]	5.39E-05	lb/HP-hr	0.01	0.00	0.02	3.10E-03
NO_x	AP-42	[3]	3.10E-02	lb/HP-hr	4.96	0.89	9.92	1.79
SO_2	Fuel S Content	[6]	7.11E-04	lb/HP-hr	0.11	0.02	0.23	0.04
CO	AP-42	[3]	6.68E-03	lb/HP-hr	1.07	0.19	2.14	0.38
VOC	AP-42	[3]	2.47E-03	lb/HP-hr	0.40	0.07	0.79	0.14
H_2SO_4	Fuel S Content	[6]	2.22E-05	lb/HP-hr	3.55E-03	6.40E-04	7.11E-03	1.28E-03

[1] Based on current project design specifications, provided by BMOP.
[2] Based on AP-42 Chapter 3, Table 3.3-1, Emission Factors for Uncontrolled Gasoline and Diesel Industrial Engines (October 1996).
[3] Emission factors are based on AP-42 Chapter 3, Table 3.3-1, Emission Factors for Uncontrolled Gasoline And Diesel Industrial Engines October 1996).

[4] Conservatively assumed $PM_{10}=PM_{2.5}$.

[5] Conservatively based on AP-42 Chapter 3, Table 3.4-1, Emission Factors for Large Stationary Diesel and all Stationary Dual-fuel Engines (October 1996).

[6] Sulfur content of 0.1 % is used for all diesel combustion sources per IMO 2015 standards. Therefore, emissions have been calculated based on a maximum sulfur content of 1000 ppm in diesel fuel assuming that 98 percent of sulfur in the fuel is oxidized to SO2 (MW=32 g/mol) and 2 percent of sulfur in the fuel is oxidized to H2SO4 (MW=98 g/mol) based on Draft Regulatory Impact Analysis: Control of Emissions from Nonroad Diesel Engines, EPA420-R-03-008, April 2003.

Normal Operations Emission Calculations
4-point Dive Support Vessel - Generators

Hazardous Air Pollutants

Pollutant	Emission Factor Basis		Emission Factor		Hourly Emissions from 1 Engine	Annual Emissions from 1 Engine	Hourly Emissions from All Engines	Annual Emissions from All Engines
			Value	Units	(lb/hr)	(tons/yr)	(lb/hr)	(tons/yr)
Acetaldehyde	AP-42	[7], [8]	7.67E-04	lb/MMBtu	8.59E-04	1.55E-04	1.72E-03	3.09E-04
Acrolein	AP-42	[7], [8]	9.25E-05	lb/MMBtu	1.04E-04	1.86E-05	2.07E-04	3.73E-05
Benzene	AP-42	[7], [8]	9.33E-04	lb/MMBtu	1.04E-03	1.88E-04	2.09E-03	3.76E-04
1,3-Butadiene	AP-42	[7], [8]	3.91E-05	lb/MMBtu	4.38E-05	7.88E-06	8.76E-05	1.58E-05
Formaldehyde	AP-42	[7], [8]	1.18E-03	lb/MMBtu	1.32E-03	2.38E-04	2.64E-03	4.76E-04
Toluene	AP-42	[7], [8]	4.09E-04	lb/MMBtu	4.58E-04	8.25E-05	9.16E-04	1.65E-04
Xylenes	AP-42	[7], [8]	2.85E-04	lb/MMBtu	3.19E-04	5.75E-05	6.38E-04	1.15E-04
Total PAH	AP-42	[7], [8]	1.68E-04	lb/MMBtu	1.88E-04	3.39E-05	3.76E-04	6.77E-05
Total VOC HAPs					**4.34E-03**	**7.81E-04**	**8.68E-03**	**1.56E-03**

[7] Emission factors based on AP-42, Chapter 3, Table 3.3-2, Speciated Organic Compound Emission Factors for Uncontrolled Stationary Diesel Engines (October 1996).
[8] An average BSFC of 7,000 Btu/hp-hr was used to convert from lb/MMBtu to lb/hp-hr to calculate emissions.

Greenhouse Gases

Pollutant	Emission Factor Basis		Emission Factor		Hourly Emissions from 1 Engine	Annual Emissions from 1 Engine	Hourly Emissions from All Engines	Annual Emissions from All Engines
			Value	Units	(lb/hr)	(tons/yr)	(lb/hr)	(tons/yr)
CO_2	EPA	[9], [12]	73.96	kg/MMBtu	182.6	32.87	365.2	65.74
CH_4	EPA	[10], [12]	3.00E-03	kg/MMBtu	7.41E-03	1.33E-03	1.48E-02	2.67E-03
N_2O	EPA	[10], [12]	6.00E-04	kg/MMBtu	1.48E-03	2.67E-04	2.96E-03	5.33E-04
CO_2e	EPA	[11]	--	--	**183.2**	**32.98**	**366.5**	**65.97**

[9] Emission factor based on 40 CFR 98 Subpart C, Table C-1 Default CO_2 Emission Factors and High Heat Values for Various Types of Fuel. The emission factor for Distillate Fuel Oil No. 2 was used to calculate emissions.

[10] Emission factors based on 40 CFR 98 Subpart C, Table C-2 Default CH_4 and N_2O Emission Factors for Various Types of Fuel. The emission factor for petroleum (All types in table C-1) was used to calculate emissions.

[11] CH_4, CO_2 and N_2O are included in the emissions of CO_2 equivalent (CO_2e), weighted according to their global warming potential (GWP). The GWP was obtained from table A-1 to Subpart A of Part 98. This is consistent with TCEQ 2015 guidance: https://www.tceq.texas.gov/assets/public/permitting/air/factsheets/factsheets-psdghg-6291.pdf

[12] An average BSFC of 7,000 Btu/hp-hr was used to convert from lb/MMBtu to lb/hp-hr to calculate emissions.

Normal Operations Emission Calculations

4-point Dive Support Vessel - Air Compressors

Engine Rating [1]	=	75	kW
	=	100	HP
Total Operating Time [1]	=	540	hrs/yr
Operating load [1]	=	70%	
Total number Main Engines [1]	=	1	
Fuel Type [1]	=	Diesel	
Average Brake-Specific Fuel Consumption [2]	=	7,000	Btu/HP-hr
Average Higher Heating Value (HHV) [2]	=	19,300	Btu/lb

Criteria Pollutants

Pollutant	Emission Factor Basis		Emission Factor		Hourly Emissions	Annual Emissions
			Value	Units	(lb/hr)	(tons/yr)
$PM_{Filterable}$	AP-42	[3], [4]	2.20E-03	lb/HP-hr	0.15	0.04
$PM_{10,\ Filterable}$	AP-42	[3], [4]	2.20E-03	lb/HP-hr	1.54E-01	4.16E-02
$PM_{2.5,\ Filterable}$	AP-42	[3], [4]	2.20E-03	lb/HP-hr	0.15	0.04
$PM_{Condensable}$	AP-42	[5]	5.39E-05	lb/HP-hr	0.00	1.02E-03
NO_x	AP-42	[3]	3.10E-02	lb/HP-hr	2.17	0.59
SO_2	Fuel S Content	[6]	7.11E-04	lb/HP-hr	0.05	0.01
CO	AP-42	[3]	6.68E-03	lb/HP-hr	0.47	0.13
VOC	AP-42	[3]	2.47E-03	lb/HP-hr	0.17	0.05
H_2SO_4	Fuel S Content	[6]	2.22E-05	lb/HP-hr	1.56E-03	4.20E-04

[1] Based on current project design specifications, provided by BMOP.

[2] Based on AP-42 Chapter 3, Table 3.3-1, Emission Factors for Uncontrolled Gasoline and Diesel Industrial Engines (October 1996).

[3] Emission factors are based on AP-42 Chapter 3, Table 3.3-1, Emission Factors for Uncontrolled Gasoline And Diesel Industrial Engines October 1996).

[4] Conservatively assumed PM_{10}=$PM_{2.5}$.

[5] Conservatively based on AP-42 Chapter 3, Table 3.4-1, Emission Factors for Large Stationary Diesel and all Stationary Dual-fuel Engines (October 1996).

[6] Sulfur content of 0.1 % is used for all diesel combustion sources per IMO 2015 standards. Therefore, emissions have been calculated based on a maximum sulfur content of 1000 ppm in diesel fuel assuming that 98 percent of sulfur in the fuel is oxidized to SO2 (MW=32 g/mol) and 2 percent of sulfur in the fuel is oxidized to H2SO4 (MW=98 g/mol) based on Draft Regulatory Impact Analysis: Control of Emissions from Nonroad Diesel Engines, EPA420-R-03-008, April 2003.

Normal Operations Emission Calculations

4-point Dive Support Vessel - Air Compressors

Hazardous Air Pollutants

Pollutant	Emission Factor Basis		Emission Factor		Hourly Emissions	Annual Emissions
			Value	Units	(lb/hr)	(tons/yr)
Acetaldehyde	AP-42	[7], [8]	7.67E-04	lb/MMBtu	3.76E-04	1.01E-04
Acrolein	AP-42	[7], [8]	9.25E-05	lb/MMBtu	4.53E-05	1.22E-05
Benzene	AP-42	[7], [8]	9.33E-04	lb/MMBtu	4.57E-04	1.23E-04
1,3-Butadiene	AP-42	[7], [8]	3.91E-05	lb/MMBtu	1.92E-05	5.17E-06
Formaldehyde	AP-42	[7], [8]	1.18E-03	lb/MMBtu	5.78E-04	1.56E-04
Toluene	AP-42	[7], [8]	4.09E-04	lb/MMBtu	2.00E-04	5.41E-05
Xylenes	AP-42	[7], [8]	2.85E-04	lb/MMBtu	1.40E-04	3.77E-05
Total PAH	AP-42	[7], [8]	1.68E-04	lb/MMBtu	8.23E-05	2.22E-05
Total VOC HAPs					**1.90E-03**	**5.12E-04**

[7] Emission factors based on AP-42, Chapter 3, Table 3.3-2, Speciated Organic Compound Emission Factors for Uncontrolled Stationary Diesel Engines (October 1996).

[8] An average BSFC of 7,000 Btu/hp-hr was used to convert from lb/MMBtu to lb/hp-hr to calculate emissions.

Greenhouse Gases

Pollutant	Emission Factor Basis		Emission Factor		Hourly Emissions	Annual Emissions
			Value	Units	(lb/hr)	(tons/yr)
CO_2	EPA	[9], [12]	73.96	kg/MMBtu	79.90	21.57
CH_4	EPA	[10], [12]	3.00E-03	kg/MMBtu	3.24E-03	8.75E-04
N_2O	EPA	[10], [12]	6.00E-04	kg/MMBtu	6.48E-04	1.75E-04
CO_2e	EPA	[11]	--	--	**80.17**	**21.65**

[9] Emission factor based on 40 CFR 98 Subpart C, Table C-1 Default CO_2 Emission Factors and High Heat Values for Various Types of Fuel. The emission factor for Distillate Fuel Oil No. 2 was used to calculate emissions.

[10] Emission factors based on 40 CFR 98 Subpart C, Table C-2 Default CH_4 and N_2O Emission Factors for Various Types of Fuel. The emission factor for petroleum (All types in table C-1) was used to calculate emissions.

[11] CH_4, CO_2 and N_2O are included in the emissions of CO_2 equivalent (CO_2e), weighted according to their global warming potential (GWP). The GWP was obtained from table A-1 to Subpart A of Part 98. This is consistent with TCEQ 2015 guidance: https://www.tceq.texas.gov/assets/public/permitting/air/factsheets/factsheets-psdghg-6291.pdf

[12] An average BSFC of 7,000 Btu/hp-hr was used to convert from lb/MMBtu to lb/hp-hr to calculate emissions.

Normal Operations Emission Calculations

4-point Dive Support Vessel - Dive Compressor

Engine Rating [1]	=	60	kW
	=	80	HP
Total Operating Time [1]	=	360	hrs/yr
Operating load [1]	=	70%	
Total number Gen Sets [1]	=	2	
Fuel Type [1]	=	Diesel	
Average Brake-Specific Fuel Consumption [2]	=	7,000	Btu/HP-hr
Average Higher Heating Value (HHV) [2]	=	19,300	Btu/lb

Criteria Pollutants

Pollutant	Emission Factor Basis		Emission Factor		Hourly Emissions from 1 Engine	Annual Emissions from 1 Engine	Hourly Emissions from All Engines	Annual Emissions from All Engines
			Value	Units	(lb/hr)	(tons/yr)	(lb/hr)	(tons/yr)
PM $_{Filterable}$	AP-42	[3], [4]	2.20E-03	lb/HP-hr	0.12	0.02	0.25	0.04
$PM_{10, Filterable}$	AP-42	[3], [4]	2.20E-03	lb/HP-hr	1.23E-01	2.22E-02	0.25	4.44E-02
$PM_{2.5, Filterable}$	AP-42	[3], [4]	2.20E-03	lb/HP-hr	0.12	0.02	0.25	0.04
PM $_{Condensable}$	AP-42	[5]	5.39E-05	lb/HP-hr	3.02E-03	5.43E-04	6.04E-03	1.09E-03
NO_x	AP-42	[3]	3.10E-02	lb/HP-hr	1.74	0.31	3.47	0.62
SO_2	Fuel S Content	[6]	7.11E-04	lb/HP-hr	0.04	7.17E-03	0.08	1.43E-02
CO	AP-42	[3]	6.68E-03	lb/HP-hr	0.37	0.07	0.75	0.13
VOC	AP-42	[3]	2.47E-03	lb/HP-hr	0.14	0.02	0.28	0.05
H_2SO_4	Fuel S Content	[6]	2.22E-05	lb/HP-hr	1.24E-03	2.24E-04	2.49E-03	4.48E-04

[1] Based on current project design specifications, provided by BMOP.
[2] Based on AP-42 Chapter 3, Table 3.3-1, Emission Factors for Uncontrolled Gasoline and Diesel Industrial Engines (October 1996).
[3] Emission factors are based on AP-42 Chapter 3, Table 3.3-1, Emission Factors for Uncontrolled Gasoline And Diesel Industrial Engines October 1996).
[4] Conservatively assumed PM_{10}=$PM_{2.5}$.
[5] Conservatively based on AP-42 Chapter 3, Table 3.4-1, Emission Factors for Large Stationary Diesel and all Stationary Dual-fuel Engines (October 1996).
[6] Sulfur content of 0.1 % is used for all diesel combustion sources per IMO 2015 standards. Therefore, emissions have been calculated based on a maximum sulfur content of 1000 ppm in diesel fuel assuming that 98 percent of sulfur in the fuel is oxidized to SO2 (MW=32 g/mol) and 2 percent of sulfur in the fuel is oxidized to H2SO4 (MW=98 g/mol) based on Draft Regulatory Impact Analysis: Control of Emissions from Nonroad Diesel Engines, EPA420-R-03-008, April 2003.

Normal Operations Emission Calculations

4-point Dive Support Vessel - Dive Compressor

Hazardous Air Pollutants

Pollutant	Emission Factor Basis		Emission Factor		Hourly Emissions from 1 Engine	Annual Emissions from 1 Engine	Hourly Emissions from All Engines	Annual Emissions from All Engines
			Value	Units	(lb/hr)	(tons/yr)	(lb/hr)	(tons/yr)
Acetaldehyde	AP-42	[7], [8]	7.67E-04	lb/MMBtu	3.01E-04	5.41E-05	6.01E-04	1.08E-04
Acrolein	AP-42	[7], [8]	9.25E-05	lb/MMBtu	3.63E-05	6.53E-06	7.25E-05	1.31E-05
Benzene	AP-42	[7], [8]	9.33E-04	lb/MMBtu	3.66E-04	6.58E-05	7.31E-04	1.32E-04
1,3-Butadiene	AP-42	[7], [8]	3.91E-05	lb/MMBtu	1.53E-05	2.76E-06	3.07E-05	5.52E-06
Formaldehyde	AP-42	[7], [8]	1.18E-03	lb/MMBtu	4.63E-04	8.33E-05	9.25E-04	1.67E-04
Toluene	AP-42	[7], [8]	4.09E-04	lb/MMBtu	1.60E-04	2.89E-05	3.21E-04	5.77E-05
Xylenes	AP-42	[7], [8]	2.85E-04	lb/MMBtu	1.12E-04	2.01E-05	2.23E-04	4.02E-05
Total PAH	AP-42	[7], [8]	1.68E-04	lb/MMBtu	6.59E-05	1.19E-05	1.32E-04	2.37E-05
Total VOC HAPs					**1.52E-03**	**2.73E-04**	**3.04E-03**	**5.47E-04**

[7] Emission factors based on AP-42, Chapter 3, Table 3.3-2, Speciated Organic Compound Emission Factors for Uncontrolled Stationary Diesel Engines (October 1996).

[8] An average BSFC of 7,000 Btu/hp-hr was used to convert from lb/MMBtu to lb/hp-hr to calculate emissions.

Greenhouse Gases

Pollutant	Emission Factor Basis		Emission Factor		Hourly Emissions from 1 Engine	Annual Emissions from 1 Engine	Hourly Emissions from All Engines	Annual Emissions from All Engines
			Value	Units	(lb/hr)	(tons/yr)	(lb/hr)	(tons/yr)
CO_2	EPA	[9], [12]	73.96	kg/MMBtu	63.92	11.51	127.8	23.01
CH_4	EPA	[10], [12]	3.00E-03	kg/MMBtu	2.59E-03	4.67E-04	5.19E-03	9.33E-04
N_2O	EPA	[10], [12]	6.00E-04	kg/MMBtu	5.19E-04	9.33E-05	1.04E-03	1.87E-04
CO_2e	EPA	[11]	--	--	**64.14**	**11.54**	**128.3**	**23.09**

[9] Emission factor based on 40 CFR 98 Subpart C, Table C-1 Default CO_2 Emission Factors and High Heat Values for Various Types of Fuel. The emission factor for Distillate Fuel Oil No. 2 was used to calculate emissions.

[10] Emission factors based on 40 CFR 98 Subpart C, Table C-2 Default CH_4 and N_2O Emission Factors for Various Types of Fuel. The emission factor for petroleum (All types in table C-1) was used to calculate emissions.

[11] CH_4, CO_2 and N_2O are included in the emissions of CO_2 equivalent (CO_2e), weighted according to their global warming potential (GWP). The GWP was obtained from table A-1 to Subpart A of Part 98. This is consistent with TCEQ 2015 guidance: https://www.tceq.texas.gov/assets/public/permitting/air/factsheets/factsheets-psdghg-6291.pdf

[12] An average BSFC of 7,000 Btu/hp-hr was used to convert from lb/MMBtu to lb/hp-hr to calculate emissions.

Normal Operations Emission Calculations

4-point Dive Support Vessel - Crane

Engine Rating [1]	=	250	kW
	=	335	HP
Total Operating Time [1]	=	360	hrs/yr
Operating load [1]	=	20%	
Total number Gen Sets [1]	=	2	
Fuel Type [1]	=	Diesel	
Average Brake-Specific Fuel Consumption [2]	=	7,000	Btu/HP-hr
Average Higher Heating Value (HHV) [2]	=	19,300	Btu/lb

Criteria Pollutants

Pollutant	Emission Factor Basis		Emission Factor		Hourly Emissions from 1 Engine	Annual Emissions from 1 Engine	Hourly Emissions from All Engines	Annual Emissions from All Engines
			Value	Units	(lb/hr)	(tons/yr)	(lb/hr)	(tons/yr)
PM $_{Filterable}$	AP-42	[3], [4]	2.20E-03	lb/HP-hr	0.15	2.65E-02	0.29	5.31E-02
$PM_{10,\ Filterable}$	AP-42	[3], [4]	2.20E-03	lb/HP-hr	1.47E-01	2.65E-02	0.29	5.31E-02
$PM_{2.5,\ Filterable}$	AP-42	[3], [4]	2.20E-03	lb/HP-hr	0.15	2.65E-02	0.29	5.31E-02
PM $_{Condensable}$	AP-42	[5]	5.39E-05	lb/HP-hr	3.61E-03	6.50E-04	7.22E-03	1.30E-03
NO_x	AP-42	[3]	3.10E-02	lb/HP-hr	2.08	0.37	4.15	0.75
SO_2	Fuel S Content	[6]	7.11E-04	lb/HP-hr	0.05	8.57E-03	0.10	1.71E-02
CO	AP-42	[3]	6.68E-03	lb/HP-hr	0.45	0.08	0.90	0.16
VOC	AP-42	[3]	2.47E-03	lb/HP-hr	0.17	0.03	0.33	0.06
H_2SO_4	Fuel S Content	[6]	2.22E-05	lb/HP-hr	1.49E-03	2.68E-04	2.98E-03	5.36E-04

[1] Based on current project design specifications, provided by BMOP.
[2] Based on AP-42 Chapter 3, Table 3.3-1, Emission Factors for Uncontrolled Gasoline and Diesel Industrial Engines (October 1996).
[3] Emission factors are based on AP-42 Chapter 3, Table 3.3-1, Emission Factors for Uncontrolled Gasoline And Diesel Industrial Engines October 1996).

[4] Conservatively assumed PM_{10}=$PM_{2.5}$.

[5] Conservatively based on AP-42 Chapter 3, Table 3.4-1, Emission Factors for Large Stationary Diesel and all Stationary Dual-fuel Engines (October 1996).

[6] Sulfur content of 0.1 % is used for all diesel combustion sources per IMO 2015 standards. Therefore, emissions have been calculated based on a maximum sulfur content of 1000 ppm in diesel fuel assuming that 98 percent of sulfur in the fuel is oxidized to SO2 (MW=32 g/mol) and 2 percent of sulfur in the fuel is oxidized to H2SO4 (MW=98 g/mol) based on Draft Regulatory Impact Analysis: Control of Emissions from Nonroad Diesel Engines, EPA420-R-03-008, April 2003.

Normal Operations Emission Calculations

4-point Dive Support Vessel - Crane

Hazardous Air Pollutants

Pollutant	Emission Factor Basis		Emission Factor		Hourly Emissions from 1 Engine	Annual Emissions from 1 Engine	Hourly Emissions from All Engines	Annual Emissions from All Engines
			Value	Units	(lb/hr)	(tons/yr)	(lb/hr)	(tons/yr)
Acetaldehyde	AP-42	[7], [8]	7.67E-04	lb/MMBtu	3.60E-04	6.48E-05	7.19E-04	1.30E-04
Acrolein	AP-42	[7], [8]	9.25E-05	lb/MMBtu	4.34E-05	7.81E-06	8.68E-05	1.56E-05
Benzene	AP-42	[7], [8]	9.33E-04	lb/MMBtu	4.38E-04	7.88E-05	8.75E-04	1.58E-04
1,3-Butadiene	AP-42	[7], [8]	3.91E-05	lb/MMBtu	1.83E-05	3.30E-06	3.67E-05	6.60E-06
Formaldehyde	AP-42	[7], [8]	1.18E-03	lb/MMBtu	5.53E-04	9.96E-05	1.11E-03	1.99E-04
Toluene	AP-42	[7], [8]	4.09E-04	lb/MMBtu	1.92E-04	3.45E-05	3.84E-04	6.91E-05
Xylenes	AP-42	[7], [8]	2.85E-04	lb/MMBtu	1.34E-04	2.41E-05	2.67E-04	4.81E-05
Total PAH	AP-42	[7], [8]	1.68E-04	lb/MMBtu	7.88E-05	1.42E-05	1.58E-04	2.84E-05
Total VOC HAPs					**1.82E-03**	**3.27E-04**	**3.63E-03**	**6.54E-04**

[7] Emission factors based on AP-42, Chapter 3, Table 3.3-2, Speciated Organic Compound Emission Factors for Uncontrolled Stationary Diesel Engines (October 1996).
[8] An average BSFC of 7,000 Btu/hp-hr was used to convert from lb/MMBtu to lb/hp-hr to calculate emissions.

Greenhouse Gases

Pollutant	Emission Factor Basis		Emission Factor		Hourly Emissions from 1 Engine	Annual Emissions from 1 Engine	Hourly Emissions from All Engines	Annual Emissions from All Engines
			Value	Units	(lb/hr)	(tons/yr)	(lb/hr)	(tons/yr)
CO_2	EPA	[9], [12]	73.96	kg/MMBtu	76.47	13.76	152.9	27.53
CH_4	EPA	[10], [12]	3.00E-03	kg/MMBtu	3.10E-03	5.58E-04	6.20E-03	1.12E-03
N_2O	EPA	[10], [12]	6.00E-04	kg/MMBtu	6.20E-04	1.12E-04	1.24E-03	2.23E-04
CO_2e	EPA	[11]	--	--	**76.73**	**13.81**	**153.5**	**27.62**

[9] Emission factor based on 40 CFR 98 Subpart C, Table C-1 Default CO_2 Emission Factors and High Heat Values for Various Types of Fuel. The emission factor for Distillate Fuel Oil No. 2 was used to calculate emissions.
[10] Emission factors based on 40 CFR 98 Subpart C, Table C-2 Default CH_4 and N_2O Emission Factors for Various Types of Fuel. The emission factor for petroleum (All types in table C-1) was used to calculate emissions.
[11] CH_4, CO_2 and N_2O are included in the emissions of CO_2 equivalent (CO_2e), weighted according to their global warming potential (GWP). The GWP was obtained from table A-1 to Subpart A of Part 98. This is consistent with TCEQ 2015 guidance: https://www.tceq.texas.gov/assets/public/permitting/air/factsheets/factsheets-psdghg-6291.pdf
[12] An average BSFC of 7,000 Btu/hp-hr was used to convert from lb/MMBtu to lb/hp-hr to calculate emissions.

Normal Operations Emission Calculations

Supply Vessel - Main Engines

Engine Rating [1]	=	746	kW
	=	1,000	HP
Total Operating Time [1]	=	720	hrs/yr
Operating load [1]	=	80%	
Total number Main Engines [1]	=	2	
Fuel Type [1]	=	Diesel	
Average Brake-Specific Fuel Consumption [2]	=	7,000	Btu/HP-hr
Average Higher Heating Value (HHV) [2]	=	19,300	Btu/lb

Criteria Pollutants

Pollutant	Emission Factor Basis		Emission Factor		Hourly Emissions from 1 Engine	Annual Emissions from 1 Engine	Hourly Emissions from All Engines	Annual Emissions from All Engines
			Value	Units	(lb/hr)	(tons/yr)	(lb/hr)	(tons/yr)
$PM_{Filterable}$	AP-42	[3]	4.34E-04	lb/HP-hr	0.35	0.12	0.69	0.25
$PM_{10, Filterable}$	AP-42	[3]	3.47E-04	lb/HP-hr	0.28	0.10	0.56	0.20
$PM_{2.5, Filterable}$	AP-42	[3]	3.35E-04	lb/HP-hr	0.27	0.10	0.54	0.19
$PM_{Condensable}$	AP-42	[3]	5.39E-05	lb/HP-hr	0.04	1.55E-02	0.09	3.10E-02
NO_x	AP-42	[2]	2.40E-02	lb/HP-hr	19.20	6.91	38.40	13.82
SO_2	Fuel S Content	[4]	7.11E-04	lb/HP-hr	0.57	0.20	1.14	0.41
CO	AP-42	[2]	5.50E-03	lb/HP-hr	4.40	1.58	8.80	3.17
VOC	AP-42	[2], [5]	6.42E-04	lb/HP-hr	0.51	0.18	1.03	0.37
H_2SO_4	Fuel S Content	[4]	2.22E-05	lb/HP-hr	1.78E-02	6.40E-03	0.04	1.28E-02

[1] Based on current project design specifications, provided by BMOP.

[2] Emission factors are based on AP-42 Chapter 3, Table 3.4-1, Emission Factors for Large Stationary Diesel and all Stationary Dual-fuel Engines (October 1996).

[3] PM_{10} and $PM_{2.5}$ emission factors based on AP-42 Chapter 3, Table 3.4-2, Particulate and Particle-sizing Emission Factors for Large Uncontrolled Stationary Diesel Engines (October 1996). An average brake-specific fuel consumption (BSFC) of 7,000 Btu/hp-hr was used to convert from lb/MMBtu to lb/hp-hr. PM < 3um taken as $PM_{2.5}$. Total particulate emissions is the sum of filterable and condensable particulate emissions.

[4] Sulfur content of 0.1 % is used for all diesel combustion sources per IMO 2015 standards. Therefore, emissions have been calculated based on a maximum sulfur content of 1000 ppm in diesel fuel assuming that 98 percent of sulfur in the fuel is oxidized to SO2 (MW=32 g/mol) and 2 percent of sulfur in the fuel is oxidized to H2SO4 (MW=98 g/mol) based on Draft Regulatory Impact Analysis: Control of Emissions from Nonroad Diesel Engines, EPA420-R-03-008, April 2003.

[5] Per footnote f of AP-42 Chapter 3, Table 3.4-1, non methane VOC emission factor has calculated as 91% of TOC emission factor.

Normal Operations Emission Calculations
Supply Vessel - Main Engines

Hazardous Air Pollutants

Pollutant	Emission Factor Basis		Emission Factor Value	Emission Factor Units	Hourly Emissions from 1 Engine (lb/hr)	Annual Emissions from 1 Engine (tons/yr)	Hourly Emissions from All Engines (lb/hr)	Annual Emissions from All Engines (tons/yr)
Acetaldehyde	AP-42	[6], [7]	2.52E-05	lb/MMBtu	1.41E-04	5.08E-05	2.82E-04	1.02E-04
Acrolein	AP-42	[6], [7]	7.88E-06	lb/MMBtu	4.41E-05	1.59E-05	8.83E-05	3.18E-05
Benzene	AP-42	[6], [7]	7.76E-04	lb/MMBtu	4.35E-03	1.56E-03	8.69E-03	3.13E-03
Formaldehyde	AP-42	[6], [7]	7.89E-05	lb/MMBtu	4.42E-04	1.59E-04	8.84E-04	3.18E-04
Toluene	AP-42	[6], [7]	2.81E-04	lb/MMBtu	1.57E-03	5.66E-04	3.15E-03	1.13E-03
Xylenes	AP-42	[6], [7]	1.93E-04	lb/MMBtu	1.08E-03	3.89E-04	2.16E-03	7.78E-04
Total PAH	AP-42	[6], [7]	2.12E-04	lb/MMBtu	1.19E-03	4.27E-04	2.37E-03	8.55E-04
Total VOC HAPs					**8.81E-03**	**3.17E-03**	**1.76E-02**	**6.35E-03**

[6] Emission factors based on AP-42, Chapter 3, Table 3.4-3, Speciated Organic Compound Emission Factors for Large Uncontrolled Stationary Diesel Engines (October 1996).
[7] An average BSFC of 7,000 Btu/hp-hr was used to convert from lb/MMBtu to lb/hp-hr to calculate emissions.

Greenhouse Gases

Pollutant	Emission Factor Basis		Emission Factor Value	Emission Factor Units	Hourly Emissions from 1 Engine (lb/hr)	Annual Emissions from 1 Engine (tons/yr)	Hourly Emissions from All Engines (lb/hr)	Annual Emissions from All Engines (tons/yr)
CO_2	EPA	[8], [11]	73.96	kg/MMBtu	913.1	328.7	1,826	657.4
CH_4	EPA	[9], [11]	3.00E-03	kg/MMBtu	3.70E-02	1.33E-02	7.41E-02	2.67E-02
N_2O	EPA	[9], [11]	6.00E-04	kg/MMBtu	7.41E-03	2.67E-03	1.48E-02	5.33E-03
CO_2e	EPA	[10]	--	--	**916.23**	**329.84**	**1,832**	**659.7**

[8] Emission factor based on 40 CFR 98 Subpart C, Table C-1 Default CO_2 Emission Factors and High Heat Values for Various Types of Fuel. The emission factor for Distillate Fuel Oil No. 2 was used to calculate emissions.

[9] Emission factors based on 40 CFR 98 Subpart C, Table C-2 Default CH_4 and N_2O Emission Factors for Various Types of Fuel. The emission factor for petroleum (All types in table C-1) was used to calculate emissions.

[10] CH_4, CO_2 and N_2O are included in the emissions of CO_2 equivalent (CO_2e), weighted according to their global warming potential (GWP). The GWP was obtained from table A-1 to Subpart A of Part 98. This is consistent with TCEQ 2015 guidance: https://www.tceq.texas.gov/assets/public/permitting/air/factsheets/factsheets-psdghg-6291.pdf

[11] An average BSFC of 7,000 Btu/hp-hr was used to convert from lb/MMBtu to lb/hp-hr to calculate emissions.

Normal Operations Emission Calculations
Supply Vessel - Generator Engines

Engine Rating [1]	=	149	kW
	=	200	HP
Total Operating Time [1]	=	360	hrs/yr
Operating load [1]	=	80%	
Total number Gen Sets [1]	=	2	
Fuel Type [1]	=	Diesel	
Average Brake-Specific Fuel Consumption [2]	=	7,000	Btu/HP-hr
Average Higher Heating Value (HHV) [2]	=	19,300	Btu/lb

Criteria Pollutants

Pollutant	Emission Factor Basis		Emission Factor		Hourly Emissions from 1 Engine	Annual Emissions from 1 Engine	Hourly Emissions from All Engines	Annual Emissions from All Engines
			Value	Units	(lb/hr)	(tons/yr)	(lb/hr)	(tons/yr)
PM $_{Filterable}$	AP-42	[3], [4]	2.20E-03	lb/HP-hr	0.35	6.34E-02	0.70	1.27E-01
$PM_{10, Filterable}$	AP-42	[3], [4]	2.20E-03	lb/HP-hr	3.52E-01	6.34E-02	0.70	1.27E-01
$PM_{2.5, Filterable}$	AP-42	[3], [4]	2.20E-03	lb/HP-hr	0.35	6.34E-02	0.70	1.27E-01
PM $_{Condensable}$	AP-42	[5]	5.39E-05	lb/HP-hr	8.62E-03	1.55E-03	1.72E-02	3.10E-03
NO_x	AP-42	[3]	3.10E-02	lb/HP-hr	4.96	0.89	9.92	1.79
SO_2	Fuel S Content	[6]	7.11E-04	lb/HP-hr	0.11	0.02	0.23	0.04
CO	AP-42	[3]	6.68E-03	lb/HP-hr	1.07	0.19	2.14	0.38
VOC	AP-42	[3]	2.47E-03	lb/HP-hr	0.40	0.07	0.79	0.14
H_2SO_4	Fuel S Content	[6]	2.22E-05	lb/HP-hr	3.55E-03	6.40E-04	7.11E-03	1.28E-03

[1] Based on current project design specifications, provided by BMOP.
[2] Based on AP-42 Chapter 3, Table 3.3-1, Emission Factors for Uncontrolled Gasoline and Diesel Industrial Engines (October 1996).
[3] Emission factors are based on AP-42 Chapter 3, Table 3.3-1, Emission Factors for Uncontrolled Gasoline And Diesel Industrial Engines October 1996).

[4] Conservatively assumed PM_{10}=$PM_{2.5}$.
[5] Conservatively based on AP-42 Chapter 3, Table 3.4-1, Emission Factors for Large Stationary Diesel and all Stationary Dual-fuel Engines (October 1996).

[6] Sulfur content of 0.1 % is used for all diesel combustion sources per IMO 2015 standards. Therefore, emissions have been calculated based on a maximum sulfur content of 1000 ppm in diesel fuel assuming that 98 percent of sulfur in the fuel is oxidized to SO2 (MW=32 g/mol) and 2 percent of sulfur in the fuel is oxidized to H2SO4 (MW=98 g/mol) based on Draft Regulatory Impact Analysis: Control of Emissions from Nonroad Diesel Engines, EPA420-R-03-008, April 2003.

Normal Operations Emission Calculations

Supply Vessel - Generator Engines

Hazardous Air Pollutants

Pollutant	Emission Factor Basis		Emission Factor		Hourly Emissions from 1 Engine	Annual Emissions from 1 Engine	Hourly Emissions from All Engines	Annual Emissions from All Engines
			Value	Units	(lb/hr)	(tons/yr)	(lb/hr)	(tons/yr)
Acetaldehyde	AP-42	[7], [8]	7.67E-04	lb/MMBtu	8.59E-04	1.55E-04	1.72E-03	3.09E-04
Acrolein	AP-42	[7], [8]	9.25E-05	lb/MMBtu	1.04E-04	1.86E-05	2.07E-04	3.73E-05
Benzene	AP-42	[7], [8]	9.33E-04	lb/MMBtu	1.04E-03	1.88E-04	2.09E-03	3.76E-04
1,3-Butadiene	AP-42	[7], [8]	3.91E-05	lb/MMBtu	4.38E-05	7.88E-06	8.76E-05	1.58E-05
Formaldehyde	AP-42	[7], [8]	1.18E-03	lb/MMBtu	1.32E-03	2.38E-04	2.64E-03	4.76E-04
Toluene	AP-42	[7], [8]	4.09E-04	lb/MMBtu	4.58E-04	8.25E-05	9.16E-04	1.65E-04
Xylenes	AP-42	[7], [8]	2.85E-04	lb/MMBtu	3.19E-04	5.75E-05	6.38E-04	1.15E-04
Total PAH	AP-42	[7], [8]	1.68E-04	lb/MMBtu	1.88E-04	3.39E-05	3.76E-04	6.77E-05
Total VOC HAPs					**4.34E-03**	**7.81E-04**	**8.68E-03**	**1.56E-03**

[7] Emission factors based on AP-42, Chapter 3, Table 3.3-2, Speciated Organic Compound Emission Factors for Uncontrolled Stationary Diesel Engines (October 1996).
[8] An average BSFC of 7,000 Btu/hp-hr was used to convert from lb/MMBtu to lb/hp-hr to calculate emissions.

Greenhouse Gases

Pollutant	Emission Factor Basis		Emission Factor		Hourly Emissions from 1 Engine	Annual Emissions from 1 Engine	Hourly Emissions from All Engines	Annual Emissions from All Engines
			Value	Units	(lb/hr)	(tons/yr)	(lb/hr)	(tons/yr)
CO_2	EPA	[9], [12]	73.96	kg/MMBtu	182.6	32.87	365.2	65.74
CH_4	EPA	[10], [12]	3.00E-03	kg/MMBtu	7.41E-03	1.33E-03	1.48E-02	2.67E-03
N_2O	EPA	[10], [12]	6.00E-04	kg/MMBtu	1.48E-03	2.67E-04	2.96E-03	5.33E-04
CO_2e	EPA	[11]	--	--	**183.2**	**32.98**	**366.5**	**65.97**

[9] Emission factor based on 40 CFR 98 Subpart C, Table C-1 Default CO_2 Emission Factors and High Heat Values for Various Types of Fuel. The emission factor for Distillate Fuel Oil No. 2 was used to calculate emissions.
[10] Emission factors based on 40 CFR 98 Subpart C, Table C-2 Default CH_4 and N_2O Emission Factors for Various Types of Fuel. The emission factor for petroleum (All types in table C-1) was used to calculate emissions.
[11] CH_4, CO_2 and N_2O are included in the emissions of CO_2 equivalent (CO_2e), weighted according to their global warming potential (GWP). The GWP was obtained from table A-1 to Subpart A of Part 98. This is consistent with TCEQ 2015 guidance: https://www.tceq.texas.gov/assets/public/permitting/air/factsheets/factsheets-psdghg-6291.pdf
[12] An average BSFC of 7,000 Btu/hp-hr was used to convert from lb/MMBtu to lb/hp-hr to calculate emissions.

Normal Operations Emission Calculations
Helicopter

Engine Rating [1]	=	503	kW
	=	675	HP
Total Operating Time [1]	=	260	hrs/yr
Landing and take Off Cycle [1]	=	260	per year
Operating load [1]	=	80%	
Total number Main Engines [1]	=	1	
Fuel Type [1]	=	Aviation Kerosene	

Criteria Pollutants

Pollutant	Emission Factor Basis		Emission Factor		Hourly Emissions	Annual Emissions
			Value	Units	(lb/hr)	(tons/yr)
PM $_{Filterable}$	BOEM	[2]	6.00E-02	lb/LTO	0.06	7.80E-03
PM_{10}, $_{Filterable}$	BOEM	[2]	6.00E-02	lb/LTO	0.06	7.80E-03
$PM_{2.5, Filterable}$	BOEM	[2]	1.95E+00	lb/LTO	1.95	0.25
PM $_{Condensable}$	BOEM	[2]	6.00E-02	lb/LTO	0.06	7.80E-03
NO_x	BOEM	[2]	1.95E+00	lb/LTO	1.95	0.25
SO_2	BOEM	[2]	2.90E-01	lb/LTO	0.29	0.04
CO	BOEM	[2]	5.33E+00	lb/LTO	5.33	0.69
VOC	BOEM	[2]	4.01E+00	lb/LTO	4.01	0.52
H_2SO_4	% Conversion	[3]	1.45E-02	lb/LTO	1.45E-02	1.89E-03

[1] Based on current project design specifications, provided by BMOP.
[2] Table 6-12 Year 2011 Gulfwide Emission Inventory Study (BOEM 2014-666) Twin Engine medium lift
[3] Assume 5% of SO_2 emissions are oxidized to H_2SO_4.

Normal Operations Emission Calculations
Helicopter

Hazardous Air Pollutants

Pollutant	Emission Factor Basis		Emission Factor		Hourly Emissions	Annual Emissions
			Value	Units	(lb/hr)	(tons/yr)
Acetaldehyde	AP-42	[4]	1.40E-04	tons/LTO	2.80E-01	3.64E-02
Acetylene	AP-42	[4]	1.29E-04	tons/LTO	2.58E-01	3.35E-02
Ethylene	AP-42	[4]	5.07E-04	tons/LTO	1.01E+00	1.32E-01
Formaldehyde	AP-42	[4]	4.03E-04	tons/LTO	8.06E-01	1.05E-01
Propylene	AP-42	[4]	1.49E-04	tons/LTO	2.98E-01	3.87E-02
Total VOC HAPs					**2.66**	**0.35**

[4] Per "Documentation for Aircraft Component of the National Emissions Inventory: Inventory Methodology USEPA, Emissions, Monitoring and Analysis Division, Contract No.: EP-D-07-097, April 23, 2010.

Greenhouse Gases

Pollutant	Emission Factor Basis		Emission Factor		Hourly Emissions	Annual Emissions
			Value	Units	(lb/hr)	(tons/yr)
CO_2	EPA	[5]	414.5	lb/LTO	414.5	53.89
CH_4	EPA	[5]	3.00E-02	lb/LTO	3.00E-02	3.90E-03
N_2O	EPA	[5]	3.00E-02	lb/LTO	3.00E-02	3.90E-03
CO_2e	EPA	[6]	--	--	**424.2**	**55.15**

[5] Table 6-12 Year 2011 Gulfwide Emission Inventory Study (BOEM 2014-666) Twin Engine medium lift

[6] CH_4, CO_2 and N_2O are included in the emissions of CO_2 equivalent (CO_2e), weighted according to their global warming potential (GWP). The GWP was obtained from table A-1 to Subpart A of Part 98. This is consistent with TCEQ 2015 guidance: https://www.tceq.texas.gov/assets/public/permitting/air/factsheets/factsheets-psdghg-6291.pdf

Normal Operations Emission Calculations
VLCC - Main Engines

Engine Rating [1]	=	25,438	kW
	=	34,113	HP
Total Operating Time [1]	=	8,760	hrs/yr
Operating load [1]	=	5%	
Total number Main Engines [1]	=	2	
Fuel Type [1]	=	Diesel	
Average Brake-Specific Fuel Consumption [2]	=	7,000	Btu/HP-hr
Average Higher Heating Value (HHV) [2]	=	19,300	Btu/lb

Criteria Pollutants

Pollutant	Emission Factor Basis		Emission Factor		Hourly Emissions from 1 Engine	Annual Emissions from 1 Engine	Hourly Emissions from All Engines	Annual Emissions from All Engines
			Value	Units	(lb/hr)	(tons/yr)	(lb/hr)	(tons/yr)
$PM_{Filterable}$	AP-42	[3]	4.34E-04	lb/HP-hr	0.74	3.24	1.48	6.48
$PM_{10, Filterable}$	AP-42	[3]	3.47E-04	lb/HP-hr	0.59	2.59	1.18	5.19
$PM_{2.5, Filterable}$	AP-42	[3]	3.35E-04	lb/HP-hr	0.57	2.50	1.14	5.01
$PM_{Condensable}$	AP-42	[3]	5.39E-05	lb/HP-hr	0.09	0.40	0.18	0.81
NO_x	AP-42	[2]	2.40E-02	lb/HP-hr	40.94	179.30	81.87	358.6
SO_2	Fuel S Content	[4]	7.11E-04	lb/HP-hr	1.21	5.31	2.43	10.62
CO	AP-42	[2]	5.50E-03	lb/HP-hr	9.38	41.09	18.76	82.18
VOC	AP-42	[2], [5]	6.42E-04	lb/HP-hr	1.09	4.79	2.19	9.59
H_2SO_4	Fuel S Content	[4]	2.22E-05	lb/HP-hr	3.79E-02	0.17	0.08	0.33

[1] Based on current project design specifications, provided by BMOP.

[2] Emission factors are based on AP-42 Chapter 3, Table 3.4-1, Emission Factors for Large Stationary Diesel and all Stationary Dual-fuel Engines (October 1996).

[3] PM_{10} and $PM_{2.5}$ emission factors based on AP-42 Chapter 3, Table 3.4-2, Particulate and Particle-sizing Emission Factors for Large Uncontrolled Stationary Diesel Engines (October 1996). An average brake-specific fuel consumption (BSFC) of 7,000 Btu/hp-hr was used to convert from lb/MMBtu to lb/hp-hr. PM < 3um taken as $PM_{2.5}$. Total particulate emissions is the sum of filterable and condensable particulate emissions.

[4] Sulfur content of 0.1 % is used for all diesel combustion sources per IMO 2015 standards. Therefore, emissions have been calculated based on a maximum sulfur content of 1000 ppm in diesel fuel assuming that 98 percent of sulfur in the fuel is oxidized to SO2 (MW=32 g/mol) and 2 percent of sulfur in the fuel is oxidized to H2SO4 (MW=98 g/mol) based on Draft Regulatory Impact Analysis: Control of Emissions from Nonroad Diesel Engines, EPA420-R-03-008, April 2003.

[5] Per footnote f of AP-42 Chapter 3, Table 3.4-1, non methane VOC emission factor has calculated as 91% of TOC emission factor.

Normal Operations Emission Calculations
VLCC - Main Engines

Hazardous Air Pollutants

Pollutant	Emission Factor Basis		Emission Factor Value	Emission Factor Units	Hourly Emissions from 1 Engine (lb/hr)	Annual Emissions from 1 Engine (tons/yr)	Hourly Emissions from All Engines (lb/hr)	Annual Emissions from All Engines (tons/yr)
Acetaldehyde	AP-42	[6], [7]	2.52E-05	lb/MMBtu	3.01E-04	1.32E-03	6.02E-04	2.64E-03
Acrolein	AP-42	[6], [7]	7.88E-06	lb/MMBtu	9.41E-05	4.12E-04	1.88E-04	8.24E-04
Benzene	AP-42	[6], [7]	7.76E-04	lb/MMBtu	9.27E-03	4.06E-02	1.85E-02	8.12E-02
Formaldehyde	AP-42	[6], [7]	7.89E-05	lb/MMBtu	9.42E-04	4.13E-03	1.88E-03	8.25E-03
Toluene	AP-42	[6], [7]	2.81E-04	lb/MMBtu	3.36E-03	1.47E-02	6.71E-03	2.94E-02
Xylenes	AP-42	[6], [7]	1.93E-04	lb/MMBtu	2.30E-03	1.01E-02	4.61E-03	2.02E-02
Total PAH	AP-42	[6], [7]	2.12E-04	lb/MMBtu	2.53E-03	1.11E-02	5.06E-03	2.22E-02
Total VOC HAPs					**1.88E-02**	**8.23E-02**	**3.76E-02**	**0.16**

[6] Emission factors based on AP-42, Chapter 3, Table 3.4-3, Speciated Organic Compound Emission Factors for Large Uncontrolled Stationary Diesel Engines (October 1996).
[7] An average BSFC of 7,000 Btu/hp-hr was used to convert from lb/MMBtu to lb/hp-hr to calculate emissions.

Greenhouse Gases

Pollutant	Emission Factor Basis		Emission Factor Value	Emission Factor Units	Hourly Emissions from 1 Engine (lb/hr)	Annual Emissions from 1 Engine (tons/yr)	Hourly Emissions from All Engines (lb/hr)	Annual Emissions from All Engines (tons/yr)
CO_2	EPA	[8], [11]	73.96	kg/MMBtu	1,947	8,527	3,894	17,054
CH_4	EPA	[9], [11]	3.00E-03	kg/MMBtu	7.90E-02	3.46E-01	1.58E-01	0.69
N_2O	EPA	[9], [11]	6.00E-04	kg/MMBtu	1.58E-02	6.92E-02	3.16E-02	0.14
CO_2e	EPA	[10]	--	--	**1,953**	**8,556**	**3,907**	**17,112**

[8] Emission factor based on 40 CFR 98 Subpart C, Table C-1 Default CO_2 Emission Factors and High Heat Values for Various Types of Fuel. The emission factor for Distillate Fuel Oil No. 2 was used to calculate emissions.
[9] Emission factors based on 40 CFR 98 Subpart C, Table C-2 Default CH_4 and N_2O Emission Factors for Various Types of Fuel. The emission factor for petroleum (All types in table C-1) was used to calculate emissions.
[10] CH_4, CO_2 and N_2O are included in the emissions of CO_2 equivalent (CO_2e), weighted according to their global warming potential (GWP). The GWP was obtained from table A-1 to Subpart A of Part 98. This is consistent with TCEQ 2015 guidance: https://www.tceq.texas.gov/assets/public/permitting/air/factsheets/factsheets-psdghg-6291.pdf
[11] An average BSFC of 7,000 Btu/hp-hr was used to convert from lb/MMBtu to lb/hp-hr to calculate emissions.

Normal Operations Emission Calculations

VLCC - Diesel Generator

Engine Rating [1]	=	1,189	kW
	=	1,595	HP
Total Operating Time [1]	=	8,760	hrs/yr
Operating load [1]	=	60%	
Total number Main Engines [1]	=	2	
Fuel Type [1]	=	Diesel	
Average Brake-Specific Fuel Consumption [2]	=	7,000	Btu/HP-hr
Average Higher Heating Value (HHV) [2]	=	19,300	Btu/lb

Criteria Pollutants

Pollutant	Emission Factor Basis		Emission Factor		Hourly Emissions from 1 Engine	Annual Emissions from 1 Engine	Hourly Emissions from All Engines	Annual Emissions from All Engines
			Value	Units	(lb/hr)	(tons/yr)	(lb/hr)	(tons/yr)
$PM_{Filterable}$	AP-42	[3]	4.34E-04	lb/HP-hr	0.42	1.82	0.83	3.64
$PM_{10, Filterable}$	AP-42	[3]	3.47E-04	lb/HP-hr	0.33	1.46	0.66	2.91
$PM_{2.5, Filterable}$	AP-42	[3]	3.35E-04	lb/HP-hr	0.32	1.41	0.64	2.81
$PM_{Condensable}$	AP-42	[3]	5.39E-05	lb/HP-hr	0.05	0.23	0.10	0.45
NO_x	AP-42	[2]	2.40E-02	lb/HP-hr	22.97	100.6	45.94	201.2
SO_2	Fuel S Content	[4]	7.11E-04	lb/HP-hr	0.68	2.98	1.36	5.96
CO	AP-42	[2]	5.50E-03	lb/HP-hr	5.26	23.05	10.53	46.11
VOC	AP-42	[2], [5]	6.42E-04	lb/HP-hr	0.61	2.69	1.23	5.38
H_2SO_4	Fuel S Content	[4]	2.22E-05	lb/HP-hr	2.13E-02	0.09	0.04	0.19

[1] Based on current project design specifications, provided by BMOP.

[2] Emission factors are based on AP-42 Chapter 3, Table 3.4-1, Emission Factors for Large Stationary Diesel and all Stationary Dual-fuel Engines (October 1996).

[3] PM_{10} and $PM_{2.5}$ emission factors based on AP-42 Chapter 3, Table 3.4-2, Particulate and Particle-sizing Emission Factors for Large Uncontrolled Stationary Diesel Engines (October 1996). An average brake-specific fuel consumption (BSFC) of 7,000 Btu/hp-hr was used to convert from lb/MMBtu to lb/hp-hr. PM < 3um taken as $PM_{2.5}$. Total particulate emissions is the sum of filterable and condensable particulate emissions.

[4] Sulfur content of 0.1 % is used for all diesel combustion sources per IMO 2015 standards. Therefore, emissions have been calculated based on a maximum sulfur content of 1000 ppm in diesel fuel assuming that 98 percent of sulfur in the fuel is oxidized to SO2 (MW=32 g/mol) and 2 percent of sulfur in the fuel is oxidized to H2SO4 (MW=98 g/mol) based on Draft Regulatory Impact Analysis: Control of Emissions from Nonroad Diesel Engines, EPA420-R-03-008, April 2003.

[5] Per footnote f of AP-42 Chapter 3, Table 3.4-1, non methane VOC emission factor has been taken as 91% of TOC emission factor.

Normal Operations Emission Calculations
VLCC - Diesel Generator

Hazardous Air Pollutants

Pollutant	Emission Factor Basis		Emission Factor Value	Emission Factor Units	Hourly Emissions from 1 Engine (lb/hr)	Annual Emissions from 1 Engine (tons/yr)	Hourly Emissions from All Engines (lb/hr)	Annual Emissions from All Engines (tons/yr)
Acetaldehyde	AP-42	[6], [7]	2.52E-05	lb/MMBtu	1.69E-04	7.39E-04	3.38E-04	1.48E-03
Acrolein	AP-42	[6], [7]	7.88E-06	lb/MMBtu	5.28E-05	2.31E-04	1.06E-04	4.62E-04
Benzene	AP-42	[6], [7]	7.76E-04	lb/MMBtu	5.20E-03	2.28E-02	1.04E-02	4.55E-02
Formaldehyde	AP-42	[6], [7]	7.89E-05	lb/MMBtu	5.29E-04	2.32E-03	1.06E-03	4.63E-03
Toluene	AP-42	[6], [7]	2.81E-04	lb/MMBtu	1.88E-03	8.24E-03	3.76E-03	1.65E-02
Xylenes	AP-42	[6], [7]	1.93E-04	lb/MMBtu	1.29E-03	5.66E-03	2.59E-03	1.13E-02
Total PAH	AP-42	[6], [7]	2.12E-04	lb/MMBtu	1.42E-03	6.22E-03	2.84E-03	1.24E-02
Total VOC HAPs					**1.05E-02**	**4.62E-02**	**2.11E-02**	**9.24E-02**

[6] Emission factors based on AP-42, Chapter 3, Table 3.4-3, Speciated Organic Compound Emission Factors for Large Uncontrolled Stationary Diesel Engines (October 1996).
[7] An average BSFC of 7,000 Btu/hp-hr was used to convert from lb/MMBtu to lb/hp-hr to calculate emissions.

Greenhouse Gases

Pollutant	Emission Factor Basis		Emission Factor Value	Emission Factor Units	Hourly Emissions from 1 Engine (lb/hr)	Annual Emissions from 1 Engine (tons/yr)	Hourly Emissions from All Engines (lb/hr)	Annual Emissions from All Engines (tons/yr)
CO_2	EPA	[8], [11]	73.96	kg/MMBtu	1,092	4,784	2,185	9,569
CH_4	EPA	[9], [11]	3.00E-03	kg/MMBtu	4.43E-02	1.94E-01	8.86E-02	0.39
N_2O	EPA	[9], [11]	6.00E-04	kg/MMBtu	8.86E-03	3.88E-02	1.77E-02	0.08
CO_2e	EPA	[10]	--	--	**1,096**	**4,801**	**2,192**	**9,601**

[8] Emission factor based on 40 CFR 98 Subpart C, Table C-1 Default CO_2 Emission Factors and High Heat Values for Various Types of Fuel. The emission factor for Distillate Fuel Oil No. 2 was used to calculate emissions.
[9] Emission factors based on 40 CFR 98 Subpart C, Table C-2 Default CH_4 and N_2O Emission Factors for Various Types of Fuel. The emission factor for petroleum (All types in table C-1) was used to calculate emissions.
[10] CH_4, CO_2 and N_2O are included in the emissions of CO_2 equivalent (CO_2e), weighted according to their global warming potential (GWP). The GWP was obtained from table A-1 to Subpart A of Part 98. This is consistent with TCEQ 2015 guidance: https://www.tceq.texas.gov/assets/public/permitting/air/factsheets/factsheets-psdghg-6291.pdf
[11] An average BSFC of 7,000 Btu/hp-hr was used to convert from lb/MMBtu to lb/hp-hr to calculate emissions.

This page left blank intentionally.

APPENDIX G-2

NATIONAL ENVIRONMENTAL POLICY ACT AIR DISPERSION MODELING REPORT

This page left blank intentionally.

DEEPWATER PORT – AIR DISPERSION MODELING REPORT
NEPA Air Quality Analysis

BLUE MARLIN OFFSHORE PORT LLC

Prepared By:

TRINITY CONSULTANTS
1 Galleria Blvd
Suite 1030
Metairie, LA 70001
(504) 828 - 5845

September 2020

Project 191001.0117

Trinity Consultants

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1. INTRODUCTION

Blue Marlin Offshore Port LLC (BMOP; the Applicant) is proposing to develop the Blue Marlin Offshore Port Project (Project) in the Gulf of Mexico (GOM). BMOP is filing this application for a license to construct, own, and operate the Deepwater Port (DWP) pursuant to the Deepwater Port Act (DWPA) of 1974, as amended, and in accordance with U.S. Coast Guard (USCG) and U.S. Maritime Administration (MARAD) implementing regulations. The DWP will be utilized to load crude oil onto very large crude carriers (VLCCs) (and other crude oil carriers) for export to the global market.

Consistent with previous U.S. Environmental Protection Agency (EPA) guidance for similar DWP license (DWPL) applications, BMOP has performed air quality dispersion modeling in support of National Environmental Policy Act (NEPA) regulations to demonstrate that the offshore portion of the Project will not result in a violation of the National Ambient Air Quality Standards (NAAQS). The following report provides a detailed description of the air quality dispersion modeling methodology, analyses, and approach, and demonstrates that direct, indirect, and cumulative impacts from the offshore portion of the Project do not result in a violation of the NAAQS.

1.1 Project Description

1.1.1 Project Overview

The primary purpose of the Project will be to provide for safe and reliable long-term supply of crude oil for export to the global market. Oil for export will be transported from the Nederland Terminal (NT), an existing terminal and storage facility owned by Sunoco Partners Marketing and Terminals, L.P., located in Jefferson County, Texas. This terminal has direct access to multiple crude oil pipelines connecting to production from across the U.S. and North America. In addition, the Applicant owns the Stingray Pipeline System and has confirmed that its subsea pipeline and offshore platforms are suitable for converting to facilitate crude oil export from a DWP in the northern GOM.

The DWP will be located in federal waters within and adjacent to the Outer Continental Shelf (OCS) in West Cameron Lease Blocks (WC) 509, WC 508, and East Cameron (EC) Block 263. The DWP will be approximately eighty-two (82) statute miles from the nearest point on land in Cameron Parish, Louisiana, with an approximate water depth of 162 feet. Crude oil will be routed from pumps at Nederland, through a new 42-inch outer diameter (OD) onshore pipeline to the existing Stingray Mainline at Station 501 to the DWP. The crude oil will be metered on the existing WC 509B Platform and routed through two Crude Oil Loading Lines to Pipeline End Manifolds (PLEMs) located on the seafloor below two Catenary Anchor Leg Mooring (CALM) Buoys located in WC 508 and in East Cameron Block 263 (EC 263). From each PLEM, the crude oil will be routed to its respective floating CALM Buoy through submerged flexible hoses. VLCCs (or other large seafaring crude oil vessels) will moor at a CALM Buoy, retrieve and connect the floating crude oil hoses connected to the CALM Buoy and the crude oil will then route from the Buoy to the VLCC for loading. Up to 365 large seafaring crude oil vessels will load per year. The BMOP facilities consist of the pumps and meters at NT; a new 37-mile, 42-inch OD pipeline; the existing 36-inch OD Mainline; an existing fixed, manned platform complex at WC 509; an existing platform at WC 148; and two new PLEM and CALM Buoys located in WC 508 and EC 263. A process flow diagram is provided in Figure 2 of Appendix A (Volume I) and reproduced for quick reference as Figure 1-1 of this document, below. Schematics of the proposed DWP are provided in Figure 3 of Appendix A (Volume I) and reproduced for quick reference as Figure 1-2 of this document, below. The crude oils that would be exported range from light to heavy grade crudes and will be sent from the existing the NT facility.

Figure 1-1. BMOP Project Process Flow Diagram

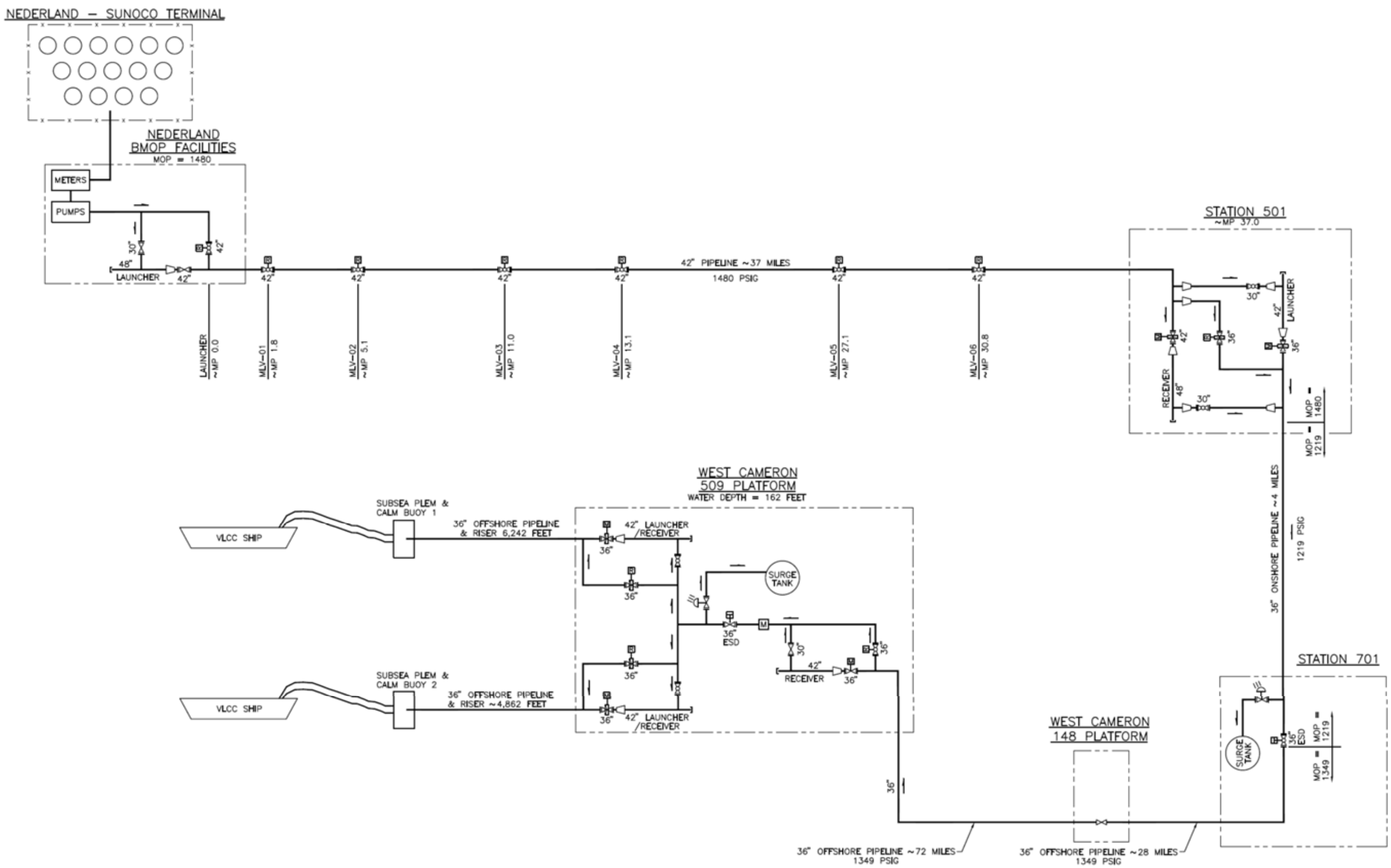
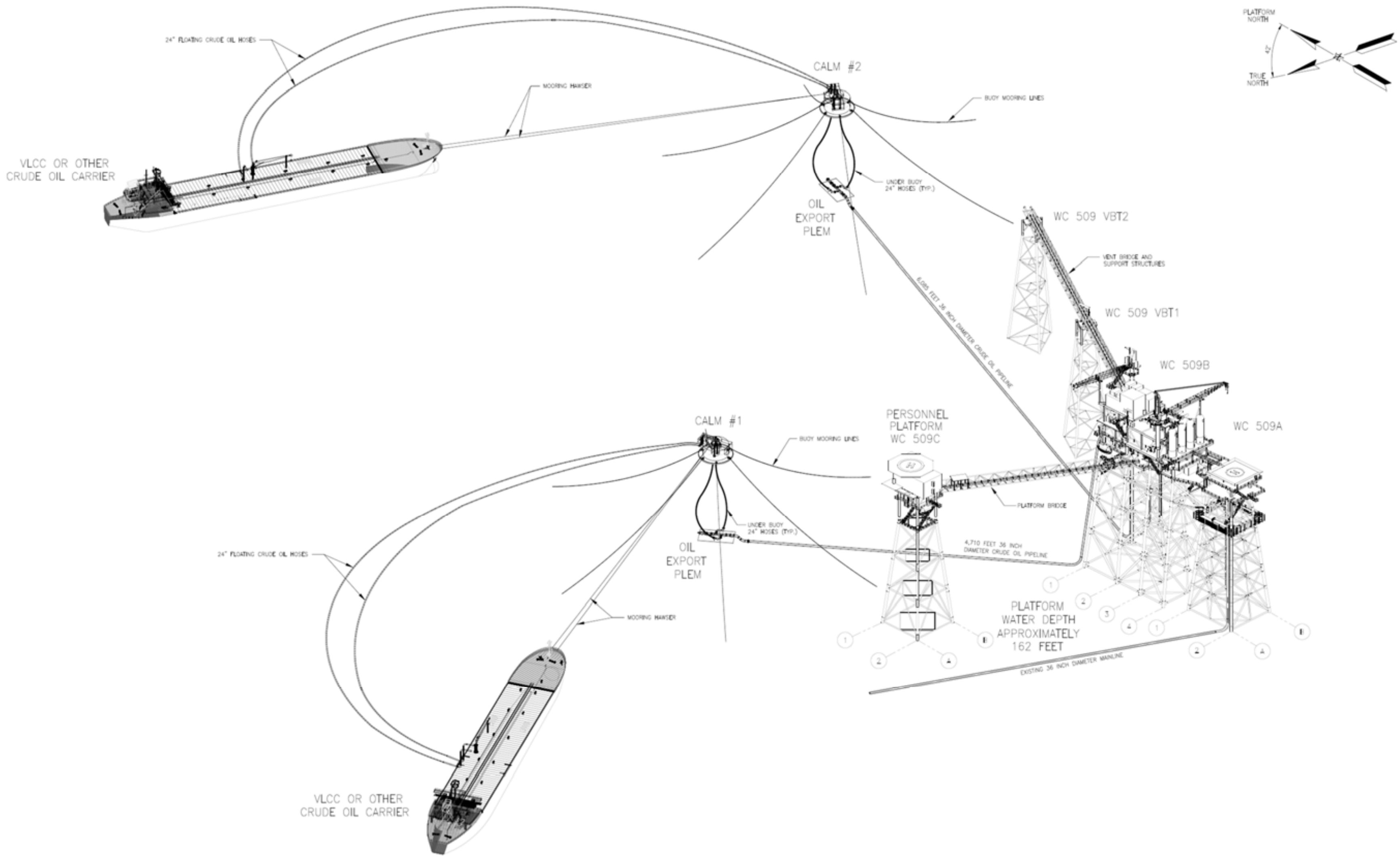


Figure 1-2. Schematic of the DWP with VLCCs



1.1.1 Major Onshore Project Components

The onshore portions of the Project are included for information purposes. This air dispersion modeling report is specific to the offshore portions of the Project, only.

The Project will consist of the construction and operation of the following onshore facilities:

- Converted Existing Facilities
  - The existing Station 501 is located at approximate MP 37 of the new 42-inch pipeline in Cameron Parish, Louisiana. All existing natural gas-related equipment will be removed from the Station and new crude oil pipeline facilities will be installed. The new 42-inch pipeline will tie into the existing 36-inch Mainline at the site.
  - The existing compressor Station 701 in Cameron Parish, Louisiana, will be demolished. All existing natural gas equipment will be removed from the Station except for two (2) 10,000-barrel storage tanks to be used as surge vessels. The new facility will maintain office space, a natural gas interconnect, and surge tanks. Approximately 1,500 feet of new pipe, surge tanks, surge valves, and a new mainline valve (MLV) will be installed.
  - The existing Mainline from Station 501 to the WC 509 Platform Complex.
- New Facilities
  - A new, approximate 37.02-mile, 42-inch pipeline connecting the existing NT in Jefferson County, Texas, to the existing 36-inch Mainline at Station 501 in Cameron Parish, Louisiana.
  - A new pump station (BMOP Pump Station) located in Jefferson County, Texas, within the existing NT in Jefferson County, Texas at MP 0.0.
  - Six new MLVs will be installed within the permanent pipeline right-of-way along the new build pipeline.

The NEPA air quality analysis does not include operations associated with the aforementioned onshore facilities. See Volume IIb for more details regarding the onshore components of the Project.

1.1.2 Major Offshore Project Components

The Project will include the construction and operation of the following offshore facilities:

- Converted Existing Facilities
  - The WC 148 Platform will be converted to crude oil service and a new MLV installed.
  - The existing WC 509 Platform Complex will be converted from a gas transmission facility to a dual-purpose gas transmission and crude oil export facility. The existing equipment that will remain at the Converted Complex will include:
    - Existing natural gas piping and risers on 509A platform;
    - Natural gas blowdown Vent Boom on 509VBT platform;
    - Natural gas liquid separation facilities on 509B platform;
    - Heliport on 509A platform; and
    - Helicopter fuel tank on 509A platform.
- New Facilities
  - Two new CALM Buoys installed, one in WC 508 (CALM Buoy No. 1) positioned approximately 4,710 feet from the WC 509 Platform complex, and the other in EC 263 (CALM Buoy No. 2) positioned approximately 6,085 feet from the WC 509 Platform complex. The CALM Buoys will be anchored to the seafloor via an engineered mooring system capable of accommodating mooring forces exerted by a VLCC or other large seafaring vessels during loading operations. Two 20- or 24-inch diameter

floating hoses will be connected to each CALM Buoy. They will be approximately 1,500 feet long and used for loading operations.
- Two new PLEMs installed and anchored on the seafloor. Two 24-inch undersea flexible hoses will be connected to each PLEM and associated CALM Buoy.
- Two Crude Oil Loading Pipelines, approximately 4,710 feet long to PLEM / CALM buoy No. 1 and 6,085 feet long to PLEM / CALM buoy No. 2, installed from the WC 509 Platform complex to the PLEM and CALM locations, one for each PLEM and CALM Buoy. The pipelines will be installed with the top of pipe at least three feet below the natural seafloor.
- Two new 36-inch risers connected to the Crude Oil Loading Pipelines on 509B Platform;
- New control room on 509B platform;
- Three new pig barrels for crude oil, one on WC 509A platform and two on WC 509B platform;
- Meter station for crude oil on WC5 509B platform;
- Living quarters on WC 509C platform;
- Heliport on WC 509C platform;
- Surge tank and valves on WC 509B platform; and
- New ancillary equipment (e.g., power generators, instrument/utility air systems, fuel tanks, ac units, freshwater makers, firewater system, seawater and freshwater system, sewage treatment unit, fuel gas system, diesel system, closed drain system, open drain system, hydraulic power unit, hypochlorite system, cranes, communications tower and system, radar) to support operation of the offshore facilities.

The WC 148 platform is located greater than 50 kilometers (km) away from the WC 509 complex and will have insignificant emissions. As such, the WC 148 platform will not have a cumulative impact with WC 509 sources. For this reason, the WC 148 platform has not been included in this air quality analysis report.

The WC 509 Platform Complex will be used to support the loading of VLCCs moored to either of the new CALM buoys (CALM Buoy No.1 and 2). Floating hoses will extend from the CALM buoys to the moored VLCC to allow for the loading of crude oil. As defined in the 1974 DWPA, and revised in 2012, the DWP is "*any fixed or floating manmade structure other than a vessel, or any group of such structures, that are located beyond State seaward boundaries and that are used or intended for use as a port or terminal for the transportation, storage, or further handling of oil or natural gas for transportation to or from any State…*"

Based on the definition above, BMOP considers the following operations as part of the DWP project:

- ► Marine loading of crude oil; and
- ► Stationary sources of emissions located on WC 509 Platform Complex, including:
  - Stationary combustion ignition (CI) and spark ignition (SI) internal combustion engines;
  - Fugitive piping losses; and
  - Diesel fuel tanks, crude oil surge vessel, and storage tanks for other materials (e.g., aviation fuel).

Based on the same definition above, BMOP does not consider any mobile support vessel or VLCC vessels, moored to the DWP CALM buoys for the loading of crude oil, a primary/direct source of emissions from the Project. Therefore, BMOP considers the following sources "indirect" sources of emissions from the Project:

- ► Tugboats with the following equipment:
  - Main engines;
  - Generator sets;
  - Winch engines.
- ► Support vessels with the following equipment:

    - Main engines;
    - Generator sets;
    - Winch engines.
- ► Supply Vessels with the following equipment:
    - Main engines;
    - Generator engines.
- ► Dive Support Vessels with the following equipment:
    - Main engines;
    - Generators;
    - Air compressors;
    - Dive compressors;
    - Cranes.
- ► Helicopters; and
- ► Crude oil carriers with the following equipment:
    - Main engines;
    - Diesel generators.

A detailed list of emissions sources addressed in the modeling analysis is provided in Section 3 of this report.

1.2 Report Contents

The rest of the report is organized as follows:

- ► Section 2 details the air quality dispersion modeling methodology;
- ► Section 3 details the NEPA modeling analyses;
- ► Section 4 provides the air quality analysis results;
- ► Appendix A includes the regional inventory sources; and
- ► Appendix B includes a summary of the electronic modeling files.

2. AIR QUALITY DISPERSION MODELING METHODOLOGY

BMOP has performed air quality dispersion modeling in support of the NEPA analysis to demonstrate that the proposed operations associated with the Project will not result in a violation of the NAAQS. As part of NEPA guidance, BMOP has performed this air quality analysis to account for direct, indirect, and cumulative impacts from the Project to satisfy the requirements of the June 2011 *Memorandum of Understanding regarding Air Quality Analyses and Mitigation for Federal Oil and Gas Decisions through the NEPA Process.*[1] In order to address the applicable NEPA requirements, BMOP has modeled the following criteria pollutants for which a NAAQS standard applies:

- Particulate Matter with a nominal aerodynamic diameter of 10 microns or less (PM_{10});
- Particulate Matter with a nominal aerodynamic diameter of 2.5 microns or less ($PM_{2.5}$);
- Nitrogen dioxide (NO_2);
- Sulfur dioxide (SO_2); and
- Carbon monoxide (CO).

The following section describes the details of NEPA air quality dispersion modeling methodology utilized for the Project.

2.1 Guidance Documents

The NEPA dispersion modeling analyses were conducted in consideration of the following guidance documents:

- June 2011 Memorandum of Understanding regarding Air Quality Analyses and Mitigation for Federal Oil and Gas Decisions through the NEPA Process, and
- Guideline on Air Quality Models 40 CFR 51, Appendix W (EPA, Revised, January 17, 2017).

2.2 Significance Analysis

In order to perform a comprehensive NEPA air quality impact analysis, BMOP performed a "Significance" Analysis to determine whether the emissions associated with the Project could cause a significant impact at the nearest shoreline. For a NEPA analysis, "Significance" is analyzed based on modeling Project related emissions sources (direct sources) as well as emissions sources from support vessels (indirect sources) to evaluate the "total impacts" from the Project.

"Significant" impacts are defined by design concentration thresholds commonly referred to as the Significant Impact Level (SIL). BMOP modeled the following pollutants, provided in the table below, for significance.

The highest design concentration out of all given modeling years for each applicable averaging period is then compared to the SIL level, shown in the table below, to determine if the ambient air impact is significant. The table below provides the Class II SIL and Primary NAAQS NEPA air quality standards. These standards are promulgated by the EPA and are typically addressed when demonstrating compliance with NEPA regulatory requirements.

[1] https://www.epa.gov/sites/production/files/2014-08/documents/air-quality-analyses-mou-2011.pdf

Table 2-1. NEPA Air Quality Modeling Thresholds

Pollutant	Averaging Period	Class II SIL (µg/m³)	Primary NAAQS (µg/m³)
PM_{10}	24-hour	5	150(1)
	Annual	1	--
$PM_{2.5}$	24-hour	1.2(2)	35(3)
	Annual	0.2(2)	12(4)
NO_2	1-hour	7.55(4,9)	188(5)
	Annual	1	100(6)
SO_2	1-hour	7.86(5,9)	196(7)
	3-hour	25	--
	24-hour	5	--
	Annual	1	--
CO	1-hour	2,000	40,000(8)
	8-hour	500	10,000(8)

(1) Not to be exceeded more than three times in 3 consecutive years (highest sixth high modeled output).

(2) EPA promulgated $PM_{2.5}$ SILs, Significant Monitoring Concentrations (SMCs), and PSD Increments on October 20, 2010 [75 FR 64864, PSD for Particulate Matter Less Than 2.5 Micrometers Increments, Significant Impact Levels (SILs) and Significant Monitoring Concentration (SMC); Final Rule]. The SILs and SMCs became effective on December 20, 2010 (i.e., 60 days after the rule was published in the Federal Register) but the U.S. Court of Appeals decision on January 22, 2013 vacated the SMC and remanded the SIL values back to EPA for reconsideration. EPA has recently provided guidance (August 2016) and a finalized memo (April 2018) which recommended use of a 24-hr $PM_{2.5}$ SIL of 1.2 µg/m³, and an annual SIL of 0.2 µg/m³. However, the guidance indicated that the permitting authority had the discretion to continue to utilize the previously established annual SIL of 0.3 µg/m³. EPA responded to the vacatur of the SMCs by indicating that existing background monitors should be sufficient to fulfill the ambient monitoring requirements for $PM_{2.5}$.

(3) The 3-year average of the 98th percentile 24-hour average concentration (highest eighth high modeled output).

(4) The 3-year average of the annual arithmetic average concentration (highest first high modeled output).

(5) The 3-year average of the 98th percentile of the daily maximum 1-hr average (highest eighth high modeled output).

(6) Annual arithmetic average (highest first high modeled output).

(7) 3-year average of the 99th percentile of the annual distribution of daily maximum 1-hour concentrations.

(8) Not to be exceeded more than once per calendar year.

(9) PSD Increments, Significant Impact Levels, and Significant Monitoring Concentration levels for the 1-hour SO_2 and NO_2 standards have not yet been proposed. However, interim Significant Impact Levels of 3 ppb (~7.86 µg/m³) for SO_2 and 4 ppb (~7.55 µg/m³) for NO_2 were provided by EPA in general guidance implementation memos dated August 23, 2010 and June 28, 2010, respectively.

A review of ozone impacts from the Project have been separately addressed in the PSD evaluation for the Project, as provided in Appendix C-5 (Volume IIa).

2.3 NEPA Cumulative Analysis

When modeled design concentrations of the significance analysis are less than the applicable SIL, a cumulative impacts analysis is not required, as the conservative SIL modeling confirms the proposed Project will not significantly contribute to cumulative impacts. If modeled impacts are greater than the SIL, a full cumulative impacts analysis, including ambient background and, potentially, regional inventory sources, may be required in order to demonstrate that the project neither causes nor contributes to any NAAQS exceedances at the nearest shoreline.

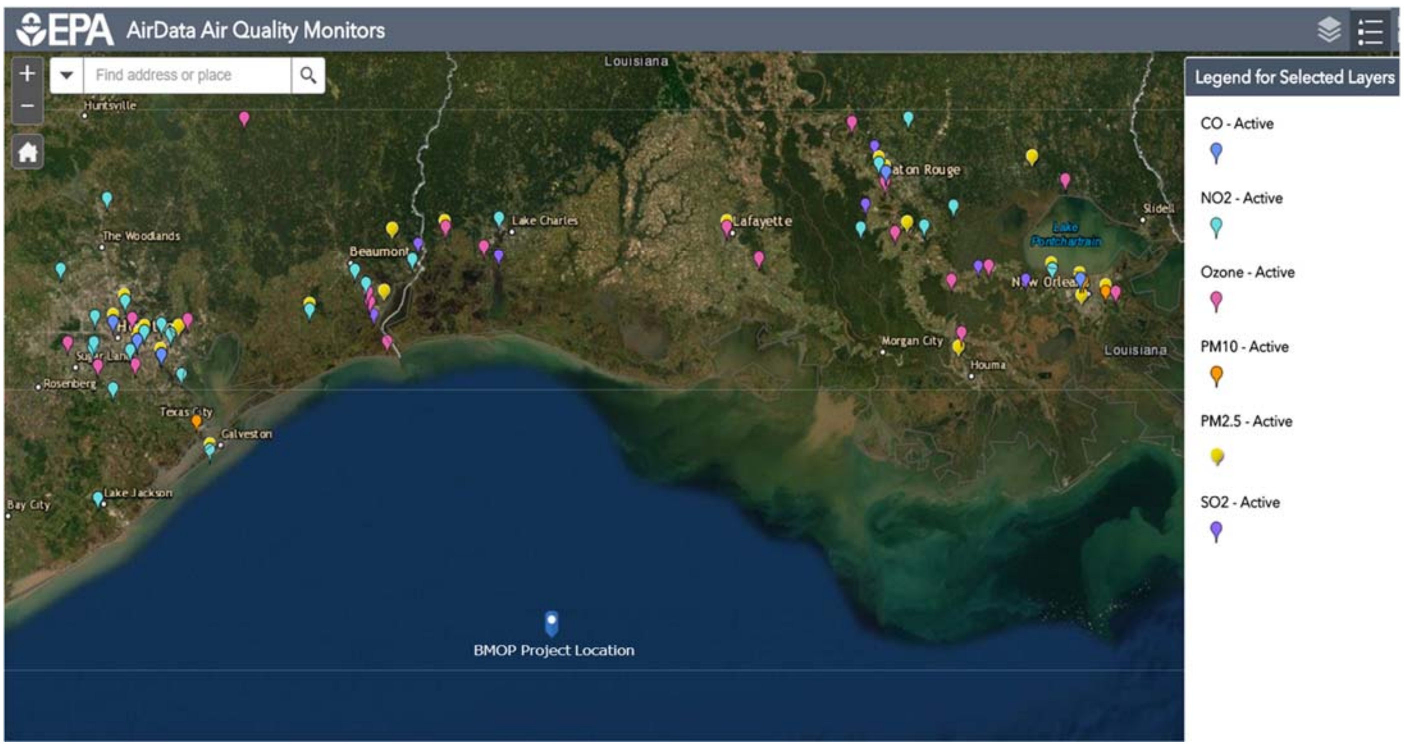
For modeled impacts from the significance analysis that resulted in concentration values greater than the applicable SIL, BMOP modeled direct and indirect sources of the Project, as well as all applicable regional sources surrounding the Project. The modeled concentrations were then added to the appropriate ambient background concentrations to compare to the primary and/or secondary NAAQS standards.

This assessment was performed to demonstrate that the cumulative impacts from the Project will not result in a violation of the NAAQS.

2.3.1 Background Monitor Selection

Representative ambient background concentrations are necessary for a complete Class II NAAQS analysis. For the NEPA air quality dispersion model analysis, the ambient background concentration was added to the modeled concentrations for comparison against the corresponding NAAQS thresholds. BMOP considered nearby onshore background monitors and chose representative monitor data to conservatively allocate ambient pollutant concentrations for the Project.

Figure 2-1. Monitors in the Vicinity of the Project



Due to the absence of offshore ambient concentration monitors, it was critical to evaluate the representativeness of the onshore monitor location that best represented the proposed project location. The "representativeness" of the monitor locations was determined based on several factors; such as distance from the project location, terrain characteristics (e.g. roughness, remote vs industrialized location etc.), as well as the completeness of the available data for required averaging periods. BMOP utilized a design concentration averaged over the latest three-year (2017-2019) period. After thorough evaluation of the available ambient monitors data and their representativeness, BMOP used the following onshore ambient monitors and data for the various pollutants.

Table 2-2. Background Monitor Information

Pollutant	Averaging Period	Rank	Monitor	2017	2018	2019	Ambient Concentration	NAAQS	Units
CO	8-hour	2nd High	A	1	1.7	0.9	1.7 *Highest 2nd High (2018)*	9	ppm
	1-hour	2nd High	A	3.2	2.2	1.4	3.2 *Highest 2nd High (2017)*	35	ppm
NO_2	1-hour	98th Percentile	B	20	18	23	20 *3-year Average of 98th Percentile*	100	ppb
	Annual	Mean	B	4.49	3.78	2.75	4.49 *Highest Annual Mean (2017)*	53	ppb
$PM_{2.5}$	Annual	Mean	C	7.8	7.9	6.8	7.5 *3-year Average of Annual Mean*	12.0	$\mu g/m^3$
	24-Hour	98th Percentile	C	21	25	14	20 *3-year Average of 98th Percentile*	35	$\mu g/m^3$
PM_{10}	24-Hour	2nd High	D	69[a]	108[b]	52[c]	108 *Highest 2nd High (2018)*	150	$\mu g/m^3$
SO_2	1-hour	99th Percentile	E	21	31	26	26 *3-year Average of 99th Percentile*	75	ppb
	3-Hour	2nd High	E	0.03[d]	0.04[d]	0.03[d]	0.04 *Highest 2nd High (2018)*	0.5	ppm
	24-Hour	2nd High	E	0.005	0.008	0.007	0.008 *Highest 2nd High (2018)*	0.14	ppm
	Annual	Mean	E	0.001	0.0005	0.001	0.001 *Highest Annual Mean (2017, 2019)*	0.03	ppm

Notes:
[a] 365 valid days of data of the 365 required days.
[b] 348 valid days of data of the 365 required days.
[c] 331 valid days of data of the 365 required days.
[d] Because 3-hour data is not available, the 2nd highest maximum 1-hour value is utilized.

Monitor Station Key:
A: 22-033-0009: 1061-A Leesville Ave, Baton Rouge, LA, ~285 km from DWP.
B. 22-047-0009: 65180 Belleview Road, Iberville, LA, ~ 256 km from DWP.
C: 22-019-0009: 2284 Paul Bellow Road, Vinton, LA, ~207 km from DWP.
D: 22-055-0007: 700 Cajundome, Lafayette, LA, ~219 km from DWP.
E: 22-019-0011: 8220 Big Lake Rd, Lake Charles, LA, ~186 km from DWP.

To address representativeness, BMOP has considered the lack of offshore monitored data and has chosen onshore ambient air quality monitors that are some of the closest monitors to the proposed BMOP locations. Due to the distant offshore location of the BMOP Project, the selection of the background monitors considered both the remoteness of the monitor and the surrounding industrial density of the monitor compared to the Project location.

For example, selecting the ambient air quality monitor for NO_2, BOU PLAQUEMINE (#220470009) was preferred over Westlake (#220190008) due to its representativeness of the proposed project location.

Westlake is closer to the project location (~204 km from the Project location) than the BOU PLAQUEMINE monitor (~256 km from the Project location). As shown in the images below, BOU PLAQUEMINE is located in a more remote location, which is similar to the offshore Project location, while Westlake is located in a more industrialized area with higher background NO_2 concentrations. Hence, BOU PLAQUEMINE is determined as a more representative monitor for the Project.

Figure 2-2. Comparison of NO_2 Monitor Locations

2.3.2 Regional Inventory Sources

If modeled impacts resulted in concentration values greater than the SIL, BMOP performed a cumulative impacts analysis. BMOP reviewed regional inventory sources within a fifty (50) km radius from the Project location, in accordance with guidance from LDEQ.[2]

For demonstrating compliance with the NAAQS standards, emissions from nearby off-site sources (also known as the regional inventory) were incorporated in the dispersion modeling analysis along with the direct and indirect Project sources. The regional inventory sources within a 50 km radius circle surrounding the Project location were obtained from the Bureau of Ocean Energy Management's (BOEM's) latest published emission inventory data: the 2017 Gulfwide Emission Inventory. BOEM collects the operational activity data on a tri-annual basis under Gulfwide Offshore Activity Data System (GOADS) program from both platform and non-platform sources in the GOM. BOEM publishes the emissions generated from these sources for the reporting year, therefore, the GOADS data collected for the Project is based on emissions for the 2017 reporting year[3]. To develop the regional inventory to be used in the cumulative impacts analyses, only platform emission sources will be included, as non-platform sources are considered mobile (non-stationary) sources such as helicopters, support vessels, etc.

For the cumulative impacts analysis, BMOP conservatively utilized all sources within the 50 km area. No further refinement of the inventory is necessary for the analysis, as demonstrated by the modeled impacts.

Appendix A of this report includes the list of regional inventory sources used in the cumulative impacts analysis as well as a figure of the model source layout.

---

[2] Based on conversations between LDEQ and Trinity Consultants in August 2019.

[3] BOEM is working to finalize current inventory data. If available, BMOP will utilize newer data in lieu of the 2017 inventory.

3. NEPA MODELING ANALYSES

This section of the modeling report describes the modeling procedures and data resources utilized in the setup of the NEPA air quality modeling analyses. The techniques used for the air quality analysis are consistent with current EPA guidance.

3.1 Dispersion Model Selection

The American Meteorological Society/Environmental Protection Agency Regulatory Model (AERMOD) is a refined, steady-state, multiple source, Gaussian dispersion model and was promulgated in December 2005 as a preferred model for use by industrial sources for NSR and PSD air quality analysis.[4] Due to the steady-state assumption of AERMOD, gaussian plume models are generally applicable to distances less than 50 km.

The AERMOD, Version 19191 modeling system is composed of three modular components: AERMAP, the terrain preprocessor; AERMET, the meteorological preprocessor; and AERMOD, the dispersion and post-processing module. AERMAP is the terrain pre-processor that is used to import terrain elevations for selected model objects and to generate the receptor hill height scale data that are used by AERMOD to drive advanced terrain processing algorithms. AERMET generates a separate surface file and vertical profile file to pass meteorological observations and turbulence parameters to AERMOD.

For the purpose of modeling offshore air dispersion, AERCOARE, the overwater meteorological data processor, was used as an alternative to the AERMET data processor. As required by Section 3.2.2 of 40 CFR 51, Appendix W, a request for approval for the use of an alternative model was submitted to EPA, providing justification that the use of AERCOARE Processor to generate overwater meteorological data to use with AERMOD (referred to as AERMOD/AERCOARE model) is more appropriate and applicable for this Project over EPA's preferred air quality model.[5] Accordingly, BMOP used AERMOD/AERCOARE model for the NEPA modeling analysis. As AERMOD's accuracy is limited to 50 km, BMOP evaluated impacts from the NEPA model at a 50 km radius to estimate onshore impacts.

3.2 Meteorological Data

Overwater hourly meteorological data obtained from the National Oceanic and Atmospheric Administration (NOAA) - National Data Buoy Center for 2012 through 2017 were used for the air dispersion modeling analyses. AERCOARE requires measurements of wind speed, wind direction, air and sea temperature, atmospheric pressure, wave height, and wave period. This data was obtained from the NOAA website[6]. The required relative humidity values were calculated from measurements of dew point temperature and dry bulb temperature. Buoy 42035 was identified as the closest buoy with sufficient and current meteorological measurements. Other nearby buoys either did not monitor all the required meteorological parameters, did not have historical measurements, or the data records did not meet the 90% by quarter completeness criterion of the USEPA's Meteorological Monitoring Guidance.[7]

---

[4] 40 CFR Part 51, Appendix W, Guideline on Air Quality Models, Appendix A.1 AMS/EPA Regulatory Model (AERMOD).

[5] The alternative modeling request was submitted under separate cover to EPA.

[6] https://www.ndbc.noaa.gov/station_page.php?station=42035

[7] U.S. Environmental Protection Agency (USEPA). 2000, Meteorological Monitoring Guidance for Regulatory Modeling Applications, EPA-454/R-99-0005. February 2000.

Figure 3-1. Locations of Buoy 42035 and BMOP Project

Buoy 42035 is located 22 nautical miles (25.3 statute miles, or 40.7 km) east of Galveston, Texas, and approximately 88.2 nautical miles (101.5 statute miles, or 163.4 kilometers) northwest of the BMOP project location. Prior to substitution, the data from this buoy met the 90% by quarter completeness criterion for all required meteorological parameters except for relative humidity data. The relative humidity data is not provided by Buoy 42035 which is required by AERCOARE. Thus, the relative humidity data from the nearest National Weather Association (NWA) station, Scholes International Airport (KGLS) was substituted. The buoy 42035 data completeness evaluation results are shown in table below. As provided in the table below, calendar year 2014 did not meet the minimum data requirements required for the modeling analysis, and therefore it was excluded from air dispersion modeling.

Table 3-1. Buoy 42035 Data Completeness Evaluation Results

Year	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
	Wind Direction				Pressure			
2012	99.9%	99.9%	100.0%	99.8%	100.0%	100.0%	100.0%	100.0%
2013	99.6%	99.9%	99.8%	99.9%	100.0%	100.0%	100.0%	100.0%
2014 [1]	99.9%	45.2%	45.5%	100.0%	100.0%	100.0%	100.0%	100.0%
2015	100.0%	99.4%	100.0%	99.8%	100.0%	100.0%	100.0%	100.0%
2016	99.9%	99.0%	99.4%	99.4%	100.0%	100.0%	100.0%	100.0%
2017	99.8%	98.4%	98.9%	99.3%	100.0%	100.0%	100.0%	100.0%
Year	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
	Wind Speed				Air Temperature			
2012	99.9%	99.9%	100.0%	99.8%	99.9%	99.9%	100.0%	99.8%
2013	99.6%	99.9%	99.8%	99.9%	99.6%	99.9%	99.8%	99.9%
2014 [1]	99.9%	45.1%	45.1%	100.0%	99.9%	45.0%	44.5%	100.0%
2015	100.0%	99.4%	100.0%	99.8%	100.0%	99.4%	100.0%	99.8%
2016	99.9%	99.0%	99.4%	99.4%	99.9%	99.0%	99.4%	99.4%

Year	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
	Wind Speed				Air Temperature			
2017	99.8%	98.4%	98.9%	99.3%	99.8%	98.4%	98.9%	99.3%
	Relative Humidity							
2012	100.0%	100.0%	99.8%	99.5%				
2013	100.0%	99.9%	96.7%	99.9%				
2014 [1]	98.7%	100.0%	100.0%	99.7%				
2015	99.4%	99.9%	97.8%	99.6%				
2016	99.6%	99.8%	99.7%	99.5%				
2017	99.9%	99.1%	99.8%	99.9%				

[1]The 2014 meteorological data was excluded because it did not meet the 90% completeness criterion.

Additionally, the figures below represent the 5-year average (for 2012, 2013, 2015-2017) wind rose data for both the surface and profile data sets used in the air quality analysis. The surface and profile data sets contain surface characteristics along with wind and temperature observations necessary to determine specific meteorological factors for dispersion calculations. The surface data is based on hourly observations while the profile data is based on twice-daily upper air observations.[8] As shown below, the 5-year average primary wind direction is from the Southeast.

[8] https://www3.epa.gov/ttn/scram/7thconf/aermod/aermet_userguide.pdf

Figure 3-2. Buoy 42035 Surface Data Wind Rose

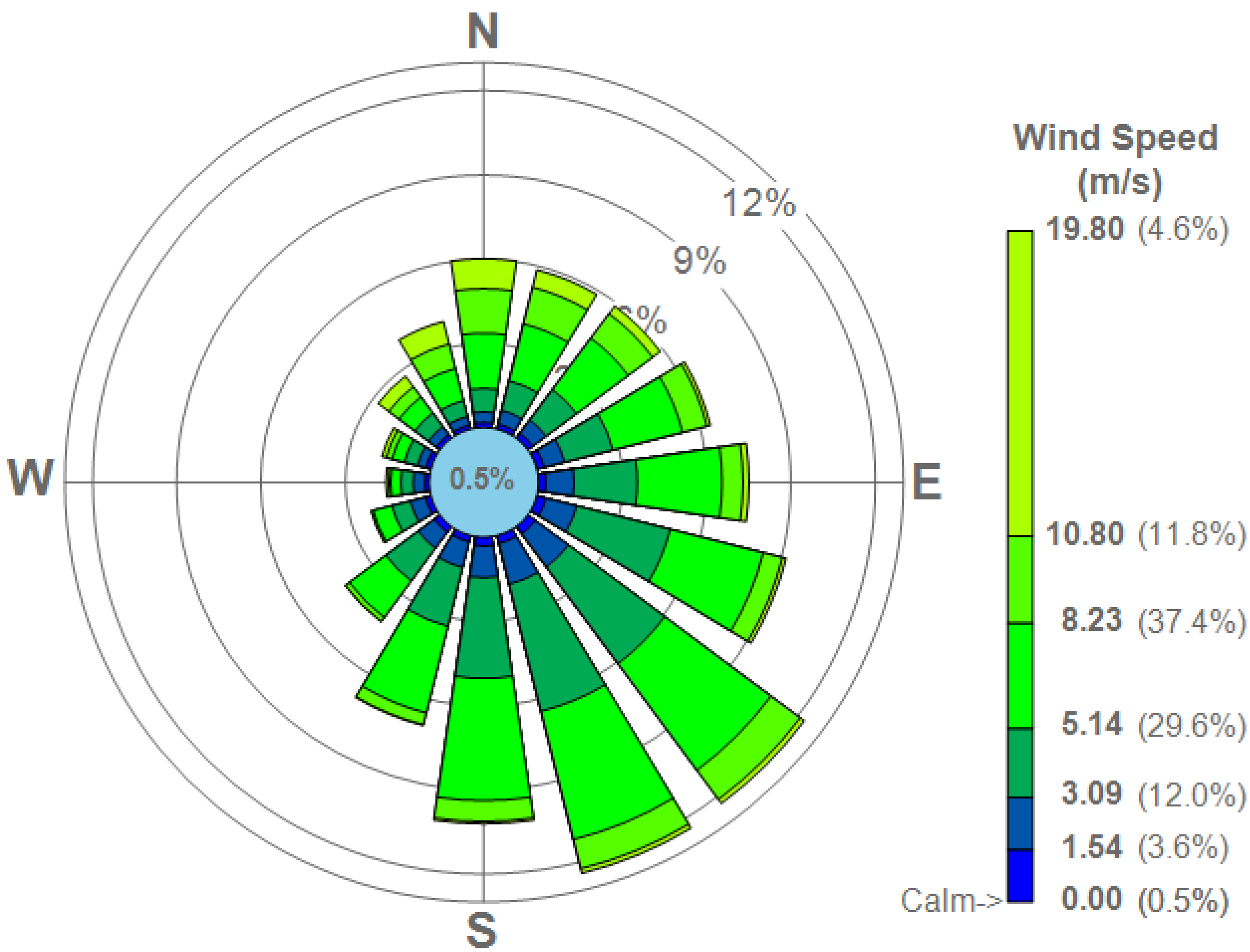
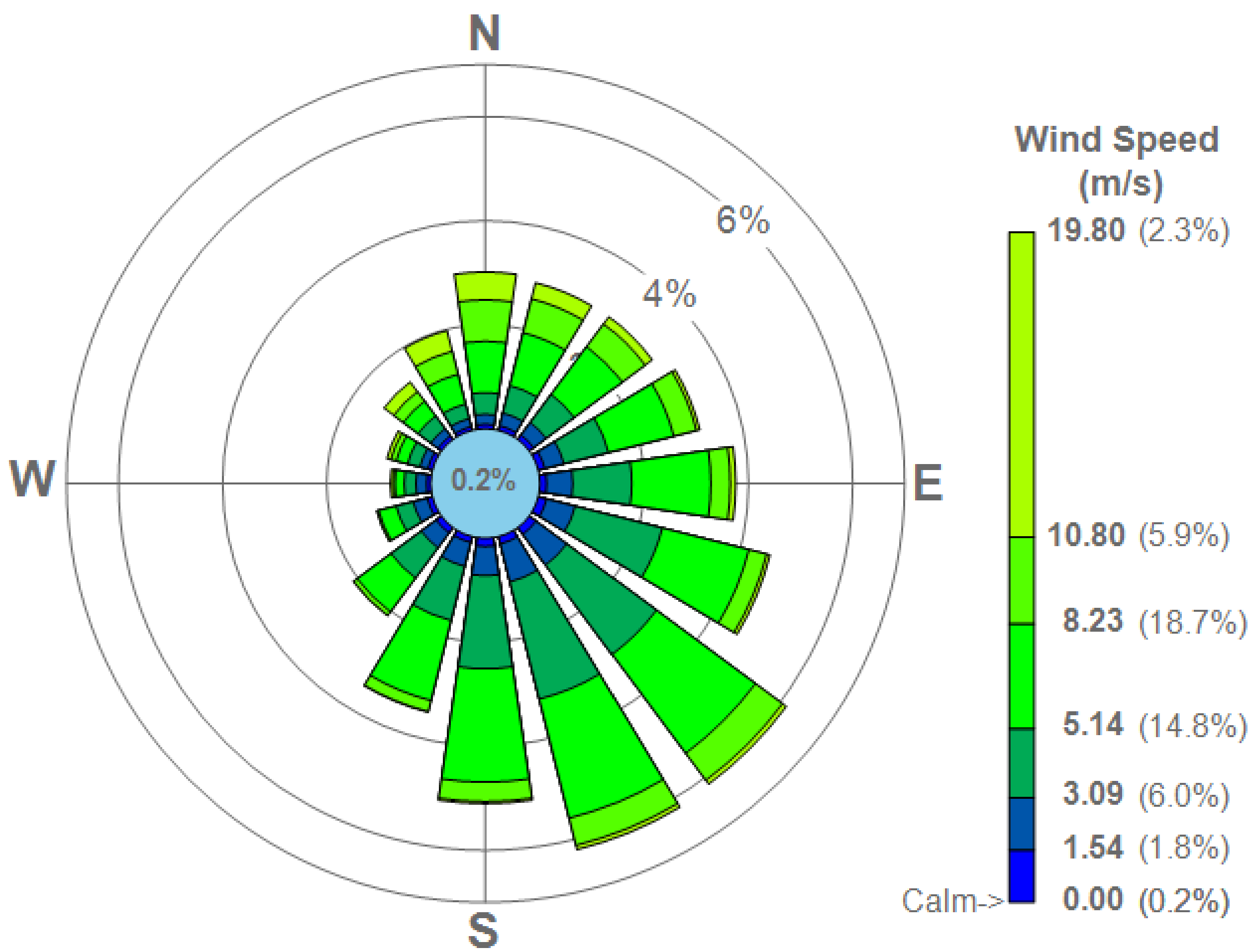


Figure 3-3. Buoy 42035 Profile Data Wind Rose



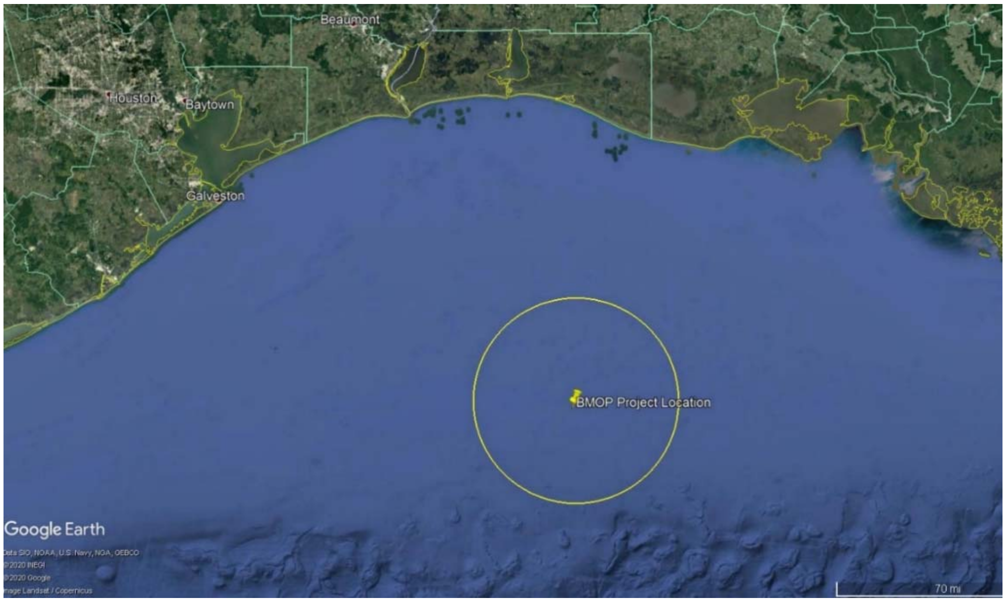
3.3 Terrain Elevations

The Project location in the Gulf of Mexico is approximately eighty-two (82) statute miles from the nearest point on land in Louisiana. As such, the Project is situated at sea level and terrain features have not been considered (i.e. simple terrain only).

3.4 Receptor Grid and Coordinate System

Due to AERMOD accuracy constraints, BMOP established a radial receptor ring with receptors spaced at 500m at a distance of 50 km from the platform complex as seen in the figure below.

Figure 3-4. NEPA Analysis Receptor Locations



3.5 Source Types and Parameters

3.5.1 Modeled Sources

For the purpose of the NEPA dispersion modeling analysis, both project-related (e.g. stationary or direct) and support vessels (e.g. mobile or indirect) sources associated with the DWP platform were modeled. The following emissions sources were included as part of the NEPA air quality analysis:

Table 3-2. NEPA Modeled Direct Sources

Source ID	Source	Modeled Location	UTM WGS84, Zone 15 Easting (m)	UTM WGS84, Zone 15 Northing (m)
NGGEN1	Natural Gas Generator #1	Platform B	499,558.50	3,145,263.24
NGGEN2	Natural Gas Generator #2	Platform B	499,563.03	3,145,259.16
DGEN	Emergency Diesel Generator	Platform B	499,567.56	3,145,255.08
BCRANE1	Platform B Crane #1	Platform B	499,573.09	3,145,256.67
BCRANE2	Platform B Crane #2	Platform B	499,528.13	3,145,242.60
BFWP	Platform B Firewater Pump	Platform B	499,552.80	3,145,247.80
CFWP	Platform C Firewater Pump	Platform C	499,507.67	3,145,358.27

Table 3-3. NEPA Modeled Indirect Sources

Source ID	Source (Amount)	Modeled Location	UTM WGS84, Zone 15 Easting (m)	UTM WGS84, Zone 15 Northing (m)
TUG1 TUG2 TUG3	Tugboat #1: -Main Engines (2) -Generator Set (2) -Winch Engine (1)	~30 m East of VLCC #1	499,566.34	3,147,118.30
TUG4 TUG5 TUG6	Tugboat #2: -Main Engines (2) -Generator Set (2) -Winch Engine (1)	~30 m West of VLCC #1	499,688.26	3,147,118.30
TUG7 TUG8 TUG9	Tugboat #3:[9] -Main Engines (2) -Generator Set (2) -Winch Engine (1)	~30 m North of VLCC #1	499,627.30	3,147,300.78
4PDMAIN 4PDGEN 4PDAC 4PDDC 4PDCRANE	4-Point Dive Support Vessel: -Main Engines (2) -Generators (2) -Air Compressors (1) -Dive Compressors (2) -Crane (2)	approximate center of the WC 509 Platform Complex	499,527.15	3,145,272.84
SUPMAIN SUPGEN	Supply Vessel: -Main Engines (2) -Generators (2)	~100 m South of the Platform B	499,552.80	3,145,147.80
HELI	WC 509 Platform System Helicopter (1)	Platform A	499,518.31	3,145,209.49
VLCC1 VLCC3	VLCC #1: -Main Engines (1) -Diesel Generators (1)	~274 m North of CALM Buoy #1[10]	499,627.30	3,147,270.30
VLCC2 VLCC4	VLCC #2: -Main Engines (1) -Diesel Generators (1)	~274 m North of CALM Buoy #2[10]	501,099.00	3,146,871.60

The following figures provide a detailed description of the NEPA modeled sources at the proposed project location, based on current designs.

[9] Tugboat #3 is also considered a support vessel for the mooring of the VLCC's at the CALM buoys. For simplicity, the vessel is modeled as a third tugboat.

[10] Locations were based on the most conservative direction surrounding the CALM buoy based on the 5-year average primary wind direction.

Figure 3-5. NEPA Model Source Layout

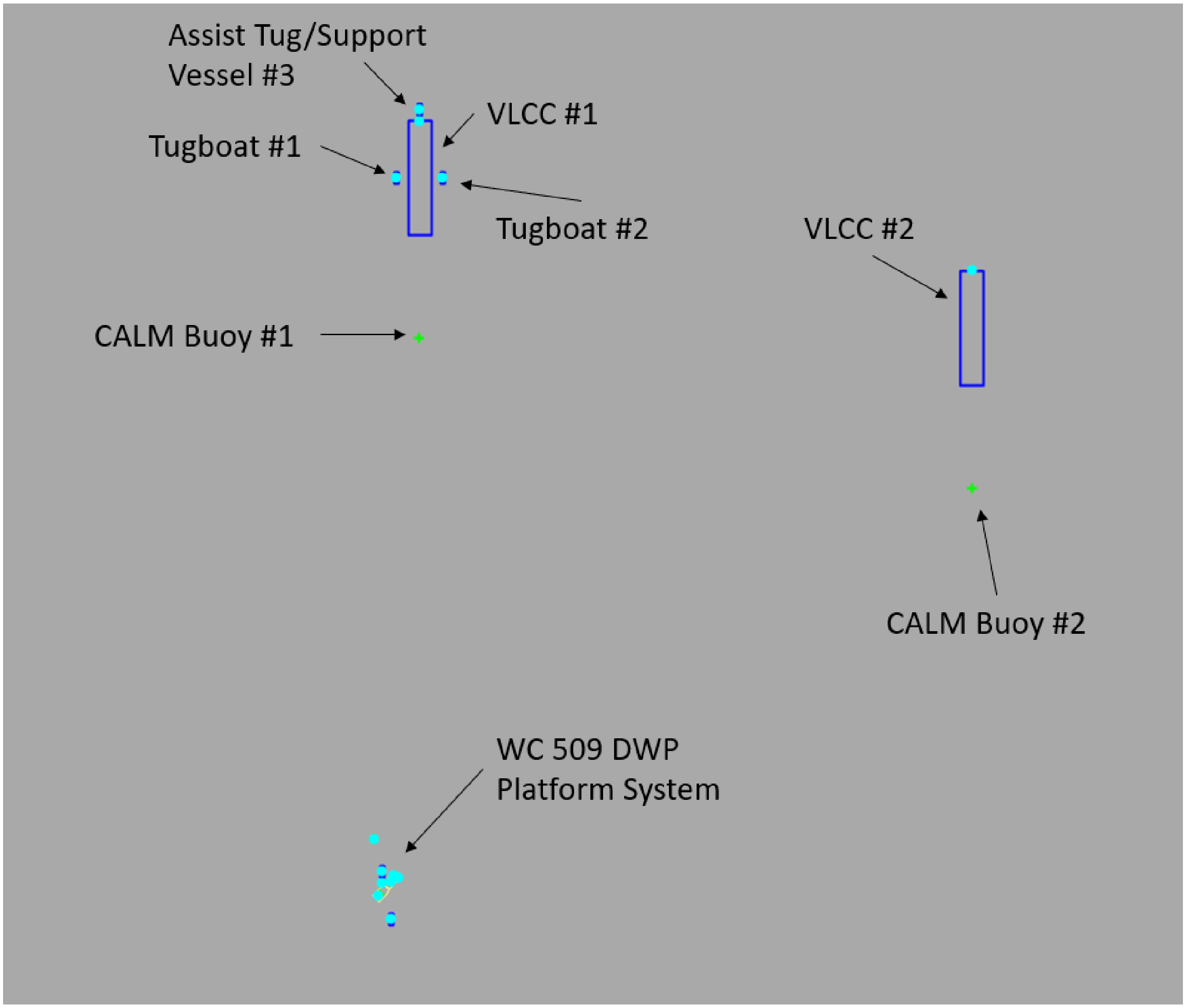
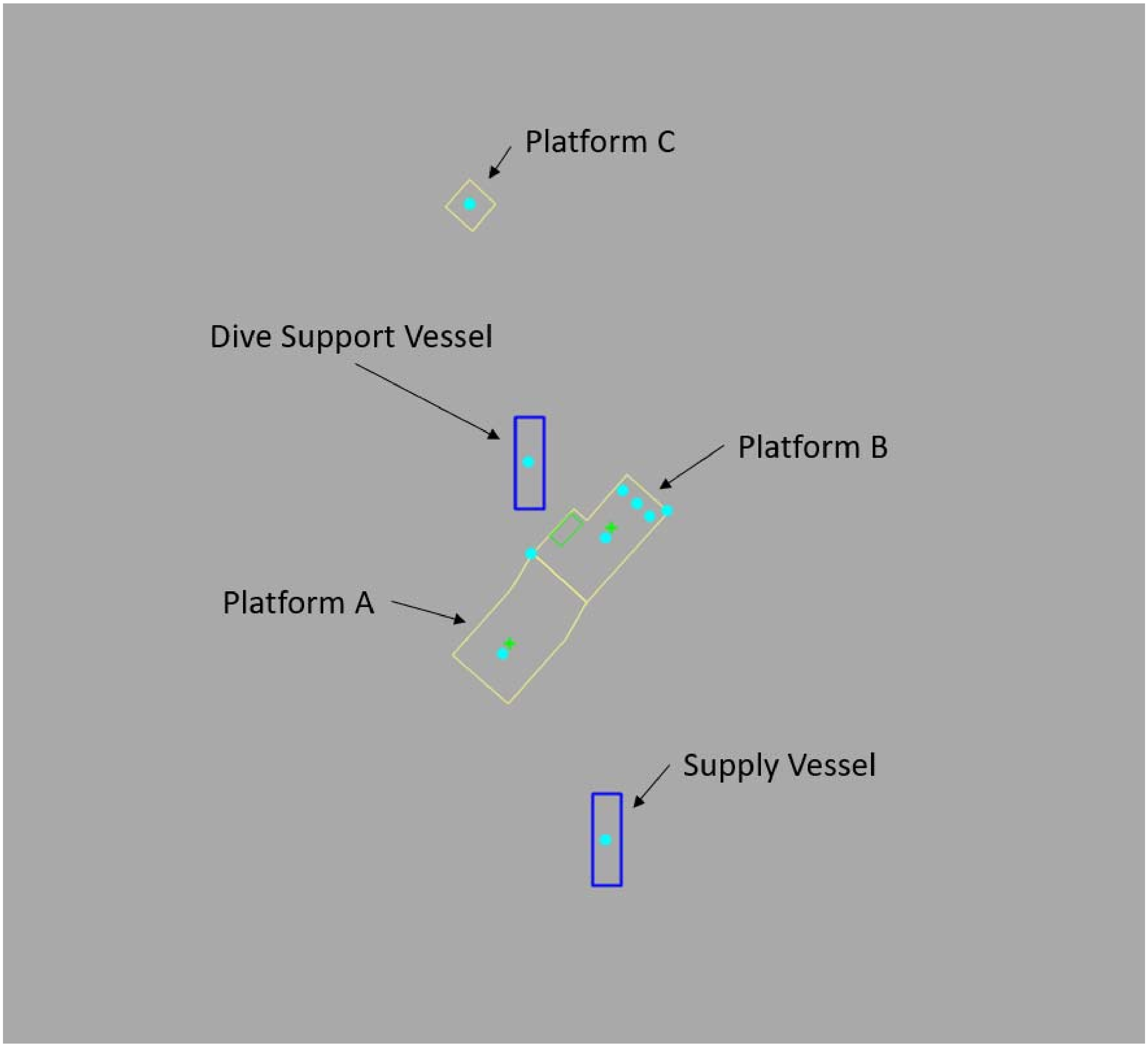


Figure 3-6. NEPA Model Platform Layout



3.5.1.1 Emission Rates

The hourly emission rates used for the air dispersion modeling analysis are based on current Project design specifications. Detailed emissions calculations, including the calculation methodology, are provided in Appendix H-1 (Volume IIa). The table below provides a summary of the modeled emission rates utilized for the air dispersion modeling analysis.

Table 3-4. NEPA Modeled Emission Rates

Source ID	NO_2/NO_2 Annualized (lb/hr)	CO (lb/hr)	SO_2 (lb/hr)	PM_{10} (lb/hr)	$PM_{2.5}$ (lb/hr)
TUG1	8.13	1.86	0.24	0.14	0.13
TUG2	3.22	0.69	0.07	0.23	0.23
TUG3	2.98	0.64	0.07	0.22	0.22
TUG4	8.13	1.86	0.24	0.14	0.13
TUG5	3.22	0.69	0.07	0.23	0.23
TUG6	2.98	0.64	0.07	0.22	0.22
TUG7	8.13	1.86	0.24	0.14	0.13
TUG8	3.22	0.69	0.07	0.23	0.23
TUG9	2.98	0.64	0.07	0.22	0.22
4PDMAIN	43.20	9.90	1.28	0.72	0.70
4PDGEN	4.96	1.07	0.11	0.36	0.36
4PDAC	2.17	0.47	0.05	0.16	0.16
4PDDC	1.74	0.37	0.04	0.13	0.13
4PDCRANE	2.08	0.45	0.05	0.15	0.15
SUPMAIN	19.20	4.40	0.57	0.32	0.31
SUPGEN	4.96	1.07	0.11	0.36	0.36
HELI	1.95	5.33	0.29	0.12	2.01
VLCC1	40.94	9.38	1.21	0.68	0.66
VLCC2	22.97	5.26	0.68	0.38	0.37
VLCC3	40.94	9.38	1.21	0.68	0.66
VLCC4	22.97	5.26	0.68	0.38	0.37
NGGEN1	5.13	10.26	0.01	0.18	0.18
NGGEN2[11]	0	0	0	0	0
DGEN	21.17/0.24	11.58	1.43	0.77	0.77
BCRANE1	0.47	2.73	0.34	0.05	0.05
BCRANE2	0.47	2.73	0.34	0.05	0.05
BFWP	4.3/0.05	3.73	0.46	0.25	0.25
CFWP	4.3/0.05	3.73	0.46	0.25	0.25

Per EPA's March 2011 memorandum, EPA recommends that compliance demonstrations for the 1-hour NO_2 NAAQS address emission scenarios that can logically be assumed to be relatively continuous or which occur frequently enough to contribute significantly to the annual distribution of daily maximum 1-hour concentrations. Normal operation of the emergency generator and emergency firewater pumps will be no more than 100 hours per year. Therefore, to conservatively estimate the impact from these sources on the annual distribution of daily maximum 1-hour concentrations, NO_2 emissions were annualized (i.e. spread out over 8,760 hours per year) for the NO_2 1-hour averaging period. The maximum hourly emission rates for the NO_2 annual averaging period and for all other pollutants were utilized.

[11] Based on current Project designs, only one natural gas engine will be operating at any given time, therefore, a single engine was modeled at maximum hourly and annual emission rates.

3.5.1.2 Load/Operating Conditions

For stationary sources located on the platform, the maximum hourly operations were modeled against both the short term and long term averaging period thresholds, except as described above for the NO_2 1-hour averaging period threshold, to ensure a conservative air dispersion modeling approach.
Mobile support vessel sources will operate at a reduced load for a majority of the operating time while at the BMOP Project location. Therefore, the expected load and power factor for each vessel's emissions sources were utilized for the air quality dispersion modeling analysis.

Emissions associated with startup and shutdown were not considered for this air dispersion modeling analysis. Due to the emission source types and operating requirements for the Project, startup and shutdown emissions are not worst case or would only occur intermittently and are not expected to significantly impact operating emissions from the modeled sources.

3.5.1.3 Stack Parameters

The source specific stack parameters used for the air dispersion modeling analysis are based on current Project design specifications. The table below provides the modeled stack parameters utilized for the NEPA modeling analysis.

Table 3-5. NEPA Modeled Stack Parameters

Source ID	Elevation (ft)	Release Height (ft)	Stack Temp. (K)	Stack Velocity (ft/s)	Stack Diameter (ft)
TUG1	0	49	796	43.3	1.33
TUG2	0	54	728	37.9	0.50
TUG3	0	49	800	43.7	0.25
TUG4	0	49	796	43.3	1.33
TUG5	0	54	728	37.9	0.50
TUG6	0	49	800	43.7	0.25
TUG7	0	49	796	43.3	1.33
TUG8	0	54	728	37.9	0.50
TUG9	0	49	800	43.7	0.25
4PDMAIN	0	50	720	51.2	1.00
4PDGEN	0	50	800	41.0	0.33
4PDAC	0	50	800	36.4	0.25
4PDDC	0	50	800	65.5	0.17
4PDCRANE	0	50	800	68.6	0.33
SUPMAIN	0	50	796	51.2	0.67
SUPGEN	0	50	728	41.0	0.33
HELI	0	122	533	138	0.33
VLCC1	0	195	616	41.8	3.28
VLCC2	0	195	616	41.8	3.28
VLCC3	0	195	616	41.8	3.28
VLCC4	0	195	616	41.8	3.28
NGGEN1	0	104	769	126	0.67
NGGEN2	0	104	769	126	0.67
DGEN	0	104	676	103	0.67
BCRANE1	0	155	800	97.3	0.33

BCRANE2	0	155	800	97.3	0.33
BFWP	0	56	800	133	0.33
CFWP	0	56	800	133	0.33

3.5.1.4 NO_2 Analysis-Special Considerations

The revised Guideline indicates Ambient Ratio Method 2 (ARM2) has replaced ARM as the regulatory default Tier 2 NO_2 modeling method. BMOP utilized ARM2 for modeling NO_2 for the 1-hour and annual modeling assessments. Based on the results, further refinement was not necessary to confirm modeled impacts less than the NAAQS. Tier 3 modeling methods, such as the Ozone Limiting Method (OLM) or Plume Volume Molar Ratio Method (PVMRM), were not used in this analysis.

3.5.1.5 Good Engineering Practice Stack Height Analysis

EPA has promulgated stack height regulations that restrict the use of stack heights in excess of "Good Engineering Practice" (GEP) in air dispersion modeling analyses. Under these regulations, that portion of a stack in excess of the GEP height is generally not creditable when modeling to determine source impacts. This essentially prevents the use of excessively tall stacks to reduce ground-level pollutant concentrations. For this analysis, the modeled sources stacks did not exceed the GEP height and therefore the actual release heights of each source were utilized.

3.5.1.6 Building Downwash Analysis

AERMOD incorporates the Plume Rise Model Enhancements (PRIME) downwash algorithms. Direction specific building parameters required by AERMOD are calculated using the BPIP-PRIME (BPIPP) preprocessor (version 04272). For the proposed project, vessel dimensions were included, based on current project designs.

For the Project, a base elevation of zero (sea level) and the building/structure's height above sea level were used for the modeling analysis. This method was utilized because BPIPP is not designed to calculate structure dimensions that are not located on the ground.

Building sources for the marine support vessels were included in the air dispersion modeling analysis. Based on current Project designs, the platform structures will not be 4-walled structures and will allow air flow to pass through for greater than 50% of the surface area. As such, building sources for the platform structures were not included.

4. AIR QUALITY ANALYSIS RESULTS

This section summarizes the results of the NEPA air quality model analysis for the Project, which includes significance modeling results and cumulative impact results. The electronic modeling files used to develop the presented results are listed in Appendix B.

4.1 Significance Modeling Analysis Results

Table 4-1. Significance Analysis Results

Pollutant	Averaging Period	Concentration Basis	Date/Time	Modeled Concentration (μg/m^3)	Class II SIL (μg/m^3)	Cumulative Impacts Required? (Yes/No)
NO_2	1-Hour	5-year avg. H1H	2012-2017	19.60	7.5	Yes
	Annual	H1H in any year	2012	0.30	1	No
SO_2	1-Hour	5-year avg. H1H	2012-2017	1.16	7.8	No
	3-Hour	H1H in any year	12112303	1.14	25	No
	24-Hour	H1H in any year	13102424	0.22	5	No
	Annual	H1H in any year	2012	0.01	1	No
$PM_{2.5}$	24-Hour	H1H in any year	2013	0.26	1.2	No
	Annual	H1H in any year	2012	0.01	0.2	No
PM_{10}	24-Hour	H1H in any year	13102424	0.22	5	No
	Annual	H1H in any year	2012	0.01	1	No
CO	1-Hour	H1H in any year	17021213	16.50	2,000	No
	8-Hour	H1H in any year	12080808	5.03	500	No

As shown above, all modeled pollutants resulted in concentrations below their applicable Class II SIL except for the NO_2 1-hour standard. As such, a cumulative impacts analysis was performed for NO_2 1-hour emissions, as described below.

4.2 Cumulative Impacts Analysis Results

As described in Section 3 of this report, should modeled design concentrations of the significance analysis be less than the applicable SIL, a cumulative impacts analysis is not required. If modeled impacts are greater than the SIL, a cumulative impacts analysis, including regional inventory sources and ambient background concentrations, is performed to demonstrate that the Project neither causes nor contributes to any NAAQS exceedances at the nearest shoreline.

Per Section 4.1 of this report, the modeled results from the NO_2 1-hour averaging period exceeded the SIL. Therefore, NO_2 1-hour emissions from Project and all applicable regional sources were modeled. The NO_2 ambient background concentration was added to the modeled design concentration and compared to the NO_2 1-hr primary NAAQS. The table below summarizes the results from the NO_2 1-hour cumulative impacts analysis.

Table 4-2. Cumulative Impacts Analysis Results

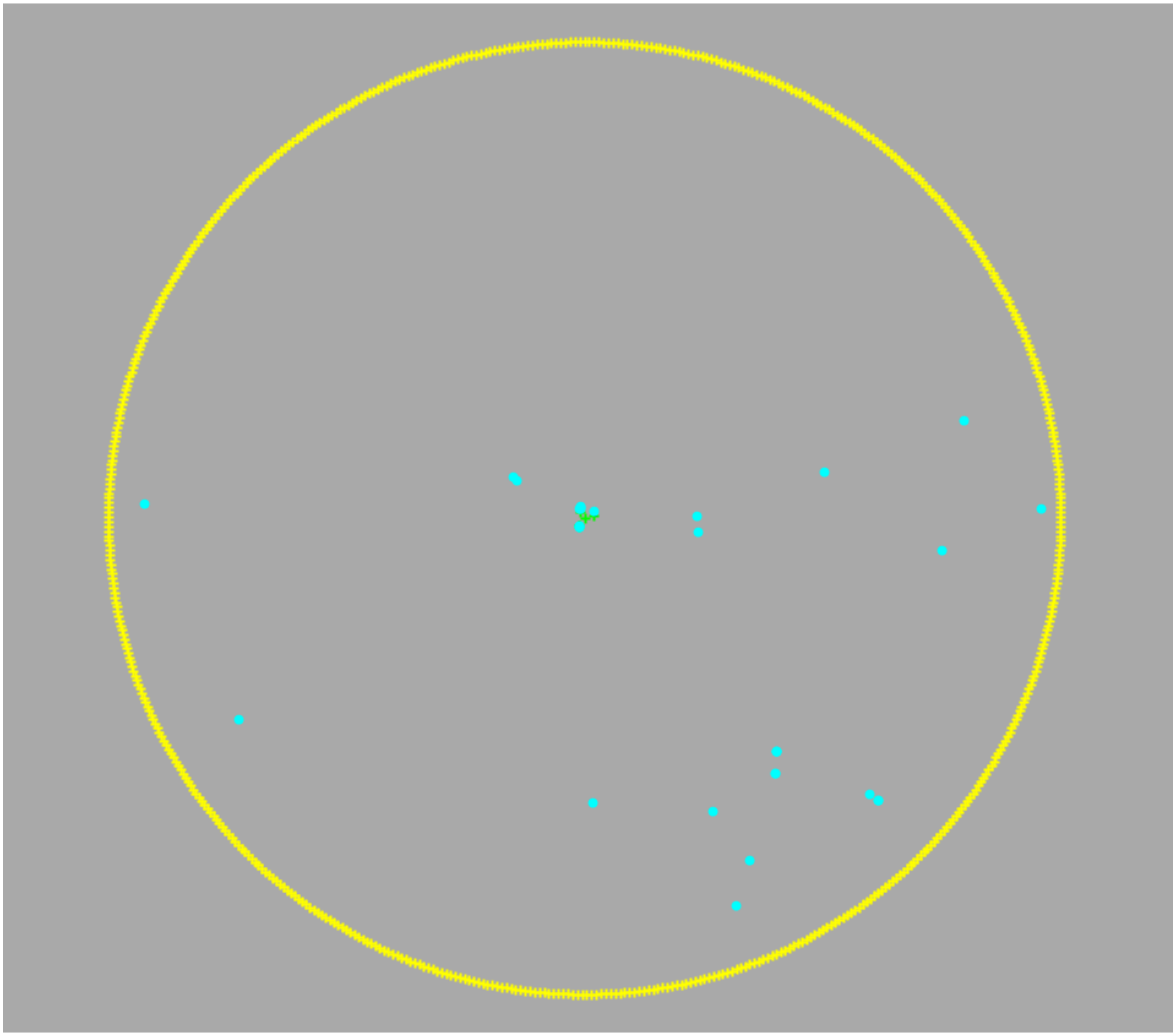
Pollutant	Averaging Period	Project + Inventory Modeled Concentration[12] (µg/m^3)	Background Monitor Concentration (µg/m^3)	Cumulative Impacts (µg/m^3)	Primary NAAQS (µg/m^3)	Exceed NAAQS? (Yes/No)
NO_2	1-Hour	48.09	38.25	86.34	188	No

As shown above, model results from the cumulative impacts analysis are below the primary NAAQS for the NO_2 1-hour NAAQS and demonstrates that the Project is not expected to result in direct, indirect, or cumulative impacts that will result in a violation of the NAAQS.

[12] Results based on the 8th highest high of the 5-year average modeled results, for 2012-2017.

APPENDIX A. REGIONAL INVENTORY SOURCES

Figure A-1. Cumulative Impacts Model Source Layout



Blue Marlin Offshore Port LLC
Air Quality Modeling Report
Appendix A - Regional Inventory

Off-site Sources based on Year 2017 Gulfwide Offshore Activity Data System (GOADS) Emissions Inventory published by Bureau of Ocean Energy Management (BOEM).
https://www.boem.gov/environment/environmental-studies/ocs-emissions-inventory-2017

Company Name	Area Block	Distance from BMOP Facility (km)	ID	Description	Easting (m)	Northing (m)	Base Elevation (ft)	Stack Height (ft)	Stack Temp (°F)	Stack Velocity (ft/s)	Stack Diameter (ft)	NO_X (lb/hr, max hourly)
Fieldwood Energy, LLC	EC257	25.8	INS1	EC257DIE700	525243	3150946	0	80	900	17.56	1.00	4.35
			INS2	EC257NGE700	525243	3150946	0	60	1100	26.69	0.67	2.53
Fieldwood Energy, LLC	EC265	12.0	INS3	EC265DIE001	511877	3146394	0	77	900	277.81	0.25	4.30
			INS4	EC265DIE002	511877	3146394	0	77	900	245.70	0.17	1.69
Fieldwood Energy, LLC	EC278	12.1	INS5	EC278DIE100	511928	3144721	0	85	900	214.98	0.33	5.92
			INS6	EC278NGE100	511928	3144721	0	91	1100	75.12	1.50	36.09
			INS7	EC278NGE700	511928	3144721	0	94	1100	98.23	0.50	5.24
			INS8	EC278NGE701	511928	3144721	0	94	1100	91.93	0.50	5.24
Arena Offshore, LP	EC321	31.7	INS9	EC321DIE100	520175	3121571	0	72	900	17.56	1.00	4.55
			INS10	EC321DIE101	520175	3121571	0	61	900	17.56	1.00	5.58
			INS11	EC321DIE102	520175	3121571	0	78	900	301.10	0.50	7.47
			INS12	EC321DIE500	520175	3121571	0	45	900	0.75	2.00	0.75
			INS13	EC321DIE700	520091	3119373	0	84	900	4.82	1.00	1.19
			INS14	EC321NGE100	520175	3121571	0	61	1100	51.55	1.17	11.84
			INS15	EC321NGE101	520091	3119373	0	84	1100	19.93	1.00	6.06
			INS16	EC321NGT100	520175	3121571	0	40	1000	83.50	2.00	2.30
			INS17	EC321NGT101	520175	3121571	0	40	1000	83.50	2.00	2.30
			INS18	EC321NGT102	520175	3121571	0	40	1000	83.50	2.00	2.30
			INS19	EC321NGT103	520175	3121571	0	40	1000	83.50	2.00	2.27
Arena Offshore, LP	EC328	42.7	INS20	EC328BOI700	530873	3116516	0	80	500	32.96	1.67	0.39
			INS21	EC328BOI701	530873	3116516	0	80	500	32.96	1.67	0.40
			INS22	EC328BOI702	530873	3116516	0	80	500	32.96	1.67	0.40
			INS23	EC328BOI703	530873	3116516	0	80	500	32.96	1.67	0.40
			INS24	EC328BOI704	530873	3116516	0	80	500	32.96	1.67	0.39
			INS25	EC328BOI705	530873	3116516	0	80	500	32.96	1.67	0.40
			INS26	EC328DIE001	530873	3116516	0	95	150	50.97	0.46	4.83
			INS27	EC328DIE002	530873	3116516	0	85	150	407.73	0.16	0.81
			INS28	EC328DIE500	529986	3117188	0	95	150	50.97	0.46	4.83
			INS29	EC328DIE700	529986	3117188	0	100	800	12.03	0.67	1.33
			INS30	EC328NGE700	530873	3116516	0	54	250	21.77	1.00	10.22
			INS31	EC328NGE701	530873	3116516	0	54	250	21.77	1.00	10.21
			INS32	EC328NGE702	530873	3116516	0	100	900	84.99	1.00	20.08
			INS33	EC328NGE703	530873	3116516	0	100	900	84.99	1.00	20.08
Fieldwood Energy, LLC	EC332	33.4	INS34	EC332BOI700	513499	3115388	0	87	400	13.66	1.50	0.14
			INS35	EC332DIE700	513499	3115388	0	80	900	95.55	0.50	5.92
			INS36	EC332DIE701	513499	3115388	0	80	900	100.37	0.50	6.22
			INS37	EC332DIE702	513499	3115388	0	100	900	120.44	0.50	7.46
			INS38	EC332NGE700	513499	3115388	0	82	1100	28.35	1.50	13.62
			INS39	EC332NGE701	513499	3115388	0	97	1100	70.54	0.83	10.46
Energy XXI GOM, LLC	EC334	32.7	INS40	EC334DIE001	500901	3116225	0	98	450	135.17	0.25	4.61
			INS41	EC334DIE700	500901	3116225	0	90	450	168.96	0.25	2.92
			INS42	EC334DIE701	500901	3116225	0	90	450	168.96	0.25	2.53
			INS43	EC334NGE001	500901	3116225	0	96.75	850	212.29	0.83	1.99
			INS44	EC334NGE100	500901	3116225	0	96.75	850	162.96	0.83	4.02
W&T Offshore, Inc.	EC338	39.7	INS45	EC338BOI100	517329	3110226	0	84	400	7.29	1.50	0.07
			INS46	EC338DIE001	517329	3110226	0	84	900	70.26	0.50	4.35
			INS47	EC338DIE002	517329	3110226	0	76	900	93.94	0.50	5.82
			INS48	EC338DIE100	517329	3110226	0	81	900	78.77	0.83	13.55
			INS49	EC338DIE700	517329	3110226	0	70	900	4.39	1.00	1.09
			INS50	EC338DIE701	517329	3110226	0	70	900	33.62	1.00	8.33
			INS51	EC338NGE100	517329	3110226	0	81	1100	55.11	0.83	12.05
			INS52	EC338NGE101	517329	3110226	0	81	1100	36.74	0.83	10.94
			INS53	EC338NGE102	517329	3110226	0	81	1100	33.89	0.83	9.76
W&T Offshore, Inc.	EC349	43.6	INS54	EC349DIE001	515949	3105412	0	91	900	96.35	0.50	5.97
			INS55	EC349DIE700	515949	3105412	0	81	900	31.62	0.33	0.87
Fieldwood Energy, LLC	VR261	41.3	INS56	VR261DIE700	539897	3156382	0	78	900	160.59	0.25	0.67
			INS57	VR261DIE100	539848	3156415	0	100	900	10.04	1.00	2.49
			INS58	VR261NGE700	539848	3156415	0	100	1100	45.03	1.00	9.62
			INS59	VR261NGE701	539848	3156415	0	100	1100	14.99	1.00	3.20
			INS60	VR261NGE702	539848	3156415	0	100	1100	14.99	1.00	3.20
			INS61	VR261NGE703	539848	3156415	0	100	1100	14.99	1.00	3.20
W&T Offshore, Inc.	VR279	48.1	INS62	VR279BOI001	547983	3147094	0	90	400	20.49	1.00	0.09
			INS63	VR279BOI700	547983	3147094	0	90	400	20.49	1.00	0.09
			INS64	VR279DIE500	547983	3147094	0	94	900	23.89	1.00	5.92
			INS65	VR279DIE501	547983	3147094	0	92	900	42.15	1.00	10.45
			INS66	VR279NGE500	547983	3147094	0	90	1100	64.36	1.00	13.14
			INS67	VR279NGE501	547983	3147094	0	90	1100	35.30	1.00	7.13
GoMex Energy Offshore, Ltd.	VR282	37.9	INS68	VR282BOI500	537650	3142772	0	55	400	67.63	1.00	0.32
			INS69	VR282DIE500	537650	3142772	0	60	900	10.14	1.00	2.49
			INS70	VR282DIE502	537650	3142772	0	60	900	10.04	1.00	2.49
			INS71	VR282NGE500	537650	3142772	0	63	1100	65.06	1.00	13.89
			INS72	VR282NGE700	537650	3142772	0	63	1100	63.78	1.00	13.62
Fieldwood Energy, LLC	WC485	8.6	INS73	WC485DIE700	492610	3150512	0	68	900	45.16	0.33	1.24
			INS74	WC485DIE701	492610	3150512	0	68	900	144.53	0.33	3.98
			INS75	WC485NGE700	492610	3150512	0	75	1100	55.81	1.00	11.92
			INS76	WC485NGE701	492610	3150512	0	75	1100	55.81	1.00	11.92
			INS77	WC485NGE702	492610	3150512	0	70	1100	70.16	0.50	3.75
Energy XXI GOM, LLC	WC498	46.1	INS78	WC498DIE500	453816	3147573	0	80	350	186.48	0.25	3.01
			INS79	WC498BOI100	453816	3147573	0	100	350	9.65	1.00	0.04
			INS80	WC498DIE100	453816	3147573	0	100	350	119.79	0.33	2.11
			INS81	WC498DIE101	453816	3147573	0	96	350	24.06	0.25	1.61
			INS82	WC498DIE102	453816	3147573	0	98	350	183.48	0.50	1.48
			INS83	WC498NGE100	453816	3147573	0	78	1100	125.94	1.00	16.30
			INS84	WC498BOI101	453816	3147573	0	100	400	16.65	2.00	0.27
			INS85	WC498NGE101	453816	3147573	0	100	450	29.82	1.00	16.19
Fieldwood Energy, LLC	WC507	8.1	INS86	WC507DIE500	492991	3150013	0	80	900	112.41	0.25	1.74
Peregrine Oil and Gas II, LLC	WC565	41.9	INS91	WC565DIE100	463705	3124952	0	80	900	54.20	0.50	3.36

APPENDIX B. ELECTRONIC MODELING FILES

Modeling files for this analysis will be provided separately to EPA. Modeling files will include the following:

- Significance analysis modeling files for the following pollutants and averaging periods:
  - CO;
    - 1-hr and 8-hr average files for 2012, 2013, 2015, 2016, and 2017.
  - NO_2;
    - 1-hr average files for the 2012, 2013, 2015, 2016, and 2017 period.
    - Annual average files for 2012, 2013, 2015, 2016, and 2017.
  - PM_{10};
    - 24-hr and annual average files for 2012, 2013, 2015, 2016, and 2017.
  - $PM_{2.5}$; and
    - 24-hr and annual average files for 2012, 2013, 2015, 2016, and 2017.
  - SO_2
    - 1-hr average files for the 2012, 2013, 2015, 2016, and 2017 period.
    - 3-hr, 24-hr, and annual average files for 2012, 2013, 2015, 2016, and 2017.
- Cumulative impacts analysis modeling files for the following pollutants and averaging periods:
  - NO_2
    - 1-hr average files for the 2012, 2013, 2015-2017 period.

Each set of modeling files provided above includes the following files utilized in the air quality dispersion analysis:

- Meteorological files;
- AERMOD Input file;
- AERMOD Output file;
- BPIPP Input file;
- BPIPP Output file; and
- BPIPP Summary file.